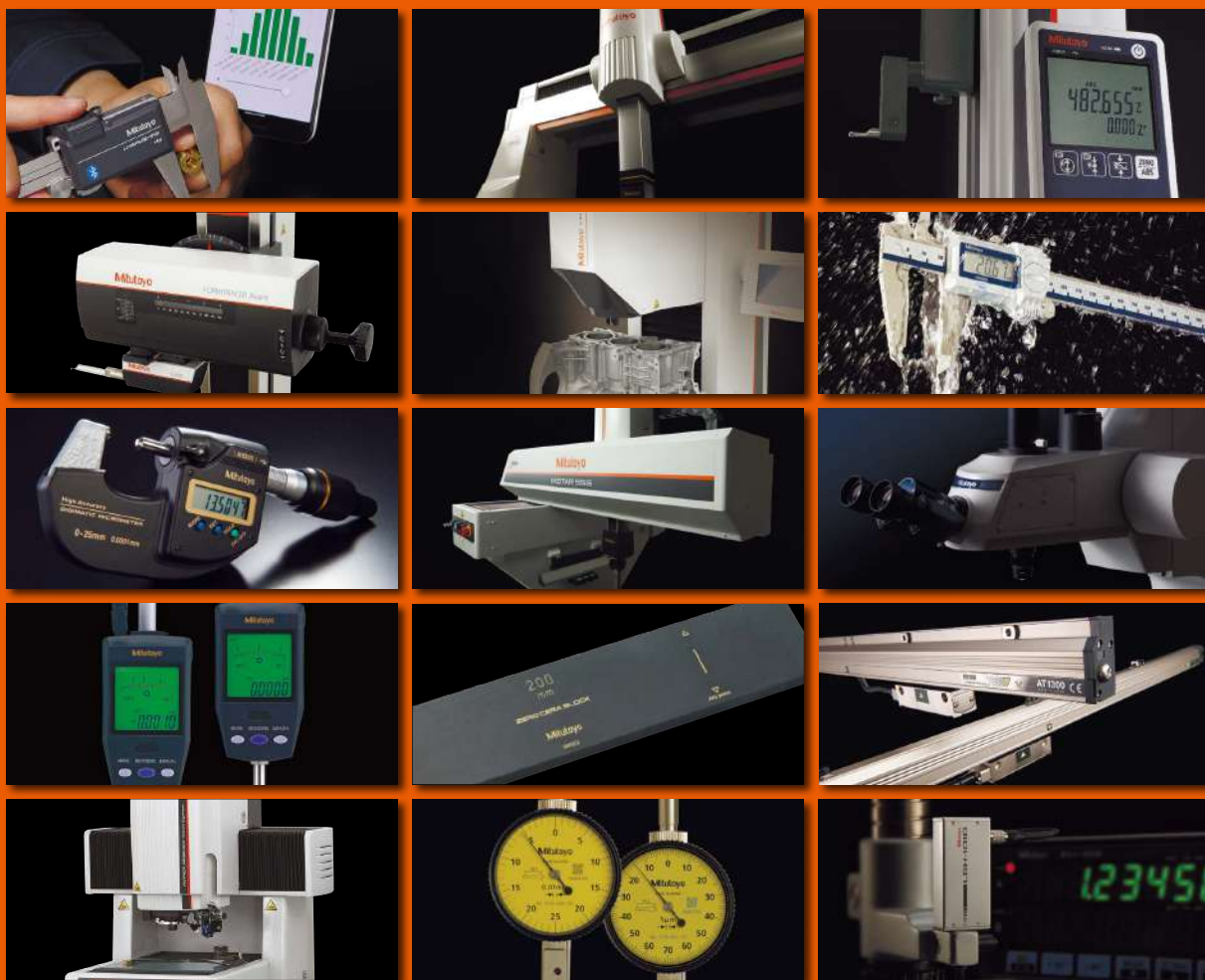


Mitutoyo

Catalog No. E2020



MEASURING INSTRUMENTS CATALOG



Notes on Use

Export Control

Export permission by the Japanese government may be required for exporting our products according to the Foreign Exchange and Foreign Trade Law.
Please consult our sales office near you before you export our products or you offer technical information to a nonresident.

Sale of inch-model products

Sale of inch-model products in Japan is regulated by the Japanese laws and ordinances.
If you request to purchase inch-model products, contact your nearest Mitutoyo sales office.

Safety Caution








Carefully read the specifications and functions in this catalog before selecting products.
Safety may be compromised if you use products for purposes other than those stated here.
Feel free to contact your nearest Mitutoyo sales center if you wish to use a product for other purposes or in a special environment.












Appearance and Specifications

Mitutoyo reserves the right to change any or all aspects of any product specification, including prices, designs and service content, without notice.
The product names in this catalog are registered trademarks or trademarks of Mitutoyo or their respective companies.

Mitutoyo Precision Measuring Machines – Trusted Throughout the World

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Examples of data management system design using various Mitutoyo measuring instruments

A Measurement Data Management

A-1 to A-32



Length standards brought to you by Mitutoyo

E Gauge Blocks Height Master Reference Gages Granite Surface Plates

E-1 to E-50



The origin of Mitutoyo's trustworthy brand of small tool instruments

B Micrometers Micrometer Heads Digimatic Micrometers

B-1 to B-116



Comparison measuring instruments which ensure high quality, high accuracy and reliability.

F Digimatic Indicators Dial Indicators Dial Test Indicators Stands

F-1 to F-96



For easy and accurate measurement of inside diameters

C Holtest Inside Micrometers Bore Gages

C-1 to C-50



To realize simultaneous multi-point measurement and automated measurement

G Linear Gages Mu-Checker Laser Scan Micrometers

G-1 to G-38



The standard measuring tool in industry

D Calipers Height Gages Linear Height Depth Gages

D-1 to D-70



To precisely determine the position of slides on machine tools and measuring devices

H Digimatic Scale Units Linear Scales

H-1 to H-22



To inspect and precisely measure angles and lengths on small workpieces

J Profile Projectors
Microscopes

J-1 to J-16



The fruits of leading-edge precision measuring technology capturing three dimensions

N Coordinate Measuring Machines

N-1 to N-22



Vision measuring systems for multipurpose use

K Vision Measuring Systems

K-1 to K-16



For better communication with our customers

U Mitutoyo's Domestic Network
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M³ Solution Centers

U-1 to U-14



To measure surface roughness, waviness, profile, roundness and straightness

L Surftest
Contracer
Formtracer
Roundtest

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To enhance reliability and quality of products

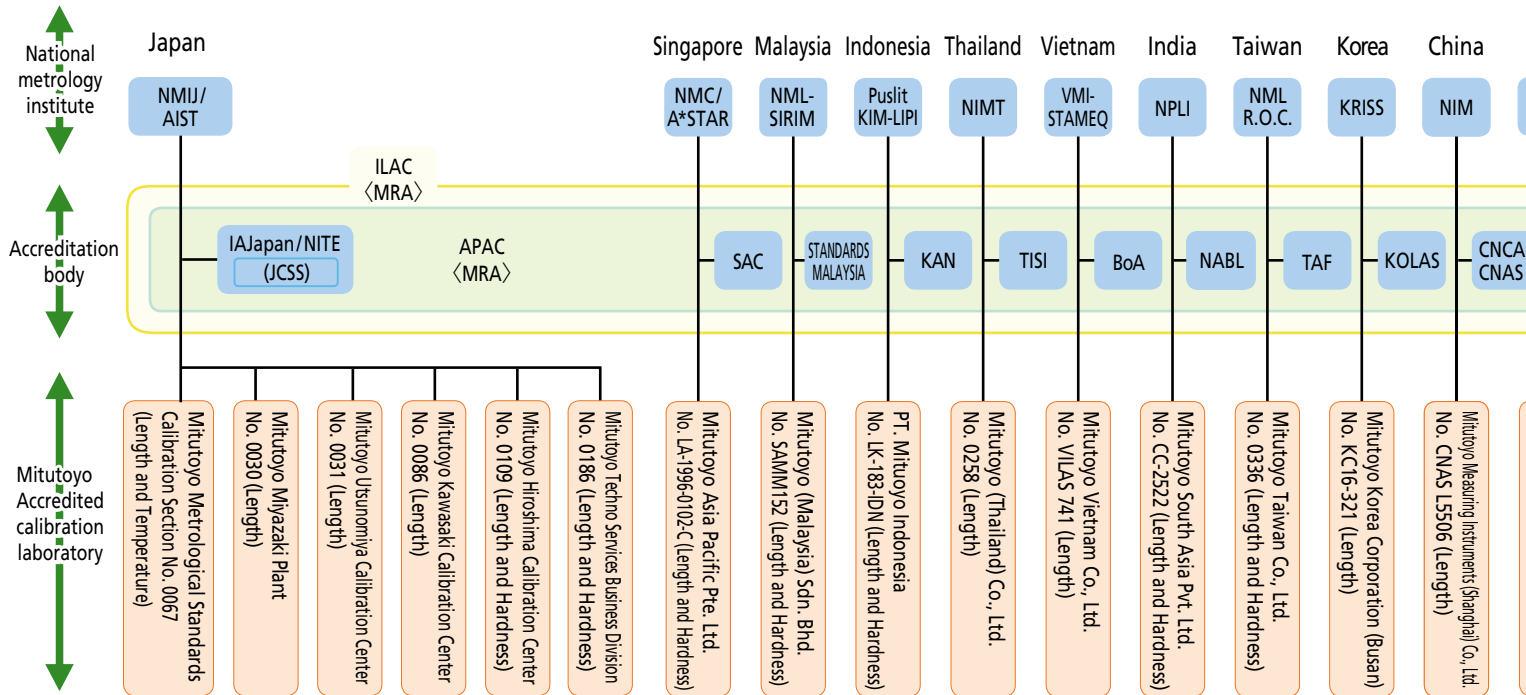
M Hardness Testing Machines

M-1 to M-10



Calibration Laboratories Worldwide

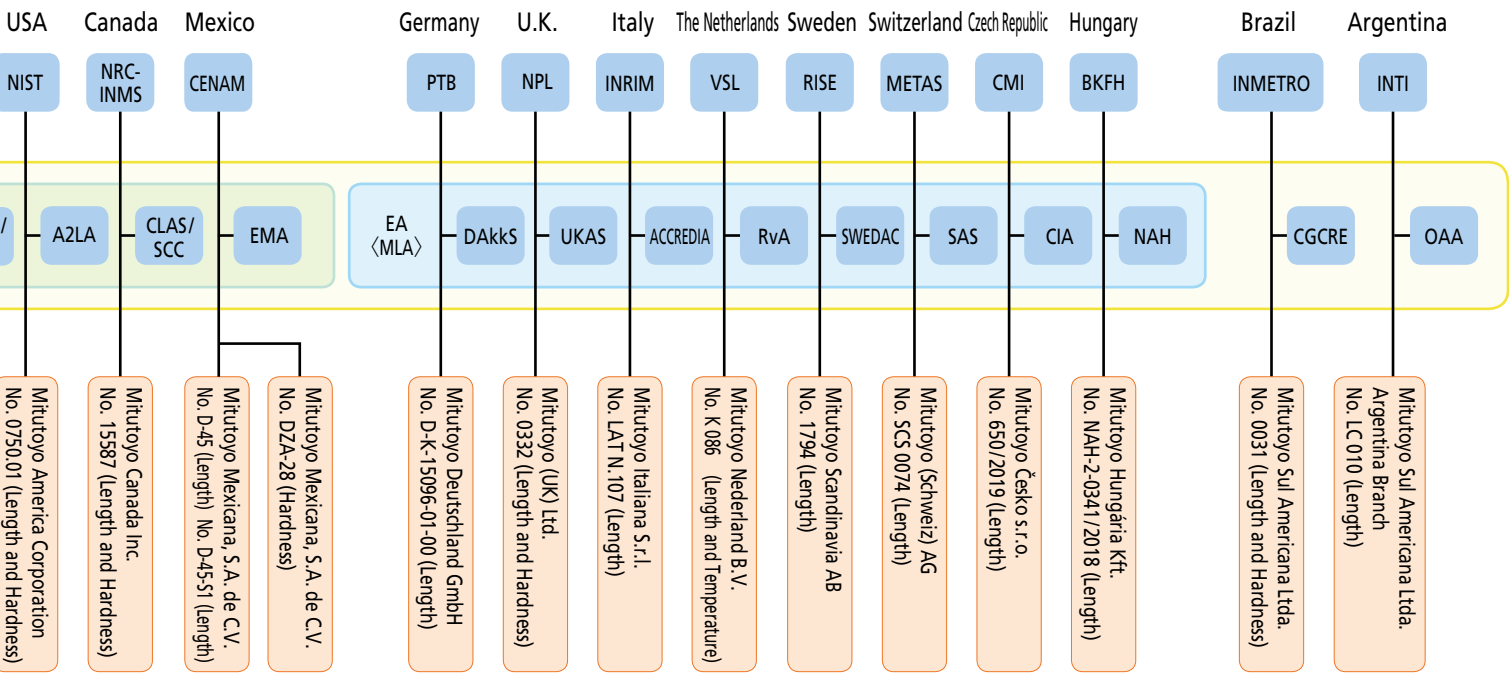
Mitutoyo has built a network for comprehensive calibration support of precision measuring products in the global market. To provide calibration services on a global scale, Mitutoyo has gained ISO/IEC 17025 certification from the accreditation body in each country, and has issued calibration certificates carrying the mark of each accreditation body. In addition, the calibration certificates issued by each calibration laboratory are mutually recognized in the countries and commercial areas signed in the MRA (Mutual Recognition Arrangement) of ILAC and APAC, or the MLA (Multilateral Agreement) of EA.



- Japan
 - AIST : National Institute of Advanced Industrial Science and Technology
 - NMIJ : National Metrology Institute of Japan
 - IAJapan : International Accreditation Japan
 - NITE : National Institute of Technology and Evaluation
 - JCSS : Japan Calibration Service System
- Singapore
 - NMC/A*STAR : National Metrology Centre/Agency for Science, Technology and Research
 - SAC : Singapore Accreditation Council
- Malaysia
 - NML-SIRIM : National Metrology Laboratory-Standards and Industrial Research Institute of Malaysia
 - STANDARDS MALAYSIA : STANDARDS MALAYSIA
- Indonesia
 - Puslit KIM-LIPI : Research Center for Calibration, Instrumentation and Metrology- Indonesian Institute of Science
 - KAN : Komite Akreditasi Nasional
- Thailand
 - NIMT : National Institute of Metrology (Thailand)
 - TISI : Thai Industrial Standard Institute
- Vietnam
 - VMI-STAMEQ : Vietnam Metrology Institute, Directorate for Standards and Quality
 - BoA : BUREAU OF ACCREDITATION
- India
 - NPLI : National Physical Laboratory of India
 - NABL : National Accreditation Board for Testing and Calibration Laboratories

- Taiwan
 - NML R.O.C. : National Measurement Laboratory R.O.C.
 - TAF : Taiwan Accreditation Foundation
- Korea
 - KRISS : Korea Research Institute of Standards and Science
 - KOLAS : Korea Laboratory Accreditation Scheme
- China
 - NIM : National Institute of Metrology
 - CNCA : Certification and Accreditation Administration of the people's republic of China
 - CNAS : China National Accreditation Service for Conformity Assessment
- U.S.A.
 - NIST : National Institute of Standards and Technology
 - A2LA : American Association for Laboratory Accreditation
- Canada
 - NRC-INMS : National Research Council Canada/Institute for National Measurement Standards
 - CLAS/SCC : Calibration Laboratory Assessment Service/Standards Council of Canada
- Mexico
 - CENAM : Centro Nacional de Metrología
 - EMA : Entidad Mexicana de Acreditación, a.c.
- Germany
 - PTB : Physikalisch-Technische Bundesanstalt
 - DAKKS : Deutsche Akkreditierungsstelle GmbH
- U.K.
 - NPL : National Physical Laboratory
 - UKAS : United Kingdom Accreditation Service

Note: The above are domestic and international locations where Mitutoyo provides ISO/IEC 17025 accredited calibration services. (As of August, 2020)



• Italy
 INRIM : Istituto Nazionale di Ricerca Metrologica
 ACCREDIA : L'ENTE ITALIANO DI ACCREDITAMENTO

• The Netherlands
 VSL : Van Swinden Laboratorium
 RvA : Raad voor Accreditatie

• Sweden
 RISE : RISE Research Institutes of Sweden AB
 SWEDAC : Swedish Board for Accreditation and Conformity Assessment

• Switzerland
 METAS : The Federal Institute of Metrology
 SAS : Swiss Accreditation Service

• Czech Republic
 CMI : Český Metrologický Institut
 CIA : Český Institut pro Akreditaci

• Hungary
 BKFH : Government Office of the Capital City Budapest
 NAH : Nemzeti Akkreditáló Hatóság

• Brazil
 INMETRO : Instituto Nacional de Metrologia Qualidade e Tecnologia
 CGCRE : Coordenação Geral de Acreditação do INMETRO

• Argentina
 INTI : Instituto Nacional de Tecnología Industrial
 OAA : Organismo Argentino de Acreditación

ILAC : International Laboratory Accreditation Cooperation

APAC : Asia Pacific Accreditation Cooperation

MRA : Mutual Recognition Arrangement

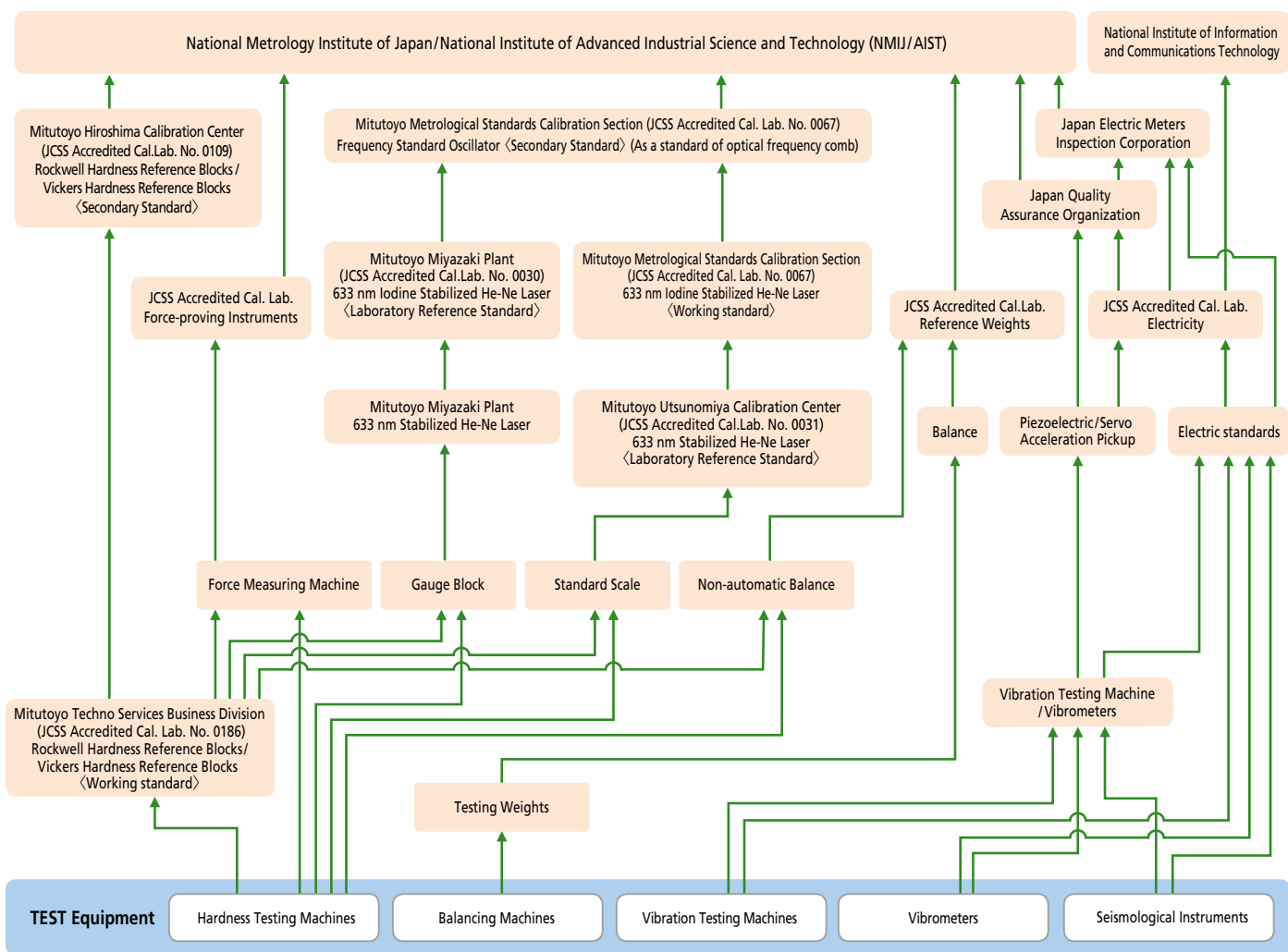
EA : European co-operation for Accreditation

MLA : Multilateral Agreement



Name of each National metrology institutes and Accreditation bodies are based on our survey.
 For the latest information, please refer to our website. <https://www.mitutoyo.co.jp>

Traceability of Test Equipment



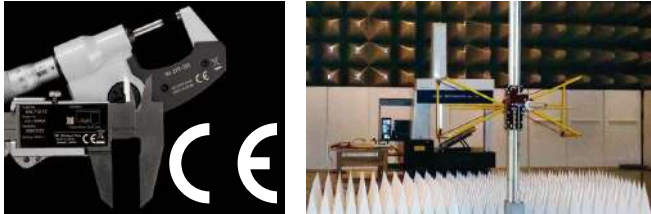
Note: This chart shows a simplified traceability system of a part of Mitutoyo products. Detailed traceability charts are published for each product. (As of August, 2020)

For the latest information, please refer to our website. <https://www.mitutoyo.co.jp>

Response to Safety and Environmental Protection Regulations

Conformance to CE Marking

In order to improve safety, each plant has programs to comply with the Machinery Directive, the EMC Directive, and the Low Voltage Directive. Compliance to CE marking is also met. CE stands for "Conformité Européenne". CE marking indicates that a product complies with the essential requirements of the relevant European health, safety and environmental protection legislation.



Conformity evaluation for CE marking (EMC Directives)

Major EU Directives relating to Mitutoyo products

| Name of EU Directive | Applicable range |
|---|--|
| Machinery Directive | At least one part of a machine that may cause injury to the human body if it moves due to movement of an actuator such as a motor. |
| EMC Directive (Electromagnetic Compatibility Directive) | A product that may produce electromagnetic radiation or which is influenced by electromagnetic radiation from outside. |
| Low Voltage Directive | Equipment (device) that uses AC voltage of 50 to 1000 V or DC voltage of 75 to 1500 V. |
| Radio Equipment Directive | All electrical and electronic equipment that intentionally transmits and receives radio waves at frequencies below 3000 GHz. |
| RoHS Directive | Restriction of the use of certain hazardous substances in electrical and electronic equipment. Restricted substances and maximum concentration values tolerated by weight: <ul style="list-style-type: none"> · Lead (0.1 %) · Cadmium (0.01 %) · Mercury (0.1 %) · Hexavalent chromium (0.1 %) · Polybrominated biphenyls (PBB) (0.1 %) · Polybrominated diphenyl ethers (PBDE) (0.1 %) · Bis (2-ethylhexyl) phthalate (DEHP) (0.1 %)* · Butyl benzyl phthalate (BBP) (0.1 %)* · Dibutyl phthalate (DBP) (0.1 %)* · Diisobutyl phthalate (DIBP) (0.1 %)* * Our products fall under Cat.9 "Monitoring and control instruments including industrial monitoring and control instruments". The restriction of DEHP, BBP, DBP and DIBP applies to products in Cat.9 from 22 July 2021. |

Precautions to be taken when handling button cells

Warning Failure to comply with the following could result in "death or serious injury".

- Do not place the cell within an infant's reach. If swallowed, contact a doctor immediately.
- Do not dismantle, heat or throw the cell in a fire.
- If alkaline solution leaks from the cell and contacts your skin or clothes, immediately wash the affected area with water. IF IN EYES, immediately rinse eyes cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing and summon immediate assistance from a doctor.

Caution Failure to comply with the following could result in "injury".

- Do not try to charge the cell as it is not chargeable. Install the cell with correct polarity. Failure to do so can cause cell leakage or burst resulting in damage to the instrument or personal injury.
- Do not solder directly to a cell.
- Do not use new and used cells together. Do not use different types of cells together.
- Do not use nor leave cells in direct sunlight nor in locations subject to high temperature or humidity.
- Avoid letting cells contact water.
- Ensure cells are inserted without coming into contact with metal parts of equipment.
- Read the equipment instruction manual and precautions carefully before using.
- Remove cells from equipment that will not be used for a prolonged period.
- In case of disposal, insulate (+) and (-) terminals of a cell by applying an insulating material.
- Follow the regulations of each country when disposing of batteries.

Response to WEEE Directive

The WEEE Directive*1 is a directive that mandates appropriate collection and recycling of electrical and electronic equipment waste. The purpose of this directive is to increase the reuse and recycling of these products, and seeks eco-friendly product design. To differentiate between equipment waste and household waste, a crossed-out wheeled-bin symbol is marked on a product. We will promote eco-friendly design for our products.

*1 WEEE Directive: Directive 2012/19/EU of the European Parliament and of the Council on waste electrical and electronic equipment.

Response to REACH Regulation

REACH Regulation*2 is a regulation governing registration, evaluation, authorization and restriction of chemical substances in Europe, and all products such as substances, mixtures and molded products (including accessories and packaging materials) are regulated. Chemical substances scientifically proven to be substances that are hazardous to human health and the global environment (Candidate List of substances of very high concern for Authorisation (CLS)) are prohibited to be sold or information concerning them disclosed is mandated in Europe.

We will actively disclose information about our products and provide replacement if we find our products contain any of the listed substances.

*2 REACH Regulation: Regulation (EC) No1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorization and Restriction of Chemicals

Response to Management Methods for Restricted Use of Hazardous Substances in Electrical and Electronic Product (China RoHS 2)

We set the environmental protection use period regulated by China RoHS 2 per product and label with the marks shown on the right, together with a list of the contained substances.



*3 The environmental protection use period does not indicate the product warranty period.

Meaning of Symbols

ABSOLUTE™

ABSOLUTE is a trademark of Mitutoyo Corporation.

ABSOLUTE Linear Encoder

This is an electronic measuring scale that provides a direct readout of absolute linear position when switched on, without needing to be zeroed or reset. Mitutoyo measuring instruments incorporating these scales provide the significant benefit of being always ready for measurement without the need of preliminary setting after switching on. There are three types of absolute linear encoders depending on whether the method used is electrostatic, electromagnetic, or optical. They are widely used in various measuring instruments as measuring systems endowed with enhanced reliability of measured values.

Advantages:

1. No count error occurs even if you move the slider or spindle extremely rapidly.
2. You do not have to reset the system to zero when turning on the system after turning it off*1.
3. As this type of encoder can drive with less power than the incremental encoder, the battery life is prolonged to about 3.5 years (continuous operation of 18,000 hours)*2 under normal use.

*1 Unless the battery is removed.

*2 In the case of the ABSOLUTE Digimatic caliper (electrostatic capacitance model).

IP Codes

These are codes that indicate the degree of protection provided (by an enclosure) for the electrical function of a product against the ingress of foreign bodies, dust and water as defined in IEC standards (IEC 60529: 2001) and JIS C 0920: 2003. [IEC: International Electrotechnical Commission]

| First characteristic numeral | Degrees of protection against solid foreign objects | |
|------------------------------|---|--|
| | Brief description | Definition |
| 0 | Unprotected | — |
| 1 | Protected against solid foreign objects of ≥ 50 mm and greater | A ≥ 50 mm object probe shall not fully penetrate enclosure* |
| 2 | Protected against solid foreign objects of ≥ 12.5 mm and greater | A ≥ 12.5 mm object probe shall not fully penetrate enclosure* |
| 3 | Protected against solid foreign objects of ≥ 2.5 mm and greater | A ≥ 2.5 mm object probe shall not fully penetrate enclosure* |
| 4 | Protected against solid foreign objects of ≥ 1.0 mm and greater | A ≥ 1.0 mm object probe shall not fully penetrate enclosure* |
| 5 | Protected against dust | Ingress of dust is not totally prevented, but dust that does penetrate must not interfere with satisfactory operation of the apparatus or impair safety. |
| 6 | Dust-proof | No ingress of dust allowed. |

* For details of the test conditions used in evaluating each degree of protection, please refer to the original standard.

| Second characteristic numeral | Degrees of protection against water | |
|-------------------------------|---|---|
| | Brief description | Definition |
| 0 | Unprotected | — |
| 1 | Protected against vertical water drops | Vertically falling water drops shall have no harmful effects. |
| 2 | Protected against vertical water drops within a tilt angle of 15° | Vertically falling water drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical. |
| 3 | Protected against spraying water | Water sprayed at an angle up to 60° either side of the vertical shall have no harmful effects. |
| 4 | Protected against splashing water | Water splashed against the enclosure from any direction shall have no harmful effects. |
| 5 | Protected against water jets | Water projected in jets against the enclosure from any direction shall have no harmful effects. |
| 6 | Protected against powerful water jets | Water projected in powerful jets against the enclosure from any direction shall have no harmful effects. |
| 7 | Protection against water penetration | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time. |
| 8 | Protected against the effects of continuous immersion in water | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for IPX7. |

IP65

IP66

IP67

IP is a trademark of Mitutoyo Corporation.



www.tuv.com
ID 000006883

About the TÜV Rheinland certification marks

All products with the marks shown on the left have passed the IP test carried out by the German accreditation organization, TÜV Rheinland.



Measuring Instruments Shipped with Inspection Certificate

Mitutoyo guarantees product quality as a leading precision measuring instrument manufacturer and ships measuring instruments with an inspection certificate that includes inspection data so that customers can use them with confidence.

Mitutoyo also calibrates the purchased measuring instrument and issues, for a fee, a calibration certificate that proves traceability to the relevant standard.

* For the meaning of the inspection marks shown at left, refer to the detailed description of each product.

MeasurLink ENABLED
Data Management Software by Mitutoyo

MeasurLink ENABLED marks

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink. MeasurLink® is a registered trademark of Mitutoyo Corporation in Japan and Mitutoyo America Corporation in the United States.

Main Unit Startup System

Installation of Main Unit Startup System

As a part of the enhancement of our export control system, the large CNC measuring machines (all the CNC Coordinate Measuring Machines, Vision Measuring Systems, and Form Measuring Machines) are now equipped with a Main Unit Startup System (relocation detecting system) before export.

This system is designed to take a machine out of operation upon detecting the mechanical shock that accompanies relocation. If you intend to relocate a measuring machine fitted with this system, please contact us beforehand so that our service engineers can assist you.

On the other hand, the system may be triggered in the event of a natural event such as a powerful earthquake. In this case, our service engineers will deal with the situation at the earliest opportunity.

Features of Mitutoyo Small Tool Instruments

High Accuracy Digimatic Micrometer SERIES 293 with resolution of 0.0001 mm



Resolution: 0.0001 mm

The High-Accuracy Digimatic Micrometer utilizes Mitutoyo's innovative 0.1 μ m resolution ABS (absolute) rotary sensor and high-accuracy screw machining technology to reduce the instrumental error to $\pm 0.5 \mu$ m, delivering higher accuracy (0.1 μ m) without sacrificing operability.



COOLANT PROOF

COOLANT PROOF™

COOLANT PROOF is the universal term for Mitutoyo Digimatic Small Tool Instruments that are not only resistant to dust and water ingress (rated to IP65 or better) but also to deterioration of materials due to contact with the cutting oil or coolant fluids in normal use.

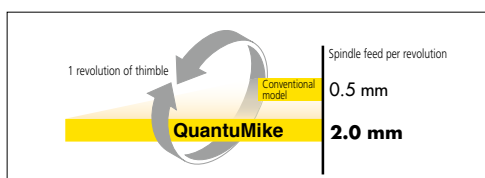
Note: Some types of aggressive cutting oil or coolant may degrade the sealing materials over time.



QuantuMike with 2 mm/rev Spindle Feed



Faster measurement is achieved by using a finer thread which feeds the spindle by 2 mm per revolution of the thimble instead of the standard 0.5 mm. This increase of spindle feed has been made possible thanks to new high precision thread-cutting and test techniques. In addition, the ratchet thimble mechanism helps ensure repeatable results and it enables easy operation- even when making measurement one-handed.



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New Products



Measurement Data Network System MeasurLink

Refer to pages A-5 to A-11 for details.

| | A | B | C | D | G |
|---|------------------|------------------|------------------|------------------|---------------------------|
| 1 | Displacement (1) | Displacement (2) | Displacement (3) | Displacement (4) | Measurement date and time |
| 2 | 0.281 | 0.162 | 0.121 | 0.051 | 2013/4/1 7:30:00 |
| 3 | 0.279 | 0.152 | 0.133 | 0.064 | 2013/4/1 7:30:05 |
| 4 | 0.265 | 0.149 | 0.142 | 0.089 | 2013/4/1 7:30:10 |
| 5 | | | | | |
| 6 | | | | | |



Measurement Data Management USB-ITPAK V2.1

Refer to pages A-22 to A-24 for details.



Digimatic Gage/PC Data Input Device USB Input Tool IT-016U/IT-007R

Refer to page A-14 for details.



Measurement Data Wireless Communication System U-WAVE

Refer to pages A-15 to A-21 for details.



Mini-Printer Equipped with Data Logging Function DP-1VA LOGGER

Refer to page A-25 for details.

A

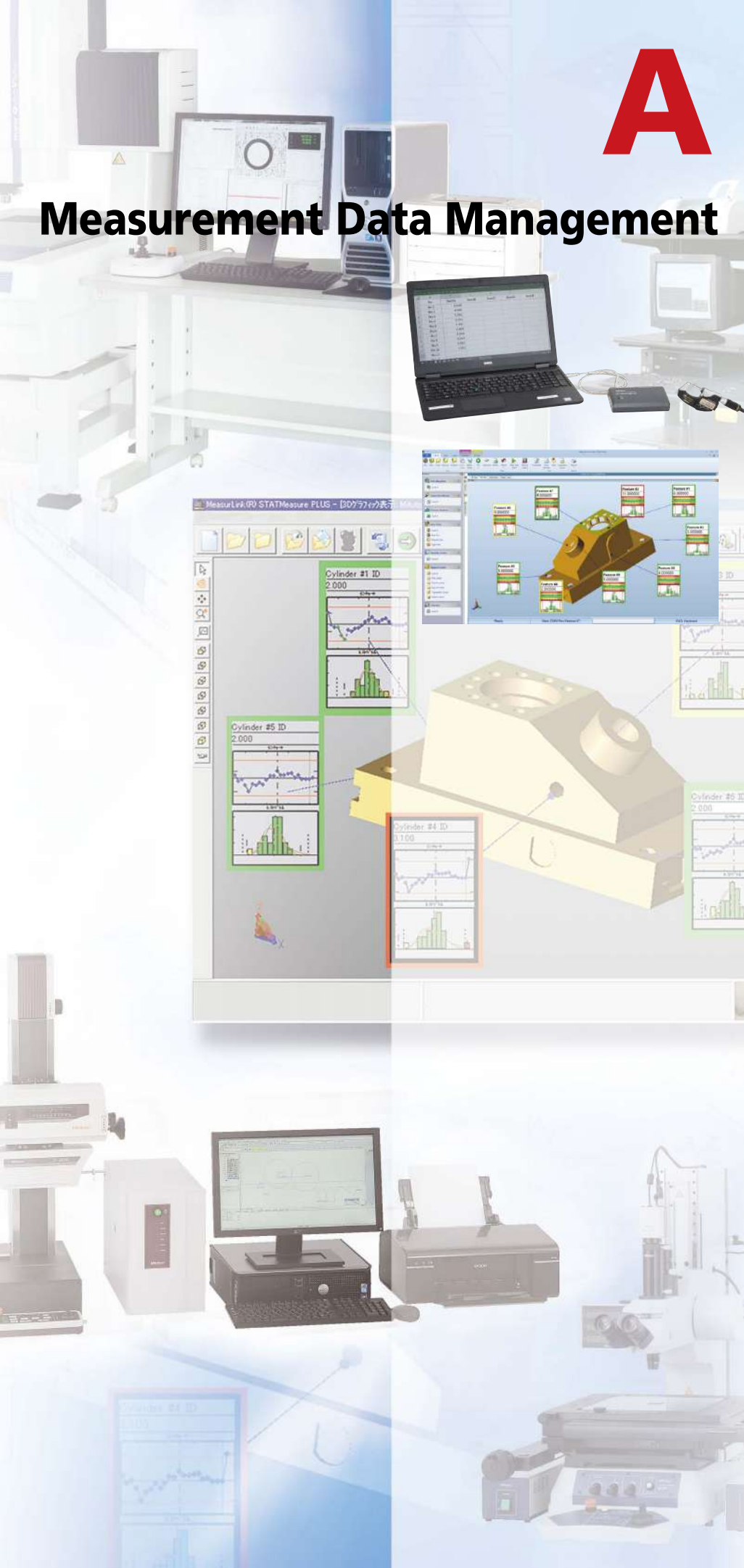
Measurement Data Management

Measurement Data Management

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Example of Measurement Data Management System

A system for recording and analyzing measurement results from various Mitutoyo measuring instruments for quality assurance purposes.

Implementation Step 1

Implementation Step 2

Recording measurement results

No more transcribing



DP-1VA LOGGER A-25

Equipped with the data logger function, it allows batch transfer of stored data to a PC with a USB cable.

Direct data input to a PC

Connecting cable-integrated USB-ITN



USB Input Tool Direct A-13

Lineup of two models with different output specifications IT-016U/IT-007R



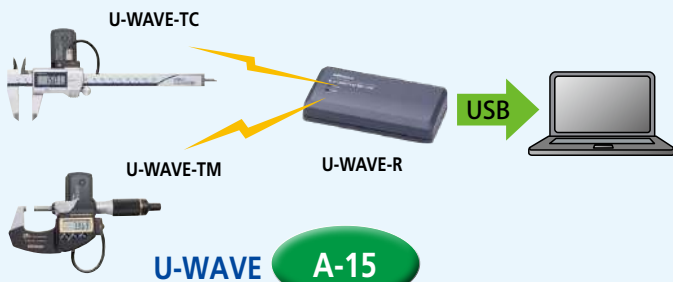
Input Tool Series A-14

Connect to a RS-232C interface PC with 4 channels and a sequencer



Multiplexer MUX-10F A-26

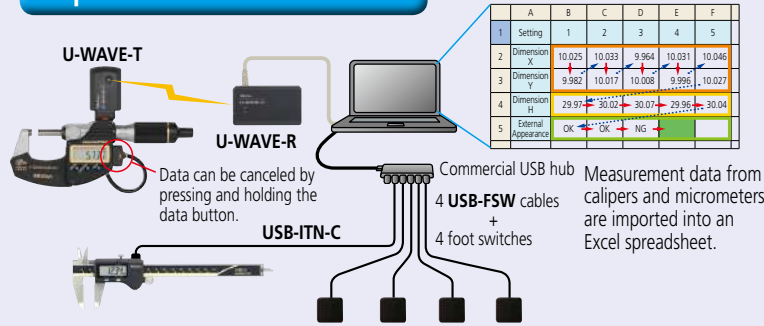
Wireless



U-WAVE A-15

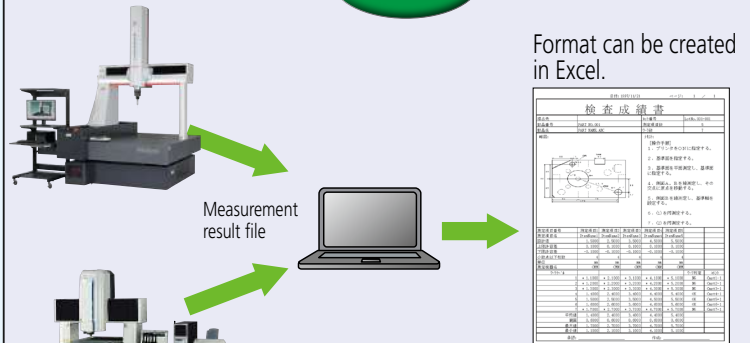
Software dedicated to inspection and quality control

Inspection certificate creation

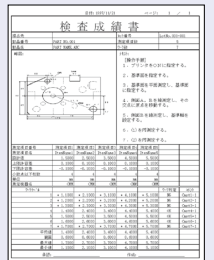


USB-ITPAK A-22

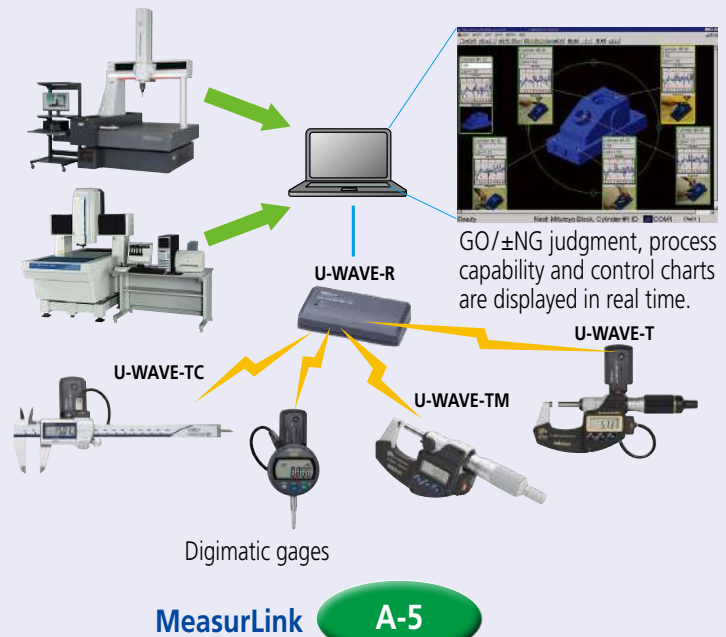
Measurement data from calipers and micrometers are imported into an Excel spreadsheet.



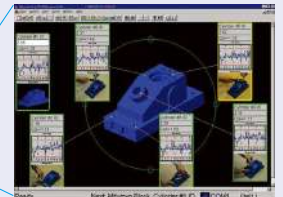
MeasureReport A-12



Statistical Process Control



MeasurLink A-5

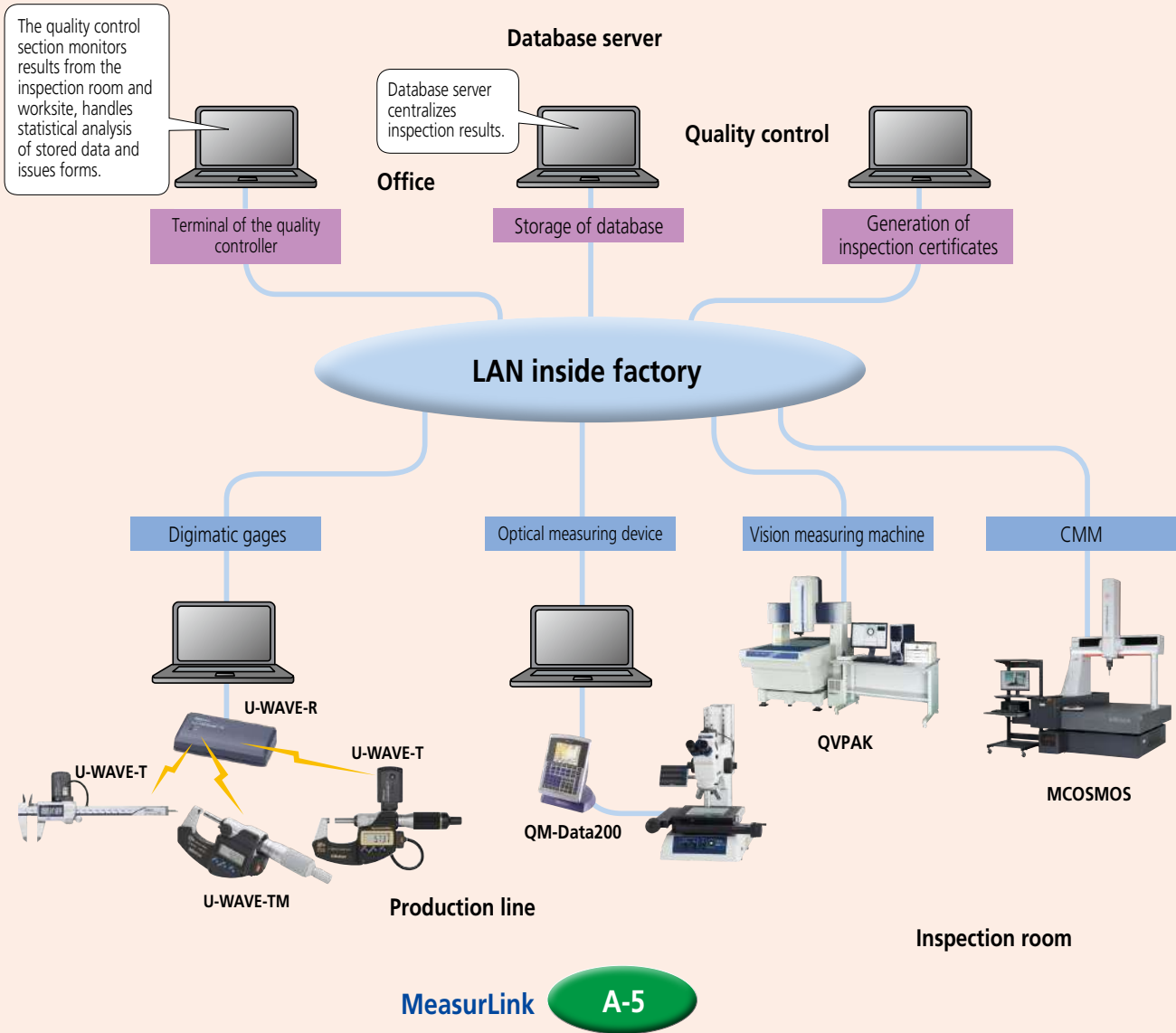


GO/±NG judgment, process capability and control charts are displayed in real time.

Implementation Step 3

Creating a quality control network covering a wide area within the factory

Unify management of the quality test using the network in the factory



Measurement Data Management

Convenient data collection tool and quality control software

Measurement Data Network System MeasurLink

• **MeasurLink** is a data management modular software system that enables collecting data from a wide range of Mitutoyo measuring tools and systems including Coordinate Measuring Machines.

Measurement data storage can be centralized by implementing a network system using a company LAN. Quality information such as checking, monitoring, analysis of the measurement results and creating inspection reports can be shared among separate offices to maximize efficiency.

Is the inspection record data utilized to solve quality-related problems?

Measurement results printed out in the inspection room

Measurement results manually entered in a check sheet on the machining line

Hard to identify problems with only numerical data

Hard to respond quickly since it takes time to enter and analyze data. Unsure about reliability of analysis.

Current problem

- Data scattered in various locations in the plant
- Numerical data not effectively utilized
- Lack of knowledge about statistical calculations
- Management using spreadsheet software
- Problems need to be tackled by the on-site person in charge

Isn't there any quicker, simpler and more reliable management method?

SPC management can be easily done by combining Mitutoyo measuring instruments and MeasurLink!!

The SPC management can be done with MeasurLink with a surprisingly simple procedure

MeasurLink Real-Time

Proactive management

Process capability

Range of dispersion

MeasurLink is an IoT platform for quality management that realizes "Visualization of quality"!!

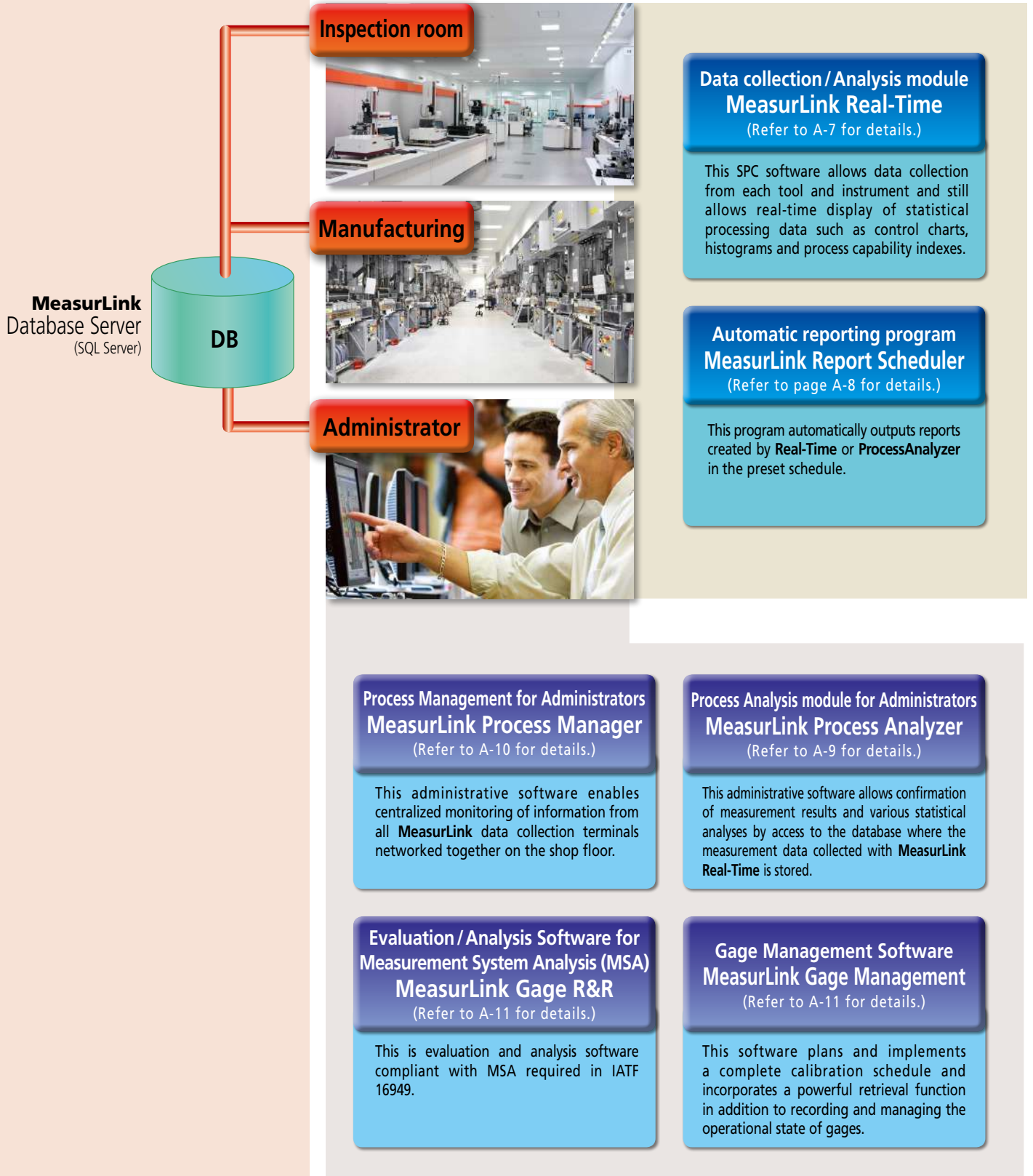
MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
MeasurLink



Refer to the **MeasurLink Brochure (E12028)** for more details.

- **Centralized monitoring from all MeasurLink data collection terminals networked together on the shop floor**

Enables easy networking through the Database Server (SQL Server). Comprising the following software packages as described below, data collection in the inspection room or on the shop floor and process management/analysis can be carried out depending on the application.



Measurement Data Management

Convenient data collection tool and quality control software

MeasurLink Data Collection/Analysis Software

Real-Time Standard (RT Std)

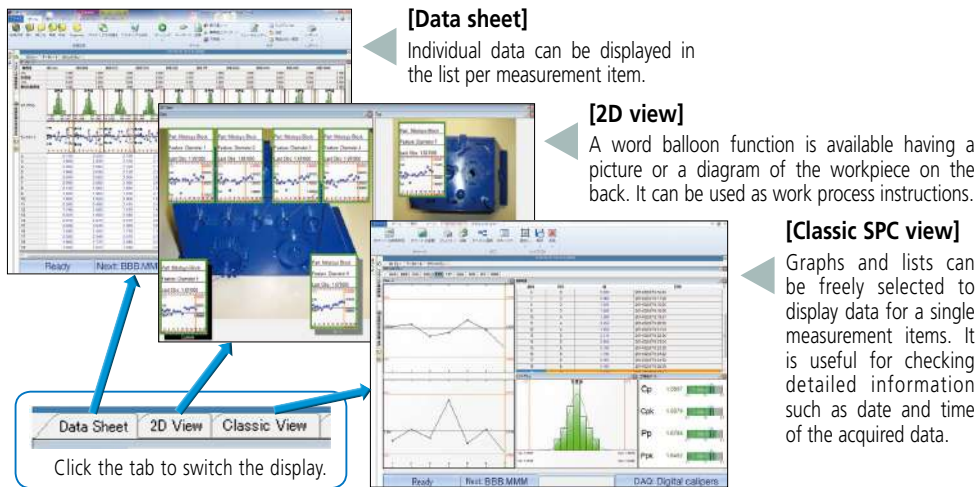
Real-Time Professional (RT Pro)

Real-Time Professional 3D (RT Pro 3D)

MeasurLink Real-Time is the Statistical Process Control (SPC) MeasurLink module that collects data from Mitutoyo and third-party measuring devices and systems to provide analysis functionality in real-time by displaying control charts or process capability indexes. Three versions are offered so that a customer can choose the version that best suits the requirements, from a standard version providing basic functionality through to the full-spec version offering data handling using Hoops 3D graphics. (Refer to Table 1 on the next page.)

• Various data views

The measurement results are displayed in various views, including statistical analysis results, data lists, and work process imaging. The display can be switched instantly according to the needs of the operator.



• Adding traceability information

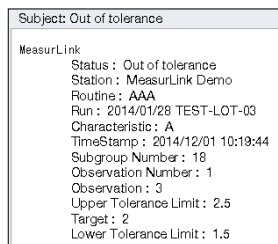
Traceability information for each workpiece can be added, for example, serial no., lot no., inspector name, machine no., or cause of problems and remedies.

This information can be used as search criteria when extracting data using the filtering function (**RT Pro/RT Pro 3D**) when a problem occurs.

• Alarm function

The operator is notified when an "Out of Tolerance" or "Out of Control Limit" situation occurs.

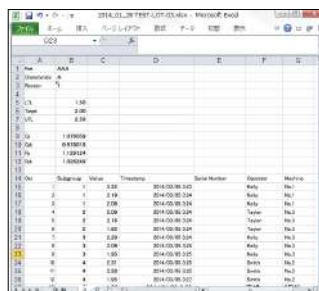
The method of notification can be selected from a pop-up window, E-mail (Fig. 1), or log file recording.



(Fig. 1) Alarm notification by E-mail

• Exporting data to an Excel file

Measurement data can be exported to an Excel file. This function is useful if the data needs to be used in a department that does not have **MeasurLink**. (Fig. 2)



(Fig. 2) Export to Excel

RT Std/RT Pro/RT Pro 3D Common Functions

- Connectable measuring instruments
 - Measuring tool with Digimatic output (equipped with PC data processing unit)
- [Supported interfaces]
 - Wireless (USB) **U-WAVE** (VCP)
 - Wired (USB) **IT-016U/USB-ITN** (VCP or HID)
 - Wireless (D-sub 9 pin) **IT-007R, MUX-10F, DP-1VA LOGGER**, and others
 - Various RS-232C devices (partially restricted)
- Screen display mode when collecting data
 - Classic SPC view
 - Data sheet
 - 2D view
 - Parts data sheet, etc.
- Statistical Analysis result [Chart]
 - Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tear chart, Box plot chart, Meter chart, Indicator bar, multivariate data control chart, etc.
- [Statistics]
 - Maximum value, Minimum value, Standard deviation, Average $\pm 3\sigma/4\sigma/6\sigma$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio, etc.
- Alarm function [Target items]
 - Out of tolerance
 - 1 point exceeds control limit line (following are related to management chart)
 - Consecutive 9 points on one side of center line
 - 6 points successively increasing or decreasing
 - Others including 8 judgment criteria for Shewhart control chart
- Adding traceability information
 - Measurement date (automatically added)
 - Serial No. (Keyboard entry)
 - Special causes and remedies
 - Selection from comment list registered as an option
 - Enter from keyboard when measuring classified title registered as an option (e.g. Lot No. LOT 001)
- Report print out function
 - Measurement values, analysis calculation results and various charts can be arranged to output according to requirements.
- Export function of measuring result
 - Excel format
 - CSV format
- Security function
 - Once the access authorization is set, it requires "User name" and "Password" input before the program will start. Data editing actions such as reference, entry and changes require authorization according to the user's role in order to preserve data reliability.
- Operation languages
 - 17 languages are supported: English, Japanese, French, German, Dutch, Spanish, Swedish, Polish, Italian, Turkish, Korean, Chinese (simplified/traditional), Czech, Finnish, Portuguese, Russian

MeasurLink Common Functions

- Operating environments
[Operating System]
Microsoft Windows 7 (32-bit/64-bit)
Microsoft Windows 8.1 (32-bit/64-bit)
(Microsoft Windows 8.1 RT is not supported)
Windows 10 (32-bit/64-bit)
(Windows 10 Mobile and IoT editions are not supported)
- [Data base]
Microsoft SQL Server 2017 Standard / Enterprise Edition
Microsoft SQL Server 2016 Standard / Enterprise Edition
Microsoft SQL Server 2014 Standard / Business Intelligence / Enterprise Edition

RT Pro/RT Pro 3D Common Functions

- Connectable measuring instrument
- Mitutoyo Measurement Data Management System (equipped with PC data processing unit)
- [Supported data processing software]
- CMM: **MCOSMOS V3.2** or later
- Vision System: **QVPAK V10.0** or later/**QSPAK V10.2** or later/**QSPAK MSE V3.1** or later/**QIPAK V4.1** or later
- Vision unit: **QSPAK VUE V4.1** or later
- Surface Roughness/contour instruments:
FORMTRACEPAK V5.311 or later
- Roundness instruments: **ROUNDPAK V7.0** or later
- Hardness testing machines: **AVPAK V2.0** or later
- Filter function
- Keyword items for data extraction
- Measurement data (year, month, day, time, week, etc.)
- Serial No.
- Traceability information (e.g. Inspectors, Machine No., etc.)
- Alarm item
- Import function for text data
- Default format files (mbf, dfq, etc.)
- Customize function
- A template can be created according to the ASCII file to be imported.

RT Pro 3D functions

- Screen display mode when collecting data
- 3D view

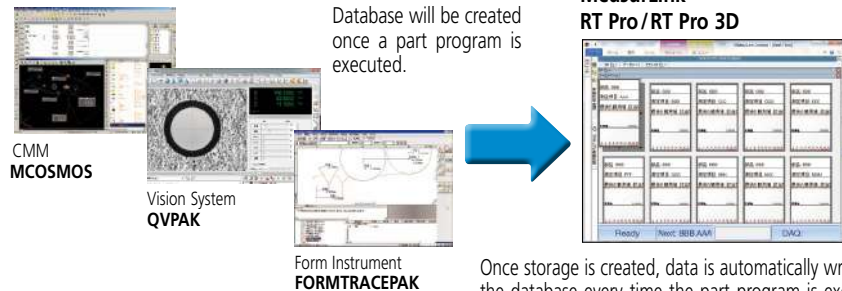
| Functions | | Data collection software | | |
|------------------------------|--------------------------------|--------------------------|------------------------|---------------------------|
| | | Real-Time Standard | Real-Time Professional | Real-Time Professional 3D |
| Collected data display | Classic SPC view | ✓ | ✓ | ✓ |
| | Data sheet | ✓ | ✓ | ✓ |
| | 2D view | ✓ | ✓ | ✓ |
| | 3D view (Hoops) | | | ✓ |
| Data extract | Filter | | ✓ | ✓ |
| Input from tools and devices | Measuring tools (RS-232C, USB) | ✓ | ✓ | ✓ |
| | Measuring instruments (DDE) | | ✓ | ✓ |
| Text input | Import | | ✓ | ✓ |

Table 1 Data collection/analysis software **Real-Time** functional comparison

• **Real-time Professional 3D** is a full-spec package. The feature to be measured can be displayed in detail using 3D CAD data.

• Automatic linking with part programs

Linking with part programs created in CMM or Vision Measuring Systems, data such as part no.; measurement item; nominal size; tolerance value and more can be loaded from a part program. A database to store all of the data is automatically configured when a part program is run.



• Filtering function

Required data can be easily extracted based on the date and time of the measurement, added comments, or alarms.

• Import function

Measurement data saved in ASCII files can be loaded. Also, a feature to customize a template for loading according to the format is provided.

• Real-time Professional 3D is a full-spec package

The feature to be measured can be displayed in detail using 3D CAD data.



[3D view]

3D graphics library HOOPS displays real view of the workpiece using an hsf file created from 3D CAD data. The displayed workpiece image can be freely turned, translated, or scaled so that you can get a clear view of the feature to be measured.

The word balloons and lead lines that display the measurement result and measured feature will move following the CAD data translation.

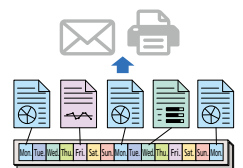
MeasurLink Automatic Report Generation Program MeasurLink Report Scheduler

Automatically generates a report created by the **Real-Time (RT Std/RT Pro/RT Pro 3D)** or **Process Analyzer (PA Lite/PA Pro)** modules, each of which is connected to the network according to a specified schedule.

The Use of MeasurLink Report Scheduler

• Typical applications

- Automatic generation of a weekly report specified from among last week's data.
- Automatic report generation by extracting only data with tag information about "tool replacement" (due to wear, breakage, etc.)
- Automatic generation of a daily report for each shift by filtering inspection record data on the basis of a shift



MeasurLink Report Scheduler common functions

• Report output destinations

- Printer, file, E-mail (as an attached document)

Measurement Data Management

Convenient data collection tool and quality control software

MeasurLink Optional Process Analysis Software for Administrators Process Analyzer Professional (PA Pro)

Process Analyzer is an optional software package provided for administrators who are authorized to access the database storing measurement data collected by MeasurLink **Real-Time** for the purpose of checking and analyzing measurement results.

• **PA Pro** is a full-spec package that provides additional data check and analysis capability.

Can also perform various analyses by filtering, data processing, etc., in addition to data checking.



The same data displayable by data collection software can be displayed, including measurement results, charts, and statistical calculation results with the look and feel of Windows Explorer.

• Filtering function that allows data extraction and grouping

Data can be extracted or grouped by selecting the date and time and other traceability information as keywords.

Example) Filtering data by an operator name Displays statistical analysis result in charts (Xbar-R, for example).



Filtering item selection menu

Result of filtering in the chart

Example) Grouping by Machine No. Cp, Cpk comparison



Item selection for grouping

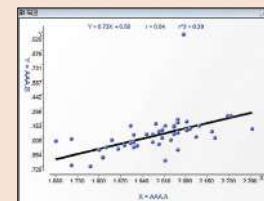
Cpk value and bar graph per machine

PA Pro Functions

- Result display
 - Classic SPC view
 - Data sheet
 - 2D view
 - Parts data sheet, etc.
- Statistical Analysis result [Chart]
 - Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tear chart, Box plot chart, Meter chart, Indicator bar, multivariate data control chart, etc.
- [Statistics]
 - Maximum value, Minimum value, Standard deviation, Average $\pm 3\sigma/4\sigma/6\sigma$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio, etc.
- Report print out function
 - Measurement values, analysis calculation results and various charts can be arranged to output according to requirements.
- Exporting function of measurement result
 - Excel format
 - CSV format

PA Pro Functions

- Statistical analysis result [Chart]
 - Scatter plots: The relationship between two items can be plotted.



- Filter function
 - Keyword items for data extraction
 - Measurement data (year, month, day, time, week, etc.)
 - Serial No.
 - Traceability information (e.g. Inspectors, Machine No., etc.)
 - Alarm item
- Data processing
 - Data file merging, Copying
 - Editing
- Data processing capability
 - Old data can be displayed extracting from the list of the data collection software.
- Electronic certification function
 - Conforms to FDA 21CFR PART11

| Function | Process analysis software | |
|-----------------|-------------------------------------|---|
| | Process Analyzer Professional | |
| Result display | Classic SPC view | ✓ |
| | Data sheet | ✓ |
| | 2D view | ✓ |
| Data extract | Filter | ✓ |
| Data processing | Data file merging, Copying, Editing | ✓ |
| Masking | Archive data | ✓ |

Loggable Event

- Start and end of measurement
- Recollection/change of measurement data
- Irregular value occurrence (Out of tolerance, out of management, sequence, tendency, etc.)
- Unmissable causes
- Change of process capability index (Acceptance to rejection/Rejection to acceptance)

Contents of Call-out Display

- Station name (terminal name of each measuring instrument)
- Inspection procedure (measuring procedure name for each part)
- Final revision date/time (data input time, etc.)
- Measured item information: Displays the designated number of items from the top
 - 1) Inspection record file name*
 - 2) Measurement item*
 - 3) Process capability index* (Cp, Cpk, Pp, Ppk, etc., multiple selection available)
- * Measurement items are sortable (ascending, descending order)

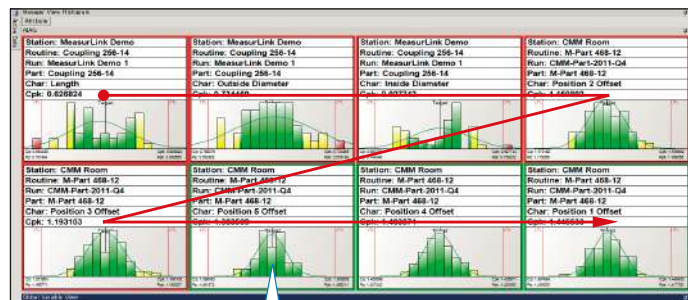
MeasurLink Process Management for Administrators

Process Manager

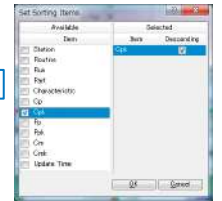
MeasurLink Process Manager enables centralized monitoring of real-time measurement information and checking of detailed information from all **MeasurLink** data collection terminals networked together on the shop floor. Measurement results can be checked in real-time to enable minimizing defects without visiting the shop floor. In addition to simple GO/NG judgments, use of tools such as Manager View, histograms, process capability indexes, etc., make it possible to find abnormal process trends easily.

• Manager View

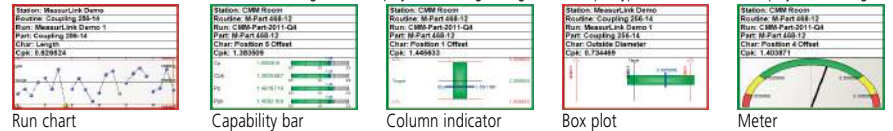
Displays various types of charts as an at-a-glance guide. The administrator can narrow down all items of data currently being measured into a specific monitoring range of those of critical importance or sort those data (in ascending or descending order) on the basis of process capability index.



Possible to sort charts in the view and narrow down the monitoring range.



Selects various charts such as run charts and histograms to display as an at-a-glance guide. (Multiple types of charts can be displayed in Manager View.)



• Global measurement value view

| Station | Station | Run | Part | Characteristic | Cpk | Spk | Spk |
|----------|-----------------|-----------------|-----------------|--------------------|----------|----------|----------|
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Length | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Outside Diameter | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Inside Diameter | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 2 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 3 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 4 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 5 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 6 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 7 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 8 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 9 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 10 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 11 Offset | 0.828824 | 0.828824 | 0.828824 |
| 00110120 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 12 Offset | 0.828824 | 0.828824 | 0.828824 |

Displays bar graphs that can determine good or bad process capability indexes at a glance. This allows the administrator to sort all current measurement data (in ascending or descending order) on the basis of process capability index, measurement date and time, part name, etc.

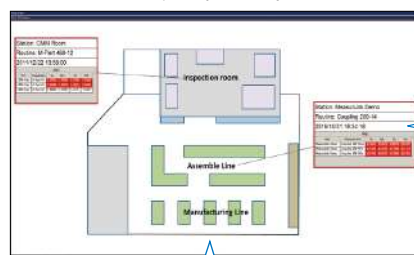
• Log view

Displays various types of events that occur during measurement. This allows the administrator to grasp the state of measurement operation (measurement start/termination, etc.) and the occurrence of an abnormal event (out-of-tolerance, etc.) for all current measurement data.

| Time/Date | Station | Run | Part | Characteristic | Observation Number | Observation | Abnormal Cause | Corrective Action |
|---------------------|-----------------|-----------------|-----------------|--------------------|--------------------|-------------|----------------|-------------------|
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Length | 01 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Outside Diameter | 02 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Inside Diameter | 03 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 2 Offset | 04 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 3 Offset | 05 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 4 Offset | 06 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 5 Offset | 07 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 6 Offset | 08 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 7 Offset | 09 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 8 Offset | 10 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 9 Offset | 11 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 10 Offset | 12 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 11 Offset | 13 | 0.828824 | | |
| 2016/10/31 18:34:18 | MeasurLink Demo | MeasurLink Demo | Coupling 256-14 | Position 12 Offset | 14 | 0.828824 | | |

• Plant view

Displays a process capability index for each measuring instrument on the plant layout drawing. This allows the administrator to quickly identify the location where an abnormality has occurred.



Displays graphics files (bmp, jpg, gif, png) in the plant layout drawing in the background.

Call-out boxes with a leader can be arranged on an instrument-by-instrument (station-by-station) basis in conformity with the plant layout drawing in the background.

Call-out for each station

| Run | Characteristic | Cp | Cpk | Pp | Ppk |
|-----------------|-----------------|----------|----------|----------|----------|
| MeasurLink Demo | Coupling 256-14 | 0.828824 | 0.828824 | 0.828824 | 0.828824 |
| MeasurLink Demo | Coupling 256-14 | 0.828824 | 0.828824 | 0.828824 | 0.828824 |
| MeasurLink Demo | Coupling 256-14 | 0.828824 | 0.828824 | 0.828824 | 0.828824 |



Measurement Data Management

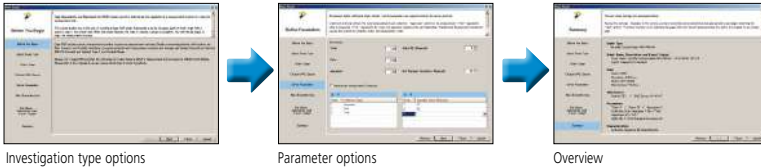
Convenient data collection tool and quality control software

MeasurLink Evaluation / Analysis Software for Measurement System Analysis (MSA) Gage R&R

This is evaluation and analysis software conforming to Measurement System Analysis (MSA) required in IATF 16949. Implementing MSA evaluation can be performed easily and quickly. ISO/TS 16949 requires that a proper measurement system be achieved by analyzing the accuracy of each instrument and variations in operator effects on repeatability using statistical methods.

• Automatic calculation of MSA evaluation results

This allows the operator to simply input an evaluation method/evaluation condition and measurement data with the Wizard function. The operator can implement MSA evaluation simply by selecting an "investigation type option", "gage option", "data input source option", "parameter option", etc.



• Evaluation method compliant with MSA (fourth edition)

The software can implement evaluation using the following methods compliant with MSA (Measurement System Analysis).

- 1) Measurement value tolerance gage R&R variance analysis method
- 2) Measurement value tolerance gage R&R range & average method
- 3) Measurement value branching gage R&R variance analysis method
- 4) Measurement value branching gage R&R average & range method
- 5) Measurement value range method
- 6) Measurement value simplified method
- 7) Measurement value MSA4
- 8) Deviation
- 9) Linearity
- 10) Stability

• Registration of gage-specific information

1. Registration of information on gages within the system
This allows registration of gage information on the following items and association with evaluated results.

Registration items: Gage name, maker, model, resolution, unit, measuring range, etc.

2. Information link between MeasurLink Gage Management and this software

This software can use gage information that has been registered in **Gage Management** directly as options.

Additionally, since gage R&R evaluation results are also linked with gage information, the schedule of gage R&R expiry dates can be managed by Gage Management.

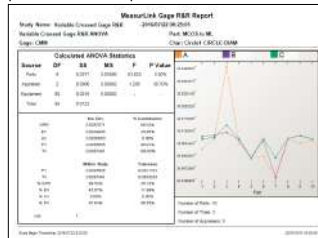
• Analysis chart view

Various charts such as the control chart are effective for analysis/judgment on variations due to operator, the adequacy of gage accuracy, etc., and remedies for problems.



• Output of results as a report

Evaluated results and charts can be printed as a report.



MeasurLink Gage Management Software Gage Management

This software can plan and implement a reliable calibration schedule with a powerful retrieval function in addition to recording and controlling the status of gages. It enables simple recording of gage usage state (operation, storage, calibration, gage R&R, repair and out-of-service) to speedily understand the current location and status of all gages. Common gage information can be viewed from all networked terminals in which this network-compatible software has been installed. Gage information can be shared between software packages linked to **MeasurLink Gage R&R**.

• Creation of a list of calibration-targeted gages from the gage management table

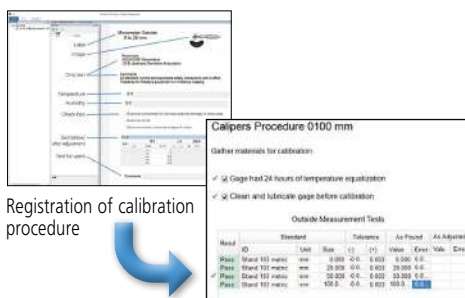
The target gages are retrieved from a variety of search items such as gage ID, gage type, model, maker, distributor, calibration date, current usage state and location to create the list.



Gage management table

• Registration and running a calibration procedure

Allows simple registration of the calibration procedure for each gage and implementation of the calibration.

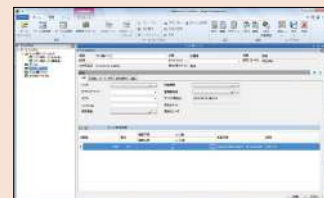


Registration of calibration procedure

Calibration run

• Confirmation of detailed gage information

Allows confirmation of detailed information on individual gages. The software allows you to display a list of gages depending on "Calibration Overdue", "Next Month Due", etc., by setting a calibration date and confirm detailed information on the calibration history of gages.



Display of detailed gage information



Display of gages listed depending on calibration date



Display of calibration history

Main specifications of MeasureReport

- Document creation:
 - Automatic creation of template sample style (Number of items × number of workpieces specified)
 - GO/±NG Judgment:
 - Tolerance judgment (marked in NG value)
 - Workpiece judgment (OK or NG in judgment column)
 - Statistical analysis: mean, maximum, minimum, range, standard deviation, Cp, Cpk, fraction defective, number of defectives, etc. 15 items in total.
 - Capacity:
 - 1) Measurement result file conversion
 - 2) On-line data input
 - Max. 200 items × Max. 2,000 workpieces
 - 3) MeasurLink database import
 - Max. 200 items × Max. 2,000 workpieces or
 - Max. 2,000 items × Max. 200 workpieces
 - File combined:
 - A maximum of 10 measurement files can be specified and both measurement items and workpieces can be combined respectively.
 - Printing and saving of inspection table:
 - Automatic printing and saving in Excel format
 - Comment output to the inspection table:
 - 30 items including part number and lot number can be input.
 - Workpiece drawing output to the inspection table:
 - Image files (bmp, jpg) can be displayed in arbitrary positions.
 - Others:
 - Decimal point digit justification, error display, automatic page break
 - File conversion: Supported file formats
- <CMM>
- 1) **MCOSMOS** ASCII file (**Geopak-3**)
 - 2) **MPK2700** statistic file (Binary format)
 - 3) **MPK2700** ASCII file (Text format)
- <Vision Measuring Systems>
- 1) QUICK VISION **QVPAK-QV Report**
 - 2) QUICK SCOPE **QSPAK** measurement result file
 - 3) QUICK IMAGE **QIPAK** measurement result file
- <Optical Instruments>
- 1) Vision Unit **QSPAK** measurement result file

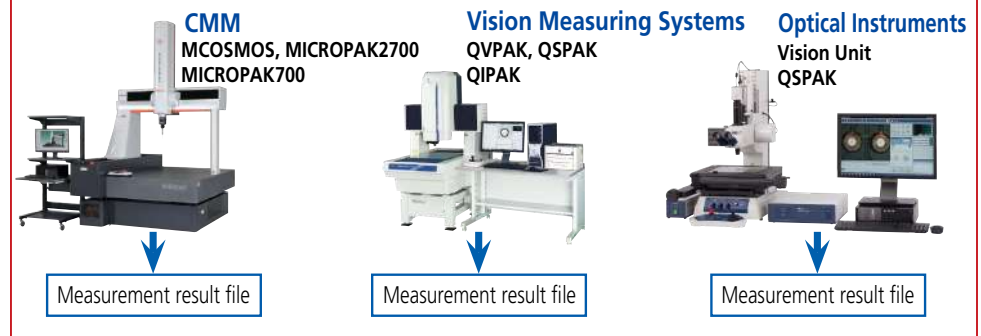
Measure Report operation environment (recommended)

- OS: Windows 2000
 - Windows XP
 - Windows Vista (32-bit)
 - Windows 7 (32-bit/64-bit)
 - Windows 10 (64-bit)
 - Microsoft Excel: 2000/2002/2003/2007/2010/2013/2016/2019
- (Only 32-bit edition is available regardless of Windows version. It doesn't work on 64-bit Windows.)
- CPU: Processor of 1 GHz or more
 - Memory: 2 GB or more
 - Hard disk: 3 GB or more free space
 - Display: 1024×768 or larger
 - Drive: CD-ROM or DVD drive (required for installation)

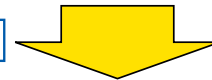
Data Conversion Program into Inspection Certificates in Excel Format MeasureReport

- Data from a measurement result file generated with a CMM, vision measuring machine or other machine can be output to an inspection table generated with Excel. Data from multiple measuring machines can be combined into a single inspection table (up to 200 measurement items).
- A customized format can be created for an inspection sheet using simple editing (copy & paste, etc.) by using a sample format as the template.
- The computation function is available for tolerance judgment, workpiece judgment, statistical calculation and other types of processing at inspection-table generation time.

Create inspection table from measurement result file for each measuring machine (PC data processing)



Measurement result file conversion



Select and extract data, design value, tolerance value, etc., and output in specified Excel format.

Example of inspection table.

Excel inspection table creation macro program

- Measurement result file, data loaded from on-line communication, or data specified from database file of MeasurLink can be output to an Excel table.
- Original format can be created by simple editing with sample style as a template. Desired template style can be automatically created by specifying required number of items and workpieces.
- Tolerance judgment (*marked in NG data), workpiece judgment (OK or NG is indicated in judgment column), statistical analysis, page break are automatically processed.
- Data from several measuring machines can be combined in one inspection table.

Measurement Data Management

Convenient data collection tool and quality control software

Digimatic Gage/PC Data Input Device USB Input Tool Direct USB-ITN

A data collection tool that offers simple and popular operability (HID connection) and optional software to input data to Microsoft Excel at a reasonable price. A more sophisticated way to improve operational efficiency.

Use USB-ITN standalone as a dedicated interface for Digimatic indicators compatible with HID keyboard devices.

In common with the popular model IT-016U, this device is capable of entering measurement data to Microsoft Excel or a memo pad. Application example: using USB-ITN standalone to input data while selecting the data entry point flexibly during a measurement whose procedures cannot be determined in advance (such as the inspection of items or trial products with few measurements or without repeated procedures).

Using USB-ITN in combination with dedicated options

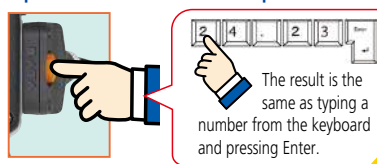
Refer to pages A-22 to A-24 for details.

If you need more than just the ability to load the measurement data to Excel, the optional software **USB-ITPAK** can create a data input procedure to an Excel sheet to improve the operational efficiency of repeated inspections. Application example: using USB-ITN in combination with **USB-ITPAK V2.1** to improve the operational efficiency of daily inspections such as sampling tests or complete inspections of mass-produced product.



USB-ITN

Input data to the PC with the push of a button.



Just press the data button to send the displayed value to the PC.

Can be connected directly to a USB port on a PC with 1 cable.

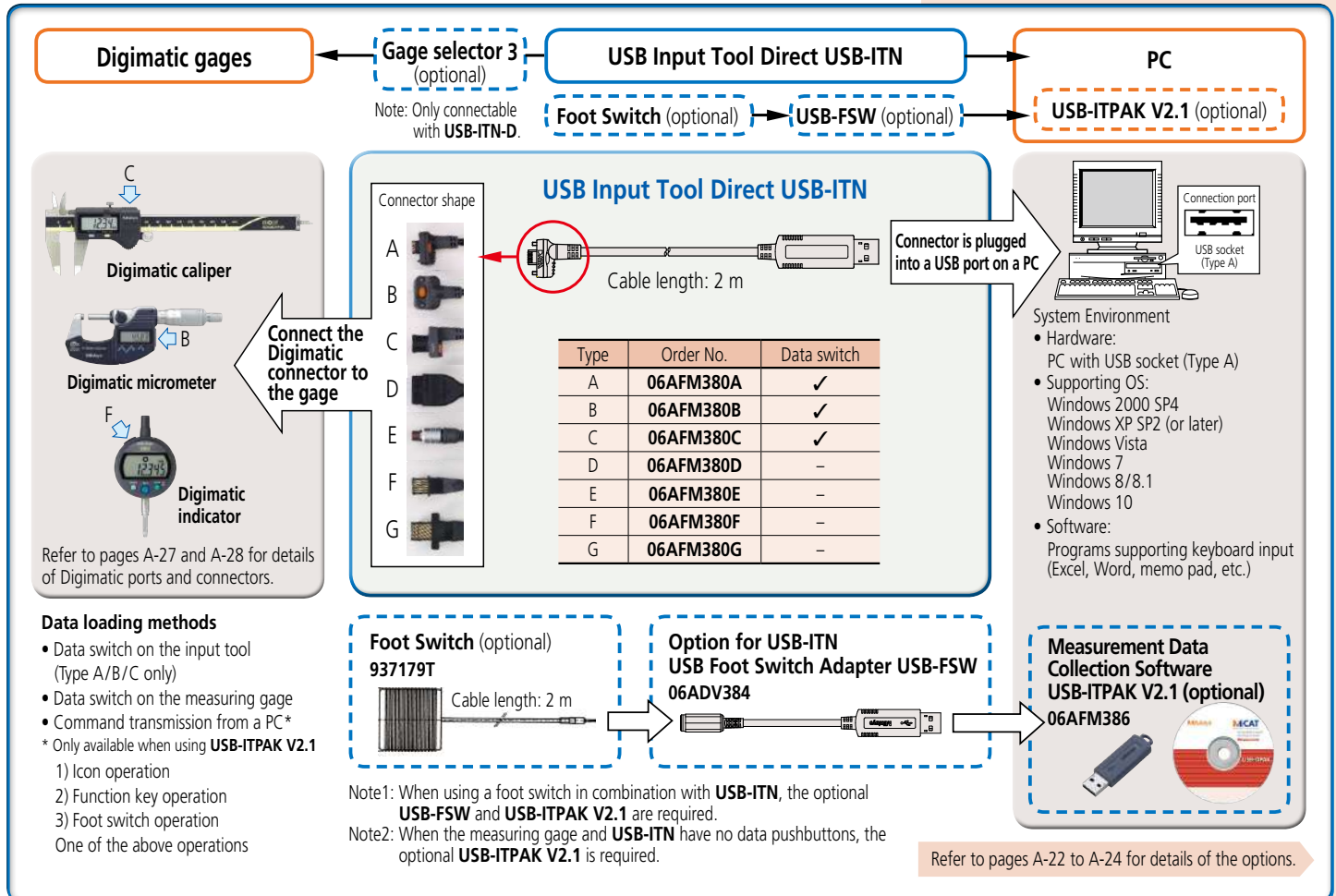
USB Input Tool Direct
USB-ITN-B

USB Input Tool Direct is automatically recognized as a HID* keyboard device (standard driver of Windows) by connecting it to a USB port.
* Human Interface Device

Main specification

- Output compatibility: USB1.0 or USB2.0
 - Supporting driver software: Switchable between 2 items below
 - 1) When using standalone: HID keyboard device*
 - 2) When using with **USB-ITPAK V2.1**: Virtual COM port (VCP)
 - Communication speed: 12 Mbps (Full Speed)
 - Power supply: USB bus power
 - Mass: 59 g
 - USB2.0 certificate
 - Conforms to EU EMC Directives.
- * Since this device is compatible with Windows standard driver software, dedicated driver software is not required.

USB-ITN System Configuration



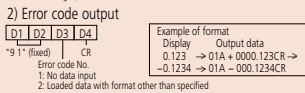
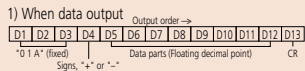
Refer to pages A-22 to A-24 for details of the options.

Specifications of IT-007R RS-232C Communication

- Output specification: RS-232C compliant
- Communication method: Full duplex
- Communication speed: 2400 bps (fixed)
- Bit configuration: Start bit 1
Data length 8
(Most significant bit, 0 (fixed))
Parity, None
Stop bit 1

Flow control: None
Home position: DCE (modem definition)

• Data format



• Data request signal

Data can be output by transmitting a character from the PC.

• Connector specification and power supply from the PC

This product operates while accumulating the power supplied from the PC. A second or more input interval is required.

| Pin No. | Symbol | in/out | Description of functions |
|---------|--------|--------|---|
| 1 | (N.C.) | — | No connection |
| 2 | RXD | OUT | Data output from this product to the PC |
| 3 | TXD | IN | Data input from the PC to this product |
| 4 | DTR | IN | +12 V power supply from the PC* |
| 5 | GND | — | Ground |
| 6 | DSR | OUT | Not used |
| 7 | RTS | IN | +12 V power supply from the PC* |
| 8 | CTS | OUT | Not used |
| 9 | (N.C.) | — | No connection |

* "4" and "6", "7" and "8" are connected with each other inside this product.
When connecting to a sequencer, a power supply is required.
Input voltage: Supplied in the range 6 V to 16 V
Power supply terminal: Supplied to pins 4 and 7

Measurement Data Input Unit Input Tool SERIES IT-016U/IT-007R

USB Keyboard Signal Conversion Type IT-016U

The IT-016U, a popular USB input tool that enables easy data recording. Allows you to perform inspection work more efficiently.

The IT-016U is equipped with a connector socket for a push-button or switch-foot operation.

Functional improvements include:

- A bigger, easy-to-press data switch. Size increased from $\phi 4$ mm to $\phi 18$ mm. Durability of the push button increased from 1 million to 10 million operations.
- May be used with optional software **USB-ITPAK V2.1**. Enables efficient routine inspection work, for example, in mass production.

RS-232C Communication Conversion Type IT-007R

Input tool for RS-232C communication best suited for communication control of the software!

Control is available by transmitting data request commands via RS-232C.

For example, production engineers can create communication programs to load the measurement data by transmitting a command from the PC.

This product is a compact and low-cost RS-232C communication interface, which is convenient when it is installed in a machine tool or dedicated device to feed back measurement data.

Main Specifications of IT-016U

Supported driver software: Changeable between two types

Output specification: USB2.0 or USB1.0

1) Stand-alone: HID keyboard device*

2) Using **USB-ITPAK V2.1**: Virtual COM port (VCP)

Communication speed: 12 Mbps (Full Speed)

Power supply: USB bus power

USB2.0 certificate

Conforms to EMC Directives

* This product is compatible with the standard driver software for Windows. No dedicated driver software is required.



IT-016U



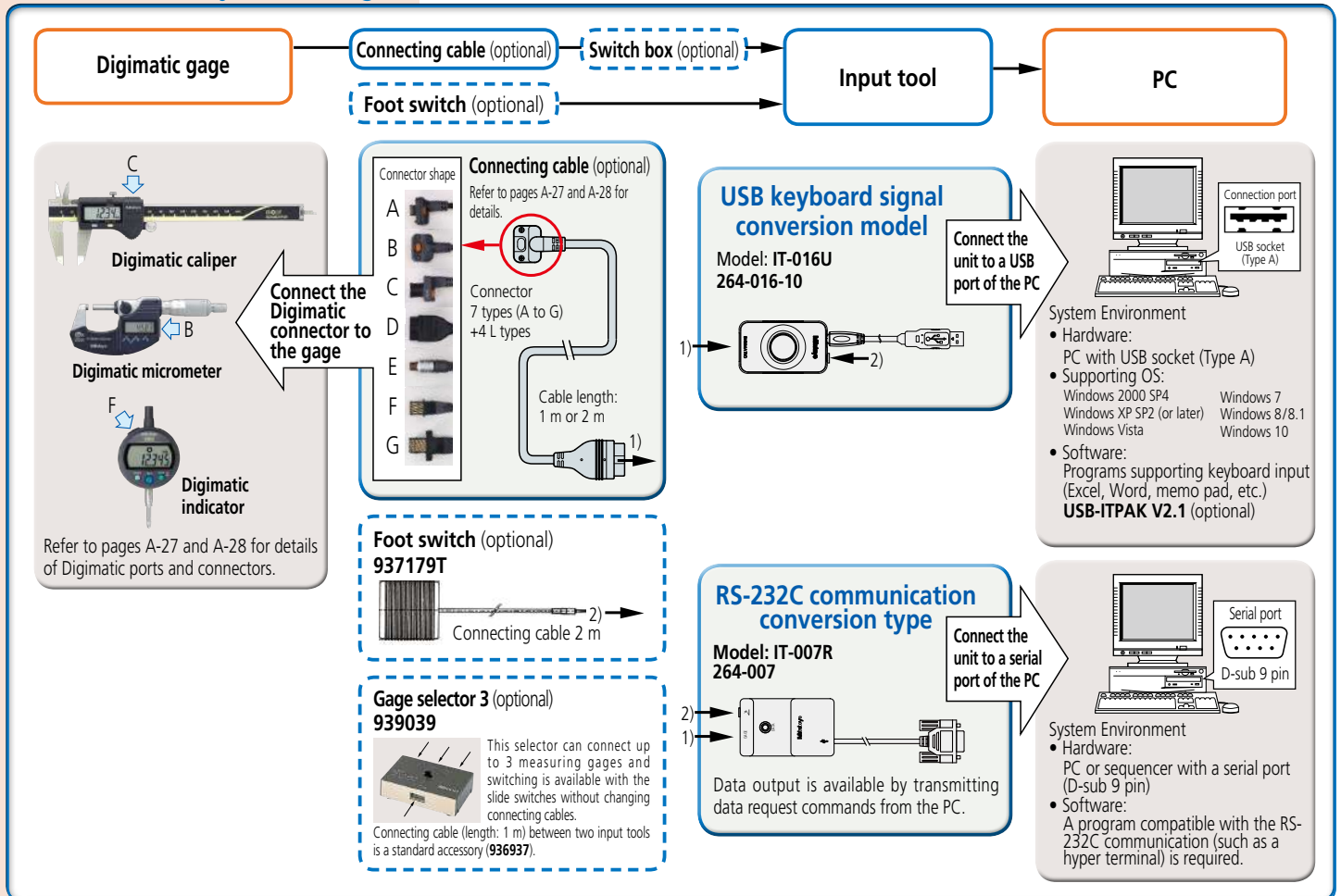
IT-007R



The HID* keyboard device (standard driver software for Windows) is **automatically recognized** when connected to a USB port.

* HID (Human Interface Device)

IT-016U/IT-007R System Configuration



Measurement Data Management

Convenient data collection tool and quality control software

Measurement Data Wireless Communication System

U-WAVE-TCB/TMB (Mitutoyo Bluetooth® U-WAVE)

- Bluetooth® communication allows for wireless transmission of measurement data from digimatic micrometers and calipers to PCs, smartphones, tablets and other such terminals.
- More compact and thinner for a better fit with Digimatic gages, and featuring improved operability and performance inherited from its predecessor, U-WAVE-TCB/TMB is now available with Bluetooth® wireless technology. No receiver is required, and one PC can connect up to seven units of Mitutoyo Bluetooth® U-WAVE. Dust/water-proof models are also available for arduous shop floor usage.
- Bluetooth® communication not only allows cost reduction, as it does not require the conventional dedicated receiver unit, but it also improves operability.
- The application software for transferring measurement data to smartphones and tablets, or the application **U-WAVEPAK-BM** (English version only) is available at app stores (Google Play, Apple Store) for download.

U- WAVEPAK-BM



- **U-WAVEPAK-BW**, the computer communication software for transferring measurement data to computer software, is available for download from our company's website.

<https://www.mitutoyo.co.jp/contact/products/u-wave/>



Bluetooth® communication not only allows cost reduction, as it does not require the conventional dedicated receiver unit, but it also improves operability.

U-WAVE-TCB/TMB (Mitutoyo Bluetooth® U-WAVE) System Communication Specifications

• Wireless Communication Specifications

| | |
|---------------------------------|---|
| Wireless communication | Bluetooth® 4.2 Low Energy |
| Wireless communication distance | Approx. 16 m (line of sight) Approx. 10 m (in a factory environment) |
| Transmission output | 3.2 mW (5 dBm) or less (Class2) |
| Modulation method | FH-SS (Frequency-hopping spread spectrum) |
| Communication frequency | 2.4 GHz band |

Note1 To use **U-WAVE-TCB/TMB**, conformity to the radio law of each country is required. Please contact your dealer or nearest Mitutoyo sales office.

Note2 **U-WAVE-TCB/TMB** is not compatible with **U-WAVE fit**, for which communication specifications are different.

Optional Accessories

| | |
|--------------------------|--|
| Model No. | USB-ITPAK V2.1 |
| Order No. | 06AFM386 |
| Compatible OS (Windows) | 10 (64 bit) |
| Compatible Excel version | 2016 (The operation with Excel for MAC OS is not guaranteed.) |

Note: Refer to pages A-22 to A-24 for details of **USB-ITPAK V2.1**.

USB-ITPAK V2.1



A USB dongle must be connected to the PC running the software.



Refer to the Measurement Data Wireless Communication System **Mitutoyo Bluetooth® U-WAVE** Brochure (**E12048**) for more details.

Measurement Data Wireless Communication System U-WAVE-TMB/TCB (Mitutoyo Bluetooth® U-WAVE)

Transmitter / Receiver



SPECIFICATIONS

| Order No. | For Digimatic micrometers | | For Digimatic calipers | |
|---------------------------|---|------------------------------------|---|------------------------------------|
| | 264-626 | 264-627 | 264-624 | 264-625 |
| Model | U-WAVE-TMB (IP67 type dust/water-proof) | U-WAVE-TMB (buzzer type) | U-WAVE-TCB (IP67 type dust/water-proof) | U-WAVE-TCB (buzzer type) |
| Protection level | IP67 | N/A | IP67 | N/A |
| Data reception indication | LED | LED, buzzer | LED | LED, buzzer |
| Power supply | Lithium battery CR2032x1 | | | |
| Battery life | Approx. 1 year under normal conditions of use, but varies according to usage. | | | |
| Mass (g) | 18 | | | |

U-WAVE fit
U-WAVE-TM compatible
Digimatic micrometers/heads

| Compatible micrometers | Compatible heads | Compatible calipers | Compatible units |
|------------------------|------------------|---------------------|------------------|
| 100mm | 100mm | 100mm | 100mm |
| 150mm | 150mm | 150mm | 150mm |
| 200mm | 200mm | 200mm | 200mm |
| 250mm | 250mm | 250mm | 250mm |
| 300mm | 300mm | 300mm | 300mm |
| 350mm | 350mm | 350mm | 350mm |
| 400mm | 400mm | 400mm | 400mm |
| 450mm | 450mm | 450mm | 450mm |
| 500mm | 500mm | 500mm | 500mm |
| 550mm | 550mm | 550mm | 550mm |
| 600mm | 600mm | 600mm | 600mm |
| 650mm | 650mm | 650mm | 650mm |
| 700mm | 700mm | 700mm | 700mm |
| 750mm | 750mm | 750mm | 750mm |
| 800mm | 800mm | 800mm | 800mm |
| 850mm | 850mm | 850mm | 850mm |
| 900mm | 900mm | 900mm | 900mm |
| 950mm | 950mm | 950mm | 950mm |
| 1000mm | 1000mm | 1000mm | 1000mm |
| 1050mm | 1050mm | 1050mm | 1050mm |
| 1100mm | 1100mm | 1100mm | 1100mm |
| 1150mm | 1150mm | 1150mm | 1150mm |
| 1200mm | 1200mm | 1200mm | 1200mm |
| 1250mm | 1250mm | 1250mm | 1250mm |
| 1300mm | 1300mm | 1300mm | 1300mm |
| 1350mm | 1350mm | 1350mm | 1350mm |
| 1400mm | 1400mm | 1400mm | 1400mm |
| 1450mm | 1450mm | 1450mm | 1450mm |
| 1500mm | 1500mm | 1500mm | 1500mm |
| 1550mm | 1550mm | 1550mm | 1550mm |
| 1600mm | 1600mm | 1600mm | 1600mm |
| 1650mm | 1650mm | 1650mm | 1650mm |
| 1700mm | 1700mm | 1700mm | 1700mm |
| 1750mm | 1750mm | 1750mm | 1750mm |
| 1800mm | 1800mm | 1800mm | 1800mm |
| 1850mm | 1850mm | 1850mm | 1850mm |
| 1900mm | 1900mm | 1900mm | 1900mm |
| 1950mm | 1950mm | 1950mm | 1950mm |
| 2000mm | 2000mm | 2000mm | 2000mm |
| 2050mm | 2050mm | 2050mm | 2050mm |
| 2100mm | 2100mm | 2100mm | 2100mm |
| 2150mm | 2150mm | 2150mm | 2150mm |
| 2200mm | 2200mm | 2200mm | 2200mm |
| 2250mm | 2250mm | 2250mm | 2250mm |
| 2300mm | 2300mm | 2300mm | 2300mm |
| 2350mm | 2350mm | 2350mm | 2350mm |
| 2400mm | 2400mm | 2400mm | 2400mm |
| 2450mm | 2450mm | 2450mm | 2450mm |
| 2500mm | 2500mm | 2500mm | 2500mm |
| 2550mm | 2550mm | 2550mm | 2550mm |
| 2600mm | 2600mm | 2600mm | 2600mm |
| 2650mm | 2650mm | 2650mm | 2650mm |
| 2700mm | 2700mm | 2700mm | 2700mm |
| 2750mm | 2750mm | 2750mm | 2750mm |
| 2800mm | 2800mm | 2800mm | 2800mm |
| 2850mm | 2850mm | 2850mm | 2850mm |
| 2900mm | 2900mm | 2900mm | 2900mm |
| 2950mm | 2950mm | 2950mm | 2950mm |
| 3000mm | 3000mm | 3000mm | 3000mm |
| 3050mm | 3050mm | 3050mm | 3050mm |
| 3100mm | 3100mm | 3100mm | 3100mm |
| 3150mm | 3150mm | 3150mm | 3150mm |
| 3200mm | 3200mm | 3200mm | 3200mm |
| 3250mm | 3250mm | 3250mm | 3250mm |
| 3300mm | 3300mm | 3300mm | 3300mm |
| 3350mm | 3350mm | 3350mm | 3350mm |
| 3400mm | 3400mm | 3400mm | 3400mm |
| 3450mm | 3450mm | 3450mm | 3450mm |
| 3500mm | 3500mm | 3500mm | 3500mm |
| 3550mm | 3550mm | 3550mm | 3550mm |
| 3600mm | 3600mm | 3600mm | 3600mm |
| 3650mm | 3650mm | 3650mm | 3650mm |
| 3700mm | 3700mm | 3700mm | 3700mm |
| 3750mm | 3750mm | 3750mm | 3750mm |
| 3800mm | 3800mm | 3800mm | 3800mm |
| 3850mm | 3850mm | 3850mm | 3850mm |
| 3900mm | 3900mm | 3900mm | 3900mm |
| 3950mm | 3950mm | 3950mm | 3950mm |
| 4000mm | 4000mm | 4000mm | 4000mm |
| 4050mm | 4050mm | 4050mm | 4050mm |
| 4100mm | 4100mm | 4100mm | 4100mm |
| 4150mm | 4150mm | 4150mm | 4150mm |
| 4200mm | 4200mm | 4200mm | 4200mm |
| 4250mm | 4250mm | 4250mm | 4250mm |
| 4300mm | 4300mm | 4300mm | 4300mm |
| 4350mm | 4350mm | 4350mm | 4350mm |
| 4400mm | 4400mm | 4400mm | 4400mm |
| 4450mm | 4450mm | 4450mm | 4450mm |
| 4500mm | 4500mm | 4500mm | 4500mm |
| 4550mm | 4550mm | 4550mm | 4550mm |
| 4600mm | 4600mm | 4600mm | 4600mm |
| 4650mm | 4650mm | 4650mm | 4650mm |
| 4700mm | 4700mm | 4700mm | 4700mm |
| 4750mm | 4750mm | 4750mm | 4750mm |
| 4800mm | 4800mm | 4800mm | 4800mm |
| 4850mm | 4850mm | 4850mm | 4850mm |
| 4900mm | 4900mm | 4900mm | 4900mm |
| 4950mm | 4950mm | 4950mm | 4950mm |
| 5000mm | 5000mm | 5000mm | 5000mm |
| 5050mm | 5050mm | 5050mm | 5050mm |
| 5100mm | 5100mm | 5100mm | 5100mm |
| 5150mm | 5150mm | 5150mm | 5150mm |
| 5200mm | 5200mm | 5200mm | 5200mm |
| 5250mm | 5250mm | 5250mm | 5250mm |
| 5300mm | 5300mm | 5300mm | 5300mm |
| 5350mm | 5350mm | 5350mm | 5350mm |
| 5400mm | 5400mm | 5400mm | 5400mm |
| 5450mm | 5450mm | 5450mm | 5450mm |
| 5500mm | 5500mm | 5500mm | 5500mm |
| 5550mm | 5550mm | 5550mm | 5550mm |
| 5600mm | 5600mm | 5600mm | 5600mm |
| 5650mm | 5650mm | 5650mm | 5650mm |
| 5700mm | 5700mm | 5700mm | 5700mm |
| 5750mm | 5750mm | 5750mm | 5750mm |
| 5800mm | 5800mm | 5800mm | 5800mm |
| 5850mm | 5850mm | 5850mm | 5850mm |
| 5900mm | 5900mm | 5900mm | 5900mm |
| 5950mm | 5950mm | 5950mm | 5950mm |
| 6000mm | 6000mm | 6000mm | 6000mm |
| 6050mm | 6050mm | 6050mm | 6050mm |
| 6100mm | 6100mm | 6100mm | 6100mm |
| 6150mm | 6150mm | 6150mm | 6150mm |
| 6200mm | 6200mm | 6200mm | 6200mm |
| 6250mm | 6250mm | 6250mm | 6250mm |
| 6300mm | 6300mm | 6300mm | 6300mm |
| 6350mm | 6350mm | 6350mm | 6350mm |
| 6400mm | 6400mm | 6400mm | 6400mm |
| 6450mm | 6450mm | 6450mm | 6450mm |
| 6500mm | 6500mm | 6500mm | 6500mm |
| 6550mm | 6550mm | 6550mm | 6550mm |
| 6600mm | 6600mm | 6600mm | 6600mm |
| 6650mm | 6650mm | 6650mm | 6650mm |
| 6700mm | 6700mm | 6700mm | 6700mm |
| 6750mm | 6750mm | 6750mm | 6750mm |
| 6800mm | 6800mm | 6800mm | 6800mm |
| 6850mm | 6850mm | 6850mm | 6850mm |
| 6900mm | 6900mm | 6900mm | 6900mm |
| 6950mm | 6950mm | 6950mm | 6950mm |
| 7000mm | 7000mm | 7000mm | 7000mm |
| 7050mm | 7050mm | 7050mm | 7050mm |
| 7100mm | 7100mm | 7100mm | 7100mm |
| 7150mm | 7150mm | 7150mm | 7150mm |
| 7200mm | 7200mm | 7200mm | 7200mm |
| 7250mm | 7250mm | 7250mm | 7250mm |
| 7300mm | 7300mm | 7300mm | 7300mm |
| 7350mm | 7350mm | 7350mm | 7350mm |
| 7400mm | 7400mm | 7400mm | 7400mm |
| 7450mm | 7450mm | 7450mm | 7450mm |
| 7500mm | 7500mm | 7500mm | 7500mm |
| 7550mm | 7550mm | 7550mm | 7550mm |
| 7600mm | 7600mm | 7600mm | 7600mm |
| 7650mm | 7650mm | 7650mm | 7650mm |
| 7700mm | 7700mm | 7700mm | 7700mm |
| 7750mm | 7750mm | 7750mm | 7750mm |
| 7800mm | 7800mm | 7800mm | 7800mm |
| 7850mm | 7850mm | 7850mm | 7850mm |
| 7900mm | 7900mm | 7900mm | 7900mm |
| 7950mm | 7950mm | 7950mm | 7950mm |
| 8000mm | 8000mm | 8000mm | 8000mm |
| 8050mm | 8050mm | 8050mm | 8050mm |
| 8100mm | 8100mm | 8100mm | 8100mm |
| 8150mm | 8150mm | 8150mm | 8150mm |
| 8200mm | 8200mm | 8200mm | 8200mm |
| 8250mm | 8250mm | 8250mm | 8250mm |
| 8300mm | 8300mm | 8300mm | 8300mm |
| 8350mm | 8350mm | 8350mm | 8350mm |
| 8400mm | 8400mm | 8400mm | 8400mm |
| 8450mm | 8450mm | 8450mm | 8450mm |
| 8500mm | 8500mm | 8500mm | 8500mm |
| 8550mm | 8550mm | 8550mm | 8550mm |
| 8600mm | 8600mm | 8600mm | 8600mm |
| 8650mm | 8650mm | 8650mm | 8650mm |
| 8700mm | 8700mm | 8700mm | 8700mm |
| 8750mm | 8750mm | 8750mm | 8750mm |
| 8800mm | 8800mm | 8800mm | 8800mm |
| 8850mm | 8850mm | 8850mm | 8850mm |
| 8900mm | 8900mm | 8900mm | 8900mm |
| 8950mm | 8950mm | 8950mm | 8950mm |
| 9000mm | 9000mm | 9000mm | 9000mm |
| 9050mm | 9050mm | 9050mm | 9050mm |
| 9100mm | 9100mm | 9100mm | 9100mm |
| 9150mm | 9150mm | 9150mm | 9150mm |
| 9200mm | 9200mm | 9200mm | 9200mm |
| 9250mm | 9250mm | 9250mm | 9250mm |
| 9300mm | 9300mm | 9300mm | 9300mm |
| 9350mm | 9350mm | 9350mm | 9350mm |
| 9400mm | 9400mm | 9400mm | 9400mm |
| 9450mm | 9450mm | 9450mm | 9450mm |
| 9500mm | 9500mm | 9500mm | 9500mm |
| 9550mm | 9550mm | 9550mm | 9550mm |
| 9600mm | 9600mm | 9600mm | 9600mm |
| 9650mm | 9650mm | 9650mm | 9650mm |
| 9700mm | 9700mm | 9700mm | 9700mm |
| 9750mm | 9750mm | 9750mm | 9750mm |
| 9800mm | 9800mm | 9800mm | 9800mm |
| 9850mm | 9850mm | 9850mm | 9850mm |
| 9900mm | 9900mm | 9900mm | 9900mm |
| 9950mm | 9950mm | 9950mm | 9950mm |
| 10000mm | 10000mm | 10000mm | 10000mm |

For model compatibility information, refer to "U-WAVE fit Compatible Devices", a separate sheet provided with **Catalog No. 12000**: Measurement Data Wireless Communication System U-WAVE.
https://www.mitutoyo.co.jp/support/service/catalog/09_system/1200_appendix.pdf



02AZF310



02AZF300

Choose a connecting unit compatible with your gage.

| Order No. | 02AZF310 | 02AZF300 |
|------------------|---|---------------------------------------|
| Protection level | IP67 | N/A |
| Mass (g) | 6 | |
| Connecting unit | U-WAVE-TCB/TMB (for dust/water-proof type) | U-WAVE-TCB (for standard type) |

Compatibility of measuring tool and unit

| | Assembled appearance | Connecting unit | Transmitter |
|-----------------|----------------------|-----------------|--|
| For micrometers | Standard | 02AZF310 | 264-627 U-WAVE-TMB (buzzer type) |
| | Water-proof type | 02AZF310 | 264-626 U-WAVE-TMB (IP67 type dust/water-proof) |
| For calipers | Standard | 02AZF300 | 264-625 U-WAVE-TCB (buzzer type) |
| | Coolant-proof type | 02AZF310 | 264-624 U-WAVE-TCB (IP67 type dust/water-proof) |

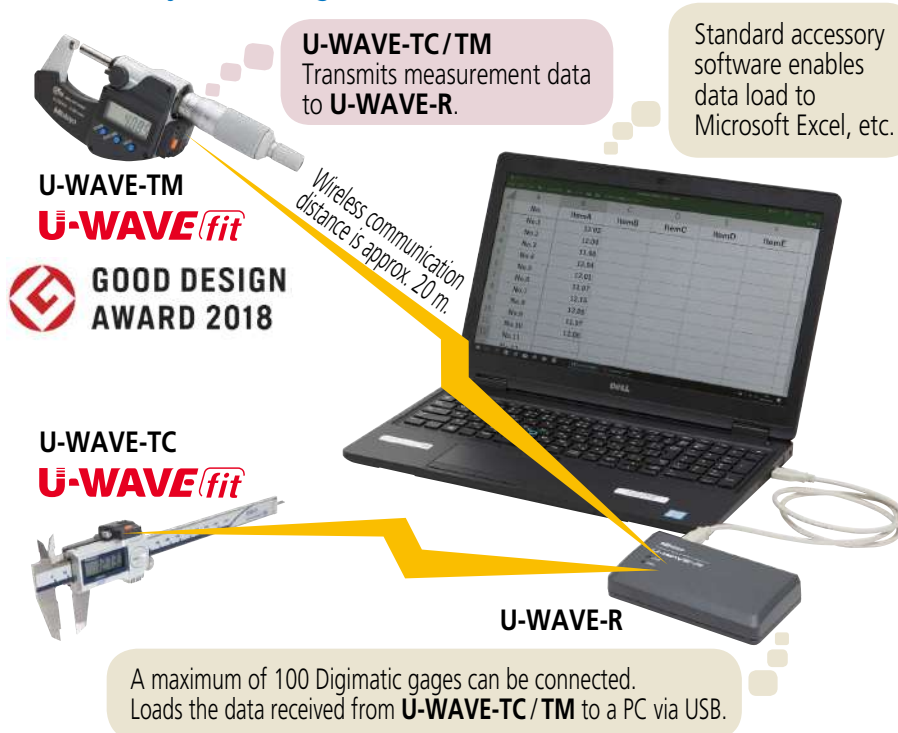
Measurement Data Management

Convenient data collection tool and quality control software

Measurement data wireless communication system U-WAVE-TC/TM (U-WAVE fit)

- Data from tools with Digimatic output function can be sent to a PC via wireless communication.
- With functions and performance inherited from **U-WAVE-T**, the compact and thinner design provides better fitting to an instrument and improved operability, which enables further improvement of efficiency.
- The data interface function of the **U-WAVE-R** standard accessory software enables data input to commonly available software (Microsoft Excel, Notepad, etc.) by keyboard input.
- Wireless communication eliminates cabling, improving measuring operability.
- By combining with **USB-ITPAK V2.1**, recording of inspections using Excel becomes more efficient. Loading multiple measurement data into separate Excel sheets, or simultaneous measurement using the event driven is now available without the need for macro programming yourself. (Automatic loading in a certain interval is available with a timer function.)

U-WAVE fit system configuration



U-WAVE-R

Receives data from **U-WAVE-TC/TM**, **U-WAVE-T** and loads to a PC via USB.

| Model | U-WAVE-R |
|---|--------------------------------------|
| Order No.* | 02AZD810D/02AZD810E/02AZD810F |
| Power supply | USB bus power system |
| Number of U-WAVE-R units that can be connected to one PC | Up to 15 |
| Number of U-WAVE-T units that can be connected | Up to 100 |
| External dimensions | 140x80x31.6 mm |
| Mass (g) | 130 |

* Order No. differs depending on the destination country.

U-WAVEPAK software (standard accessory)

System Environment: Compatible OS
Windows 2000 Professional (SP4 or later)
Windows XP Home Edition (SP2 or later)
Windows XP Professional (SP2 or later)*
Windows Vista*, Windows 7*, Windows 8/8.1*
Windows 10*

* 32-bit, 64-bit OS supported
<Versions confirmed operational on Windows 10>
• **U-WAVEPAK Version1.020** or later

- Connectability confirmed for tablet PC
- Microsoft Surface Pro 6 (the version whose operation on Windows 10 Professional is confirmed)
 - Required environment: DVD drive (required for installation), USB port x2 ports or more

Note: Cannot be connected to a device other than a PC (such as **DP-1VA LOGGER**, sequencer etc.).

U-WAVE-R main unit



USB2.0 cable (1 m) attached

U-WAVEPAK



U-WAVE-TC/TM (U-WAVE fit) System Communication Specifications

• Wireless communication

| | |
|---------------------------------|--|
| Wireless specifications | IEEE802.15.4 base |
| Wireless communication distance | Approx. 20 m (line of sight) |
| Wireless communication speed | 250 kbps |
| Transmission output | 2.5 mW (4 dBm) or less |
| Modulation method | DS-SS (Direct Sequence - Spread Spectrum) Resistant to interfering signals and noise |
| Communication frequency | 2.4 GHz band (ISM band: Universal frequency) |
| Used band | 15 channels (2.405 to 2.475 GHz at intervals of 5 MHz) The noise search function avoids interference with other communication devices. |

Note: To use **U-WAVE-TC/TM**, the conformity to the radio law of each country is required. If you use this product outside the country of purchase, please contact your dealer or nearest Mitutoyo sales office.



Refer to the **U-WAVE Brochure (E12000)** for more details.

U-WAVE fit
U-WAVE-TM compatible
Digimatic micrometers/heads

| Model | Product name | Unit | Order No. | Measuring range |
|---------------------------|--------------|------|-----------|-----------------|
| Standard micrometers | Outside | mm | 02AZD810D | 0-25 |
| | Inside | mm | 02AZD810E | 0-25 |
| Contact point micrometers | Outside | mm | 02AZD810F | 0-25 |
| | Inside | mm | 02AZD810G | 0-25 |
| Level micrometers | Outside | mm | 02AZD810H | 0-25 |
| | Inside | mm | 02AZD810I | 0-25 |
| Step micrometers | Outside | mm | 02AZD810J | 0-25 |
| | Inside | mm | 02AZD810K | 0-25 |
| Box micrometers | Outside | mm | 02AZD810L | 0-25 |
| | Inside | mm | 02AZD810M | 0-25 |

For model compatibility information, refer to "U-WAVE fit Compatible Devices", a separate sheet provided with **Catalog No. 12000: Measurement Data Wireless Communication System U-WAVE**.

Main specifications of U-WAVEPAK

- Setup of dedicated driver software (USB and virtual COM port)
- Initial setting of ID number and frequency selection (required only once for the first time)
- Load data to Microsoft Excel or Notepad through the data interface function

Measurement data wireless communication system U-WAVE-TM/TC (U-WAVE fit)

Type of transmission unit



264-622



264-621

SPECIFICATIONS

IP67 type is resistant to water and dust ingress. Buzzer type notifies data reception by buzzer sound and LED.

| Connectable measuring instruments | Micrometer | | Caliper | |
|-----------------------------------|--|-------------------------|---------------|-------------------------|
| | Order No. | Model | Order No. | Model |
| | 264-622* | U-WAVE-TM (IP67 type) | 264-620* | U-WAVE-TC (IP67 type) |
| | 264-623* | U-WAVE-TM (Buzzer type) | 264-621* | U-WAVE-TC (Buzzer type) |
| Protection Rating | IP67 | N/A | IP67 | N/A |
| Data reception indication | LEDs | Buzzer and LEDs | LEDs | Buzzer and LEDs |
| Power supply | Lithium battery CR2032x1 | | | |
| Battery life | Approx. 400,000 times continuous data transmission | | | |
| External dimensions (mm) | 41.9x12.9x38.8 | | 56x11.45x30.4 | |
| Mass (g) | 18 | | | |

* Order No. differs depending on the destination country. Add the following suffix to the order No.: K for Korea, B for Brazil and Argentina.

Note: IP67 type is water/dust-proofed suitable for the factory floor. Buzzer type is not water/dust-proofed.



02AZF310



02AZF300

Fixed to transmission unit and inserted into output connector of Digimatic gage.

| Order No. | 02AZF310 | 02AZF300 |
|-------------------------------|--------------------------|-------------------------|
| Protection level | IP67 | N/A |
| Mass (g) | 6 | |
| Connectable transmission unit | U-WAVE-TC/TM (IP67 type) | U-WAVE-TC (buzzer type) |

Note: 02AZF310 ensures water-proof performance only when attached to measuring instruments of IP67 type. For information on supported connecting units, please contact your local Mitutoyo sales office.

Compatibility of measuring tool and unit

| Digimatic gage | Assembled appearance (Front/Back) | Connecting unit | Transmission unit |
|----------------|-----------------------------------|-----------------|----------------------------------|
| Micrometer | Standard | 02AZF310 | 264-623* U-WAVE-TM (buzzer type) |
| | Water-proof type | | 264-622* U-WAVE-TM (IP67 type) |
| Caliper | Standard | 02AZF300 | 264-621* U-WAVE-TC (buzzer type) |
| | Coolant-proof type | 02AZF310 | 264-620* U-WAVE-TC (IP67 type) |

* Order No. differs depending on the destination country. Add the following suffix to the order No.: K for Korea, B for Brazil and Argentina.

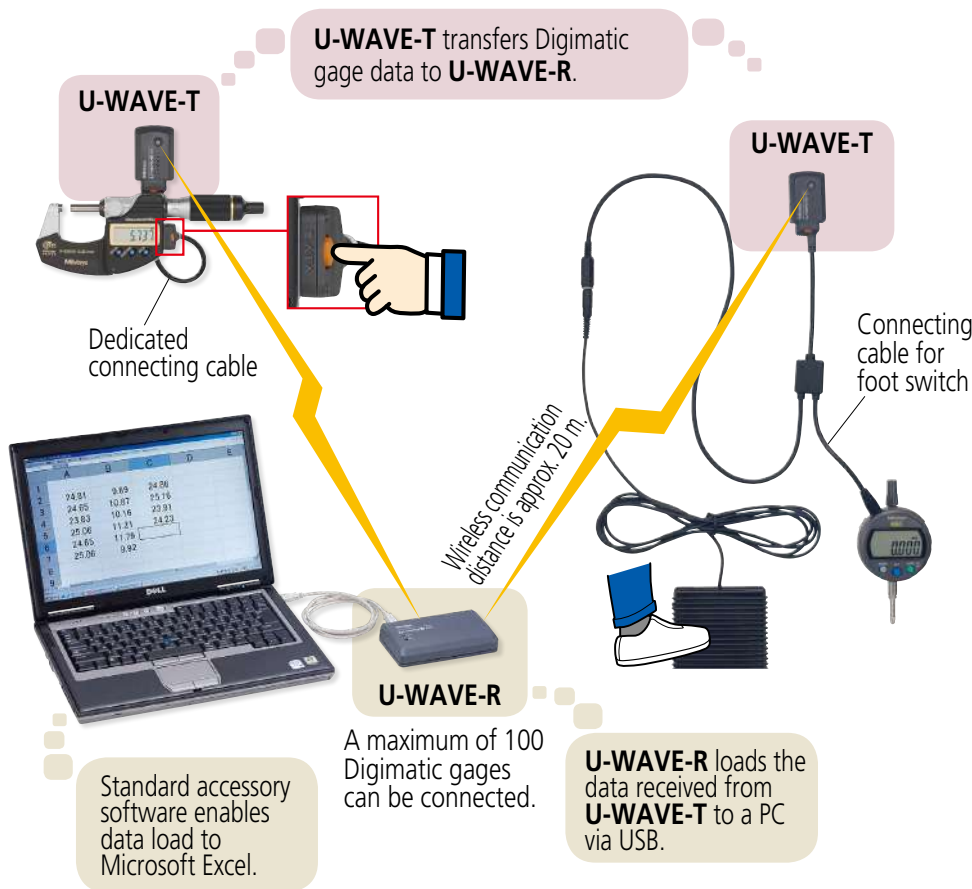
Measurement Data Management

Convenient data collection tool and quality control software

Measurement Data Wireless Communication System U-WAVE

- Data from Digimatic gages can be loaded to a PC easily.
- Wireless communication eliminates cabling, improving measuring operability.
- The Data Interface Function of the **U-WAVE-R** standard accessory software enables data input to commonly available software by keyboard input (Microsoft Excel, Notepad, etc.).
- **USB-ITPAK V2.1** supports **U-WAVE!**
Loading multiple measurement data into separate Excel sheets, or simultaneous measurement using the event driven is now available without the need for macro programming yourself. (Automatic loading in a certain interval is available with the timer function.)

U-WAVE system configuration



• Refer to page A-17 for details of **U-WAVE-R**.

U-WAVE-T

System Communication Specifications

• Wireless communication

| Order No.* | 02AZD730G/02AZD730H/ 02AZD880G/02AZD880H | 02AZD730J/02AZD880J |
|---------------------------------|--|----------------------|
| Transmission output | 1 mW (0 dBm) or less | 5 mW (7 dBm) or less |
| Wireless specifications | IEEE802.15.4 base | |
| Wireless communication distance | Approx. 20 m (within visible range) | |
| Wireless communication speed | 250 kbps | |
| Modulation method | DS-SS (Direct Sequence - Spread Spectrum) Resistant to interfering signals and noise | |
| Communication frequency | 2.4 GHz band (ISM band: Universal frequency) | |
| Used band | 15 channels (2.405 to 2.475 GHz at intervals of 5 MHz) The noise search function avoids interference with other communication devices. | |

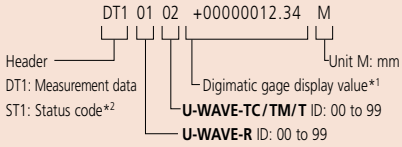
* Order No. differs depending on the destination country.
Note: To use **U-WAVE-T**, the conformity to the radio law of each country is required. If you use this product outside the country of purchase, please contact your dealer or nearest Mitutoyo sales office.



Refer to the **U-WAVE Brochure (E12000)** for more details.

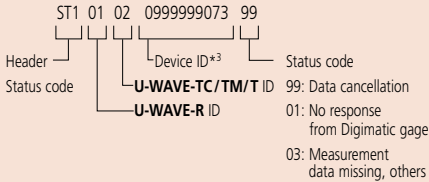
• Data format

Example of format when the Digimatic gage displays 12.34



*1 Data interface function is switchable to "Measurement value only" e.g.) 12.34

*2 Example of status code format



*3 Unique number assigned to U-WAVE at shipment

Notes on Identification of Measurement Data and Multiple Systems Operation

Following the above format, the U-WAVE data format starts with a 4-digit code where the first two digits represent receiver channels and the last two are transmitter channels. The large number of transmitter/receiver combinations possible with this scheme ensures that the receivers in a factory measurement system only accept data from the intended transmitters, even when several receivers are all within communication range of different transmitters using the same channel. Different frequency bands (up to 15 available) may also be used to further ensure that there are no communication problems between adjacent U-WAVE-R units.

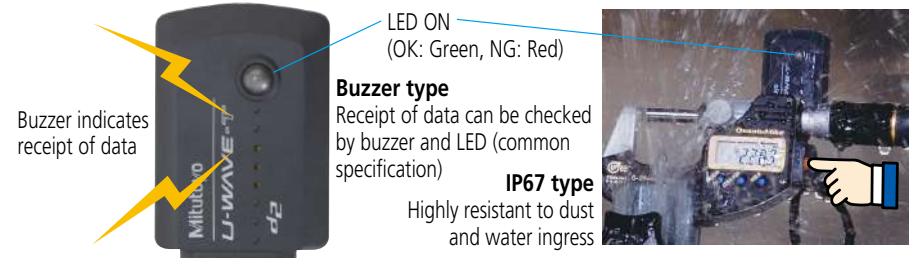
Measurement Data Wireless Communication System U-WAVE

U-WAVE-T

Transmits measurement data to U-WAVE-R. Select IP67 or buzzer type, according to your application. U-WAVE-R can be connected to Digimatic gages by dedicated cable for U-WAVE-T (optional).

| Model | U-WAVE-T (IP67 type) | U-WAVE-T (Buzzer type) |
|---------------------------|-----------------------------------|-----------------------------------|
| Order No.* | 02AZD730G / 02AZD730H / 02AZD730J | 02AZD880G / 02AZD880H / 02AZD880J |
| Protection Rating | IP67 | None |
| Data reception indication | LEDs | Buzzer and LEDs |
| Power supply | Lithium battery CR2032x1 | |
| Battery life | Approx. 400,000 transmissions | |
| Dimensions (mm) | 44x29.6x18.5 | |
| Mass (g) | 23 | |

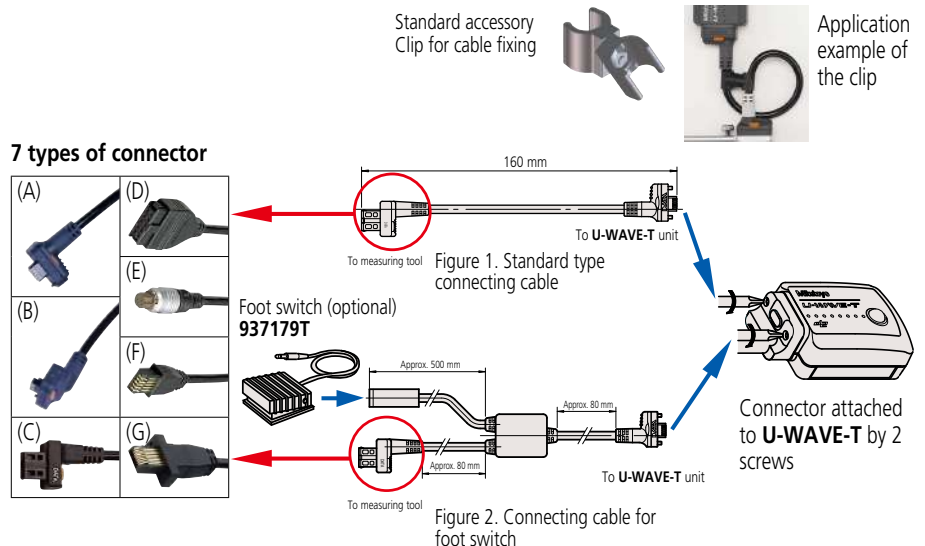
* Order No. differs depending on the destination country.



U-WAVE-T dedicated connection cable

A dedicated cable connects a Digimatic gage to U-WAVE-T. Check the connector (A to G; refer to pages A-27 and A-28 for details) compatible with the Digimatic gage to be used and select either standard type (figure 1) or foot switch type (figure 2) according to your application.

| Type | Standard connecting cable | Connecting cable for foot switch |
|---|---------------------------|----------------------------------|
| | Order No. | Order No. |
| (A) Water-proof model with output button | 02AZD790A | 02AZE140A |
| (B) Water-proof model with output button | 02AZD790B | 02AZE140B |
| (C) With data-out button | 02AZD790C | 02AZE140C |
| (D) 10-pin plain type | 02AZD790D | 02AZE140D |
| (E) 6-pin round type | 02AZD790E | 02AZE140E |
| (F) Plain type straight | 02AZD790F | 02AZE140F |
| (G) Plain type straight water-proof model | 02AZD790G | 02AZE140G |



Measurement Data Management

Convenient data collection tool and quality control software

Measurement Data Wireless Communication System U-WAVE

Optional Accessories for U-WAVE-T

U-WAVE-T mounting plate

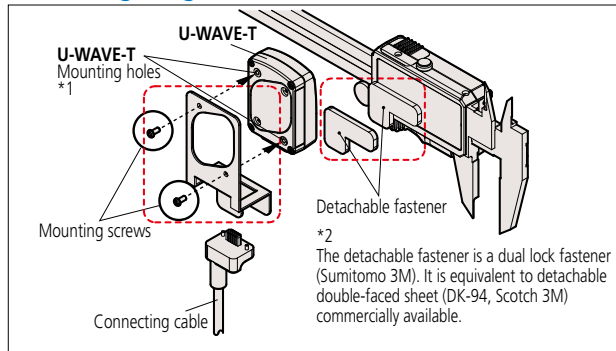
Since the standard cable clip is not sufficient to support the **U-WAVE-T** on a Digimatic gage, a mounting plate is provided. The mounting plate can be fixed to the gage by the easily detachable hook-and-eye type fasteners provided. Batteries can be replaced without needing to detach the **U-WAVE-T** from the gage.



**U-WAVE-T mounting plate
02AZE200**

- Standard accessories
- Detachable fasteners: 1 set
 - Mounting screw: 2 pcs.

Mounting diagram (02AZE200)



- *1 To avoid damaging the threaded holes in the plastic body of the **U-WAVE-T** unit, the mounting screws should be tightened only just sufficiently to grip. Repeated removal of these screws should also be avoided for the same reason.
- *2 In order to avoid loss of adhesion, do not allow oil or coolant to come into contact with the bonding surfaces of the detachable fasteners.

Typical applications of the mounting plate

Super Caliper CD67-S15PM



Front view Rear view

QuantuMike MDE-25MX



Front view Rear view

Digimatic Indicator ID-C112XB



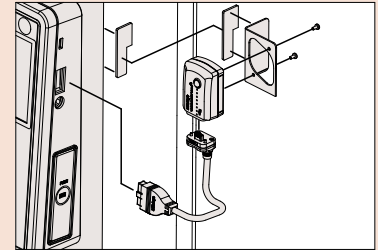
Front view Rear view

U-WAVE-T mounting plate for QM-Height 02AZE990

Standard accessories

- Detachable fastener, 2 pcs. (mirror-imaged)
- Mounting screw: 2 pcs.

Mounting Diagram for QM-Height (02AZE990)



Refer to the **U-WAVE Brochure (E12000)** for more details.

Applications of the 'Event driven' mode

Data request support from PC

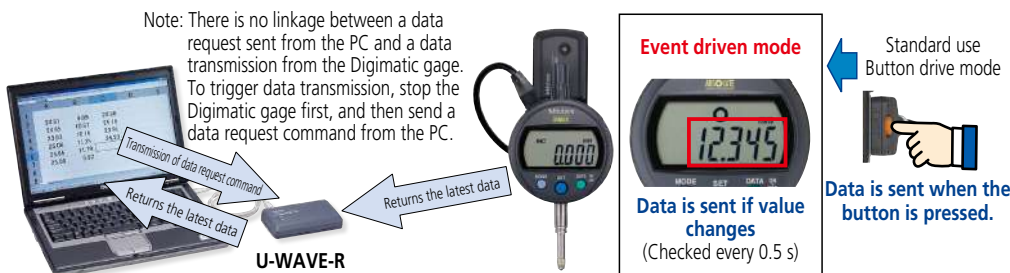
The currently displayed data can be sent by pressing the data switch. This is called "**button drive mode**".

In the "**event driven mode**", the measurement value is checked every 0.5 seconds and measurement data is automatically sent if there is a change. At this time, the data switch is disabled. The sent data is written in the **U-WAVE-R** memory, and only the latest data is kept, it is not output to the PC. The data is loaded to the PC from the **U-WAVE-R** memory when the data request command is sent. The mode switching between "button drive" and "event driven" is enabled by **U-WAVEPAK**.

In the event driven mode, pressing the data switch on the Digimatic gage is not necessary. PC operation enables loading data from multiple gages at once.

To perform simultaneous measurement using USB-ITPAK V2.1, U-WAVEPAK must be in the event driven mode.

Note: There is no linkage between a data request sent from the PC and a data transmission from the Digimatic gage. To trigger data transmission, stop the Digimatic gage first, and then send a data request command from the PC.



When using the event driven please note:

- The battery life is shorter than in normal mode. The battery lasts approximately 20 days with continuous use. Switching to the button mode when the battery is not in use extends the battery life.
- When using several Digimatic gages (**U-WAVE-T**), communication errors may occur because of radio interference in simultaneous measuring. Therefore, it is required to add **U-WAVE-R** and set different frequencies (15 ch) to avoid radio wave interference.

Order No.

| | |
|-----------|-----------------------|
| Model No. | USB-ITPAK V2.1 |
| Order No. | 06AFM386 |

Upgrade pricing from V1.0 and V2.0 is not available. Please purchase V2.1.

USB-ITPAK V2.1 USB dongle



A USB dongle must be connected to the PC running the software.

Operating environment

| | |
|-----------------------------|---|
| Compatible OS *1 | Windows 2000 SP4 Windows XP SP2 or later Windows Vista Windows 7 Windows 8 Windows 8.1 Windows 10 |
| Supported Excel versions *2 | Excel 2002 Excel 2003 Excel 2007 Excel 2010 Excel 2013 Excel 2016 |
| Hard disk | Free space of more than 10 MB |
| CD-ROM drive | For program installation |
| USB port *3 | 2 ports or more |
| Monitor resolution | 800x600, 256 colors or more |

*1 32-bit, 64-bit OS supported

*2 Operation with Excel for MAC OS is not guaranteed.

*3 A commercially available hub can be used.
(USB certified product is recommended)

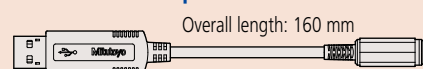
Language support

- Operation language (15 languages)
Japanese, English, German, French, Spanish, Italian, Czech, Swedish, Turkish, Polish, Hungarian, Russian, Korean, Chinese (traditional/simplified)
- Operation manual (PDF file)
Japanese, English, German

Order No.

| | |
|-----------|-----------------|
| Model No. | USB-FSW |
| Order No. | 06ADV384 |

Foot Switch Adapter USB-FSW



Overall length: 160 mm

Measurement Data Collection Software

USB-ITPAK V2.1 (IT-016U/USB-ITN/U-WAVE/DP-1VA LOGGER connectable)

- **USB-ITPAK V2.1** creates a procedure to input data from gages equipped with Digimatic output to Excel sheets via **USB-ITN** or **U-WAVE**. This optional software facilitates the daily inspection work for mass-produced products.

The combined use with USB-ITPAK V2.1 will improve the operational efficiency of repetition inspection work. Best suited for keeping track of inspection data of mass-produced products.

- Automatically calls Excel sheet.
- Cursor moves can be specified.
- Input range can be specified per Digimatic gage, which reduces improper input.
- The last data input can be canceled by a single operation (foot switch, function key etc.)
- Data input or cancellation can be performed at once in multiple-point simultaneous measurement.

Main features of USB-ITPAK V2.1

• Setting of Microsoft Excel input:

Designation of where to input (workbook, worksheet, cell range), cursor move (right, down), and others.

• Selection of measuring method (3 modes available)

1) Sequential measurement 2) Simultaneous measurement 3) Individual measurement (refer to page A-24 for details).

• Control item and instruction at data input

| Control item | Mouse operation | Function key | Foot switch + USB-FSW | Data switch when using U-WAVE | Data switch other than U-WAVE |
|--|-----------------|--------------|------------------------------------|-------------------------------|-------------------------------|
| Data output request | ✓*1 | ✓*1 | ✓ | ✓*2 | ✓ |
| Data cancel | ✓*1 | ✓*1 | ✓ | ✓ Press and hold*2 | |
| Data skip | ✓*1 | ✓*1 | ✓ | | |
| Character input (example: OK or NG etc.) | | | ✓ Pre-registered character strings | | |

*1 Not available during individual measurement.

*2 Not available during simultaneous measurement in the event driven mode.

• Number of connectable gages

| Available devices | Maximum number of connection (total of (1), (2), and (3)) | Others |
|---|---|---|
| 1) IT-016U/USB-ITN | For Windows 2000/XP Up to 100 units*3 For Windows Vista/7/8/8.1/10 Up to 20 units*3 (For U-WAVE-R, plus 100 per unit) in terms of available gages. | • Maximum registration (total of (1), (2), and (3)) 400 units • Control/identification of connecting gage VCP (Virtual COM port) Switch from HID to VCP for (1) and (2). The VCP driver software is supplied with USB-ITPAK . |
| 2) USB-FSW | | |
| 3) U-WAVE-R (Up to 100 gages connectable to each U-WAVE-R.) U-WAVE-T ID: 00 to 99 | | |

- **Data loading time:** when using **IT-016U/USB-ITN**, 0.2 s to 0.3 s per gage unit
U-WAVE event driven mode: 0.5 s data refresh interval

- **Timer input function** (only in simultaneous measurement)

Input interval (time): 0.1 s*4 to 24 hours at maximum

- **Measurement date / time display function** (available in sequential and simultaneous measurements)

The display format is subject to the setting of the Excel sheet.

*3 The actual number can be less depending on the system configuration.

*4 If a shorter time is set, a priority is given to the longer time compared with the actual communication time.

Optional Accessories for USB-ITPAK

USB Foot Switch Adapter USB-FSW

This USB adapter for connecting a PC is required when using the Foot Switch (**937179T**) in **USB-ITN**.

A dedicated VCP driver for this adapter is included in **USB-ITPAK**.

Main specification

- With **USB-ITPAK**, application of the foot switch can be set.
- Data control: "Data request", "Data cancel", "Data skip"
- Character string input (e.g. GO/NG, etc.)

Note: **USB-FSW** is used for installation of the VCP driver.



Foot switch (937179T)

USB-FSW

Measurement Data Management

Convenient data collection tool and quality control software

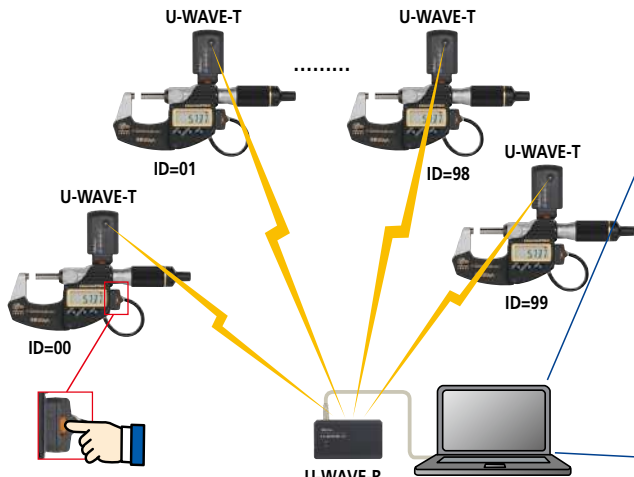
Measurement Data Management

USB-ITPAK V2.1 (IT-016U / USB-ITN / U-WAVE / DP-1VA LOGGER connectable)

More applications can be handled due to new features (Wireless (U-WAVE) support, Timer input, Measurement date/time display)

Example of measurement using the U-WAVE wireless communication system — data sorting of individual measurements

Data from multiple Digimatic gages (U-WAVE-T, U-WAVE-TM/TC) sent to separate Excel sheets

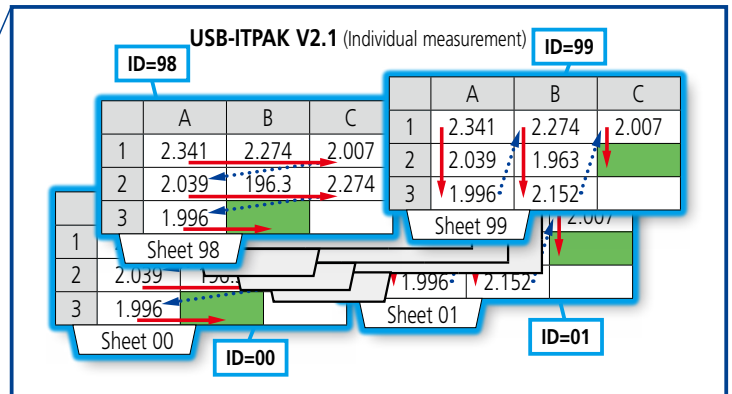


The last data input may be canceled by pressing and holding the data switch

Up to 100 gages can be handled by one U-WAVE-R unit

Note: U-WAVE-TM/TC can also be applicable.

Loading data from multiple Digimatic gages (U-WAVE-T) into separate Excel sheets is now available without the need for macro programming.

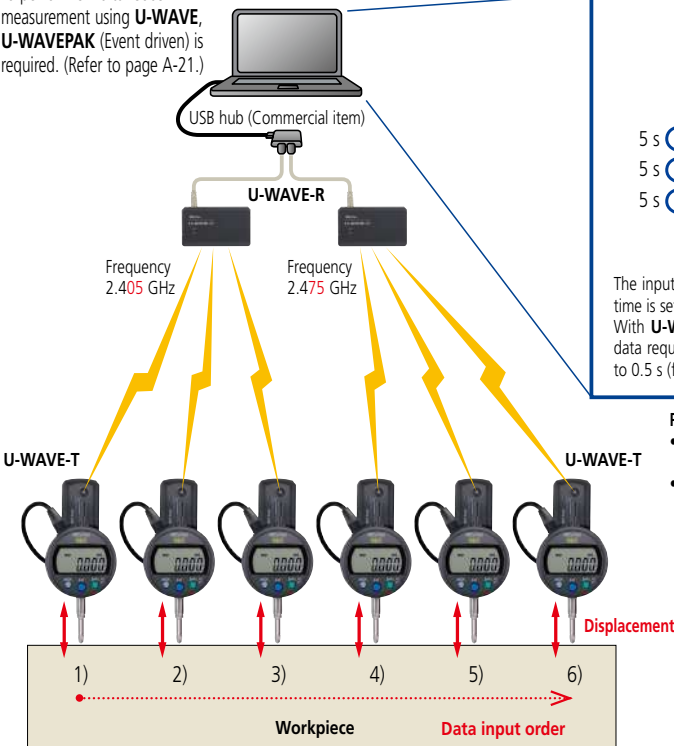


- Entry point can be specified per gage (by U-WAVE-T ID).
- Specifying an Excel file: Excel Book (full path) +sheet name
 - Specifying data input cells (example: A1:C3)
 - Specifying cursor move (right or down)

Example of measurement using the U-WAVE wireless communication system — timer input + measurement date/time display during simultaneous measurement

Automatically obtains displacement data in a certain input interval

To perform simultaneous measurement using U-WAVE, U-WAVEPAK (Event driven) is required. (Refer to page A-21.)



If using USB-ITPAK V2.1 supporting U-WAVE event driven, arbitrary timer input is allowed without the need for macro programming.

USB-ITPAK V2.1 simultaneous measurement + timer input (example: 5 s interval)

| | A | B | C | D | E | F | G |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------------|
| 1 | Displacement 1) | Displacement 2) | Displacement 3) | Displacement 4) | Displacement 5) | Displacement 6) | Measurement date/time |
| 2 | 0.281 | 0.162 | 0.121 | 0.051 | 0.011 | -0.001 | 2013/4/1 7 30 00 |
| 3 | 0.279 | 0.152 | 0.133 | 0.064 | 0.018 | -0.003 | 2013/4/1 7 30 05 |
| 4 | 0.265 | 0.149 | 0.142 | 0.089 | 0.021 | -0.007 | 2013/4/1 7 30 10 |
| 5 | | | | | | | |
| 6 | | | | | | | |

The input interval can be arbitrarily set by 0.1 s intervals up to 24 hours. If a smaller value than the data loading time is set, the actual measurement time will be the input interval. With U-WAVE, an error (no data) may occur if less than 0.5 s is set for the input interval. This is because the data request signal is issued before the data comes in, based on the event driven data refresh interval that is set to 0.5 s (fixed).

Points to note when performing simultaneous measurement using U-WAVE and USB-ITPAK V2.1

- The battery life of U-WAVE-T becomes shorter in the event mode, reducing to approximately 20 days for continuous measurement.
- When using several Digimatic gages, communication errors may occur because simultaneous transmission from all gages may cause radio interference. With U-WAVE, radio wave interference can be mostly avoided if data is transmitted after making sure there is no other radio communication. CSMA/CA method: this avoids radio interference and enables successful simultaneous data transmission of three U-WAVE-T units per U-WAVE-R. To perform simultaneous measurement with more than three units of U-WAVE-T, add U-WAVE-R and set different frequencies (15 ch) to avoid radio interference.

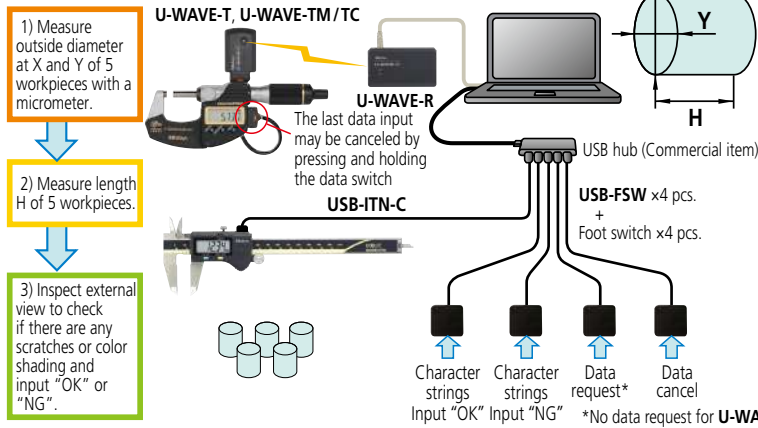
You can set up the procedure to input the measurement data to the Excel sheet in combination with **USB-ITPAK V2.1** and **IT-016U/USB-ITN/U-WAVE**

Measurement applications of USB-ITPAK V2.1 (Three examples of how **USB-ITPAK V2.1** can be deployed are shown below)

Sequential measurement

Measurement values are input one by one according to a procedure previously defined by using one or more Digimatic gages (via **IT-016U/USB-ITN** or **U-WAVE**).

(Measurement example – see figure at right)



When a measuring procedure is executed, a window (as below) is displayed. "Data request*", "Data cancel*", "Data skip*", "Aborting", "Complete" can be specified. * These operations can be allocated to the function key or foot switch (via **USB-FSW**).



| | A | B | C | D | E | F |
|---|---------------------|--------|--------|--------|--------|--------|
| 1 | Setting | 1 | 2 | 3 | 4 | 5 |
| 2 | Dimension X | 10.025 | 10.033 | 9.964 | 10.031 | 10.046 |
| 3 | Dimension Y | 9.982 | 10.017 | 10.008 | 9.996 | 10.027 |
| 4 | Dimension H | 29.97 | 30.02 | 30.07 | 29.96 | 30.04 |
| 5 | External Appearance | OK | OK | NG | | |

Cell movement direction after inputting data (down and right)

Carriage return (Low, column)

Microsoft Excel sheet previously specified

Input range of micrometer (B2 to F3)

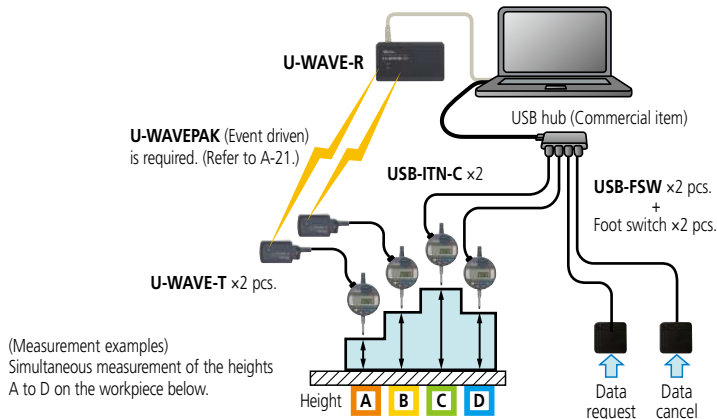
Input range of caliper (B4 to F4)

Input range of visual judgment (B5 to F5)

Cell that will receive next input is highlighted in green

Simultaneous measurement

Measurement values are input simultaneously from several Digimatic gages (via **IT-016U/USB-ITN**, **U-WAVE**)



(Measurement examples) Simultaneous measurement of the heights A to D on the workpiece below.



| | A | B | C | D | E |
|---|---|----------|----------|----------|----------|
| 1 | | Height A | Height B | Height C | Height D |
| 2 | 1 | 5.02 | 8.03 | 9.96 | 6.03 |
| 3 | 2 | 4.98 | 8.02 | 10.01 | 5.99 |
| 4 | 3 | 4.97 | 8.04 | 10.07 | 5.96 |
| 5 | 4 | | | | |
| 6 | 5 | | | | |

First measurement (finished)

Second measurement (finished)

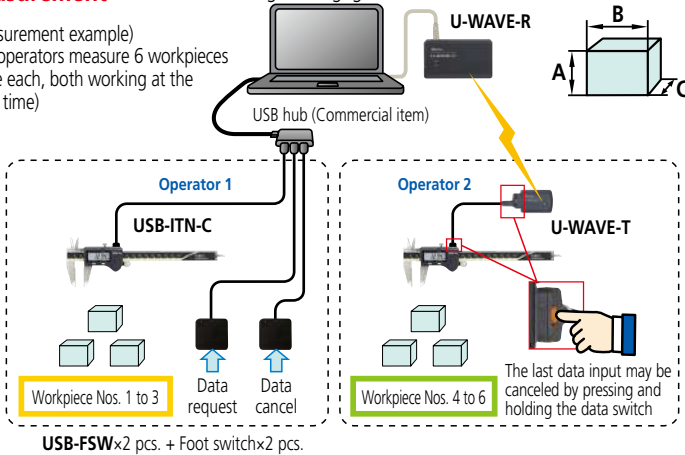
Third measurement (finished)

Fourth measurement (Wait for next input)

Individual measurement

Several operators input measurement data asynchronously according to individually defined procedures (where to input, move direction, etc.) from each Digimatic gage via **IT-016U/USB-ITN** or **U-WAVE**.

(Measurement example) Two operators measure 6 workpieces (three each, both working at the same time)



Since several individual operators perform measurement simultaneously, an operation key and a function key in the window below cannot be used at the same time. The only effective input device in this case is the foot switch (via **USB-FSW**).



| | A | B | C | D | E | F | G |
|---|-------------|-------|-------|-------|-------|-------|-------|
| 1 | Setting | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | Dimension A | 10.02 | 10.03 | 9.96 | 10.15 | 10.23 | 10.04 |
| 3 | Dimension B | 9.98 | 10.01 | 10.07 | 9.99 | 9.78 | |
| 4 | Dimension C | 10.15 | 10.14 | | 9.96 | 10.27 | |

Operator 1

Operator 2

Cell that will receive next input

Cell that will receive next input

Notes on using USB-ITPAK V2.1:

Do not merge the cells in the specified range as a measurement data input. During measurement, the Microsoft Excel worksheet cannot be modified in any way apart from entering data. If you need to modify the sheet, it is necessary to abort or finish the measurement.

Measurement Data Management

Convenient data collection tool and quality control software

Mini-Printer Equipped with Data Logging Function SERIES 264 — Digimatic Mini-Processor DP-1VA LOGGER

In addition to the conventional (DP-1VR) printing and statistical calculation functions, data logger and USB output functions are added and enhanced!

- This is a palm-sized printer used to print measurement data from Digimatic gages or to perform statistical analysis.
- The versatile **DP-1VA LOGGER** printer not only prints measurement data, but performs a variety of statistical analyses, draws histograms and D-charts and also performs complex operations on Xbar-R control charts.
- The data logger function allows storage of up to 1,000 pieces of data in memory, and batch transfer of stored data to an Excel-format inspection certificate, etc., by connecting to a PC with a USB cable (optional).



Example of printout

MODE1

Various statistical calculations are executed using all input data. If the tolerance limits have been set, GO/±NG judgment and histogram creation are also enabled.

```

*LIMIT DATA 1*
LSL 19.11 mm
USL 21.00 mm
TOL 1.89 mm

1 20.14 mm
2 20.18 mm
3 19.68 mm
4 19.77 mm
5 20.27 mm
6 20.28 mm
7 19.31 mm
8 19.64 mm
9 19.93 mm
10 19.30 mm
11 19.56 mm
12 19.99 mm
13 20.82 mm

PART NO.:
DATE 2018/ 2/15
TIME 12: 8

NAME:
* RESULT *
MAX 21.00 mm
MIN 19.68 mm
R 2.07 mm
S 19.9550 mm
σn 0.4501 mm
σn-1 0.4578 mm

-NG 1
+NG 0.867
P 0.868
Cpk 0.618

* HISTOGRAM *
LSL 19.11 mm
USL 21.00 mm
TOL 1.89 mm

DIV 1 10

-NG 1
LSL 19.11 mm
USL 21.00 mm
TOL 1.89 mm
    
```

MODE2

In addition to the MODE1 function, measurements within the tolerance limits are printed out as a D chart*. This chart allows you to identify the trend of variations in measurement data. * D chart stands for Displacement chart.

```

*LIMIT MODE2*
*LIMIT DATA 1*
*NO LIMIT DATA*
L.LIMIT1 27.22 mm
L.LIMIT2 28.27 mm

*NEW LIMIT DATA*
*LIMIT DATA 1*
DATE 2018/ 2/17
TIME 14:37

LSL 27.22 mm
USL 28.27 mm
TOL 1.05 mm

L C U
28.08mm | : |
27.67mm | : |
28.14mm | : |
28.01mm | : |
27.72mm | : |
27.41mm | : |
28.97mm | : |
27.72mm | : |
27.58mm | : |
10 27.62mm | : |
28.14mm | : |
28.22mm | : |
28.45mm | : |
28.45mm | : |
28.50mm | : |

PART NO.:
DATE 2018/ 2/17
TIME 14:38

NAME:
* RESULT *
N 15 mm
MAX 28.45 mm
MIN 26.97 mm
R 1.48 mm
S 27.8184 mm
σn 0.4270 mm
σn-1 0.4270 mm
    
```

MODE3

Only input of data automatically enables calculation processing of complex control limit values as well as calculation for creating an Xbar-R control chart.

```

SUB GR. NO. 1
1 26.39 mm
2 26.77 mm
3 28.82 mm
4 26.70 mm
5 27.41 mm
6 28.84 mm
7 26.57 mm

X 26.3488 mm
R 4.98 mm

DATE 2018/ 2/17
TIME 14:40

NAME:
SUB GR. NO. 2
1 27.77 mm
2 27.13 mm
3 27.98 mm
4 27.84 mm
5 27.90 mm
6 26.68 mm
7 28.85 mm

X 27.7329 mm
R 1.99 mm

DATE 2018/ 2/17
TIME 14:40

NAME:
*CONTROL LIMITS*
DATE 2018/ 2/17
TIME 14:40
NO. OF SUB GR. 2
SAMPLE SIZE 7
X-CL 27.6007 mm
R-CL 3.4850 mm
R-LCL 3.7051 mm
R-UCL 0.2699 mm
    
```

Statistical calculation data

MODE0

GO/±NG judgment

MODE1, 2

N: Number of pieces of data

MAX: Maximum value

MIN: Minimum value

R: Range

X̄: Mean value

σn: Standard deviation of a population (N)

σn-1: Sample standard deviation (N-1)

-NG: For the number of pieces of data smaller than the lower limit

+NG: For the number of pieces of data larger than the upper limit

P: Percentage of rejects

Cp: Maximum process capability potential

Cpk: Actual process capability achieved

MODE3

N: Number of pieces of data

MAX: Maximum value

MIN: Minimum value

n: Number of subgroups (up to 10)

X̄: Mean value in a subgroup

R: Range of a subgroup

X̄: Mean value

X-UCL: Upper control limit

X-LCL: Lower control limit

R: Center (R control)

R-UCL: Upper control limit (R control)

R-LCL: Lower control limit (R control)

Example of batch printing log data

In OUTLOG Setting 1

```

* OUT LOG START *
* LOG = 10

DATE 2018/ 2/15

10:16:32 37.20 mm
10:16:44 39.64 mm
10:16:58 37.22 mm
10:17: 8 37.27 mm
10:17:58 38.88 mm
10:18:41 37.68 mm
10:18:18 37.70 mm
10:18:47 37.80 mm
10:20:17 37.58 mm
10:20:43 37.04 mm

* OUT LOG END *
    
```

This setting allows printout of measurement time, measurement value, and GO/±NG judgment result.

In OUTLOG Setting 2

```

* OUT LOG START *
* LOG = 10

DATE 2018/ 2/15

1 20.41 mm
2 20.37 mm
3 20.05 mm
4 20.31 mm
5 20.68 mm
6 20.19 mm
7 21.29 mm
8 22.53 mm
    
```

This setting allows printout of data number, measurement value, and GO/±NG judgment result.

In OUTLOG Setting 3

```

* OUT LOG START *
* LOG = 10

1 2018/ 2/15 10:28:28 21.00 mm
2 2018/ 2/15 10:28:31 20.10 mm
3 2018/ 2/15 10:28:33 18.00 mm
4 2018/ 2/15 10:28:37 18.03 mm
5 2018/ 2/15 10:29:29 20.85 mm
    
```

This setting allows printout of data number, measurement date and time, and GO/±NG judgment result.

Specifications

- **264-505**
 - Model: **DP-1VA LOGGER**
 - Data input: Digimatic input, RS-232C input (specific to Mitutoyo **KA** counter)
 - Data processing capacity:
 - Mode 0: 100,000 pcs. of data
 - Modes 1,2: 9,999 pcs. of data
 - Mode 3: Sample size
 - 10x9,999 subgroups=99,990 pcs. of data
 - GO/±NG judgment (five sets can be defined)
 - Output:
 - 1) USB output
 - 2) RS-232C data output at TTL levels
 - 3) GO/±NG judgment result output (+NG, GO, -NG)
 - Input timer: Input intervals
 - 0.25 s, 1 s, 5 s, 30 s, 1 min, 30 min, 60 min
 - Printing method: Thermal line printer
 - Printing speed: 0.8 s per line (6.5 mm/s) (using AC adapter)
 - Printing line: 10,000 lines of normal characters per roll
 - 7,000 lines of large characters per roll
 - Printing paper: High durability thermo-sensitive paper
 - Width 58 mm x length 48 m
- Note: If it is to be used for official documents, or stored more than 5 years, it is recommended to make a more durable copy.
- Power supply: 2 power methods
 - 1) AC adapter 100 to 240 V 50/60 Hz AC adapter (6 V, 2 A) as a standard accessory.
 - 2) 4 pcs. of LR6/AA size (alkaline or Ni-Mh)
- Note: Manganese dioxide batteries are not usable.
- Battery life: About 10,000 lines* (if data is printed once every 5 seconds using 1,600 mA NiMH batteries at 20 °C)
 - * This is a typical value and is not guaranteed.
 - External dimensions: 94 (W) x201 (D) x75.2 (H) mm
 - Mass: 390 g (main unit)

Optional Accessories

- 1) USB cable (A-microB) : **06AFZ050** (1 m)
- 2) RS-232C output cable: **09EAA084** (1 m, D-SUB 9 pin)
- 3) RS-232C counter cable: **09EAA094**
 - Cable for **KA** counter (1 m, D-SUB 25-pin)
- 4) GO/±NG judgment cable: **965516**
 - (2 m, 10 pin terminal/separate)
- 5) Foot switch: **937179T**

Consumable Items

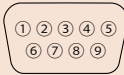
Printing paper (10 rolls): **09EAA082**



Refer to the **DP-1VA LOGGER Brochure (E12041)** for more details.

Specifications

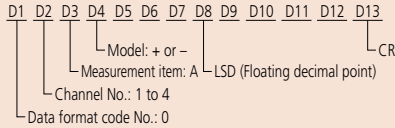
- **264-002**
- Model: **MUX-10F**
- Data input port: 4 channels for Digimatic gages
- Output: (RS-232C)
Data output Via RS-232C interface:
Data transmission method: Half-duplex
Data transmission code: ASCII/JIS
Data length: 8 bits
Parity check: None
Stop bit: 1
Data transmission speed: 300/600/1200/2400/9600/
19200 bps
- Connector specification:



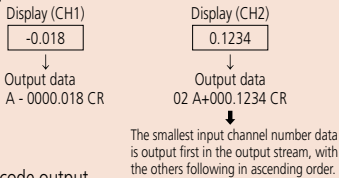
| Pin No. | Signal | Function | in/out |
|---------|--------|--------------------|--------|
| 1 | CD | | out |
| 2 | RD | Received data | out |
| 3 | TD | Communication data | in |
| 4 | | | |
| 5 | GND | Ground | |
| 6 | DR | | out |
| 7 | | | |
| 8 | CS | | out |
| 9 | | | |

Note: For connection with a PC, use a commercially available RS-232C straight cable.

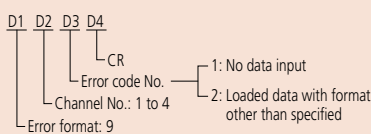
- Data format
- 1) When data output



- 2) Example of format



- 3) Error code output



- Power supply: AC adapter (9 V, 500 mA)
- External dimensions: 91.4 (W) x92.5 (D) x50.4 (H) mm
- Note: Communication software is not included.

Digimatic/RS-232C Interface Unit Multiplexer MUX-10F

- Multiplexer **MUX-10F** is a measurement data transfer device that converts incoming Digimatic output measurement data to RS-232C and outputs it to other devices such as a PC and sequencer.
- Up to four measuring instruments with Digimatic output can be connected.



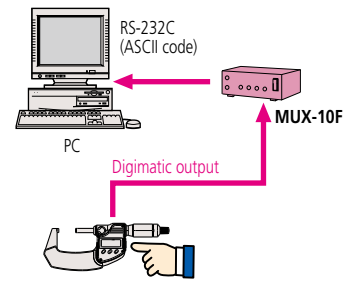
264-002
MUX-10F



Typical Application

Data input using the data button on the Digimatic gage

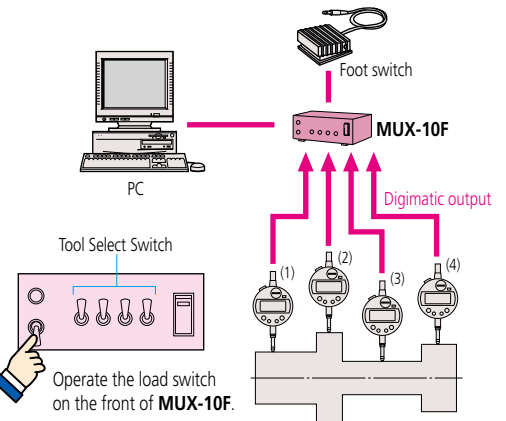
- If the Digimatic gage has a data button, data is sent to the **MUX-10F** from the gage, converted to RS-232C and sent out.



Press the data button on the measuring gage.

Data input using the load switch

- If the Digimatic gage does not have a data button, or when simultaneous measurements are performed, the **MUX-10F** load switch is used to poll data from the measuring gage (s)selected by the tool selection switch (es), converted to RS-232C, and sent out.
- If multiple measuring gages are selected by the tool selection switch, data is input in the order of channels 1 through 4.
- Optional foot switch (**937179T**) is available for quick data entry.

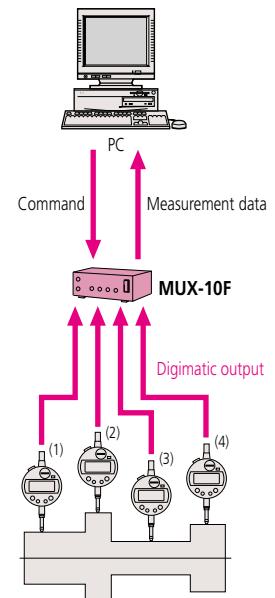


Data input using the external commands

- Data from a specified measuring gage connected to **MUX-10F** can be polled (ch 1 to 4) by inputting a command from the PC.

| Commands (ASCII) | Transfer channels |
|----------------------|-------------------|
| 1 (ASCII code31) CR | 1 |
| 2 (ASCII code32) CR | 2 |
| 3 (ASCII code33) CR | 3 |
| 4 (ASCII code34) CR | 4 |
| *A (ASCII code41) CR | 1, 2, 3, 4 |
| *B (ASCII code42) CR | 1, 2, 4 |
| *C (ASCII code43) CR | 1, 3, 4 |
| *D (ASCII code44) CR | 2, 3, 4 |
| E (ASCII code45) CR | 1, 2, 3 |
| F (ASCII code46) CR | 1, 2 |
| G (ASCII code47) CR | 1, 3 |
| H (ASCII code48) CR | 1, 4 |
| I (ASCII code49) CR | 2, 3 |
| J (ASCII code50) CR | 2, 4 |
| K (ASCII code51) CR | 3, 4 |




* Command will operate the same as previous **MUX-10** when 4-channel mode is turned off.







Measurement Data Management




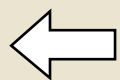
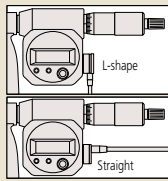
Convenient data collection tool and quality control software

Digimatic Data Cable Selector (including USB Input Tool Direct)

| | | | | | | |
|--|------------------------|-----|---|---|--|---|
| 1) USB Input Tool Direct USB-ITN  | Connector type | | A) Water-proof type with output button | B) Water-proof type with output button | C) Straight type with output button | CR) L type with output switch (cable outlet is right) |
| | Model No. Order No. | | USB-ITN-A 06AFM380A | USB-ITN-B 06AFM380B | USB-ITN-C 06AFM380C | No applicable models USB-ITN-C is available Refer to the following figure. |
| 2) IT-016U/IT-007R/DP-1VA LOGGER/MUX-10F/ EC Counter  Connector (11 types, A to G) Type D on the other end for all models | Connector type | | A) Water-proof type with output button | B) Water-proof type with output button | C) Straight type with output button | CR) L type with output switch (cable outlet is right) |
| | Order No. | 1 m | 05CZA624 | 05CZA662 | 959149 | 04AZB512 |
| | | 2 m | 05CZA625 | 05CZA663 | 959150 | 04AZB513 |
| 3) U-WAVE-T  | Connector type | | A) Water-proof type with output button | B) Water-proof type with output button | C) Straight type with output button | CR) L type with output switch (cable outlet is right) |
| | Standard | | 02AZD790A | 02AZD790B | 02AZD790C | No applicable models Type C connectors are available, but take care of the cable when using thimbles Refer to the following figure. |
| | For foot switch | | 02AZE140A | 02AZE140B | 02AZE140C | |

Select a cable (A to G) whose gage connector fits the Digimatic port on your gage (check the red dotted frame in the above pictures).








| | | | | | | |
|--|---------------------------|--|---|---|---|---|
| Gage connectors on data cable The connector dimensions are given on page A-29. | Connector type | | A) Water-proof type with output button | B) Water-proof type with output button | C) Straight type with output button | CR) L type with output switch (cable outlet is right) |
| | Picture of gage connector | |  |  |  |  |
| | Data switch | | Available | Available | Available | Available |




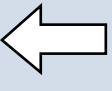
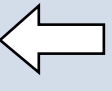
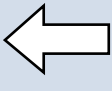

| | | | | | | |
|--|---------------------------|--|---|---|--|---|
| Digimatic ports on gage Please note that some high-precision Digimatic gages are capable of displaying the measurement result to more than 6 digits. However, according to the Digimatic output specification, the result may be output in 6 digits only. Digimatic gages whose display may exceed 26 digits <ul style="list-style-type: none"> • Laser Scan Micrometers • Litematic • Linear gage counter (EH) | Picture of Digimatic port | |  |  |  |  |
| | Applicable models | | <ul style="list-style-type: none"> • Digimatic caliper 500-776 / 500-777, etc. 500-712-20 / 500-713-20, etc. 500-712 etc. • Digimatic special application caliper 550-301-10 / 550-331-10, etc. 551-301-10 / 551-331-10, etc. 552-302-10 / 552-303-10, etc. 552-150-10 / 552-151-10, etc. 552-155-10 / 552-156-10, etc. 552-181-10 / 552-182-10, etc. • Digimatic special application caliper 573-601 / 573-602, etc. • Digimatic depth gage 571-251-10 / 571-252-10, etc. • Digimatic scale unit 572-600, 572-601, etc. | <ul style="list-style-type: none"> • Digimatic micrometer 293-140-30 / 293-141-30, etc. 293-230-30 etc. 340-251-30 / 340-252-30 293-666-20 / 293-667-20, etc. 227-201-20 / 227-203-20, etc. 227-205-20 / 227-206-20, etc. 227-221-20 etc. 227-223-20 etc. • Dedicated micrometers for Digimatic 422-230-30 / 422-231-30, etc. 406-250-30 / 406-251-30, etc. 343-250-30 / 343-251-30, etc. 369-250-30 / 369-251-30, etc. 345-250-30 / 345-251-30, etc. 314-251-30 / 314-252-30, etc. • Digimatic micrometer head 350-251-30 / 350-261-30, etc. • Digimatic holtest 468-161 / 468-162, etc. • Digimatic depth gage 329-250-30 / 329-251-30, etc. | <ul style="list-style-type: none"> • Digimatic caliper 500-150-30 / 500-151-30, etc. 500-500-10 / 500-501-10, etc. 500-443 etc. • Digimatic special application caliper 573-118-10 / 573-119-10, etc. 573-116-10 / 573-117-10, etc. 573-191-30 / 573-291-30 573-181-30 / 573-182-30, etc. • Digimatic depth gage 571-201-30 / 571-202-30, etc. • Digimatic micrometer head 164-163 / 164-164 • Digimatic scale unit 572-203-10 / 572-213-10 572-300-10 / 572-301-10, etc. | <ul style="list-style-type: none"> • Digimatic micrometer 293-582 / 293-583, etc. 389-514 / 389-714  <p>Type C straight connectors are available, but may interfere with thimble operation.</p> |

| | | | | | | |
|--------------------------------------|--------------------------------------|--------------------------------------|--|--|---|---|
| D) Flat 10-pin type | E) Round 6-pin type | F) Flat straight type | FB) Flat L-shape (cable outlet is back) | FR) Flat L-shape (cable outlet is right) | FL) Flat L-shape (cable outlet is left) | G) Flat straight water-proof type |
| USB-ITN-D 06AFM380D | USB-ITN-E 06AFM380E | USB-ITN-F 06AFM380F | No applicable models USB-ITN-F is available. | | | USB-ITN-G 06AFM380G |
| D) Flat 10-pin type | E) Round 6-pin type | F) Flat straight type | FB) Flat L-shape (cable outlet is back) | FR) Flat L-shape (cable outlet is right) | FL) Flat L-shape (cable outlet is left) | G) Flat straight water-proof type |
| 936937 | 937387 | 905338 | 905689 | 905691 | 905693 | 21EAA194 |
| 965014 | 965013 | 905409 | 905690 | 905692 | 905694 | 21EAA190 |
| D) Flat 10-pin type | E) Round 6-pin type | F) Flat straight type | FB) Flat L-shape (cable outlet is back) | FR) Flat L-shape (cable outlet is right) | FL) Flat L-shape (cable outlet is left) | G) Flat straight water-proof type |
| 02AZD790D | 02AZD790E | 02AZD790F | No applicable models Use 02AZD790F or 02AZD140F . | | | 02AZD790G |
| 02AZE140D | 02AZE140E | 02AZE140F | | | | 02AZE140G |



Note 1: **ID-F**, **EB**, **EC-101D**, **ID-U**, **ID-SS**, **ID-SX** are required to use with the **USB-ITN**.
 Note 2: **USB-ITN**, **IT-016U**, and **U-WAVE** cannot be used with **EF/EH**, **VL-50-B/50S-B**, and **SJ-500/SV-2100**.

| | | | | | | |
|---|---|---|---|--|---|---|
| D) Flat 10-pin type | E) Round 6-pin type | F) Flat straight type | FB) Flat L-shape (cable outlet is back) | FR) Flat L-shape (cable outlet is right) | FL) Flat L-shape (cable outlet is left) | G) Flat straight water-proof type |
|  |  |  |  |  |  |  |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A |

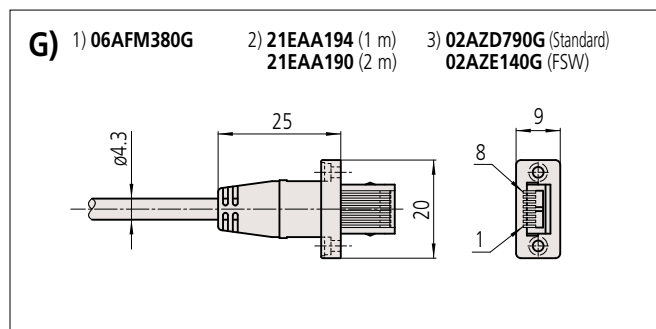
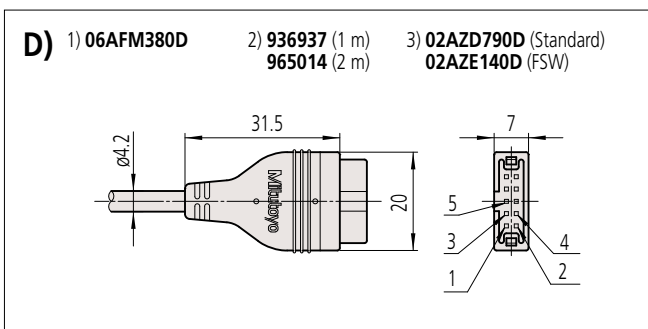
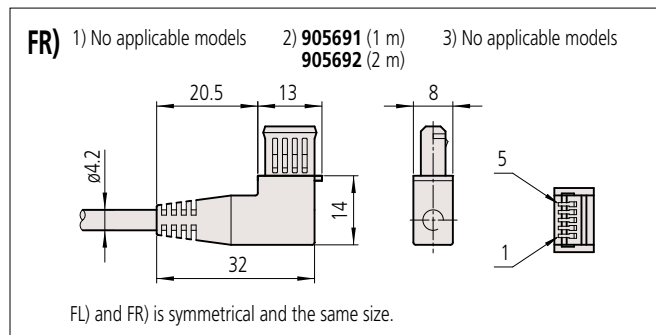
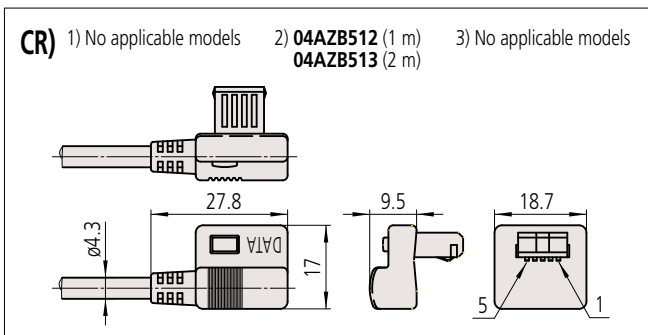
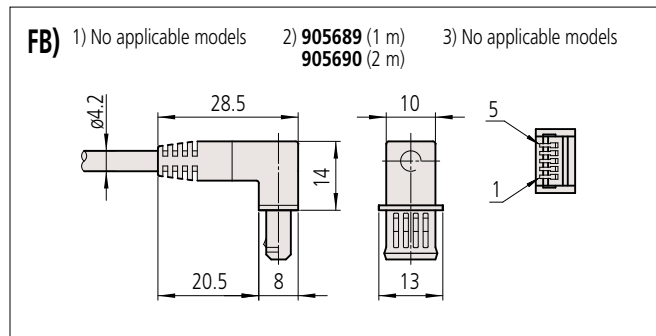
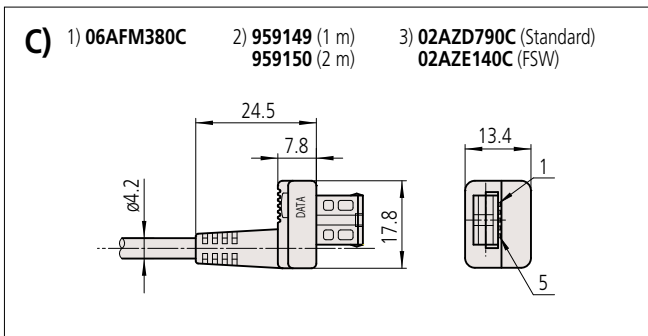
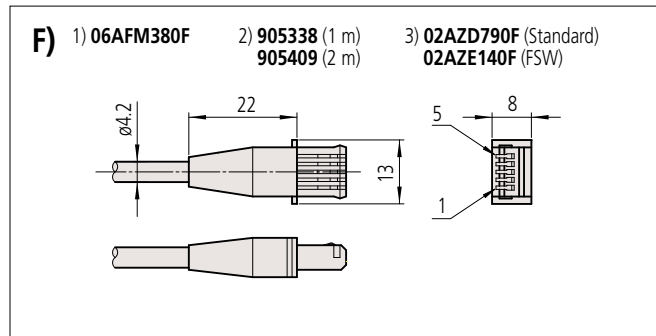
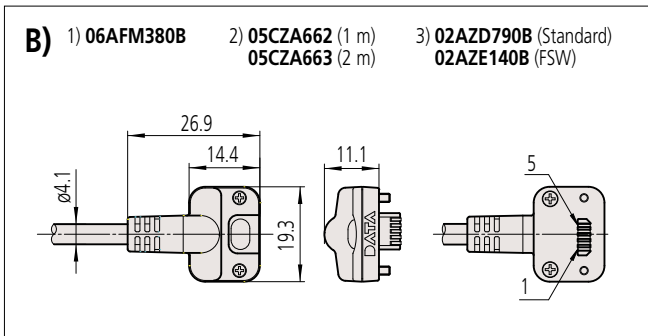
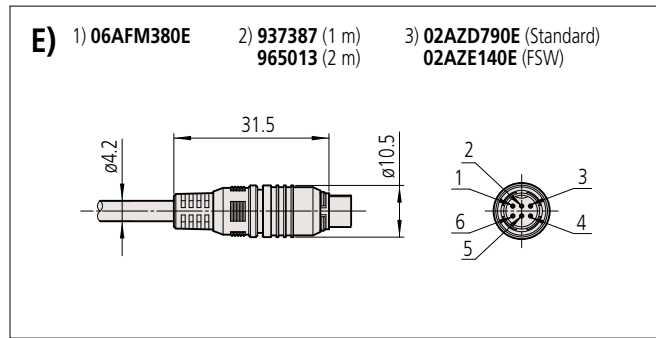
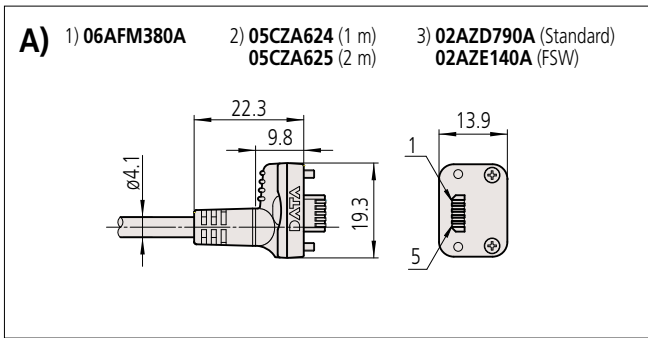
| | | | | | | |
|--|---|--|---|---|---|--|
|  |  |  |  |  |  |  |
| <ul style="list-style-type: none"> • Digimatic indicator ID-H • ID-F (Note 1) • High-precision height gage QM-Height • Mu-checker Digital Mu-checker (using a foot switch) • Laser scan micrometer LSM-9506 • Linear gage counter EF/EH (Note 2) • EB (Note 1), EC-101D (Note 1) • Litematic VL-50-B/50S-B (Note 2) • Contour measuring system SJ-210/310/410 • SJ-500/SV-2100 (Note 2) • Hardness testing machines HM-210/220 • HM-110/120 | <ul style="list-style-type: none"> • Hardness testing machines HM-100 • HM-200 • HV-100 • HR-300/400/500 • HH-411 | <ul style="list-style-type: none"> • Digimatic indicator ID-CX, ID-C (Peak-Value Hold Type), ID-C (Calculation type), ID-C (Bore Gage Type), ID-U (Note 1), ID-SS (Note 1), ID-SX (Note 1) • Digimatic height gage 192-663-10/192-613-10/570-322/570-227, etc. (Flat L-shape, cable outlet is right) • ABS borematic 568-361/568-362, etc. • Scale unit 572-460/572-560/572-480-10/572-580-10, etc. • Digimatic bore gage 511-501/511-502, etc. • Hardness testing machines HH-300 • Digimatic depth gage Digimatic type (ID-CX) | | | | <ul style="list-style-type: none"> • Digimatic indicator ID-N • ID-B |

Measurement Data Management

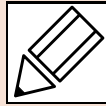
Convenient data collection tool and quality control software

Digimatic data cable specifications (Dimensions)

Gage connector dimensions (Unit: mm)



Quick Guide to Precision Measuring Instruments



Quality Control

Quality control (QC)

A system for economically producing products or services of a quality that meets customer requirements.

Process quality control

Activities to reduce variation in product output by a process and keep this variation low. Process improvement and standardization as well as technology accumulation are promoted through these activities.

Statistical process control (SPC)

Process quality control through statistical methods.

Population

A group of all items that have characteristics to be considered for improving and controlling processes and quality of product. A group which is treated based on samples is usually the population represented by the samples.

Lot

Collection of product produced under the same conditions.

Sample

An item of product (or items) taken out of the population to investigate its characteristics.

Sample size

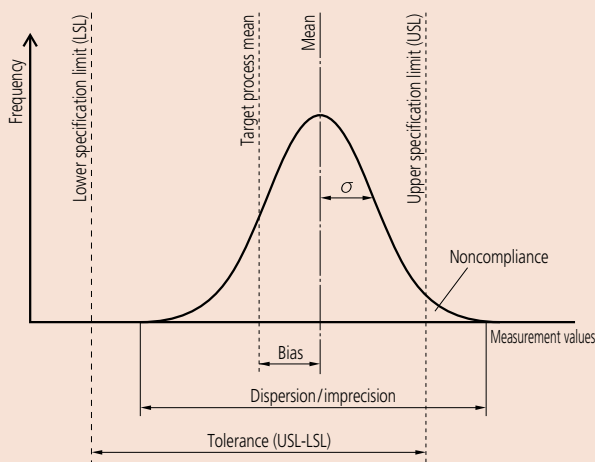
Number of product items in the sample.

Bias

Value calculated by subtracting the true value from the mean of measurement values when multiple measurements are performed.

Dispersion, Imprecision

Variation in the values of a target characteristic in relation to the mean value. Standard deviation is usually used to represent the dispersion of values around the mean.



Histogram

A diagram that divides the range between the maximum and the minimum measurement values into several divisions and shows the number of values (appearance frequency) in each division in the form of a bar graph. This makes it easier to understand the rough average or the approximate extent of dispersion. A bell-shaped symmetric distribution is called the normal distribution and is much used in theoretical examples on account of its easily calculable characteristics. However, caution should be observed because many real processes do not conform to the normal distribution, and error will result if it is assumed that they do.

Process capability

Process-specific performance demonstrated when the process is sufficiently standardized, any causes of malfunctions are eliminated, and the process is in a state of statistical control. The process capability is represented by mean $\pm 3\sigma$ or 6σ when the quality characteristic output from the process shows normal distribution. σ (sigma) indicates standard deviation.

Process capability index (PCI or Cp)

The index value is calculated by dividing the tolerance of a target characteristic by the process capability (6σ). The value calculated by dividing the difference between the mean (\bar{X}) and the standard value by 3σ may be used to represent this index in cases of a unilateral tolerance. The process capability index assumes that a characteristic follows the normal distribution.

Notes: If a characteristic follows the normal distribution, 99.74 % data is within the range $\pm 3\sigma$ from the mean.

Bilateral tolerance

$$C_p = \frac{USL - LSL}{6\sigma}$$

USL: Upper specification limit
LSL: Lower specification limit

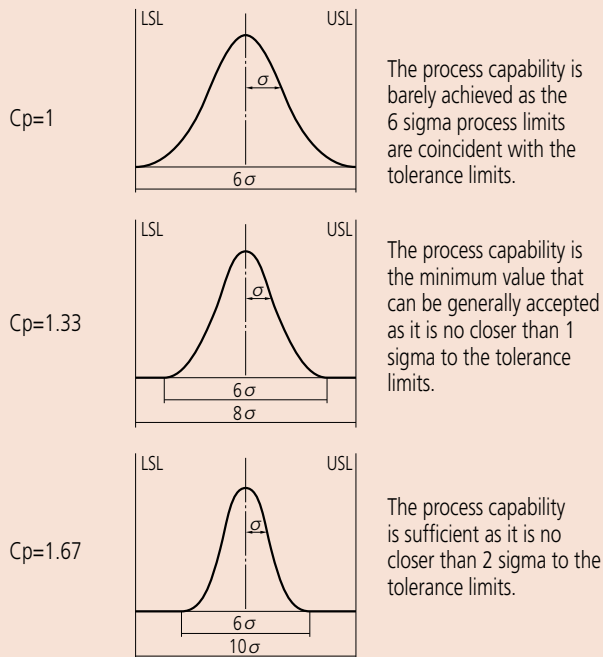
Unilateral tolerance ... If only the upper limit is stipulated

$$C_p = \frac{USL - \bar{X}}{3\sigma}$$

Unilateral tolerance ... If only the lower limit is stipulated

$$C_p = \frac{\bar{X} - LSL}{3\sigma}$$

Specific examples of a process capability index (Cp) (bilateral tolerance)

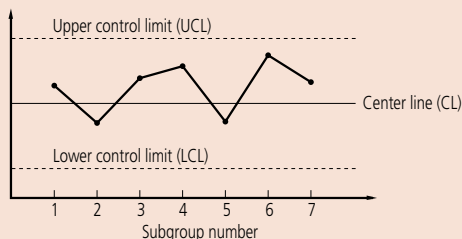


Note that Cp only represents the relationship between the tolerance limits and the process dispersion and does not consider the position of the process mean.

Notes: A process capability index that takes the difference between the process mean from the target process mean into consideration is generally called Cpk, which is the upper tolerance (USL minus the mean) divided by 3σ (half of process capability) or the lower tolerance (the mean value minus LSL) divided by 3σ , whichever is smaller.

Control chart

Used to control the process by separating the process variation into that due to chance causes and that due to a malfunction. The control chart consists of one center line (CL) and the control limit lines rationally determined above and below it (UCL and LCL). It can be said that the process is in a state of statistical control if all points are within the upper and lower control limit lines without notable trends when the characteristic values that represent the process output are plotted. The control chart is a useful tool for controlling process output, and therefore quality.



Chance causes

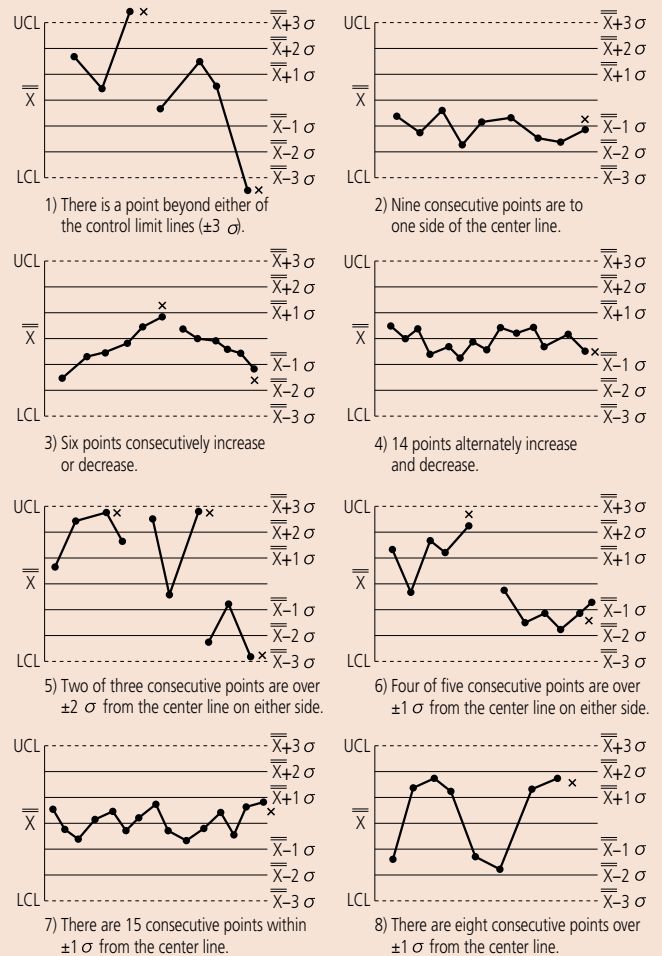
These causes of variation are of relatively low importance. Chance causes are technologically or economically impossible to eliminate even if they can be identified.

\bar{X} -R control chart

A control chart used for process control that provides the most information on the process. The \bar{X} -R control chart consists of the \bar{X} control chart that uses the mean of each subgroup for control to monitor abnormal bias of the process mean and the R control chart that uses the range for control to monitor abnormal variation. Usually, both charts are used together.

How to read the control chart

Typical trends of successive point position in the control chart that are considered undesirable are shown below. These trends are taken to mean that a 'special cause' is affecting the process output and that action from the process operator is required to remedy the situation. These determination rules only provide a guideline. Take the process-specific variation into consideration when actually making determination rules. Assuming that the upper and the lower control limits are 3σ away from the center line, divide the control chart into six regions at intervals of 1σ to apply the following rules. These rules are applicable to the \bar{X} control chart and the \bar{X} control chart. Note that these 'trend rules for action' were formulated assuming a normal distribution. Rules can be formulated to suit any other distribution.



Note: This part of 'Quick Guide to Precision Measuring Instruments' (A-31 to A-32) has been written by Mitutoyo based on its own interpretation of the JIS Quality Control Handbook published by the Japanese Standards Association.

References

- JIS Quality Control Handbook (Japanese Standards Association)

- Z 8101: 1981
- Z 8101-1: 1999
- Z 8101-2: 1999
- Z 9020: 1999
- Z 9021: 1998

New Products



High-Accuracy Digimatic Micrometer

Refer to pages B-3 to B-4 for details.



QuantuMike

Refer to pages B-5 to B-6 for details.



Coolant Proof Micrometers

Refer to pages B-7 to B-8 for details.



Digimatic Micrometer Heads

Refer to pages B-77 to B-79 for details.



Micrometer Heads (Fine Spindle Feed of 0.1 mm/rev)

Refer to pages B-101 to B-102 for details.



B

Small Tool Instruments Micrometers Micrometer Heads

Micrometers



Micrometer Heads



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Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

High-Accuracy Digimatic Micrometer SERIES 293

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Enabling 0.1 μm resolution measurement, this micrometer is ideal for customers who need to make highly accurate measurements with a hand-held tool.
- The High-Accuracy Digimatic Micrometer utilizes Mitutoyo's innovative 0.1 μm resolution ABS (absolute) rotary sensor*1 and high-accuracy screw machining technology to reduce the Maximum Permissible Error to $\pm 0.5 \mu\text{m}$, delivering higher accuracy without sacrificing operability.
*1 Patent pending in Japan, the United States of America, the European Union, and China.
- A highly rigid frame and high-performance constant-force mechanism*2 enable more stable measurement, while the clicks emitted while the workpiece is being measured assure the operator that measurement is proceeding normally.
*2 Patent pending in Japan, the United States of America, the European Union, and China.
- Body heat transferred to the instrument is reduced by a (removable) heat shield, minimizing the error caused by thermal expansion of the frame when performing handheld measurements.

- The ABS (absolute) rotary sensor also eliminates the need to perform origin setting each time the power is turned on, letting you start measuring straight away. With no possibility of overspeed errors, the High-Accuracy Digimatic Micrometer also delivers a higher level of reliability.
- The High-Accuracy Digimatic Micrometer has a range of features to enable flexible measurement including switchable resolution (0.0001 mm/0.0005 mm), function lock and preset.
- Carbide-tipped measuring faces



Function lock



293-100-10

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo



Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

An inspection certificate is supplied as standard. Refer to page U-11 for details.

ABSOLUTE[™]

Functions

Preset (ABS measurement system):

The measurement origin can be preset to any value within the display range for convenience in measuring.

Zero-setting (INC measurement system):

The display can be zeroed at any position of the spindle, making comparison measurement easier. Returning to the absolute-measurement mode is easily accomplished.

Hold:

The displayed value is held while the spindle is withdrawn and the micrometer moved so that the display can be read at the operator's convenience. After cancelling the hold, the instrument returns to the previous measuring mode (absolute or incremental).

Resolution switching:

The resolution of the display can be switched. If 0.1 μm measurement is not required, the resolution can be switched to 0.5 μm .

Function lock:

Functions such as preset or zero-set can be locked to avoid inadvertently changing the origin position.

On / off:

The power can be turned off after measurement is complete. Even after the power is turned off, the origin or last zero-set position remains in the memory.

Auto power off:

Even if the power is left on, the power turns off automatically if the micrometer is not used within a 20-minute period.

Measurement data output:

Measurement data can be output, allowing easy incorporation of this instrument into a statistical process control or measurement system.

Error alarm:

In the unlikely event of a display overflow or calculation error, an error message is displayed and measurement stops. Measurement cannot continue until the error is corrected.

Also, if the battery voltage drops below a certain point, the battery indicator will turn on before measurement becomes impossible, warning the user that the battery needs to be replaced.

Standard Accessories

Heat shield (**04AAB969A: 293-100-10**
04AAB969B: 293-130-10) ×1

Lithium battery CR2032 (1 pc.),
for initial operational checks (standard accessory)
Spanner (**200877**) ×1
Screwdriver (**04AAB985**) ×1
Cleaning paper for measuring faces
Inspection certificate



With heat shield attached

Heat shield



Optional Accessories

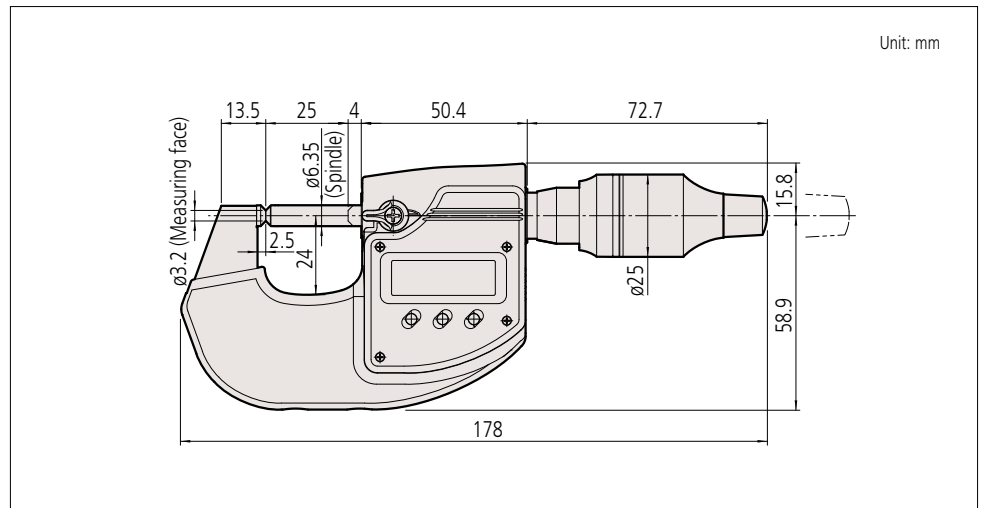
- Connecting cables with output switch
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- Connecting cables for U-WAVE-T
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.
- Cleaning paper for measuring faces (1,000 sheet): **04AZB581**



Recommended micrometer stand: **156-101-10**



DIMENSIONS



SPECIFICATIONS

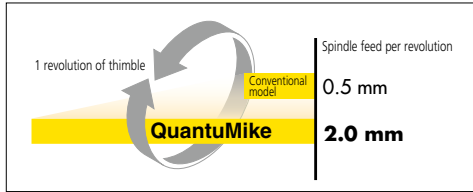
| | Metric | Inch/Metric |
|-------------------------------------|---|--|
| Order No. | 293-100-10 | 293-130-10 |
| Measuring range | 0 – 25 mm | 0 – 1 in |
| Resolution | 0.0001 mm/0.0005 mm (switchable) | 0.000005 in/0.00002 in 0.0001 mm/0.0005 mm (switchable) |
| Maximum permissible error J_{MPE} | $\pm 0.5 \mu\text{m}$ | ± 0.00002 in |
| Flatness/Parallelism | 0.3 μm /0.6 μm | 0.000012 in/0.000024 in |
| Measuring surface | $\phi 3.2$ mm | |
| Measuring force | 7 to 9 N | |
| Measuring system | Electromagnetic induction type ABS rotary sensor | |
| Mass | 400 g (440 g with heat shield attached) | |
| Power supply | Lithium battery (CR2032) ×1 | |
| Battery life | Approx. two years when used under normal conditions | |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

QuantuMike SERIES 293 — IP65 Micrometer with 2 mm/rev Spindle Feed

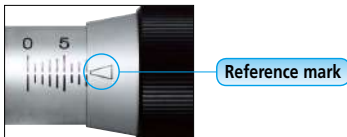
- Advanced pioneering technology has created the next generation of micrometer, the most revolutionary advance in micrometer technology since James Watt invented the instrument.
- Faster measurement is achieved by using a coarser thread which feeds the spindle by 2 mm per revolution of the thimble. This increase in thread lead has been made possible thanks to new high precision thread-cutting and testing techniques.



- QuantuMike is equipped with a function lock feature to prevent the origin point being moved by mistake during measurement.



- A graduated scale is provided on the sleeve for use with a reference mark on the thimble so that every millimeter displacement can be checked to provide extra confidence.



- A statistical process control system and a measurement network system can be established to share information regarding quality with a model equipped with the data output function. (Refer to page A-3 for details.)
- There is a lineup of convenient Interface Input Tools which enable the conversion of measurement data to keyboard signals and directly input them to cells in off-the-shelf spreadsheet software such as Excel. (Refer to page A-13 for details.)
- Excellent resistance against oil, water and dust (IP65 protection level) enables this product to be used in machining situations that include splashing coolant fluid.
- Measuring faces: Carbide.



Ratchet-induced microvibrations along the spindle help ensure repeatable measurements.

MeasurLink[®] ENABLED
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293-140-30



293-142-30



293-143-30



293-141-30



An inspection certificate is supplied as standard. Refer to page U-11 for details. (Maximum measuring range up to 50 mm)

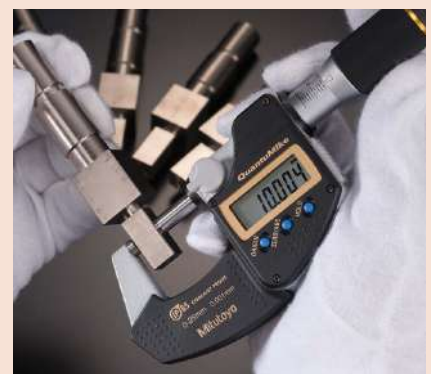


MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



- The name QuantuMike is from Quantum and Micrometer, reflecting our belief this tool represents a quantum leap in micrometer ergonomics.

IP Codes

Level 6: Dust -proof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Dust/Water protection level: IP65 (IEC60529)*2
- Measuring force: 7 to 12 N*3
- Battery: SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use
- Length standard: Electromagnetic rotary sensor
- Standard accessories: Reference bar, 1 pc. (except for 0 to 25 mm (0 to 1 in) models) Spanner (**301336**), 1 pc.

*2 Rustproofing shall be applied after use.

*3 Measuring force when using the speeder ratchet (Apply a measuring force in the same condition as for measurement and then set the origin.)

Functions

Origin point setting (ABS length measurement system):

Pressing the ORIGIN button resets the ABS origin at the current spindle position. Origin values can be set depending on each size.

Zero setting (INC length measurement system):

A brief press on the ZERO/ABS button sets display to zero at the current spindle position and switches to the incremental (INC) measuring mode. A longer press resets to the ABS measuring mode.

Hold:

Pressing the HOLD button freezes the current value in the display. This function is useful for preserving a measurement in situations of poor visibility when the instrument must be moved away from the workpiece before the reading can be recorded.

Function lock:

This function allows the ORIGIN (origin point setting) function and the ZERO (zero setting) function to be locked to prevent these points being reset accidentally.

Auto power ON/OFF:

The reading on the LCD disappears after this instrument is idle for approx. 20 minutes, but the origin point is retained. Turning the spindle causes the reading on the LCD to reappear.

Data output*4:

Models equipped with this function have an output port for transferring measurement data to a Statistical Process Control (SPC) system.

Error alarm:

In case of an overflow on the LCD or a computing error, an error message appears on the LCD, and the measuring function stops. This prevents an instrument from giving an erroneous reading. Also, when the battery voltage drops to a certain level, the low-battery-voltage alarm annunciator appears well before the micrometer becomes unusable.

*4 Only for the models with SPC data output

Optional Accessories

(Only for models with data output function)

- Connecting cables with output switch
1 m: **05CZA662** 2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**

Wireless Data Output U-WAVE™

- **U-WAVE-TM 264-622** (IP67 type) **264-623** (Buzzer type)
 - **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
- Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB**
02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.

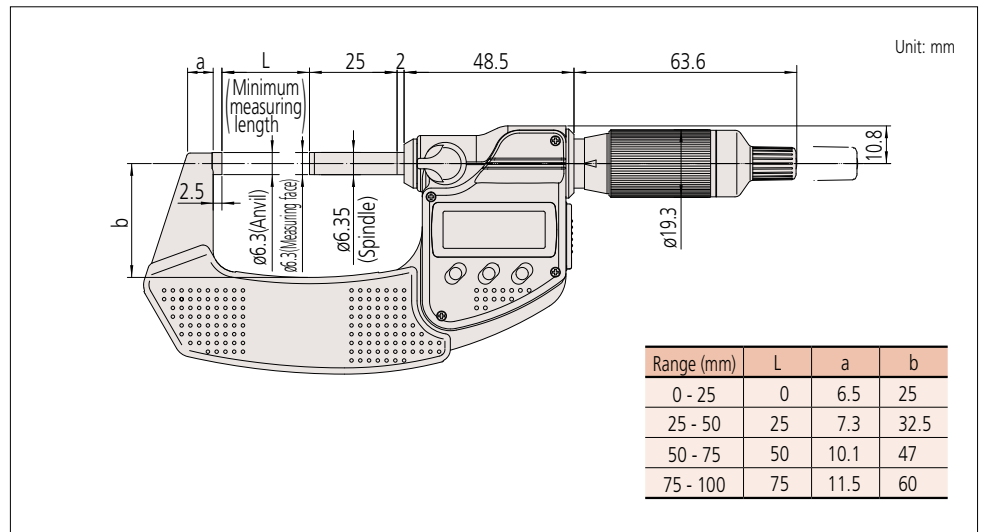


SPECIFICATIONS

| | | Metric | | | | | |
|-------------------------|-------------------|------------|-----------------|--|---------------|------------------|----------|
| | Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) | Mass (g) |
| with SPC data output | 293-140-30 | 0 - 25 | 0.001 | ±1 | 0.3 | 1 | 265 |
| | 293-141-30 | 25 - 50 | | | | | 325 |
| | 293-142-30 | 50 - 75 | | ±2 | | 2 | 465 |
| | 293-143-30 | 75 - 100 | | | | | 620 |
| without SPC data output | 293-145-30 | 0 - 25 | 0.001 | ±1 | 0.3 | 1 | 265 |
| | 293-146-30 | 25 - 50 | | | | | 325 |
| | 293-147-30 | 50 - 75 | | ±2 | | 2 | 465 |
| | 293-148-30 | 75 - 100 | | | | | 620 |

| | | Inch/Metric | | | | | |
|-------------------------|-------------------|-------------|-------------------------|--|---------------|------------------|----------|
| | Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Mass (g) |
| with SPC data output | 293-180-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ±0.00005 | 0.000012 | 0.00004 | 265 |
| | 293-181-30 | 1 - 2 | | | | | 325 |
| | 293-182-30 | 2 - 3 | | ±0.0001 | | 0.00008 | 465 |
| | 293-183-30 | 3 - 4 | | | | | 620 |
| without SPC data output | 293-185-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ±0.00005 | 0.000012 | 0.00004 | 265 |
| | 293-186-30 | 1 - 2 | | | | | 325 |
| | 293-187-30 | 2 - 3 | | ±0.0001 | | 0.00008 | 465 |
| | 293-188-30 | 3 - 4 | | | | | 620 |

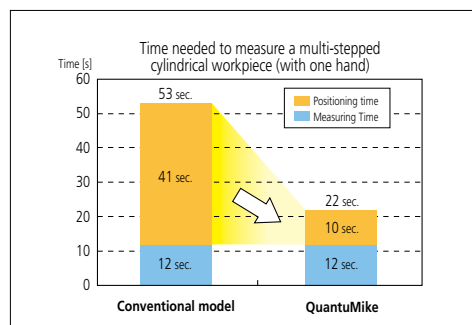
DIMENSIONS



Measuring time on a 6-stepped workpiece with one hand

Thanks to the quick movement, positioning times are reduced by 60 %* and measuring times by 35 %* compared with a conventional micrometer.

* According to Mitutoyo's comparison test data for measuring time on typical workpieces.



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Coolant Proof Micrometers SERIES 293 — with Dust/Water Protection Conforming to IP65 Level

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- World's highest performing micrometer overall.
- Extended battery life of approximately 2.4 years.
- Ergonomic anti-slip frame cover and front panel for more comfortable hand-held measurements.
- Ratchet thimble provides better operability for one-handed operation.
- Oil-resistant material used for all plastic parts.
- Models equipped with a Digimatic output port can form part of a statistical process control or networked measurement system. (Refer to page A-3 for details.)
- Interface Input Tools are available that enable the conversion of measurement data to keyboard signals that are then directly input to cells in off-the-shelf spreadsheet software such as Excel. (Refer to page A-13 for details.)
- Two types of constant-force devices are available: Ratchet Stop and Ratchet Thimble.
- Measuring faces: Carbide.



293-230-30



293-252-30



293-234-30
With ratchet thimble

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



An inspection certificate is supplied as standard. Refer to page U-11 for details. (Maximum measuring range up to 50 mm)

IP Codes

Level 6: Dust-proof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Flatness: 0.3 μm /0.000012 in
- Dust/water protection level: IP65 (IEC60529)*1
- Measuring force: 5 to 10 N (ratchet thimble type is 7 to 12 N)*2
- Battery: SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use
- Length standard: Electromagnetic rotary sensor
- Standard accessories: Reference bar, 1 pc. (except for 0 to 25 mm (0 to 1 in) models)
Spanner (**301336**), 1 pc.

*1 Rustproofing shall be applied after use.

*2 Refer to page B-6 for details.

Optional Accessories

(Only for models with data output function)

- Connecting cables with output switch
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.



Wireless Data Output **u-WAVE^{fit}**

U-WAVE-TM 264-622 (IP67 type)
264-623 (Buzzer type)

- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth[®] U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB 02AZF310** (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.



Functions

Origin point setting (ABS measurement system):

Resets the ABS origin at the current spindle position to the minimum value of the measuring range and switches to ABS mode.

Zero-setting:

A brief press on the ZERO/ABS button sets display to zero at the current spindle position and switches to the incremental (INC) measuring mode. A longer press resets to the ABS measuring mode.

Hold:

Pressing the HOLD button freezes the current value in the display. This function is useful for preserving a measurement in situations of poor visibility where the instrument must be moved away from the workpiece before the reading can be recorded.

Data output*1:

Models equipped with this function have an output port for transferring measurement data to a Statistical Process Control (SPC) system.

*1 Only models with the data output function

Auto power ON/OFF:

The reading on the LCD disappears after this instrument is idle for about 20 minutes, but the reading and measurement mode are retained. Turning the spindle causes the reading to reappear.

Error alarm:

In case of an overflow on the LCD or a computing error, an error message appears on the LCD, and the measuring function stops. This prevents an instrument from giving an erroneous reading. Also, when the battery voltage drops to a certain level, the low-battery-voltage alarm annunciator appears well before the micrometer becomes unusable.

Function lock:

This function allows the ORIGIN (origin point setting) function and the ZERO (zero-setting) function to be locked to prevent these points being reset accidentally.

SPECIFICATIONS

| Metric | | | | | | | | | |
|-------------------------|------------|------------|-----------------|---|-------------------------------|-----------------------|----------------------|----------------------|-----|
| | Order No | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Parallelism (μm) | Constant-force device | Mass (g) | | |
| with SPC data output | 293-230-30 | 0 - 25 | 0.001 | ± 1 | 1 | With ratchet stop | 270 | | |
| | 293-231-30 | 25 - 50 | | | | | 330 | | |
| | 293-232-30 | 50 - 75 | | | 470 | | | | |
| | 293-233-30 | 75 - 100 | | | 625 | | | | |
| | 293-250-30 | 100 - 125 | | 600 | | | | | |
| | 293-251-30 | 125 - 150 | | 740 | | | | | |
| | 293-252-30 | 150 - 175 | | 800 | | | | | |
| | 293-253-30 | 175 - 200 | | 970 | | | | | |
| | 293-254-30 | 200 - 225 | | 1100 | | | | | |
| | 293-255-30 | 225 - 250 | | 1270 | | | | | |
| | 293-256-30 | 250 - 275 | | 1370 | | | | | |
| | 293-257-30 | 275 - 300 | | 1590 | | | | | |
| | 293-234-30 | 0 - 25 | | ± 1 | 1 | | With ratchet thimble | 280 | |
| | 293-235-30 | 25 - 50 | | | | | | 340 | |
| 293-236-30 | 50 - 75 | 480 | | | | | | | |
| 293-237-30 | 75 - 100 | 635 | | | | | | | |
| without SPC data output | 293-240-30 | 0 - 25 | 0.001 | ± 1 | 1 | With ratchet stop | | 270 | |
| | 293-241-30 | 25 - 50 | | | | | | 330 | |
| | 293-242-30 | 50 - 75 | | 470 | | | | | |
| | 293-243-30 | 75 - 100 | | 625 | | | | | |
| | 293-244-30 | 0 - 25 | | ± 1 | 1 | | | With ratchet thimble | 280 |
| | 293-245-30 | 25 - 50 | | | | | | | 340 |
| | 293-246-30 | 50 - 75 | | 480 | | | | | |
| | 293-247-30 | 75 - 100 | | 635 | | | | | |

Note: All digits of models over 125 mm (5 in) measuring range are presettable.

| Inch/Metric | | | | | | | | | | |
|-------------------------|------------|------------|-----------------------|--|------------------|-----------------------|----------------------|-----------------------|----------------------|-----|
| | Order No | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Parallelism (in) | Constant-force device | Mass (g) | | | |
| with SPC data output | 293-330-30 | 0 - 1 | 0.00005 in / 0.001 mm | ± 0.00005 | 0.00004 | With ratchet stop | 270 | | | |
| | 293-331-30 | 1 - 2 | | | | | 330 | | | |
| | 293-332-30 | 2 - 3 | | | 470 | | | | | |
| | 293-333-30 | 3 - 4 | | | 625 | | | | | |
| | 293-350-30 | 4 - 5 | | ± 0.00015 | 0.00012 | | With ratchet stop | 600 | | |
| | 293-351-30 | 5 - 6 | | | | | | 740 | | |
| | 293-352-30 | 6 - 7 | | | 800 | | | | | |
| | 293-353-30 | 7 - 8 | | | 970 | | | | | |
| | 293-354-30 | 8 - 9 | | ± 0.0002 | 0.00016 | | | With ratchet stop | 1100 | |
| | 293-355-30 | 9 - 10 | | | | | | | 1270 | |
| | 293-356-30 | 10 - 11 | | | 1370 | | | | | |
| | 293-357-30 | 11 - 12 | | | 1590 | | | | | |
| | 293-334-30 | 0 - 1 | | ± 0.00005 | 0.00004 | | | | With ratchet thimble | 280 |
| | 293-335-30 | 1 - 2 | | | | | | | | 275 |
| 293-336-30 | 1 - 2 | 335 | | | | | | | | |
| without SPC data output | 293-340-30 | 0 - 1 | 0.00005 in / 0.001 mm | ± 0.00005 | 0.00004 | With ratchet stop | | | | 270 |
| | 293-341-30 | 1 - 2 | | | | | | | | 330 |
| | 293-342-30 | 2 - 3 | | 470 | | | | | | |
| | 293-343-30 | 3 - 4 | | 625 | | | | | | |
| | 293-344-30 | 0 - 1 | | ± 0.00005 | 0.00004 | | With ratchet thimble | | | 280 |
| | 293-345-30 | 1 - 2 | | | | | | | | 340 |
| | 293-346-30 | 2 - 3 | | 480 | | | | | | |
| | 293-347-30 | 3 - 4 | | 635 | | | | | | |
| | 293-348-30 | 0 - 1 | | ± 0.00005 | 0.00004 | | | With friction thimble | | 275 |

Note: All digits of models over 125 mm (5 in) measuring range are presettable.

DIMENSIONS

Measuring range: 100 mm or less

Measuring range: over 100 mm

Unit: mm

| Range (mm) | Order No. | L | a | b | c | |
|------------|-----------------------|-----|------|------|-----|-----|
| 0 - 25 | 293-230-30/293-240-30 | 0 | 6.5 | 25 | 2.5 | |
| 25 - 50 | 293-231-30/293-241-30 | 25 | 7.3 | 32.5 | | |
| 50 - 75 | 293-232-30/293-242-30 | 50 | 10.1 | 47 | | |
| 75 - 100 | 293-233-30/293-243-30 | 75 | 11.5 | 60 | | |
| 0 - 25 | 293-234-30/293-244-30 | 0 | 6.5 | 25 | 2.5 | |
| 25 - 50 | 293-235-30/293-245-30 | 25 | 7.3 | 32.5 | | |
| 100 - 125 | 293-250-30 | 100 | 16.7 | 76 | | 5.3 |
| 125 - 150 | 293-251-30 | 125 | 18.8 | 90 | | 5.7 |
| 150 - 175 | 293-252-30 | 150 | 19.1 | 103 | 6.1 | |
| 175 - 200 | 293-253-30 | 175 | 18.2 | 115 | 6.3 | |
| 200 - 225 | 293-254-30 | 200 | 16.8 | 126 | 6.7 | |
| 225 - 250 | 293-255-30 | 225 | 18 | 139 | 5.5 | |
| 250 - 275 | 293-256-30 | 250 | 18 | 152 | 6.5 | |
| 275 - 300 | 293-257-30 | 275 | 16 | 166 | 6.5 | |

IP Codes

Level 6: Dust -proof.

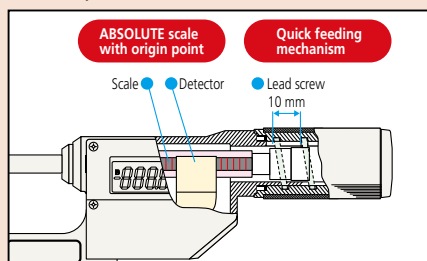
No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Resolution: 0.001 mm, 0.00005 in/0.001 mm
- Accuracy: Refer to the list of specifications.
- Measuring force: 5 to 12 N
- SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5 years under normal use
- Approx. 18,000 hours in continuous use
(1 year previous models **293-667/68/69/77/78/79**)
- Length standard: Electrostatic capacity absolute sensor
- Standard accessories: Reference bar, 1 pc.
(except for measuring range 0 to 30 mm (0 to 1.2 in) models)
- Maximum response speed: without limit
- The non-rotating spindle enables even inexperienced operators to perform measurements repeatably and accurately.



Optional Accessories

- Connecting cables
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- Connecting cables for **U-WAVE-T**
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.



Quickmike SERIES 293 — IP65 ABSOLUTE Digimatic Micrometers

- The Quickmike provides a speedy spindle feed of 10 mm per thimble rotation which enables widely differently sized features to be measured quickly.
- Set the origin only once. The absolute linear scale maintains the origin throughout the life of battery, meaning no more zero setting (presetting) or overspeed error.
- Excellent resistance against oil, water and dust (IP65 protection level) enables this product to be used in machining operations that includes splashing coolant fluid.
- Equipped with a large LCD offering easy readability.
- Pressing the HOLD button freezes the current value in the display.
- With function lock added to prevent unintended operation.
- A new low current consumption IC provides extremely long battery life.
- Measuring faces: Carbide.
- Supplied with a Ratchet Stop for constant measuring force.
- The lineup includes Blade Micrometer types (refer to page B-49), Disk Micrometer types (refer to page B-35) and Crimp Height Micrometer types (refer to page B-42).



293-666-20



293-667-20



293-668-20



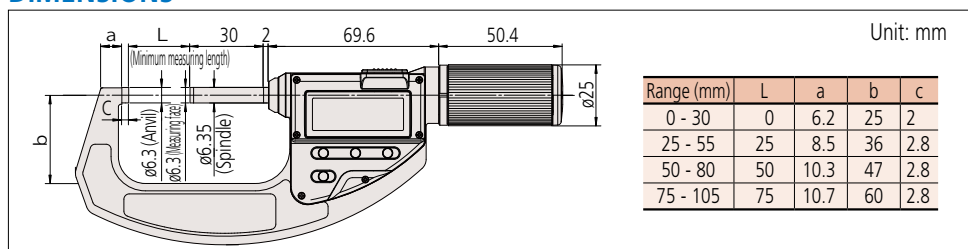
293-669-20

SPECIFICATIONS

| Metric | | | | | | | |
|------------|------------|--|---------------------|------------------------|-----------------------|----------|-----------------|
| Order No. | Range (mm) | Maximum permissible error J_{MPE} (μ m) | Flatness (μ m) | Parallelism (μ m) | Constant-force device | Mass (g) | Output function |
| 293-666-20 | 0 - 30 | ±2 | 0.3 | 2 | Yes | 275 | With |
| 293-667-20 | 25 - 55 | | | | | 340 | |
| 293-668-20 | 50 - 80 | ±3 | 3 | 480 | | | |
| 293-669-20 | 75 - 105 | | | 585 | | | |

| Inch / Metric | | | | | | | |
|---------------|------------|--|---------------|------------------|-----------------------|----------|-----------------|
| Order No. | Range (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Constant-force device | Mass (g) | Output function |
| 293-676-20 | 0 - 1.2 | ±0.0001 | 0.000012 | 0.00008 | Yes | 275 | With |
| 293-677-20 | 1 - 2.2 | | | | | 340 | |
| 293-678-20 | 2 - 3.2 | ±0.00015 | 0.00012 | 480 | | | |
| 293-679-20 | 3 - 4.2 | | | 585 | | | |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

ABSOLUTE Digimatic Micrometers SERIES 227 — with Adjustable Measuring Force

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Digimatic micrometer dedicated to applications requiring a constant/low measuring force such as measuring wire, paper, and plastic/rubber parts.
- Ratchet mechanism in the thimble applies constant force to workpiece.
- Compact and easy to handle.
- Measuring force is adjustable (in steps) to suit various kinds of workpieces.
- High-accuracy measurement can be performed even by unskilled operators due to the repeatability of the automatically applied measuring force.
- Non-rotating spindle.
- Measuring faces: Carbide.
- In addition to standard specification, a non-rotating spindle type tooth thickness micrometer (refer to page B-35 for details) is also available.



SPECIFICATIONS

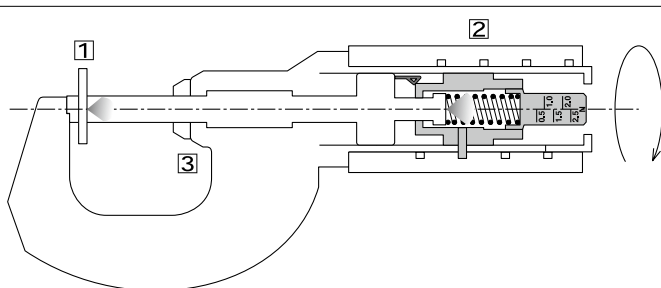
| Metric | | | | | | | | |
|------------|------------------------|------------|-----------------|---|-------------------------|--|---------------------------------------|----------|
| Order No. | Measuring force (N) | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Measuring force (N) | Accuracy of the selected measuring force* (N) | Repeatability of measuring force* (N) | Mass (g) |
| 227-201-20 | 0.5 - 2.5 (adjustable) | 0 - 15 | 0.001 | ± 2 | 0.5, 1.0, 1.5, 2.0, 2.5 | $\pm (0.1 + \text{the selected measuring force}/10)$ | within 0.1 | 300 |
| 227-203-20 | | 15 - 30 | | | | | | 380 |
| 227-205-20 | 2 - 10 (adjustable) | 0 - 10 | | | 345 | | | |
| 227-206-20 | | 10 - 20 | | | 425 | | | |
| 227-207-20 | | 20 - 30 | | | 2, 4, 6, 8, 10 | $\pm (0.4 + \text{the selected measuring force}/10)$ | within 0.4 | 415 |

* These values are guaranteed when micrometer is used in a horizontal orientation (within ± 3 degrees)

| Inch / Metric | | | | | | | | |
|---------------|------------------------|------------|-----------------------|--|-------------------------|--|---------------------------------------|----------|
| Order No. | Measuring force (N) | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Measuring force (N) | Accuracy of the selected measuring force* (N) | Repeatability of measuring force* (N) | Mass (g) |
| 227-211-20 | 0.5 - 2.5 (adjustable) | 0 - 0.6 | 0.00005 in / 0.001 mm | ± 0.0001 | 0.5, 1.0, 1.5, 2.0, 2.5 | $\pm (0.1 + \text{the selected measuring force}/10)$ | within 0.1 | 300 |
| 227-213-20 | | 0.6 - 1.2 | | | | | | 380 |
| 227-215-20 | 2 - 10 (adjustable) | 0 - 0.4 | | | 345 | | | |
| 227-216-20 | | 0.4 - 0.8 | | | 425 | | | |
| 227-217-20 | | 0.8 - 1.2 | | | 2, 4, 6, 8, 10 | $\pm (0.4 + \text{the selected measuring force}/10)$ | within 0.4 | 415 |

* These values are guaranteed when micrometer is used in a horizontal orientation (within ± 3 degrees)

Constant-Measuring-Force Mechanism



- 1 Measuring force is generated by the action of trapping a workpiece between the spindle face and the anvil.
- 2 The constant-force unit applies the specified measuring force.
- 3 When the preset measuring force is reached, the count on the LCD is automatically held and the hold symbol appears. (To cancel the hold, reverse the thimble more than 1/10 revolution and press the hold button.)

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE[™]

Technical Data

- Flatness: 0.3 $\mu\text{m}/0.000012$ in
- Parallelism: 2 $\mu\text{m}/0.00008$ in
- Measurement posture: horizontal orientation only (Recommended spindle inclination: within $\pm 3^\circ$)
- SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5 years under normal use
- Length standard: Electrostatic capacity absolute sensor
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 15 mm (0 to 0.6 in)/ 0 to 10 mm (0 to 0.4 in) models)
Screwdriver (**210183**), 1 pc.

Functions

Adjustable measuring force mechanism
Origin point setting
Zero setting
Hold
Function Lock
Auto power off
Measurement data output
Error alarm

Optional Accessories

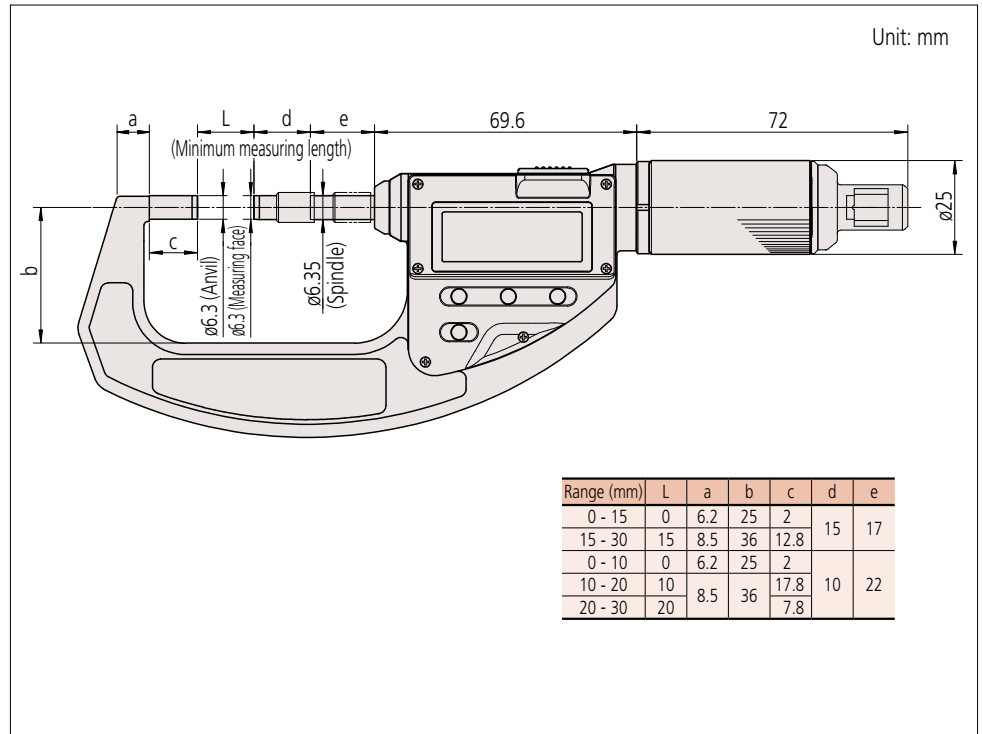
- Connecting cables
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- Connecting cables for **U-WAVE-T**
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Adjustable Measuring Force

To preset the measuring force, adjust the measuring force setting scale on the thimble with the screwdriver supplied.



DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Outside Micrometers SERIES 102

- Heat-insulated frame.
- Cut-away frame (behind anvil) for measuring in hard-to-reach places.
- Equipped with Ratchet Stop for constant measuring force.
- Measuring faces: Carbide.
- In addition to standard specification, a non-rotating spindle type tooth thickness micrometer (refer to page B-35 for details) is also available.



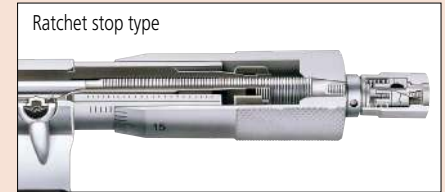
Ratchet stop
102-301



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Common specifications

- Measuring force: 5 to 10 N
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm models)
- Spanner (**301336**), 1 pc. (for measuring range 0 to 25 mm/25 to 50 mm models)
- Spanner (**200877**), 1 pc. (for measuring range 50 to 75 mm/75 to 100 mm models)



SPECIFICATIONS

Metric

| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) | Constant-force device |
|----------------|------------|-----------------|---|----------------------------|-------------------------------|-----------------------|
| 102-301 | 0 - 25 | 0.01 | ± 2 | 0.6 | 2 | Ratchet stop |
| 102-302 | 25 - 50 | | | | | |

Metric

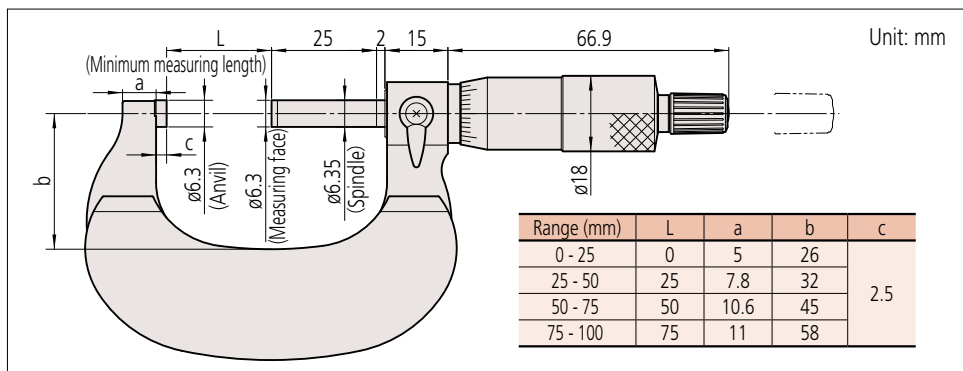
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) | Constant-force device |
|----------------|------------|-----------------|---|----------------------------|-------------------------------|-----------------------|
| 102-311 | 0 - 25 | 0.001 | ± 1 | 0.3 | 1 | Ratchet stop |
| 102-313 | | | | | | friction thimble |
| 102-312 | 25 - 50 | 0.01 | ± 2 | 0.6 | 2 | Ratchet stop |
| 102-303 | 50 - 75 | | | | | |
| 102-304 | 75 - 100 | | | | | |

Metric

Micrometer set

| Order No. | Range (mm) | Models included |
|-------------------|---------------------------------------|---|
| 102-911-40 | 0 - 100 (Four micrometers per set) | <ul style="list-style-type: none"> • 102-301 • 102-302 • 102-303 • 102-304 • 3 micrometer standards |

DIMENSIONS



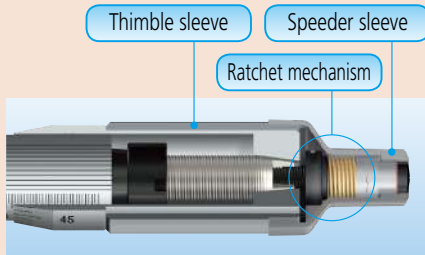


An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

- Measuring force: 5 to 10 N
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models) Spanner (301336), 1 pc.

Internal Structure

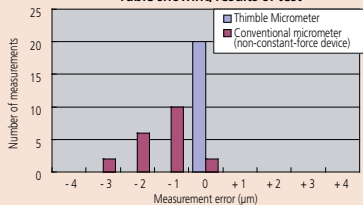


Greatly Improved Accuracy and Repeatability

Measurement results of one-handed operation

A beginner performed a test by measuring a workpiece 20 times using a conventional micrometer and a Ratchet Thimble Micrometer.

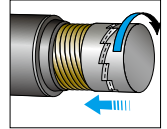
Table showing results of test



Ratchet Thimble Micrometer SERIES 102 — Outside Micrometers

- More accurate in one-handed operation: inexperienced operators measure significantly more accurately with the new micrometer.
- Ratchet function works both from the thimble and the speeder.

- Rotating the thimble/speeder when the workpiece is between the anvil and spindle causes the ratchet mechanism to operate and apply a constant measuring force to the workpiece.
- Clearly audible ratchet operation for reassurance that measurement is being performed at constant, preset force.
- The speeder is always available for quick rotation of spindle.
- A simple mechanism, which requires neither parts maintenance nor special technique, is employed in the constant-force device.
- Heat-insulated frame.
- Measuring faces: Carbide.

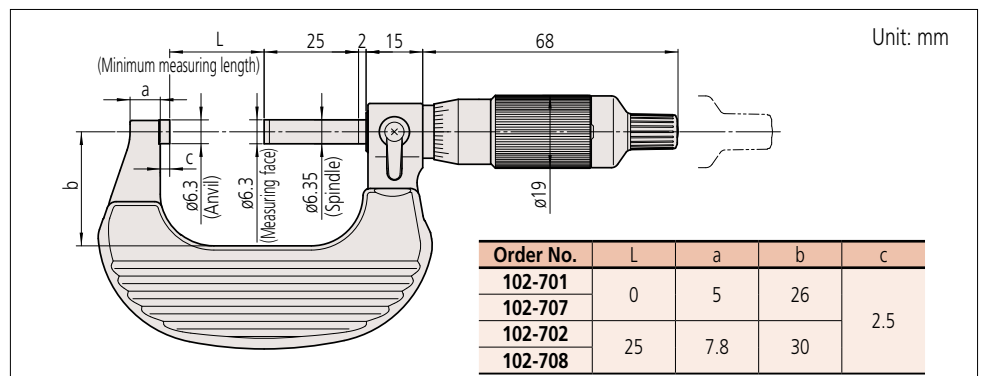


SPECIFICATIONS

| Metric | | | | | | |
|-----------|------------|-----------------|--|---------------|------------------|----------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) | Mass (g) |
| 102-701 | 0 - 25 | 0.01 | ±2 | 0.6 | 2 | 180 |
| 102-707 | | 0.001 | | | | |
| 102-702 | 25 - 50 | 0.01 | | | | |
| 102-708 | | 0.001 | | | | 270 |

| Inch | | | | | | |
|-----------|------------|-----------------|--|---------------|------------------|----------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Mass (g) |
| 102-717 | 0 - 1 | 0.0001 | ±0.0001 | 0.000024 | 0.00008 | 180 |
| 102-718 | 1 - 2 | | | | | 270 |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Outside Micrometers SERIES 103

- Baked-enamel-finished frame.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



Technical Data

- Parallelism:
($2+R/100$) μm , R=max, range (mm)
[0.00008+0.00004 (R/4)] in, R=max, range (inch)
fraction rounded down
- Standard accessories: Reference bar, 1 pc.
(except for measuring range 0 to 25 mm (0 to 1 in) models)
Spanner (**301336**), 1 pc.
(for maximum measuring range up to 300 mm (12 in))
Spanner (**200154**), 1 pc.
(for maximum measuring range 325 mm (13 in) or over)

| Metric With ratchet stop | | | | | | | |
|--------------------------|------------|-----------------|---|---------------------|----------------------------|---------|---|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Measuring force (N) | Flatness (μm) | | |
| 103-129 | 0 - 25 | 0.001 | ±2 | 5 - 10 | 0.6 | | |
| 103-130 | 25 - 50 | 0.001 | | | | | |
| 103-139-10 | 50 - 75 | 0.01 | ±3 | | | 10 - 15 | 1 |
| 103-140-10 | 75 - 100 | | | | | | |
| 103-141-10 | 100 - 125 | | | | | | |
| 103-142-10 | 125 - 150 | | | | | | |
| 103-143-10 | 150 - 175 | | | | | | |
| 103-144-10 | 175 - 200 | | | | | | |
| 103-145-10 | 200 - 225 | | | | | | |
| 103-146-10 | 225 - 250 | | | | | | |
| 103-147-10 | 250 - 275 | | | | | | |
| 103-148-10 | 275 - 300 | | | | | | |
| 103-149 | 300 - 325 | | | | | | |
| 103-150 | 325 - 350 | | | | | | |
| 103-151 | 350 - 375 | | | | | | |
| 103-152 | 375 - 400 | | | | | | |
| 103-153 | 400 - 425 | | | | | | |
| 103-154 | 425 - 450 | | | | | | |
| 103-155 | 450 - 475 | | | | | | |
| 103-156 | 475 - 500 | | | | | | |
| 103-157 | 500 - 525 | | | | | | |
| 103-158 | 525 - 550 | | | | | | |
| 103-159 | 550 - 575 | | | | | | |
| 103-160 | 575 - 600 | | | | | | |
| 103-161 | 600 - 625 | | | | | | |
| 103-162 | 625 - 650 | | | | | | |
| 103-163 | 650 - 675 | | | | | | |
| 103-164 | 675 - 700 | | | | | | |
| 103-165 | 700 - 725 | | | | | | |
| 103-166 | 725 - 750 | | | | | | |
| 103-167 | 750 - 775 | | | | | | |
| 103-168 | 775 - 800 | | | | | | |
| 103-169 | 800 - 825 | | | | | | |
| 103-170 | 825 - 850 | | | | | | |
| 103-171 | 850 - 875 | | | | | | |
| 103-172 | 875 - 900 | | | | | | |
| 103-173 | 900 - 925 | | | | | | |
| 103-174 | 925 - 950 | | | | | | |
| 103-175 | 950 - 975 | | | | | | |
| 103-176 | 975 - 1000 | ±15 | | | | | |

| Inch With ratchet stop | | | | | | | |
|------------------------|------------|-----------------|--|---------------------|---------------|---------|---------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Measuring force (N) | Flatness (in) | | |
| 103-177 | 0 - 1 | 0.001 | ±0.0001 | 5 - 10 | 0.00024 | | |
| 103-131 | | 0.0001 | | | | | |
| 103-178 | | 0.001 | | | | | |
| 103-132 | 1 - 2 | 0.0001 | ±0.00015 | | | 10 - 15 | 0.00004 |
| 103-179 | | 2 - 3 | | | | | |
| 103-180 | 3 - 4 | | | | | | |
| 103-181 | 4 - 5 | | | | | | |
| 103-182 | 5 - 6 | | | | | | |
| 103-183 | 6 - 7 | | | | | | |
| 103-184 | 7 - 8 | | | | | | |
| 103-185 | 8 - 9 | | | | | | |
| 103-186 | 9 - 10 | | | | | | |
| 103-187 | 10 - 11 | | | | | | |
| 103-188 | 11 - 12 | | | | | | |
| 103-189 | 12 - 13 | | | | | | |
| 103-190 | 13 - 14 | | | | | | |
| 103-191 | 14 - 15 | | | | | | |
| 103-192 | 15 - 16 | | | | | | |
| 103-193 | 16 - 17 | | | | | | |
| 103-194 | 17 - 18 | | | | | | |
| 103-195 | 18 - 19 | | | | | | |
| 103-196 | 19 - 20 | | | | | | |
| 103-197 | 20 - 21 | | | | | | |
| 103-198 | 21 - 22 | | | | | | |
| 103-199 | 22 - 23 | | | | | | |
| 103-200 | 23 - 24 | | | | | | |
| 103-201 | 24 - 25 | | | | | | |
| 103-202 | 25 - 26 | | | | | | |
| 103-203 | 26 - 27 | | | | | | |
| 103-204 | 27 - 28 | | | | | | |
| 103-205 | 28 - 29 | | | | | | |
| 103-206 | 29 - 30 | | | | | | |
| 103-207 | 30 - 31 | | | | | | |
| 103-208 | 31 - 32 | | | | | | |
| 103-209 | 32 - 33 | | | | | | |
| 103-210 | 33 - 34 | | | | | | |
| 103-211 | 34 - 35 | | | | | | |
| 103-212 | 35 - 36 | | | | | | |
| 103-213 | 36 - 37 | | | | | | |
| 103-214 | 37 - 38 | | | | | | |
| 103-215 | 38 - 39 | | | | | | |
| 103-216 | 39 - 40 | ±0.00075 | | | | | |

| Metric With ratchet stop | | | | | |
|--------------------------|------------|-----------------|---|---------------------|----------------------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE}^* (μm) | Measuring force (N) | Flatness (μm) |
| 103-137 | 0 - 25 | 0.01 | ±2 | 5 - 10 | 0.6 |
| 103-138 | 25 - 50 | 0.01 | | | |

| Inch With friction thimble | | | | | |
|----------------------------|------------|-----------------|--|---------------------|---------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Measuring force (N) | Flatness (in) |
| 103-135 | 0 - 1 | 0.0001 | ±0.0001 | 5 - 10 | 0.00024 |
| 103-136 | 1 - 2 | | | | |

* Maximum permissible error of the indication measured by contacting the full measuring face with the object to be measured. J_{MPE} is a term specified by JIS B 7502: 2016 which has been prepared based on ISO 3611: 2010 with some modifications of the technical contents. The measurement method has not been changed from JIS B 7502: 1994. For details refer to B-74.

Technical Data

- Standard accessories:
Reference rod 1 pc.
(Excluding the measuring range 0 to 25 mm)
Spanner (301336) 1 pc.
(Maximum measuring length Less than 300 mm)
Spanner (200154) 1 pc.
(Maximum measuring length More than 325 mm)



103-904-10



103-905-10



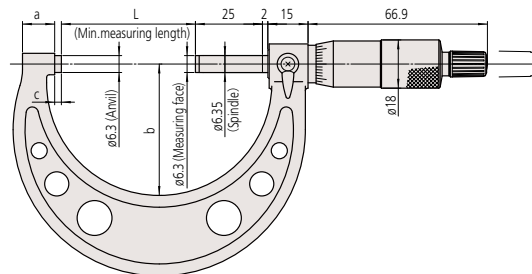
103-906

| Metric Micrometer set/With ratchet thimble | | |
|--|---------------------------|--|
| Order No. | Range (mm) | Models included |
| 103-927-10 | 0 - 75 (3 pcs./set) | 103-137, 103-138, 103-139-10, 2 micrometer standards |
| 103-913-50 | 0 - 150 (6 pcs./set) | 103-137, 103-138, 103-139-10, 103-140-10, 103-141-10, 103-142-10, 5 micrometer standards |
| 103-915-10 | 150 - 300 (6 pcs./set) | 103-143-10, 103-144-10, 103-145-10, 103-146-10, 103-147-10, 103-148-10, 6 micrometer standards |
| 103-914-50 | 0 - 300 (12 pcs./set) | All micrometers of 103-913-50 and 103-915-10 in one set, 11 micrometer standards |

| Inch Micrometer set/With ratchet thimble | | |
|--|-------------------------|---|
| Order No. | Range (in) | Models included |
| 103-929 | 0 - 3 (3 pcs./set) | 103-177, 103-178, 103-179, 2 micrometer standards |
| 103-930 | 0 - 4 (4 pcs./set) | 103-177, 103-178, 103-179, 103-180, 3 micrometer standards |
| 103-904-10 | 0 - 6 (6 pcs./set) | 103-177, 103-178, 103-179, 103-180, 103-181, 103-182, 5 micrometer standards |
| 103-906 | 6 - 12 (6 pcs./set) | 103-183, 103-184, 103-185, 103-186, 103-187, 103-188, 6 micrometer standards |
| 103-905-10 | 0 - 12 (12 pcs./set) | All micrometers of 103-904-10 and 103-906 in one set, 11 micrometer standards |

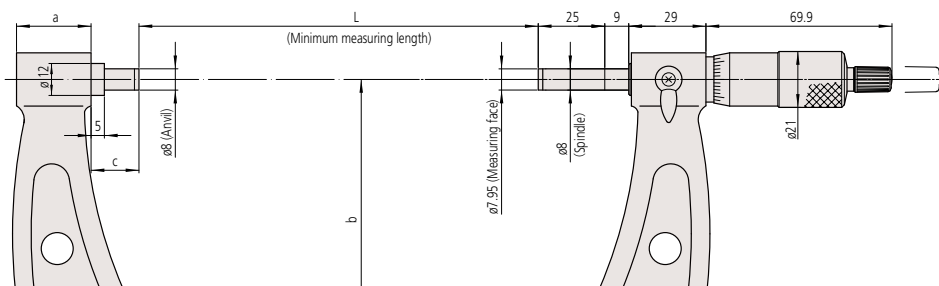
DIMENSIONS

103-137 and 103-138, Models 75 mm to 300 mm



Unit: mm

Models 325 mm to 1000 mm



| Range (mm) | L | a | b | c |
|------------|-----|------|-----|-----|
| 0 - 25 | 0 | 9 | 28 | 2.5 |
| 25 - 50 | 25 | 10 | 38 | |
| 50 - 75 | 50 | 12 | 49 | |
| 75 - 100 | 75 | 14 | 60 | |
| 100 - 125 | 100 | 16.7 | 79 | 5.3 |
| 125 - 150 | 125 | 18.8 | 94 | 5.7 |
| 150 - 175 | 150 | 19.1 | 106 | 6.1 |
| 175 - 200 | 175 | 18.2 | 118 | 6.3 |
| 200 - 225 | 200 | 16.8 | 130 | 6.7 |
| 225 - 250 | 225 | 18 | 143 | 5.5 |

| Range (mm) | L | a | b | c |
|------------|-----|----|-----|-----|
| 250 - 275 | 250 | 18 | 156 | 6.5 |
| 275 - 300 | 275 | | 169 | |
| 300 - 325 | 300 | | 187 | |
| 325 - 350 | 325 | | 199 | |
| 350 - 375 | 350 | 28 | 212 | 18 |
| 375 - 400 | 375 | | 224 | |
| 400 - 425 | 400 | | 236 | |
| 425 - 450 | 425 | | 248 | |
| 450 - 475 | 450 | | 261 | |
| 475 - 500 | 475 | | 273 | |

| Range (mm) | L | a | b | c |
|------------|-----|-----|-----|----|
| 500 - 525 | 500 | 28 | 307 | 40 |
| 525 - 550 | 525 | | | 15 |
| 550 - 575 | 550 | | 332 | 40 |
| 575 - 600 | 575 | | | 15 |
| 600 - 625 | 600 | | 355 | 40 |
| 625 - 650 | 625 | | | 15 |
| 650 - 675 | 650 | | 382 | 40 |
| 675 - 700 | 675 | | | 15 |
| 700 - 725 | 700 | | 405 | 40 |
| 725 - 750 | 725 | | | 15 |
| 750 - 775 | 750 | | 430 | 40 |
| 775 - 800 | 775 | | | 15 |
| 800 - 825 | 800 | 455 | 40 | |
| 825 - 850 | 825 | | 15 | |
| 850 - 875 | 850 | 480 | 40 | |
| 875 - 900 | 875 | | 15 | |
| 900 - 925 | 900 | 505 | 40 | |
| 925 - 950 | 925 | | 15 | |
| 950 - 975 | 950 | 530 | 40 | |
| 975 - 1000 | 975 | | 15 | |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Outside Micrometers SERIES 101

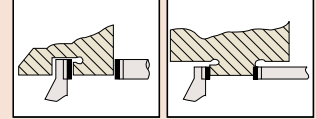
- Satin-chrome-finished frame, tapered (on the anvil side) for hard-to-reach places.
- Supplied with a setting standard (except for 0 to 1 in models).
- Measuring faces: Carbide.



101-114

Technical Data

- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 1 in models)
- Spanner (**301336**), 1 pc. (for measuring range 0 to 1 in/1 to 2 in models)
- Spanner (**200877**), 1 pc. (for measuring range 2 to 3 in/3 to 4 in models)

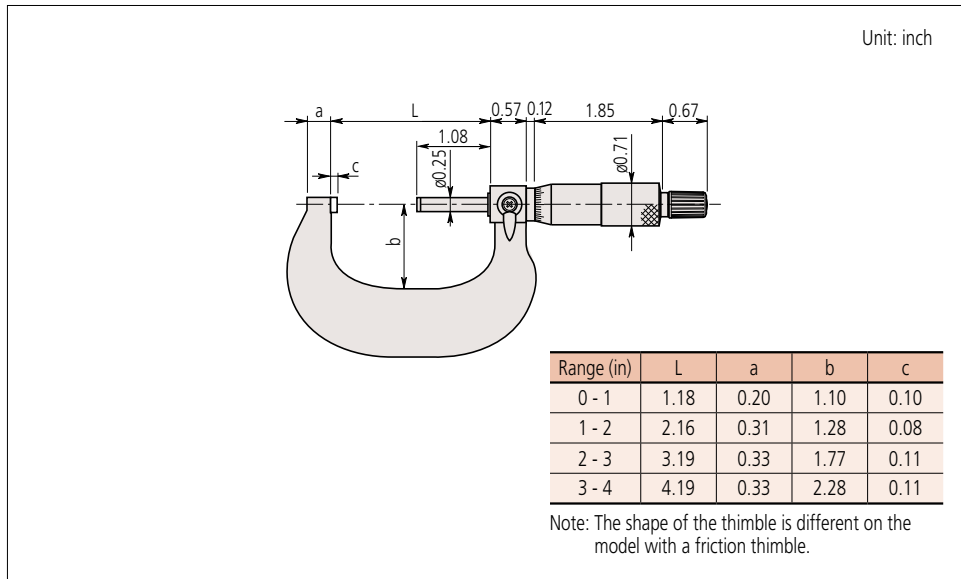


SPECIFICATIONS

| Inch | | With ratchet stop | | | |
|-----------|------------|-------------------|--|---------------|------------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) |
| 101-113 | 0 - 1 | 0.0001 | ±0.0001 | 0.000024 | 0.00008 |
| 101-114 | 1 - 2 | | | | |
| 101-119 | 2 - 3 | | ±0.00015 | | 0.00012 |
| 101-120 | 3 - 4 | | | | |

| Inch | | With friction thimble | | | |
|-----------|------------|-----------------------|--|---------------|------------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) |
| 101-117 | 0 - 1 | 0.0001 | ±0.0001 | 0.000024 | 0.00008 |
| 101-118 | 1 - 2 | | | | |

DIMENSIONS



Technical Data

- Counter Reading : 0.01 mm or 0.001 in
- Parallelism: (2 + R/100) μm, R = max. range (mm) [0.00008 + 0.00004 (R/4)] in, R = max. range (inch) fraction rounded down
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models) Spanner (301336), 1 pc.

Digit Outside Micrometers SERIES 193

- Mechanical digit counter with 0.01 mm or 0.001 in resolution for quick and error-free reading.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.

SPECIFICATIONS

| Metric | | With ratchet stop | | |
|-----------|------------|--|--|---------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) |
| 193-111 | 0 - 25 | 0.001 (reading is obtained with vernier) | ±2 | 0.6 |
| 193-112 | 25 - 50 | | | |
| 193-113 | 50 - 75 | | | |
| 193-114 | 75 - 100 | | | |
| 193-101 | 0 - 25 | 0.01 | ±2 | 0.6 |
| 193-102 | 25 - 50 | | | |
| 193-103 | 50 - 75 | | | |
| 193-104 | 75 - 100 | | | |

| Inch | | With friction thimble | | |
|-----------|------------|-----------------------|--|---------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) |
| 193-211 | 0 - 1 | 0.0001 | ±0.0001 | 0.000024 |
| 193-212 | 1 - 2 | | | |

| Inch | | With ratchet stop | | |
|-----------|------------|-------------------|--|---------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) |
| 193-213 | 2 - 3 | 0.0001 | ±0.00015 | 0.000024 |
| 193-214 | 3 - 4 | | | |

| Metric | | Micrometer set | | |
|-----------|----------------------|--|---------------|--|
| Order No. | Range (mm) | Models included | Flatness (μm) | |
| 193-901 | 0 - 75 (3 pcs./set) | • 193-101, 193-102, 193-103 • 2 micrometer standards | 0.6 | |
| 193-902 | 0 - 100 (4 pcs./set) | • 193-101, 193-102, 193-103, 193-104 • 3 micrometer standards | | |

| Inch | | Micrometer set | | |
|-----------|--------------------|---|---------------|--|
| Order No. | Range (in) | Models included | Flatness (in) | |
| 193-923 | 0 - 3 (3 pcs./set) | • 193-211, 193-212, 193-213 • 2 micrometer standards | 0.000024 | |



193-101



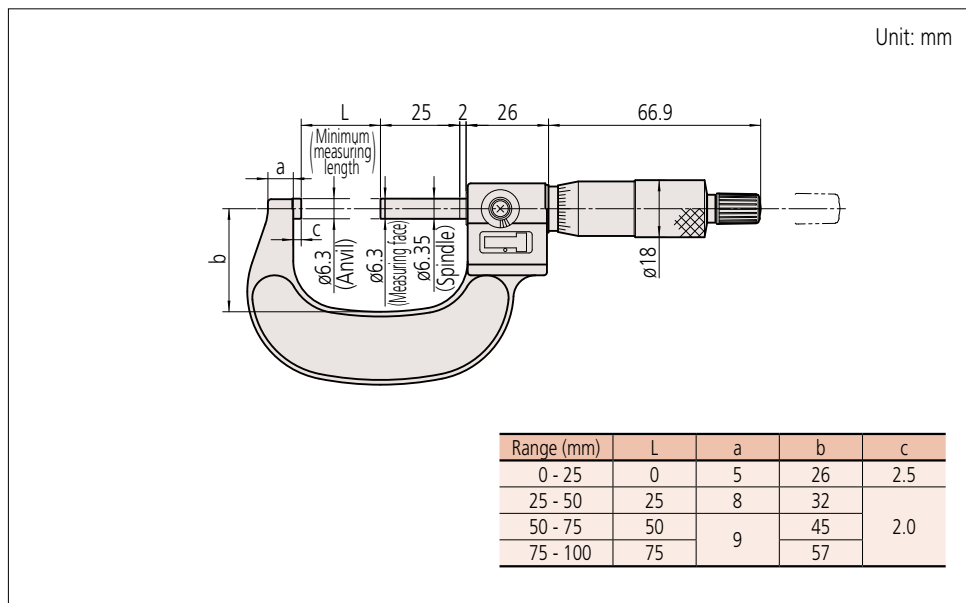
193-111



193-112



DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Outside Micrometers SERIES 406 — Non-Rotating Spindle Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Non-rotating spindle.
- Measuring face of the spindle is carbide tipped.
- Spindle $\phi 6.35$ mm
- Equipped with Ratchet Stop for constant measuring force.



406-250-30

Metric

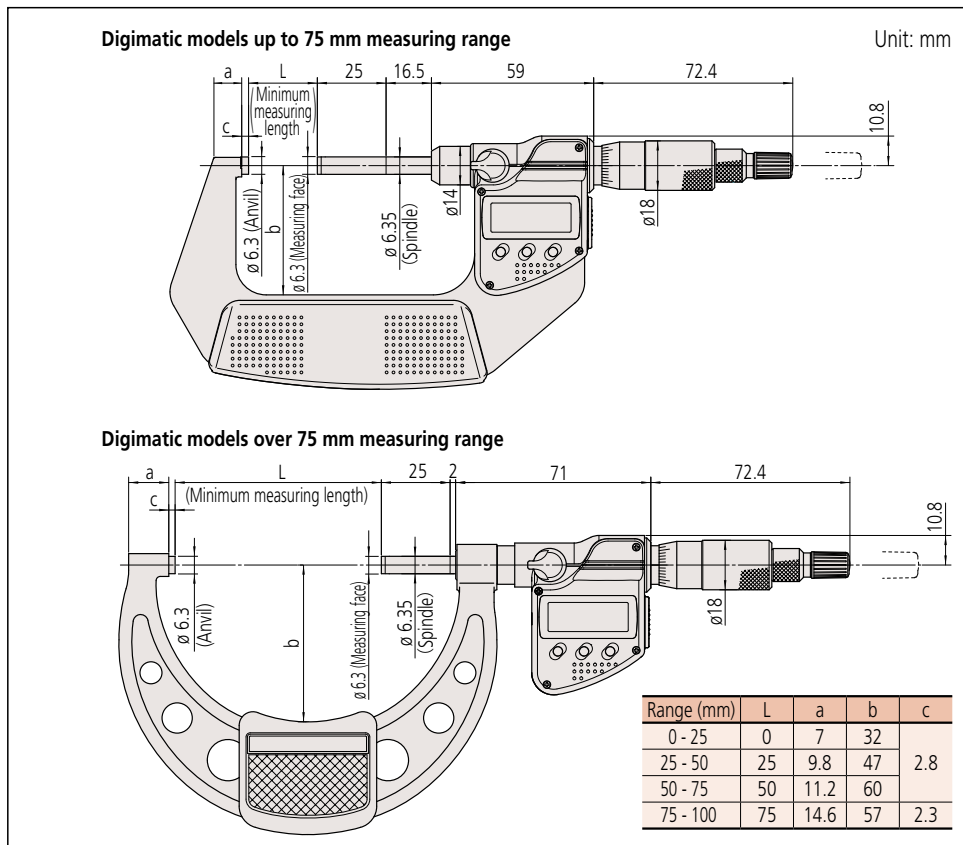
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) |
|------------|------------|-----------------|---|----------------------------|-------------------------------|
| 406-250-30 | 0 - 25 | 0.001 | ± 3 | 0.3 | 3 |
| 406-251-30 | 25 - 50 | | | | |
| 406-252-30 | 50 - 75 | | | | |
| 406-253-30 | 75 - 100 | | | | |

Note: For functional details of series 406, refer to page B-8. Please note that these models are not water-proof.

Inch / Metric

| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) |
|------------|------------|-------------------------|--|---------------|------------------|
| 406-350-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ± 0.00015 | 0.000012 | 0.00012 |
| 406-351-30 | 1 - 2 | | | | |
| 406-352-30 | 2 - 3 | | | | |
| 406-353-30 | 3 - 4 | | | | |

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Technical Data

- Battery: SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use
- Length standard: Electromagnetic rotary sensor
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models) Spanner (**301336**), 1 pc.

Optional Accessories

- Connecting cables
 - 1 m: **05CZA662**
 - 2 m: **05CZA663**
- USB Input Tool Direct
 - USB-ITN-B** (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
 - 160 mm: **02AZD790B**
 - For foot switch: **02AZE140B**
 - Refer to page A-27 for details.



Wireless Data Output **U-WAVE™**

- **U-WAVE-TM 264-622** (IP67 type) **264-623** (Buzzer type)
- **U-WAVE-TMB** Transmitter **Mitutoyo Bluetooth[®] U-WAVE 264-626** (IP type) **264-627** (Buzzer type)
- Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB 02AZF310** (IP67/buzzer type common specification)
- Refer to pages A-16 and A-18 for details.

Standard Accessories

Reference bar, 1 pc.
(except for measuring range 0 to 25 mm models)
Spanner (301336), 1 pc.



Typical Indicator Choice

Dial indicator (0.01 mm)/20465B
Dial indicator (0.001 mm)/21095B-10
ABS Digimatic Indicator (0.01 mm)/543-400B
ABS Digimatic Indicator (0.001 mm)/543-390B

*1 Indicators with stems cannot be installed on this micrometer.

Indicator Type Micrometers SERIES 107

- Designed to mount a dial indicator for direct GO/ \pm NG judgment on mass-produced parts.
- Anvil retracting trigger for quick measurement.
- Various kinds of indicators*1 are selectable depending on the measurement type (accuracy required, measuring range, etc.).
- Measuring faces: Carbide.
- Anvil stroke: 3 mm.



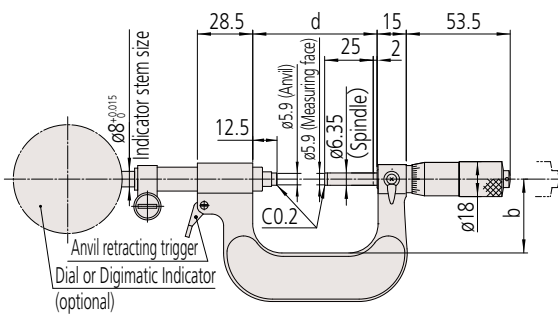
107-201
(Indicator shown is optional)

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|-------------------------------|---------------------|------------------------|
| Order No. | Range (mm) | Spindle feed error (μ m) | Flatness (μ m) | Parallelism (μ m) |
| 107-201 | 0 - 25 | 3 | 0.6 | 2 |
| 107-202 | 25 - 50 | | | |
| 107-203 | 50 - 75 | | | |
| 107-204 | 75 - 100 | | | 3 |
| 107-205 | 100 - 125 | | | |
| 107-206 | 125 - 150 | | | |
| 107-207 | 150 - 175 | | | |
| 107-208 | 175 - 200 | 4 | | |

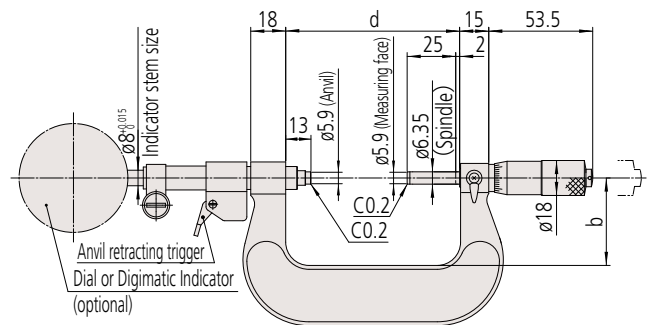
DIMENSIONS

Measuring range up to 50 mm

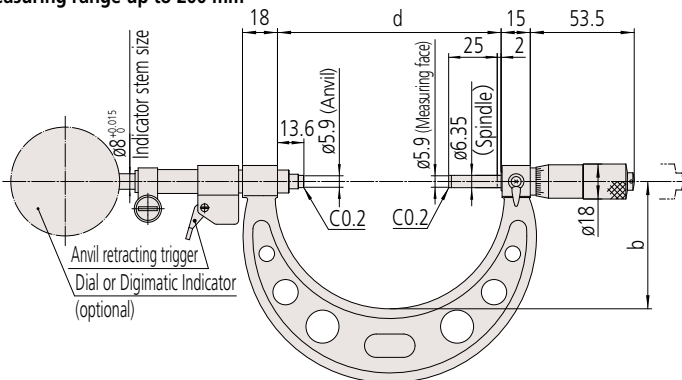


Measuring range up to 75 mm

Unit: mm



Measuring range up to 200 mm



| Range (mm) | b | d |
|------------|-----|-------|
| 0 - 25 | 30 | 39 |
| 25 - 50 | 38 | 64 |
| 50 - 75 | 45 | 89.5 |
| 75 - 100 | 65 | 115.1 |
| 100 - 125 | 79 | 140.1 |
| 125 - 150 | 93 | 165.1 |
| 150 - 175 | 105 | 190 |
| 175 - 200 | 118 | 214 |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Outside Micrometers SERIES 340, 104 — with Interchangeable Anvils

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

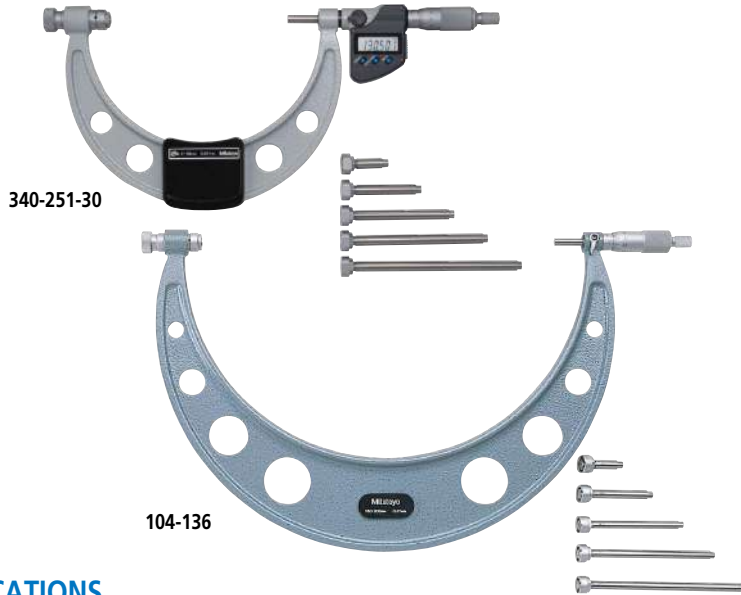
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



- Wide measuring range with interchangeable anvils.
- Measuring face of the spindle is carbide tipped (standard model).
- IP 65 water/dust protection (340-251-30, 340-252-30, 340-351-30, 340-352-30).
- Equipped with Ratchet Stop for constant measuring force.



IP Codes (340-251-30, 340-252-30, 340-351-30, 340-352-30)

- Level 6: Dust -proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Spindle feed error: 3 μm/0.00015 in
- Flatness
Measuring range 0 to 300: 0.6 μm
Measuring range 300 to 1000: 1.0 μm
- Parallelism
Measuring range 0 to 75: 2 μm
Measuring range 75 to 150: 3 μm
Measuring range 150 to 1000
(2+R/100) μm, R=max. range (mm) (fraction rounded up)

SPECIFICATIONS

| Metric | | | | | | | |
|-----------------|------------|-----------------|------------------------|------------------|-----------|-----------------------------|-----------|
| Order No. | Range (mm) | Resolution (mm) | Interchangeable anvils | Setting Standard | | Micrometer head stroke (mm) | |
| | | | | Qty | Size (mm) | | |
| Digimatic (LCD) | | | | | | | |
| 340-251-30 | 0 - 150 | 0.001 | 6 pcs. | 5 | 25 - 125 | 25 | |
| 340-252-30 | 150 - 300 | | | 6 | 150 - 275 | | |
| 340-520 | 300 - 400 | | 4 pcs. | 4 | | | 300 - 375 |
| 340-521 | 400 - 500 | | | | | | 400 - 475 |
| 340-522 | 500 - 600 | | | | | | 500 - 575 |
| 340-523 | 600 - 700 | | | | | | 600 - 675 |
| 340-524 | 700 - 800 | | | | | | 700 - 775 |
| 340-525 | 800 - 900 | | | | | | 800 - 875 |
| 340-526 | 900 - 1000 | | | | | | 900 - 975 |

| Inch/Metric | | | | | | | |
|-----------------|------------|-------------------------|------------------------|------------------|-----------|-----------------------------|---------|
| Order No. | Range (in) | Resolution | Interchangeable anvils | Setting Standard | | Micrometer head stroke (in) | |
| | | | | Qty | Size (in) | | |
| Digimatic (LCD) | | | | | | | |
| 340-351-30 | 0 - 6 | 0.00005 in/ 0.001 mm | 6 pcs. | 5 | 1 - 5 | 1 | |
| 340-352-30 | 6 - 12 | 0.0001 in/ 0.001 mm | | 6 | | | 6 - 11 |
| 340-720 | 12 - 18 | | | | | | 12 - 17 |
| 340-721 | 18 - 24 | | | | | | 18 - 23 |
| 340-722 | 24 - 30 | | | | | | 24 - 29 |
| 340-723 | 30 - 36 | | | | | | 30 - 35 |

| Metric | | | | | | | |
|-----------|------------|-----------------|------------------------|------------------|-----------|-----------------------------|-----------|
| Order No. | Range (mm) | Graduation (mm) | Interchangeable anvils | Setting Standard | | Micrometer head stroke (mm) | |
| | | | | Qty | Size (mm) | | |
| Analog | | | | | | | |
| 104-171* | 0 - 50 | 0.01 | 1 pc. | 1 | 25 | 25 | |
| 104-139A | 0 - 100 | | 4 pcs. | 3 | 25 - 75 | | |
| 104-135A | 0 - 150 | | 6 pcs. | 5 | 25 - 125 | | |
| 104-161A | 50 - 150 | | 4 pcs. | 4 | | | 50 - 125 |
| 104-140A | 100 - 200 | | | | | | 100 - 175 |
| 104-136A | 150 - 300 | | 4 pcs. | 4 | | | 150 - 275 |
| 104-141A | 200 - 300 | | | | | | 200 - 275 |
| 104-142A | 300 - 400 | | | | | | 300 - 375 |
| 104-143A | 400 - 500 | | | | | | 400 - 475 |
| 104-144A | 500 - 600 | | | | | | 500 - 575 |
| 104-145A | 600 - 700 | | | | | | 600 - 675 |
| 104-146A | 700 - 800 | | | | | | 700 - 775 |
| 104-147A | 800 - 900 | | | | | | 800 - 875 |
| 104-148A | 900 - 1000 | | | 900 - 975 | | | |

| Inch | | | | | | | |
|-----------|------------|------------------------|-----------------|------------------|-----------|-----------------------------|---------|
| Order No. | Range (in) | Interchangeable anvils | Graduation (in) | Setting Standard | | Micrometer head stroke (in) | |
| | | | | Qty | Size (in) | | |
| Analog | | | | | | | |
| 104-165 | 0 - 2 | 1 pc. | 0.0001 | 1 | 1 | 1 | |
| 104-149 | 0 - 4 | 4 pcs. | 0.001 | 3 | 1 - 3 | | |
| 104-137 | 0 - 6 | 6 pcs. | | 5 | 1 - 5 | | |
| 104-162 | 2 - 6 | 4 pcs. | | 4 | | | 2 - 5 |
| 104-150 | 4 - 8 | | | | | | 4 - 7 |
| 104-138 | 6 - 12 | 6 pcs. | | 6 | 6 - 11 | | |
| 104-151 | 8 - 12 | 4 pcs. | | 4 | | | 8 - 11 |
| 104-152 | 12 - 16 | | | | | | 12 - 15 |
| 104-201 | 12 - 18 | 6 pcs. | | 6 | 12 - 17 | | |
| 104-153 | 16 - 20 | 4 pcs. | | 4 | 16 - 19 | | |
| 104-202 | 18 - 24 | 6 pcs. | | 6 | 18 - 23 | | |
| 104-154 | 20 - 24 | 4 pcs. | | 4 | | | 20 - 23 |
| 104-155 | 24 - 28 | | | | | | 24 - 27 |
| 104-203 | 24 - 30 | 6 pcs. | | 6 | 24 - 29 | | |
| 104-156 | 28 - 32 | 4 pcs. | | 4 | 28 - 31 | | |
| 104-204 | 30 - 36 | 6 pcs. | | 6 | 30 - 35 | | |
| 104-157 | 32 - 36 | 4 pcs. | | 4 | | 32 - 35 | |
| 104-158 | 36 - 40 | | | | 36 - 39 | | |
| 104-205 | 36 - 42 | 6 pcs. | 6 | 36 - 41 | | | |

* The frame is fitted with a heat shield.
 Note 1: For functional details of 340-251-30, 340-252-30, 340-351-30, 340-352-30, refer to page B-8.
 Please note that origin setting of these models is by presetting.
 Optional connecting cable is available only for water-proof type (Digimatic model).
 Note 2: For functional details of 340-520 to 340-723, refer to page B-9.

Technical Data

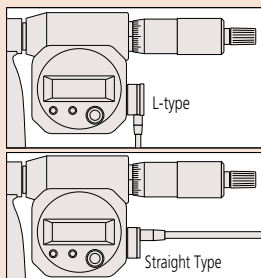
- Battery for series 340
340-251-30, 340-252-30, 340-351-30, 340-352-30: SR44 (1 pc.)
340-520 to 340-526 340-720 to 340-723: SR44 (2 pcs.)
938882, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for series **340-2XX, 340-3XX**)
 Approx. 1.8 years under normal use (for series **340-5XX, 340-7XX**)
- Length standard: Electromagnetic rotary sensor (for series **340**)
- Standard accessories: Spanner (**301336**), 1 pc. (for maximum measuring range up to 300 mm (12 in))
 Spanner (**200154**), 1 pc. (for maximum measuring range 400 mm (16 in) or over)

Optional Accessories

- Connecting cables for **340-251-30, 340-252-30, 340-351-30** and **340-352-30**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- SPC cables for **U-WAVE-T** w/data switch (160 mm):
02AZD790B
 For foot switch: **02AZE140B**

Wireless Data Output* U-WAVE™

- U-WAVE-TM 264-622** (IP67 type)
264-623 (Buzzer type)
- U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
 Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB 02AZF310** (IP67/buzzer type common specification)
 Refer to pages A-16 and A-18 for details
 * Only **340-251-30, 340-252-30, 340-351-30** and **340-352-30** can be attached
- Connecting cables for **340-5XX, 340-7XX**
 Recommended cables:
 L-Type (does not interfere with operating the thimble.)
 1 m: **04AZB512**
 2 m: **04AZB513**
 Straight type (may interfere with operating the thimble.)
 1 m: **959149**
 2 m: **959150**



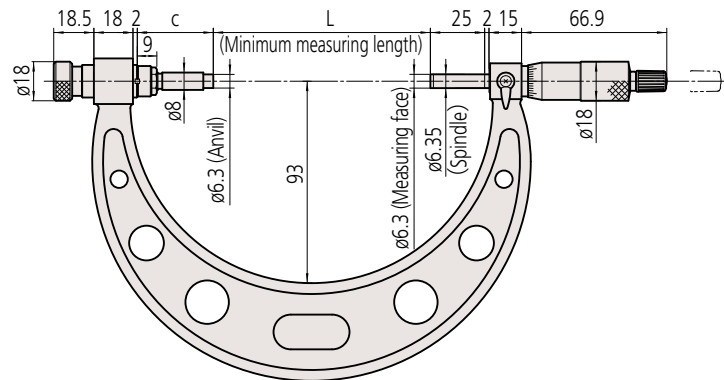
Refer to page A-27 for detailed information about recommended cables.



DIMENSIONS

104-135A

Unit: mm

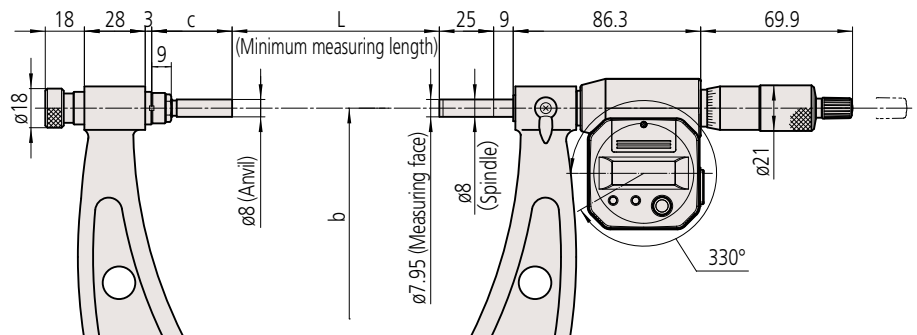


Interchangeable Anvil

| Range | L: Range (mm) | | | | | | |
|-------|------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | 0 - 150 mm models | 0 - 25 | 25 - 50 | 50 - 75 | 75 - 100 | 100 - 125 | 125 - 150 |
| Range | 150 - 300 mm models | 150 - 175 | 175 - 200 | 200 - 225 | 225 - 250 | 250 - 275 | 275 - 300 |
| | Order No. | 303950 | 303951 | 303952 | 303953 | 303954 | 303955 |
| | c: Overall length (mm) | 135 | 110 | 85 | 60 | 35 | 10 |
| | Interchangeable anvil | M1 | M2 | M3 | M4 | M5 | M6 |

| Range | L: Range (mm) | | | | |
|-------|------------------------|---------------|---------------|---------------|---------------|
| | 300 - 400 mm models | 325 - 350 | 350 - 375 | 375 - 400 | |
| Range | 400 - 500 mm models | 400 - 425 | 425 - 450 | 450 - 475 | 475 - 500 |
| Range | 500 - 600 mm models | 500 - 525 | 525 - 550 | 550 - 575 | 575 - 600 |
| Range | 600 - 700 mm models | 600 - 625 | 625 - 650 | 650 - 675 | 675 - 700 |
| Range | 700 - 800 mm models | 700 - 725 | 725 - 750 | 750 - 775 | 775 - 800 |
| Range | 800 - 900 mm models | 800 - 825 | 825 - 850 | 850 - 875 | 875 - 900 |
| Range | 900 - 1000 mm models | 900 - 925 | 925 - 950 | 950 - 975 | 975 - 1000 |
| | Order No. | 304001 | 304002 | 304003 | 304004 |
| | c: Overall length (mm) | 87 | 62 | 37 | 12 |
| | Interchangeable anvil | M3 | M4 | M5 | M6 |

Over 400 mm up to 1000 mm



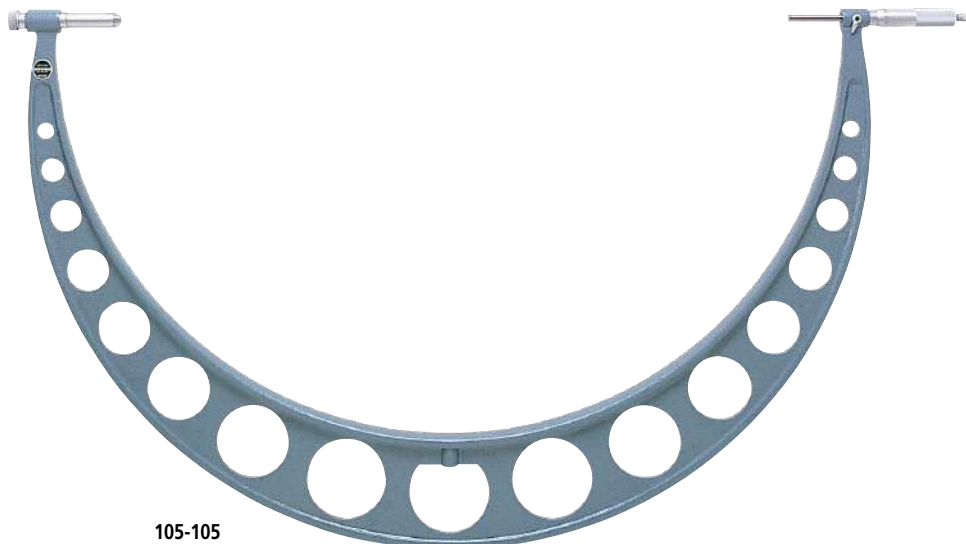
| Range | L: Range (mm) | | | | | b |
|-------|-----------------------|---------------|---------------|---------------|---------------|-----|
| | 300 - 400 mm models | 325 - 350 | 350 - 375 | 375 - 400 | 375 - 400 | |
| Range | 400 - 500 mm models | 400 - 425 | 425 - 450 | 450 - 475 | 475 - 500 | 273 |
| Range | 500 - 600 mm models | 500 - 525 | 525 - 550 | 550 - 575 | 575 - 600 | 332 |
| Range | 600 - 700 mm models | 600 - 625 | 625 - 650 | 650 - 675 | 675 - 700 | 382 |
| Range | 700 - 800 mm models | 700 - 725 | 725 - 750 | 750 - 775 | 775 - 800 | 430 |
| Range | 800 - 900 mm models | 800 - 825 | 825 - 850 | 850 - 875 | 875 - 900 | 480 |
| Range | 900 - 1000 mm models | 900 - 925 | 925 - 950 | 950 - 975 | 975 - 1000 | 530 |
| | Order No. | 304001 | 304002 | 304003 | 304004 | |
| | c: Overall (mm) | 87 | 62 | 37 | 12 | |
| | Interchangeable anvil | M3 | M4 | M5 | M6 | |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Outside Micrometers SERIES 105 — with Anvil Extension Collars

- Adjustable measuring range with extension collars.
- 50 mm/2 in spindle stroke.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



105-105

SPECIFICATIONS

| Metric | | | | | | | |
|-----------|------------|-----------------|-------------------|------------------|-------------------------|---------------|--|
| Order No. | Range (mm) | Graduation (mm) | Extension Collars | Setting Standard | Spindle feed error (μm) | Flatness (μm) | Parallelism |
| 105-103 | 500 - 600 | 0.01 | 1 pc. (50 mm) | 2 pcs. | 6 | 1.3 | (2 + R/100) μm R=max. range (mm) fraction rounded down |
| 105-104 | 600 - 700 | | | | | | |
| 105-105 | 700 - 800 | | | | | | |
| 105-106 | 800 - 900 | | | | | | |
| 105-107 | 900 - 1000 | | | | | | |

Technical Data



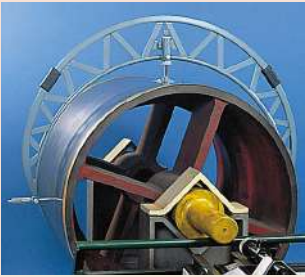
Measuring range 700 to 750 mm with **105-105**



Measuring range 750 to 800 mm with **105-105**

Standard Accessories

Spanner (**200154**), 1 pc.

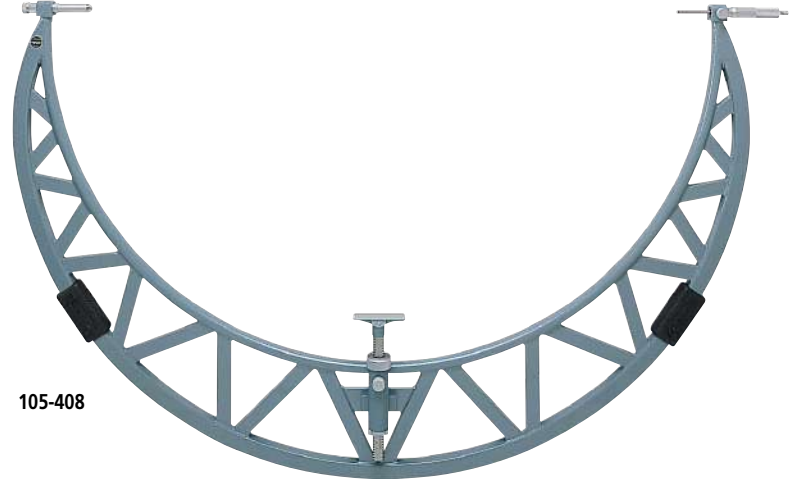


Standard Accessories

Spanner (200154), 1 pc.

Outside Micrometers SERIES 105 — with Anvil Extension Collars

- Large, lightweight micrometer with excellent strength based on a pipe-structure frame made of a combination of square and round pipes.
- Wide measuring range with anvil extension collars.
- 50 mm/2 in spindle stroke.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



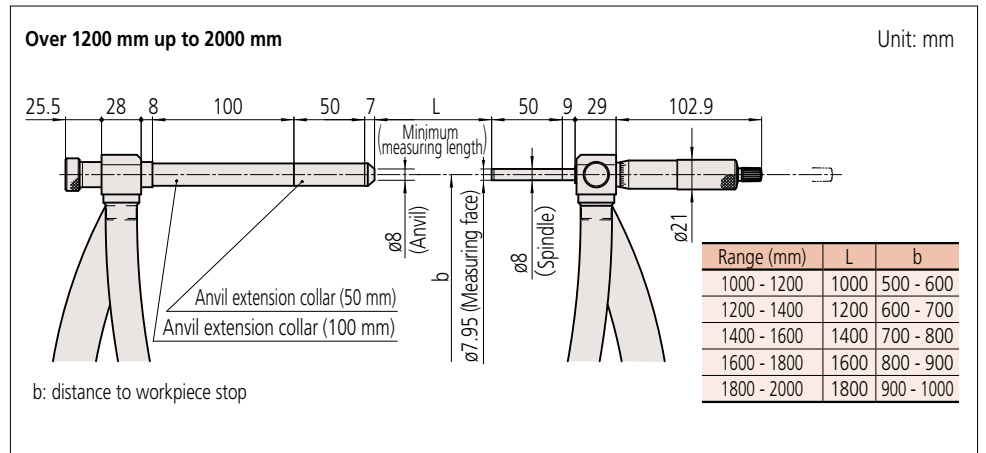
SPECIFICATIONS

| Metric | | | | | | | |
|----------------|-------------|-----------------|------------------------------|-------------------------|-------------------------|---------------|---|
| Order No. | Range (mm) | Graduation (mm) | Extension Collars | Setting Standard (pcs.) | Spindle feed error (µm) | Flatness (µm) | Parallelism (µm) |
| (every 100 mm) | | | | | | | |
| 105-408 | 1000 - 1100 | 0.01 | 1 pc. (50 mm) | 2 | 6 | 1.3 | 2+R/100 R=max. range (mm) fraction rounded down |
| 105-409 | 1100 - 1200 | | | | | | |
| 105-410 | 1200 - 1300 | | | | | | |
| 105-411 | 1300 - 1400 | | | | | | |
| 105-412 | 1400 - 1500 | | | | | | |
| 105-413 | 1500 - 1600 | | | | | | |
| 105-414 | 1600 - 1700 | | | | | | |
| 105-415 | 1700 - 1800 | | | | | | |
| 105-416 | 1800 - 1900 | | | | | | |
| 105-417 | 1900 - 2000 | | | | | | |
| (every 200 mm) | | | | | | | |
| 105-418 | 1000 - 1200 | 0.01 | 2 pcs. (50 mm, 100 mm) | 4 (every 50 mm) | 6 | 1.3 | 2+R/100 R=max. range (mm) fraction rounded down |
| 105-419 | 1200 - 1400 | | | | | | |
| 105-420 | 1400 - 1600 | | | | | | |
| 105-421 | 1600 - 1800 | | | | | | |
| 105-422 | 1800 - 2000 | | | | | | |

| Inch | | | | | | | |
|-----------|------------|-----------------|-------------------|-------------------------|-------------------------|---------------|--|
| Order No. | Range (in) | Graduation (in) | Extension Collars | Setting Standard (pcs.) | Spindle feed error (in) | Flatness (in) | Parallelism (in) |
| 105-428 | 40 - 44 | 0.001 | 1 pc. (2 in) | 2 | 0.0003 | 0.000052 | 0.00008+ 0.00004 (R/4) R=max. range (inch) fraction rounded down |
| 105-429 | 44 - 48 | | | | | | |
| 105-430 | 48 - 52 | | | | | | |
| 105-431 | 52 - 56 | | | | | | |
| 105-432 | 56 - 60 | | | | | | |
| 105-433 | 60 - 64 | | | | | | |
| 105-434 | 64 - 68 | | | | | | |
| 105-435 | 68 - 72 | | | | | | |
| 105-436 | 72 - 76 | | | | | | |
| 105-437 | 76 - 80 | | | | | | |



DIMENSIONS





Standard Accessories
Spanner (301336), 1 pc.

Screw Thread Micrometers SERIES 125

- Fitted with one type of anvil/spindle tip for screw thread measurement.
- Directly indicates screw pitch diameter (no need for calculation).
- Equipped with Ratchet Stop for constant measuring force.
- Fixed anvil type to suit 60° threads.



125-103

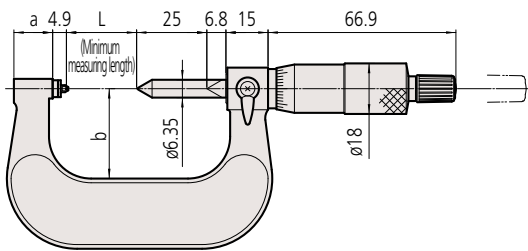
SPECIFICATIONS

| Metric | | | | |
|-----------|--|------------|-----------------|-------------------------|
| Order No. | Thread to be measured (Metric/Unified) | Range (mm) | Graduation (mm) | Spindle feed error (μm) |
| 125-101 | 0.4 - 0.5 mm/64 - 48TPI | 0 - 25 | 0.01 | 3 |
| 125-102 | 0.6 - 0.9 mm/44 - 28TPI | | | |
| 125-103 | 1 - 1.75 mm/24 - 14TPI | | | |
| 125-104 | 2 - 3 mm/13 - 9TPI | | | |
| 125-105 | 3.5 - 5 mm/8 - 5TPI | | | |
| 125-106 | 0.4 - 0.5 mm/64 - 48TPI | 25 - 50 | | |
| 125-107 | 0.6 - 0.9 mm/44 - 28TPI | | | |
| 125-108 | 1 - 1.75 mm/24 - 14TPI | | | |
| 125-109 | 2 - 3 mm/13 - 9TPI | | | |
| 125-110 | 3.5 - 5 mm/8 - 5TPI | | | |
| 125-111 | 0.6 - 0.9 mm/44 - 28TPI | 50 - 75 | | |
| 125-112 | 1 - 1.75 mm/24 - 14TPI | | | |
| 125-113 | 2 - 3 mm/13 - 9TPI | | | |
| 125-114 | 3.5 - 5 mm/8 - 5TPI | | | |
| 125-115 | 5.5 - 7 mm/4.5 - 3.5TPI | | | |
| 125-116 | 0.6 - 0.9 mm/44 - 28TPI | 75 - 100 | | |
| 125-117 | 1 - 1.75 mm/24 - 14TPI | | | |
| 125-118 | 2 - 3 mm/13 - 9TPI | | | |
| 125-119 | 3.5 - 5 mm/8 - 5TPI | | | |
| 125-120 | 5.5 - 7 mm/4.5 - 3.5TPI | | | |

Note: A matching setting standard is supplied with each model (except for 0 to 25 mm measuring range). (Refer to page B-61 for details.) The setting standard is for metric threads (unified) 60°.

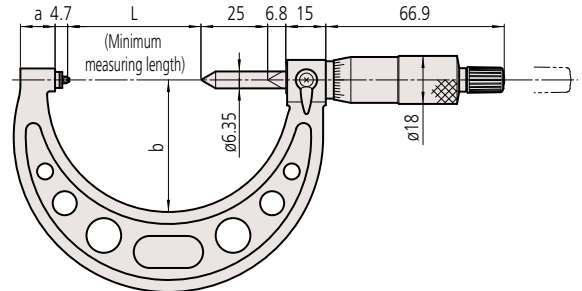
DIMENSIONS

125-101, 125-106



| Range (mm) | L | a | b |
|------------|----|------|----|
| 0 - 25 | 0 | 13.8 | 25 |
| 25 - 50 | 25 | | 32 |

125-111, 125-116



| Range (mm) | L | a | b |
|------------|----|----|----|
| 50 - 75 | 50 | 12 | 49 |
| 75 - 100 | 75 | 14 | 63 |

Unit: mm

Standard Accessories

Spanner (301336), 1 pc.

Universal Micrometer SERIES 116 — Interchangeable Anvil Type

- Non-rotating spindle type which accepts seven forms of optional interchangeable anvil/spindle tip (flat, spline, spherical, point, knife-edge, disk, and blade) for a wide range of applications.
- Equipped with Ratchet Stop for constant measuring force.
- Interchangeable anvils/spindle tips are optional.



116-101-10



SPECIFICATIONS

| Metric | | | |
|--------------|------------|-----------------|-------------------------|
| Order No. | Range (mm) | Graduation (mm) | Spindle feed error (μm) |
| 116-101-10 | 0 - 25 | 0.01 | 3 |
| 116-102-10*1 | 25 - 50 | | |

| Inch | | | |
|--------------|------------|-----------------|-------------------------|
| Order No. | Range (in) | Graduation (in) | Spindle feed error (in) |
| 116-105-10 | 0 - 1 | 0.001 | 0.00015 |
| 116-106-10*2 | 1 - 2 | | |

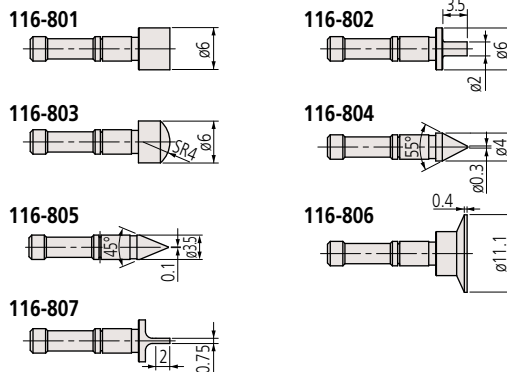
*1 Provided with a plain setting standard (167-101) and a 60°-thread setting standard (167-261) for adjusting the minimum range point according to the application.

*2 Provided with a plain setting standard (167-141) and a 60°-thread setting standard (167-294) for adjusting the minimum range point according to the application.

| Order No. | Description |
|-----------|---|
| 116-801 | Flat |
| 116-802 | Spline |
| 116-803 | Spherical |
| 116-804 | Point |
| 116-805 | Knife-edge |
| 116-806 | Disk |
| 116-807 | Blade |
| 116-800 | Anvils/spindle tips set (7 pairs) (116-801 - 116-807 Set) |

Optional Accessories

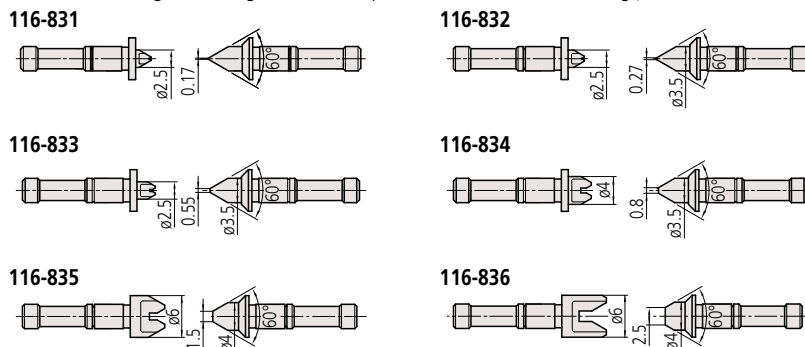
- Interchangeable anvils/spindle tips are available in matching pairs.



| Order No. | Set Identifier Range of measurement |
|-----------|--|
| 116-831 | 0.4 - 0.5 mm/64 - 48TPI |
| 116-832 | 0.6 - 0.9 mm/44 - 28TPI |
| 116-833 | 1 - 1.75 mm/24 - 14TPI |
| 116-834 | 2 - 3 mm/13 - 9TPI |
| 116-835 | 3.5 - 5 mm/8 - 5TPI |
| 116-836 | 5.5 - 7 mm/4.5 - 3.5TPI |
| 116-830 | 116-831 - 116-836 M (U) Set |

Note: The shape differs from the interchangeable contact point of series 326 and 126.

- Thread-measuring interchangeable contact points are available in matching pairs.



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

3-Wire Units SERIES 313

- Attached to the measuring faces of both the spindle and anvil of the micrometer, enables measurement of pitch diameter of screw threads.
- Determination of the pitch diameter: refer to "Quick Guide to Precision Measuring Instruments" on page B-72.



Technical Data

- Accuracy of wire diameter: ± 0.002 mm

SPECIFICATIONS

| Order No. (One pair) (Support spindle dia.) 6.35 mm (0.25 in) | Wire dia. (mm) | Pitch | | |
|--|-------------------|-----------------------|--------------------------------------|--|
| | | Metric thread (mm) | Unified thread (threads per inch) | Whitworth thread (threads per inch) |
| 952131 | 0.170 | 0.2, 0.25, 0.3 | 80 | — |
| 952132 | 0.195 | 0.35 | 72 | — |
| 952133 | 0.220 | 0.4 | 64 | — |
| 952134 | 0.250 | 0.45 | 56 | 60 |
| 952135 | 0.290 | 0.5 | 48 | 48 |
| 952136 | 0.335 | 0.6 | 44, 40 | 40 |
| 952137 | 0.390 | 0.7 | 36 | 36 |
| 952138 | 0.455 | 0.75, 0.8 | 32 | 32 |
| 952139 | 0.530 | 0.9 | 28 | 28, 26 |
| 952140 | 0.620 | 1.0 | 24 | 24, 22 |
| 952141 | 0.725 | 1.25 | 20 | 20, 19, 18 |
| 952142 | 0.895 | 1.5 | 18, 16 | 16 |
| 952143 | 1.100 | 1.75, 2.0 | 14, 13, 12 | 14, 12 |
| 952144 | 1.350 | 2.5 | 11, 10 | 11, 10 |
| 952145 | 1.650 | 3.0 | 9, 8 | 9, 8 |
| 952146 | 2.050 | 3.5 | 7 | 7 |
| 952147 | 2.550 | 4, 4.5 | 6 | 6 |
| 952148 | 3.200 | 5, 5.5, 6 | 5, 4.5 | 5, 4.5 |

3-Wire Units set

| Order No. | Set | Wire dia. (mm) | Support spindle dia. (mm) |
|-----------|-----|----------------|---------------------------|
| 313-101 | 18 | 0.170 - 3.200 | 6.35 |

Paper Thickness Micrometers SERIES 169 — Non-Rotating Spindle Type

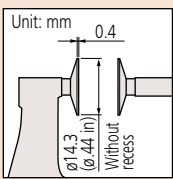


- For paper thickness measurement.
- Non-rotating spindle.
- Anvil diameter 14.3 mm (without recess)
- Equipped with Ratchet Stop for constant measuring force. (8.02±0.8 N)



169-101-10

Anvil Dimensions



() : Inch model

Standard Accessories

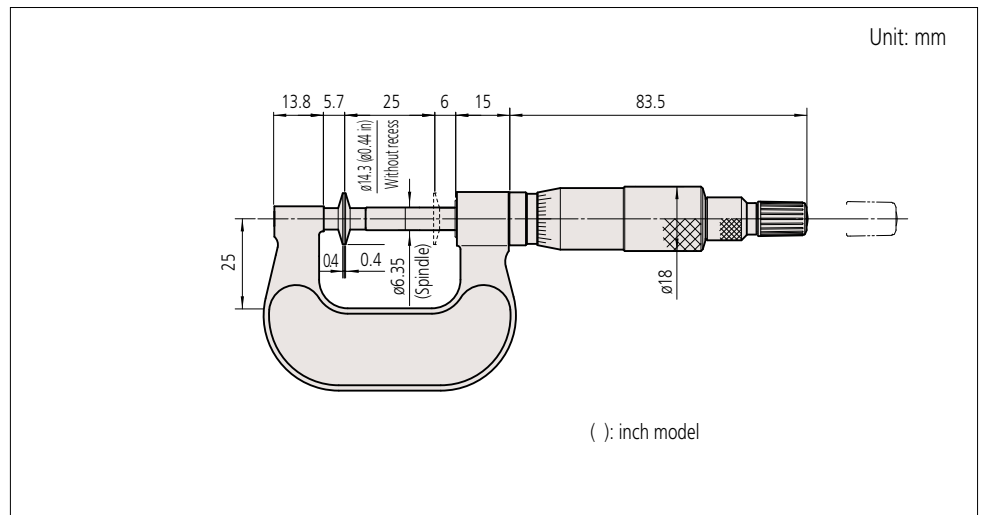
Spanner (301336), 1 pc.

SPECIFICATIONS

| Metric | | | | | |
|------------|------------|-----------------|---|----------------------------|-------------------------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) |
| 169-101-10 | 0 - 25 | 0.01 | ±4 | 1 | 3 |

| Inch | | | | | |
|------------|------------|-----------------|--|---------------|------------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) |
| 169-103-10 | 0 - 1 | 0.001 | ±0.0002 | 0.00004 | 0.00015 |

DIMENSIONS



() : inch model

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Disk Micrometers SERIES 323, 223, 123

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Measures "root tangent length" of spur gears and helical gears.
- Determination of the root tangent length: refer to "Quick Guide to Precision Measuring Instruments" on page B-72.

- Equipped with Ratchet Stop for constant measuring force.
- Supplied with a setting standard (except for 0 to 25 mm/0 to 1 in measuring range).



123-101



323-250-30



123-103

SPECIFICATIONS

| Metric | | | | | |
|-----------------|------------|-----------------|--|-----------------|-------------------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) | Anvil dia. (mm) | Measurable module |
| Digimatic (LCD) | | | | | |
| 323-250-30 | 0 - 25 | 0.001 | ±4 | ø20 | 0.5 - 6 |
| 323-251-30 | 25 - 50 | | | | |
| 323-252-30 | 50 - 75 | | ±6 | | |
| 323-253-30 | 75 - 100 | | | | |

| Inch / Metric | | | | | |
|-----------------|------------|-------------------------|--|-----------------|-------------------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Anvil dia. (in) | Measurable module |
| Digimatic (LCD) | | | | | |
| 323-350-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ±0.0002 | 0.787 | 0.5 - 6 |
| 323-351-30 | 1 - 2 | | | | |
| 323-352-30 | 2 - 3 | | ±0.0003 | | |
| 323-353-30 | 3 - 4 | | | | |

| Metric | | | | | | | |
|--------------------------|------------|-----------------|--|-----------------|-------------------|-----|----------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Anvil dia. (mm) | Measurable module | | |
| Mechanical counter model | | | | | | | |
| 223-101 | 0 - 25 | 0.01 | ±4 | ø20 | 0.5 - 6 | | |
| 223-102 | 25 - 50 | | | | | | |
| Analog | | | | | | | |
| 123-101 | 0 - 25 | 0.01 | ±4 | ø20 | 0.5 - 6 | | |
| 123-113* | | | | | | | |
| 123-102 | 25 - 50 | | ±4 | | | | |
| 123-114* | | | | | | | |
| 123-103 | 50 - 75 | | ±6 | | | | |
| 123-115* | | | | | | | |
| 123-104 | 75 - 100 | | ±6 | | | | |
| 123-116* | | | | | | | |
| 123-105 | 100 - 125 | | ±7 | | | ø30 | 0.7 - 11 |
| 123-106 | 125 - 150 | | | | | | |
| 123-107 | 150 - 175 | ±8 | | | | | |
| 123-108 | 175 - 200 | | | | | | |
| 123-109 | 200 - 225 | ±9 | | | | | |
| 123-110 | 225 - 250 | | | | | | |
| 123-111 | 250 - 275 | ±9 | | | | | |
| 123-112 | 275 - 300 | | | | | | |

| Inch | | | | | |
|--------------------------|------------|-----------------|--|-----------------|-------------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Anvil dia. (in) | Measurable module |
| Mechanical counter model | | | | | |
| 223-125 | 0 - 1 | 0.001 | ±0.0002 | 0.787 | 0.5 - 6 |
| Analog | | | | | |
| 123-125 | 0 - 1 | 0.001 | ±0.0002 | 0.787 | 0.5 - 6 |
| 123-126 | 1 - 2 | | | | |
| 123-127 | 2 - 3 | | ±0.0003 | | |
| 123-128 | 3 - 4 | | | | |

* The measuring disks have carbide tips.

Note 1: For functional details of **series 323**, refer to page B-8.

Optional connecting cable is available only for water-proof type (Digimatic model).

Note 2: Root tangent length measurement is not available for some types of gears.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



IP Codes (series 323)

Level 6: Dust-proof.

No ingress of dust allowed.

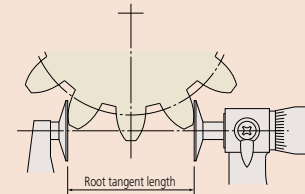
Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Flatness:
 - Measuring range 0 to 100: 1 μ m
 - Measuring range 100 to 300: 1.6 μ m
- Parallelism:
 - Measuring range 0 to 50: 4 μ m
 - Measuring range 50 to 100: 6 μ m
 - Measuring range 100 to 150: 7 μ m
 - Measuring range 150 to 225: 8 μ m
 - Measuring range 225 to 300: 9 μ m

Root Tangent Length of Gear (En)



Technical Data

- Battery for **series 323**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 323**)
- Length standard: Electromagnetic rotary sensor (for **series 323**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models)
Spanner (**301336**), 1 pc.

Optional Accessories for Series 323

- Connecting cables
 - 1 m: **05CZA662**
 - 2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

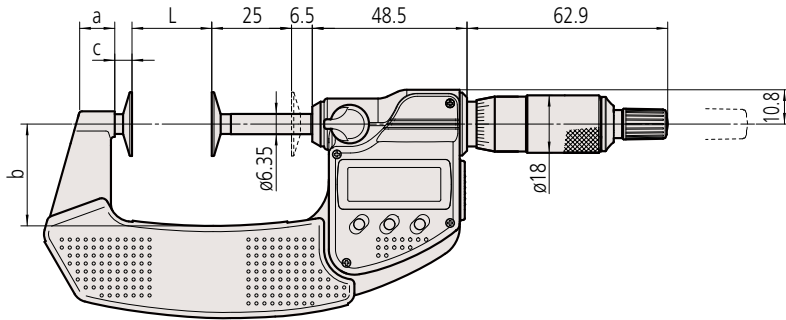
Wireless Data Output **U-WAVE**

- **U-WAVE-TM 264-622** (IP67 type)
264-623 (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth[®] U-WAVE
264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB**
02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.

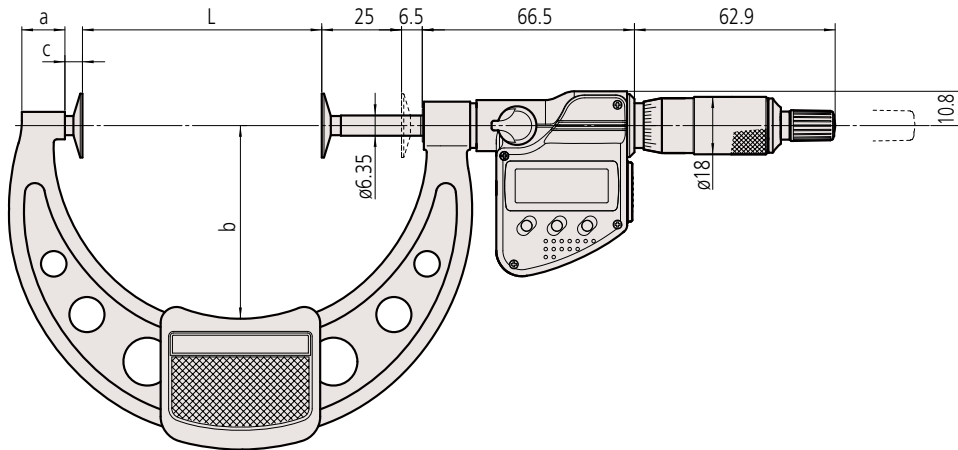
DIMENSIONS

Digimatic models up to 75 mm measuring range

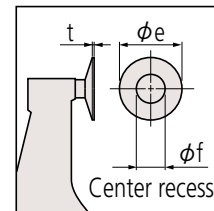
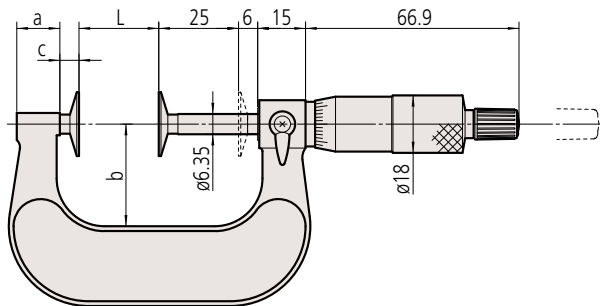
Unit: mm



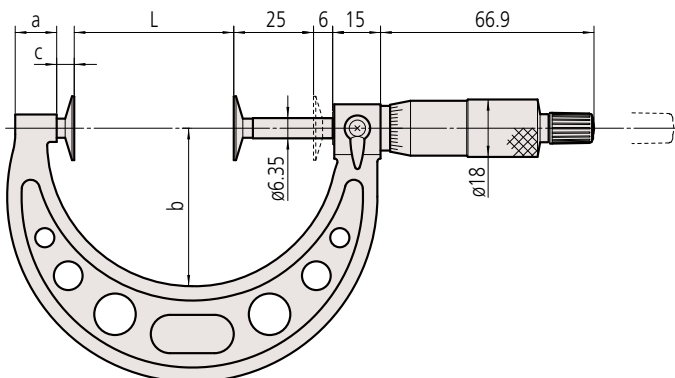
Digimatic models up to 100 mm measuring range



Analog models up to 50 mm measuring range



Analog over 50 mm measuring range



| Range (mm) | L | a | b | c | e | f | t |
|------------------------|-----|------|-----|-----|----|------------|--------------|
| Digimatic (LCD) | | | | | | | |
| 0 - 25 | 0 | 9.2 | 25 | 4.5 | 20 | 8 | 0.7 |
| 25 - 50 | 25 | 11 | 31 | 5.4 | | | |
| 50 - 75 | 50 | 12.2 | 50 | 5.5 | | | |
| 75 - 100 | 75 | 14 | 60 | | | | |
| Analog | | | | | | | |
| 0 - 25 | 0 | 13.8 | 25 | 5.7 | 20 | 8 (9.8) | 0.7 (0.7) |
| 25 - 50 | 25 | | 32 | 5.5 | | | |
| 50 - 75 | 50 | 12 | 49 | | | | |
| 75 - 100 | 75 | 14 | 63 | | | | |
| 100 - 125 | 100 | 12 | 79 | 6 | 30 | 12 | 1 |
| 125 - 150 | 125 | 14.5 | 94 | | | | |
| 150 - 175 | 150 | 15.2 | 106 | | | | |
| 175 - 200 | 175 | 14.5 | 118 | | | | |
| 200 - 225 | 200 | 13.5 | 130 | | | | |
| 225 - 250 | 225 | | 143 | | | | |
| 250 - 275 | 250 | 14.5 | 156 | | | | |
| 275 - 300 | 275 | | 169 | | | | |

Note: Data in () applies to those with carbide-faced disks.

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Gear Tooth Micrometers SERIES 324, 124 — Interchangeable Ball Anvil/Spindle Tip Type

MeasurLink ENABLED
Data Management Software by Mitutoyo

- Measures over-pin diameter of gears using precision steel (or carbide) ball anvils/spindle tips.
- **Series 324:** IP65 Digimatic gear tooth micrometers.
- Determination of the over-pin diameter: refer to "Quick Guide to Precision Measuring Instruments" on page B-72.
- Interchangeable ball anvils/spindle tips for various gear modules (0.5 to 5.25) are optional.
- Equipped with Ratchet Stop for constant measuring force.
- Ball anvil/spindle tips: optional.



SPECIFICATIONS

| Metric | | | |
|-----------------|------------|-----------------|-------------------------|
| Order No. | Range (mm) | Resolution (mm) | Spindle feed error (μm) |
| Digimatic (LCD) | | | |
| 324-251-30 | 0 - 25 | 0.001 | 3 |
| 324-252-30 | 25 - 50 | | |
| 324-253-30 | 50 - 75 | | |
| 324-254-30 | 75 - 100 | | |

Note: For functional details of **series 324** refer to page B-8.
Please note that origin setting of these models is by presetting. Optional connecting cable is available only for water-proof type (Digimatic model).

| Metric | | | |
|-----------|------------|-----------------|-------------------------|
| Order No. | Range (mm) | Graduation (mm) | Spindle feed error (μm) |
| Analog | | | |
| 124-173 | 0 - 25 | 0.01 | 3 |
| 124-174 | 25 - 50 | | |
| 124-175 | 50 - 75 | | |
| 124-176 | 75 - 100 | | |
| 124-177 | 100 - 125 | | |
| 124-178 | 125 - 150 | | |
| 124-179 | 150 - 175 | | |
| 124-180 | 175 - 200 | | |
| 124-181 | 200 - 225 | | |
| 124-182 | 225 - 250 | | |
| 124-183 | 250 - 275 | | |
| 124-195 | 275 - 300 | | |

| Inch / Metric | | | |
|-----------------|------------|-------------------------|-------------------------|
| Order No. | Range (in) | Resolution | Spindle feed error (in) |
| Digimatic (LCD) | | | |
| 324-351-30 | 0 - 1 | 0.00005 in/ 0.001 mm | 0.00015 |
| 324-352-30 | 1 - 2 | | |
| 324-353-30 | 2 - 3 | | |
| 324-354-30 | 3 - 4 | | |

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



IP Codes (series 324)

Level 6: Dust-proof. No ingress of dust allowed.
Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.



Optional Accessories

- Interchangeable ball anvil/spindle tip set

| Order No. | Diameter* (mm) | Gear module | Dia. pitch |
|-----------|---|-------------|------------|
| 124-801 | 0.8 | 0.5 - 0.55 | 50 |
| 124-802 | 1.0 | 0.6 - 0.65 | 45 |
| 124-803 | 1.191 (³ / ₆₄ " | 0.7 - 0.8 | 35 - 30 |
| 124-821 | 1.5 | 0.9 - 1 | 28 - 26 |
| 124-804 | 1.588 (¹ / ₁₆ " | 0.9 - 1 | 28 - 26 |
| 124-805 | 2.0 | 1.25 | 22 |
| 124-806 | 2.381 (³ / ₃₂ " | 1.5 | 17 |
| 124-822 | 2.5 | 1.5 | 17 |
| 124-807 | 3.0 | 1.75 | 15 |
| 124-808 | 3.175 (¹ / ₈ " | — | 14 |
| 124-823 | 3.5 | 2 | 13 |
| 124-809 | 3.969 (⁵ / ₃₂ " | 2 | 13 |
| 124-810 | 4.0 | 2.25 | 11 |
| 124-824 | 4.5 | 2.5 | 10 |
| 124-811 | 4.763 (³ / ₁₆ " | 2.5 | 10 |
| 124-812 | 5.0 | 2.75 | 9 |
| 124-813 | 5.556 (⁷ / ₃₂ " | 3.0 - 3.25 | 8 |
| 124-814 | 6.0 | 3.5 | 7 |
| 124-815 | 6.35 (¹ / ₄ " | 3.75 | 7 |
| 124-816 | 7.0 | 4.0 | 6.5 |
| 124-817 | 7.144 (⁹ / ₃₂ " | 4.25 | 6 |
| 124-818 | 7.938 (⁵ / ₁₆ " | 4.5 | 5.5 |
| 124-819 | 8.0 | 4.75 | 5.5 |
| 124-820 | 8.731 (¹¹ / ₃₂ " | 5.0 - 5.25 | 5 |

* 2 mm less for /carbide-tipped type

Technical Data

- Battery for **series 324**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 324**)
- Length standard: Electromagnetic rotary sensor (for **series 324**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models) Spanner (**301336**), 1 pc.

Optional Accessories for Series 324

- Connecting cables for **series 324**
1 m: **05CZA662** 2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B** For foot switch: **02AZE140B**
Refer to page A-27 for details.

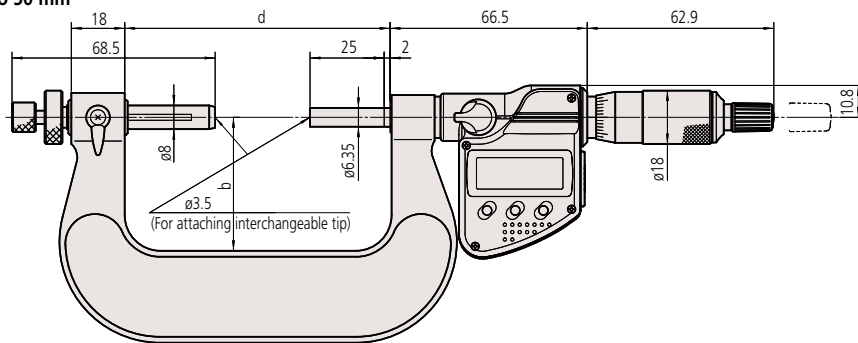
Wireless Data Output **U-WAVE**™

- **U-WAVE-TM** **264-622** (IP67 type) **264-623** (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® **U-WAVE**
264-626 (IP type) **264-627** (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB**
02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.

DIMENSIONS

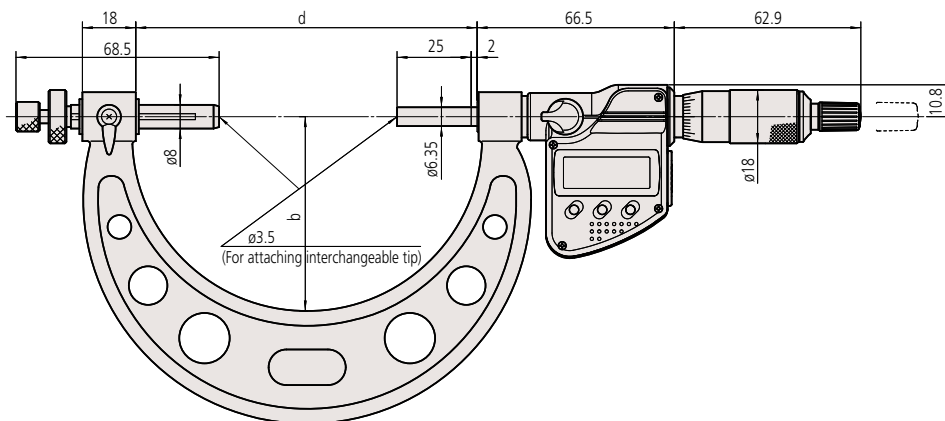
Unit: mm

Digimatic models up to 50 mm



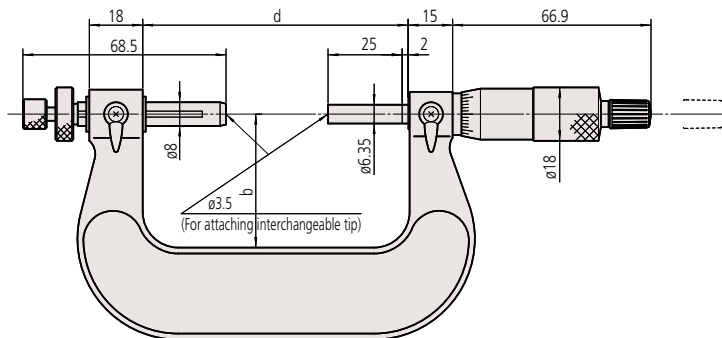
| Range (mm) | b | d |
|------------|----|------|
| 0 - 25 | 32 | 64 |
| 25 - 50 | 45 | 89.5 |

Digimatic models over 50 mm up to 100 mm



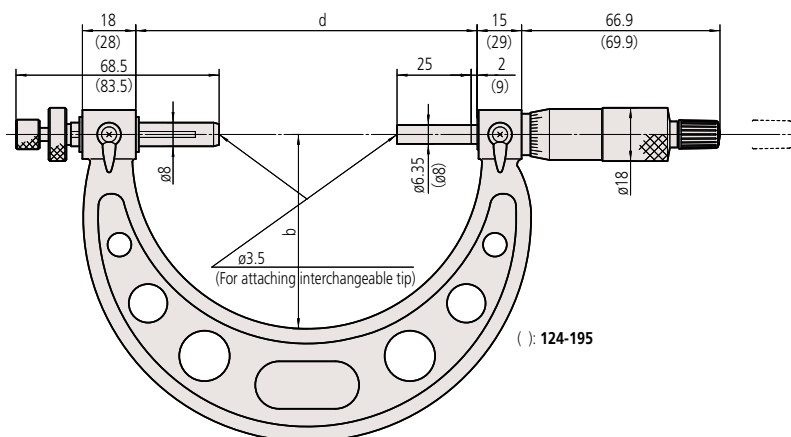
| Range (mm) | b | d |
|------------|----|-------|
| 50 - 75 | 65 | 115.1 |
| 75 - 100 | 79 | 140.1 |

Analog models up to 50 mm



| Range (mm) | b | d |
|------------|----|------|
| 0 - 25 | 32 | 64 |
| 25 - 50 | 45 | 89.5 |

Analog models over 50 mm up to 300 mm



| Range (mm) | b | d |
|------------|-----|-------|
| 50 - 75 | 65 | 115.1 |
| 75 - 100 | 79 | 140.1 |
| 100 - 125 | 93 | 165.1 |
| 125 - 150 | 105 | 190 |
| 150 - 175 | 118 | 214 |
| 175 - 200 | 131 | 240 |
| 200 - 225 | 144 | 265 |
| 225 - 250 | 156 | 290 |
| 250 - 275 | 169 | 314 |
| 275 - 300 | 187 | 352 |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Disk Micrometers SERIES 369, 227, 169 — Non-Rotating Spindle Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Measures "root tangent length" of spur gears and helical gears.
- Determination of the root tangent length: refer to "Quick Guide to Precision Measuring Instruments" on page B-72.
- Non-rotating spindle type.
- Measurable range of gear pitch: 0.5 to 6 module (**series 227**: 0.4 to 3 module).
- Equipped with Ratchet Stop for constant measuring force.
- Supplied with a setting standard (except for 0 to 25 mm/0 to 1 in measuring range).



SPECIFICATIONS

| Metric | | | | | | | | |
|---|------------|------------|-----------------|-----------------|--|---------------------|------------------------|---------------------|
| | Order No. | Range (mm) | Resolution (mm) | Anvil dia. (mm) | Maximum permissible error J_{MPE} (μ m) | Flatness (μ m) | Parallelism (μ m) | Measuring force (N) |
| Digimatic (LCD) | 369-250-30 | 0 - 25 | 0.001 | 20 | ± 4 | 1 | 4 | 3 - 8 |
| | 369-251-30 | 25 - 50 | | | | | 6 | |
| | 369-252-30 | 50 - 75 | | | 4 | | | |
| | 369-253-30 | 75 - 100 | | | | | | |
| Quickmike type (LCD) | 369-411-20 | 0 - 30 | 14.3 | ± 4 | 3 | 4 | 0.5 - 2.5 | |
| | 369-412-20 | 25 - 55 | | | | 2 - 10 | | |
| Quickmike type adjustable measuring force (LCD) | 227-221-20 | 0 - 15 | 14.3 | ± 4 | 3 | 3 | 0.5 - 2.5 | |
| | 227-223-20 | 0 - 10 | | | | | 2 - 10 | |

| Metric | | | | | | | | |
|--------|------------|------------|-----------------|-----------------|--|---------------------|------------------------|---------------------|
| | Order No. | Range (mm) | Graduation (mm) | Anvil dia. (mm) | Maximum permissible error J_{MPE} (μ m) | Flatness (μ m) | Parallelism (μ m) | Measuring force (N) |
| Analog | 169-201-10 | 0 - 25 | 0.01 | 20 | ± 4 | 1 | 4 | 3 - 8 |
| | 169-202-10 | 25 - 50 | | | | | 6 | |
| | 169-205-10 | 50 - 75 | | | 4 | | | |
| | 169-207-10 | 75 - 100 | | | | | | |

| Inch / Metric | | | | | | | | |
|----------------------|------------|------------|-------------------------|-----------------|--|---------------|------------------|---------------------|
| | Order No. | Range (in) | Resolution | Anvil dia. (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Measuring force (N) |
| Digimatic (LCD) | 369-350-30 | 0 - 1 | 0.00005 in/ 0.001 mm | 0.787 | ± 0.0002 | 0.00004 | 0.0002 | 3 - 8 |
| | 369-351-30 | 1 - 2 | | | | | 0.0003 | |
| | 369-352-30 | 2 - 3 | | | 4 | | | |
| | 369-353-30 | 3 - 4 | | | | | | |
| Quickmike type (LCD) | 369-421-20 | 0 - 1.2 | 1 - 2.2 | 0.787 | ± 0.0002 | 0.0002 | 0.0002 | |
| | 369-422-20 | 1 - 2.2 | | | | | | |

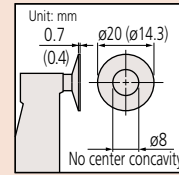
| Inch | | | | | | | | |
|--------|------------|------------|-----------------|-----------------|--|---------------|------------------|---------------------|
| | Order No. | Range (in) | Graduation (in) | Anvil dia. (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Measuring force (N) |
| Analog | 169-203-10 | 0 - 1 | 0.001 | 0.787 | ± 0.0002 | 0.00004 | 0.0002 | 3 - 8 |
| | 169-204-10 | 1 - 2 | | | | | 0.0003 | |
| | 169-206-10 | 2 - 3 | | | 4 | | | |
| | 169-208-10 | 3 - 4 | | | | | | |

Note 1: For functional details of **series 369** refer to page B-8. Please note that these models are not water-proof.
Note 2: Root tangent length measurement is not available for some types of gears.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Anvil



() : Adjustable measuring force type

Technical Data

- Battery for **series 369** and **227** SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 369-2XX, 3XX**)
Approx. 5 year under normal use (for **series 369-4XX**)
Approx. 5 years under normal use (for **series 227-2XX**)
- Length standard: Electromagnetic rotary sensor (for **series 369-2XX, 3XX**)
Electrostatic capacity absolute sensor (for **series 369-4XX, 2XX**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 10 mm/0 to 15 mm/0 to 25 mm/0 to 30 mm (0 to 1/0 to 1.2 in) models)
Spanner (**301336**), 1 pc. (for **series 169-2XX, 369-2XX, 3XX**)
Screwdriver (**210183**), 1 pc. (for **series 227-2XX**)

Optional Accessories

- Connecting cables for **369, 227 Series**
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct **USB-ITN-B** (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Wireless Data Output* U-WAVE™

- **U-WAVE-TM 264-622** (IP67 type) **264-623** (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB** **02AZF310** (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.
* Only **series 369-2XX, 3XX** can be attached.



Quickmike

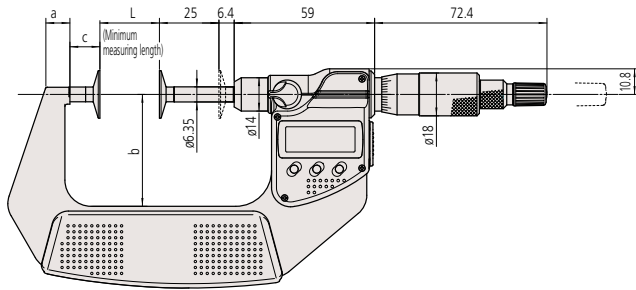
- Provides a speedy spindle feed of 10 mm per thimble rotation, which enables widely differently sized features to be measured quickly.

Quickmike Type with Adjustable Measuring Force

- Digimatic micrometer dedicated to applications requiring a constant/low measuring force such as measuring wire, paper, and plastic/rubber parts.

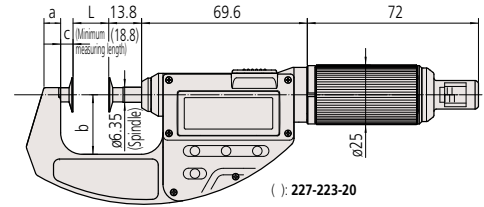
DIMENSIONS

Digimatic models up to 75 mm

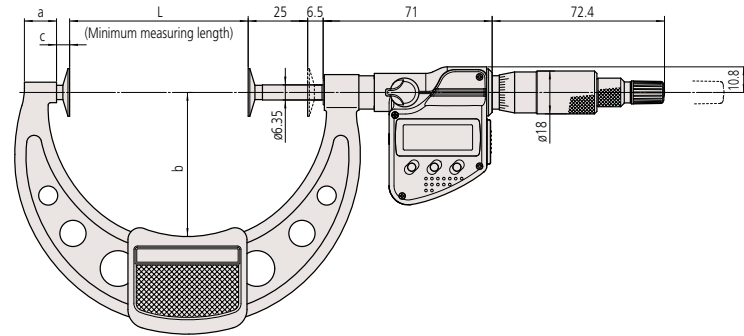


Quickmike adjustable measuring force type

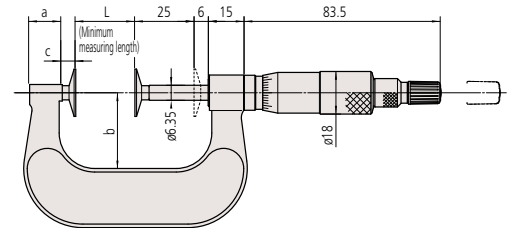
Unit: mm



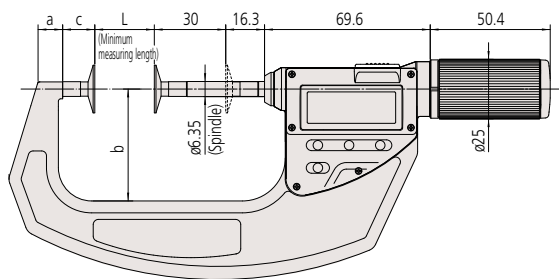
Digimatic models over 75 mm



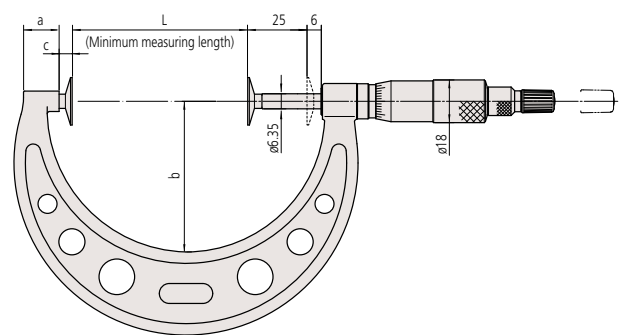
Analog models up to 50 mm



Quickmike type



Analog models over 50 mm



Digimatic models

| Range (mm) | L | a | b | c |
|------------|----|------|----|------|
| 0 - 25 | 0 | 7 | 32 | 12.9 |
| 25 - 50 | 25 | 9.8 | 47 | |
| 50 - 75 | 50 | 11.2 | 60 | 5.5 |
| 75 - 100 | 75 | 13.5 | | |

Analog models

| Range (mm) | L | a | b | c |
|------------|----|------|----|-----|
| 0 - 25 | 0 | 13.8 | 25 | 5.7 |
| 25 - 50 | 25 | | 32 | |
| 50 - 75 | 50 | 12 | 49 | 5.5 |
| 75 - 100 | 75 | 14 | 63 | |

Quickmike adjustable measuring force type

| Range (mm) | L | a | b | c |
|------------|---|-----|----|-----|
| 0 - 15 | 0 | 6.2 | 25 | 5.2 |
| 0 - 10 | 0 | | | |

Quickmike type

| Range (mm) | L | a | b | c |
|------------|----|------|----|------|
| 0 - 30 | 0 | 8.5 | 36 | 13.5 |
| 25 - 55 | 25 | 10.3 | 47 | |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Sheet Metal Micrometers SERIES 389, 118

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Measures thickness of sheet metal.
- IP65 water/dust protection (**series 389**).
- Measuring faces: Carbide.

- Profile of measuring faces: Flat-Flat, Spherical-Flat and Spherical-Spherical.
- Equipped with Ratchet Stop for constant measuring force.



389-251-30



118-102

SPECIFICATIONS

| Metric | | | | | |
|-----------------|------------|-----------------|--|-------------------|--------------------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) | Throat depth (mm) | Measuring surfaces |
| Digimatic (LCD) | | | | | |
| 389-251-30 | 0 - 25 | 0.001 | ± 4 | 150 | F-F |
| 389-261-30 | | | | | S-F |
| 389-271-30 | | | | | S-S |
| 389-514 | | | | | F-F |
| 389-252-30 | 25 - 50 | 0.001 | ± 4 | 150 | S-F |
| 389-262-30 | | | | | S-S |
| 389-272-30 | | | | | S-S |

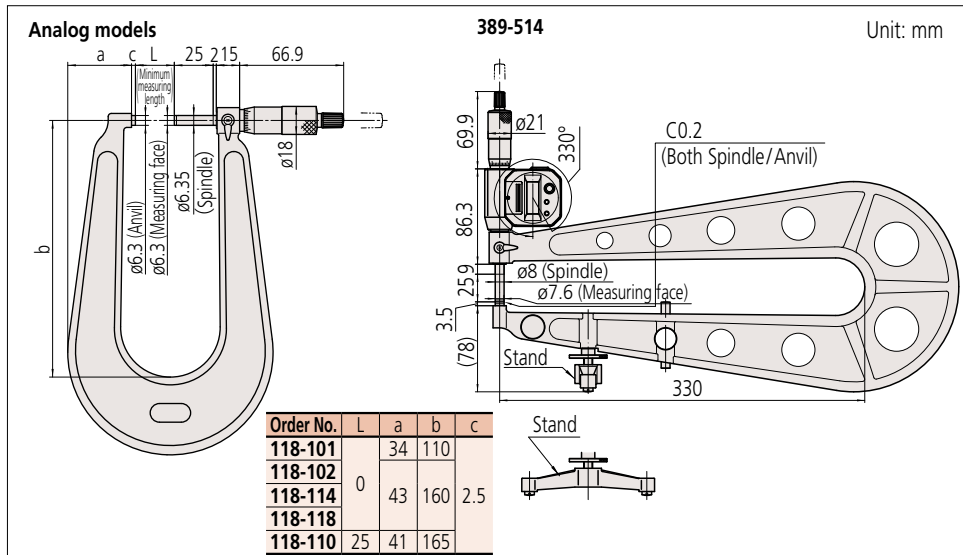
| Inch / Metric | | | | | |
|-----------------|------------|----------------------|--|-------------------|--------------------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Throat depth (in) | Measuring surfaces |
| Digimatic (LCD) | | | | | |
| 389-351-30 | 0 - 1 | 0.0005 in / 0.001 mm | ± 0.0002 | 6 | F-F |
| 389-361-30 | | | | | S-F |
| 389-371-30 | | | | | S-S |
| 389-714 | | | | | F-F |
| 389-352-30 | 1 - 2 | 0.001 mm | ± 0.0002 | 6 | S-F |
| 389-362-30 | | | | | S-S |
| 389-372-30 | | | | | S-S |

| Metric | | | | | |
|-----------|------------|-----------------|--|-------------------|--------------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Throat depth (mm) | Measuring surfaces |
| Analog | | | | | |
| 118-101 | 0 - 25 | 0.01 | ± 4 | 100 | F-F |
| 118-102 | | | | 150 | S-F |
| 118-114 | | | | 150 | S-S |
| 118-118 | | | | 300* | F-F |
| 118-103 | 25 - 50 | 0.01 | ± 5 | 300* | F-F |
| 118-110 | | | | 150 | S-S |
| 118-126 | | | | 150 | S-S |

| Inch | | | | | |
|-----------|------------|-----------------|--|-------------------|--------------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Throat depth (in) | Measuring surfaces |
| Analog | | | | | |
| 118-129 | 0 - 1 | 0.0001 | ± 0.0002 | 6 | F-F |
| 118-116 | | | | | S-F |
| 118-120 | | | | | S-S |
| 118-107 | | | | | F-F |
| 118-112 | 1 - 2 | 0.001 | ± 0.00025 | 12* | F-F |
| | | | ± 0.0002 | 6 | S-S |

* Models with a 300 mm (12 in) throat are equipped with a stand for convenience of measurement in the horizontal orientation as standard.
Note1: For functional details of 389-251-30/389-252-30/389-351-30/389-352-30 refer to page B-8.
Note2: For functional details of 389-514/389-714 refer to page B-9.
Note3: In spherical-flat anvil type micrometers, the measuring face on the anvil side is spherical.

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.

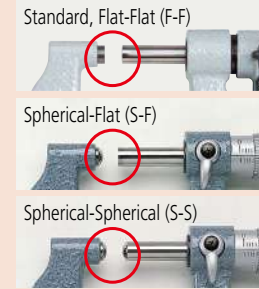


IP Codes (series 389)

Level 6: Dust-proof. No ingress of dust allowed.
Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Flatness: 0.6 μ m for models with 150 mm / 6 in throat
1 μ m for models with 300 mm / 12 in throat
- Parallelism: 3 μ m

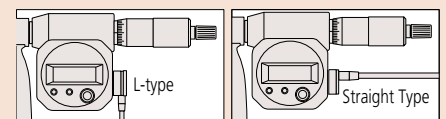


Technical Data

- Battery for **series 389**
SR44 (1 pc.), 938882, 2 pcs.: 389-514, 389-714 for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 389-2XX, 3XX**)
Approx. 1.8 years under normal use (for **series 389-514, 714**)
- Length standard: Electromagnetic rotary sensor (for **series 389**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models)
Spanner (200877), 1 pc. (for **series 118-1XX**)
Spanner (301336), 1 pc. (for **series 389-2XX, 3XX**)
Spanner (200154), 1 pc. (for **series 118-103/107, 389-514/714**)

Optional Accessories for Series 389

- Connecting cables for **series 389** (excluding 389-514 and 389-714)
1 m: 05CZA662 2 m: 05CZA663
- USB Input Tool Direct
USB-ITN-B (2 m): 06AFM380B
- U-WAVE-T dedicated connection cable for **series 389** (excluding 389-514 and 389-714)
160 mm: 02AZD790B
For foot switch: 02AZE140B
- SPC cables for **series 389** (excluding 389-514 and 389-714)
- Connecting cables for 389-514, 389-714
- Recommended cables: L-Type (does not interfere with operating the thimble.)
1 m: 04AZB512 2 m: 04AZB513
- Straight type (may interfere with operating the thimble.)
1 m: 959149 2 m: 959150



Refer to page A-27 for detailed information about recommended cables.

Wireless Data Output* U-WAVE™

- U-WAVE-TM 264-622 (IP67 type)
264-623 (Buzzer type)
- U-WAVE-TMB Transmitter
Mitutoyo Bluetooth® U-WAVE
264-626 (IP type) 264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for U-WAVE-TM/TMB
02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.
* Only **series 389** (except for 389-514 and 389-714) can be attached.

Sheet Metal Micrometer SERIES 119

- Large diameter dial model enables easy and quick measurement of sheet metal thickness.
- Equipped with Ratchet Stop for constant measuring force.
- Adjustable anvil.
- Measuring faces: Carbide.



Standard Accessories

Spanner (200168), 1 pc.

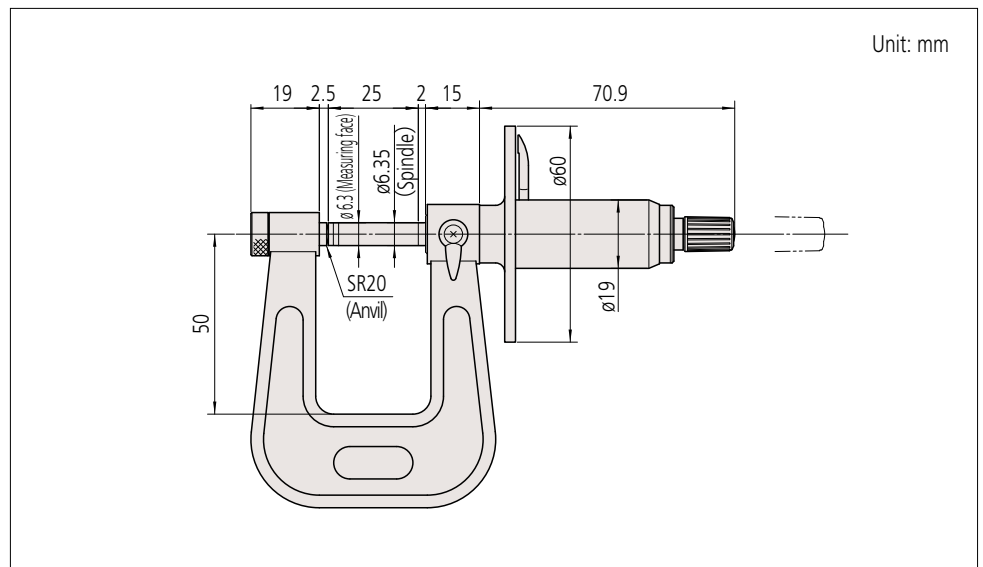


119-202

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|-----------------|---|-------------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Throat depth (mm) |
| 119-202 | 0 - 25 | 0.01 | ± 4 | 50 |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Tube Micrometers SERIES 395, 115, 295

MeasurLink ENABLED
Data Management Software by Mitutoyo

- Measuring faces: Carbide.
(**115-101**: only the spindle is carbide tipped.)
- **series 395**: IP65 digital spherical-flat anvil type micrometer.
- Equipped with Ratchet Stop for constant measuring force.



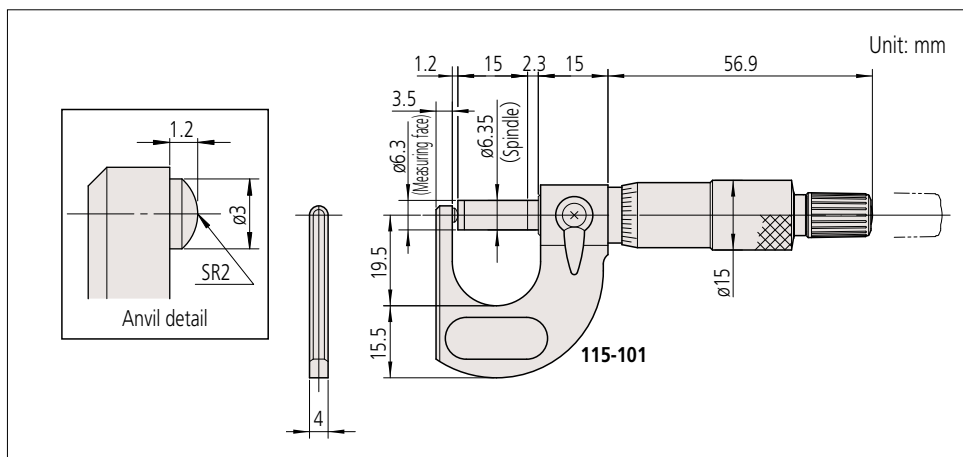
SPECIFICATIONS

| Metric | | | | |
|-------------------|------------|-----------------|---|-----------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | ϕD |
| Digimatic (LCD) | | | | |
| 395-251-30 | 0 - 25 | 0.001 | ± 2 | $\phi 15$ |
| 395-252-30 | 25 - 50 | | | $\phi 19$ |
| 395-253-30 | 50 - 75 | | ± 3 | $\phi 20$ |
| 395-254-30 | 75 - 100 | | | |

| Metric | | | | |
|--------------------------|------------|-----------------|---|------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | ϕD |
| Analog | | | | |
| 115-101 | 0 - 15 | 0.01 | ± 3 | $\phi 5.5$ |
| 115-115 | 0 - 25 | | | $\phi 10$ |
| 115-116 | 25 - 50 | | | $\phi 11$ |
| 115-117 | 50 - 75 | | | $\phi 17$ |
| 115-118 | 75 - 100 | | | $\phi 18$ |
| Mechanical counter model | | | | |
| 295-115 | 0 - 25 | | ± 3 | $\phi 10$ |

Note: For functional details of **series 395** refer to page B-8.
Optional connecting cable is available only for water-proof type (Digimatic model).

DIMENSIONS



MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

IP 65

These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.

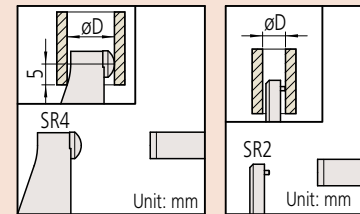


IP Codes (series 395)

- Level 6: Dust-proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Flatness: 0.6 μm /0.000024 in (**series 115 & 295**)
0.3 μm /0.000012 in (**series 395**)



Other than **115-101** **115-101**

Technical Data

- Battery for **series 395**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 395**)
- Length standard: Electromagnetic rotary sensor (for **series 395**)
- Standard accessories: Reference bar, 1 pc.
(except for measuring range 0 to 15 mm/0 to 25 mm (0 to 1 in) models)
Spanner (**200168**), 1 pc. (for **series 115-101**)
Spanner (**301336**), 1 pc. (for models other than **series 115-101**)

Optional Accessories

- Connecting cables for **series 395**
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Wireless Data Output **U-WAVE** fit

- **U-WAVE-TM** **264-622** (IP67 type)
264-623 (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® **U-WAVE**
264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB**
02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



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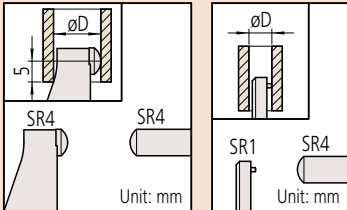
IP Codes (series 395)

Level 6: Dust-proof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.



Other than 115-201

115-201

Technical Data

- Battery for **series 395**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 395**)
- Length standard: Electromagnetic rotary sensor (for **series 395**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 15 mm/0 to 25 mm (0 to 1 in) models)
Spanner (**200168**), 1 pc. (for **series 115-201**)
Spanner (**301336**), 1 pc. (for models other than **series 115-201**)

Optional Accessories

- Connecting cables for **series 395**
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Wireless Data Output **U-WAVE**™

- U-WAVE-TM 264-622** (IP67 type)
264-623 (Buzzer type)
- U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB 02AZF310** (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.

Tube Micrometers SERIES 395, 115, 295 — Spherical Anvil and Spindle Type

- Measuring faces: Carbide. (**115-201**: only the spindle is carbide tipped.)
- series 395**: IP65 spherical anvil and spindle type digital micrometer.
- Equipped with Ratchet Stop for constant measuring force.



SPECIFICATIONS

| Metric | | | | |
|-------------------|------------|-----------------|--|-----|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | øD |
| Digimatic (LCD) | | | | |
| 395-271-30 | 0 - 25 | 0.001 | ±2 | ø15 |
| 395-272-30 | 25 - 50 | | | |
| 395-273-30 | 50 - 75 | | | |
| 395-274-30 | 75 - 100 | | | |

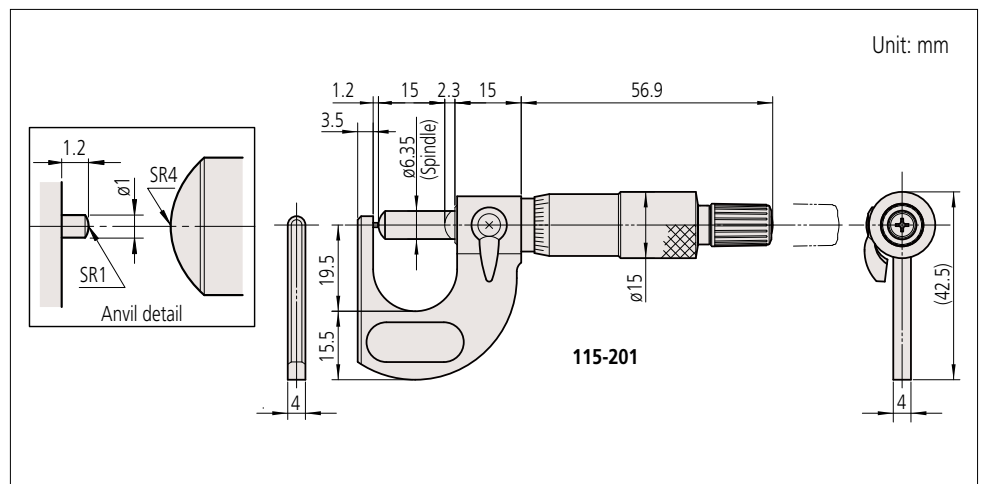
| Inch / Metric | | | | |
|-------------------|------------|-------------------------|--|---------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | øD (in) |
| Digimatic (LCD) | | | | |
| 395-371-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ±0.0001 | ø0.59 |
| 395-372-30 | 1 - 2 | | | |
| 395-373-30 | 2 - 3 | | | |
| 395-374-30 | 3 - 4 | | | |

| Metric | | | | |
|----------------|------------|-----------------|--|------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | øD |
| Analog | | | | |
| 115-201 | 0 - 15 | 0.01 | ±3 | ø5.5 |
| 115-215 | 0 - 25 | | | ø10 |
| 115-216 | 25 - 50 | | | ø11 |
| 115-217 | 50 - 75 | | | ø17 |
| 115-218 | 75 - 100 | | | ø18 |
| 295-215 | 0 - 25 | | | ±4 |

| Inch | | | | |
|--------------------------|------------|-----------------|--|---------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | øD (in) |
| Analog | | | | |
| 115-253 | 0 - 1 | 0.0001 | ±0.00015 | ø0.40 |
| 115-242 | 1 - 2 | 0.001 | | ø0.44 |
| 115-243 | 2 - 3 | | | ø0.67 |
| Mechanical counter model | | | | |
| 295-253 | 0 - 1 | 0.0001 | ±0.00015 | ø0.40 |

Note: For functional details of **series 395** refer to page B-8.
Optional connecting cable is available only for water-proof type (Digimatic model).

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Tube Micrometers SERIES 395, 115, 295 — Spherical and Cylindrical Anvil Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Spindle face: Carbide.
- **Series 395:** IP65 spherical and cylindrical anvil type digital micrometers.

- Equipped with Ratchet Stop for constant measuring force.



SPECIFICATIONS

| Metric | | | | |
|-----------------|------------|-----------------|--|---------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) | Remarks |
| Digimatic (LCD) | | | | |
| 395-261-30 | 0 - 25 | 0.001 | ± 3 | Type A |
| 395-262-30 | | | | Type B |
| 395-263-30 | | | | Type C |
| 395-264-30 | | | | Type D |

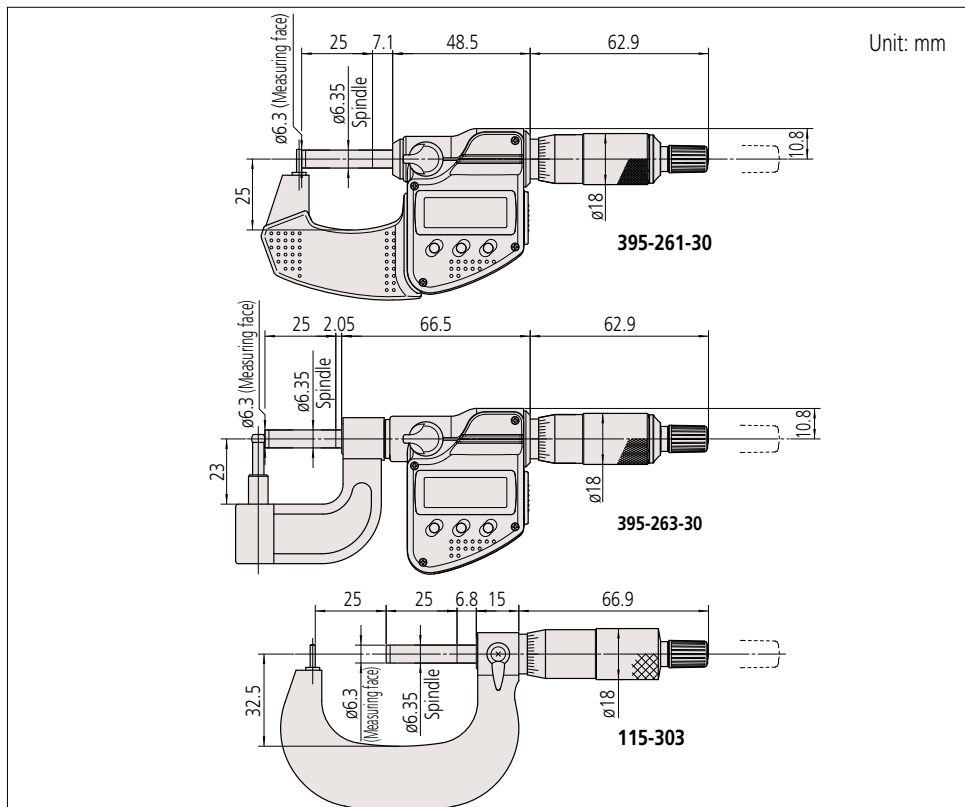
| Inch / Metric | | | | |
|-----------------|------------|-----------------------|--|---------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Remarks |
| Digimatic (LCD) | | | | |
| 395-362-30 | 0 - 1 | 0.00005 in / 0.001 mm | ± 0.00015 | Type B |
| 395-363-30 | | | | Type C |
| 395-364-30 | | | | Type D |

| Metric | | | | |
|-----------|------------|-----------------|--|---------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Remarks |
| Analog | | | | |
| 115-302 | 0 - 25 | 0.01 | ± 3 | Type A |
| 115-308 | | | | Type B |
| 115-303 | 25 - 50 | 0.01 | ± 3 | Type A |
| 115-309 | | | | Type B |
| 115-315 | 0 - 25 | 0.01 | ± 3 | Type C |
| 115-316 | | | | Type D |

| Inch | | | | |
|-----------|------------|-----------------|--|---------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Remarks |
| Analog | | | | |
| 115-305 | 0 - 1 | 0.001 | ± 0.00015 | Type A |
| 115-313 | | 0.0001 | | Type C |
| 115-314 | | Type D | | |

Note: For functional details of **series 395** refer to page B-8.
Optional connecting cable is available only for water-proof type (Digimatic model).

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



IP Codes (series 395)

- Level 6: Dust-proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

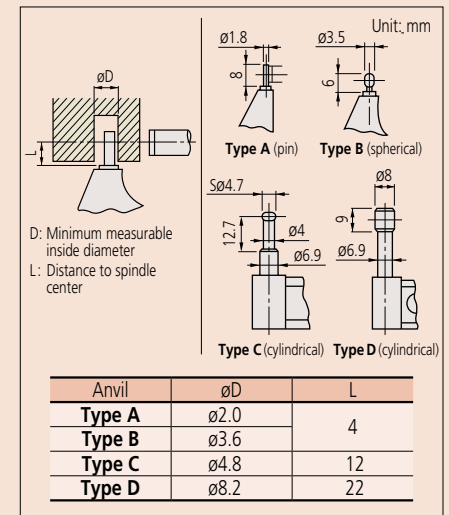
Type A (pin)

Type B (spherical)



Type C (cylindrical)

Type D (cylindrical)



Technical Data

- Battery for **series 395**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 395**)
- Length standard: Electromagnetic rotary sensor (for **series 395**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models)
Spanner (**301336**), 1 pc.

Optional Accessories

- Connecting cables for **series 395**
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Wireless Data Output **U-WAVE**

- **U-WAVE-TM 264-622** (IP67 type)
264-623 (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth[®] U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB**
02AZF310 (IP67 / buzzer type common specification)
Refer to pages A-16 and A-18 for details.



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



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ID 0000063013

IP Codes (series 342-271-30, 342-371-30, 342-451-20)

Level 6: Dust-proof.

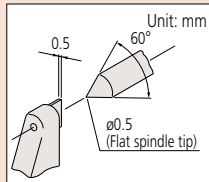
No ingress of dust allowed.

Level 5: Protected against water jets.

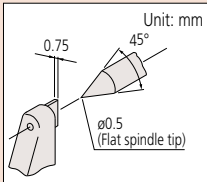
Water projected in jets against the enclosure from any direction shall have no harmful effects.



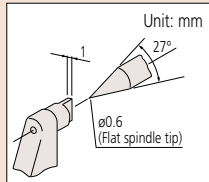
Anvil and spindle tip detail



342-271-30, 342-371-30, 112-401



342-451-20



142-402, 142-403

Technical Data

- Battery for series 342 SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for series 342-271-30/342-371-30) Approx. 5 years under normal use
- Length standard: Electromagnetic rotary sensor (for series 342-271-30/342-371-30) Electrostatic capacity absolute sensor (for series 342-451-20)
- Standard accessories: Spanner (**301336**), 1 pc. (except for series 342-451-20)

Optional Accessories

- Connecting cables (Digimatic model, Quickmike)
 - 1 m: **05CZA662**
 - 2 m: **05CZA663**
- USB Input Tool Direct **USB-ITN-B** (2 m): **06AFM380B**
- U-WAVE-T** dedicated connection cable (for series 342-271-30/342-371-30 and 342-451-20) 160 mm: **02AZD790B** For foot switch: **02AZE140B**

Wireless Data Output* U-WAVE^{fit}

- U-WAVE-TM** 264-622 (IP67 type) 264-623 (Buzzer type)
- U-WAVE-TMB** Transmitter **Mitutoyo Bluetooth[®] U-WAVE** 264-626 (IP type) 264-627 (Buzzer type) Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB** **02AZF310** (IP67/buzzer type common specification) Refer to pages A-16 and A-18 for details. * 342-271-30 and 342-371-30 can be attached. Not available for 342-451-20.

Crimp Height Micrometers Series 342,112,142

- Measures the height of crimp contacts.
- Equipped with Ratchet Stop for constant measuring force.
- IP65 water/dust protection (Digimatic model).
- Model **342-451-20** is a Quickmike type model with spindle feed of 10 mm per thimble rotation.



ABSOLUTE[™]



SPECIFICATIONS

| Metric | | | |
|-----------------|------------|-----------------|--|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) |
| Digimatic (LCD) | | | |
| 342-271-30 | 0 - 20 | 0.001 | ± 3 |
| Quickmike (LCD) | | | |
| 342-451-20 | 0 - 15 | 0.001 | ± 3 |

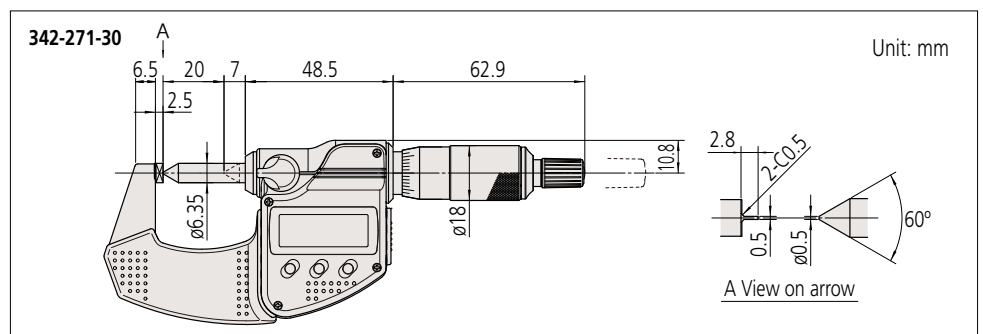
| Inch/Metric | | | |
|-----------------|------------|-------------------------|--|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) |
| Digimatic (LCD) | | | |
| 342-371-30 | 0 - 0.8 | 0.00005 in/ 0.001 mm | ± 0.00015 |

| Metric | | | |
|--------------------------|------------|-----------------|--|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) |
| Mechanical counter model | | | |
| 142-402 | 0 - 25 | 0.01 | ± 3 |
| 142-403 | | 0.001 | |

| Metric | | | |
|-----------|------------|-----------------|--|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) |
| Analog | | | |
| 112-401 | 0 - 25 | 0.01 | ± 3 |

Note: For functional details of series 342 refer to page B-8.
Optional connecting cable is available only for water-proof type (Digimatic model).

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Spline Micrometers SERIES 331, 111, 131

- The anvil and spindle are of small diameter for measuring splined shafts, slots and keyways.
- IP65 water/dust protection (**series 331**).
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.

MeasurLink ENABLED
Data Management Software by Mitutoyo

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

IP 65

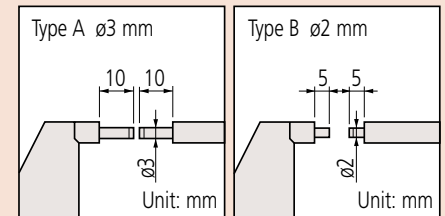
These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.

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ID 000040131



IP Codes (series 331)

- Level 6: Dust-proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.



SPECIFICATIONS

| Metric | | | | | | |
|-----------------|------------|-----------------|---|----------------------------|-------------------------------|---------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) | Remarks |
| Digimatic (LCD) | | | | | | |
| 331-251-30 | 0 - 25 | 0.001 | ±2 | 0.3 | 2 | Type A |
| 331-252-30 | 25 - 50 | | | | 3 | |
| 331-253-30 | 50 - 75 | | | | 3 | |
| 331-254-30* | 75 - 100 | | ±3 | | 2 | Type B |
| 331-261-30 | 0 - 25 | | ±2 | | 3 | |
| 331-262-30 | 25 - 50 | | ±2 | | 3 | |
| 331-263-30 | 50 - 75 | | ±3 | | 2 | Type B |
| 331-264-30* | 75 - 100 | ±3 | 3 | | | |

* Made to order.
Note: For functional details of **series 331** refer to page B-8.
Optional connecting cable is available only for water-proof type (Digimatic model).

| Inch / Metric | | | | | | |
|-----------------|------------|-------------------------|--|---------------|------------------|---------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Remarks |
| Digimatic (LCD) | | | | | | |
| 331-351-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ±0.0001 | 0.000012 | 0.00008 | Type A |
| 331-352-30 | 1 - 2 | | | | 0.00012 | |
| 331-353-30 | 2 - 3 | | | | 0.00012 | |
| 331-354-30 | 3 - 4 | | ±0.00015 | | 0.00008 | Type B |
| 331-361-30 | 0 - 1 | | ±0.0001 | | 0.00012 | |
| 331-362-30 | 1 - 2 | | ±0.0001 | | 0.00012 | |
| 331-363-30 | 2 - 3 | | ±0.00015 | | 0.00012 | Type B |
| 331-364-30 | 3 - 4 | ±0.00015 | 0.00012 | | | |

| Metric | | | | | | |
|--------------------------|------------|-----------------|---|----------------------------|-------------------------------|---------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness (μm) | Parallelism (μm) | Remarks |
| Analog | | | | | | |
| 111-215 | 0 - 25 | 0.01 | ±3 | 0.3 | 2 | Type A |
| 111-115 | 0 - 25 | | | | 3 | |
| 111-116 | 25 - 50 | | | | 4 | |
| 111-117 | 50 - 75 | | | | 5 | |
| 111-118 | 75 - 100 | | | | 6 | |
| 111-119 | 100 - 125 | | | | 6 | |
| 111-120 | 125 - 150 | | ±4 | | 3 | Type A |
| 111-121 | 150 - 175 | | | | 4 | |
| 111-122 | 175 - 200 | | | | 5 | |
| 111-123 | 200 - 225 | | | | 6 | |
| 111-124 | 225 - 250 | | | | 6 | |
| 111-125 | 250 - 275 | | | | 6 | |
| 111-126 | 270 - 300 | 6 | 5 | | | |
| Mechanical counter model | | | | | | |
| 131-115 | 0 - 25 | | ±3 | 0.3 | 2 | Type A |

| Inch | | | | | | |
|-----------|------------|-----------------|--|---------------|------------------|---------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness (in) | Parallelism (in) | Remarks |
| Analog | | | | | | |
| 111-166 | 0 - 1 | 0.0001 | ±0.00015 | 0.000012 | 0.00008 | Type A |

Technical Data

- Battery for **series 331**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 331**)
- Length standard: Electromagnetic rotary sensor (for **series 331**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models)
Spanner (**301336**), 1 pc.

Optional Accessories

- Connecting cables for **series 331**
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Wireless Data Output **U-WAVE fit**

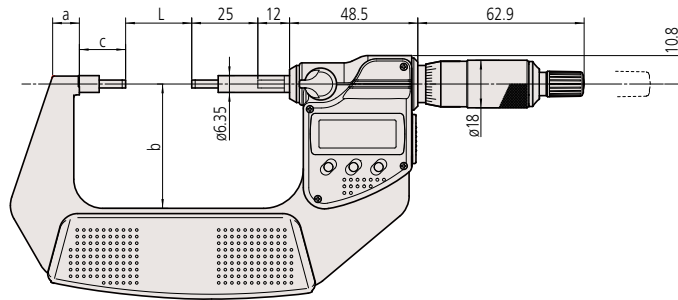
- **U-WAVE-TM 264-622** (IP67 type)
264-623 (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB 02AZF310** (IP67 / buzzer type common specification)
Refer to pages A-16 and A-18 for details.

DIMENSIONS

Unit: mm

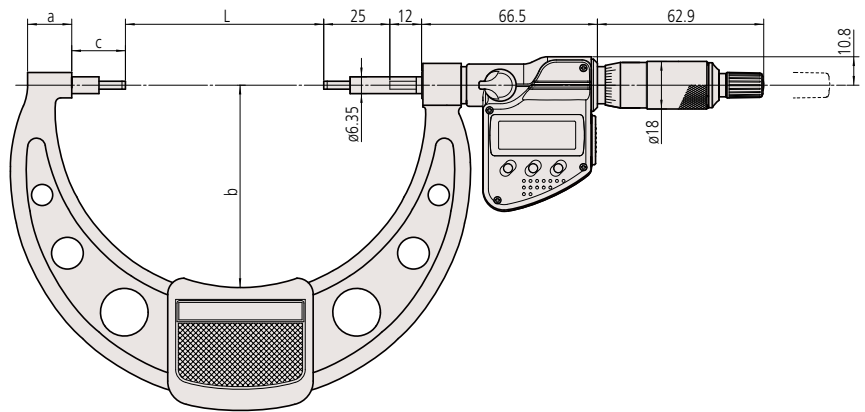
Digimatic models

Models up to 75 mm measuring range



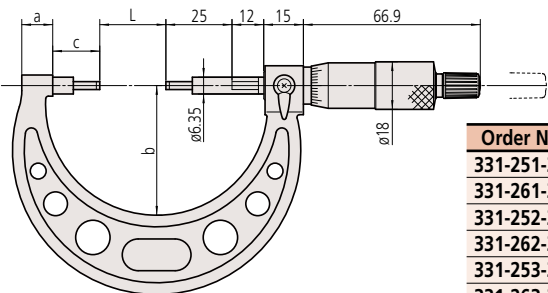
Models over 75 mm measuring range

Digimatic models



Analog models

Models up to 300 mm measuring range



| Order No. | L | a | b | c |
|-------------------|-----|------|------|------|
| 331-251-30 | 0 | 7.3 | 32.5 | 17.5 |
| 331-261-30 | 25 | 10.1 | 47 | |
| 331-252-30 | 50 | 11.5 | 60 | |
| 331-262-30 | 75 | 16.7 | 76 | |
| 331-253-30 | 100 | 18.8 | 94 | 20.7 |
| 331-263-30 | 125 | 19.1 | 106 | 21.1 |
| 331-254-30 | 150 | 18.2 | 118 | 21.3 |
| 331-264-30 | 175 | 16.8 | 130 | 21.7 |
| 111-215 | 0 | 10 | 38 | 17.5 |
| 111-115 | 25 | 12 | 49 | |
| 111-117 | 50 | 14 | 60 | |
| 111-118 | 75 | 16.7 | 79 | |
| 111-119 | 100 | 18.8 | 94 | 20.7 |
| 111-120 | 125 | 19.1 | 106 | 21.1 |
| 111-121 | 150 | 18.2 | 118 | 21.3 |
| 111-122 | 175 | 16.8 | 130 | 21.7 |
| 111-123 | 200 | 18 | 143 | 20.5 |
| 111-124 | 225 | | 156 | 21.5 |
| 111-125 | 250 | | 169 | |
| 111-126 | 275 | | 181 | |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Point Micrometers SERIES 342, 112, 142

- Measures trough diameters, such as drill web diameters.
- The measuring points (carbide tipped) have approximately 0.3 mm radius.
- **Series 342:** IP65 Digimatic micrometers.
- Equipped with Ratchet Stop for constant measuring force.

MeasurLink ENABLED
Data Management Software by Mitutoyo

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV.



342-251-30



112-201

SPECIFICATIONS

| Metric | | | | |
|------------------------------------|------------|-----------------|--|-------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Point |
| Digimatic (LCD) (With carbide tip) | | | | |
| 342-251-30 | 0 - 25 | 0.001 | ±2 | 15° |
| 342-252-30 | 25 - 50 | | | |
| 342-253-30 | 50 - 75 | | | |
| 342-254-30* | 75 - 100 | | ±3 | 30° |
| 342-261-30 | 0 - 25 | | | |
| 342-262-30 | 25 - 50 | | | |
| 342-263-30 | 50 - 75 | ±2 | | |
| 342-264-30* | 75 - 100 | ±3 | | |

* Made to order.

| Metric | | | | |
|---------------------------|------------|-----------------|--|-------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Point |
| Analog | | | | |
| 112-153 | 0 - 25 | 0.01 | ±3 | 15° |
| 112-154 | 25 - 50 | | | |
| 112-155 | 50 - 75 | | | |
| 112-156 | 75 - 100 | | ±4 | 30° |
| 112-201 | 0 - 25 | | | |
| 112-202 | 25 - 50 | | | |
| 112-203 | 50 - 75 | ±3 | | |
| 112-204 | 75 - 100 | ±4 | | |
| Analog (With carbide tip) | | | | |
| 112-165 | 0 - 25 | 0.01 | ±3 | 15° |
| 112-166 | 25 - 50 | | | |
| 112-167 | 50 - 75 | | | |
| 112-168 | 75 - 100 | | ±4 | 30° |
| 112-213 | 0 - 25 | | | |
| 112-214 | 25 - 50 | | | |
| 112-215 | 50 - 75 | ±3 | | |
| 112-216 | 75 - 100 | ±4 | | |
| Mechanical counter model | | | | |
| 142-153 | 0 - 25 | | ±3 | 15° |
| 142-201 | | | | 30° |

Note: For functional details of series 342 refer to page B-8.

Optional connecting cable is available only for water-proof type (Digimatic model).

| Inch / Metric | | | | |
|------------------------------------|------------|-------------------------|--|-------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Point |
| Digimatic (LCD) (With carbide tip) | | | | |
| 342-351-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ±0.0001 | 15° |
| 342-352-30 | 1 - 2 | | | |
| 342-353-30 | 2 - 3 | | | |
| 342-354-30 | 3 - 4 | | ±0.00015 | 30° |
| 342-361-30 | 0 - 1 | | | |
| 342-362-30 | 1 - 2 | | | |
| 342-363-30 | 2 - 3 | ±0.0001 | | |
| 342-364-30 | 3 - 4 | ±0.00015 | | |

| Inch | | | | |
|--------------------------|------------|-----------------|--|-------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Point |
| Analog | | | | |
| 112-177 | 0 - 1 | 0.001 | ±0.00015 | 15° |
| 112-178 | 1 - 2 | | | |
| 112-225 | 0 - 1 | | | |
| 112-226 | 1 - 2 | | ±0.00015 | 30° |
| 112-189 | 0 - 1 | | | |
| 112-190 | 1 - 2 | | | |
| 112-191 | 2 - 3 | ±0.00015 | 15° | |
| 112-237 | 0 - 1 | | | |
| 112-238 | 1 - 2 | | | |
| Mechanical counter model | | | | |
| 142-177 | 0 - 1 | | ±0.00015 | 15° |
| 142-225 | | | | 30° |

IP Codes (series 342)

Level 6: Dust-proof.

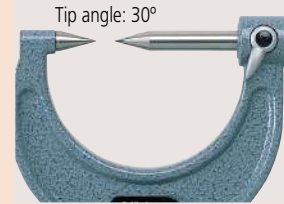
No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.



Tip angle: 15°



Tip angle: 30°

Technical Data

- Battery for series 342 SR44 (1 pc.), 938882, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for series 342)
- Length standard: Electromagnetic rotary sensor (for series 342)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models) Spanner (301336), 1 pc.

Optional Accessories

- Connecting cables for series 342
 - 1 m: 05CZA662
 - 2 m: 05CZA663
- USB Input Tool Direct USB-ITN-B (2 m): 06AFM380B
- U-WAVE-T dedicated connection cable 160 mm: 02AZD790B
For foot switch: 02AZE140B
Refer to page A-27 for details.

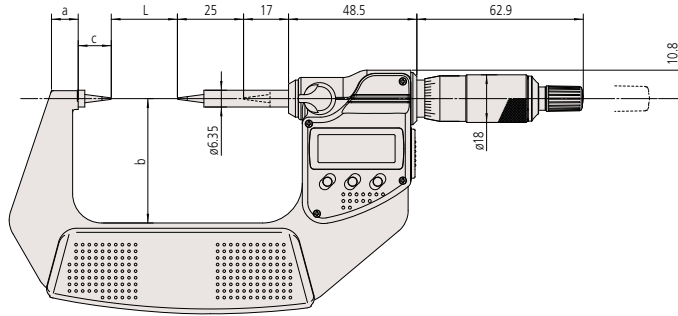
Wireless Data Output U-WAVE™

- U-WAVE-TM 264-622 (IP67 type) 264-623 (Buzzer type)
- U-WAVE-TMB Transmitter Mitutoyo Bluetooth® U-WAVE 264-626 (IP type) 264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for U-WAVE-TM/TMB 02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.

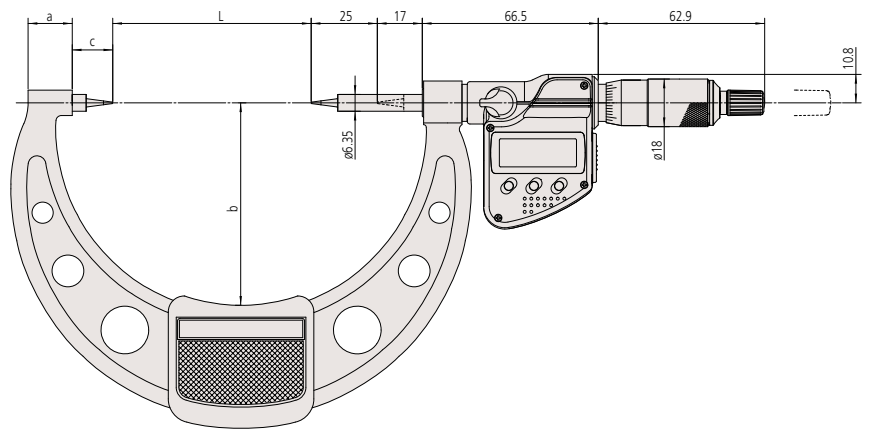
DIMENSIONS

Unit: mm

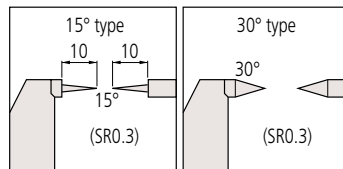
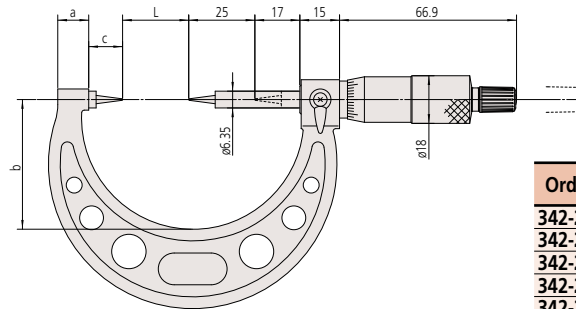
Digimatic models up to 75 mm measuring range



Digimatic models over 75 mm measuring range



Analog models measuring range



| Order No. | L | a | b | c | Frame thickness* |
|-------------------|----|------|------|------|------------------|
| 342-251-30 | 0 | 7.3 | 32.5 | | (11.2) |
| 342-261-30 | | | | | |
| 342-252-30 | 25 | 10.1 | 47 | 12.5 | (12.8) |
| 342-262-30 | | | | | |
| 342-253-30 | 50 | 11.5 | 60 | | (12.8) |
| 342-263-30 | | | | | |
| 342-254-30 | 75 | 16.7 | 76 | 15.3 | (20.8) |
| 342-264-30 | | | | | |
| 112-153 | 0 | 10 | 38 | | (9) |
| 112-154 | 25 | 12 | 49 | 12.5 | (10) |
| 112-155 | 50 | 14 | 60 | | (11) |
| 112-156 | 75 | 16.7 | 79 | 15.3 | (13) |

* Digimatic type: thickness over heat shield

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

V-Anvil Micrometers SERIES 314, 114 — 3 Flutes and 5 Flutes

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Measures the outside diameter of taps and reamers with an odd number of flutes.
- Measures pitch diameter: refer to "Quick Guide to Precision Measuring Instruments" on page B-72.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



314-251-30



114-121



114-102



114-101

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Technical Data

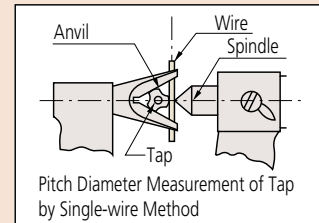
- Flatness: (**series 114**) 0.6 μm /0.000024 in (Spindle)
1.3 μm /0.000052 in (Anvil)
(**series 314**) 0.3 μm /0.000012 in (Spindle)
1.0 μm /0.00004 in (Anvil)
- Battery for **series 314**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 314**)
- Length standard: Electromagnetic rotary sensor (for **series 314**)
- Standard accessories:
Reference bar, 1 pc.
Spanner (**301336**), 1 pc.

Optional Accessories

- Connecting cables for **series 314**
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- **U-WAVE-T** dedicated connection cable
160 mm: **02AZD790B**
For foot switch: **02AZE140B**
Refer to page A-27 for details.

Wireless Data Output **U-WAVE™**

- **U-WAVE-TM** **264-622** (IP67 type)
264-623 (Buzzer type)
- **U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE
264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB**
02AZF310 (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.



SPECIFICATIONS

Metric For 3-flute cutting tools

| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) | Anvil | Remarks |
|-----------------|------------|-----------------|--|-------|----------|
| Digimatic (LCD) | | | | | |
| 314-251-30 | 1 - 15 | 0.001 | ± 4 | 60° | w/groove |
| 314-252-30 | 10 - 25 | | | | |
| 314-253-30 | 25 - 40 | | | | |
| 314-261-30 | 1 - 15 | | | | |
| 314-262-30 | 10 - 25 | | | | |

Metric For 3-flute cutting tools

| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Anvil | Remarks | | | | |
|--|------------|-----------------|--|-------|---------|---------|-----|----------|---|
| Analog Anvil, Spindle (With carbide tip) | | | | | | | | | |
| 114-204 | 2.3 - 25 | 0.01 | ± 4 | 60° | — | | | | |
| Analog Spindle (With carbide tip) | | | | | | | | | |
| 114-101 | 1 - 15 | | | | | ± 4 | 60° | w/groove | — |
| 114-102 | 10 - 25 | | | | | | | | |
| 114-103 | 25 - 40 | | | | | | | | |
| 114-104 | 40 - 55 | | | | | | | | |
| 114-105 | 55 - 70 | | | | | | | | |
| 114-106 | 70 - 85 | | | | | ± 7 | — | — | — |
| 114-161 | 1 - 15 | | | | | ± 4 | 60° | — | — |
| 114-162 | 10 - 25 | | | | | | | | |

Metric For 5-flute cutting tools

| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Anvil | Remarks | | | | |
|--|------------|-----------------|--|-------|---------|---------|------|----------|---|
| Analog Anvil, Spindle (With carbide tip) | | | | | | | | | |
| 114-137 | 2.3 - 25 | 0.01 | ± 4 | 108° | — | | | | |
| Analog Spindle (With carbide tip) | | | | | | | | | |
| 114-121 | 5 - 25 | | | | | ± 4 | 108° | w/groove | — |
| 114-122 | 25 - 45 | | | | | | | | |
| 114-123 | 45 - 65 | | | | | | | | |
| 114-124 | 65 - 85 | | | | | | | | |
| 114-165 | 5 - 25 | | | | | | | | |

Note: For functional details of **series 314** refer to page B-8.
Please note that these models are not water-proof, and that origin setting is by presetting. Optional connecting cable is available only for water-proof type (Digimatic model).

Inch/Metric For 3-flute cutting tools

| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Anvil | Remarks |
|-----------------|------------|-------------------------|--|-------|----------|
| Digimatic (LCD) | | | | | |
| 314-351-30 | 0.05 - 0.6 | 0.00005 in/ 0.001 mm | ± 0.0002 | 60° | w/groove |
| 314-352-30 | 0.4 - 1 | | | | |
| 314-353-30 | 1 - 1.6 | | | | |
| 314-361-30 | 0.05 - 0.6 | | | | |
| 314-362-30 | 0.4 - 1 | | | | |

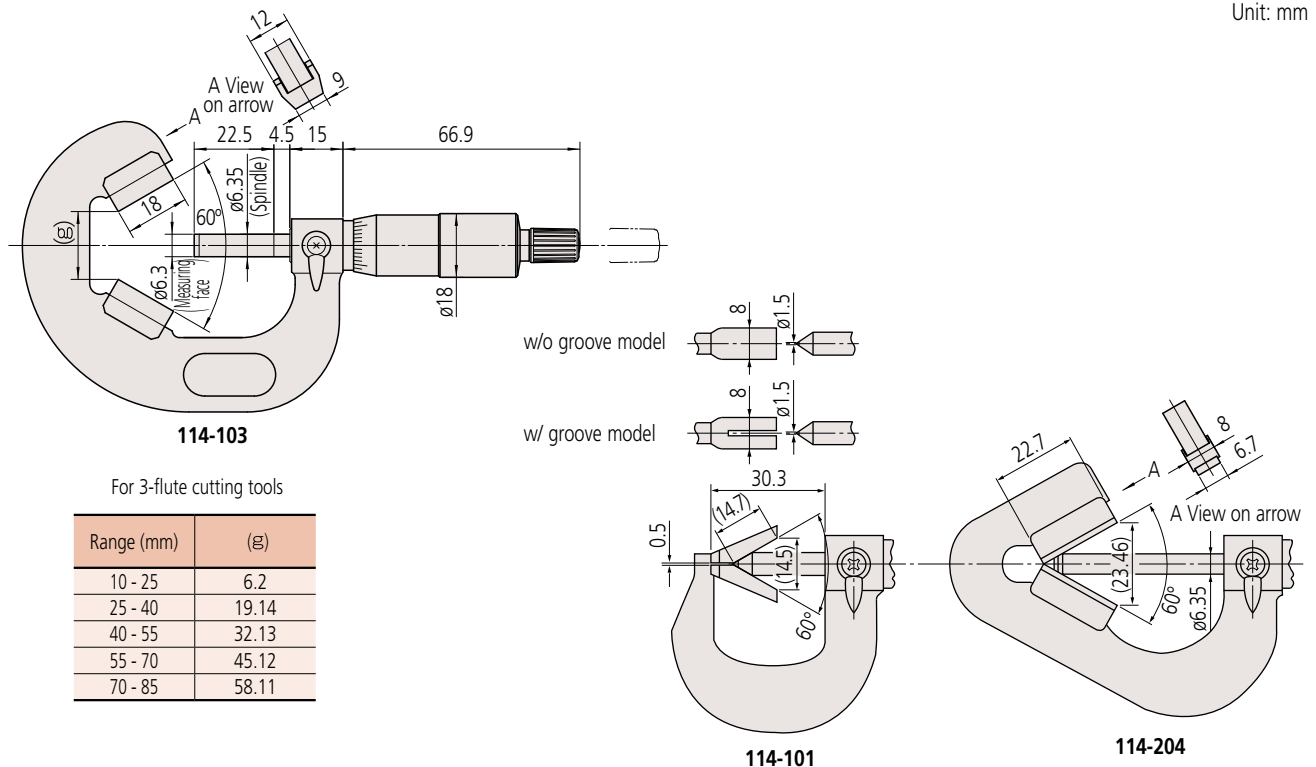
Inch For 3-flute cutting tools

| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Anvil | Remarks |
|--|------------|-----------------|--|-------|---------|
| Analog Anvil, Spindle (With carbide tip) | | | | | |
| 114-202 | 0.09 - 1 | 0.0001 | ± 0.0002 | 60° | — |
| Analog Spindle (With carbide tip) | | | | | |
| 114-163 | 0.05 - 0.6 | 0.001 | ± 0.0002 | 60° | — |
| 114-113 | 1 - 1.6 | | ± 0.00025 | | |
| 114-114 | 1.6 - 2.2 | | ± 0.0003 | | |

Inch For 5-flute cutting tools

| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Anvil | Remarks |
|--|------------|-----------------|--|-------|---------|
| Analog Anvil, Spindle (With carbide tip) | | | | | |
| 114-135 | 0.09 - 1 | 0.0001 | ± 0.0002 | 108° | — |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Blade Micrometers SERIES 422, 122 — Non-Rotating Spindle Type

- The anvil and spindle are blade-shaped for measuring the groove diameter of shafts, keyways, and other hard-to-reach features.
- Carbide-tipped measuring faces are available.
- Non-rotating spindle type.
- Equipped with Ratchet Stop for constant measuring force.



Digimatic (LCD)
422-230-30



Quickmike Type (LCD)
422-411-20



122-101-10

MeasurLink ENABLED
Data Management Software by Mitutoyo

MeasurLink ENABLED
Data Management Software by Mitutoyo



IP Codes (series 422 Quickmike type)

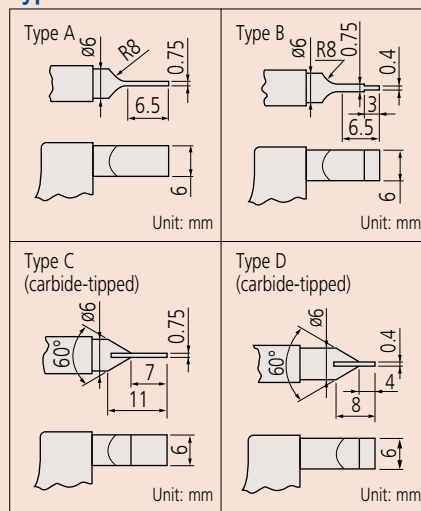
Level 6: Dust-proof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Type and Dimensions



SPECIFICATIONS

| Metric | | | | | |
|-----------------|------------|-----------------|--|------------------------|--------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) | Parallelism (μ m) | Remark |
| Digimatic (LCD) | | | | | |
| 422-230-30 | 0 - 25 | 0.001 | ± 3 | 3 | Type A |
| 422-231-30 | 25 - 50 | | | | |
| 422-232-30 | 50 - 75 | | | | |
| 422-233-30 | 75 - 100 | | | | |
| 422-260-30 | 0 - 25 | | 3 | Type B | |
| 422-261-30 | 25 - 50 | | | | |
| 422-270-30 | 0 - 25 | | Type C | | |
| 422-271-30 | | | | | Type D |

| Metric Quickmike type | | | | | |
|-----------------------|------------|-----------------|--|------------------------|--------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μ m) | Parallelism (μ m) | Remark |
| Digimatic (LCD) | | | | | |
| 422-411-20 | 0 - 30 | 0.001 | ± 3 | 3 | Type A |
| 422-412-20 | 25 - 55 | | | | |

| Metric | | | | | |
|---------------------------|------------|-----------------|--|------------------------|--------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Parallelism (μ m) | Remark |
| Analog | | | | | |
| 122-101-10 | 0 - 25 | 0.01 | ± 3 | 3 | Type A |
| 122-102-10 | 25 - 50 | | | | |
| 122-103-10 | 50 - 75 | | | | |
| 122-104-10 | 75 - 100 | | | | |
| 122-105-10 | 100 - 125 | | ± 4 | 4 | |
| 122-106-10 | 125 - 150 | | | | |
| 122-107-10 | 150 - 175 | | ± 5 | 5 | |
| 122-108-10 | 175 - 200 | | | | |
| 122-109-10 | 200 - 225 | | ± 6 | 6 | |
| 122-110-10 | 225 - 250 | | | | |
| 122-115-10 | 250 - 275 | ± 3 | 3 | Type B | |
| 122-112-10 | 275 - 300 | | | | |
| Analog (With carbide tip) | | | | | |
| 122-161-10 | 0 - 25 | 0.01 | ± 3 | 3 | Type C |
| 122-162-10 | 25 - 50 | | | | |
| 122-141-10 | 0 - 25 | | | | Type D |
| 122-142-10 | 25 - 50 | | | | |

Note: A heat shield is provided with Digimatic (LCD) and 122-101-10, 122-111-10, 122-125-10, 122-135-10, 122-141-10, 122-151-10 as standard.

| Inch/Metric | | | | | |
|-----------------|------------|-------------------------|--|------------------|--------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Parallelism (in) | Remark |
| Digimatic (LCD) | | | | | |
| 422-330-30 | 0 - 1 | 0.00005 in/ 0.001 mm | ± 0.00015 | 0.00015 | Type A |
| 422-331-30 | 1 - 2 | | | | |
| 422-332-30 | 2 - 3 | | | | |
| 422-333-30 | 3 - 4 | | | | |
| 422-360-30 | 0 - 1 | | ± 0.00015 | 0.00015 | Type B |
| 422-361-30 | 1 - 2 | | | | |
| 422-370-30 | 0 - 1 | | Type C | | |
| 422-371-30 | | | | | Type D |

| Inch/Metric Quickmike type | | | | | |
|----------------------------|------------|-------------------------|--|------------------|--------|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Parallelism (in) | Remark |
| Digimatic (LCD) | | | | | |
| 422-421-20 | 0 - 1.2 | 0.00005 in/ 0.001 mm | ± 0.00015 | 0.00015 | Type A |

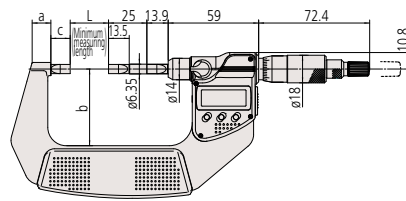
| Inch | | | | | |
|------------|------------|-----------------|--|------------------|--------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Parallelism (in) | Remark |
| Analog | | | | | |
| 122-125-10 | 0 - 1 | 0.0001 | ± 0.00015 | 0.00015 | Type A |
| 122-126-10 | 1 - 2 | | | | |
| 122-127-10 | 2 - 3 | | | | |
| 122-128-10 | 3 - 4 | | | | |
| 122-135-10 | 0 - 1 | | ± 0.00015 | 0.00015 | Type B |
| 122-151-10 | | | | | |

Note: A heat shield is provided with Digimatic (LCD) and 122-125-10, 122-135-10, 122-151-10 as standard.

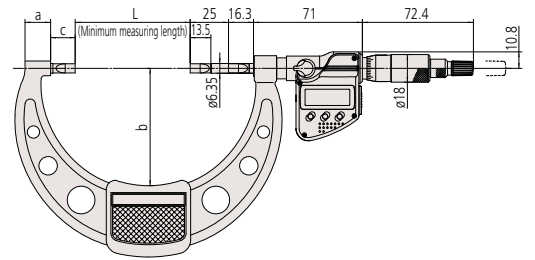
Note: For functional details of series 422 refer to page B-8. Please note that these models are not water-proof.

DIMENSIONS

Digimatic models up to 50 mm measuring range

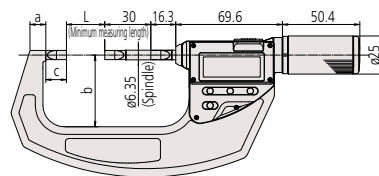


Digimatic models over 50 mm to 100 mm measuring range

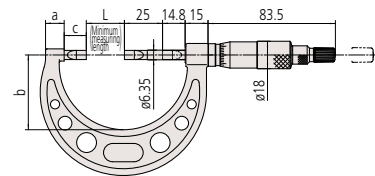


Unit: mm

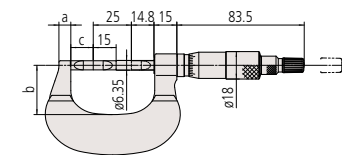
Quickmike type



Analog models over 25 mm to 300 mm measuring range



Analog models up to 25 mm measuring range



Technical Data

- Battery for **series 422**
SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use (for **series 422-2XX, 3XX**)
Approx. 5 year under normal use (for **series 422-4XX**)
- Length standard: Electromagnetic rotary sensor (for **series 422-2XX, 3XX**)
Electrostatic capacity absolute sensor (for **series 422-4XX**)
- Standard accessories: Reference bar, 1 pc. (except for measuring range 0 to 25 mm/0 to 30 mm (0 to 1 in/0 to 1.2 in) models)
Spanner (**301336**), 1 pc. (for **series 122-1XX, 422-2XX, 3XX**)

Optional Accessories

- Connecting cables for Digimatic models
1 m: **05CZA662**
2 m: **05CZA663**
- USB Input Tool Direct
USB-ITN-B (2 m): **06AFM380B**
- Connecting for **422-230-30** to **422-271-30**, **422-330-30** to **422-371-30**
- U-WAVE-T** dedicated connection cable (for **series 422**)
160 mm: **02AZD790B**
For foot switch: **02AZE140B**

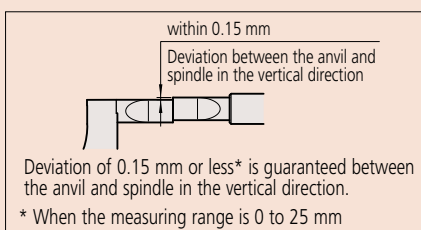
Wireless Data Output* **U-WAVE** fit

- U-WAVE-TM 264-622** (IP67 type)
264-623 (Buzzer type)
- U-WAVE-TMB** Transmitter
Mitutoyo Bluetooth® U-WAVE 264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-16 for details.
- Connecting unit for **U-WAVE-TM/TMB 02AZF310** (IP67/buzzer type common specification)
Refer to pages A-16 and A-18 for details.
* Only **series 422** (except for Quickmike type) can be attached.

Quickmike

- Provides a speedy spindle feed of 10 mm per thimble rotation which enables widely differently sized features to be measured quickly.

Deviation Between the Anvil and Spindle in the Vertical Direction



| Order No. | L | a | b | C |
|-------------------|-----|------|-----|------|
| 422-230-30 | 0 | 11 | 31 | 12.5 |
| 422-231-30 | 25 | 12.2 | 50 | 12.6 |
| 422-232-30 | 50 | 14.6 | 57 | 13 |
| 422-233-30 | 75 | 16.7 | 76 | 16 |
| 422-260-30 | 0 | 11 | 31 | 12.5 |
| 422-261-30 | 25 | 12.2 | 50 | 12.6 |
| 422-270-30 | | | | |
| 422-271-30 | 0 | 11 | 31 | 12.5 |
| 122-101-10 | | 7.8 | 32 | 15 |
| 122-102-10 | 25 | 12.2 | 49 | 14.5 |
| 122-103-10 | 50 | 14.6 | 60 | |
| 122-104-10 | 75 | 16.7 | 79 | 17.5 |
| 122-105-10 | 100 | 18.8 | 94 | 17.9 |
| 122-106-10 | 125 | 19.1 | 106 | 18.3 |
| 122-107-10 | 150 | 18.2 | 118 | 18.5 |
| 122-108-10 | 175 | 16.8 | 130 | 18.9 |
| 122-109-10 | 200 | | 143 | 17.7 |
| 122-110-10 | 225 | | 156 | |
| 122-115-10 | 250 | 18 | 169 | 18.7 |
| 112-116-10 | 275 | | 181 | |
| 422-411-20 | 0 | 8.5 | 36 | 13.5 |
| 422-412-20 | 25 | 10.3 | 47 | |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Can Seam Micrometers SERIES 147

- Measures the width, height, and depth of can seams.



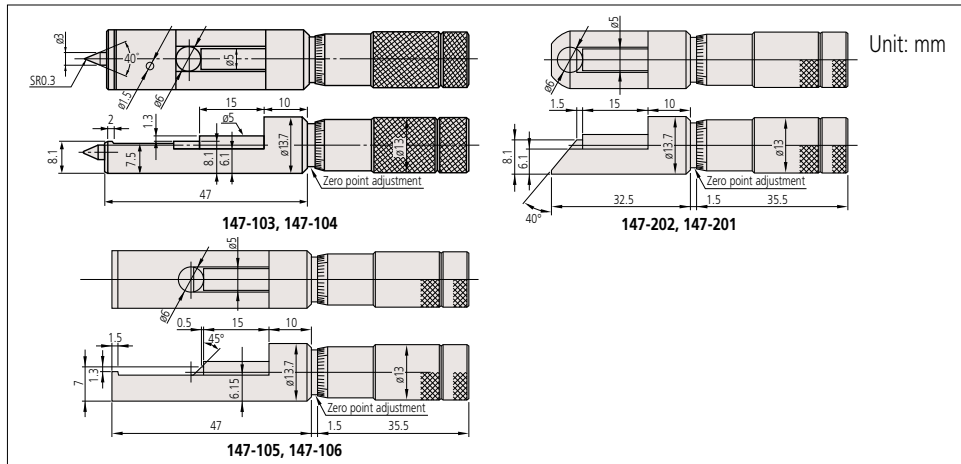
147-103

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|-----------------|---|-------------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Remarks |
| 147-103 | 0 - 13 | 0.01 | ± 3 | for steel cans |
| 147-105 | | | | for aluminum cans |
| 147-202 | | | | for spray cans |

| Inch | | | | |
|-----------|------------|-----------------|--|-------------------|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Remarks |
| 147-104 | 0 - 0.5 | 0.001 | ± 0.00015 | for steel cans |
| 147-106 | | | | for aluminum cans |
| 147-201 | | | | for spray cans |

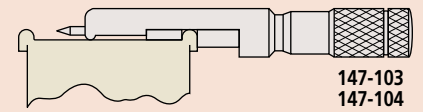
DIMENSIONS



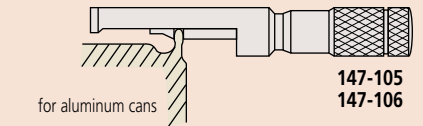
Unit: mm

Standard Accessories

- Spanner (200168), 1 pc.
- Spanner (202863), 1 pc.

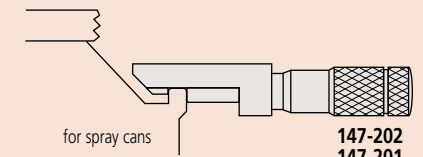


147-103
147-104



for aluminum cans

147-105
147-106



for spray cans

147-202
147-201

Hub Micrometers SERIES 147

- Measures hub thickness and shoulders inside a bore.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



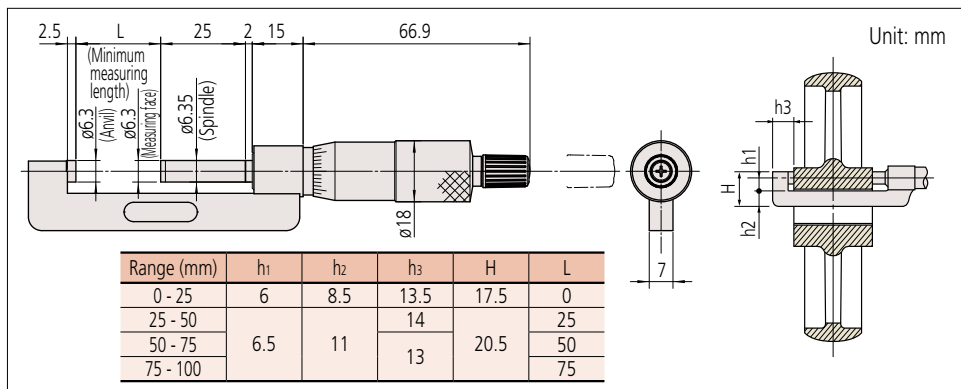
147-301

SPECIFICATIONS

| Metric | | | |
|-----------|------------|-----------------|---|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) |
| 147-301 | 0 - 25 | 0.01 | ± 2 |
| 147-302 | 25 - 50 | | |
| 147-303 | 50 - 75 | | |
| 147-304 | 75 - 100 | | ± 3 |

| Inch | | | |
|-----------|------------|-----------------|--|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) |
| 147-351 | 0 - 1 | 0.001 | ± 0.0001 |
| 147-352 | 1 - 2 | | |
| 147-353 | 2 - 3 | | |
| 147-354 | 3 - 4 | | ± 0.00015 |

DIMENSIONS



Unit: mm

| Range (mm) | h ₁ | h ₂ | h ₃ | H | L |
|------------|----------------|----------------|----------------|------|----|
| 0 - 25 | 6 | 8.5 | 13.5 | 17.5 | 0 |
| 25 - 50 | 6.5 | 11 | 14 | 20.5 | 25 |
| 50 - 75 | | | 13 | | 50 |
| 75 - 100 | | | 75 | | |

Technical Data

- Flatness: 0.6 μm / 0.000024 in
- Parallelism: 3 μm / 0.00012 in

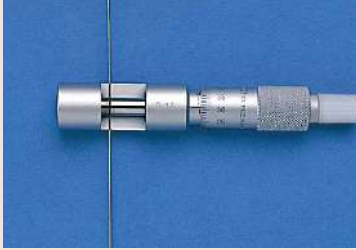


Standard Accessories

- Reference bar, 1 pc. (except for measuring range 0 to 25 mm (0 to 1 in) models)
- Spanner (301336), 1 pc.

Technical Data

- Flatness: 0.6 μm /0.000024 in
- Parallelism: 1.3 μm /0.00005 in



Standard Accessories

Spanner (200168), 1 pc.

Wire Micrometers SERIES 147

- Designed for measuring wire thickness.
- Measurable wire diameter: 10 mm or less.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



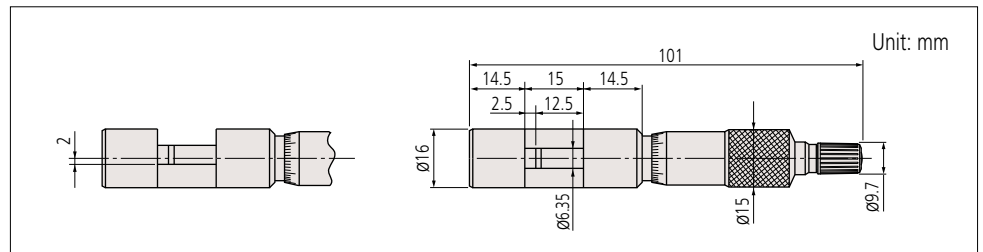
147-401

SPECIFICATIONS

| Metric | | | |
|-----------|------------|-----------------|---|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) |
| 147-401 | 0 - 10 | 0.01 | ± 3 |

| Inch | | | |
|-----------|------------|-----------------|--|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) |
| 147-402 | 0 - 0.4 | 0.0001 | ± 0.00015 |

DIMENSIONS



Limit Micrometers SERIES 113



Standard Accessories

- Reference bar, 1 pc.
(except for measuring range 0 to 25 mm and 0 to 1 in models)
- Spanner (200877), 1 pc.

- Dual-spindle design enables use as a GO/ \pm NG gage by setting upper and lower limits.
- Measuring faces: Carbide.

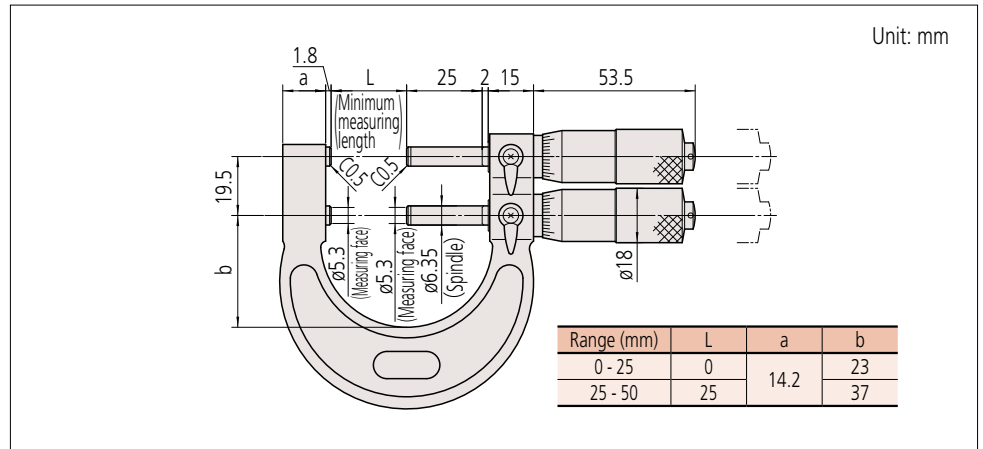


113-102

SPECIFICATIONS

| Metric | | | | | |
|-----------|------------|-----------------|--|---------------------|------------------------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μ m) | Flatness (μ m) | Parallelism (μ m) |
| 113-102 | 0 - 25 | 0.01 | ± 3 | 0.6 | 3 |
| 113-103 | 25 - 50 | | | | |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Indicating Micrometers SERIES 510

- Suited to the measurement of low-volume manufactured parts.
- Easy to use when operating one-handed due to retractable anvil.
- In the 25 mm measuring range, the model lineup offers a choice of left or right positioning of the anvil-retraction button.
- Greatly improved accuracy: indication error and graduation of 1 μm .
- IP protection level: 54, coolant-splash resistant during grinding process.
- Hard-coated crystal: enhanced oil and scratch resistance.
- Indicator scale is large and easy to read.
- All models come with the zero position adjustment feature.
- Measuring faces: Carbide.

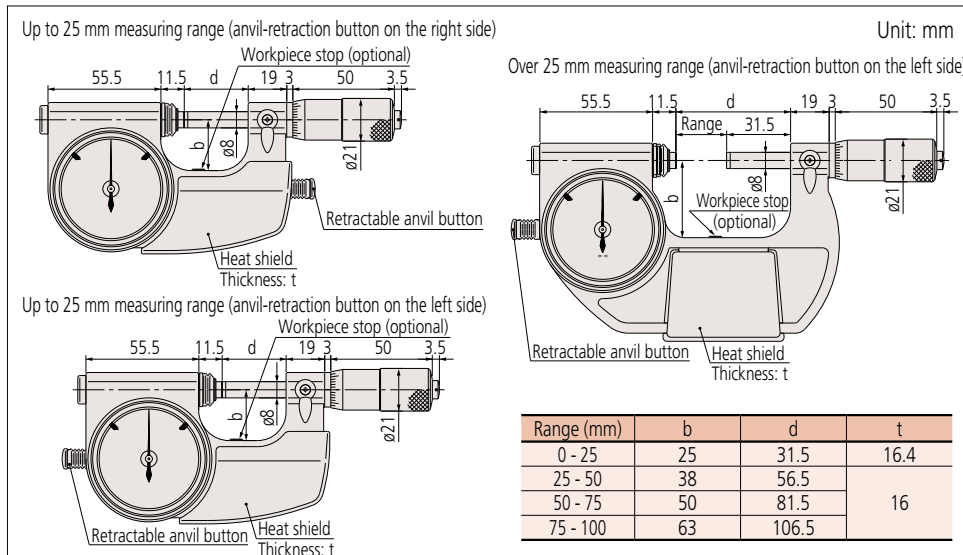


SPECIFICATIONS

| Metric | | | | | | | |
|-----------|------------|-----------------------|-----------------|----------------------|---------------------|-------------------------|----------|
| Order No. | Range (mm) | Indicating range (mm) | Graduation (mm) | Dial graduation (mm) | Measuring force (N) | Anvil retraction button | Mass (g) |
| 510-121 | 0 - 25 | | 0.001 | 0.001 | 5 - 10 | Right side | 520 |
| 510-141 | | | | | | Left side | 530 |
| 510-122 | 25 - 50 | ± 0.06 | 0.001 | 0.001 | 5 - 10 | Left side | 670 |
| 510-123 | 50 - 75 | | | | | | 820 |
| 510-124 | 75 - 100 | | | | | | 970 |

| Inch | | | | | | | |
|-----------|------------|-----------------------|-----------------|----------------------|---------------------|-------------------------|----------|
| Order No. | Range (in) | Indicating range (in) | Graduation (in) | Dial graduation (in) | Measuring force (N) | Anvil retraction button | Mass (g) |
| 510-131 | 0 - 1 | | 0.0001 | 0.00005 | 5 - 10 | Right side | 520 |
| 510-151 | | | | | | Left side | 530 |
| 510-132 | 1 - 2 | ± 0.0023 | 0.0001 | 0.00005 | 5 - 10 | Left side | 670 |
| 510-133 | 2 - 3 | | | | | | 820 |
| 510-134 | 3 - 4 | | | | | | 970 |

DIMENSIONS



Technical Data

- Flatness: 0.3 $\mu\text{m}/0.000012$ in
- Parallelism: 0.6 $\mu\text{m}/0.000024$ in for models up to 50 mm/2 in
1 $\mu\text{m}/0.00004$ in for models over 50 mm/2 in
- Spindle feed error: 3 $\mu\text{m}/0.00015$ in
- Dispersion of indication: 0.4 $\mu\text{m}/0.00002$ in
- Dial indication accuracy: 1 $\mu\text{m}/0.00005$ in

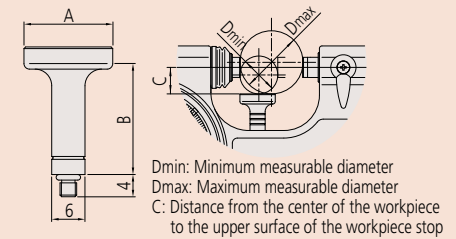
Standard Accessories

- Reference bar, 1 pc.
(except for measuring range 0 to 25 mm (0 to 1 in) models)
- Spanner (200154), 1 pc.

Workpiece Stop (optional)

- Produces more stable measurement.
- Three types are available to suit workpieces of different sizes.

| Range | Unit: mm | |
|------------------------------|-----------|------|
| | A | B |
| Workpiece stop A 04AZA124 | $\phi 16$ | 23 |
| Workpiece stop B 04AZA125 | $\phi 14$ | 20.5 |
| Workpiece stop C 04AZA126 | $\phi 14$ | 15 |



- Order No 510-121, 510-141, 510-131, 510-151 Unit: mm

| | Dmin | Dmax | C |
|------------------|------|------|------|
| Workpiece stop A | N/A | N/A | N/A |
| Workpiece stop B | 4 | 16 | 5.0 |
| Workpiece stop C | 15 | 25 | 10.5 |

- 510-122 and 510-132

| | Dmin | Dmax | C |
|------------------|------|------|------|
| Workpiece stop A | 25 | 37 | 15.5 |
| Workpiece stop B | 30 | 42 | 18.0 |
| Workpiece stop C | 41 | 50 | 23.5 |

- 510-123 and 510-133

| | Dmin | Dmax | C |
|------------------|------|------|------|
| Workpiece stop A | 50 | 61 | 27.5 |
| Workpiece stop B | 54 | 66 | 30.0 |
| Workpiece stop C | 65 | 75 | 35.5 |

- 510-124 and 510-134

| | Dmin | Dmax | C |
|------------------|------|------|------|
| Workpiece stop A | 75 | 87 | 40.5 |
| Workpiece stop B | 80 | 92 | 43.0 |
| Workpiece stop C | 91 | 100 | 48.2 |

Technical Data

- Indicator
 Indicating range: ± 0.06 mm/ ± 0.0023 in
 Repeatability of indication: $0.4 \mu\text{m}/0.00002$ in
 Dial indication accuracy: $1 \mu\text{m}/0.00005$ in
- Flatness: $0.3 \mu\text{m}/0.000012$ in
- Parallelism: $0.6 \mu\text{m}/0.000024$ in for models up to 50 mm/2 in measuring range
 $1 \mu\text{m}/0.00004$ in for models over 50 mm/2 in measuring range



**Dial Snap Meters
SERIES 523**

- Suited for the measurement of mass-produced parts.
- Designed for measurement using a stand: produces stable measurement.
- Greatly improved accuracy: indication error and graduation of $1 \mu\text{m}$.
- IP protection level: 54, coolant-splash resistant during grinding process.
- Hard-coated crystal: enhanced oil and scratch resistance.
- Indicator scale is large and easy to read.
- All models come with the zero position adjustment feature.
- Equipped with an elevating workpiece stop as standard.
- Measuring faces: Carbide.



523-121

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|----------------------|---------------------|----------|
| Order No. | Range (mm) | Dial graduation (mm) | Measuring force (N) | Mass (g) |
| 523-121 | 0 - 25 | 0.001 | 5 - 10 | 740 |
| 523-122 | 25 - 50 | | | 840 |
| 523-123 | 50 - 75 | | | 950 |
| 523-124 | 75 - 100 | | | 1080 |
| Inch | | | | |
| Order No. | Range (in) | Dial graduation (in) | Measuring force (N) | Mass (g) |
| 523-131 | 0 - 1 | 0.00005 | 5 - 10 | 740 |
| 523-132 | 1 - 2 | | | 840 |
| 523-133 | 2 - 3 | | | 950 |
| 523-134 | 3 - 4 | | | 1080 |

DIMENSIONS

Unit: mm

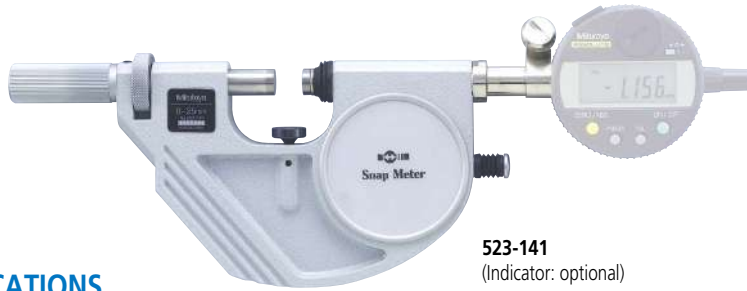
| Range (mm) | b | d |
|------------|----|-----|
| 0 - 25 | 25 | 31 |
| 25 - 50 | 35 | 56 |
| 50 - 75 | 47 | 81 |
| 75 - 100 | 60 | 106 |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Snap Meters SERIES 523

- Suited for the measurement of mass-produced parts.
- Various indicators (optional) are available to suit accuracy and resolution requirements.
- Measuring faces: Carbide.



523-141
(Indicator: optional)

SPECIFICATIONS

Metric

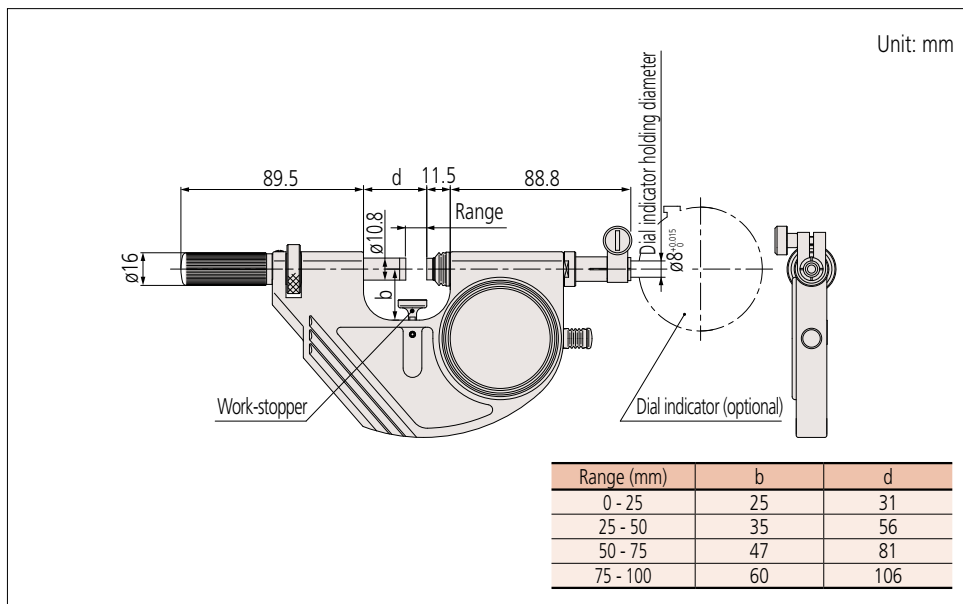
| Order No. | Range (mm) | Anvil movement (mm) | Measuring force* (N) | Mass (g) | Repeatability of indication (μm) | Flatness (μm) | Parallelism (μm) |
|-----------|------------|---------------------|----------------------|----------|----------------------------------|---------------|------------------|
| 523-141 | 0 - 25 | 2 | 5 - 10 | 710 | 0.4 | 0.3 | 0.6 |
| 523-142 | 25 - 50 | | | 810 | | | |
| 523-143 | 50 - 75 | | | 920 | | | |
| 523-144 | 75 - 100 | | | 1050 | | | 1 |

Inch

| Order No. | Range (in) | Anvil movement (in) | Measuring force* (N) | Mass (g) | Repeatability of indication (in) | Flatness (in) | Parallelism (in) |
|-----------|------------|---------------------|----------------------|----------|----------------------------------|---------------|------------------|
| 523-151 | 0 - 1 | 0.078 | 5 - 10 | 710 | 0.00002 | 0.000012 | 0.000024 |
| 523-152 | 1 - 2 | | | 810 | | | |
| 523-153 | 2 - 3 | | | 920 | | | |
| 523-154 | 3 - 4 | | | 1050 | | | 0.00004 |

* Measured at the position where the anvil is retracted by 1 mm from the free position without installing the indicator.

DIMENSIONS



Typical Indicators Used with Gage

- ID-C (0.001 mm)/**543-390B**
- LGF-L (0.0001 mm)/**542-181** & Counter **542-015**



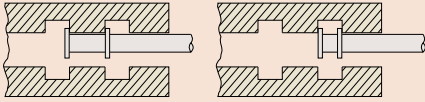
ABS Digimatic Indicator



Linear Gage and counter

Technical Data

- Parallelism: 10 µm/0.0004 in



Standard accessories

Spanner (301336), 1 pc.

Groove Micrometers SERIES 146

- Flanged spindle and anvil for measuring width and location of grooves inside bores and tubes.
- Two-directional ratchet stop.
- For ID and OD (except for 0 - 25 mm) measurement, a master gage is required for adjusting the reference point.



SPECIFICATIONS

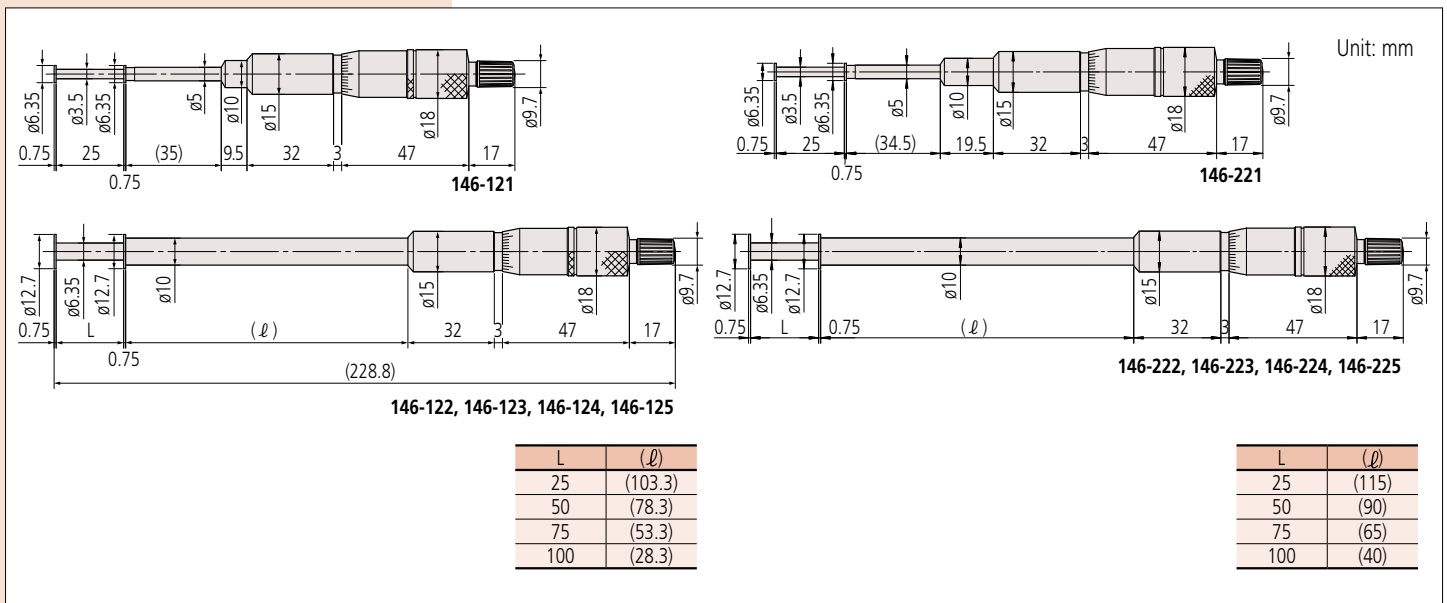
| Metric | | | | | |
|------------------|-------------------|--------------------|-----------------|--|-------------|
| Order No. | Range Inside (mm) | Range Outside (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (µm) | Flange (mm) |
| Rotating spindle | | | | | |
| 146-121 | 1.6 - 26.5 | 0 - 25 | 0.01 | ±10 | ø6.35 |
| 146-122 | | | | | ø12.7 |
| 146-123 | 26.5 - 51.5 | 25 - 50 | | | ø12.7 |
| 146-124 | 51.5 - 76.5 | 50 - 75 | | | ø12.7 |
| 146-125 | 76.5 - 101.5 | 75 - 100 | | | ø12.7 |

| Metric | | | | | |
|----------------------|-------------------|--------------------|-----------------|--|-------------|
| Order No. | Range Inside (mm) | Range Outside (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (µm) | Flange (mm) |
| Non-rotating spindle | | | | | |
| 146-221 | 1.6 - 26.5 | 0 - 25 | 0.01 | ±10 | ø6.35 |
| 146-222 | | | | | ø12.7 |
| 146-223 | 26.5 - 51.5 | 25 - 50 | | | ø12.7 |
| 146-224 | 51.5 - 76.5 | 50 - 75 | | | ø12.7 |
| 146-225 | 76.5 - 101.5 | 75 - 100 | | | ø12.7 |

| Inch | | | | | |
|------------------|-------------------|--------------------|-----------------|--|-------------|
| Order No. | Range Inside (in) | Range Outside (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flange (in) |
| Rotating spindle | | | | | |
| 146-131 | 0.055 - 1.05 | 0 - 1 | 0.001 | ±0.0004 | ø0.25 |
| 146-132 | | | | | ø0.5 |
| 146-133 | 1.05 - 2.05 | 1 - 2 | | | ø0.5 |
| 146-134 | 2.05 - 3.05 | 2 - 3 | | | ø0.5 |
| 146-135 | 3.05 - 4.05 | 3 - 4 | | | ø0.5 |

| Inch | | | | | |
|----------------------|-------------------|--------------------|-----------------|--|-------------|
| Order No. | Range Inside (in) | Range Outside (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flange (in) |
| Non-rotating spindle | | | | | |
| 146-231 | 0.055 - 1.05 | 0 - 1 | 0.001 | ±0.0004 | ø0.25 |
| 146-232 | | | | | ø0.5 |
| 146-233 | 1.05 - 2.05 | 1 - 2 | | | ø0.5 |
| 146-234 | 2.05 - 3.05 | 2 - 3 | | | ø0.5 |
| 146-235 | 3.05 - 4.05 | 3 - 4 | | | ø0.5 |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

QUICKmini SERIES 700

- Lightweight, compact, palm-sized device.
 - Measurement of small, thin workpieces is possible by only a single operation.
 - Electromagnetic induction type ABSOLUTE encoder is adopted.
 - Built-in ABS (absolute) scale requires no zero-set every time the power is turned on. In addition, reliability has improved by eliminating overspeed errors.
 - Measurement readout with large characters on the LCD reduces eye fatigue.
- **Typical applications:**
 - Measurement of small workpieces: Pearl, jewel, engine tappet shim, screws.
 - Measurement of thin workpieces: Printing paper, polyethylene bags, sheet material, noodles and other food products, medium substrate, foil, thin plate, filter cloth and other medical supplies.
 - Measurement of thin lines and bars: Fishing line, dental reamers, spaghetti, drill for PCBs, wiring.



SPECIFICATIONS

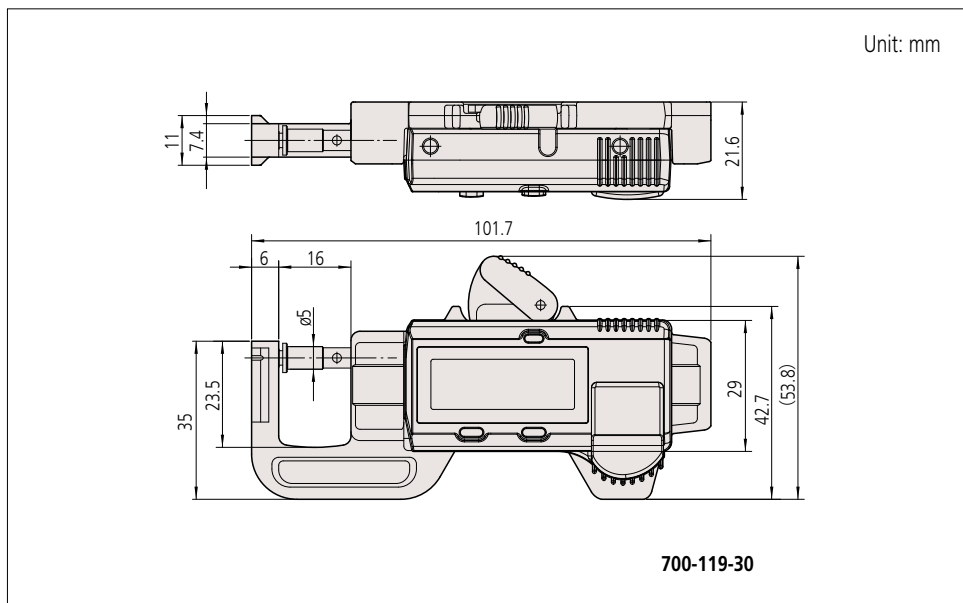
| Metric | | | | |
|------------|------------|-----------------|----------------|----------|
| Order No. | Range (mm) | Resolution (mm) | Accuracy* (mm) | Mass (g) |
| 700-119-30 | 0 - 12 | 0.01 | ±0.02 | 100 |

* Excluding quantizing error of ±1 count

| Inch/Metric | | | | |
|-------------|------------|-------------------|----------------|----------|
| Order No. | Range (in) | Resolution | Accuracy* (in) | Mass (g) |
| 700-118-30 | 0 - 0.5 | 0.0005 in/0.01 mm | ±0.001 | 100 |

* Excluding quantizing error of ±1 count

DIMENSIONS



Technical Data

SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)

Silver oxide button cell battery SR44 (**938882**), 1 pc. for monitor (standard accessory)

Functions

ABS measurement function:

after a data is displayed, next measurement can be performed without zero-setting. Also, the ABS origin point can be changed with ORIGIN switch.

INC measurement function:

clears the displayed data at any point. The comparative measurement can be easily performed.

Low battery alarm:

notifies that the battery is worn with "B" mark before becoming immeasurable. Thus, the timing for battery replacement can be confirmed in advance.

Small Hole Gage Set SERIES 154



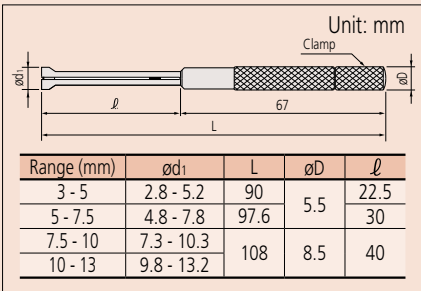
- Extra long for gaging deep and shallow holes, slots, and similar workpiece features.

- Two sprung leaves are fully expanded inside a feature so that its size can be measured with an outside micrometer after extraction.



154-902

DIMENSIONS



SPECIFICATIONS

| Metric | |
|----------------|------------|
| Order No. | Range (mm) |
| 4-gage Set | |
| 154-902 | 3 - 13 |
| Gages included | |
| 154-101 | 3 - 5 |
| 154-102 | 5 - 7.5 |
| 154-103 | 7.5 - 10 |
| 154-104 | 10 - 13 |

| Inch | |
|----------------|-------------|
| Order No. | Range (in) |
| 4-gage Set | |
| 154-901 | 0.125 - 0.5 |
| Gages included | |
| 154-105 | 0.125 - 0.2 |
| 154-106 | 0.2 - 0.3 |
| 154-107 | 0.3 - 0.4 |
| 154-108 | 0.4 - 0.5 |

Telescoping Gage Set SERIES 155



- A spring-loaded plunger expands within a bore (or groove) and is locked in place allowing measurement of diameter (or width) with an outside micrometer after extraction.

SPECIFICATIONS

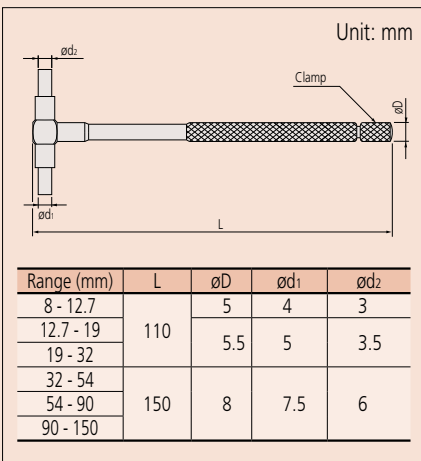
| Metric | |
|----------------|------------|
| Order No. | Range (mm) |
| 6-gage Set | |
| 155-905 | 8 - 150 |
| Gages included | |
| 155-127 | 8 - 12.7 |
| 155-128 | 12.7 - 19 |
| 155-129 | 19 - 32 |
| 155-130 | 32 - 54 |
| 155-131 | 54 - 90 |
| 155-132 | 90 - 150 |



155-905

| Inch | |
|----------------|--------------|
| Order No. | Range (in) |
| 6-gage Set | |
| 155-903 | 0.313 - 6 |
| Gages included | |
| 155-121 | 0.313 - 0.5 |
| 155-122 | 0.5 - 0.75 |
| 155-123 | 0.75 - 1.25 |
| 155-124 | 1.25 - 2.125 |
| 155-125 | 2.125 - 3.5 |
| 155-126 | 3.5 - 6 |

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

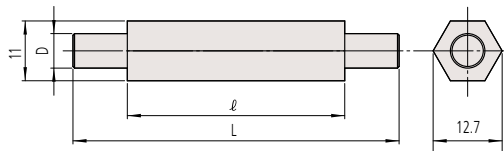
Setting Standards for Outside Micrometers SERIES 167

- Used for adjusting the reference point of outside micrometers.



SPECIFICATIONS and DIMENSIONS

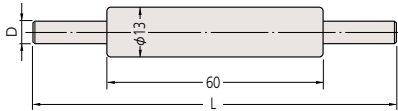
167-101 to 167-103
167-141 to 167-143



Unit: mm

| Metric | | | | | Inch | | | | |
|-----------|--|-----------------------------|-------------|--|-----------|--|----------------|-------------|--|
| Order No. | Length $\langle L \rangle$ (mm) | Tolerance (μm) | ℓ (mm) | Diameter $\langle D \rangle$ (mm) | Order No. | Length $\langle L \rangle$ (in) | Tolerance (in) | ℓ (mm) | Diameter $\langle D \rangle$ (in) |
| 167-101 | 25 | ± 1.5 | 18 | 6.35 | 167-141 | 1 | ± 0.00005 | 18 | 0.25 |
| 167-102 | 50 | ± 2.0 | 40 | | 167-142 | 2 | ± 0.0001 | 40 | |
| 167-103 | 75 | ± 2.5 | 40 | | 167-143 | 3 | ± 0.0001 | 40 | |

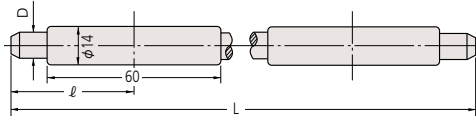
167-104 to 167-107
167-144 to 167-147



Unit: mm

| Metric | | | | Inch | | | |
|-----------|--|-----------------------------|--|-----------|--|----------------|--|
| Order No. | Length $\langle L \rangle$ (mm) | Tolerance (μm) | Diameter $\langle D \rangle$ (mm) | Order No. | Length $\langle L \rangle$ (in) | Tolerance (in) | Diameter $\langle D \rangle$ (in) |
| 167-104 | 100 | ± 3 | 7.9 | 167-144 | 4 | ± 0.0001 | 0.31 |
| 167-105 | 125 | ± 3.5 | | 167-145 | 5 | ± 0.00015 | |
| 167-106 | 150 | ± 4 | | 167-146 | 6 | | |
| 167-107 | 175 | ± 4.5 | | 167-147 | 7 | | |

167-108 to 167-119
167-148 to 167-159



Unit: mm

| Metric | | | | | Inch | | | | |
|-----------|--|-----------------------------|-------------|--|-----------|--|----------------|-------------|--|
| Order No. | Length $\langle L \rangle$ (mm) | Tolerance (μm) | ℓ (mm) | Diameter $\langle D \rangle$ (mm) | Order No. | Length $\langle L \rangle$ (in) | Tolerance (in) | ℓ (mm) | Diameter $\langle D \rangle$ (in) |
| 167-108 | 200 | ± 5.0 | 47 | 9.4 | 167-148 | 8 | ± 0.00015 | 47 | 0.37 |
| 167-109 | 225 | ± 5.5 | 47 | | 167-149 | 9 | ± 0.0002 | 47 | |
| 167-110 | 250 | ± 6.0 | 52 | | 167-150 | 10 | ± 0.0002 | 52 | |
| 167-111 | 275 | ± 6.5 | 57 | | 167-151 | 11 | ± 0.0002 | 57 | |
| 167-112 | 300 | ± 7 | 64 | | 167-152 | 12 | ± 0.00025 | 64 | |
| 167-113 | 325 | ± 7.5 | 69 | | 167-153 | 13 | ± 0.00025 | 69 | |
| 167-114 | 350 | ± 8 | 74 | | 167-154 | 14 | ± 0.00025 | 74 | |
| 167-115 | 375 | ± 8.5 | 80 | | 167-155 | 15 | ± 0.00025 | 80 | |
| 167-116 | 400 | ± 9 | 85 | | 167-156 | 16 | ± 0.00025 | 85 | |
| 167-117 | 425 | ± 9.5 | 90 | | 167-157 | 17 | ± 0.00025 | 90 | |
| 167-118 | 450 | ± 10 | 95 | | 167-158 | 18 | ± 0.00025 | 95 | |
| 167-119 | 475 | ± 10.5 | 101 | | 167-159 | 19 | ± 0.0003 | 101 | |

Technical Data

- Flatness: $0.3 \mu\text{m}$
- Parallelism: $2 \mu\text{m}$



Micrometer Inspection Gauge Block Set

Refer to page E-11 for details.

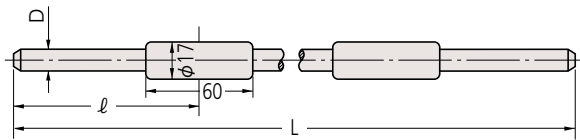


516-152/153/154



Micro Checker (holder only)
516-607

167-120 to 167-404
167-160 to 167-180



Unit: mm

| Metric | | | | |
|-----------|-----------------|----------------|--------|-------------------|
| Order No. | Length <L> (mm) | Tolerance (µm) | ℓ (mm) | Diameter <D> (mm) |
| 167-120 | 500 | ±11 | 106 | 0.47 |
| 167-121 | 525 | ±11.5 | 112 | |
| 167-122 | 550 | ±12 | 117 | |
| 167-123 | 575 | ±12.5 | 122 | |
| 167-124 | 600 | ±13 | 128 | |
| 167-125 | 625 | ±13.5 | 133 | |
| 167-126 | 650 | ±14 | 138 | |
| 167-127 | 675 | ±14.5 | 142 | |
| 167-128 | 700 | ±15 | 147 | |
| 167-129 | 725 | ±15.5 | 153 | |
| 167-130 | 750 | ±16 | 158 | |
| 167-131 | 775 | ±16.5 | 164 | |
| 167-132 | 800 | ±17 | 170 | |
| 167-133 | 825 | ±17.5 | 175 | |
| 167-134 | 850 | ±18 | 180 | |
| 167-135 | 875 | ±18.5 | 185 | |
| 167-136 | 900 | ±19 | 191 | |
| 167-137 | 925 | ±19.5 | 196 | |
| 167-138 | 950 | ±20 | 201 | |
| 167-139 | 975 | ±20.5 | 207 | |
| 167-140 | 1000 | ±21 | 211 | |
| 167-365 | 1025 | ±21.5 | 217 | |
| 167-366 | 1050 | ±22 | 222 | |
| 167-367 | 1075 | ±22.5 | 227 | |
| 167-368 | 1100 | ±23 | 232 | |
| 167-369 | 1125 | ±23.5 | 238 | |
| 167-370 | 1150 | ±24 | 243 | |
| 167-371 | 1175 | ±24.5 | 248 | |
| 167-372 | 1200 | ±25 | 254 | |
| 167-373 | 1225 | ±25.5 | 259 | |
| 167-374 | 1250 | ±26 | 264 | |
| 167-375 | 1275 | ±26.5 | 269 | |
| 167-376 | 1300 | ±27 | 275 | |
| 167-377 | 1325 | ±27.5 | 280 | |
| 167-378 | 1350 | ±28 | 285 | |
| 167-379 | 1375 | ±28.5 | 291 | |
| 167-380 | 1400 | ±29 | 296 | |
| 167-381 | 1425 | ±29.5 | 301 | |
| 167-382 | 1450 | ±30 | 306 | |
| 167-383 | 1475 | ±30.5 | 312 | |
| 167-384 | 1500 | ±31 | 317 | |
| 167-385 | 1525 | ±31.5 | 322 | |
| 167-386 | 1550 | ±32 | 328 | |
| 167-387 | 1575 | ±32.5 | 333 | |
| 167-388 | 1600 | ±33 | 338 | |
| 167-389 | 1625 | ±33.5 | 343 | |
| 167-390 | 1650 | ±34 | 349 | |
| 167-391 | 1675 | ±34.5 | 354 | |
| 167-392 | 1700 | ±35 | 359 | |
| 167-393 | 1725 | ±35.5 | 364 | |
| 167-394 | 1750 | ±36 | 370 | |
| 167-395 | 1775 | ±36.5 | 375 | |
| 167-396 | 1800 | ±37 | 380 | |
| 167-397 | 1825 | ±37.5 | 386 | |
| 167-398 | 1850 | ±38 | 391 | |
| 167-399 | 1875 | ±38.5 | 396 | |
| 167-400 | 1900 | ±39 | 401 | |
| 167-401 | 1925 | ±39.5 | 407 | |
| 167-402 | 1950 | ±40 | 412 | |
| 167-403 | 1975 | ±40.5 | 417 | |
| 167-404 | 2000 | ±41 | 423 | |

| Inch | | | | |
|-----------|-----------------|----------------|--------|-------------------|
| Order No. | Length <L> (in) | Tolerance (in) | ℓ (mm) | Diameter <D> (in) |
| 167-160 | 20 | ±0.0003 | 106 | 0.47 |
| 167-161 | 21 | ±0.0003 | 112 | |
| 167-162 | 22 | ±0.0003 | 117 | |
| 167-163 | 23 | ±0.0003 | 122 | |
| 167-164 | 24 | ±0.0003 | 128 | |
| 167-165 | 25 | ±0.00035 | 133 | |
| 167-166 | 26 | ±0.00035 | 138 | |
| 167-167 | 27 | ±0.00035 | 142 | |
| 167-168 | 28 | ±0.00035 | 147 | |
| 167-169 | 29 | ±0.00035 | 153 | |
| 167-170 | 30 | ±0.00035 | 158 | |
| 167-171 | 31 | ±0.00035 | 164 | |
| 167-172 | 32 | ±0.00035 | 170 | |
| 167-173 | 33 | ±0.00035 | 175 | |
| 167-174 | 34 | ±0.00035 | 180 | |
| 167-175 | 35 | ±0.00035 | 185 | |
| 167-176 | 36 | ±0.00035 | 191 | |
| 167-177 | 37 | ±0.0004 | 196 | |
| 167-178 | 38 | ±0.0004 | 201 | |
| 167-179 | 39 | ±0.0004 | 207 | |
| 167-180 | 40 | ±0.0004 | 211 | |

Note: Available up to 79 in

11.9

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Setting Standards for Screw Thread Micrometers SERIES 167

- Used for accurately setting screw thread micrometers at the start or end of the measuring range.



167-264
(60° screw)



167-262
(60° screw)



| Metric | | |
|------------------------------------|-------------|---------------|
| Order No. | Length (mm) | Accuracy (μm) |
| Metric (unified) $\theta=60^\circ$ | | |
| 167-261 | 25 | ±4 |
| 167-262 | 50 | ±5 |
| 167-263 | 75 | ±6 |
| 167-264 | 100 | ±7 |
| 167-265 | 125 | ±8 |
| 167-266 | 150 | ±9 |
| 167-267 | 175 | ±10 |
| 167-268 | 200 | ±11 |
| 167-269 | 225 | ±12 |
| 167-270 | 250 | ±13 |
| 167-271 | 275 | ±14 |
| Whitworth $\theta=55^\circ$ | | |
| 167-272 | 25 | ±4 |
| 167-273 | 50 | ±5 |
| 167-274 | 75 | ±6 |
| 167-275 | 100 | ±7 |
| 167-276 | 125 | ±8 |
| 167-277 | 150 | ±9 |
| 167-278 | 175 | ±10 |
| 167-279 | 200 | ±11 |
| 167-280 | 225 | ±12 |
| 167-281 | 250 | ±13 |
| 167-282 | 275 | ±14 |

| Inch | | |
|------------------------------------|-----------------|---------------|
| Order No. | Length <L> (in) | Accuracy (in) |
| Metric (unified) $\theta=60^\circ$ | | |
| 167-294 | 1 | ±0.00015 |
| 167-295 | 2 | ±0.0002 |
| 167-296 | 3 | ±0.00025 |
| 167-297 | 4 | ±0.0003 |
| 167-298 | 5 | ±0.00035 |
| 167-299 | 6 | ±0.0004 |
| Whitworth $\theta=55^\circ$ | | |
| 167-283 | 1 | ±0.00015 |
| 167-284 | 2 | ±0.0002 |
| 167-285 | 3 | ±0.00025 |
| 167-286 | 4 | ±0.0003 |
| 167-287 | 5 | ±0.00035 |
| 167-288 | 6 | ±0.0004 |

Setting Standards for V-Anvil Micrometers SERIES 167

- Specially designed for accurately setting V-anvil micrometers.



167-329



| Metric | | | |
|----------------|-------------|---------------|------|
| Order No. | Length (mm) | Accuracy (μm) | Type |
| 167-327 | 5 | ±2 | Plug |
| 167-328 | 10 | | |
| 167-329 | 25 | | |
| 167-330 | 40 | ±3 | Ring |
| 167-331 | 55 | | |
| 167-332 | 70 | | |
| 167-333 | 85 | | |
| 167-334 | 100 | ±5 | Ring |
| 167-335 | 115 | | |
| 167-336 | 130 | | |

| Inch | | | |
|----------------|-----------------|---------------|------|
| Order No. | Length <L> (in) | Accuracy (in) | Type |
| 167-337 | 0.2 | ±0.0001 | Plug |
| 167-338 | 0.4 | | |
| 167-339 | 1 | | |
| 167-340 | 1.6 | ±0.00015 | Ring |

Optical Parallels SERIES 157

- Designed to inspect parallelism and flatness of measuring faces of micrometers. For details, refer to "Quick Guide to Precision Measuring Instruments" on page B-73.
- Each set consists of 4 sizes to aid in testing parallelism at various angular positions of the micrometer spindle.



157-903

SPECIFICATIONS

| Metric | | | | | | |
|-----------|--|---|---------------|---------------|------------------|--------------|
| Order No. | Range of micrometer to be checked (mm) | Sizes of parallels included in set (mm) | Diameter (mm) | Flatness (μm) | Parallelism (μm) | Remarks (mm) |
| 157-903 | 0 - 25 | 12.00, 12.12, 12.25, 12.37 | ø30 | 0.1 | 0.2 | For 25 |
| 157-904 | 25 - 50 | 25.00, 25.12, 25.25, 25.37 | | | | For 50 |

| Inch | | | | | | |
|-----------|--|---|---------------|---------------|------------------|--------------|
| Order No. | Range of micrometer to be checked (in) | Sizes of parallels included in set (in) | Diameter (mm) | Flatness (μm) | Parallelism (μm) | Remarks (mm) |
| 157-901 | 0 - 1 | 0.5000, 0.5062, 0.5125, 0.5187 | ø30 | 0.1 | 0.2 | For 25 |
| 157-902 | 1 - 2 | 1.0000, 1.0062, 1.0125, 1.0187 | | | | For 50 |

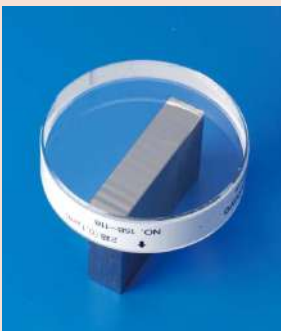
* Also available individually, using the following Order No.

| Metric | | Metric | |
|-----------|----------------|-----------|----------------|
| Order No. | Thickness (mm) | Order No. | Thickness (mm) |
| 157-101 | 12.00 | 157-105 | 25.00 |
| 157-102 | 12.12 | 157-106 | 25.12 |
| 157-103 | 12.25 | 157-107 | 25.25 |
| 157-104 | 12.37 | 157-108 | 25.37 |

| Inch | | Inch | |
|-----------|----------------|-----------|----------------|
| Order No. | Thickness (in) | Order No. | Thickness (in) |
| 157-109 | 0.5000 | 157-113 | 1.0000 |
| 157-110 | 0.5062 | 157-114 | 1.0062 |
| 157-111 | 0.5125 | 157-115 | 1.0125 |
| 157-112 | 0.5187 | 157-116 | 1.0187 |

Optical Flats SERIES 158

- Used for inspecting the flatness of very flat surfaces. For details, refer to "Quick Guide to Precision Measuring Instruments" on page B-73.



158-118

SPECIFICATIONS

| Metric | | | |
|-----------|----------------|---------------|---------------------|
| Order No. | Thickness (mm) | Diameter (mm) | Flatness grade (μm) |
| 158-117 | 12 | 45 | 0.2 |
| 158-118 | | | 0.1 |
| 158-119 | 15 | 60 | 0.2 |
| 158-120 | | | 0.1 |

| Inch | | | |
|-----------|----------------|---------------|---------------------|
| Order No. | Thickness (in) | Diameter (in) | Flatness grade (in) |
| 158-122 | 0.5 | 1.8 | 0.000004 |
| 158-124 | 0.6 | 2.4 | |

Micrometer

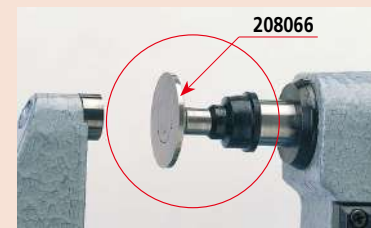
The origin of Mitutoyo's trustworthy brand of small tool instruments

Spindle Attachment Tips

- Simple interchangeable tips attached to standard micrometer spindles enable measurement of contours otherwise unmeasurable (for $\varnothing 6.35$ spindles only).
- Measuring range changes when a spindle attachment tip is mounted: the maximum measuring range is 10 mm or less (accuracy is not guaranteed).
- Please contact us for special shapes.

Technical Data

Tip length: 10 mm \pm 5 μ m



Specifications and Dimensions

Unit: mm

| Order No. | Tip type | Dimensions |
|-----------|------------|------------------------------|
| 208062 | Spline | $\varnothing 2$ 5 |
| 208063 | Comparator | 30° $\varnothing 1$ 10 |
| 208064 | Blade | 0.75 4.5 |
| 208065 | Knife-edge | 30° 0.5 |
| 208066 | Disk-plate | 0.7 $\varnothing 12.7$ |

Micrometer Oil

- Special lubricant for micrometers.



SPECIFICATIONS

| Order No. | Product name | Remarks |
|-----------|----------------|----------------|
| 207000 | Micrometer oil | Grease (32 ml) |

Color-Coded Ratchet and Speeder Covers

- Ratchet and speeder covers in a choice of seven colors for use in instrument identification control schemes: red, blue, yellow, green, brown, black and gray.

SPECIFICATIONS

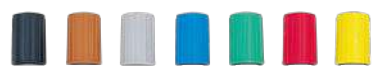
Ratchet and speeder covers



Ratchet



Speeder



Analog type: 0 to 300 mm

| Order No. | | Color | Material |
|-----------|----------|--------|----------|
| Ratchet | Speeder | | |
| 04GZA239 | 04GAA260 | Gray | Plastic |
| 985056 | 301708 | Black | |
| 985061 | 301709 | Red | |
| 985081 | 301713 | Blue | |
| 985071 | 301711 | Yellow | |
| 985076 | 301712 | Green | |
| 985066 | 301710 | Brown | |
| 950700 | — | Gray | Steel |

Analog / Digimatic types: 300 to 1000 mm

| Order No. | | Color | Material |
|-----------|----------|--------|----------|
| Ratchet | Speeder | | |
| 04GZA243 | 04GAA260 | Gray | Plastic |
| — | 301708 | Black | |
| — | 301709 | Red | |
| — | 301713 | Blue | |
| — | 301711 | Yellow | |
| — | 301712 | Green | |
| — | 301710 | Brown | |
| 950701 | — | Gray | Steel |

Digimatic type 0 to 300 mm*

| Order No.* | | Color | Material |
|------------|----------|--------|----------|
| Ratchet | Speeder | | |
| 04AZB661 | 04GAA260 | Gray | Plastic |
| 04GZA241 | 04GAA260 | Gray | |
| — | 301708 | Black | |
| — | 301709 | Red | |
| — | 301713 | Blue | |
| — | 301711 | Yellow | |
| — | 301712 | Green | |
| — | 301710 | Brown | |
| 951588 | — | Gray | Steel |

* Cannot be used for analog types.

Color-coded speeder covers



| Order No. | Color |
|-----------|--------|
| 04GAA899 | Black |
| 04GAA900 | Red |
| 04GAA901 | Yellow |
| 04GAA902 | Green |
| 04GAA903 | Blue |
| 04AAB208 | Gray |

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Stands SERIES 156

- Dedicated stand for micrometers.
- Designed to allow benchtop use of hand micrometers or other gages which have frames suitable for gripping by the clamp. Reduces the influence of temperature changes due to body heat, enabling higher-accuracy measurement.



156-105-10



156-101-10



156-102



156-105-10



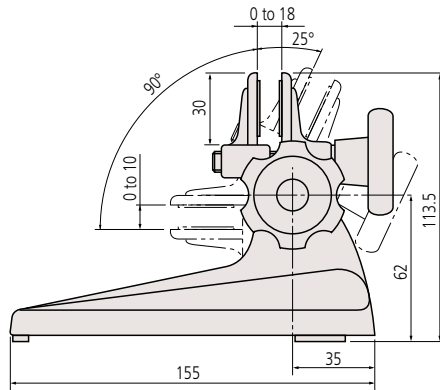
156-101-10

SPECIFICATIONS

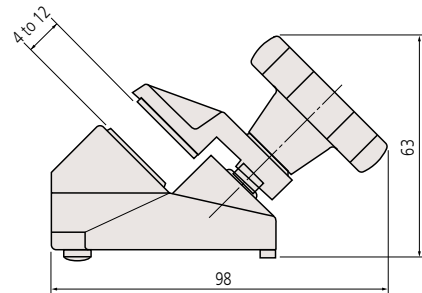
| Order No. | Measuring range of standard outside micrometer | Remarks |
|------------|--|-----------------------|
| 156-101-10 | 15 - 100 mm (0.6 - 4 in)* | Adjustable angle type |
| 156-105-10 | 25, 50 mm (1, 2 in) | Fixed angle type |
| 156-102 | 100 - 300 mm (4 - 12 in) | Vertical type |
| 156-103 | 325 - 1000 mm (13 - 40 in) | Vertical type |

* Items that cannot be mounted on these stands
(Order No. 406-253-30, 323-253-30, 331-254-30, 342-254-30, 342-264-30, 369-253-30, 422-232-30, 422-233-30, etc.)

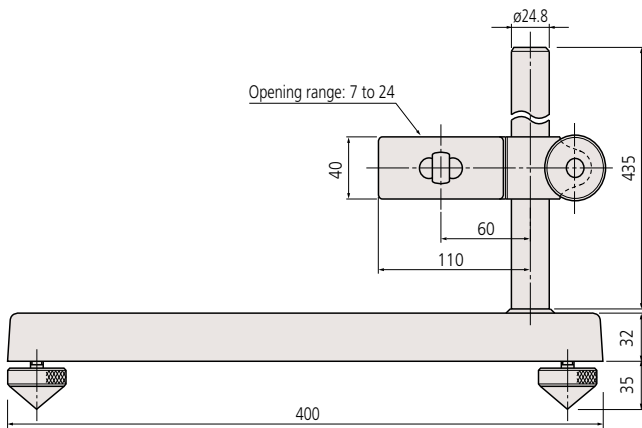
DIMENSIONS



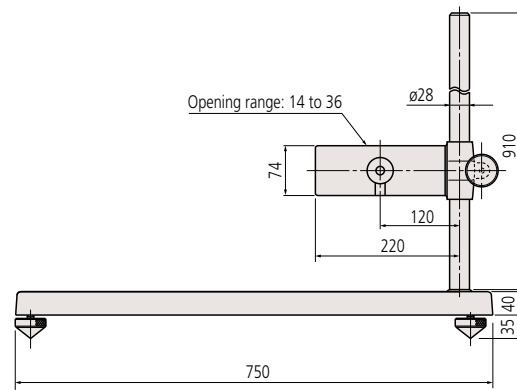
156-101-10



156-105-10



156-102

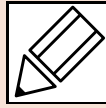


156-103

Unit: mm



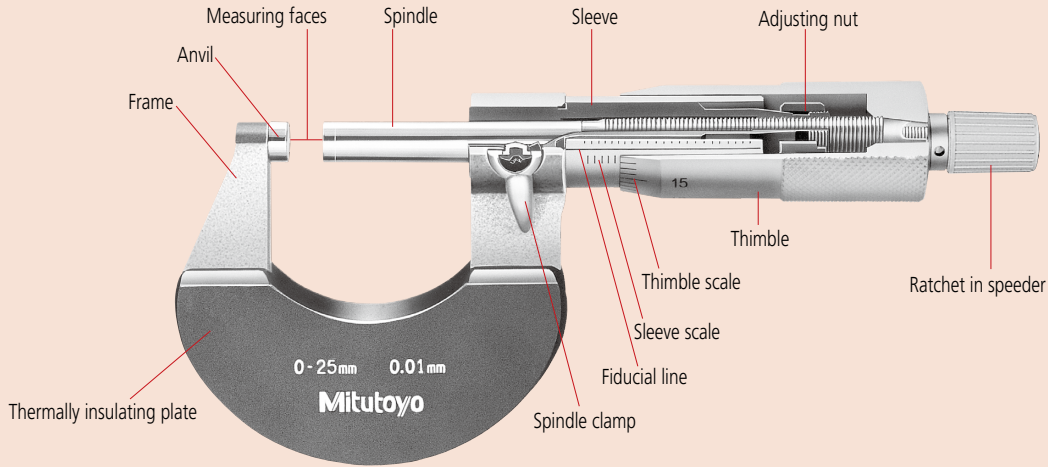
Quick Guide to Precision Measuring Instruments



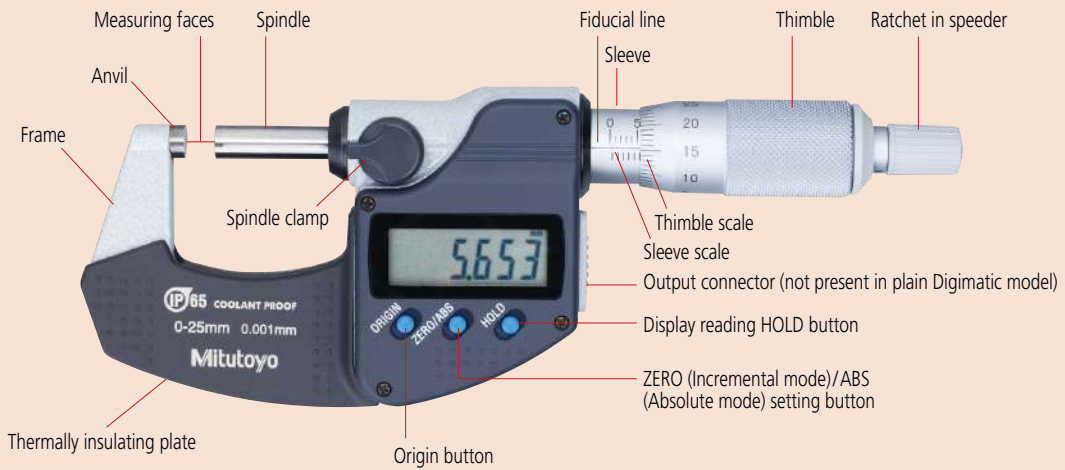
Micrometers

Nomenclature

Standard Analog Outside Micrometer

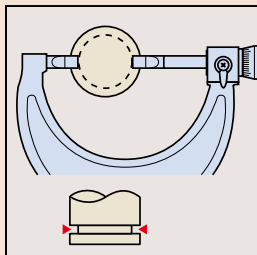


Digimatic Outside Micrometer



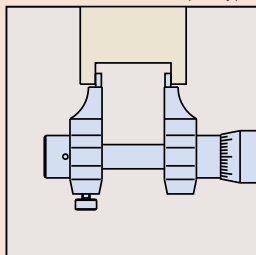
Special Purpose Micrometer Applications

Blade micrometer



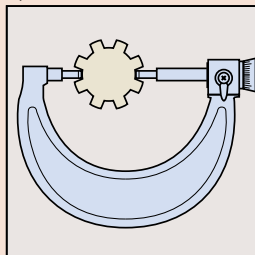
For inside diameter, and narrow groove measurement

Inside micrometer, caliper type



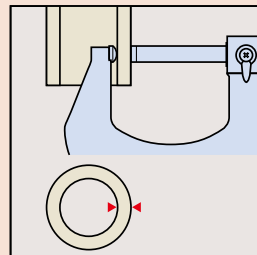
For small internal diameter, and groove width measurement

Spline micrometer



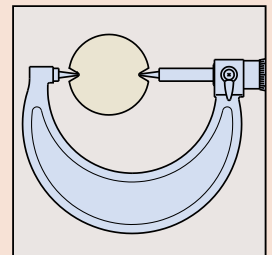
For splined shaft diameter measurement

Tube micrometer



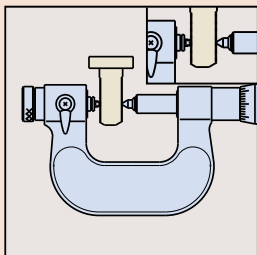
For pipe thickness measurement

Point micrometer



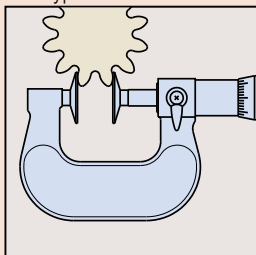
For root diameter measurement

Screw thread micrometer



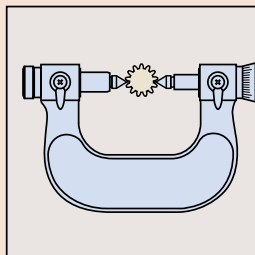
For effective thread diameter measurement

Disc type outside micrometer



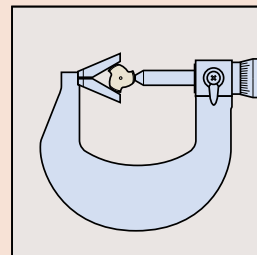
For root tangent measurement on spur gears and helical gears.

Ball tooth thickness micrometer



Measurement of gear over-pin diameter

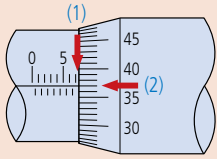
V-anvil micrometer



For measurement of 3- or 5-flute cutting tools

How to Read the Scale

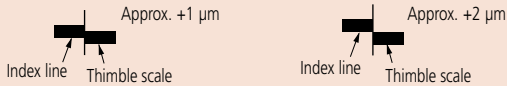
Micrometer with standard scale (graduation: 0.01 mm)



- (1) Sleeve scale reading 7. mm
 - (2) Thimble scale reading +0.37 mm
- Micrometer reading 7.37 mm

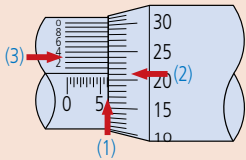
Note: 0.37 mm (2) is read at the position where the sleeve fiducial line is aligned to the thimble graduations.

The thimble scale can be read directly to 0.01 mm, as shown above, but may also be estimated to 0.001 mm when the lines are nearly coincident because the line thickness is 1/5 of the spacing between them.



Micrometer with vernier scale (graduation: 0.001 mm)

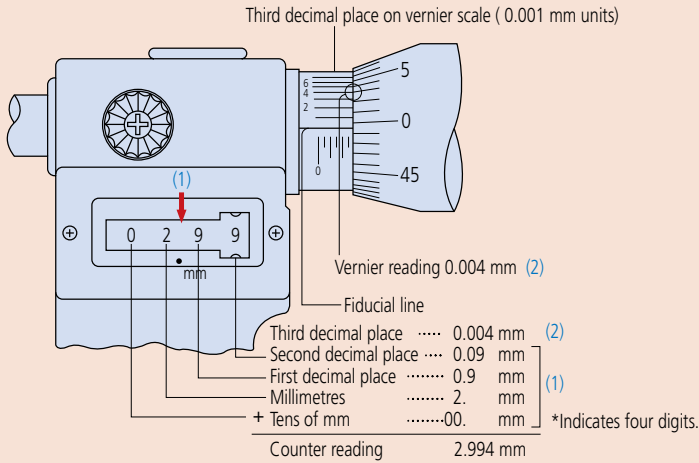
The vernier scale provided above the sleeve index line enables direct readings to be made to within 0.001 mm.



- (1) Sleeve scale reading 6. mm
 - (2) Thimble scale reading 0.21 mm
 - (3) Reading from the vernier scale marking and thimble graduation line +0.003 mm
- Micrometer reading 6.213 mm

Note: 0.21 mm (2) is read at the position where the index line is between two graduations (21 and 22 in this case). 0.003 mm (3) is read at the position where one of the vernier graduations aligns with one of the thimble graduations.

Micrometer with mechanical-digit display (digital step: 0.001 mm)

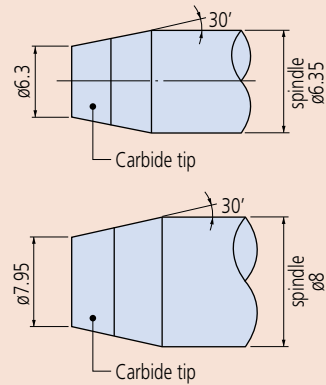


Note: 0.004 mm (2) is read at the position where a vernier graduation line corresponds with one of the thimble graduation lines.

Measuring Force Limiting Device

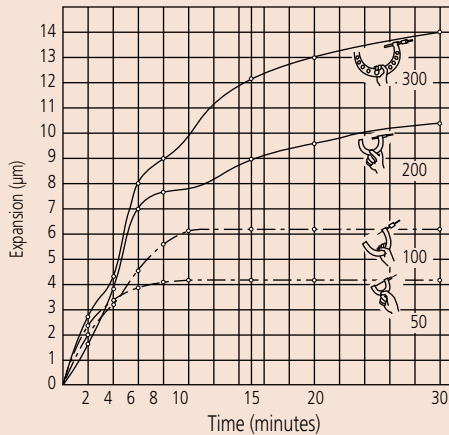
| | Audible in operation | One-handed operation | Remarks |
|---------------------------|----------------------|----------------------|---|
| Ratchet stop | Yes | Unsuitable | Audible clicking operation causes micro-shocks |
| Friction thimble (F type) | No | Suitable | Smooth operation without shock or sound |
| Ratchet thimble | Yes | Suitable | Audible operation provides confirmation of constant measuring force |

Measuring Face Detail



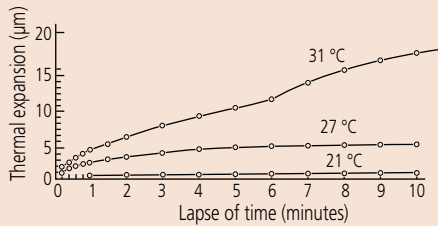
Note: The drawings above are for illustration only and are not to scale

Micrometer Expansion due to Holding Frame with the Bare Hand



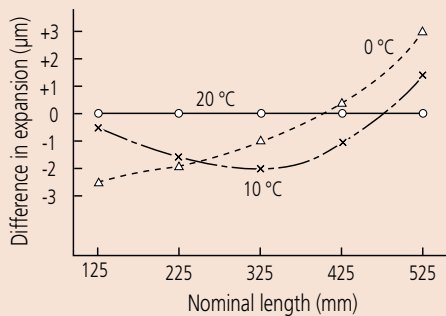
The above graph shows micrometer frame expansion due to heat transfer from hand to frame when the frame is held in the bare hand which, as can be seen, may result in a significant measurement error due to temperature-induced expansion. If the micrometer must be held by hand during measurement then try to minimize contact time. A heat insulator will reduce this effect considerably if fitted, or gloves may be worn. (Note that the above graph shows typical effects and is not guaranteed.)

Length Standard Expansion with Change of Temperature (for 200 mm bar initially at 20 °C)



The above experimental graph shows how a particular micrometer standard expanded with time as people whose hand temperatures were different (as shown) held the end of it at a room temperature of 20 °C. This graph shows that it is important not to set a micrometer while directly holding the micrometer standard but to make adjustments only while wearing gloves or lightly supporting the length standard by its heat insulators. When performing a measurement, note also that it takes time until the expanded micrometer standard returns to the original length. (Note that the graph values are not guaranteed values but experimental values.)

Difference in Thermal Expansion between Micrometer and Length Standard



In the above experiment, after the micrometer and its standard were left at a room temperature of 20 °C for about 24 hours for temperature stabilization, the start point was adjusted using the micrometer standard. Then, the micrometer with its standard were left at the temperatures of 0 °C and 10 °C for about the same period of time, and the start point was tested for shift. The above graph shows the results for each of the sizes from 125 through 525 mm at each temperature. This graph shows that both the micrometer and its standard must be left at the same location for at least several hours before adjusting the start point. (Note that the graph values are not guaranteed values but experimental values.)

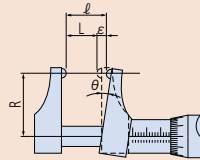
Effect of Changing Support Method and Orientation (Unit: µm)

Changing the support method and/or orientation of a micrometer after zero setting affects subsequent measuring results. The tables below highlight the measurement errors to be expected in three other cases after micrometers are zero-set in the 'Supported at the bottom and center' case. These actual results show that it is best to set and measure using the same orientation and support method.

| Supporting method | Supported at the bottom and center | Supported only at the center |
|-------------------------------|------------------------------------|------------------------------|
| Attitude | | |
| Maximum measuring length (mm) | | |
| 325 | 0 | -5.5 |
| 425 | 0 | -2.5 |
| 525 | 0 | -5.5 |
| 625 | 0 | -11.0 |
| 725 | 0 | -9.5 |
| 825 | 0 | -18.0 |
| 925 | 0 | -22.5 |
| 1025 | 0 | -26.0 |

| Supporting method | Supported at the center in a lateral orientation. | Supported by hand downward. |
|-------------------------------|---|-----------------------------|
| Attitude | | |
| Maximum measuring length (mm) | | |
| 325 | +1.5 | -4.5 |
| 425 | +2.0 | -10.5 |
| 525 | -4.5 | -10.0 |
| 625 | 0 | -5.5 |
| 725 | -9.5 | -19.0 |
| 825 | -5.0 | -35.0 |
| 925 | -14.0 | -27.0 |
| 1025 | -5.0 | -40.0 |

Abbe's Principle



Abbe's principle states that "maximum accuracy is obtained when the scale and the measurement axes are common".

This is because any variation in the relative angle (θ) of the moving measuring jaw on an instrument, such as a caliper jaw micrometer, causes displacement that is not measured

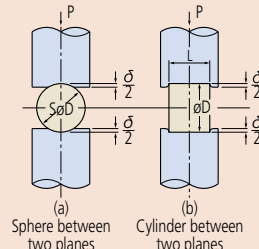
on the instrument's scale and this is an Abbe error ($\epsilon = l - L$ in the diagram). Spindle straightness error, play in the spindle guide or variation of measuring force can all cause (θ) to vary, and the error increases with R.

Hooke's Law

Hooke's law states that strain in an elastic material is proportional to the stress causing that strain, providing the strain remains within the elastic limit for that material.

Hertz's Formulae

Hertz's formulae give the apparent reduction in diameter of spheres and cylinders due to elastic compression when measured between plane surfaces. These formulae are useful for determining the deformation of a workpiece caused by the measuring force in point and line contact situations.



Assuming that the material is steel and units are as follows:
 Modulus of elasticity: $E = 205 \text{ GPa}$
 Amount of deformation: δ (μm)
 Diameter of sphere or cylinder: D (mm)
 Length of cylinder: L (mm)
 Measuring force: P (N)
 a) Apparent reduction in diameter of sphere
 $\delta_2 = 0.82 \sqrt{P^2/D}$
 b) Apparent reduction in diameter of cylinder
 $\delta_1 = 0.094 \cdot P/L \sqrt{1/D}$

Major Measurement Errors of the Screw Micrometer

| Error cause | Maximum possible error | Precautions for eliminating errors | Error that might not be eliminated even with precautions |
|------------------------------|--|---|--|
| Micrometer feed error | 3 μm | 1. Correct the micrometer before use. | ±1 μm |
| Anvil angle error | ±5 μm assuming the error of a half angle is 15 minutes | 1. Measure the angle error and correct the micrometer. 2. Adjust the micrometer using the same thread gage as the workpiece. | ±3 μm expected measurement error of half angle |
| Misaligned contact points | +10 μm | | +3 μm |
| Influence of measuring force | ±10 μm | 1. Use a micrometer with a low measuring force if possible. 2. Always use the ratchet stop. 3. Adjust the micrometer using a thread gage with the same pitch. | +3 μm |
| Angle error of thread gage | ±10 μm | 1. Perform correction calculation (angle). 2. Correct the length error. 3. Adjust the micrometer using the same thread gage as the workpiece. | +3 μm |
| Length error of thread gage | ±(3 + $\frac{L}{25}$) μm | 1. Perform correction calculation. 2. Adjust the micrometer using the same thread gage as the workpiece. | ±1 μm |
| Workpiece thread angle error | JIS 2 grade error of half angle ±229 minutes -91 μm +71 μm | 1. Minimize the angle error as much as possible. 2. Measure the angle error and perform correction calculation. 3. Use the three-wire method for a large angle error. | ±8 μm assuming the error of half angle is ±23 minutes |
| Cumulative error | (±117+40) μm | | +26 μm -12 μm |

Screw Pitch Diameter Measurement

• Three-wire method

The screw pitch diameter can be measured with the three-wire method as shown in the figure.

Calculate the pitch diameter (E) with equations (1) and (2).

Metric thread or unified screw (60°)

$$E = M - 3d + 0.866025P \quad \dots\dots(1)$$

Whitworth thread (55°)

$$E = M - 3.16568d + 0.960491P \quad \dots\dots(2)$$

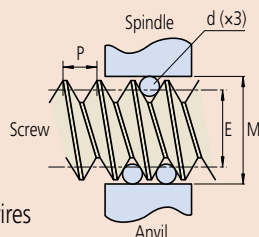
d = Wire diameter

E = Screw pitch diameter

M = Micrometer reading including three wires

P = Screw pitch

(Convert inches to millimeters for unified screws.)



| Thread type | Optimal wire size at D |
|--------------------------------------|------------------------|
| Metric thread or unified screw (60°) | 0.577P |
| Whitworth thread (55°) | 0.564P |

Major Measurement Errors of the Three-wire Method

| Error cause | Precautions for eliminating errors | Possible error | Error that might not be eliminated even with precautions |
|---------------------------------|--|--|--|
| Pitch error (workpiece) | 1. Correct the pitch error ($\delta p = \delta E$) 2. Measure several points and adopt their average. 3. Reduce single pitch errors. | ±18 μm assuming that the pitch error is 0.02 mm. | ±3 μm |
| Error of half angle (workpiece) | 1. Use the optimal wire diameter. 2. No correction is needed. | ±0.3 μm | ±0.3 μm |
| Due to anvil difference | 1. Use the optimal wire diameter. 2. Use the wire which has a diameter close to the average at the one wire side. | ±8 μm | ±1 μm |
| Wire diameter error | 1. Use the predetermined measuring force appropriate for the pitch. 2. Use the predetermined width of measurement edge. 3. Use a stable measuring force. | -3 μm | -1 μm |
| Cumulative error | | In the worst case +20 μm -35 μm | When measured carefully +3 μm -5 μm |

• One-wire method

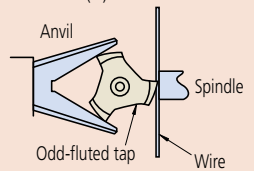
The pitch diameter of odd-fluted tap can be measured using the V-anvil micrometer with the one-wire method. Obtain the measured value (M₁) and calculate M with equation (3) or (4).

M₁ = Micrometer reading during one-wire measurement
D = Odd-fluted tap diameter

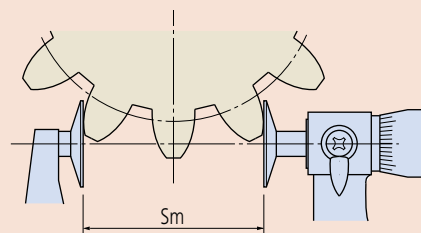
$$\text{Tap with three flutes : } M = 3M_1 - 2D \quad \dots\dots(3)$$

$$\text{Tap with five flutes : } M = 2.2360M_1 - 1.2360D \quad \dots\dots(4)$$

Then, assign the calculated M to equation (1) or (2) to calculate the pitch diameter (E).



Root Tangent Length



Formula for calculating a root tangent length (Sm):

$$S_m = m \cos \alpha_0 \{ \pi (Z_m - 0.5) + Z \operatorname{inv} \alpha_0 \} + 2Xm \sin \alpha_0$$

Formula for calculating the number of teeth within the root tangent length (Z_m):

$$Z_m' = Z \cdot K(f) + 0.5 \quad (Z_m \text{ is the integer closest to } Z_m')$$

$$\text{where, } K(f) = \frac{1}{\pi} \{ \sec \alpha_0 \sqrt{(1+2f)^2 - \cos^2 \alpha_0} - \operatorname{inv} \alpha_0 - 2f \tan \alpha_0 \}$$

$$\text{and, } f = \frac{X}{Z}$$

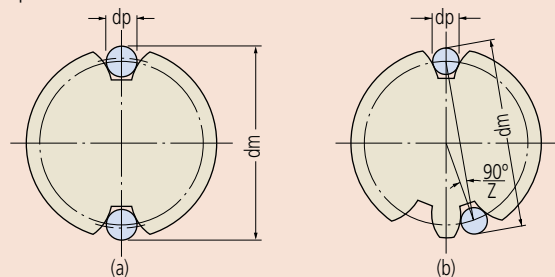
- m: Module
- α₀: Pressure angle
- Z: Number of teeth
- X: Addendum modification coefficient
- S_m: Root tangent length
- Z_m: Number of teeth within the root tangent length

$$\operatorname{inv} 20^\circ \cong 0.014904$$

$$\operatorname{inv} 14.5^\circ \cong 0.0055448$$

Gear Measurement

Over-pin method



For a gear with an even number of teeth:

$$d_m = dp + \frac{dg}{\cos \theta} = dp + \frac{Z \cdot m \cdot \cos \alpha_0}{\cos \theta}$$

For a gear with an odd number of teeth:

$$d_m = dp + \frac{dg}{\cos \theta} \cdot \cos \left(\frac{90^\circ}{Z} \right) = dp + \frac{Z \cdot m \cdot \cos \alpha_0}{\cos \theta} \cdot \cos \left(\frac{90^\circ}{Z} \right)$$

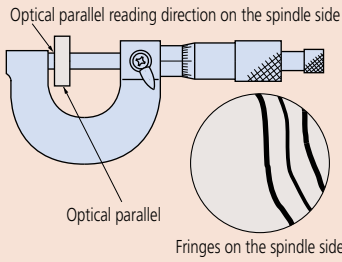
however,

$$\operatorname{inv} \theta = \frac{dp}{dg} - \frac{X}{Z} = \frac{dp}{Z \cdot m \cdot \cos \alpha_0} - \left(\frac{\pi}{2Z} - \operatorname{inv} \alpha_0 \right) + \frac{2 \tan \alpha_0}{Z} \cdot X$$

Obtain θ (invθ) from the involute function table.

- Z: Number of teeth
- α₀: Pressure angle teeth
- m: Module
- X: Addendum modification coefficient

Testing Parallelism of Micrometer Measuring Faces

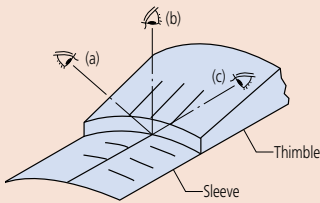


Parallelism can be estimated using an optical parallel held between the faces. First, wring the parallel to the anvil measuring face. Then close the spindle on the parallel using normal measuring force and count the number of red interference fringes seen on the measuring face of the spindle in white light. Each fringe represents a half wavelength difference in height ($0.32\ \mu\text{m}$ for red fringes).

In the above figure a parallelism of approximately $1\ \mu\text{m}$ is obtained from $0.32\ \mu\text{m} \times 3 = 0.96\ \mu\text{m}$.

General Notes on Using the Micrometer

- Carefully check the type, measuring range, accuracy, and other specifications to select the appropriate model for your application.
- Leave the micrometer and workpiece at room temperature long enough for their temperatures to equalize before making a measurement.
- Look directly at the fiducial line when taking a reading against the thimble graduations. If the graduation lines are viewed from an angle, the correct alignment position of the lines cannot be read due to parallax error.



(a) From above the index line

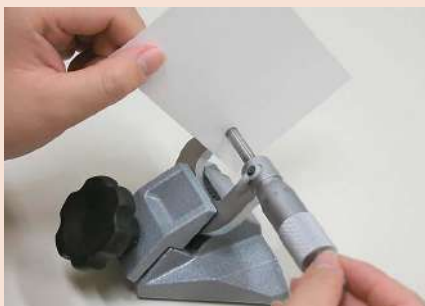


(b) Looking directly at the index line

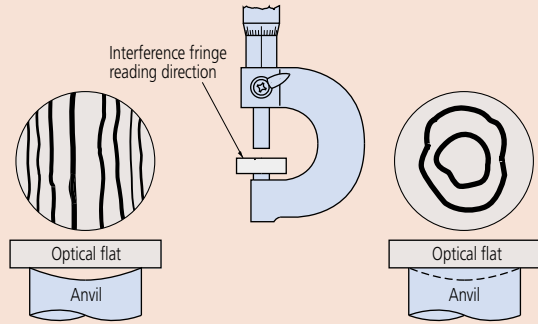


(c) From below the index line

- Wipe off the measuring faces of both the anvil and spindle with lint-free paper set the start (zero) point before measuring.



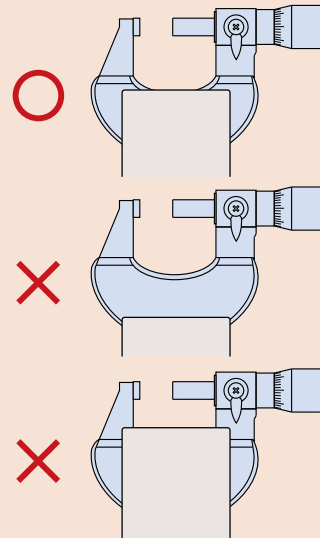
Testing Flatness of Micrometer Measuring Faces



Measuring face is curved by approximately $1.3\ \mu\text{m}$. ($0.32\ \mu\text{m} \times 4$ paired red fringes.)

Measuring face is concave (or convex) approximately $0.6\ \mu\text{m}$ deep. ($0.32\ \mu\text{m} \times 2$ continuous fringes)

- Wipe away any dust, chips and other debris from the circumference and measuring face of the spindle as part of daily maintenance. In addition, sufficiently wipe off any stains and fingerprints on each part with dry cloth.
- Use the constant-force device correctly so that measurements are performed with the correct measuring force.
- When attaching the micrometer onto a micrometer stand, the stand should clamp the center of the micrometer frame. Do not clamp it too tightly.



- Be careful not to drop or bump the micrometer on anything. Do not rotate the micrometer thimble using excessive force. If you believe a micrometer may have been damaged due to accidental mishandling, ensure that it is inspected for accuracy before further use.
- After a long storage period, or when there is no protective oil film visible, lightly apply anti-corrosion oil to the micrometer by wiping with a cloth soaked in it.
- Notes on storage:
 - Avoid storing the micrometer in direct sunlight.
 - Store the micrometer in a ventilated place with low humidity.
 - Store the micrometer in a place with little dust.
 - Store the micrometer in a case or other container, which should not be kept on the floor.
 - When storing the micrometer, always leave a gap of 0.1 to $1\ \text{mm}$ between the measuring faces.
 - Do not store the micrometer in a clamped state.

Micrometer Performance Evaluation Method

JIS B 7502 was revised and issued in 2016 as the Japanese Industrial Standards of the micrometer, and the "Instrumental error" indicating the indication error of the micrometer has been changed to "Maximum Permissible Error (MPE) of indication".

The "Instrumental error" of the old JIS adopts acceptance criteria that the specification range (precision specification) equals acceptance range, and the OK/NG judgment does not include measurement uncertainty (Fig.1).

The "Maximum Permissible Error (MPE) of indication" of the new JIS employs the basic concept of the OK/NG judgment taking into account the uncertainty adopted in the ISO standard (ISO 14253-1).

The verification of conformity and nonconformity to the specifications is clearly stipulated to use the internationally recognized acceptance criteria (simple acceptance) when the specification range equals the acceptance range, and it is accepted that the specification range equals the acceptance range if a given condition considering uncertainty is met.

The above said internationally recognized acceptance criterion is ISO/TR 14253-6: 2012 (Fig.2).

The following describes the standard inspection method including the revised content of JIS 2016.

Fig. 1 Conventional JIS Instrumental error
JIS B 7502-1994

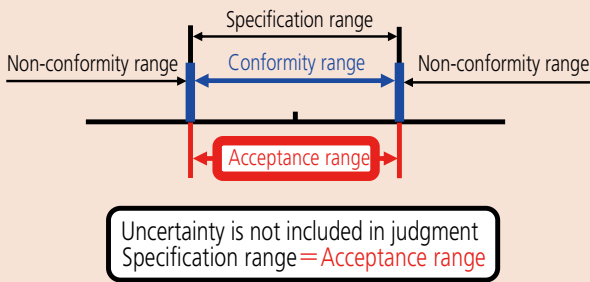
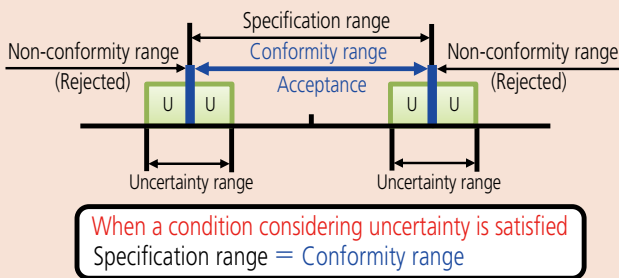


Fig. 2 New JIS Maximum Permissible Error (MPE)
JIS B 7502: 2016 (ISO/TR 14253- 6: 2012)



Maximum Permissible Error of Full Surface Contact Error J_{MPE} [JIS B 7502: 2016]

The full surface contact error of the outside micrometer is an indication error measured by contacting the entire measuring surface with the object to be measured at an arbitrary point in the measuring range.

The value can be obtained by adjusting the reference point using a constant pressure device with the minimum measuring length of the micrometer, inserting a grade 0 or 1 gauge block prescribed in JIS B 7506 or an equivalent or higher gage between the measuring surfaces (Fig. 3), and then subtracting the dimensions of the gauge block from the indication value of the micrometer using a constant pressure device.

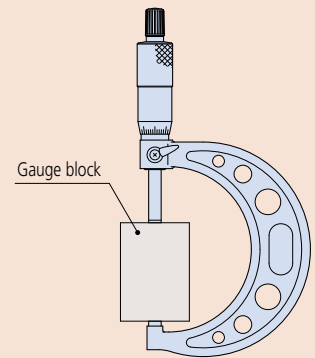


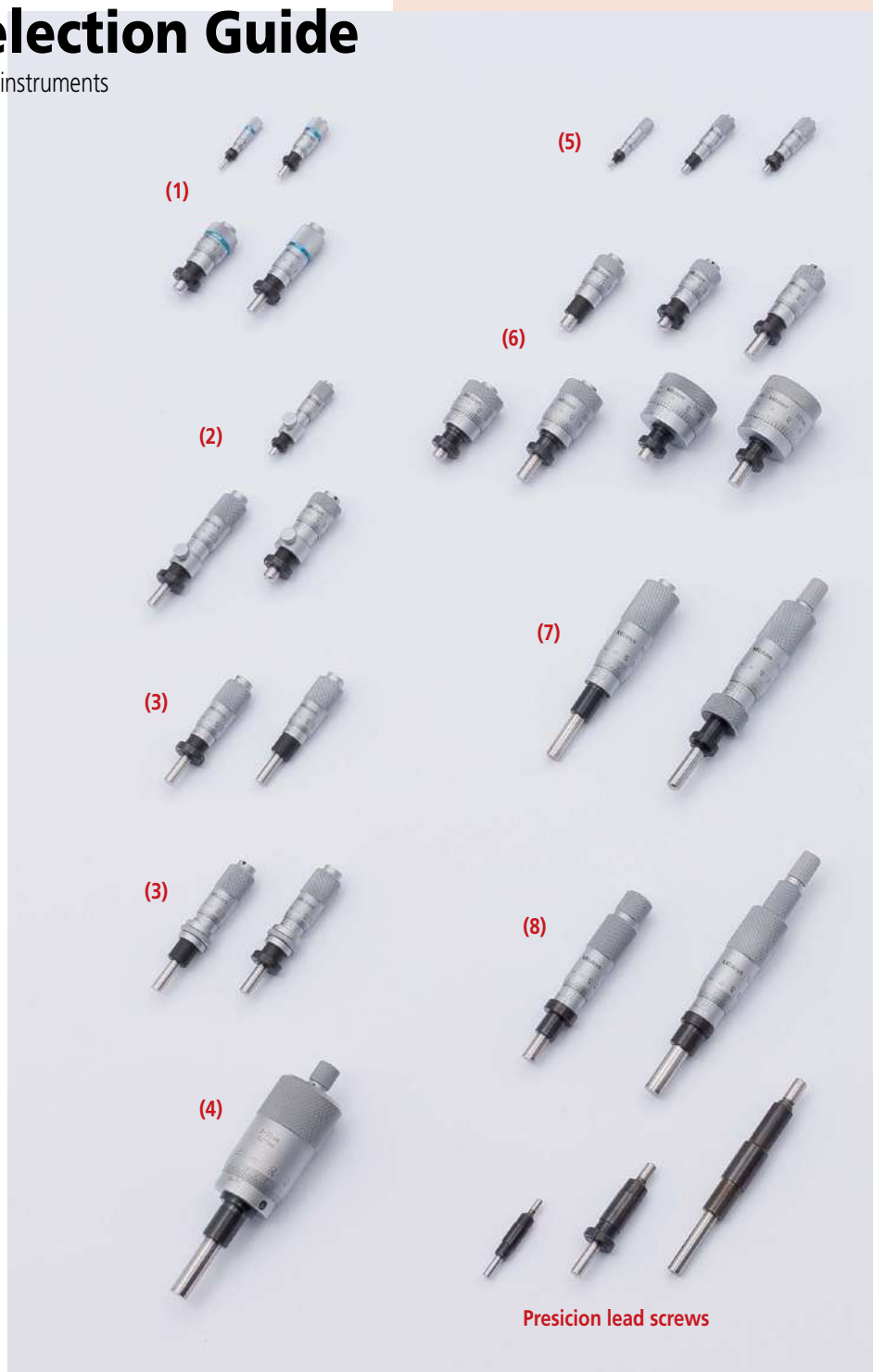
Fig. 3: Measurement of full surface contact error

Micrometer Head Selection Guide

The origin of Mitutoyo's trustworthy brand of small tool instruments

SELECTION TABLE

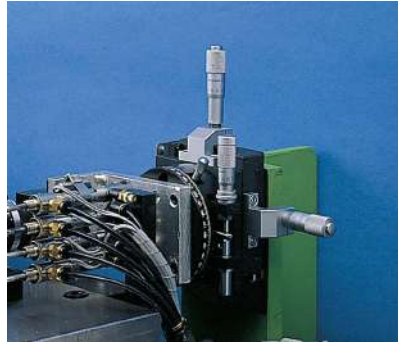
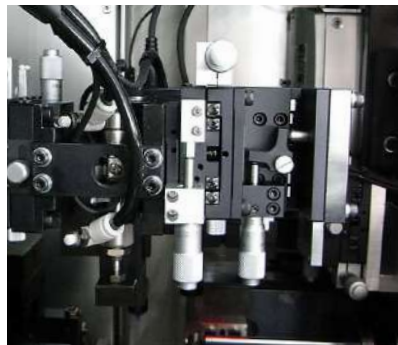
Mounted on measuring instruments and precision instruments, micrometer heads are used for various purposes including measurement, feeding and positioning. Recent developments in technology have seen the micrometer head widely utilized in precise feeding devices and cross-travel stages on laser instruments and manipulators, in addition to the usual duties on measurement jigs. In parallel with the application expansion, the customer's needs have increased. To meet customer demands, Mitutoyo provides standard micrometer heads with different measuring ranges, stem type and body size. Furthermore, high-performance types of Digimatic Micrometer Head, 0.1 mm spindle-pitch models (standard 0.5 mm), etc., are now available for the new applications. Mitutoyo also provides customization services for special applications. Micrometer heads with customized spindle tips and precision leadscrews manufactured to customer specification can be offered even in one-off quantities.



Precision lead screws

Also refer to "Quick Guide to Precision Measuring Instruments" from page B-113.

| Measuring stroke | Main feature of head | | Series | Page | |
|------------------|----------------------|---|--------|----------------------------|----------------|
| 1 mm/0.02 in | High-Function | Differential Screw Translator (Extra-Fine Feed) Type | 110 | B-104 | |
| 2.5 mm/0.05 in | High-Function | Differential Screw Translator (Extra-Fine Feed) Type (11) | | B-104 | |
| 5 mm/0.2 in | High-Function | Fine Spindle Feed of 0.1 mm/rev (1) | 148 | B-101 to B-102 | |
| | Standard | Small/Ultra-small Type (5) | | B-80 to B-81 | |
| 6.5 mm/0.25 in | Standard | Locking-screw Type (2) | | B-96 to B-98 | |
| | High-Function | Fine Spindle Feed of 0.1 mm/rev (1) | | B-101 to B-102 | |
| | High-Function | Fine Spindle Feed of 0.25 mm/rev (5) | | B-103 | |
| | | Standard | | Small/Ultra-small Type (6) | B-80 to B-81 |
| 10 mm | High-Function | Large Thimble Type (13) | | 152 | B-105 to B-106 |
| | Standard | Locking-screw Type (2) | | 148 | B-96 to B-98 |
| 13 mm/0.5 in | High-Function | Fine Spindle Feed of 0.25 mm/rev | 110 | B-103 | |
| | | Differential Screw Translator (Extra-Fine Feed) Type (11) | | B-104 | |
| | | Short Thimble with Choice of Diameter (6) | 148 | B-82 to B-83 | |
| | Standard | Small Standard Type (3) | | B-84 to B-85 | |
| | Standard | Small Thimble Diameter Standard Type (10) | | B-86 to B-87 | |



| Measuring stroke | Main feature of head | | Series | Page |
|--------------------|---|---|--------------|----------------|
| 15 mm/0.5 in | High-Function | Non-rotating Spindle Type | (8) 153 | B-99 |
| | High-Function | Quick Spindle Feed of 1 mm/rev | (4) 152 | B-100 |
| | Standard | Small Standard Type with Carbide-Tipped Spindle | (9) 149 | B-88 to B-89 |
| 25 mm/1 in | Digimatic | | 350 | B-77 to B-79 |
| | High-Function | Non-rotating Spindle Type | (8) 153 | B-99 |
| | | Quick Spindle Feed of 1 mm/rev | 152 | B-100 |
| | | Large Thimble Type | | B-105 to B-106 |
| | | XY-Stage Type | (14) 153 | B-107 |
| | High Accuracy and Resolution | 153 | B-108 | |
| Digit Counter Type | 250 | B-109 | | |
| Standard | Medium-sized Standard Type | (7) 150 | B-90 to B-92 | |
| | Medium-sized Standard Type with 8 mm Diameter Spindle | 151 | B-93 to B-95 | |
| 50 mm/2 in | Digimatic | | (15) 164 | B-77 to B-79 |
| | High-Function | Quick Spindle Feed of 1 mm/rev | 152 | B-100 |
| | | Large Thimble Type | | B-105 to B-106 |
| Standard | Long Stroke Non-rotating Spindle | 197 | B-108 | |
| | Medium-sized Standard Type with 8 mm Diameter Spindle | (12) 151 | B-93 to B-95 | |
| 60 - 75 mm | Micro Jack | | 7 | B-109 |

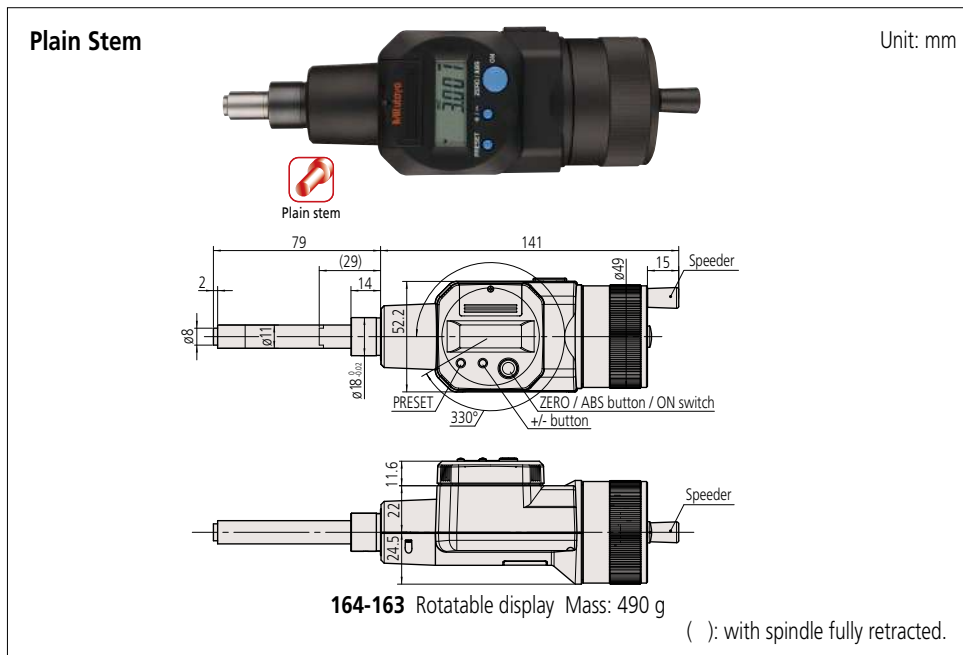
Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Digimatic Micrometer Heads SERIES 164, 350

- Equipped with digital display and output.
- **MHN-MX (IP65)/MXN (IP65)** are protection grade IP65, waterproof Digimatic micrometer heads.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector.

DIMENSIONS



SPECIFICATIONS

| Order No. | Stroke (mm) | Resolution (mm) | Graduation (mm) | Stem | Stem dia. (mm) | Spindle end | Graduation features | Maximum permissible error J_{MPE} (μm) | |
|----------------------------------|-------------|-----------------|-----------------|-------------|----------------|-------------------------------|---------------------|--|------|
| 164-163 | 50 | 0.001 | 0.01 | Plain | 18 | Flat (carbide tip) | Standard | ±2 | |
| 350-251-30 * ¹ | 25 | | | | | | | | 0.01 |
| 350-252-30 * ¹ | | | | Plain | | | | | |
| 350-253-30 * ¹ | | | | W/clamp nut | 12 | Flat (carbide tip) | | | |
| 350-254-30 * ¹ | | | | | | | | | |
| 350-281-30 * ² | | | | W/clamp nut | 12 | Spherical (SR4) (carbide tip) | | | |
| 350-282-30 * ² | | | | | | | | | |
| 350-283-30 * ² | | | | W/clamp nut | 12 | Flat | | | |
| 350-284-30 * ² | | | | | | | | | |
| 350-261-30 * ² | | | | Plain | | | | | |

*1 These models are not water-proof.

*2 IP65 dust / water protection type. Stem diameter of IP65 type is 12 mm.

Note: For functional details of series 350 refer to page B-8. Origin setting is by presetting.

| Order No. | Stroke (in) | Resolution | Graduation | Stem | Stem dia. (in) | Spindle end | Graduation features | Maximum permissible error J_{MPE} (in) | | |
|----------------------------------|-------------|-------------------------|----------------------|-------------|----------------|-------------------------------|---------------------|--|-------------------------|----------------------|
| 164-164 | 2 | 0.00005 in/ 0.001 mm | 0.001 in/ 0.01 mm | Plain | 0.709 | Flat (carbide tip) | Standard | ±0.0001 | | |
| 350-351-30 * ¹ | 1 | | | | | | | | 0.00005 in/ 0.001 mm | 0.001 in/ 0.01 mm |
| 350-352-30 * ¹ | | | | Plain | | | | | | |
| 350-353-30 * ¹ | | | | W/clamp nut | 0.5 | Flat (carbide tip) | | | | |
| 350-354-30 * ¹ | | | | | | | | | | |
| 350-381-30 * ² | | | | W/clamp nut | 0.5 | Spherical (SR4) (carbide tip) | | | | |
| 350-382-30 * ² | | | | | | | | | | |
| 350-383-30 * ² | | | | W/clamp nut | 0.5 | Flat | | | | |
| 350-384-30 * ² | | | | | | | | | | |
| 350-361-30 * ² | | | | Plain | | | | | | |

*1 These models are not water-proof.

*2 IP65 dust / water protection type. Stem diameter of IP65 type is 12 mm.

Note: For functional details of series 350 refer to page B-8. Origin setting is by presetting.



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



IP Codes (series 350*)

- Level 6: Dustproof No ingress of dust allowed.
- Level 5: Protected against water jets. Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Battery for series 350 SR44 (1 pc.), 938882 for initial operation checks (standard accessory)
 - Battery for series 164 SR44 (2 pcs.), 938882 for initial operation checks (standard accessory)
 - Battery life: Approx. 2.4 years under normal use (for series 350-XXX) Approx. 1.8 years under normal use (for series 164-163, 164)
 - Length standard: Electromagnetic rotary sensor Spanner (301336), 1 pc. (for series 350-XXX) Screwdriver (No.05CAA952), 1 pc. (for series 164-163, 164)
- * IP65 dust/water protection type

Functions (series 164)

Origin point setting (ABS measurement system): Resets the ABS origin at the current spindle position to the minimum value of the measuring stroke and switches to ABS mode.

Zero-setting (INC measurement system):

A brief press on the ZERO/ABS button sets display to zero at the current spindle position and switches to the incremental (INC) measuring mode. A longer press resets to the ABS measuring mode.

Data output:

Equipped with output port for transferring measurement data to a Statistical Process Control (SPC) and measurement system.

Auto power ON / OFF:

The reading on the LCD disappears after this instrument is idle for about 20 minutes, but the reading and measurement mode are retained. Turning the spindle causes the reading on the LCD to reappear.

Error alarm:

In case of an overflow on the LCD or a computing error, an error message appears on the LCD and the measuring function stops. This prevents an instrument from giving an erroneous reading. Also, when the battery voltage drops to a certain level, the low-battery-voltage alarm annunciator appears well before the micrometer becomes unusable.

Optional Accessories

- Connecting cables for series 164
 - 1 m: 959149
 - 2 m: 959150
- USB Input Tool Direct
 - USB-ITN-C (2 m): 06AFM380C 02AZD790C 160 mm For foot switch: 02AZE140C
- Connecting cables for series 350
 - 1 m: 05CZA662
 - 2 m: 05CZA663
- USB Input Tool Direct
 - USB-ITN-B (2 m): 06AFM380C

Wireless Data Output* U-WAVE

- U-WAVE-TM 264-622 (IP67 type) 264-623 (Buzzer type)
 - U-WAVE-TMB Transmitter Mitutoyo Bluetooth® U-WAVE 264-626 (IP67 type) 264-627 (Buzzer type) Refer to page A-16 for details.
 - Connecting unit for U-WAVE-TM/TMB 02AZF310 (IP67/buzzer type common specification) Refer to pages A-16 and A-18 for details.
- * Cannot be used with 164-163 and 164-164

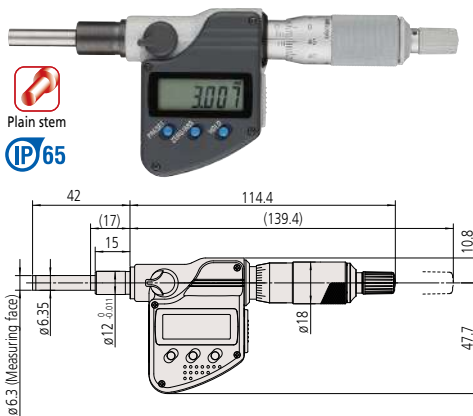
Technical Data

- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
Satin-chrome plated

DIMENSIONS

Plain Stem

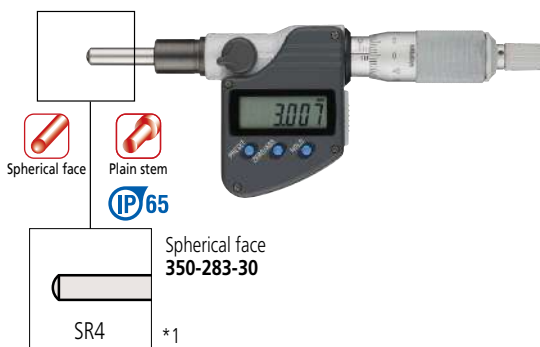
Unit: mm



350-281-30 (Stem dia. 12mm, waterproof type) Mass: 230 g

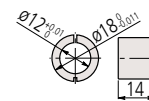


Equipped with a non-rotating device
350-261-30
(Stem dia. 12 mm, waterproof type)
Mass: 235 g



Spherical face
350-283-30

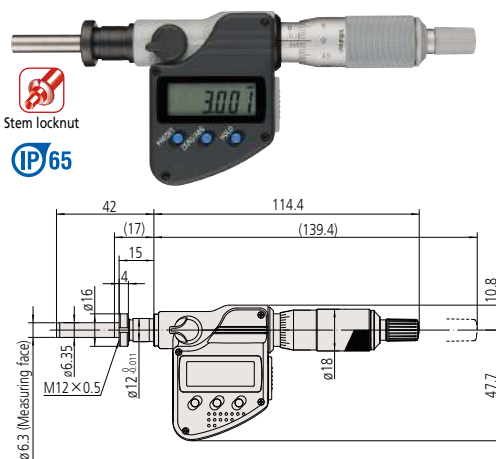
SR4 *1



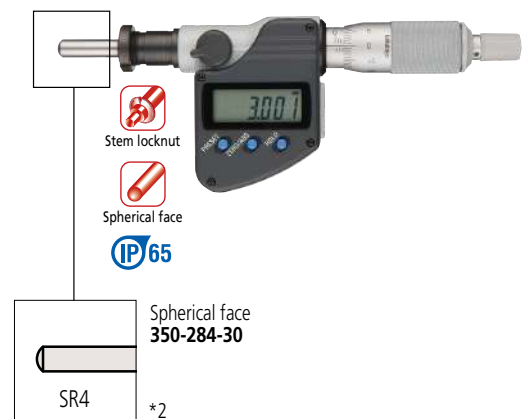
Bush (standard accessory)
350-261-30

*1 Other dimensions are the same as **350-281-30**.
(): with spindle fully retracted.

Stem locknut



• Fixture thickness: 11.5 mm
350-282-30 (Stem dia. 12 mm, equipped with locknut, waterproof type) Mass: 230 g



Spherical face
350-284-30

SR4 *2

*2 Other dimensions are the same as **350-282-30**.
(): with spindle fully retracted.

Micrometer Head

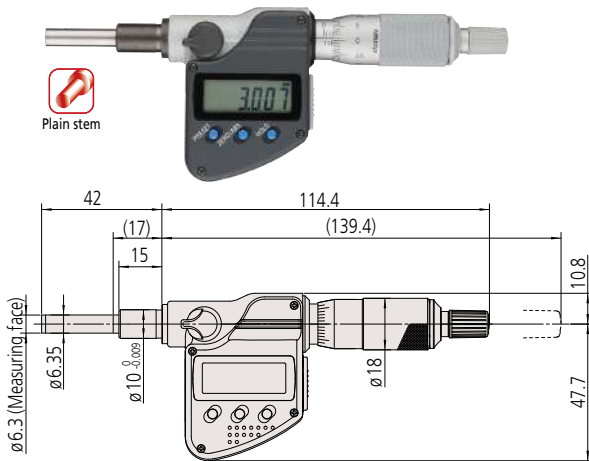
The origin of Mitutoyo's trustworthy brand of small tool instruments

Digimatic Micrometer Heads SERIES 164, 350

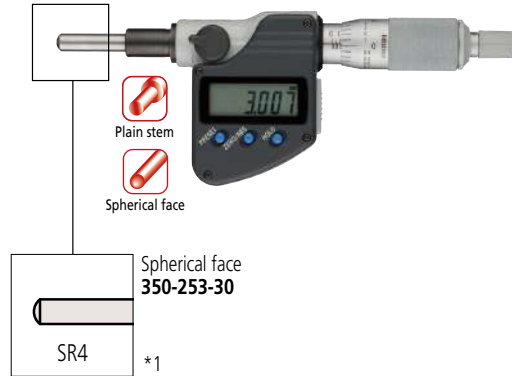
DIMENSIONS

Plain Stem

Unit: mm

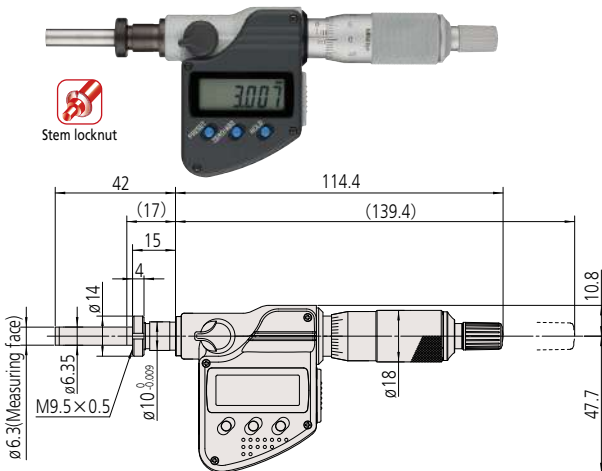


350-251-30
(Stem dia. 10 mm, for general use) Mass: 230 g

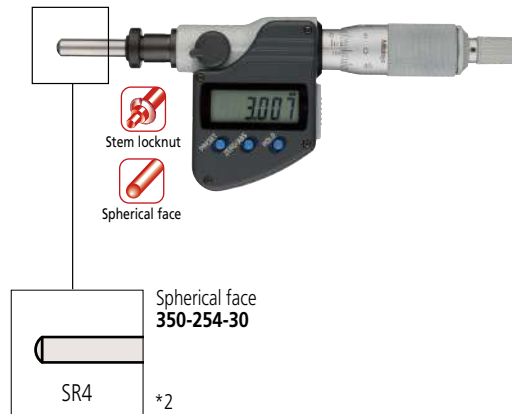


*1 Other dimensions are the same as **350-251-30**.
(): with spindle fully retracted.

Stem Locknut



• Fixture thickness: 11.5 mm
350-252-30
(Stem dia. 10 mm, for general use) Mass: 230 g



*2 Other dimensions are the same as **350-252-30**.
(): with spindle fully retracted.

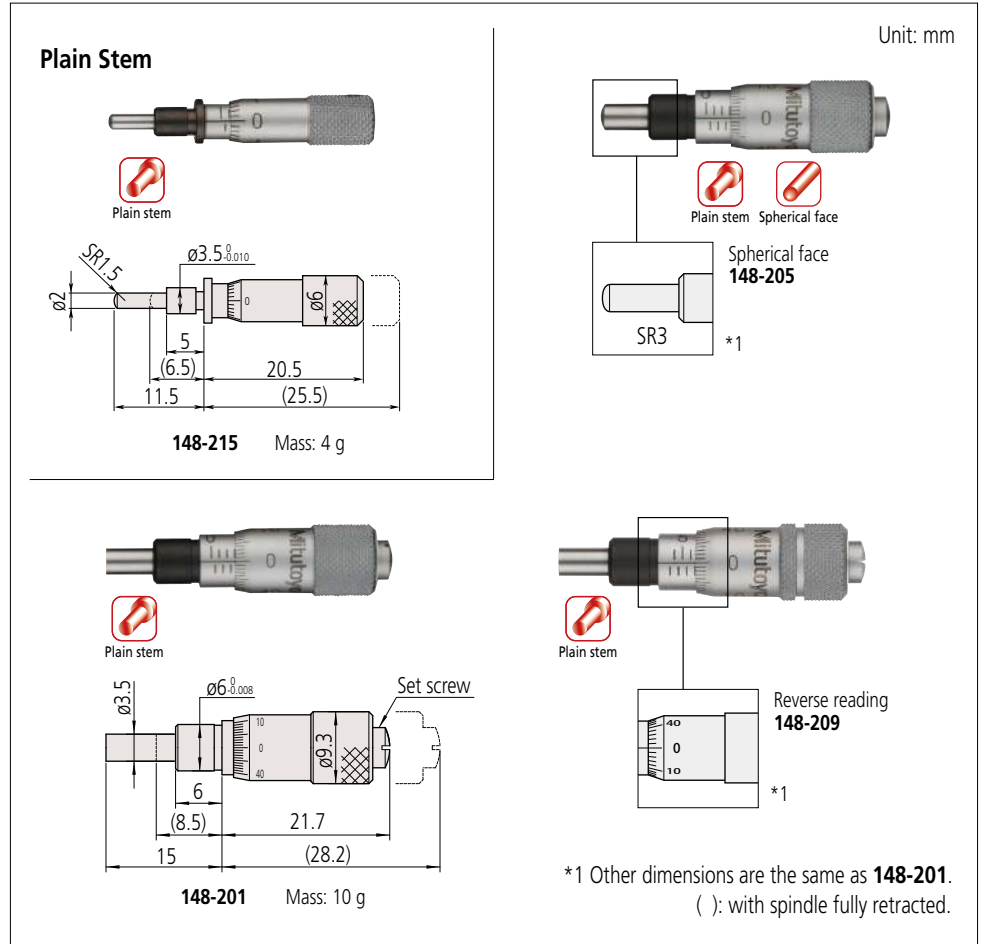
Technical Data

- Graduation: 0.02 mm (**148-215, 148-216**), 0.01 mm or 0.001 in
- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated

Micrometer Heads SERIES 148 — Small/Ultra-small Type

- Miniature micrometer heads for ease of incorporating into machines.

DIMENSIONS



SPECIFICATIONS

| Metric | | | | | | |
|----------------|-------------|----------------|-------------|-------------------|-----------------|--|
| Order No. | Stroke (mm) | Stem dia. (mm) | Stem | Spindle end | Graduation | Maximum permissible error J_{MPE} (μ m) |
| 148-215 | 5 | 3.5 | Plain | Spherical (SR1.5) | Standard | ± 5 |
| 148-216 | | | W/clamp nut | | | |
| 148-201 | 6.5 | 6 | Plain | Flat | | |
| 148-203 | | | W/clamp nut | | | |
| 148-205 | | | Plain | Spherical (SR3) | | |
| 148-207 | | | W/clamp nut | | | |
| 148-209 | 6.5 | 6 | Plain | Flat | Reverse reading | |
| 148-211 | | | W/clamp nut | | | |

| Inch | | | | | | |
|------------------|-------------|----------------|-------------|-------------------|-----------------|--|
| Order No. | Stroke (in) | Stem dia. (in) | Stem | Spindle end | Graduation | Maximum permissible error J_{MPE} (in) |
| 148-217 | 0.2 | 0.156 | Plain | Spherical (SR1.5) | Standard | ± 0.00025 |
| 148-218 | | | W/clamp nut | | | |
| 148-202 | 0.25 | 0.25 | Plain | Flat | | |
| 148-204 | | | W/clamp nut | | | |
| 148-206 | | | Plain | Spherical (SR3) | | |
| 148-208 | | | W/clamp nut | | | |
| 148-210*1 | 0.25 | 0.25 | Plain | Flat | Reverse reading | |
| 148-212*1 | | | W/clamp nut | | | |

*1 Made-to-order models

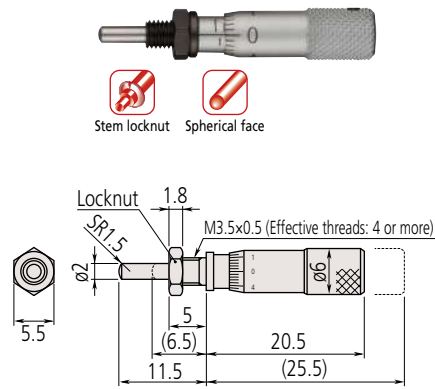
Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 148 — Small Standard Type

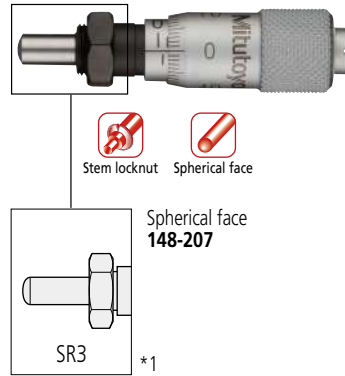
DIMENSIONS

Stem Locknut



• Fixture thickness: 3 mm
148-216 Mass: 4 g

Unit: mm

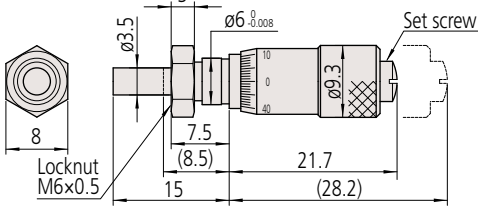


*1

Spherical face
148-207



Stem locknut



• Fixture thickness: 4 mm
148-203 Mass: 10 g



Stem locknut

Reverse reading
148-211

*1

*1 Other dimensions are the same as **148-203**.
(): with spindle fully retracted.

Micrometer Heads SERIES 148 — Short Thimble with Choice of Diameter

Technical Data

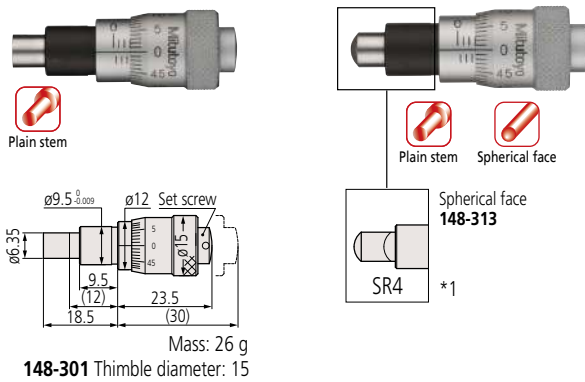
- Graduation: 0.01 mm or 0.001 in
- Spindle pitch: 0.5 mm or 0.025 in
- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated

- Short body design maintains measuring stroke for limited space applications.

- Available in three thimble diameters to provide ease-of-reading options.

DIMENSIONS

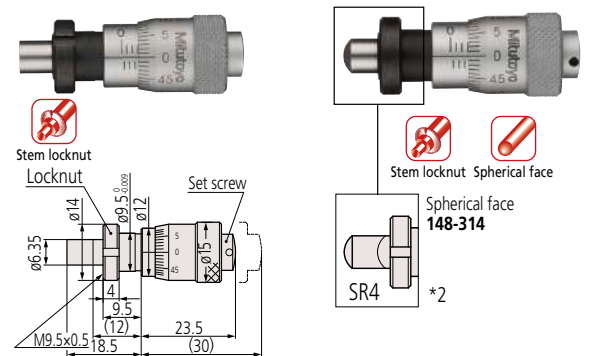
Plain Stem



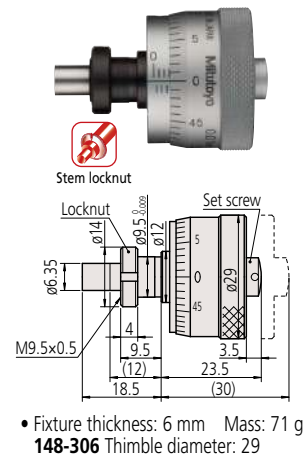
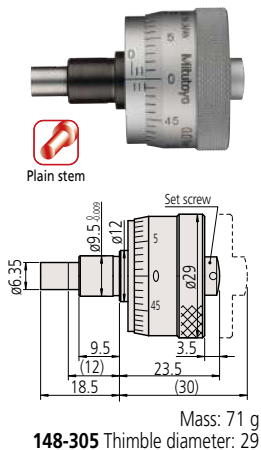
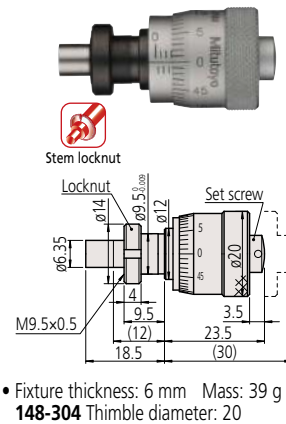
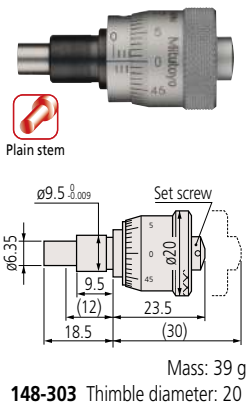
*1 Other dimensions are the same as 148-301.

Stem Locknut

Unit: mm



*2 Other dimensions are the same as 148-302.



(): with spindle fully retracted.

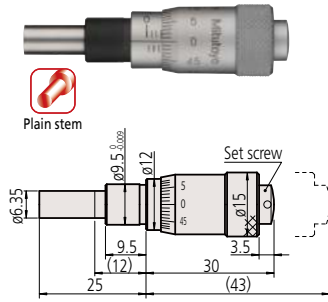
Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

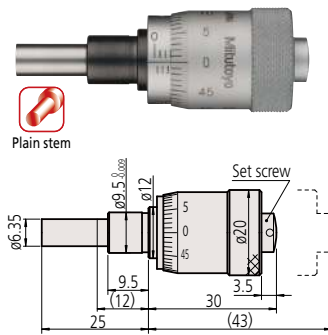
Micrometer Heads SERIES 148 — Short Thimble with Choice of Diameter

DIMENSIONS

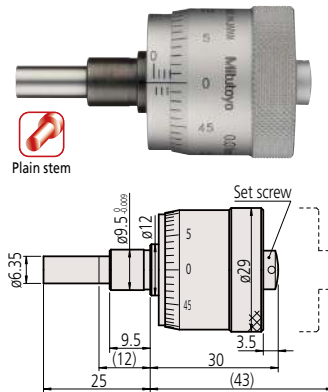
Plain Stem



Mass: 35 g
148-307 Thimble diameter: 15



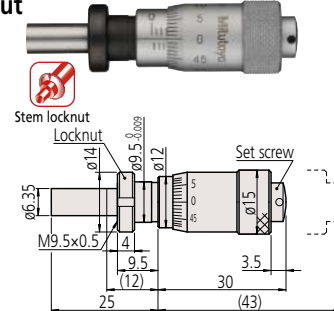
Mass: 55 g
148-309 Thimble diameter: 20



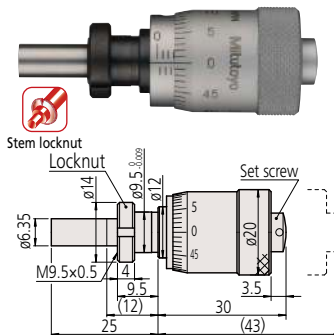
Mass: 103 g
148-311 Thimble diameter: 29

Stem Locknut

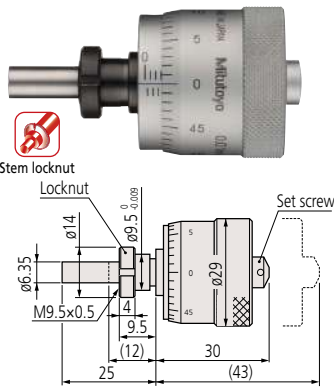
Unit: mm



• Fixture thickness: 6 mm Mass: 35 g
148-308 Thimble diameter: 15



• Fixture thickness: 6 mm Mass: 55 g
148-310 Thimble diameter: 20



• Fixture thickness: 6 mm Mass: 103 g
148-312 Thimble diameter: 29

() : with spindle fully retracted.

SPECIFICATIONS

| Metric | | | | | | |
|----------------|-------------|--|----------------|-------------|-----------------|--------------------|
| Order No. | Stroke (mm) | Maximum permissible error J_{MPE} (μ m) | Stem dia. (mm) | Stem | Spindle end | Special features |
| 148-301 | 6.5 | ± 2 | 9.5 | Plain | Flat | 15 mm thimble dia. |
| 148-302 | | | | W/clamp nut | | 20 mm thimble dia. |
| 148-303 | | | | Plain | | 29 mm thimble dia. |
| 148-304 | | | | W/clamp nut | | 15 mm thimble dia. |
| 148-305 | | | | Plain | | 20 mm thimble dia. |
| 148-306 | | | | W/clamp nut | | 29 mm thimble dia. |
| 148-313 | 13 | ± 2 | 9.5 | Plain | Spherical (SR4) | 15 mm thimble dia. |
| 148-314 | | | | W/clamp nut | | 15 mm thimble dia. |
| 148-307 | | | | Plain | | 20 mm thimble dia. |
| 148-308 | | | | W/clamp nut | | 20 mm thimble dia. |
| 148-309 | | | | Plain | | 29 mm thimble dia. |
| 148-310 | | | | W/clamp nut | | 29 mm thimble dia. |
| 148-311 | 13 | ± 2 | 9.5 | Plain | Flat | 15 mm thimble dia. |
| 148-312 | | | | W/clamp nut | | 29 mm thimble dia. |

| Inch | | | | | | |
|----------------|-------------|--|----------------|-------------|-------------|----------------------|
| Order No. | Stroke (in) | Maximum permissible error J_{MPE} (in) | Stem dia. (in) | Stem | Spindle end | Special features |
| 148-351 | 0.25 | ± 0.0001 | 0.375 | Plain | Flat | 0.59 in thimble dia. |
| 148-352 | | | | W/clamp nut | | 0.79 in thimble dia. |
| 148-353 | | | | Plain | | 1.14 in thimble dia. |
| 148-354 | | | | W/clamp nut | | 0.59 in thimble dia. |
| 148-355 | | | | Plain | | 0.79 in thimble dia. |
| 148-356 | | | | W/clamp nut | | 1.14 in thimble dia. |
| 148-357 | 0.5 | ± 0.0001 | 0.375 | Plain | Flat | 0.59 in thimble dia. |
| 148-358 | | | | W/clamp nut | | 0.79 in thimble dia. |
| 148-359 | | | | Plain | | 1.14 in thimble dia. |
| 148-360 | | | | W/clamp nut | | 0.59 in thimble dia. |
| 148-361 | | | | Plain | | 0.79 in thimble dia. |
| 148-362 | | | | W/clamp nut | | 1.14 in thimble dia. |

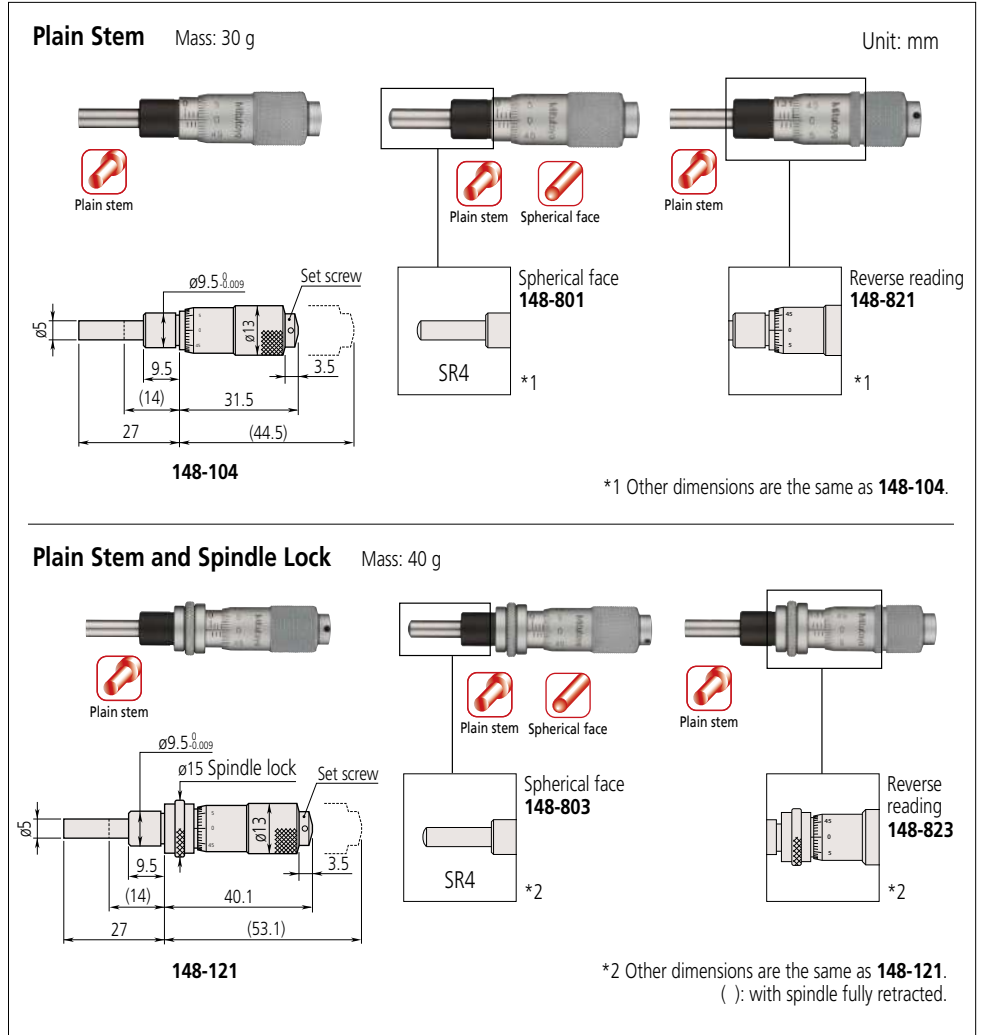
Micrometer Heads SERIES 148 — Small Standard Type

Technical Data

- Graduation: 0.01 mm or 0.001 in
- Spindle pitch: 0.5 mm or 0.025 in
- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated

- Measuring stroke of 13 mm.

DIMENSIONS



SPECIFICATIONS

| Metric | | | | | | |
|----------------|-------------|--|----------------|---------------|-----------------|---------------------|
| Order No. | Stroke (mm) | Maximum permissible error J_{MPE} (μ m) | Stem dia. (mm) | Stem | Spindle end | Graduation features |
| 148-104 | 13 | ± 2 | 9.5 | Plain | Flat | Standard |
| 148-103 | | | | W/clamp nut | | |
| 148-121 | | | | Plain*1 | | |
| 148-120 | | | | W/clamp nut*1 | Spherical (SR4) | |
| 148-801 | | | | Plain | | |
| 148-802 | | | | W/clamp nut | | |
| 148-803 | | | | Plain*1 | Flat | |
| 148-804 | | | | W/clamp nut*1 | | |
| 148-821 | | | | Plain | | |
| 148-822 | | | | W/clamp nut | Reverse reading | |
| 148-823 | | | | Plain*1 | | |
| 148-824 | | | | W/clamp nut*1 | | |

*1 With spindle lock

| Inch | | | | | | |
|-------------------|-------------|--|----------------|---------------|-----------------|---------------------|
| Order No. | Stroke (in) | Maximum permissible error J_{MPE} (in) | Stem dia. (in) | Stem | Spindle end | Graduation features |
| 148-112 | 0.5 | ± 0.0001 | 0.375 | Plain | Flat | Standard |
| 148-111 *2 | | | | W/clamp nut | | |
| 148-123 | | | | Plain*1 | | |
| 148-122 | | | | W/clamp nut*1 | Spherical (SR4) | |
| 148-811 | | | | Plain | | |
| 148-812 | | | | W/clamp nut | | |
| 148-813 | | | | Plain*1 | Flat | |
| 148-814 | | | | W/clamp nut*1 | | |
| 148-831 | | | | Plain | | |
| 148-832 | | | | W/clamp nut | Reverse reading | |
| 148-833 | | | | Plain*1 | | |
| 148-834 | | | | W/clamp nut*1 | | |

*1 With spindle lock

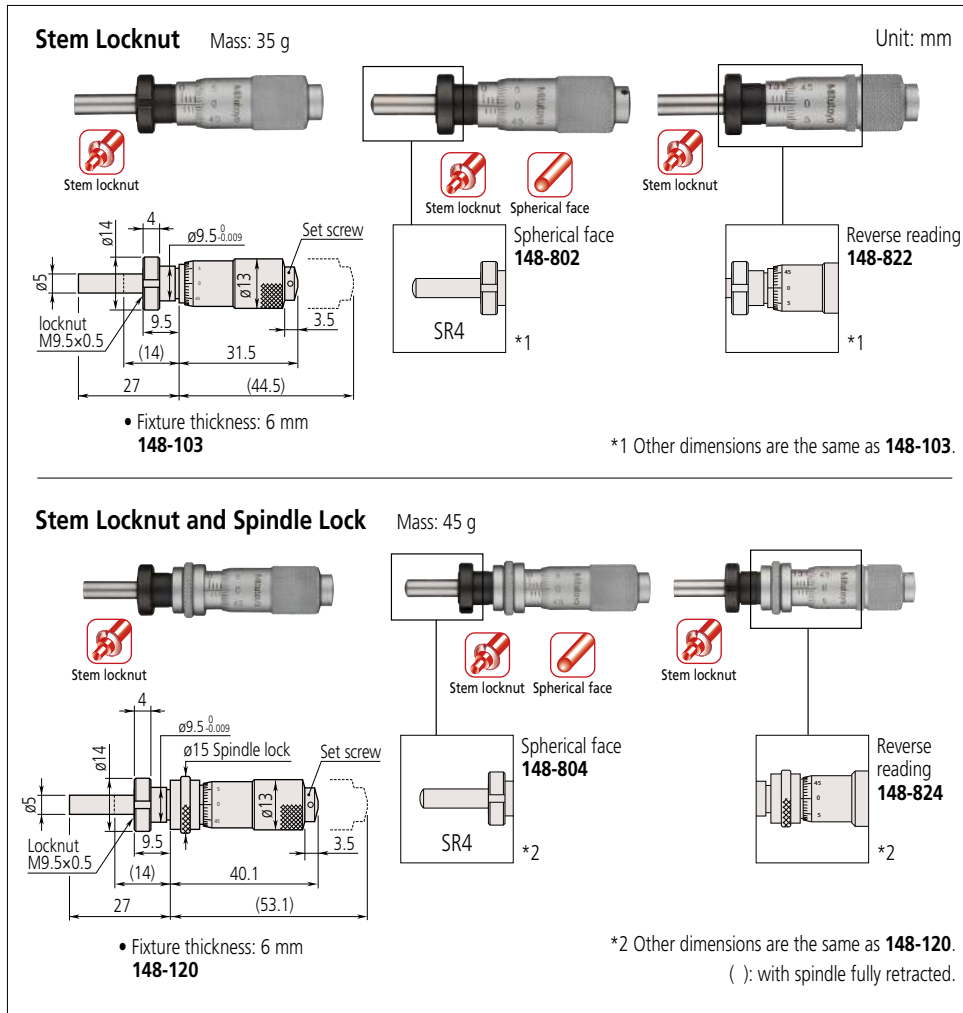
*2 Made-to-order models

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 148 — Small Standard Type

DIMENSIONS



Technical Data


- Graduation: 0.01 mm or 0.001 in
- Spindle pitch: 0.5 mm or 0.025 in
- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated

Micrometer Heads SERIES 148 — Small Thimble Diameter Standard Type



- Measuring stroke of 13 mm.
- The thimble can be set to zero at any position by loosening the setscrew.

DIMENSIONS

Plain Stem Mass: 35 g



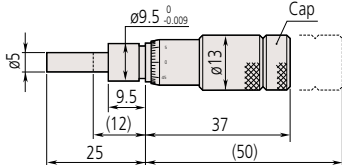
All stainless steel model

Plain stem

Plain stem Spherical face

Plain stem



148-503 148-513 All stainless steel model

Unit: mm

Spherical face
148-853


SR4 *1

Reverse reading
148-863



*1

*1 Other dimensions are the same as 148-503.

Plain Stem and Spindle Lock Mass: 35 g

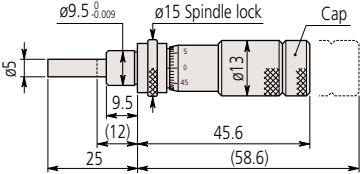


Plain stem

Plain stem Spherical face

Plain stem



148-506

Spherical face
148-856

SR4 *2

Reverse reading
148-866

*2

*2 Other dimensions are the same as 148-506.
(): with spindle fully retracted.

SPECIFICATIONS

| Metric | | | | | | | Inch | | | | | | | |
|-----------|-------------|--|----------------|---------------|-----------------|----------------------------|---------------|-------------|--|----------------|-----------------|-----------------|----------------------------|-----------------|
| Order No. | Stroke (mm) | Maximum permissible error J_{MPE} (μ m) | Stem dia. (mm) | Stem | Spindle end | Special features | Order No. | Stroke (in) | Maximum permissible error J_{MPE} (in) | Stem dia. (in) | Stem | Spindle end | Special features | |
| 148-503 | 13 | ± 2 | 9.5 | Plain | Flat | Standard | 148-501 | 0.5 | ± 0.0001 | 0.375 | Plain | Flat | Standard | |
| 148-513 | | | | | | Stainless steel throughout | 148-511*2 | | | | | | Stainless steel throughout | |
| 148-508 | | | | W/clamp nut | Spherical (SR4) | Standard | W/clamp nut | | | | 148-507*2 | W/clamp nut | Spherical (SR4) | Standard |
| 148-506 | | | | Plain*1 | | | 148-505 | | | | Plain*1 | | | |
| 148-504 | | | | W/clamp nut*1 | Flat | Reverse reading | W/clamp nut*1 | | | | 148-502 | W/clamp nut*1 | Flat | Reverse reading |
| 148-503 | | | | Plain | | | 148-851 | | | | Plain | | | |
| 148-854 | | | | W/clamp nut*1 | Spherical (SR4) | Standard | W/clamp nut*1 | | | | 148-852 | W/clamp nut*1 | Spherical (SR4) | Standard |
| 148-863 | | | | Plain | | | 148-861 | | | | Plain | | | |
| 148-864 | | | | W/clamp nut*1 | Flat | Stainless steel throughout | W/clamp nut*1 | | | | 148-861 | W/clamp nut*1 | Flat | Reverse reading |
| 148-518*2 | | | | W/clamp nut | | | 148-862 | | | | W/clamp nut*1 | | | |
| 148-858*2 | | | | W/clamp nut | Spherical (SR4) | Standard | W/clamp nut | | | | Spherical (SR4) | W/clamp nut | Spherical (SR4) | Standard |
| 148-866*2 | | | | Plain*1 | | | Flat | | | | | Reverse reading | | |
| 148-856*2 | | | | Plain*1 | Spherical (SR4) | Standard | Plain*1 | | | | Spherical (SR4) | Plain | Flat | Reverse reading |
| 148-868*2 | | | | W/clamp nut | | | Flat | | | | | Reverse reading | | |

*1 With spindle lock *2 Made-to-order models

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 148 — Small Thimble Diameter Standard Type

DIMENSIONS

Stem Locknut Mass: 40 g Unit: mm

All stainless steel model

Stem locknut

Stem locknut Spherical face

Stem locknut

Spherical face
148-858
SR4 *1

Reverse reading
148-868
*1

• Fixture thickness: 6 mm
148-508 148-518 All stainless steel model

*1 Other dimensions are the same as **148-508**.

Stem Locknut and Spindle Lock Mass: 40 g

Stem locknut

Stem locknut Spherical face

Stem locknut

Spherical face
148-854
SR4 *2

Reverse reading
148-864
*2

• Fixture thickness: 6 mm
148-504

*2 Other dimensions are the same as **148-504**.
() : with spindle fully retracted.

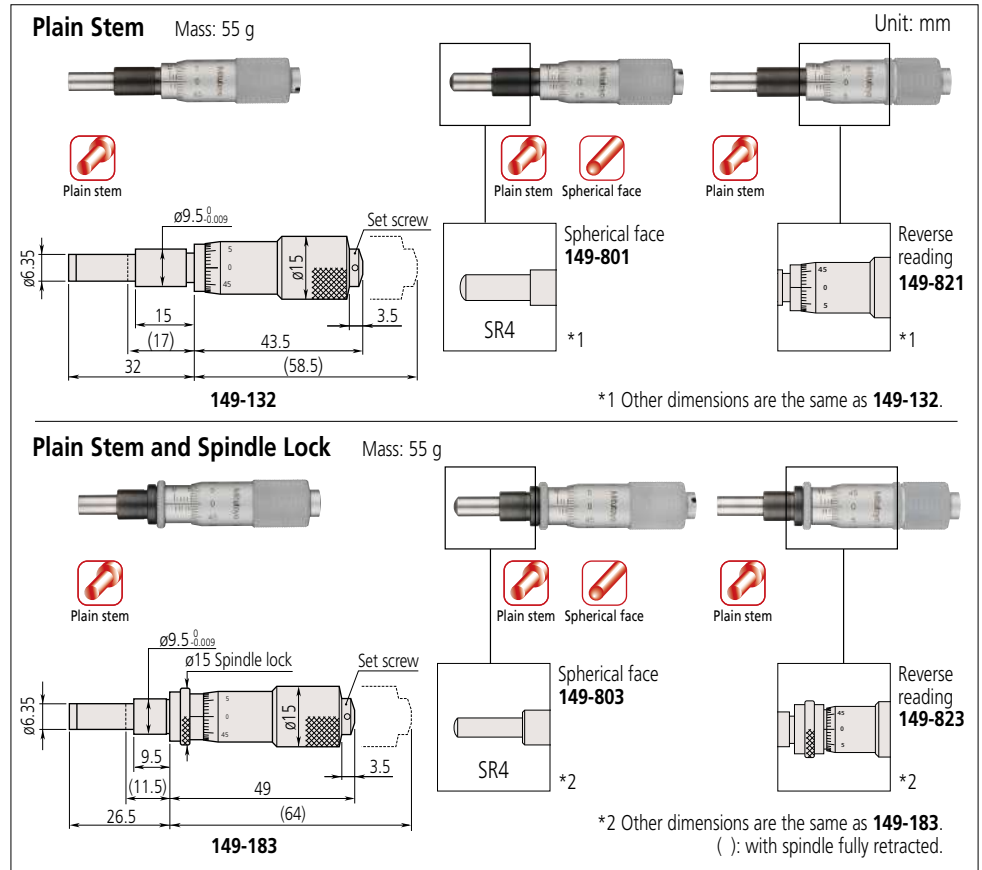
Technical Data

- Graduation: 0.01 mm or 0.001 in
- Spindle pitch: 0.5 mm or 0.025 in
- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
Satin-chrome plated

Micrometer Heads SERIES 149 — Small Standard Type with Carbide-Tipped Spindle

- Carbide-tipped spindle provides high abrasion resistance.

DIMENSIONS



SPECIFICATIONS

Metric

| Order No. | Stroke (mm) | Maximum permissible error J_{MPE} (μm) | Stem dia. (mm) | Stem | Spindle end | Graduation features |
|-------------------------------|-------------|---|----------------|---------------------------|-------------------------------|---------------------|
| 149-132 | 15 | ± 2 | 9.5 | Plain | Flat (carbide tip) | Standard |
| 149-131 | | | | W/clamp nut | | |
| 149-183 | | | | Plain* ¹ | | |
| 149-184 | | | | W/clamp nut* ¹ | | |
| 149-801 | | | | Plain | Spherical (SR4) (carbide tip) | Standard |
| 149-802 | | | | W/clamp nut | | |
| 149-821 | | | | Plain | Flat (carbide tip) | Reverse reading |
| 149-822 | | | | W/clamp nut | | |
| 149-803 * ² | | | | Plain* ¹ | Spherical (SR4) (carbide tip) | Standard |
| 149-804 * ² | | | | W/clamp nut* ¹ | | |
| 149-823 * ² | | | | Plain* ¹ | Flat (carbide tip) | Reverse reading |
| 149-824 * ² | | | | W/clamp nut* ¹ | | |

*1 With spindle lock *2 Made-to-order models

Inch

| Order No. | Stroke (in) | Maximum permissible error J_{MPE} (in) | Stem dia. (in) | Stem | Spindle end | Graduation features |
|-------------------------------|-------------|--|----------------|---------------------------|-------------------------------|---------------------|
| 149-148 | 0.5 | ± 0.0001 | 0.375 | Plain | Flat (carbide tip) | Standard |
| 149-147 | | | | W/clamp nut | | |
| 149-185 * ³ | | | | Plain* ¹ | | |
| 149-182 | | | | W/clamp nut* ¹ | | |
| 149-811 | | | | Plain | Spherical (SR4) (carbide tip) | Standard |
| 149-812 | | | | W/clamp nut | | |
| 149-831 * ² | | | | Plain | Flat (carbide tip) | Reverse reading |
| 149-832 * ² | | | | W/clamp nut | | |
| 149-181 * ² | | | | Plain* ¹ | Flat (carbide tip) | Standard |
| | | | | W/clamp nut* ¹ | | |

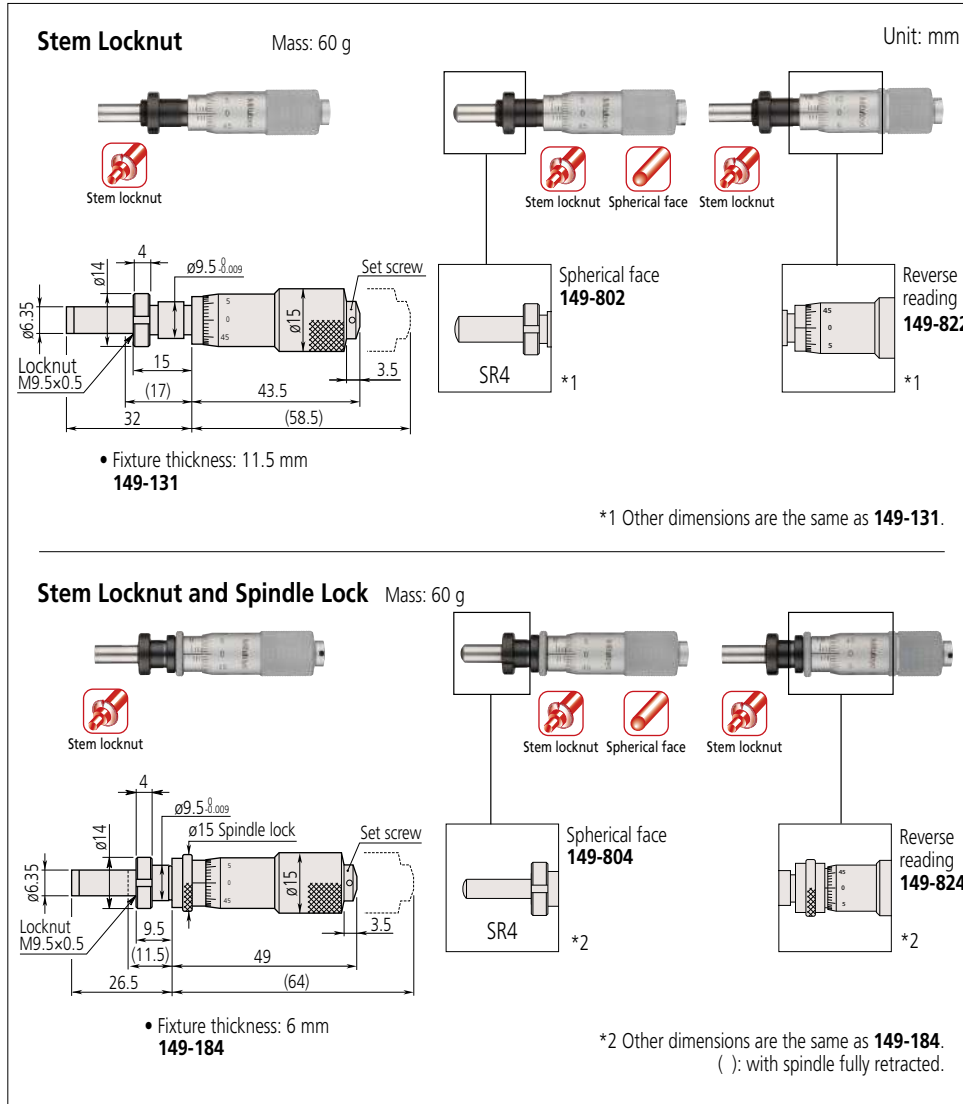
*1 With spindle lock *2 Made-to-order models *3 W/ratchet (**149-181**) is available

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 149 — Small Standard Type with Carbide-Tipped Spindle

DIMENSIONS



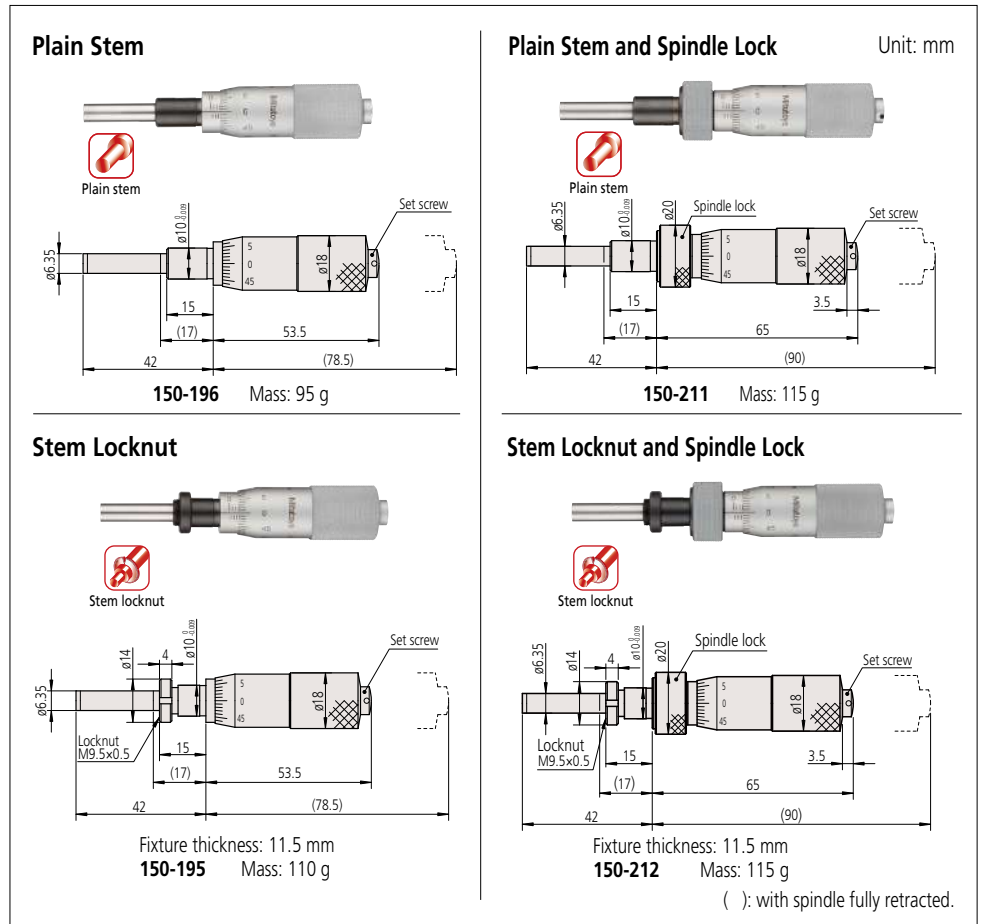
Micrometer Heads SERIES 150 — Medium-sized Standard Type

Technical Data

- Graduation: 0.01 mm, 0.001 mm (w/vernier), 0.001 in or 0.0001 in (w/vernier)
- Spindle pitch: 0.5 mm or 0.025 in
- Measuring face
Material: Carbide
(Only long spindle model is carbide tipped)
Hardness: 90 HRA or more
(Only long spindle model is 60 HRC or more)
Lapped
- Scale finishing:
Satin-chrome plated

- Measuring stroke of 25 mm.

DIMENSIONS



SPECIFICATIONS

| Metric | | | | | | |
|-----------|-------------|---|----------------|---------------|-------------------------------|------------------|
| Order No. | Stroke (mm) | Maximum permissible error J_{MPE} (μm) | Stem dia. (mm) | Stem | Spindle end | Special features |
| 150-192 | 25 | ± 2 | 10 | Plain | Flat (carbide tip) | Standard |
| 150-191 | | | | W/clamp nut | | |
| 150-209 | | | | Plain*1 | | |
| 150-210 | | | | W/clamp nut*1 | | |
| 150-801 | | | | Plain | Spherical (SR4) (carbide tip) | |
| 150-802 | | | | W/clamp nut | | |
| 150-821 | | | | Plain | Reverse reading | |
| 150-822 | | | | W/clamp nut | | |
| 150-190 | | | | Plain | | |
| 150-189 | | | | W/clamp nut | W/vernier (0.001 mm) | |
| 150-183*2 | | | | Plain*1 | | |
| 150-184 | | | | W/clamp nut*1 | | |
| 150-196 | | | | Plain | | |
| 150-195 | | | | W/clamp nut | W/o ratchet stop | |
| 150-211 | | | | Plain*1 | | |
| 150-212 | | | | W/clamp nut*1 | | |
| 150-219 | | | | Plain | Flat | Long spindle |
| 150-220 | | | | W/clamp nut | | |
| 150-803*2 | | | | Plain*1 | Spherical (SR4) (carbide tip) | Standard |
| 150-804*2 | | | | W/clamp nut*1 | | |
| 150-823*2 | | | | Plain*1 | Flat (carbide tip) | Reverse reading |
| 150-824*2 | | | | W/clamp nut*1 | | |
| 150-223*2 | | | | Plain*1 | Flat | Long spindle |
| 150-224*2 | | | | W/clamp nut*1 | | |

*1 With spindle lock *2 Made-to-order models

| Inch | | | | | | | |
|-----------|-------------|--|----------------|---------------|-------------------------------|------------------|--|
| Order No. | Stroke (in) | Maximum permissible error J_{MPE} (in) | Stem dia. (in) | Stem | Spindle end | Special features | |
| 150-208 | 1 | ± 0.0001 | 0.375 | Plain | Flat (carbide tip) | Standard | |
| 150-207 | | | | W/clamp nut | | | |
| 150-213*2 | | | | Plain*1 | | | |
| 150-214*2 | | | | W/clamp nut*1 | | | |
| 150-811 | | | | Plain | Spherical (SR4) (carbide tip) | | |
| 150-812 | | | | W/clamp nut | | | |
| 150-831 | | | | Plain | Reverse graduation | | |
| 150-832 | | | | W/clamp nut | | | |
| 150-206 | | | | Plain | | | |
| 150-205*2 | | | | W/clamp nut | W/vernier (0.0001 in) | | |
| 150-215*2 | | | | Plain*1 | | | |
| 150-216*2 | | | | W/clamp nut*1 | | | |
| 150-198 | | | | Plain | | | |
| 150-197 | | | | W/clamp nut | W/o ratchet stop | | |
| 150-217*2 | | | | Plain*1 | | | |
| 150-218*2 | | | | W/clamp nut*1 | | | |
| 150-221*2 | | | | Plain | Flat | Long spindle | |
| 150-222*2 | | | | W/clamp nut | | | |

*1 With spindle lock *2 Made-to-order models

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

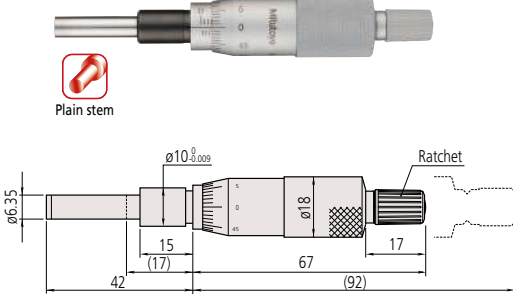
Micrometer Heads SERIES 150 — Medium-sized Standard Type

DIMENSIONS

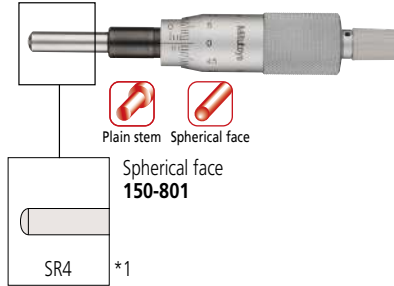
Plain Stem

Mass: 95 g

(): with spindle fully retracted. Unit: mm

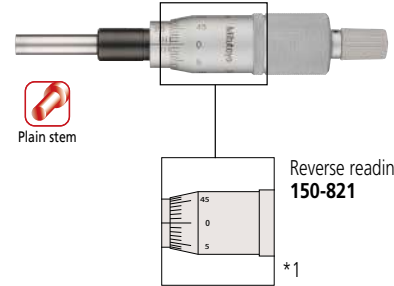


150-192



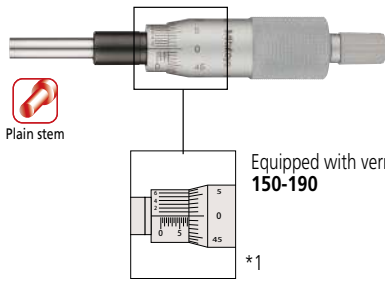
Spherical face
150-801

SR4 *1



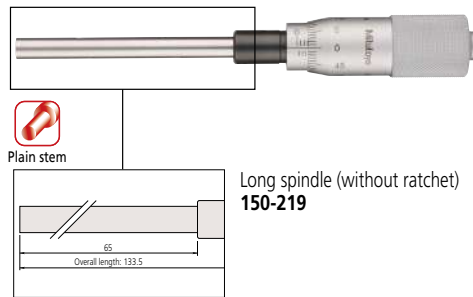
Reverse reading
150-821

*1



Equipped with vernier scale
150-190

*1

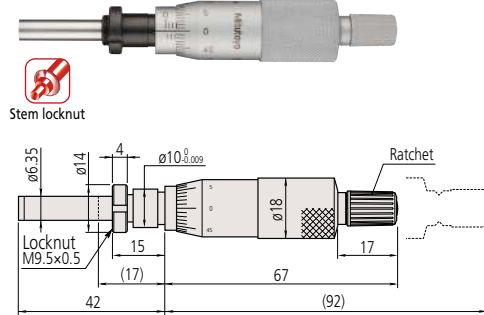


Long spindle (without ratchet)
150-219

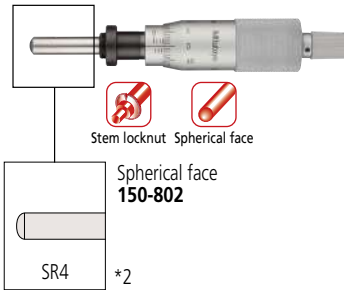
*1 Other dimensions are the same as 150-192.

Stem Locknut

Mass: 100 g

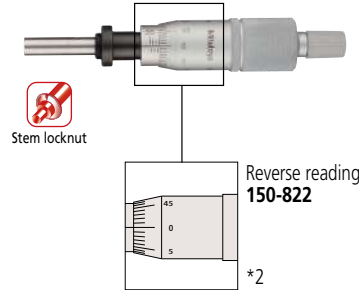


• Fixture thickness: 11.5 mm
150-191



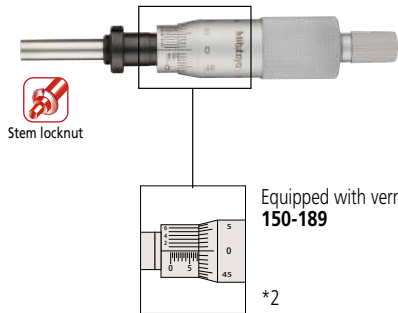
Spherical face
150-802

SR4 *2



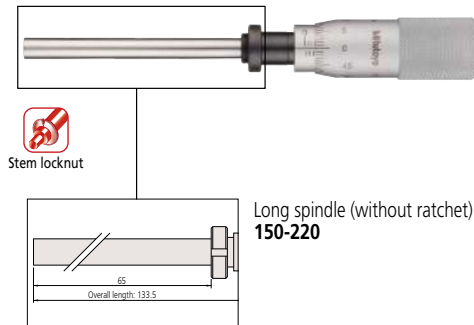
Reverse reading
150-822

*2



Equipped with vernier scale
150-189

*2



Long spindle (without ratchet)
150-220

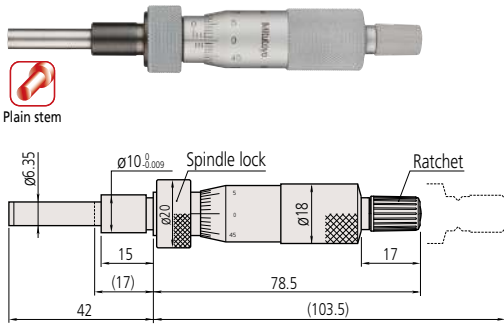
*2 Other dimensions are the same as 150-191.

Micrometer Heads SERIES 150 — Medium-sized Standard Type

DIMENSIONS

Plain Stem and Spindle Lock Mass: 110 g

() : with spindle fully retracted. Unit: mm



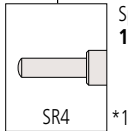
150-209



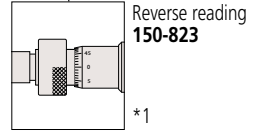
Plain stem



Plain stem Spherical face
150-803



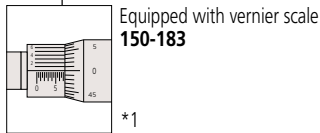
Plain stem



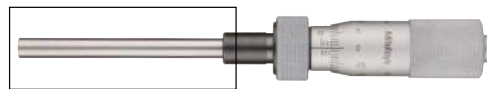
Reverse reading
150-823



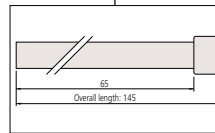
Plain stem



Equipped with vernier scale
150-183



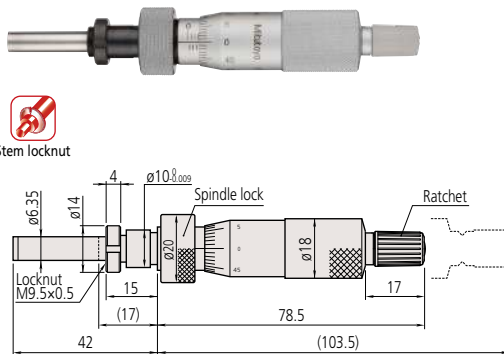
Plain stem



Long spindle (without ratchet)
150-223

*1 Other dimensions are the same as 150-209.

Stem Locknut and Spindle Lock Mass: 115 g



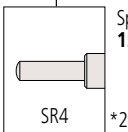
• Fixture thickness: 11.5 mm
150-210



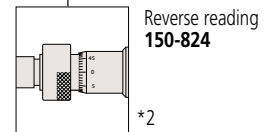
Stem locknut



Stem locknut Spherical face
150-804



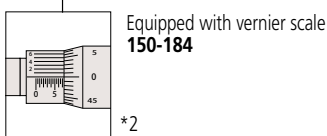
Stem locknut



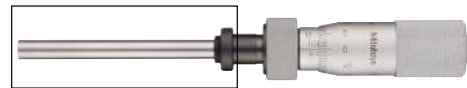
Reverse reading
150-824



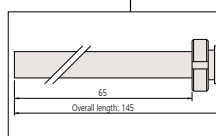
Stem locknut



Equipped with vernier scale
150-184



Stem locknut



Long spindle (without ratchet)
150-224

*2 Other dimensions are the same as 150-210.

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads

SERIES 151 — Medium-sized Standard Type with 8 mm Diameter Spindle

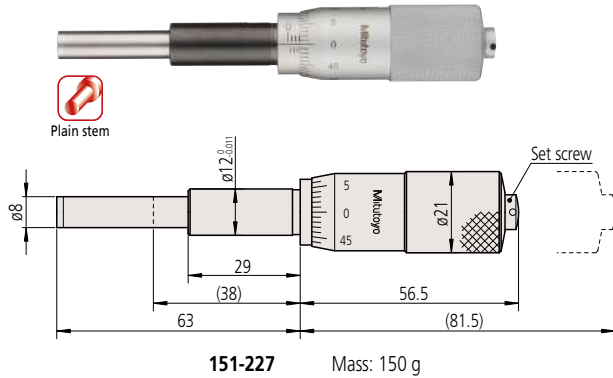
- Larger spindle ($\varnothing 8$ mm) for heavy-duty applications (normally $\varnothing 6.35$ mm).

Technical Data

- Graduation: 0.01 mm, 0.001 mm (w/vernier), 0.001 in or 0.0001 in (w/vernier)
- Spindle pitch: 0.5 mm or 0.025 in
- Measuring face Material: Carbide Hardness: 90 HRA or more Lapped
- Scale finishing: Satin-chrome plated

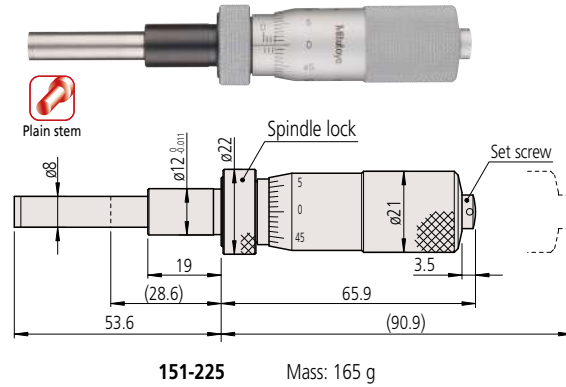
DIMENSIONS

Plain Stem

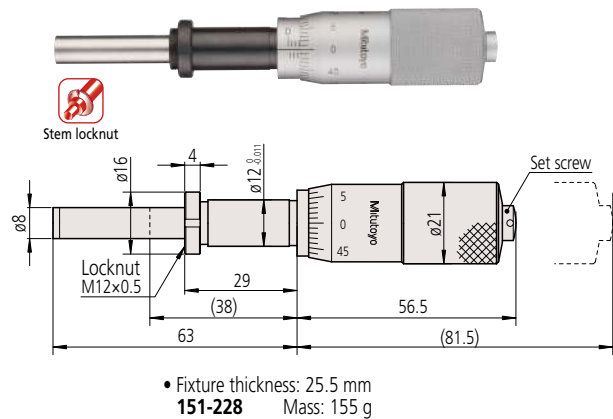


Plain Stem and Spindle Lock

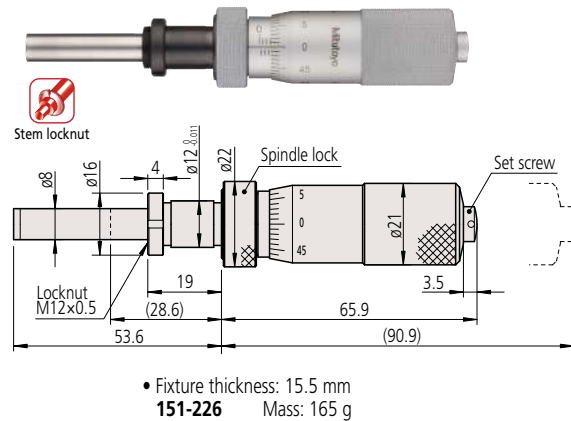
Unit: mm



Stem Locknut



Stem Locknut and Spindle Lock



(): with spindle fully retracted.

SPECIFICATIONS

| Metric | | | | | | | | | | | |
|-----------|-------------|--|----------------|---------------|--------------------|----------------------|---------|----|-------------|--------------------|------------------|
| Order No. | Stroke (mm) | Maximum permissible error J_{MPE} (μ m) | Stem dia. (mm) | Stem | Spindle end | Special features | | | | | |
| 151-224 | 25 | ± 2 | 12 | Plain | Flat (carbide tip) | W/vernier (0.001 mm) | | | | | |
| 151-223 | | | | W/clamp nut | | | | | | | |
| 151-214*2 | | | | Plain*1 | | | | | | | |
| 151-213*2 | | | | W/clamp nut*1 | | | | | | | |
| 151-222 | | | | Plain | | | | | | | |
| 151-221 | | | | W/clamp nut | | | | | | | |
| 151-212*2 | | | | Plain*1 | | | | | | | |
| 151-211*2 | | | | W/clamp nut*1 | | | | | | | |
| 151-227 | | | | Plain | | | | | | | |
| 151-228 | | | | W/clamp nut | | | | | | | |
| 151-225 | | | | Plain*1 | | | | | | | |
| 151-226 | | | | W/clamp nut*1 | | | | | | | |
| 151-256 | | | | 50 | | | ± 4 | 12 | Plain | Flat (carbide tip) | W/o ratchet stop |
| 151-255 | | | | | | | | | W/clamp nut | | |
| 151-260 | Plain | | | | | | | | | | |
| 151-259 | W/clamp nut | | | | | | | | | | |

*1 With spindle lock *2 Made-to-order models

| Inch | | | | | | | | | | | |
|-----------|---------------|--|----------------|---------------|--------------------|------------------|--------------|-----|-------------|--------------------|------------------------------|
| Order No. | Stroke (in) | Maximum permissible error J_{MPE} (in) | Stem dia. (in) | Stem | Spindle end | Special features | | | | | |
| 151-240 | 0.1 | ± 0.0001 | 0.5 | Plain | Flat (carbide tip) | W/o ratchet stop | | | | | |
| 151-239 | | | | W/clamp nut | | | | | | | |
| 151-238 | | | | Plain | | | | | | | |
| 151-237 | | | | W/clamp nut | | | | | | | |
| 151-241*2 | | | | Plain*1 | | | | | | | |
| 151-242*2 | | | | W/clamp nut*1 | | | | | | | |
| 151-243*2 | | | | Plain*1 | | | | | | | |
| 151-244*2 | | | | W/clamp nut*1 | | | | | | | |
| 151-272 | | | | Plain | | | | | | | |
| 151-271 | | | | W/clamp nut | | | | | | | |
| 151-240 | | | | 0.2 | | | ± 0.0002 | 0.5 | Plain | Flat (carbide tip) | W/o ratchet stop (0.0001 in) |
| 151-239 | | | | | | | | | W/clamp nut | | |
| 151-238 | | | | | | | | | Plain | | |
| 151-237 | | | | | | | | | W/clamp nut | | |
| 151-241*2 | Plain*1 | | | | | | | | | | |
| 151-242*2 | W/clamp nut*1 | | | | | | | | | | |

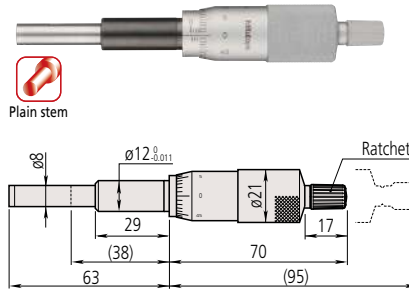
*1 With spindle lock *2 Made-to-order models

Micrometer Heads

SERIES 151 — Medium-sized Standard Type with 8 mm Diameter Spindle

DIMENSIONS

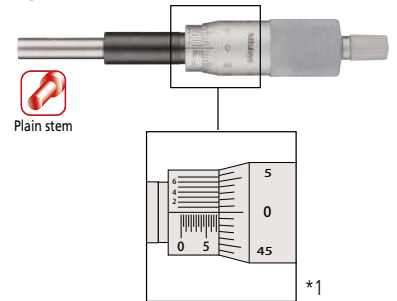
Plain Stem



151-224 Mass: 150 g

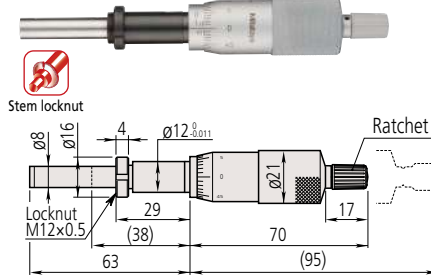
Equipped with vernier scale 151-222

Unit: mm



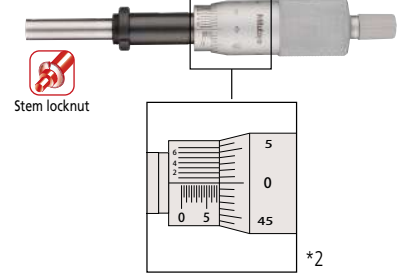
*1 Other dimensions are the same as **151-224**.

Stem Locknut



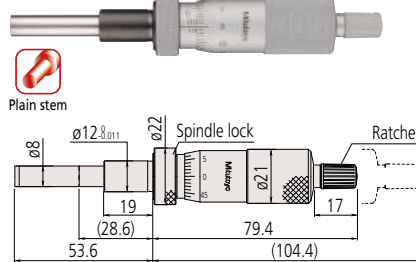
• Fixture thickness: 25.5 mm
151-223 Mass: 155 g

Equipped with vernier scale 151-221



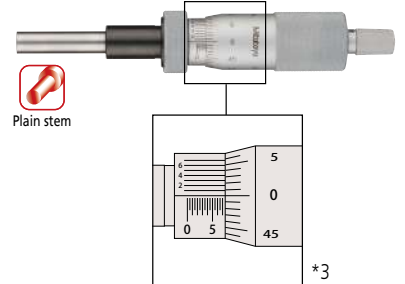
*2 Other dimensions are the same as **151-223**.

Stem Locknut and Spindle Lock



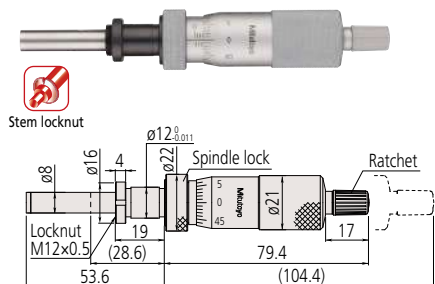
151-214 Mass: 160 g

Equipped with vernier scale 151-212



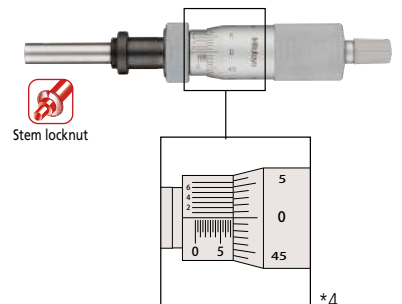
*3 Other dimensions are the same as **151-214**.

Stem Locknut and Spindle Lock



• Fixture thickness: 15.5 mm
151-213 Mass: 165 g

Equipped with vernier scale 151-211



*4 Other dimensions are the same as **151-213**.
(): with spindle fully retracted.

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

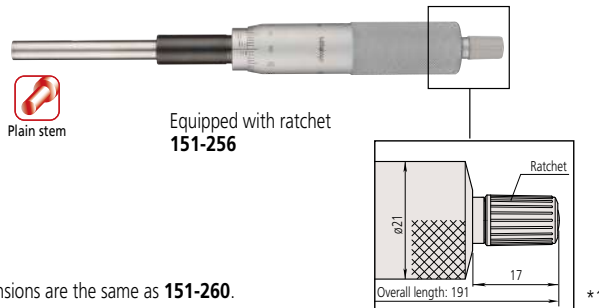
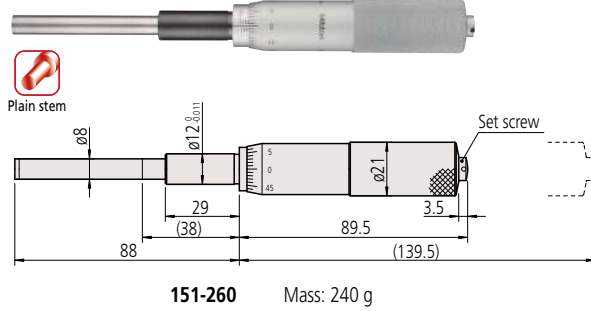
Micrometer Heads

SERIES 151 — Medium-sized Standard Type with 8 mm Diameter Spindle

DIMENSIONS

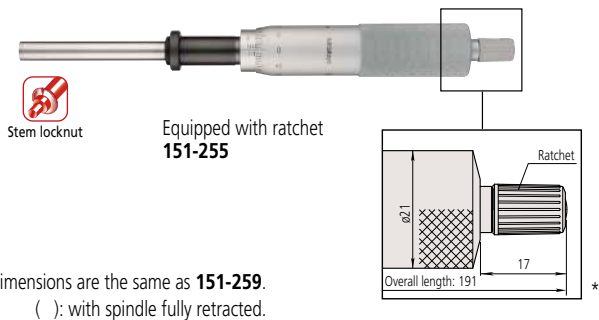
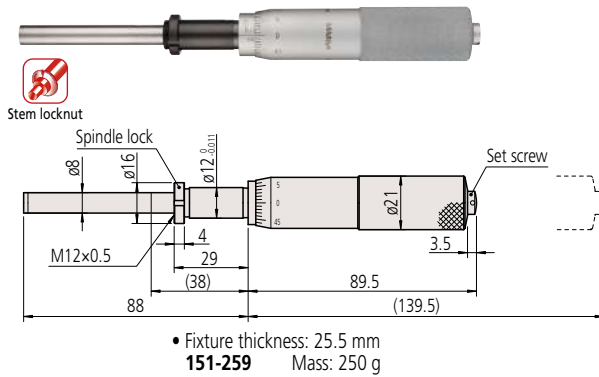
Plain Stem

Unit: mm



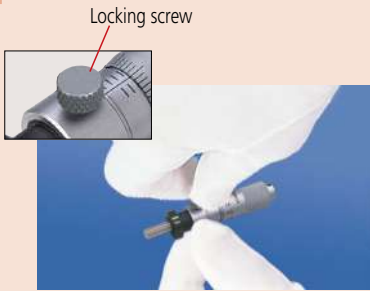
*1 Other dimensions are the same as **151-260**.

Stem Locknut



*2 Other dimensions are the same as **151-259**.
(): with spindle fully retracted.

Micrometer Heads SERIES 148 — Locking-screw Type



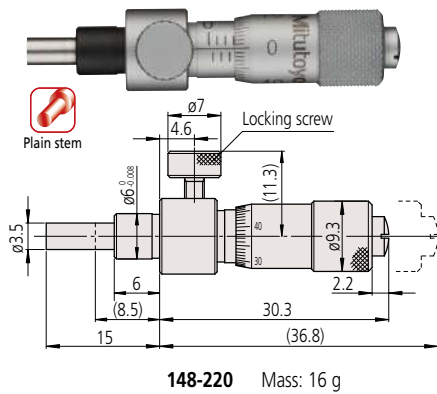
Locking screw

Secure spindle

- Locking screw provides secure locking at any position of the spindle.
- Position of the locking screw is the same as the sleeve index line.

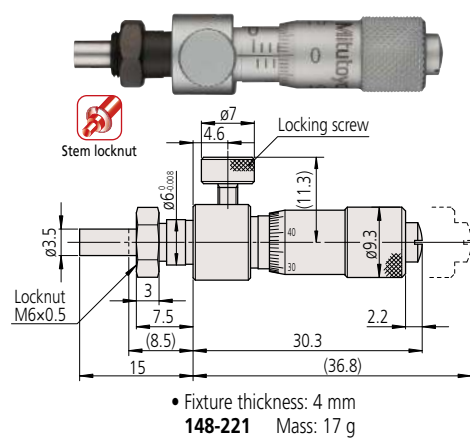
DIMENSIONS

Plain Stem



148-220 Mass: 16 g

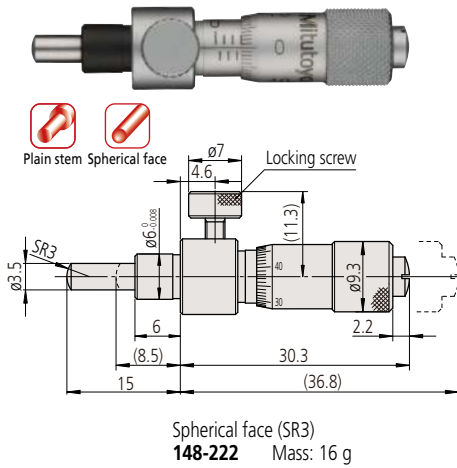
Stem Locknut



• Fixture thickness: 4 mm
148-221 Mass: 17 g

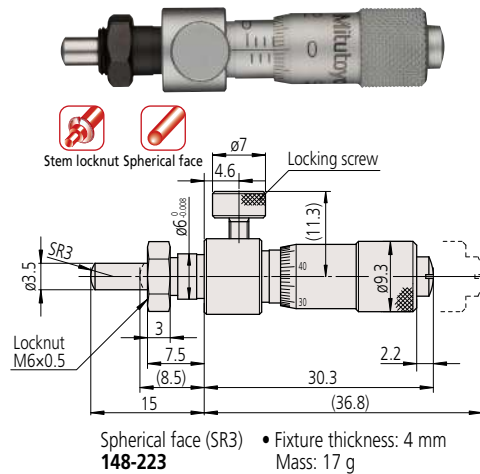
Unit: mm

Plain Stem



Spherical face (SR3)
148-222 Mass: 16 g

Stem Locknut



Spherical face (SR3) • Fixture thickness: 4 mm
148-223 Mass: 17 g

(): with spindle fully retracted.

SPECIFICATIONS

| Metric | | | | | | | | | |
|-----------|-------------|-----------------|----------------|-------------|-----------------|---------------------|--|----------|---------|
| Order No. | Stroke (mm) | Graduation (mm) | Stem dia. (mm) | Stem | Spindle end | Graduation features | Maximum permissible error J_{MPE} (μ m) | | |
| 148-220 | 6.5 | 0.01 | 6 | Plain | Flat | Standard | ± 5 | | |
| 148-221 | | | | W/clamp nut | | | | | |
| 148-222 | | | | Plain | Spherical (SR3) | | | | |
| 148-223 | W/clamp nut | | | | | | | | |
| 148-150 | 13 | 0.01 | 9.5 | Plain | Flat | | | Standard | ± 2 |
| 148-151 | | | | W/clamp nut | | | | | |
| 148-152 | | | | Plain | Spherical (SR4) | | | | |
| 148-153 | W/clamp nut | | | | | | | | |
| 148-316 | 6.5 | 0.01 | 9.5 | Plain | Flat | Standard | ± 2 | | |
| 148-317 | | | | W/clamp nut | | | | | |
| 148-318 | | | | Plain | Spherical (SR4) | | | | |
| 148-319 | W/clamp nut | | | | | | | | |

| Inch | | | | | | | | | |
|-----------|-------------|-----------------|----------------|-------------|-----------------|---------------------|--|----------|--------------|
| Order No. | Stroke (in) | Graduation (in) | Stem dia. (in) | Stem | Spindle end | Graduation features | Maximum permissible error J_{MPE} (in) | | |
| 148-230 | 0.25 | 0.001 | 0.25 | Plain | Flat | Standard | ± 0.00025 | | |
| 148-231 | | | | W/clamp nut | | | | | |
| 148-232 | | | | Plain | Spherical (SR3) | | | | |
| 148-233 | W/clamp nut | | | | | | | | |
| 148-160 | 0.5 | 0.001 | 0.375 | Plain | Flat | | | Standard | ± 0.0001 |
| 148-161 | | | | W/clamp nut | | | | | |
| 148-162 | | | | Plain | Spherical (SR4) | | | | |
| 148-163 | W/clamp nut | | | | | | | | |
| 148-326 | 0.25 | 0.001 | 0.375 | Plain | Flat | Standard | ± 0.0001 | | |
| 148-327 | | | | W/clamp nut | | | | | |
| 148-328 | | | | Plain | Spherical (SR4) | | | | |
| 148-329 | W/clamp nut | | | | | | | | |

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 148 — Locking-screw Type

Technical Data

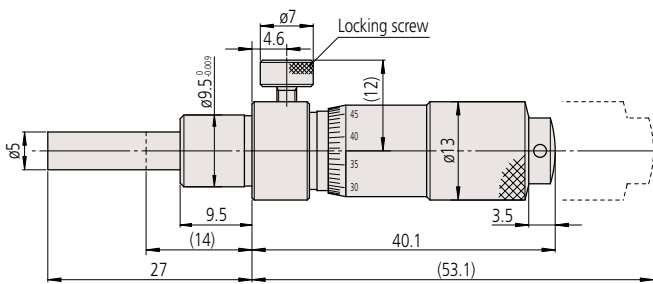
- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated

DIMENSIONS

Plain Stem



Plain stem



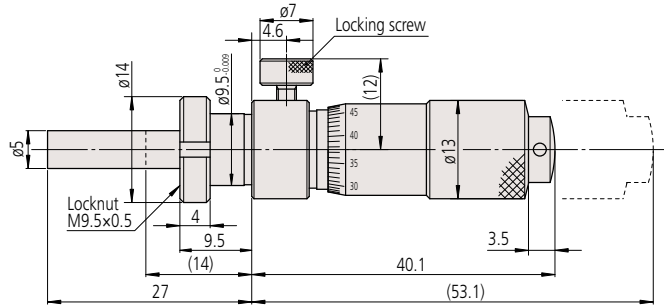
148-150 Mass: 40 g

Stem Locknut

Unit: mm



Stem locknut



• Fixture thickness: 6 mm
148-151 Mass: 43 g

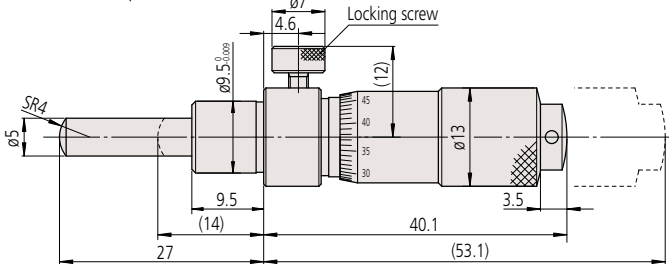
Plain Stem



Plain stem



Spherical face



Spherical face (SR4)
148-152 Mass: 40 g

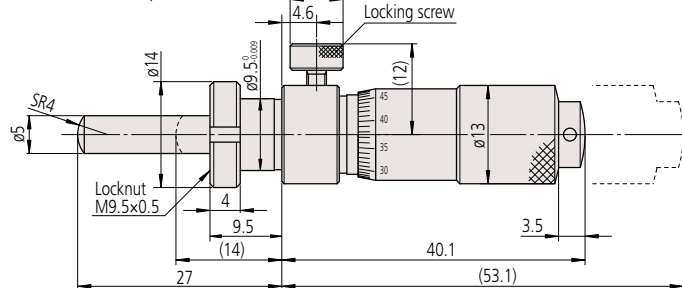
Stem Locknut



Stem locknut



Spherical face



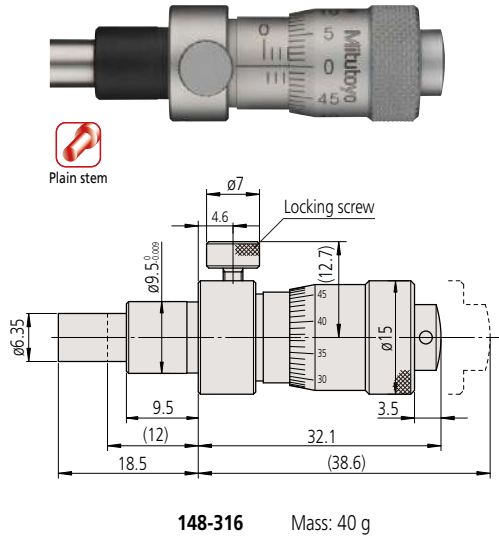
Spherical face (SR4) • Fixture thickness: 6 mm
148-153 Mass: 43 g

() : with spindle fully retracted.

Micrometer Heads SERIES 148 — Locking-screw Type

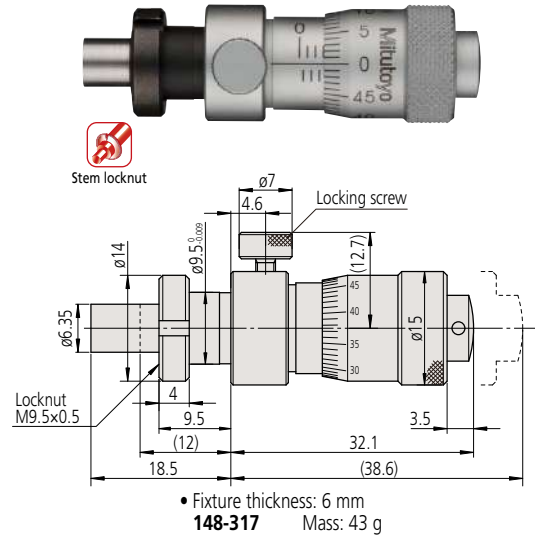
DIMENSIONS

Plain Stem

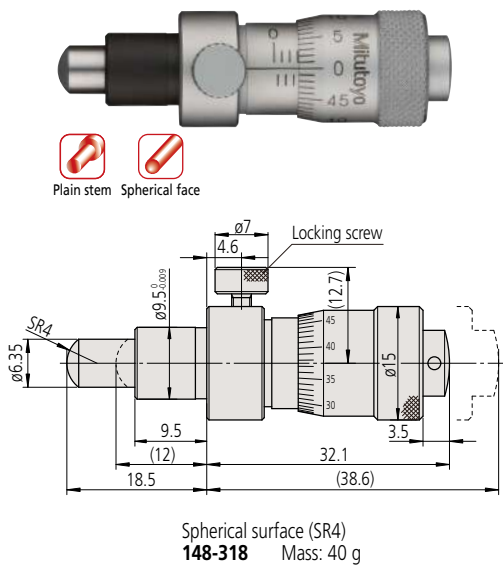


Stem Locknut

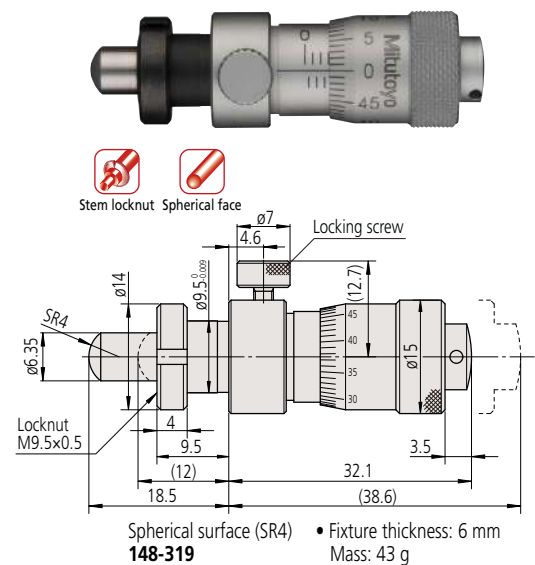
Unit: mm



Plain Stem



Stem Locknut



(): with spindle fully retracted.

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads

SERIES 153 — Non-rotating Spindle Type

- Micrometer head with non-rotating spindle.
- Torsion-free feed reduces workpiece deformation and wear.

Technical Data

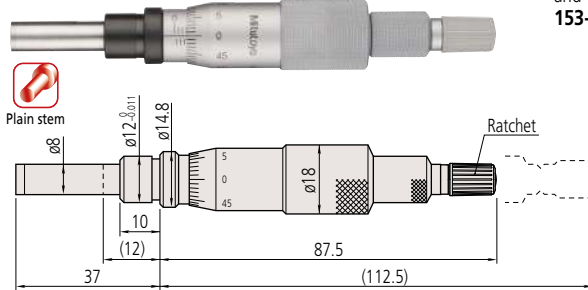
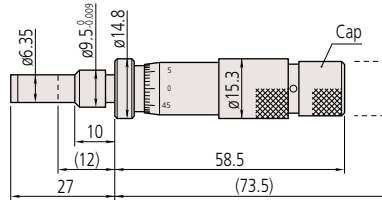
- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
Satin-chrome plated

DIMENSIONS

Unit: mm

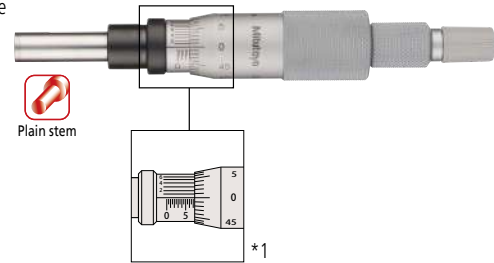


153-101 Mass: 70 g

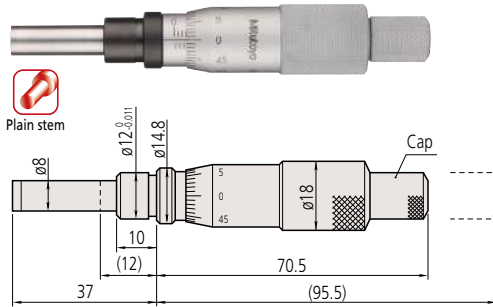


153-201 Mass: 125 g

Equipped with ratchet and vernier scale
153-202

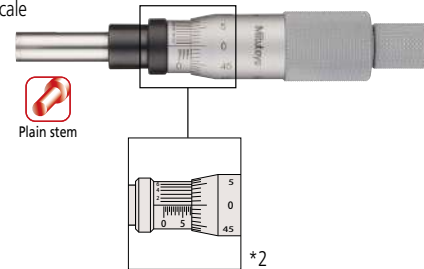


*1 Other dimensions are the same as **153-201**.



153-203 Mass: 125 g

Without ratchet / Equipped with vernier scale
153-204



*2 Other dimensions are the same as **153-203**.
(): with spindle fully retracted.

SPECIFICATIONS

Metric

| Order No. | Stroke (mm) | Graduation (mm) | Graduation features | Stem dia. (mm) | Stem | Spindle end | Spindle pitch (mm) | Maximum permissible error J_{MPE} (μm) |
|-------------------|-------------|-----------------|----------------------|----------------|-------|--------------------|--------------------|---|
| 153-101 | 15 | 0.01 | Standard | 9.5 | Plain | Flat (carbide tip) | 0.5 | ± 3 |
| 153-201 *1 | 25 | 0.001 | W/vernier (0.001 mm) | 12 | | | | |
| 153-202 *1 | | 0.01 | Standard | | | | | |
| 153-204 | | 0.001 | W/vernier (0.001 mm) | | | | | |

Inch

| Order No. | Stroke (in) | Graduation (in) | Special features | Stem dia. (in) | Stem | Spindle end | Spindle pitch (in) | Maximum permissible error J_{MPE} (in) |
|-------------------|-------------|-----------------|-----------------------|----------------|-------|--------------------|--------------------|--|
| 153-108 *2 | 0.5 | 0.001 | W/vernier (0.0001 in) | 0.375 | Plain | Flat (carbide tip) | 0.025 | ± 0.00015 |
| 153-205 *1 | 1 | 0.0001 | W/vernier (0.0001 in) | 0.5 | | | | |
| 153-206 *1 | | 0.001 | Standard | | | | | |
| 153-207 | | 0.0001 | W/vernier (0.0001 in) | | | | | |
| 153-208 | | 0.001 | Standard | | | | | |

*1 With ratchet stop *2 Made-to-order model

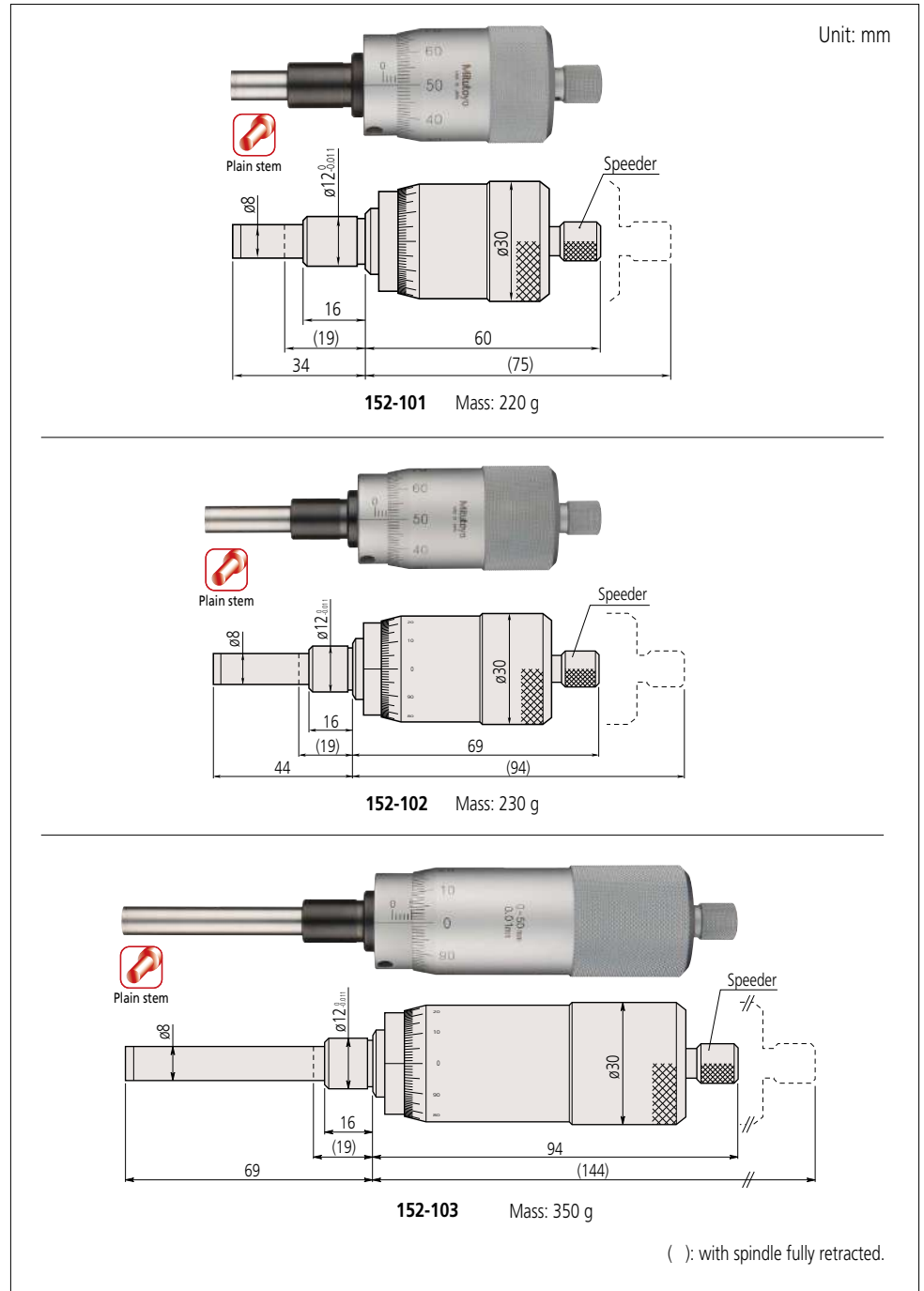
Technical Data

- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
Satin-chrome plated

Micrometer Heads SERIES 152 — Quick Spindle Feed of 1 mm/rev

- Micrometer head with 1 mm spindle pitch enables quick feeding and positioning.
- The larger screw thread also provides greater load-bearing capacity than does a standard head.

DIMENSIONS



SPECIFICATIONS

| Metric | | | | | | | |
|-----------|-------------|-----------------|----------------|-------|--------------------|--------------------|---|
| Order No. | Stroke (mm) | Graduation (mm) | Stem dia. (mm) | Stem | Spindle end | Spindle pitch (mm) | Maximum permissible error J_{MPE} (μm) |
| 152-101 | 15 | 0.01 | 12 | Plain | Flat (carbide tip) | 1 | ± 2 |
| 152-102 | 25 | | | | | | ± 4 |
| 152-103 | 50 | | | | | | ± 4 |

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads

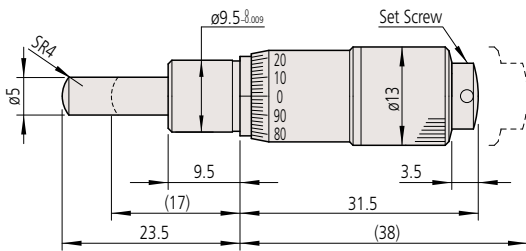
SERIES 148 — Fine Spindle Feed of 0.1 mm/rev

- Highly accurate 0.1 mm pitch thread is only one-fifth of that used for a standard-pitch head (0.5 mm).
- External dimensions are compatible with standard 0.5 mm pitch heads.

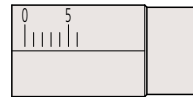
DIMENSIONS

Plain Stem

Unit: mm

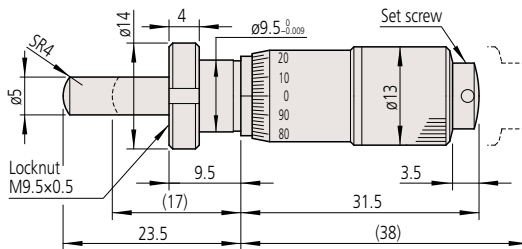


148-142 Mass: 31 g



Sleeve marker

Stem Locknut



• Fixture thickness: 6 mm
148-143 Mass: 34 g

() : with spindle fully retracted.

SPECIFICATIONS

Metric

| Order No. | Stroke (mm) | Graduation (mm) | Stem dia. (mm) | Stem | Spindle end | Spindle pitch (mm) | Maximum permissible error J_{MPE} (μm) | Special features |
|-----------|-------------|-----------------|----------------|-------------|-------------------|--------------------|---|------------------|
| 148-142 | 6.5 | 0.002 | 9.5 | Plain | Spherical (SR4) | 0.1 | ±2 | — |
| 148-143 | | | | W/clamp nut | | | | |
| 148-342 | | | | Plain | | | | |
| 148-343 | | | W/clamp nut | | | | | |
| 148-242 | 5 | 0.004 | 6 | Plain | Spherical (SR3) | ±5 | Thicker & shorter thimble | |
| 148-243 | | | | W/clamp nut | | | | |
| 148-244 | | | Plain | | | | | |
| 148-245 | | | 3.5 | W/clamp nut | Spherical (SR1.5) | | Small thimble diameter | |

Technical Data

- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated

Spindle Pitch



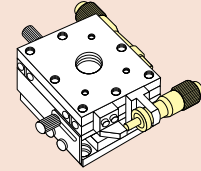
Pitch=0.1 mm



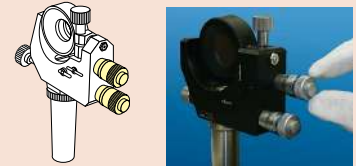
Pitch=0.5 mm

Typical Applications

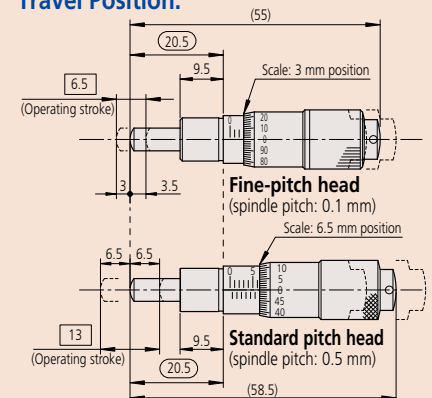
- Semiconductor-wafer positioning machinery and optical component alignment units, etc.
- Precision X-Y table positioning



- Precision adjustment of mirror in holder



Comparison of Mounting Dimensions Between a Fine-pitch Head and a Standard-pitch Head at the Midstroke Travel Position.



Note: While the fine-pitch micrometer head has a measuring stroke of 6.5 mm, the standard head has a larger range of 13 mm.

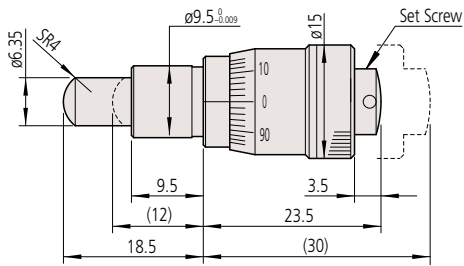
When replacing a standard head, the fine-pitch type can use the common stroke in the middle of the spindle travel. The standard and compact types of fine-pitch head are otherwise completely interchangeable.

Micrometer Heads SERIES 148 — Fine Spindle Feed of 0.1 mm/rev

DIMENSIONS

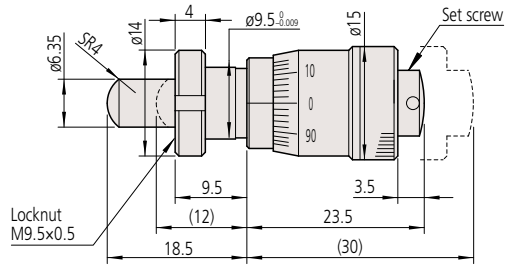
Unit: mm

Plain Stem

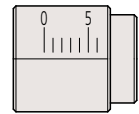


148-342 Mass: 29 g

Stem Locknut

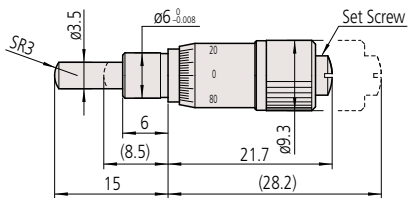


• Fixture thickness: 6 mm
148-343 Mass: 31 g



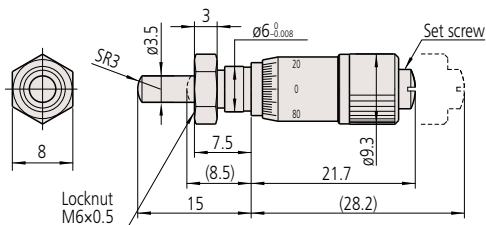
Sleeve marker

Plain Stem



148-242 Mass: 10 g

Stem Locknut

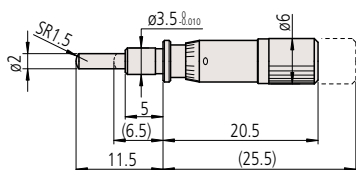


• Fixture thickness: 4 mm
148-243 Mass: 10 g



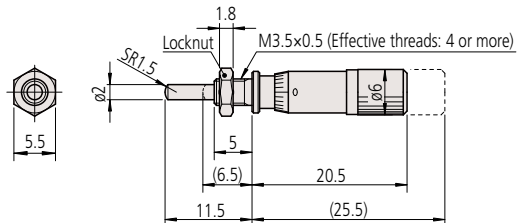
Sleeve marker

Plain Stem



148-244 Mass: 4 g

Stem Locknut



• Fixture thickness: 3 mm
148-245 Mass: 5 g



Sleeve marker

() : with spindle fully retracted.

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads

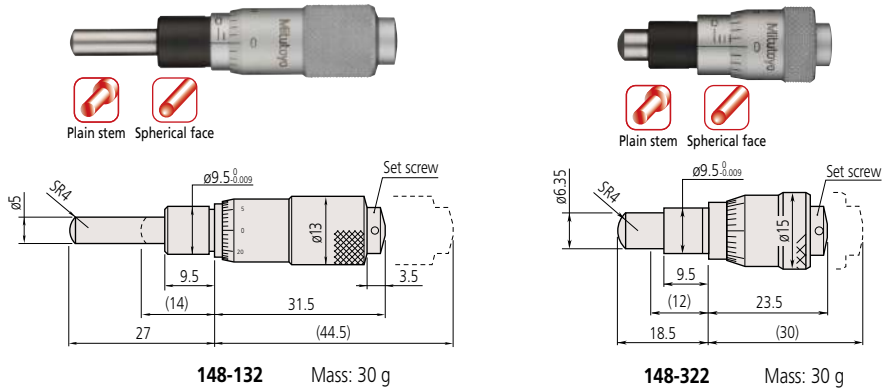
SERIES 148 — Fine Spindle Feed of 0.25 mm/rev

- Micrometer head with 0.25 mm spindle pitch is convenient for fine-feed and fine-positioning applications.

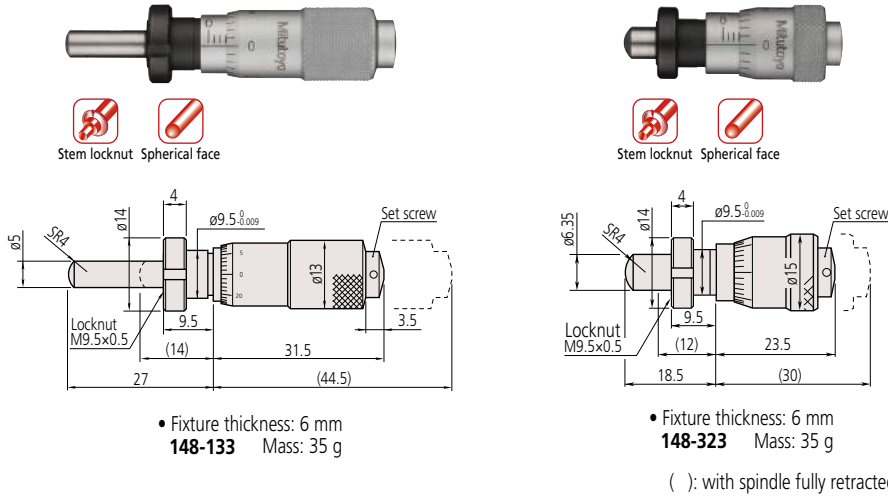
DIMENSIONS

Plain Stem

Unit: mm



Stem Locknut



SPECIFICATIONS

Metric

| Order No. | Stroke (mm) | Graduation (mm) | Stem dia. (mm) | Stem | Spindle end | Spindle pitch (mm) | Maximum permissible error J_{MPE} (μm) |
|----------------|-------------|-----------------|----------------|-------------|-----------------|--------------------|---|
| 148-132 | 13 | 0.01 | 9.5 | Plain | Spherical (SR4) | 0.25 | ± 2 |
| 148-133 | | | | W/clamp nut | | | |
| 148-322 | Plain | | | | | | |
| 148-323 | W/clamp nut | | | | | | |

Technical Data

- Measuring face
 - Material: Alloy tool steel
 - Hardness: 60 HRC or more
 - Lapped
- Scale finishing:
 - Satin-chrome plated

Micrometer Heads SERIES 110 — Differential Screw Thread Translator (Extra-Fine Feed) Type



Technical Data

- Measuring face
Material: Carbide
(110-502/504 are hardened tool steel)
Hardness: 90 HRA or more
(Only 110-502/504 are 60 HRC or more)
Lapped
- Scale finishing:
Satin-chrome plated


- The differential movement of spindle threads and nuts allows ultra-fine feeding.

DIMENSIONS

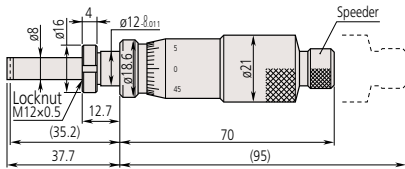
- Differential movement mechanism with double spindle.
- Non-rotating spindle.
- Fixture thickness: 9.5 mm

Equipped with vernier scale





Stem locknut




110-101
110-102 Equipped with vernier scale

Unit: mm

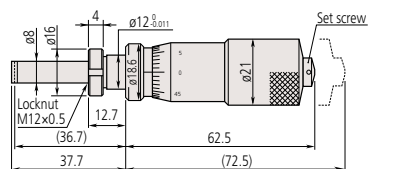
- Differential movement mechanism with double spindle.
- Non-rotating spindle.
- Fixture thickness: 9.5 mm

Equipped with vernier scale






Stem locknut



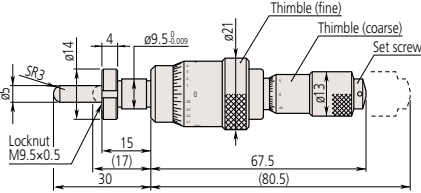
110-105
110-106 Equipped with vernier scale

Mass: 150 g

- Dual thimble
- Fixture thickness: 11.5 mm







Stem locknut Spherical face





110-502 Mass: 95 g

Spherical face

Equipped with vernier scale

Stem locknut Spherical face

SR10

110-107
110-108 Equipped with vernier scale

(): with spindle fully retracted.

SPECIFICATIONS

Metric

| Order No. | Stroke (mm) | | Graduation (mm) | | Graduation features | Stem dia. (mm) | Stem | Spindle end | Maximum permissible error J_{MPE}^{*2} (μm) |
|-----------|------------------|-----|------------------|--------|---|----------------|-------------|--------------------|--|
| 110-101 | 2.5 | | 0.001 | | Standard | 12 | W/clamp nut | Flat (carbide tip) | $\pm 5/\pm 1.5$ |
| 110-102 | | | 0.0001 | | Fine | | | | |
| 110-105 | 1 | | 0.001 | | Standard | | | | |
| 110-106 | | | 0.0001 | | Fine | | | | |
| 110-107 | | | 0.001 | | Standard | | | | |
| 110-108 | | | 0.0001 | | Fine | | | | |
| 110-502 | Thimble (fine) | 0.2 | Thimble (fine) | 0.0005 | Dual scales; 0.2 mm fine-feed stroke | 9.5 | Spherical | $\pm 3/\pm 1.5$ | |
| | Thimble (coarse) | 13 | Thimble (coarse) | 0.01 | | | | | |

Inch

| Order No. | Stroke (in) | | Graduation (in) | | Graduation features | Stem dia. (in) | Stem | Spindle end | Maximum permissible error J_{MPE}^{*2} (in) |
|-----------|------------------|-------|------------------|---------|---|----------------|-------------|---------------------------|---|
| 110-111 | 0.05 | | 0.00002 | | Standard | 0.5 | W/clamp nut | Flat (carbide tip) | $\pm 0.00025/\pm 0.00006$ |
| 110-112 | | | 0.000005 | | Fine | | | | |
| 110-115*1 | 0.02 | | 0.00002 | | Standard | | | | |
| 110-116*1 | | | 0.000005 | | Fine | | | | |
| 110-117*1 | | | 0.00002 | | Standard | | | | |
| 110-118*1 | | | 0.000005 | | Fine | | | | |
| 110-504 | Thimble (fine) | 0.006 | Thimble (fine) | 0.00002 | Dual scales; 0.2 mm/0.006 in fine-feed range | 0.375 | Spherical | $\pm 0.00015/\pm 0.00006$ | |
| | Thimble (coarse) | 0.5 | Thimble (coarse) | 0.001 | | | | | |

*1 Made-to-order models *2 Wide range/narrow range

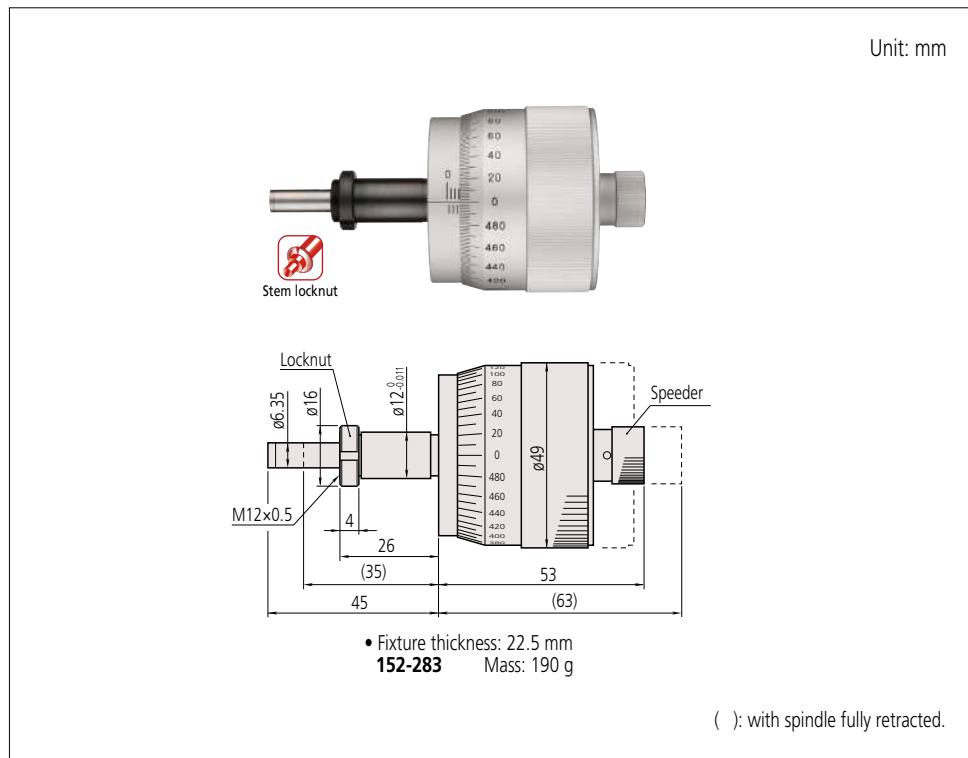
Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 152 — Large Thimble Type

- Large-diameter thimble for fine adjustment and positioning.

DIMENSIONS



Technical Data

- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
White anodized aluminum

SPECIFICATIONS

Metric

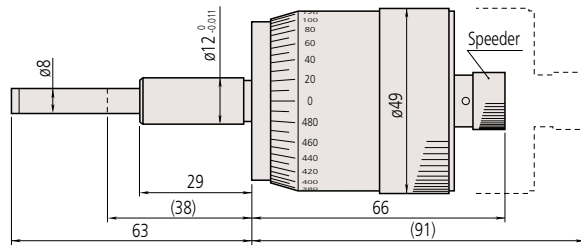
| Order No. | Stroke (mm) | Graduation (mm) | Graduation features | Stem dia. (mm) | Stem | Spindle end | Spindle pitch (mm) | Maximum permissible error J_{MPE} (μm) |
|----------------|-------------|-----------------|---------------------|----------------|-------------|--------------------|--------------------|---|
| 152-283 | 10 | 0.002 | Standard | 12 | W/clamp nut | Flat (carbide tip) | 0.5 | ± 2 |
| 152-332 | 25 | | | | Plain | | | |
| 152-348 | 50 | | Bidirectional | | ± 4 | | | |

Inch

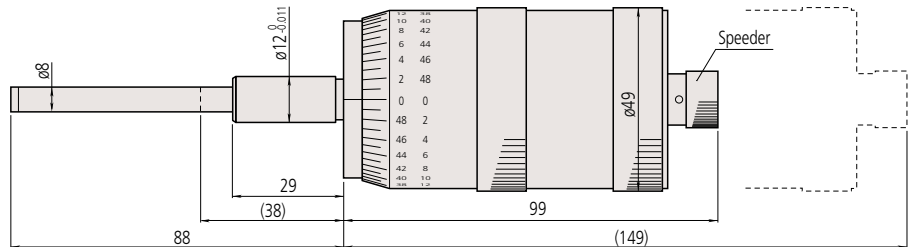
| Order No. | Stroke (in) | Graduation (in) | Graduation features | Stem dia. (in) | Stem | Spindle end | Spindle pitch (in) | Maximum permissible error J_{MPE} (in) |
|----------------|-------------|-----------------|---------------------|----------------|-------------|--------------------|--------------------|--|
| 152-372 | 1 | 0.0001 | Bidirectional | 0.5 | W/clamp nut | Flat (carbide tip) | 0.025 | ± 0.0001 |
| 152-388 | 2 | | | | | | | |

DIMENSIONS

Unit: mm



152-332
152-348 Bidirectional Mass: 310 g



152-380 Mass: 460 g

() : with spindle fully retracted.

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 152 — XY-Stage Type

- Micrometer heads especially designed for accurate cross-travel stage translation in X and Y axes.

DIMENSIONS

Technical Data

- Measuring face
Material: Carbide
(152-389/390/391/392 are alloy tool steel)
Hardness: 90 HRA or more
(152-389/390/391/392 are 60 HRC or more)
Lapped
- Scale finishing:
White anodized aluminum

152-390 Mass: 270 g

- The thimble can be rotated to a better reading position while maintaining the spindle position.

152-389

*1 Other dimensions are the same as **152-390**.

Length of A: 0 to 6 A=6 in the drawing above.

152-402 Mass: 460 g

- The zero-setting ring allows spindle movement without thimble position change for easy zero setting.

152-401

*2 Other dimensions are the same as **152-402**.
() : with spindle fully retracted.

SPECIFICATIONS

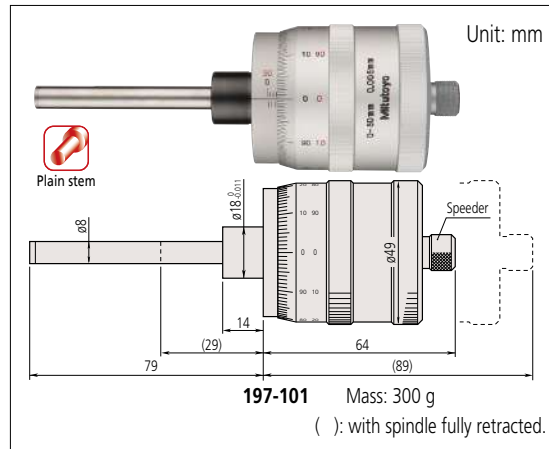
| Metric | | | | | | | |
|-----------|-------------|-----------------------------|---------------------------|----------------|-------|--------------------|--|
| Order No. | Stroke (mm) | Graduation (mm) | Graduation features | Stem dia. (mm) | Stem | Spindle pitch (mm) | Maximum permissible error J_{MPE} (μ m) |
| 152-390 | 25 | 0.005 | for Y axis, bidirectional | 18 | Plain | 1 | ±2 |
| 152-389 | | | | | | | |
| 152-402 | | 0.001 Vernier graduation | for Y axis, with Vernier | | | | |
| 152-401 | | | | | | | |
| Inch | | | | | | | |
| Order No. | Stroke (in) | Graduation (in) | Graduation features | Stem dia. (in) | Stem | Spindle pitch (in) | Maximum permissible error J_{MPE} (in) |
| 152-392 | 1 | 0.0001 | for Y axis, bidirectional | 0.709 | Plain | 0.025 | ±0.0001 |
| 152-391 | | | | | | | |

Technical Data

- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
White anodized aluminum

Micrometer Heads SERIES 197 — Long Stroke Non-rotating Spindle

DIMENSIONS



- Large thimble micrometer head with non-rotating spindle.
- Floating thimble allows easy zero setting at any spindle position.
- Dual-spindle mechanism for quick feed of 1 mm/rev (standard models: 0.5 mm/rev).

SPECIFICATIONS

| Metric | | | | | | | | |
|-----------|--------|------------|---------------------|-----------|-------|--------------------|---------------|-------------------------------------|
| Order No. | Stroke | Graduation | Graduation features | Stem dia. | Stem | Spindle end | Spindle pitch | Maximum permissible error J_{MPE} |
| 197-101 | 50 mm | 0.005 mm | Bidirectional | 18 mm | Plain | Flat (carbide tip) | 1 mm | $\pm 5 \mu\text{m}$ |

| Inch | | | | | | | | |
|-----------|--------|------------|---------------------|-----------|-------|--------------------|---------------|-------------------------------------|
| Order No. | Stroke | Graduation | Graduation features | Stem dia. | Stem | Spindle end | Spindle pitch | Maximum permissible error J_{MPE} |
| 197-201 | 2 in | 0.0002 in | Bidirectional | 0.709 in | Plain | Flat (carbide tip) | 0.05 in | ± 0.0001 in |

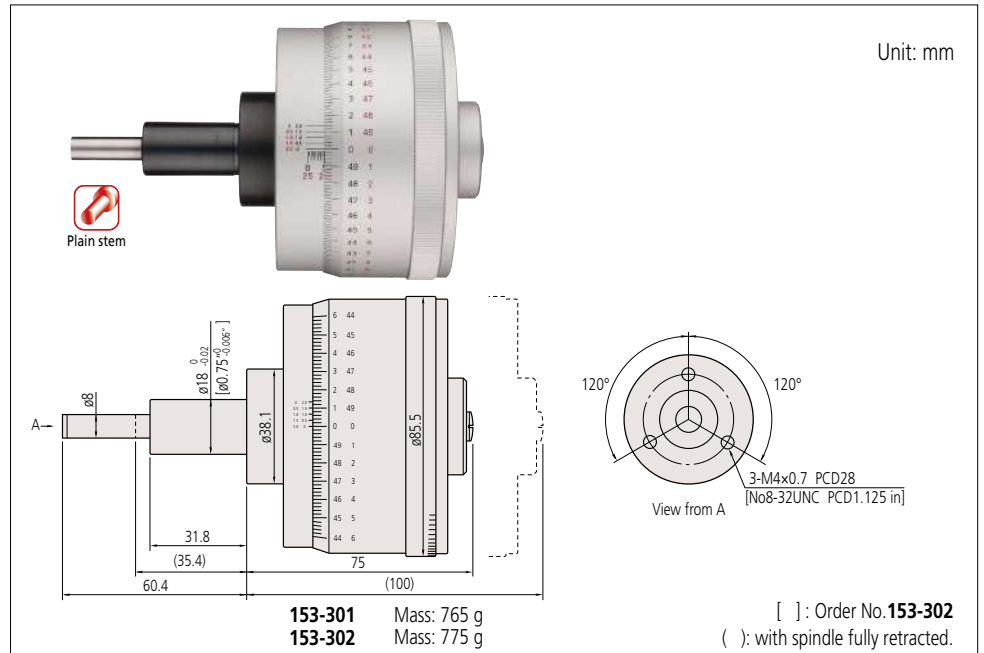
Micrometer Heads SERIES 153 — High Accuracy and Resolution

Technical Data

- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
White anodized aluminum

- Fine graduation and high resolution model.
- Non-rotating spindle type.

DIMENSIONS



SPECIFICATIONS

| Metric | | | | | | | | |
|-----------|--------|---------------------|---------------------|-----------|-------|--------------------|---------------|---------------------------------------|
| Order No. | Stroke | Graduation | Graduation features | Stem dia. | Stem | Spindle end | Spindle pitch | Maximum permissible error J_{MPE}^* |
| 153-301 | 25 mm | 0.0005 mm (vernier) | Bidirectional | 18 mm | Plain | Flat (carbide tip) | 0.5 mm | $\pm 1/\pm 0.5 \mu\text{m}$ |

| Inch | | | | | | | | |
|-----------|--------|----------------------|---------------------|-----------|-------|--------------------|---------------|---------------------------------------|
| Order No. | Stroke | Graduation | Graduation features | Stem dia. | Stem | Spindle end | Spindle pitch | Maximum permissible error J_{MPE}^* |
| 153-302 | 1 in | 0.00001 in (vernier) | Bidirectional | 0.75 in | Plain | Flat (carbide tip) | 0.025 in | ± 0.00005 in/ ± 0.00003 in |

* Wide range/narrow range

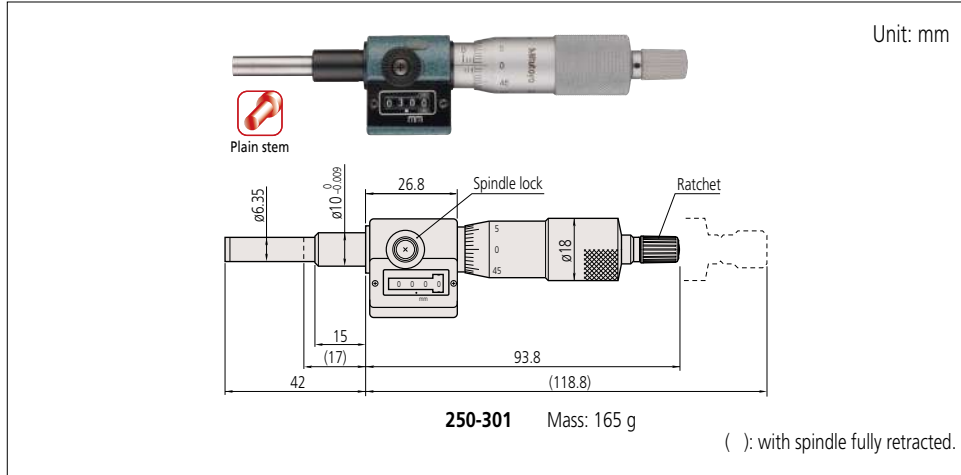
Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Heads SERIES 250 — Digit Counter Type

- Digit counter for easy reading of spindle movement.

DIMENSIONS



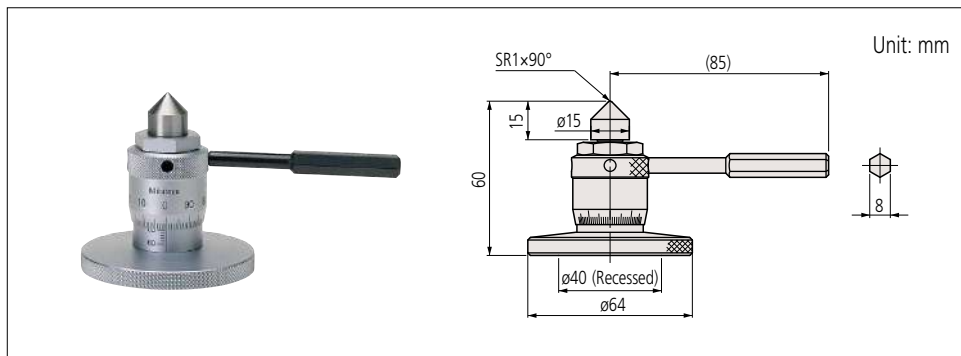
SPECIFICATIONS

| Metric | | | | | | | | |
|-----------|-------------|-----------------|----------------|-------|--------------------|--------------------|---------------------|---|
| Order No. | Stroke (mm) | Graduation (mm) | Stem dia. (mm) | Stem | Spindle end | Spindle pitch (mm) | Graduation features | Maximum permissible error J_{MPE} (μm) |
| 250-301 | 25 | 0.01 | 10 | Plain | Flat (carbide tip) | 0.5 | — | ± 2 |
| Inch | | | | | | | | |
| Order No. | Stroke (in) | Graduation (in) | Stem dia. (in) | Stem | Spindle end | Spindle pitch (in) | Graduation features | Maximum permissible error J_{MPE} (in) |
| 250-312 | 1 | 0.0001 | 0.375 | Plain | Flat (carbide tip) | 0.025 | Vernier scale | ± 0.001 |

Micro Jack SERIES 7

- Used for accurate leveling of machines, surface plates, and other precision instruments.
- Zero-setting is possible at any position.
- Easy adjustment under heavy load.

DIMENSIONS



SPECIFICATIONS

| Metric | | | | |
|-----------|-------------|-----------------|----------------|--------------------------------------|
| Order No. | Stroke (mm) | Graduation (mm) | Remarks (kg) | Handle power at the max. loading (N) |
| 7850 | 60 - 75 | 0.01 | Max. load: 400 | 90 |

Technical Data

- Measuring face
Material: Carbide
Hardness: 90 HRA or more
Lapped
- Scale finishing:
Satin-chrome plated

Technical Data

- Measuring face
Material: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing:
Satin-chrome plated



Micrometer Heads Mounting Fixtures

- Manufacturing brackets to mount micrometer heads for each particular application can be laborious and costly. Mitutoyo offers various types of fixtures for micrometer heads to meet a wide range of applications. These fixtures are made of nickel-plated cast iron.

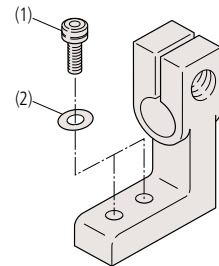
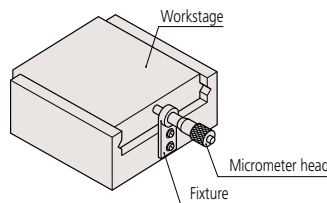


SPECIFICATIONS

Mounting hole size

| Micrometer Head | Fixtures (Order No.) | Mounting hole size |
|-------------------|---|--|
| 148 Series | 303560, 303562, 303564, 303566, 303559, 303561, 303563, 303565 | ø9.5×9.5 long for plain stem or stem locknut type micrometer heads |
| 149 Series | 303569, 303571, 303573, 303575, 303568, 303570, 303572, 303574 | ø9.5×15 long for plain stem or stem locknut type micrometer heads |
| 150 Series | 303579, 303581, 303583, 303585, 303578, 303580, 303582, 303584 | ø10×15 long for plain stem or stem locknut type micrometer heads |

Note: Supplied with a socket head screw (M3×0.5×12) for fixtures to be used with a micrometer head without stem locknut (plain stem type micrometer head).



SPECIFICATIONS

Recommended socket head screws for the fixtures

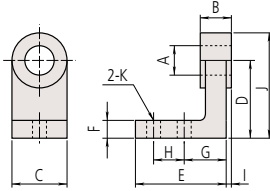
| Fixtures (Order No.) | Socket head screw (1) | Washer (2) |
|---|-----------------------|--|
| 303559, 303560, 303561, 303562, 303563, 303564, 303565, 303566 | M3×0.5×8 M3×0.5×12 | Small, Nominal dia.: 3 Small, Nominal dia.: 3 |
| 303568, 303569, 303570, 303571, 303572, 303573, 303574, 303575, 303578, 303579, 303580, 303581, 303582, 303583 | M4×0.7×10 | Small, Nominal dia.: 4 |
| 303574, 303575, 303584, 303585 | M4×0.7×12 | Small, Nominal dia.: 4 |

Micrometer Head

The origin of Mitutoyo's trustworthy brand of small tool instruments

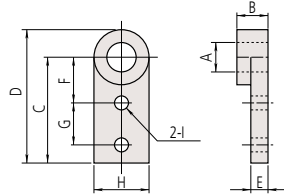
Micrometer Heads Mounting Fixtures

Fixtures for micrometer heads with stem locknut



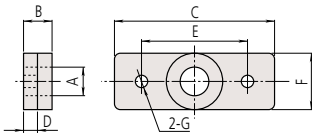
(Unit: mm)

| Order No. | A | B | C | D | E | F | G | H | I | J | K |
|-----------|------|------|----|----|----|---|----|----|------|------|------|
| 303559 | ø9.5 | 6 | 15 | 20 | 24 | 5 | 11 | 8 | 0.5 | 27.5 | ø3.4 |
| 303568 | | 11.5 | 20 | 30 | 35 | 7 | 16 | 12 | 1.75 | 40 | ø4.5 |
| 303578 | | ø10 | | | | | | | | | |



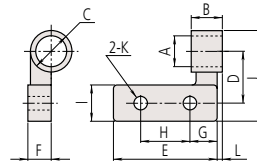
(Unit: mm)

| Order No. | A | B | C | D | E | F | G | H | I |
|-----------|------|------|----|------|-----|----|----|----|------|
| 303563 | ø9.5 | 6 | 30 | 37.5 | 4.5 | 15 | 10 | 15 | ø3.4 |
| 303572 | | 11.5 | 40 | 50 | 6.5 | 18 | 15 | 20 | ø4.5 |
| 303582 | | ø10 | | | | | | | |



(Unit: mm)

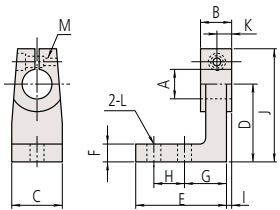
| Order No. | A | B | C | D | E | F | G |
|-----------|------|------|----|-----|----|----|------|
| 303561 | ø9.5 | 6 | 40 | 3.5 | 30 | 15 | ø3.4 |
| 303570 | | 11.5 | 60 | 5.5 | 40 | 20 | ø4.5 |
| 303580 | | ø10 | | | | | |



(Unit: mm)

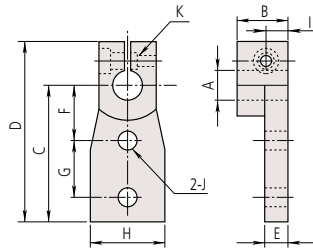
| Order No. | A | B | C | D | E | F | G | H | I | J | K | L |
|-----------|------|------|-----|----|----|-----|-----|----|----|------|------|------|
| 303565 | ø9.5 | 6 | ø15 | 15 | 25 | 8.5 | 7.5 | 10 | 10 | 27.5 | ø3.4 | 0.75 |
| 303574 | | 11.5 | | 20 | 40 | | 10 | 20 | 15 | 35 | ø4.5 | 1.25 |
| 303584 | | ø10 | | | | | | | | | | |

Fixtures for plain stem type micrometer heads



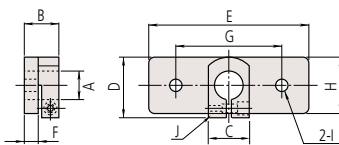
(Unit: mm)

| Order No. | A | B | C | D | E | F | G | H | I | J | K | L | M |
|-----------|------|------|----|----|----|---|----|----|------|------|------|------|--------|
| 303560 | ø9.5 | 9 | 15 | 20 | 23 | 5 | 11 | 8 | 1.5 | 3.25 | 4.5 | ø3.4 | M3×0.5 |
| 303569 | | 14.5 | 20 | 30 | 35 | 7 | 16 | 12 | 3.25 | 4.25 | 7.25 | ø4.5 | |
| 303579 | | ø10 | | | | | | | | | | | |



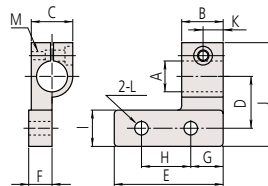
(Unit: mm)

| Order No. | A | B | C | D | E | F | G | H | I | J | K |
|-----------|------|------|----|------|---|----|----|----|------|------|--------|
| 303564 | ø9.5 | 9 | 30 | 42.5 | 4 | 15 | 10 | 15 | 4.5 | ø3.4 | M3×0.5 |
| 303573 | | 14.5 | 40 | 52.5 | 6 | 18 | 15 | 20 | 7.25 | ø4.5 | |
| 303583 | | ø10 | | | | | | | | | |



(Unit: mm)

| Order No. | A | B | C | D | E | F | G | H | I | J |
|-----------|------|------|----|----|----|----|----|------|------|--------|
| 303562 | ø9.5 | 9 | 15 | 20 | 40 | 3 | 30 | 15 | ø3.4 | M3×0.5 |
| 303571 | | 14.5 | | 60 | 5 | 40 | 20 | ø4.5 | | |
| 303581 | | ø10 | | | | | | | | |



(Unit: mm)

| Order No. | A | B | C | D | E | F | G | H | I | J | K | L | M |
|-----------|------|------|----|----|-----|-----|----|----|------|------|------|--------|---|
| 303566 | ø9.5 | 9 | 15 | 25 | 8.5 | 7.5 | 10 | 10 | 32.5 | 4.5 | ø3.4 | M3×0.5 | |
| 303575 | | 14.5 | 20 | 40 | | 10 | 20 | 15 | 40 | 7.25 | ø4.5 | | |
| 303585 | | ø10 | | | | | | | | | | | |

Technical Data

- Measuring face
- Material: Alloy tool steel
(AS-25 and BS-25 are carbide tipped)
- Hardness: 60 HRC or more
(AS-25 and BS-25 are 90 HRA or more)
- Lapped

Precision Leadscrews

- Mitutoyo manufactures simple and less expensive precision leadscrews for precise positioning mechanisms and fine-feed mechanisms, in addition to standard micrometer heads.
- Mitutoyo also manufactures leadscrews with special specifications, such as 0.25 mm pitch, as well as those with the standard 0.5 mm feed pitch and with dimensions and forms that meet customer requirements.
- Durability: 100,000 operations are guaranteed (use condition: 4 kg load; 2 kg for AS-6.5 and BS-6.5)
- Main applications:
 - Precision feed stages
 - Fine adjustment of optical elements (mirrors, prisms)
 - Fiber optic centering devices
 - Various assembly and adjustment jigs



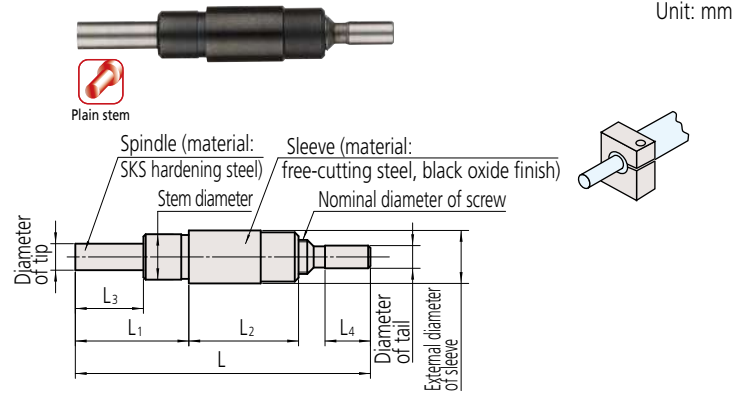
SPECIFICATIONS

| Order No. | Model* | Stroke (mm) | Feed pitch (mm) | Feed accuracy (μm) | Stem diameter (mm) | Tip diameter (mm) | Tail diameter (mm) | Screw nominal diameter | Sleeve diameter (mm) | Measuring face | Mass (g) |
|-----------|--------|-------------|-----------------|--------------------|------------------------|-------------------|----------------------|------------------------|----------------------|----------------|----------|
| 04AZA160 | AS-6.5 | 6.5 | 0.5 | ±5 | ø6 ^{-0.008} | ø3.5 | ø3 ^{-0.01} | M4.5×0.5 | ø7 | Hardened | 10 |
| 04AZA161 | BS-6.5 | | | | | | | | | | 11 |
| 04AZA162 | AS-13 | 13 | 0.5 | ±2 | ø9.5 ^{-0.009} | ø5 | ø5 ^{-0.012} | M7.35×0.5 | ø10.5 | Hardened | 27 |
| 04AZA163 | BS-13 | | | | | | | | | | 30 |
| 04AZA164 | AS-25 | 25 | 0.5 | ±2 | ø10 ^{-0.009} | ø6.35 | ø6 ^{-0.015} | M7.35×0.5 | ø12 | Carbide | 61 |
| 04AZA165 | BS-25 | | | | | | | | | | 64 |

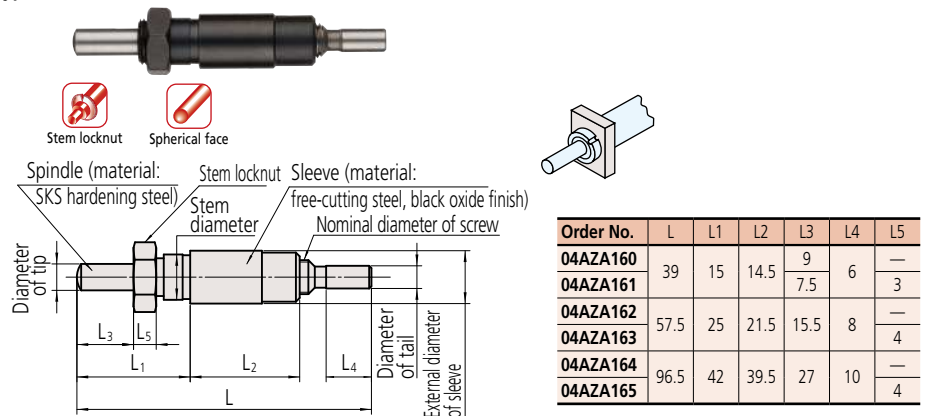
* AS type: Flat spindle tip without nut
BS type: Spherical spindle tip with nut

DIMENSIONS

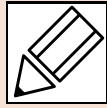
Type AS: Plain Stem



Type BS: Stem with Locknut



Quick Guide to Precision Measuring Instruments



Micrometer Heads

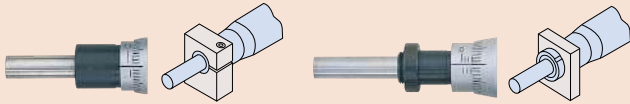
Key Factors in Selection

Key factors in selecting a micrometer head are the measuring stroke, spindle face, stem, graduations, thimble diameter, etc.

Stem

Plain stem

Stem locknut type



- The stem used to mount a micrometer head is classified as a "plain type" or "clamp nut type" as illustrated above. The stem diameter is manufactured to a nominal Metric or Imperial size with an h6 tolerance.
- The clamp nut stem allows fast and secure clamping of the micrometer head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does require a split-fixture clamping arrangement or adhesive fixing.
- General-purpose mounting fixtures are available as optional accessories.

Measuring Face



Flat face



Spherical face



Anti-rotation device

- A flat measuring face is often specified where a micrometer head is used in measurement applications.
- When a micrometer head is used as a feed device, a spherical face can minimize errors due to misalignment (Figure A). Alternatively, a flat face on the spindle can bear against a sphere, such as a carbide ball (Figure B).
- A non-rotating spindle type micrometer head or one fitted with an anti-rotation device on the spindle (Figure C) can be used if a twisting action on the workpiece must be avoided.
- If a micrometer head is used as a stop, then a flat face both on the spindle and the face it contacts provides durability.

Figure A

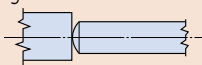


Figure C

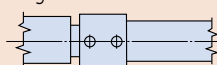
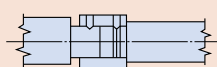
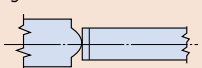


Figure B



Non-Rotating Spindle

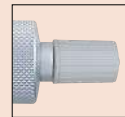
- A non-rotating spindle type head does not exert a twisting action on a workpiece, which may be an important factor in some applications.

Spindle Thread Pitch

- The standard type head has 0.5 mm pitch.
- 1 mm-pitch type: quicker to set than standard type and avoids the possibility of a 0.5 mm reading error. Excellent load-bearing characteristics due to larger screw thread.
- 0.25 mm or 0.1 mm-pitch type
This type is the best for fine-feed or fine-positioning applications.

Constant-force Device

- A micrometer head fitted with a constant-force device (ratchet or friction thimble) is recommended for measurement applications.
- If using a micrometer head as a stop, or where saving space is a priority, a head without a ratchet is probably the best choice.



Micrometer head with constant-force device



Micrometer head without constant-force device (no ratchet)

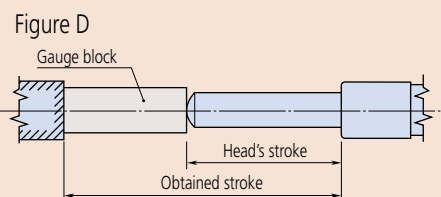
Spindle Lock

- If a micrometer head is used as a stop, it is desirable to use a head fitted with a spindle lock so that the setting will not change even under repeated shock loading.



Measuring Range (Stroke)

- When choosing a measuring range for a micrometer head, allow an adequate margin in consideration of the expected measurement stroke. Six stroke ranges, 5 mm to 50 mm, are available for standard micrometer heads.
- Even if the expected stroke is small, such as 2 mm to 3 mm, it will be cost effective to choose a 25 mm-stroke model as long as there is enough space for installation.
- If a long stroke of over 50 mm is required, the concurrent use of a gauge block can extend the effective measuring range. (Figure D)



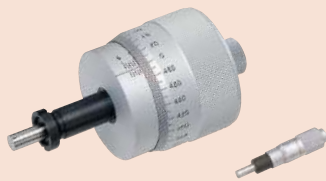
- In this guide, the range (or stroke end) of the thimble is indicated by a dashed line. For stroke ends, consider the thimble as moving to the position indicated by the line when designing the jig.

Ultra-fine Feed Applications

- Dedicated micrometer heads are available for manipulator applications, etc., which require ultra-fine feed or adjustment of spindle.

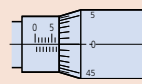
Thimble Diameter

- The diameter of a thimble greatly affects its usability and the "fineness" of positioning. A small-diameter thimble allows quick positioning whereas a large-diameter thimble allows fine positioning and easy reading of the graduations. Some models combine the advantages of both features by mounting a coarse-feed thimble (speeder) on the large-diameter thimble.

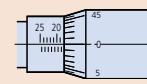


Graduation Styles

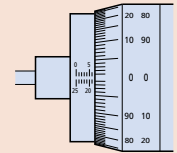
- Care is needed when taking a reading from a mechanical micrometer head, especially if the user is unfamiliar with the model.
- The "normal graduation" style, identical to that of an outside micrometer, is the standard. For this style, the reading increases as the spindle retracts into the body.
- On the contrary, in the "reverse graduation" style, the reading increases as the spindle advances out of the body.
- The "bidirectional graduation" style is intended to facilitate measurement in either direction by using black numerals for normal, and red numerals for reverse operation.
- Micrometer heads with a mechanical or electronic digital display, which allow direct reading of a measurement value, are also available. These types are free from misreading errors. A further advantage is that the electronic digital display type can enable computer-based storage and statistical processing of measurement data.



Normal graduation style



Reverse graduation style



Bidirectional graduation style

Guidelines for Self-made Fixtures

A micrometer head should be mounted by the stem in an accurately machined hole using a clamping method that does not exert excessive force on the stem. There are three common mounting methods as shown below. Method (3) is not recommended. Adopt methods (1) or (2) wherever possible.

(Unit: mm)

| Mounting method | (1) Clamp nut | | | | (2) Split-body clamp | | | | (3) Setscrew clamp | | | |
|---------------------------------|---|-----|------------------------|-----|--|-----|------------------------|-----|---|-----|-------------------|-----|
| | Points to keep in mind | | | | | | | | | | | |
| Stem diameter | ø9.5 | ø10 | ø12 | ø18 | ø9.5 | ø10 | ø12 | ø18 | ø9.5 | ø10 | ø12 | ø18 |
| Mounting hole Fitting tolerance | G7 +0.005 to +0.020 | | G7 +0.006 to +0.024 | | G7 +0.005 to +0.020 | | G7 +0.006 to +0.024 | | H5 0 to +0.006 | | H5 0 to +0.008 | |
| Precautions | Care should be taken to make Face A square to the mounting hole. The stem can be clamped without any problem at squareness within 0.16/6.5. | | | | Remove burrs generated on the wall of the mounting hole by the slitting operation. | | | | M3x0.5 or M4x0.7 is an appropriate size for the setscrew. Limit countersinking into stem to 90°x0.5 and be careful not to damage the stem in the process. | | | |

Maximum Loading Capacity of Micrometer Heads

The maximum loading capacity of a micrometer head depends mainly on the method of mounting and whether the loading is static or dynamic (used as a stop, for example). Therefore the maximum loading capacity of each model cannot be definitely specified. The loading limits recommended by Mitutoyo (at less than 100,000 revolutions if used for measuring within the guaranteed accuracy range) and the results of static load tests using a small micrometer head are given below.

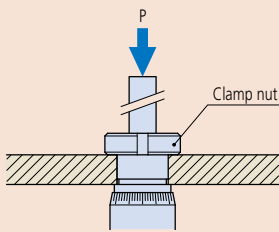
1. Recommended maximum loading limit

| | | Maximum loading limit |
|--------------------|---|-------------------------------|
| Standard type | Spindle pitch: 0.5 mm | Up to approx. 39.2 N (4 kgf)* |
| | Spindle pitch: 0.1 mm/0.25 mm | Up to approx. 19.6 N (2 kgf) |
| High function type | Spindle pitch: 0.5 mm | Up to approx. 39.2 N (4 kgf) |
| | Spindle pitch: 1.0 mm | Up to approx. 58.8 N (6 kgf) |
| | Non-rotating spindle | Up to approx. 19.6 N (2 kgf) |
| | Series 110 micro-fine feed type (with a differential mechanism) | Up to approx. 19.6 N (2 kgf) |

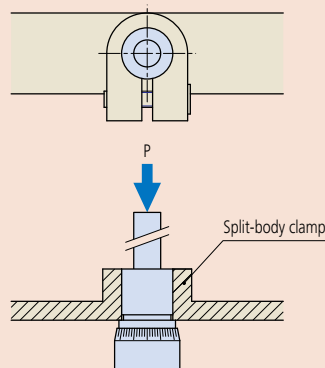
* Up to approx. 19.6 N (2 kgf) only for Ultra small models

2. Static load test for micrometer heads (using 148-104 / 148-103 for this test)

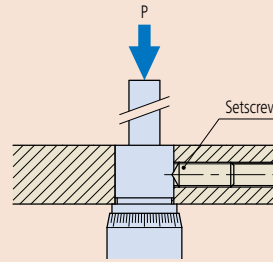
(1) Clamp nut



(2) Split-body clamp



(3) Setscrew clamp



Test method

Micrometer heads were set up as shown and the force at which the head was damaged or pushed out of the fixture when a static load was applied, in direction P, was measured. (In the tests no account was taken of the guaranteed accuracy range.)

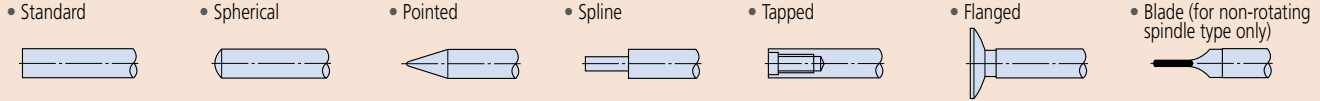
| Mounting method | Damaging/dislodging load |
|----------------------|---|
| (1) Clamp nut | Damage to the main unit will occur at 8.63 to 9.8 kN (880 to 1000 kgf). |
| (2) Split-body clamp | The main unit will be pushed out of the fixture at 0.69 to 0.98 kN (70 to 100 kgf). |
| (3) Setscrew clamp | Damage to the setscrew will occur at 0.69 to 1.08 kN (70 to 110 kgf). |

Note: These load values should only be used as an approximate guide.

Custom-built Products (Product Example Introductions)

Micrometer heads have applications in many fields of science and industry and Mitutoyo offers a wide range of standard models to meet customers' needs. However, in those cases where the standard product is not suitable, Mitutoyo can custom build a head incorporating features better suited to your special application. Please feel free to contact Mitutoyo about the possibilities - even if only one custom-manufactured piece is required.

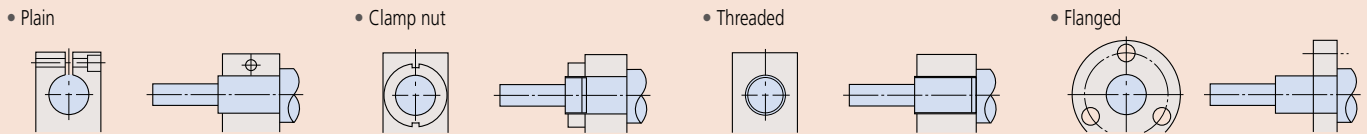
1. Spindle-end types



Note: Long spindle type is also available. Please consult Mitutoyo.

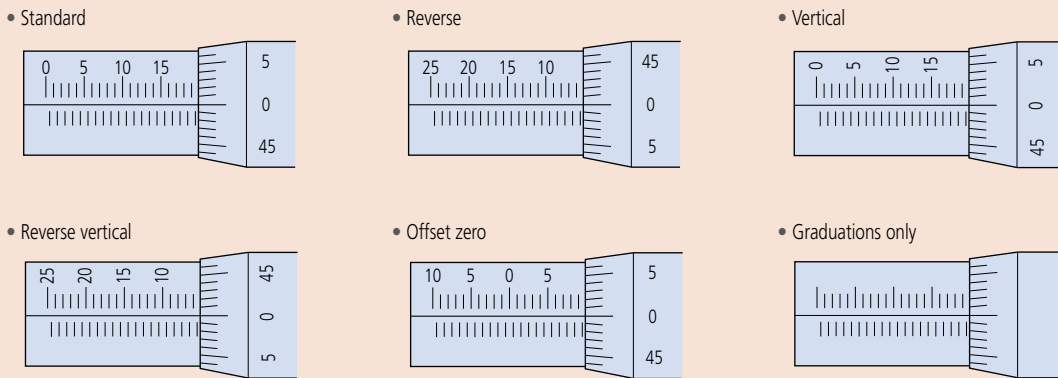
2. Stem types

A custom stem can be manufactured to suit the mounting fixture.



3. Scale graduation schemes

Various barrel and thimble scale graduation schemes, such as reverse and vertical, are available. Please consult Mitutoyo for ordering a custom scheme not shown here.

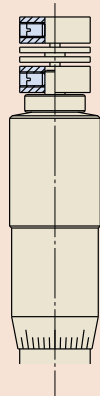


4. Logo engraving

A specific logo can be engraved as required.

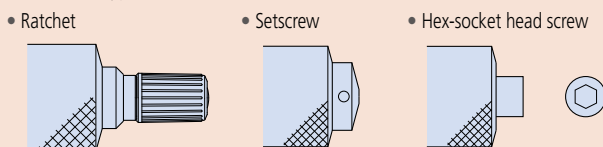
5. Motor Coupling

Couplings for providing motor drive to a head can be designed.



6. Thimble mounting

Thimble mounting methods including a ratchet, setscrew, and hex-socket head screw types are available.



7. Spindle-thread pitch

Pitches of 1 mm for fast-feed applications or 0.25 mm and 0.1 mm for fine-feed can be supplied as alternatives to the standard 0.5 mm. Inch pitches are also supplied. Please consult Mitutoyo for details.

8. Lubricant for spindle threads

Lubrication arrangements can be specified by the customer.

9. All-stainless construction

All components of a head can be manufactured in stainless steel.

10. Simple packaging

Large-quantity orders of micrometer heads can be delivered in simple packaging for OEM purposes.

11. Spindle and nut (Precision lead screw)

The spindle can be used as a precision lead screw. The nut is machined in accordance with the specified dimensions. For details, refer to "Precision Leadscrews" on page B-112.

12. Accuracy inspection certificate

An accuracy inspection certificate can be supplied at extra cost. For detailed information, contact the nearest Mitutoyo Sales Office.

New Products



Digimatic Holtest

Refer to pages C-3 to C-6 for details.



Holtest

Refer to pages C-7 to C-12 for details.



ABSOLUTE Borematic

Refer to pages C-13 to C-16 for details.



Inside Micrometers (Caliper Type)

Refer to pages C-23 to C-24 for details.



Bore Gages

Refer to pages C-33 to C-36 for details.

Bore Gages for Blind Holes

Refer to pages C-41 to C-42 for details.





Holtest/ABSOLUTE Borematic



Inside Micrometers



Bore Gages



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Holtest

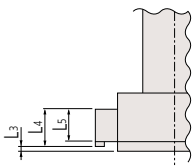
For easy and accurate measurement of inside diameters

Digimatic Holtest SERIES 468 — Three-point Internal Micrometers

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Three-point internal micrometer with large LCD readout. (Character height 7.4 mm)
- Titanium-coated measuring pins provide excellent durability and impact resistance.
- Only one SR44 battery is required and battery life is approx. 1.2 years under normal use.
- ABSolute and INCRemental measurement modes allow highly efficient operation.
- The IP65 protection rating allows the instrument to be used in the presence of splashing coolant.
- Measurements can be made close to the bottom of a blind hole.
- Deep holes can be measured by attaching an Extension Rod (optional).
- A function lock prevents accidental change of reference point.
- Measurement data output enables operation with Statistical Process Control (SPC) and measurement control systems. (Refer to page A-3)
- An interface input tool is available for transferring measurement data, under keyboard control, directly to commercial spreadsheet software. (Refer to page A-5)
- Interchangeable-Head Sets (interchangeable measuring heads type) covering an extended measuring range using multiple heads and Non-interchangeable-Head Sets are available.
- For details of Setting Rings, refer to page C-47.

| Range (mm) | L ₃ (mm) | L ₄ (mm) | L ₅ (mm) |
|------------|---------------------|---------------------|---------------------|
| 6 - 12 | 2 or below | — | 2.5 |
| 12 - 20 | 0.3 or below | 5.6 | 3.5 |
| 20 - 30 | | 8.3 | 5.2 |
| 30 - 50 | | 13.0 | 10.0 |
| 50 - 100 | | 17.0 | 14.0 |
| 100 - 300 | 12.4 or below | 21.0 | 13.8 |



468-161

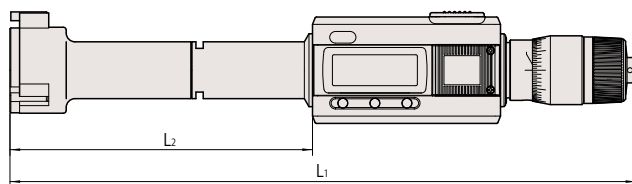


468-168



468-174

DIMENSIONS



Unit: mm

| Range | L ₂ * | L ₁ |
|---|------------------|----------------|
| 6 - 8, 8 - 10, 10 - 12 mm | 59 | 175 - 177 |
| 12 - 16, 16 - 20 mm | 84 | 197.5 - 201.5 |
| 20 - 25, 25 - 30 mm | 93 | 206.9 - 211.9 |
| 30 - 40, 40 - 50 mm | 103.8 | 214.7 - 224.7 |
| 50 - 63, 62 - 75, 75 - 88, 87 - 100 mm | 105.4 | 219.6 - 232.6 |
| 100 - 125, 125 - 150, 150 - 175, 175 - 200, 200 - 225, 225 - 250, 250 - 275, 275 - 300 mm | 151.4 | 286.3 - 311.3 |

* L₂ is maximum depth of measurement possible.
Note: External view differs depending on measurement range.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

IP 65

These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



www.tuv.com
ID 0000021605



An inspection certificate is supplied as standard. Refer to page U-11 for details.

IP Codes

Level 6: Dustproof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.



Technical Data

- Battery: SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 1.2 years under normal use
- Scale type: Electromagnetic induction-type rotary encoder

Functions

- Zero-setting
- Origin restoration
- Data hold
- 2-point Preset
- Function lock (see illustration of lock symbol below)



- inch/mm readout (inch/mm models)
- Automatic power ON/OFF
- Error alarm
- Data output

Optional Accessories

- Refer to page A-27 for details.
- USB Input Tool Direct (2 m): **06AFM380B**
 - Connecting cables for **U-WAVE-T**
For standard (160 mm): **02AZD790B**
For foot switch: **02AZE140B**

Optional Accessories

Shown mounted on stand using bracket



Mounting bracket
04AZB157

For details of Special-order Products,
refer to page C-49.

SPECIFICATIONS

| Metric | | | | | |
|-----------|--------------------------|-----------------|--|----------------------|--|
| Order No. | Range* ² (mm) | Resolution (mm) | Maximum permissible error <i>J_{MPE}</i> (μm)* ¹ | Optional Accessories | |
| | | | | Extension rod | SPC cable |
| 468-161 | 6 - 8 | 0.001 | ±2 (within 2) | 952322 (100 mm) | 05CZA662 (1 m) 05CZA663 (2 m) |
| 468-162 | 8 - 10 | | | | |
| 468-163 | 10 - 12 | | | | |
| 468-164 | 12 - 16 | | | | |
| 468-165 | 16 - 20 | | | | |
| 468-166 | 20 - 25 | | | | |
| 468-167 | 25 - 30 | | ±3 (within 3) | 952621 (150 mm) | |
| 468-168 | 30 - 40 | | | | |
| 468-169 | 40 - 50 | | | | |
| 468-170 | 50 - 63 | | | | |
| 468-171 | 62 - 75 | | | | |
| 468-172 | 75 - 88 | | | | |
| 468-173 | 87 - 100 | | ±4 (within 4) | 952622 (150 mm) | |
| 468-174 | 100 - 125 | | | | |
| 468-175 | 125 - 150 | | | | |
| 468-176 | 150 - 175 | | | | |
| 468-177 | 175 - 200 | | | | |
| 468-178 | 200 - 225 | | | | |
| 468-179 | 225 - 250 | ±5 (within 5) | 952623 (150 mm) | | |
| 468-180 | 250 - 275 | | | | |
| 468-181 | 275 - 300 | | | | |

| Inch / Metric | | | | | |
|---------------|--------------------------|------------------------------|--|----------------------|--|
| Order No. | Range* ² (in) | Resolution | Maximum permissible error <i>J_{MPE}</i> (in)* ¹ | Optional Accessories | |
| | | | | Extension rod | SPC cable |
| 468-261 | 0.275 - 0.35 | 0.00005 in/ 0.001 mm | ±0.0001 (within 0.0001) | 952322 (100 mm) | 05CZA662 (1 m) 05CZA663 (2 m) |
| 468-262 | 0.35 - 0.425 | | | | |
| 468-263 | 0.425 - 0.5 | | | | |
| 468-264 | 0.5 - 0.65 | | | | |
| 468-265 | 0.65 - 0.8 | | | | |
| 468-266 | 0.8 - 1 | | | | |
| 468-267 | 1 - 1.2 | | | | |
| 468-268 | 1.2 - 1.6 | | | | |
| 468-269 | 1.6 - 2 | | | | |
| 468-270 | 2 - 2.5 | | | | |
| 468-271 | 2.5 - 3 | | | | |
| 468-272 | 3 - 3.5 | | ±0.0002 (within 0.0002) | 952622 (150 mm) | |
| 468-273 | 3.5 - 4 | | | | |
| 468-274 | 4 - 5 | | | | |
| 468-275 | 5 - 6 | | | | |
| 468-276 | 6 - 7 | | | | |
| 468-277 | 7 - 8 | ±0.00025 (within 0.00025) | | | 952623 (150 mm) |
| 468-278 | 8 - 9 | | | | |
| 468-279 | 9 - 10 | | | | |
| 468-280 | 10 - 11 | | | | |
| 468-281 | 11 - 12 | | | | |

*1 Additionally, the difference in permissible error allowable is limited to a value within this range, as given in parentheses, and is measured with the entire measuring surface in contact with the object measured.

*2 The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).
Note: Setting rings are optional.

Holtest

For easy and accurate measurement of inside diameters

Interchangeable-Head Sets

| Metric | | | | Inch / Metric | | | |
|--------------------------------------|--|-----------------------------------|--|---------------|-------------|---|--|
| Set Order No. | Range* (mm) | Content of set | Accessories (optional) | Set Order No. | Range* (in) | Content of set | Accessories (optional) |
| 468-971 | 6 - 12 | Display unit 6 - 12 mm | SPC cable with data switch 05CZA662 (1 m) | 468-976 | 0.275 - 0.5 | Display unit 0.275 - 0.5 in | SPC cable with data switch 05CZA662 (1 m) |
| | | Measuring head 6 - 8 mm | | | | Measuring head 0.275 - 0.35 in | |
| | | 8 - 10 mm | | | | 0.35 - 0.425 in | |
| | | 10 - 12 mm | | | | 0.425 - 0.5 in | |
| | | Setting ring (ø8, ø10) 1 pc. each | | | | Setting ring (0.35 in DIA., 0.425 in DIA.) 1 pc. each | |
| Extension rod (100 mm) | Extension rod (100 mm) | | | | | | |
| Spanner | Spanner | | | | | | |
| Hex wrench | Hex wrench | | | | | | |
| Phillips screwdriver | Phillips screwdriver | | | | | | |
| 468-972 | 12 - 20 | Display unit 12 - 20 mm | SPC cable with data switch 05CZA662 (1 m) | 468-977 | 0.5 - 0.8 | Display unit 0.5 - 0.8 in | SPC cable with data switch 05CZA662 (1 m) |
| | | Measuring head 12 - 16 mm | | | | Measuring head 0.5 - 0.65 in | |
| | | 16 - 20 mm | | | | 0.65 - 0.8 in | |
| | | Setting ring (ø16) | | | | Setting ring (0.65 in DIA.) | |
| | | Extension rod (150 mm) | | | | Extension rod (150 mm) | |
| Spanner | Spanner | | | | | | |
| Hex wrench | Hex wrench | | | | | | |
| Phillips screwdriver | Phillips screwdriver | | | | | | |
| 468-973 | 20 - 50 | Display unit 20 - 50 mm | SPC cable with data switch 05CZA662 (1 m) | 468-978 | 0.8 - 2 | Display unit 0.8 - 2 in | SPC cable with data switch 05CZA662 (1 m) |
| | | Measuring head 20 - 25 mm | | | | Measuring head 0.8 - 1 in | |
| | | 25 - 30 mm | | | | 1 - 1.2 in | |
| | | 30 - 40 mm | | | | 1.2 - 1.6 in | |
| | | 40 - 50 mm | | | | 1.6 - 2 in | |
| Setting ring (ø25, ø40) 1 pc. each | Setting ring (1 in DIA., 1.6 in DIA.) 1 pc. each | | | | | | |
| Extension rod (150 mm) | Extension rod (150 mm) | | | | | | |
| Spanner | Spanner | | | | | | |
| Hex wrench | Hex wrench | | | | | | |
| Phillips screwdriver | Phillips screwdriver | | | | | | |
| 468-974 | 50 - 100 | Display unit 50 - 100 mm | SPC cable with data switch 05CZA662 (1 m) | 468-979 | 2 - 4 | Display unit 2 - 4 in | SPC cable with data switch 05CZA662 (1 m) |
| | | Measuring head 50 - 63 mm | | | | Measuring head 2 - 2.5 in | |
| | | 62 - 75 mm | | | | 2.5 - 3 in | |
| | | 75 - 88 mm | | | | 3 - 3.5 in | |
| | | 87 - 100 mm | | | | 3.5 - 4 in | |
| Setting ring (ø62, ø87) 1 pc. each | Setting ring (2.5 in DIA., 3.5 in DIA.) 1 pc. each | | | | | | |
| Extension rod (150 mm) | Extension rod (150 mm) | | | | | | |
| Spanner | Spanner | | | | | | |
| Hex wrench | Hex wrench | | | | | | |
| Phillips screwdriver | Phillips screwdriver | | | | | | |
| 468-975 | 100 - 200 | Display unit 100 - 200 mm | SPC cable with data switch 05CZA662 (1 m) | 468-980 | 4 - 8 | Display unit 4 - 8 in | SPC cable with data switch 05CZA662 (1 m) |
| | | Measuring head 100 - 125 mm | | | | Measuring head 4 - 5 in | |
| | | 125 - 150 mm | | | | 5 - 6 in | |
| | | 150 - 175 mm | | | | 6 - 7 in | |
| | | 175 - 200 mm | | | | 7 - 8 in | |
| Setting ring (ø125, ø175) 1 pc. each | Setting ring (5 in DIA., 7 in DIA.) 1 pc. each | | | | | | |
| Extension rod (150 mm) | Extension rod (150 mm) | | | | | | |
| Spanner | Spanner | | | | | | |
| Hex wrench | Hex wrench | | | | | | |
| Phillips screwdriver | Phillips screwdriver | | | | | | |

* The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).



468-971

468-972

468-973

468-974



Setting rings are supplied as standard (ø125, ø175) (Packed separately)
468-975

Optional Accessories

Refer to page A-27 for details.

- USB Input Tool Direct (2 m): **06AFM380B**
- Connecting cables for **U-WAVE-T**
For standard (160 mm): **02AZD790B**
For foot switch: **02AZE140B**

Non-Interchangeable-Head Sets

| Metric | | | | | Inch / Metric | | | | |
|---------------|--------------|--|------------------------|--|---------------|--------------|--|------------------------|--|
| Set Order No. | Range*2 (mm) | Content of set | Accessories (optional) | | Set Order No. | Range*2 (in) | Content of set | Accessories (optional) | |
| | | | Extension rod | SPC cable | | | | Extension rod | SPC cable |
| 468-981 | 6 - 12 | Display unit 6 - 8 mm 1 pc. 8 - 10 mm 1 pc. 10 - 12 mm 1 pc. Setting ring (ø8, ø10) 1 pc. each Spanner 2 pcs. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 100 mm 1 pc. | | 468-986 | 0.275 - 0.5 | Display unit 0.275 - 0.35 in 1 pc. 0.35 - 0.425 in 1 pc. 0.425 - 0.5 in 1 pc. Setting ring (0.35 in DIA., 0.425 in DIA) 1 pc. each Spanner 2 pcs. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 100 mm 1 pc. | |
| 468-982 | 12 - 25 | Display unit 12 - 16 mm 1 pc. 16 - 20 mm 1 pc. 20 - 25 mm 1 pc. Setting ring (ø16, ø20) 1 pc. each Spanner 2 pcs. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 2 pcs.*1 | | 468-987 | 0.5 - 1 | Display unit 0.5 - 0.65 in 1 pc. 0.65 - 0.8 in 1 pc. 0.8 - 1 in 1 pc. Setting ring (0.65 in DIA., 0.8 in DIA) 1 pc. each Spanner 2 pcs. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 2 pcs.*1 | |
| 468-983 | 25 - 50 | Display unit 25 - 30 mm 1 pc. 30 - 40 mm 1 pc. 40 - 50 mm 1 pc. Setting ring (ø30, ø40) 1 pc. each Spanner 1 pc. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 1 pc. | SPC cable with data switch 05CZA662 (1 m) 05CZA663 (2 m) | 468-988 | 1 - 2 | Display unit 1 - 1.2 in 1 pc. 1.2 - 1.6 in 1 pc. 1.6 - 2 in 1 pc. Setting ring (1.2 in DIA., 1.6 in DIA) 1 pc. each Spanner 1 pc. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 1 pc. | SPC cable with data switch 05CZA662 (1 m) 05CZA663 (2 m) |
| 468-984 | 50 - 75 | Display unit 50 - 63 mm 1 pc. 62 - 75 mm 1 pc. Setting ring (ø62) 1 pc. Spanner 1 pc. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 1 pc. | | 468-989 | 2 - 3 | Display unit 2 - 2.5 in 1 pc. 2.5 - 3 in 1 pc. Setting ring (2.5 in DIA) 1 pc. Spanner 1 pc. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 1 pc. | |
| 468-985 | 75 - 100 | Display unit 75 - 88 mm 1 pc. 87 - 100 mm 1 pc. Setting ring (ø87) 1 pc. Spanner 1 pc. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 1 pc. | | 468-990 | 3 - 4 | Display unit 3 - 3.5 in 1 pc. 3.5 - 4 in 1 pc. Setting ring (3.5 in DIA) 1 pc. Spanner 1 pc. Hex wrench 1 pc. Phillips screwdriver 1 pc. | 150 mm 1 pc. | |

*1 Total 2 pcs. of extension rods: 1 pc. of Order No. **952621** (for measuring range 12 to 16 mm, 16 to 20 mm) and Order No. **952622** (for measuring range 20 to 25 mm).
Two extension rods cannot be connected due to the different mounting positions.

*2 The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).



468-981



468-982



468-983



468-984



468-985

Optional Accessories

Refer to page A-27 for details.

- USB Input Tool Direct (2 m): **06AFM380B**
- Connecting cables for **U-WAVE-T**
For standard (160 mm): **02AZD790B**
For foot switch: **02AZE140B**

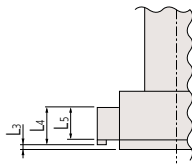
Holtest

For easy and accurate measurement of inside diameters

Holtest SERIES 368 — Three-point/Two-point Internal Micrometers

- Titanium-coated measuring pins on the three-point type (over 6 mm range models) provide excellent durability and impact resistance.
- Three-point bore micrometer with measuring range 6 mm or longer allows stable measurement through automatic centering.
- Measurement can be made close to the bottom of a blind hole.
- Deep holes can be measured by attaching an Extension Rod (optional) which is available on models over 6 mm (0.275 in) measuring range.
- Constant-force device allows repeatable measurement, regardless of operator's skill.
- For details of Setting Rings, refer to page C-47.

| Range (mm) | L ₃ (mm) | L ₄ (mm) | L ₅ (mm) |
|------------|---------------------|---------------------|---------------------|
| 2 - 6 | — | — | 2 |
| 6 - 12 | 2 or below | — | 2.5 |
| 12 - 20 | 0.3 or below | 5.6 | 3.5 |
| 20 - 30 | | 8.3 | 5.2 |
| 30 - 50 | | 13.0 | 10.0 |
| 50 - 100 | | 17.0 | 14.0 |
| 100 - 300 | 12.4 or below | 21.0 | 13.8 |



368-001
(Two-point contact model)



368-168



368-170



368-174



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Typical application using an extension rod

For details of Special-order Products, refer to page C-49.

SPECIFICATIONS

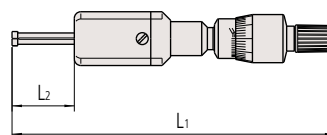
| Metric | | | | | Inch | | | | | | | | | | |
|----------------|--------------|--------------------|---|--------------------------|--------------------|------------------------|------------------------|--|--------------------------|------------------------|-----------------------------------|------------------------|--------|---------------------------------|------------------------|
| Order No. | Range*2 (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm)*1 | Extension Rod (optional) | Order No. | Range*2 (in) | Graduation (in) | Maximum permissible error J_{MPE} (in)*1 | Extension Rod (optional) | | | | | | |
| (Two-point) | | | | | (Two-point) | | | | | | | | | | |
| 368-001 | 2 - 2.5 | 0.001 | ± 2 (within 2) | — | 368-021 | 0.08 - 0.1 | 0.0001 | ± 0.0001 (within 0.0001) | — | | | | | | |
| 368-002 | 2.5 - 3 | | | | 368-022 | 0.1 - 0.12 | | | | | | | | | |
| 368-003 | 3 - 4 | | | | 368-023 | 0.12 - 0.16 | | | | | | | | | |
| 368-004 | 4 - 5 | | | | 368-024 | 0.16 - 0.2 | | | | | | | | | |
| 368-005 | 5 - 6 | | | | 368-025 | 0.2 - 0.24 | | | | | | | | | |
| (Three-point) | | | | | (Three-point) | | | | | | | | | | |
| 368-161 | 6 - 8 | 0.005 | ± 3 (within 3) | 952322 (100 mm) | 368-261 | 0.275 - 0.35 | 0.0002 | ± 0.00015 (within 0.00015) | 952322 (100 mm) | | | | | | |
| 368-162 | 8 - 10 | | | | 368-262 | 0.35 - 0.425 | | | | | | | | | |
| 368-163 | 10 - 12 | | | | 368-263 | 0.425 - 0.5 | | | | | | | | | |
| 368-164 | 12 - 16 | | | | 368-264 | 0.5 - 0.65 | | | | | | | | | |
| 368-165 | 16 - 20 | | | | 368-265 | 0.65 - 0.8 | | | | | | | | | |
| 368-166 | 20 - 25 | | | | 368-266 | 0.8 - 1 | | | | | | | | | |
| 368-167 | 25 - 30 | | | | 368-267 | 1 - 1.2 | | | | | | | | | |
| 368-168 | 30 - 40 | | | | 368-268 | 1.2 - 1.6 | | | | | | | | | |
| 368-169 | 40 - 50 | | | | 368-269 | 1.6 - 2 | | | | | | | | | |
| 368-170 | 50 - 63 | | | | ± 4 (within 4) | 952621 (150 mm) | | | | 952622 (150 mm) | 368-270 | 2 - 2.5 | 0.0002 | ± 0.0002 (within 0.0002) | 952621 (150 mm) |
| 368-171 | 62 - 75 | 368-271 | 2.5 - 3 | | | | | | | | | | | | |
| 368-172 | 75 - 88 | 368-272 | 3 - 3.5 | | | | | | | | | | | | |
| 368-173 | 87 - 100 | 368-273 | 3.5 - 4 | | | | | | | | | | | | |
| 368-174 | 100 - 125 | ± 5 (within 5) | 952623 (150 mm) | 952623 (150 mm) | | | 368-274 | 4 - 5 | 0.0002 | | ± 0.00025 (within 0.00025) | 952623 (150 mm) | | | |
| 368-175 | 125 - 150 | | | | | | 368-275 | 5 - 6 | | | | | | | |
| 368-176 | 150 - 175 | | | | | | 368-276 | 6 - 7 | | | | | | | |
| 368-177 | 175 - 200 | | | | | | 368-277 | 7 - 8 | | | | | | | |
| 368-178 | 200 - 225 | | | | | | 368-278 | 8 - 9 | | | | | | | |
| 368-179 | 225 - 250 | | | | | | 368-279 | 9 - 10 | | | | | | | |
| 368-180 | 250 - 275 | | | | ± 6 (within 6) | 952623 (150 mm) | 952623 (150 mm) | 368-280 | | 10 - 11 | | | 0.0002 | ± 0.0003 (within 0.0003) | 952623 (150 mm) |
| 368-181 | 275 - 300 | | | | | | | 368-281 | | 11 - 12 | | | | | |

*1 Additionally, the difference in permissible error allowable is limited to a value within this range, as given in parentheses, and is measured with the entire measuring surface in contact with the object measured.

*2 The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).

Note: Setting rings are optional.

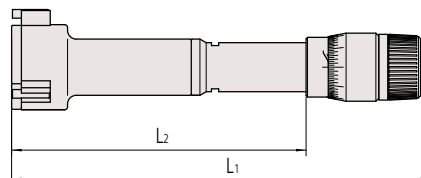
DIMENSIONS



Unit: mm

| Range | L2 | L1 |
|-------------------------------|----|-------------|
| 2 - 2.5, 2.5 - 3 mm | 12 | 103.5 - 104 |
| 3 - 4, 4 - 5, 5 - 6 mm | 22 | 113 - 114 |

Note: External appearance differs depending on the measuring range.



| Range | L2 | L1 |
|--|-----|-----------|
| 6 - 8, 8 - 10, 10 - 12 mm | 59 | 102 - 104 |
| 12 - 16, 16 - 20 mm | 82 | 126 - 130 |
| 20 - 25, 25 - 30 mm | 94 | 137 - 142 |
| 30 - 40, 40 - 50 mm | 102 | 145 - 155 |
| 50 - 63, 62 - 75, 75 - 88, 87 - 100 mm | 105 | 150 - 163 |
| 100 - 125, 125 - 150, 150 - 175, 175 - 200, 200 - 225, 225 - 250, 250 - 275, 275 - 300 mm | 161 | 227 - 252 |

Note: External appearance differs depending on the measuring range.

Holtest

For easy and accurate measurement of inside diameters

Holtest SERIES 368 — Three-point/Two-point Internal Micrometers

Non-Interchangeable-Head Sets

| Metric | | | |
|---------------------------------|-------------|-----------------|--|
| Set Order No. | Range* (mm) | Graduation (mm) | Content of Set |
| (Two-point) 368-906 | 2 - 3 | 0.001 | Micrometer head unit 2 - 2.5 mm 1 pc. 2.5 - 3 mm 1 pc. Setting ring (ø2.5) 1 pc. Hex wrench 1 pc. |
| 368-907 | 3 - 6 | | Micrometer head unit 3 - 4 mm 1 pc. 4 - 5 mm 1 pc. 5 - 6 mm 1 pc. Setting ring (ø4, ø5) 1 pc. each Hex wrench 1 pc. |
| (Three-point) 368-911 | 6 - 12 | | Micrometer head unit 6 - 8 mm 1 pc. 8 - 10 mm 1 pc. 10 - 12 mm 1 pc. Setting ring (ø8, ø10) 1 pc. each Extension rod (100 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-912 | 12 - 20 | 0.005 | Micrometer head unit 12 - 16 mm 1 pc. 16 - 20 mm 1 pc. Setting ring (ø16) 1 pc. Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-913 | 20 - 50 | | Micrometer head unit 20 - 25 mm 1 pc. 25 - 30 mm 1 pc. 30 - 40 mm 1 pc. 40 - 50 mm 1 pc. Setting ring (ø25, ø40) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-914 | 50 - 100 | | Micrometer head unit 50 - 63 mm 1 pc. 62 - 75 mm 1 pc. 75 - 88 mm 1 pc. 87 - 100 mm 1 pc. Setting ring (ø62, ø87) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-915 | 100 - 200 | | Micrometer head unit 100 - 125 mm 1 pc. 125 - 150 mm 1 pc. 150 - 175 mm 1 pc. 175 - 200 mm 1 pc. Setting ring (ø125, ø175) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |

| Inch | | | |
|---------------------------------|-------------|-----------------|--|
| Set Order No. | Range* (in) | Graduation (in) | Content of Set |
| (Two-point) 368-926 | 0.08 - 0.12 | 0.0001 | Micrometer head unit 0.08 - 0.1 in 1 pc. 0.1 - 0.12 in 1 pc. Setting ring (0.1 in DIA) 1 pc. Hex wrench 1 pc. |
| 368-927 | 0.12 - 0.28 | | Micrometer head unit 0.12 - 0.16 in 1 pc. 0.16 - 0.2 in 1 pc. 0.2 - 0.24 in 1 pc. 0.24 - 0.28 in 1 pc. Setting ring 1 pc. each (0.16 in DIA., 0.24 in DIA) Hex wrench 1 pc. |
| (Three-point) 368-916 | 0.275 - 0.5 | | Micrometer head unit 0.275 - 0.35 in 1 pc. 0.35 - 0.425 in 1 pc. 0.425 - 0.5 in 1 pc. Setting ring 1 pc. each (0.35 in DIA., 0.5 in DIA) Extension rod (100 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-917 | 0.5 - 0.8 | 0.0002 | Micrometer head unit 0.5 - 0.65 in 1 pc. 0.65 - 0.8 in 1 pc. Setting ring (0.65 in DIA) 1 pc. Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-918 | 0.8 - 2 | | Micrometer head unit 0.8 - 1 in 1 pc. 1 - 1.2 in 1 pc. 1.2 - 1.6 in 1 pc. 1.6 - 2 in 1 pc. Setting ring 1 pc. each (1 in DIA., 1.6 in DIA) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-919 | 2 - 4 | | Micrometer head unit 2 - 2.5 in 1 pc. 2.5 - 3 in 1 pc. 3 - 3.5 in 1 pc. 3.5 - 4 in 1 pc. Setting ring 1 pc. each (2.5 in DIA., 3.5 in DIA) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-920 | 4 - 8 | | Micrometer head unit 4 - 5 in 1 pc. 5 - 6 in 1 pc. 6 - 7 in 1 pc. 7 - 8 in 1 pc. Setting ring 1 pc. each (5 in DIA., 7 in DIA) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |

* The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).



368-906



368-907



368-911



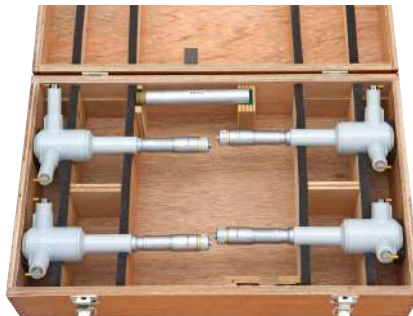
368-912



368-913



368-914



Setting rings are supplied as standard
($\phi 125$, $\phi 175$) (Packed separately)

368-915

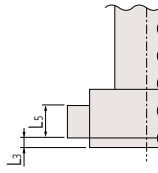
Holtest

For easy and accurate measurement of inside diameters

Holtest (Type II) SERIES 368 — Three-point Internal Micrometers

- Affordable, entry-level Holtest.
- Same accuracy as the titanium-coated Holtest models.
- For details of Setting Rings, refer to page C-47.
- Constant-force device allows repeatable measurement, regardless of operator's skill.

| Range (mm) | L ₃ (mm) | L ₅ (mm) |
|------------|---------------------|---------------------|
| 12 - 20 | 2.6 or below | 3.5 |
| 20 - 30 | 3.4 or below | 5.2 |
| 30 - 50 | | 10 |
| 50 - 100 | 19.6 or below | 14 |
| 100 - 300 | | 13.8 |



- Deep holes can be measured by attaching an Extension Rod (optional).



368-769



368-770



368-774



An inspection certificate is supplied as standard. Refer to page U-11 for details.



For details of Special-order Products, refer to page C-49.

SPECIFICATIONS

| Metric Individual | | | | |
|-------------------|--------------------------|-----------------|---|--------------------------|
| Order No. | Range* ² (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm)* ¹ | Extension Rod (optional) |
| 368-764 | 12 - 16 | 0.005 | ±3 (within 3) | 952621 (150 mm) |
| 368-765 | 16 - 20 | | | |
| 368-766 | 20 - 25 | | | |
| 368-767 | 25 - 30 | | | |
| 368-768 | 30 - 40 | | | |
| 368-769 | 40 - 50 | | | |
| 368-770 | 50 - 63 | | ±4 (within 4) | 952622 (150 mm) |
| 368-771 | 62 - 75 | | | |
| 368-772 | 75 - 88 | | | |
| 368-773 | 87 - 100 | | | |
| 368-774 | 100 - 125 | | | |
| 368-775 | 125 - 150 | | | |
| 368-776 | 150 - 175 | | ±5 (within 5) | 952623 (150 mm) |
| 368-777 | 175 - 200 | | | |
| 368-778 | 200 - 225 | | | |
| 368-779 | 225 - 250 | | | |
| 368-780 | 250 - 275 | ±6 (within 6) | | |
| 368-781 | 275 - 300 | | | |

| Inch Individual | | | | |
|-----------------|--------------------------|-------------------------|--|--------------------------|
| Order No. | Range* ² (in) | Graduation (in) | Maximum permissible error J_{MPE} (in)* ¹ | Extension Rod (optional) |
| 368-864 | 0.5 - 0.65 | 0.0002 | ±0.00015 (within 0.00015) | 952621 (150 mm) |
| 368-865 | 0.65 - 0.8 | | | |
| 368-866 | 0.8 - 1 | | | |
| 368-867 | 1 - 1.2 | | | |
| 368-868 | 1.2 - 1.6 | | | |
| 368-869 | 1.6 - 2 | | | |
| 368-870 | 2 - 2.5 | | ±0.0002 (within 0.0002) | 952622 (150 mm) |
| 368-871 | 2.5 - 3 | | | |
| 368-872 | 3 - 3.5 | | | |
| 368-873 | 3.5 - 4 | | | |
| 368-874 | 4 - 5 | | | |
| 368-875 | 5 - 6 | | | |
| 368-876 | 6 - 7 | | ±0.00025 (within 0.00025) | 952623 (150 mm) |
| 368-877 | 7 - 8 | | | |
| 368-878 | 8 - 9 | | | |
| 368-879 | 9 - 10 | | | |
| 368-880 | 10 - 11 | ±0.0003 (within 0.0003) | | |
| 368-881 | 11 - 12 | | | |

*1 Additionally, the difference in permissible error allowable is limited to a value within this range, as given in parentheses, and is measured with the entire measuring surface in contact with the object measured.

*2 The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).

Note: Setting rings are optional.

DIMENSIONS

| Unit: mm | Range | L ₂ | L ₁ |
|----------|--|----------------|----------------|
| | 12 - 16, 16 - 20 | 82 | 126 - 130 |
| | 20 - 25, 25 - 30 | 94 | 137 - 142 |
| | 30 - 40, 40 - 50 | 102 | 145 - 155 |
| | 50 - 63, 62 - 75, 75 - 88, 87 - 100 | 105 | 150 - 163 |
| | 100 - 125, 125 - 150, 150 - 175, 175 - 200 | 161 | 227 - 252 |
| | 200 - 225, 225 - 250, 250 - 275, 275 - 300 | | |

Note: External appearance differs depending on the measuring range.

Non-Interchangeable-Head Sets

| Metric | | | | Inch | | | |
|-----------|-------------|-----------------|--|-----------|-------------|-----------------|---|
| Order No. | Range* (mm) | Graduation (mm) | Content of Set | Order No. | Range* (in) | Graduation (in) | Content of Set |
| 368-991 | 12 - 20 | 0.005 | Micrometer head unit 12 - 16 mm 1 pc. 16 - 20 mm 1 pc. Setting ring (ø16) 1 pc. Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. | 368-995 | 0.5 - 0.8 | 0.002 | Micrometer head unit 0.5 - 0.65 in 1 pc. 0.65 - 0.8 in 1 pc. Setting ring (0.65 in DIA.) 1 pc. Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| | | | Micrometer head unit 20 - 25 mm 1 pc. 25 - 30 mm 1 pc. 30 - 40 mm 1 pc. 40 - 50 mm 1 pc. Setting ring (ø25, ø40) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. | | | | Micrometer head unit 0.8 - 1 in 1 pc. 1 - 1.2 in 1 pc. 1.2 - 1.6 in 1 pc. 1.6 - 2 in 1 pc. Setting ring 1 pc. each (1 in DIA., 1.6 in DIA.) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-992 | 20 - 50 | 0.005 | Micrometer head unit 50 - 63 mm 1 pc. 62 - 75 mm 1 pc. 75 - 88 mm 1 pc. 87 - 100 mm 1 pc. Setting ring (ø62, ø87) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. | 368-996 | 0.8 - 2 | 0.002 | Micrometer head unit 2 - 2.5 in 1 pc. 2.5 - 3 in 1 pc. 3 - 3.5 in 1 pc. 3.5 - 4 in 1 pc. Setting ring 1 pc. each (2.5 in DIA., 3.5 in DIA.) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| | | | Micrometer head unit 100 - 125 mm 1 pc. 125 - 150 mm 1 pc. 150 - 175 mm 1 pc. 175 - 200 mm 1 pc. Setting ring (ø125, ø175) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. | | | | Micrometer head unit 4 - 5 in 1 pc. 5 - 6 in 1 pc. 6 - 7 in 1 pc. 7 - 8 in 1 pc. Setting ring 1 pc. each (5 in DIA., 7 in DIA.) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-993 | 50 - 100 | 0.005 | Micrometer head unit 100 - 125 mm 1 pc. 125 - 150 mm 1 pc. 150 - 175 mm 1 pc. 175 - 200 mm 1 pc. Setting ring (ø125, ø175) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. | 368-997 | 2 - 4 | 0.002 | Micrometer head unit 4 - 5 in 1 pc. 5 - 6 in 1 pc. 6 - 7 in 1 pc. 7 - 8 in 1 pc. Setting ring 1 pc. each (5 in DIA., 7 in DIA.) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |
| 368-994 | 100 - 200 | 0.005 | Micrometer head unit 100 - 125 mm 1 pc. 125 - 150 mm 1 pc. 150 - 175 mm 1 pc. 175 - 200 mm 1 pc. Setting ring (ø125, ø175) 1 pc. each Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. | 368-998 | 4 - 8 | 0.002 | Micrometer head unit 4 - 5 in 1 pc. 5 - 6 in 1 pc. 6 - 7 in 1 pc. 7 - 8 in 1 pc. Setting ring 1 pc. each (5 in DIA., 7 in DIA.) Extension rod (150 mm) 1 pc. Spanner 2 pcs. Hex wrench 1 pc. |

* The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).



368-991



368-992



368-993



Setting rings are supplied as standard (ø125, ø175) (Packed separately)

368-994

Holtest

For easy and accurate measurement of inside diameters

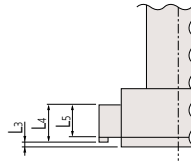
ABSOLUTE Borematic SERIES 568 — ABSOLUTE Digimatic Snap-Open Bore Gages

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- A snap-type digital display, inside-diameter measuring instrument allows quick and easy measurement with lever operation.
- Titanium-coated measuring pins provide excellent durability and impact resistance.
- Three-Point contact measuring head enables highly repeatable measurement data to be obtained.
- Built-in ABS (absolute) scale with absolute origin eliminates the need for origin setting each time power is turned on. In addition, reliability has improved due to elimination of overspeed errors.
- Equipped with GO/NO-GO judgment function, which is enabled when the upper and lower limits are set. In addition, the GO/NO-GO judgment result can be zoomed.

- Dual HOLD function buttons, optimally located, enable high operability.
- 330° rotatable display unit for easy reading at any angle.
- Measurement can be made close to the bottom of a blind hole.

| Range (mm) | L3 (mm) | L4 (mm) | L5 (mm) |
|------------|--------------|---------|---------|
| 6 - 12 | 2 or below | — | 2.5 |
| 12 - 20 | 0.3 or below | 5.6 | 3.5 |
| 20 - 30 | | 8.3 | 5.2 |
| 30 - 50 | | 13.0 | 10 |
| 50 - 125 | | 17.0 | 14 |



- Deep holes can be measured by attaching an Extension Rod (optional).



Extension Rod (optional)

- Digimatic output port enables inclusion in a statistical process control or networked measurement system. (Refer to page A-3 for details)
- Interface Input Tools are available that enable the conversion of measurement data to keyboard signals that are then directly input to cells in off-the-shelf spreadsheet software such as Excel. (Refer to page A-5 for details)
- Interchangeable-Head Sets (interchangeable measuring heads type) covering an extended measuring range using multiple heads and Non-interchangeable-Head Sets are available.
- For details of Setting Rings, refer to page C-47.



Large LCD

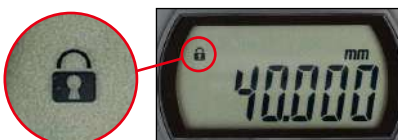
Character height of 11 mm (1.5 times the character area of conventional 8.5 mm products).



Actual size

Function Lock

Ensures reliability of measurement by locking the settings to prevent preset function settings from being changed by mistake.



Three large buttons

The three large-button design employed by ID-N/ID-B, the ABSOLUTE coolant proof Digimatic indicators, enables easier and simpler operation.



- **MODE** (ABS measurement system)
Tolerance judgment setting
Function lock setting
- **SET** (INC measurement system)
- **ON/OFF** (Power ON/OFF)
- Switches between the ABS (absolute) and INC (incremental) measurement modes

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

ABSOLUTE[™]

Technical Data

- Resolution: 0.001 mm or 0.00005 in/0.001 mm
- Response speed: Infinite
- Battery: SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Scale type: Electrostatic capacitance type absolute encoder
- Battery life: Approx. 5,000 hours in continuous use



Functions

- GO/NO-GO judgment
- GO/NO-GO judgment zoom
- 2-Point Preset
- Zero-setting
- Data hold, Error alarm
- Low battery voltage alert
- Data output
- Function Lock
- 330° rotary display
- inch/mm conversion (inch/mm models)

For details of Custom-ordered Products, refer to page C-49.

Optional Accessories

Refer to page A-28 for details

- USB Input Tool Direct (2 m): **06AFM380F**
- Connecting cables for **U-WAVE-T**
For standard (160 mm): **02AZD790F**
For foot switch: **02AZE140F**

SPECIFICATIONS

| Metric | | Individual | | | |
|-----------|--------------|---|----------|------------------------|-----------|
| Order No. | Range*2 (mm) | Maximum permissible error J_{MPE} (μm)*1 | Mass (g) | Accessories (optional) | |
| | | | | Extension Rod | SPC cable |
| 568-361 | 6 - 8 | ±5 (within 5) | 480 | 952322 (100 mm) | |
| 568-362 | 8 - 10 | | 485 | | |
| 568-363 | 10 - 12 | | 485 | | |
| 568-364 | 12 - 16 | | 475 | | |
| 568-365 | 16 - 20 | | 480 | | |
| 568-366 | 20 - 25 | ±6 (within 6) | 540 | 905338 (1 mm) | |
| 568-367 | 25 - 30 | | 555 | | |
| 568-368 | 30 - 40 | | 565 | | |
| 568-369 | 40 - 50 | | 610 | | |
| 568-370 | 50 - 63 | | 730 | | |
| 568-371 | 62 - 75 | | 740 | | |
| 568-372 | 75 - 88 | | 790 | | |
| 568-373 | 87 - 100 | | 800 | | |
| 568-374 | 100 - 113 | | 900 | | |
| 568-375 | 112 - 125 | | 910 | | |

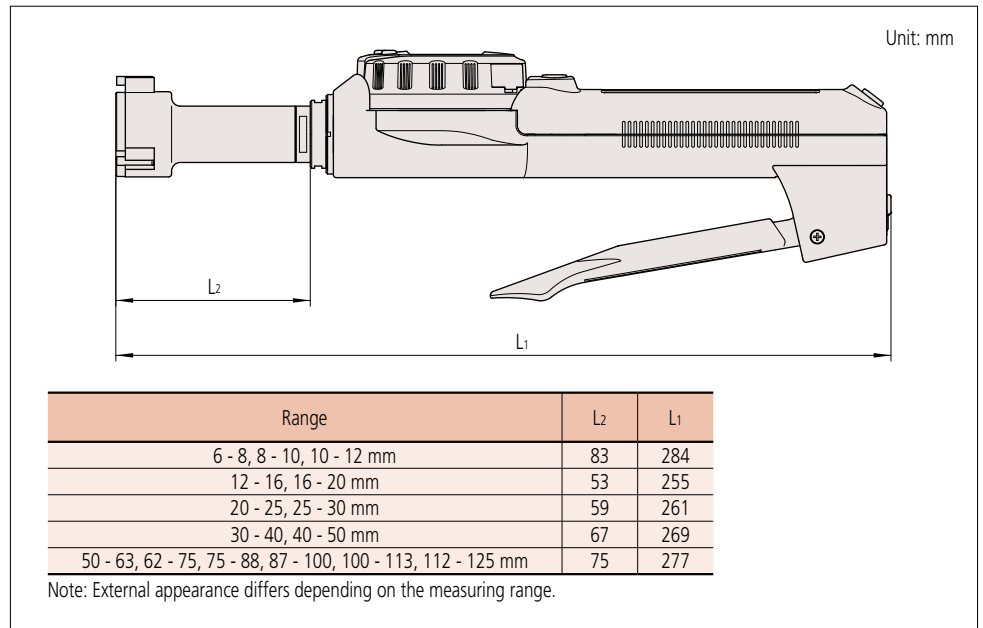
| Inch / Metric | | Individual | | | |
|---------------|--------------|--|----------|--------------------------|-----------|
| Order No. | Range*2 (in) | Maximum permissible error J_{MPE} (in)*1 | Mass (g) | Extension Rod (optional) | |
| | | | | Extension Rod | SPC cable |
| 568-461 | 0.275 - 0.35 | ±0.00025 (within 0.00025) | 480 | 952322 (100 mm) | |
| 568-462 | 0.35 - 0.425 | | 485 | | |
| 568-463 | 0.425 - 0.5 | | 485 | | |
| 568-464 | 0.5 - 0.65 | | 475 | | |
| 568-465 | 0.65 - 0.8 | | 480 | | |
| 568-466 | 0.8 - 1 | ±0.0003 (within 0.0003) | 540 | 905338 (1 mm) | |
| 568-467 | 1 - 1.2 | | 555 | | |
| 568-468 | 1.2 - 1.6 | | 565 | | |
| 568-469 | 1.6 - 2 | | 610 | | |
| 568-470 | 2 - 2.5 | | 730 | | |
| 568-471 | 2.5 - 3 | | 740 | | |
| 568-472 | 3 - 3.5 | | 790 | | |
| 568-473 | 3.5 - 4 | | 800 | | |
| 568-474 | 4 - 4.5 | | 900 | | |
| 568-475 | 4.5 - 5 | | 910 | | |

*1 Additionally, the difference in permissible error allowable is limited to a value within this range, as given in parentheses, and is measured with the entire measuring surface in contact with the object measured.

*2 The measurement range cannot be enlarged by measuring heads that are not standard-supplied (the accuracy is not guaranteed).

Note: Setting rings are optional.

DIMENSIONS



Holtest

For easy and accurate measurement of inside diameters

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE Borematic SERIES 568 — ABSOLUTE Digimatic Snap-Open Bore Gages

MeasurLink ENABLED
Data Management Software by Mitutoyo

Interchangeable-Head Bore Gage Sets

| Metric | | | |
|-----------|------------|----------------|--------|
| Order No. | Range (mm) | Content of Set | |
| 568-924 | 6 - 12 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 6 - 8 mm | 1 pc. |
| | | 8 - 10 mm | 1 pc. |
| | | 10 - 12 mm | 1 pc. |
| | | Attachment | 1 pc. |
| 568-925 | 12 - 25 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 12 - 16 mm | 1 pc. |
| | | 16 - 20 mm | 1 pc. |
| | | 20 - 25 mm | 1 pc. |
| | | Attachment | 2 pcs. |
| 568-926 | 25 - 50 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 25 - 30 mm | 1 pc. |
| | | 30 - 40 mm | 1 pc. |
| | | 40 - 50 mm | 1 pc. |
| | | Attachment | 1 pc. |
| 568-927 | 50 - 100 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 50 - 63 mm | 1 pc. |
| | | 62 - 75 mm | 1 pc. |
| | | 75 - 88 mm | 1 pc. |
| | | Attachment | 1 pc. |

| Inch / Metric | | | |
|---------------|-------------|-----------------|--------|
| Order No. | Range (in) | Content of Set | |
| 568-928 | 0.275 - 0.5 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 0.275 - 0.35 in | 1 pc. |
| | | 0.35 - 0.425 in | 1 pc. |
| | | 0.425 - 0.5 in | 1 pc. |
| | | Attachment | 1 pc. |
| 568-929 | 0.5 - 1 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 0.5 - 0.65 in | 1 pc. |
| | | 0.65 - 0.8 in | 1 pc. |
| | | 0.8 - 1 in | 1 pc. |
| | | Attachment | 2 pcs. |
| 568-930 | 1 - 2 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 1 - 1.2 in | 1 pc. |
| | | 1.2 - 1.6 in | 1 pc. |
| | | 1.6 - 2 in | 1 pc. |
| | | Attachment | 1 pc. |
| 568-936 | 2 - 4 | Display unit | 1 pc. |
| | | Measuring head | |
| | | 2 - 2.5 in | 1 pc. |
| | | 2.5 - 3 in | 1 pc. |
| | | 3 - 3.5 in | 1 pc. |
| | | Attachment | 1 pc. |

Non-Interchangeable-Head Snap-Open Bore Gage Sets

Each set includes complete gages (display units and measuring heads for each size).

| Metric | | | |
|--------------------|------------|-------------------------|------------|
| Order No. | Range (mm) | Content of Set | |
| 568-955 | 6 - 12 | Display unit | |
| | | 6 - 8 mm | 1 pc. |
| | | 8 - 10 mm | 1 pc. |
| | | 10 - 12 mm | 1 pc. |
| | | Setting ring (ø8, ø10) | 1 pc. each |
| | | Spanner | 3 pcs. |
| 568-956 | 12 - 25 | Display unit | |
| | | 12 - 16 mm | 1 pc. |
| | | 16 - 20 mm | 1 pc. |
| | | 20 - 25 mm | 1 pc. |
| | | Setting ring (ø16, ø20) | 1 pc. each |
| | | Spanner | 2 pcs. |
| 568-957 | 25 - 50 | Display unit | |
| | | 25 - 30 mm | 1 pc. |
| | | 30 - 40 mm | 1 pc. |
| | | 40 - 50 mm | 1 pc. |
| | | Setting ring (ø30, ø40) | 1 pc. each |
| | | Spanner | 2 pcs. |
| 568-958 | 50 - 75 | Display unit | |
| | | 50 - 63 mm | 1 pc. |
| | | 62 - 75 mm | 1 pc. |
| | | Setting ring (ø62) | 1 pc. |
| | | Spanner | 2 pcs. |
| | | 568-959 | 75 - 100 |
| 75 - 88 mm | 1 pc. | | |
| 87 - 100 mm | 1 pc. | | |
| Setting ring (ø87) | 1 pc. | | |
| Spanner | 2 pcs. | | |

| Inch / Metric | | | |
|---------------------------|-------------|--|------------|
| Order No. | Range (in) | Content of Set | |
| 568-965 | 0.275 - 0.5 | Display unit | |
| | | 0.275 - 0.35 in | 1 pc. |
| | | 0.35 - 0.425 in | 1 pc. |
| | | 0.425 - 0.5 in | 1 pc. |
| | | Setting ring (0.35 in DIA, 0.425 in DIA) | 1 pc. each |
| | | Spanner | 3 pcs. |
| 568-966 | 0.5 - 1 | Display unit | |
| | | 0.5 - 0.65 in | 1 pc. |
| | | 0.65 - 0.8 in | 1 pc. |
| | | 0.8 - 1 in | 1 pc. |
| | | Setting ring (0.65 in DIA, 0.8 in DIA) | 1 pc. each |
| | | Spanner | 2 pcs. |
| 568-967 | 1 - 2 | Display unit | |
| | | 1 - 1.2 in | 1 pc. |
| | | 1.2 - 1.6 in | 1 pc. |
| | | 1.6 - 2 in | 1 pc. |
| | | Setting ring (1.2 in DIA, 1.6 in DIA) | 1 pc. each |
| | | Spanner | 2 pcs. |
| 568-968 | 2 - 3 | Display unit | |
| | | 2 - 2.5 in | 1 pc. |
| | | 2.5 - 3 in | 1 pc. |
| | | Setting ring (2.5 in DIA) | 1 pc. |
| | | Spanner | 2 pcs. |
| | | 568-969 | 3 - 4 |
| 3 - 3.5 in | 1 pc. | | |
| 3.5 - 4 in | 1 pc. | | |
| Setting ring (3.5 in DIA) | 1 pc. | | |
| Spanner | 2 pcs. | | |



568-924



568-926



568-955



568-957



568-959

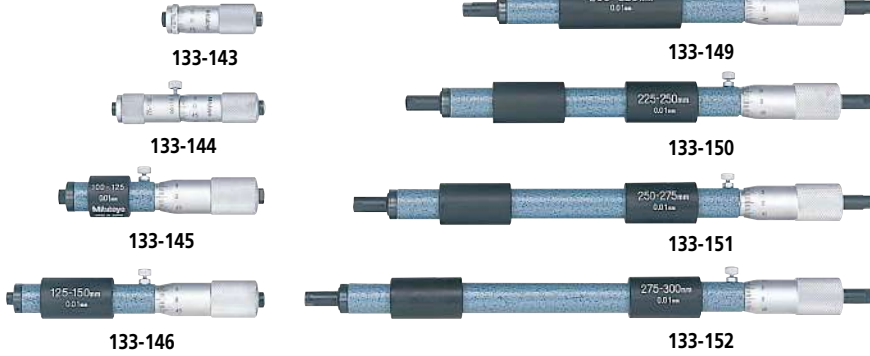
Inside Micrometers

For easy and accurate measurement of inside size and diameter

Tubular Inside Micrometers SERIES 133 — Single Rod Type

- Standard single rod type inside micrometer.
- Carbide measuring faces.
- The sleeve is rotated to adjust the reference point adjustment when setting to a length standard.
- Optional Setting Rings (nominal size below 300 mm), CERA Inside Micro Checker and Gauge Block Accessory Sets are available as reference gages datum adjustment. (Refer

to pages C-47, C-26, and E-17 to E20 for details)



SPECIFICATIONS

| Metric | | Individual | | |
|-----------|------------|-----------------|---|---------|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | |
| 133-143 | 50 - 75 | 0.01 | ± 3 | |
| 133-144 | 75 - 100 | | ± 4 | |
| 133-145 | 100 - 125 | | ± 5 | |
| 133-146 | 125 - 150 | | | |
| 133-147 | 150 - 175 | | | |
| 133-148 | 175 - 200 | | | |
| 133-149 | 200 - 225 | | | |
| 133-150 | 225 - 250 | | | |
| 133-151 | 250 - 275 | | ± 6 | |
| 133-152 | 275 - 300 | | | |
| 133-153 | 300 - 325 | | | |
| 133-154 | 325 - 350 | | | ± 7 |
| 133-155 | 350 - 375 | | | |
| 133-156 | 375 - 400 | | | |
| 133-157 | 400 - 425 | | ± 8 | |
| 133-158 | 425 - 450 | | | |
| 133-159 | 450 - 475 | | | |
| 133-160 | 475 - 500 | ± 9 | | |
| 133-161 | 500 - 525 | | | |
| 133-162 | 525 - 550 | | | |
| 133-163 | 550 - 575 | ± 10 | | |
| 133-164 | 575 - 600 | | | |
| 133-165 | 600 - 625 | | | |
| 133-166 | 625 - 650 | ± 11 | | |
| 133-167 | 650 - 675 | | | |
| 133-168 | 675 - 700 | | | |
| 133-169 | 700 - 725 | ± 12 | | |
| 133-170 | 725 - 750 | | | |
| 133-171 | 750 - 775 | | | |
| 133-172 | 775 - 800 | ± 13 | | |
| 133-173 | 800 - 825 | | | |
| 133-174 | 825 - 850 | | | |
| 133-175 | 850 - 875 | ± 14 | | |
| 133-176 | 875 - 900 | | | |
| 133-177 | 900 - 925 | | | |
| 133-178 | 925 - 950 | ± 15 | | |
| 133-179 | 950 - 975 | | | |
| 133-180 | 975 - 1000 | | ± 16 | |

| Inch | | Individual | |
|-----------|------------|-----------------|--|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) |
| 133-223 | 2 - 3 | 0.001 | ± 0.00015 |
| 133-224 | 3 - 4 | | ± 0.0002 |
| 133-225 | 4 - 5 | | ± 0.00025 |
| 133-226 | 5 - 6 | | |
| 133-227 | 6 - 7 | | |
| 133-228 | 7 - 8 | | |
| 133-229 | 8 - 9 | | |
| 133-230 | 9 - 10 | | |
| 133-231 | 10 - 11 | | ± 0.0003 |
| 133-232 | 11 - 12 | | |

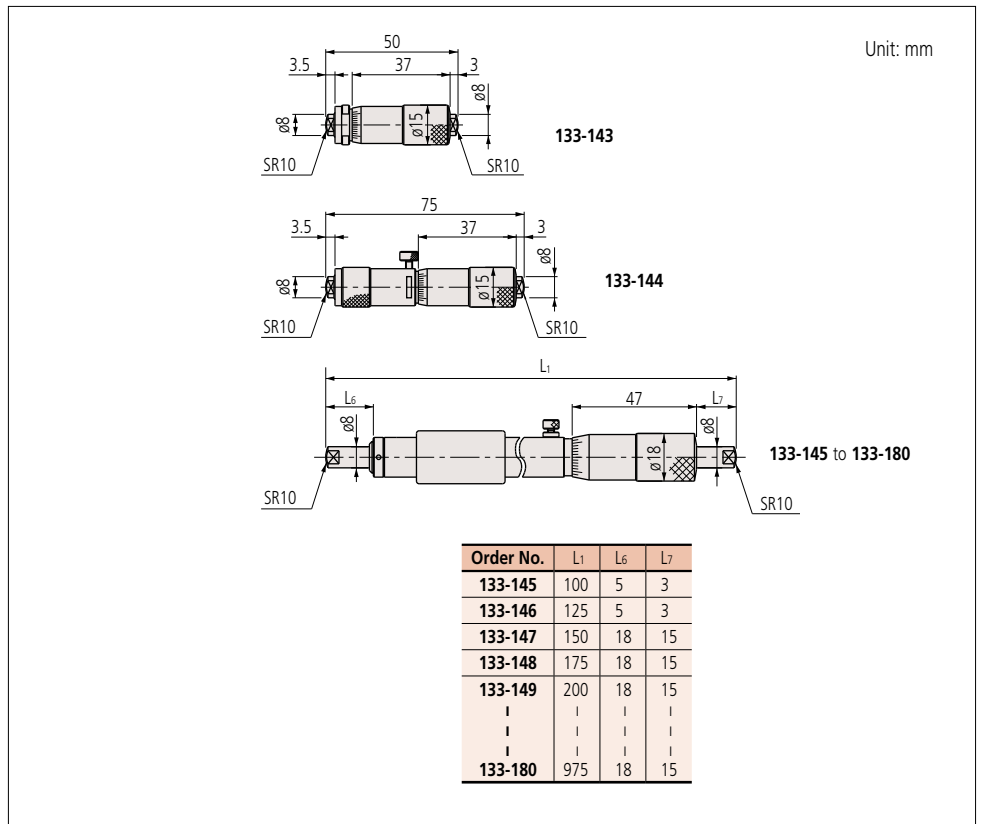
Single Rod Type Inside Micrometer Set



133-902

| Metric Micrometer set | | | Inch Micrometer set | | |
|-----------------------|----------------------------|---|---------------------|--------------------------|---|
| Order No. | Range (mm) | Models included | Order No. | Range (in) | Models included |
| 133-901 | 50 - 150 (4 heads/set) | 133-143 133-144 133-145 133-146 with fitted case | 133-903 | 2 - 6 (4 heads/set) | 133-223 133-224 133-225 133-226 with fitted case |
| 133-902 | 50 - 300 (10 heads/set) | 133-143 133-144 133-145 133-146 133-147 133-148 133-149 133-150 133-151 133-152 with fitted case | 133-904 | 2 - 12 (10 heads/set) | 133-223 133-224 133-225 133-226 133-227 133-228 133-229 133-230 133-231 133-232 with fitted case |

DIMENSIONS



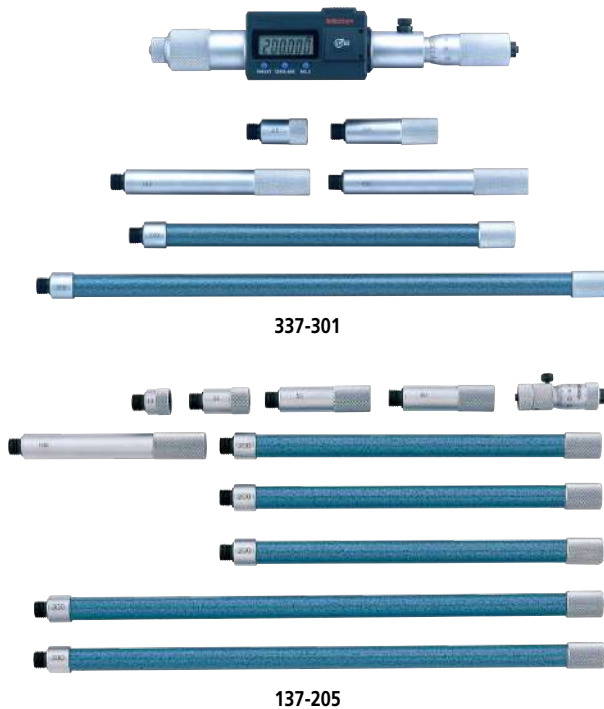
Inside Micrometers

For easy and accurate measurement of inside size and diameter

Tubular Inside Micrometers SERIES 137, 337 — Extension Rod Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Wide range of inside measurements possible by combining extension rods and anvils with the micrometer head.
- Two types of measuring faces are available; with or without carbide tip. (Order No. 337-101/301/302/102/303/304 only available with carbide tip)
- The sleeve is rotated to adjust the reference point adjustment when setting to a length standard.
- An inside length standard is required for accurately setting the micrometer.
- Order No. 337-101/301/302/102/303/304 features:
 - IP65 (water-proof) protection level that enables use in the presence of cutting fluid.
 - A large-character LCD display.
 - Storage of 2 preset values for use when setting to an inside length standard.
 - A function lock that prevents accidental changing of the reference setting during measurement.



SPECIFICATIONS

| Metric | | | | | | |
|-----------------|------------|-----------------|-----------------------------|-----|--------------------------------|-------------------|
| Order No. | Range (mm) | Resolution (mm) | Micrometer head stroke (mm) | Qty | Extension rods Size (mm) | Display unit (mm) |
| Digimatic (LCD) | | | | | | |
| 337-101 | 200 - 225 | 0.001 | 25 | — | — | 200 - 225 |
| 337-301 | 200 - 1000 | | | 6 | 25, 50, 100 (2 pcs.), 200, 300 | |
| 337-302 | 200 - 1500 | | | 7 | 25, 50, 100, 200, 300 (3 pcs.) | |

| Metric | | | | | | |
|--------------------------------------|------------|-----------------|-----------------------------|-----|--|----------------|
| Order No. | Range (mm) | Graduation (mm) | Micrometer head stroke (mm) | Qty | Extension rods Size (mm) | Main unit (mm) |
| Analog | | | | | | |
| 137-201 | 50 - 150 | 0.01 | 13 | 3 | 13, 25, 50 | 50 - 63 |
| 137-202 | 50 - 300 | | | 5 | 13, 25, 50 (2 pcs.), 100 | |
| 137-203 | 50 - 500 | | | 6 | 13, 25, 50 (2 pcs.), 100, 200 | |
| 137-204 | 50 - 1000 | | | 8 | 13, 25, 50 (2 pcs.), 100, 200 (2 pcs.), 300 | |
| 137-205 | 50 - 1500 | | | 10 | 13, 25, 50 (2 pcs.), 100, 200 (3 pcs.), 300 (2 pcs.) | |
| Analog (With carbide measuring face) | | | | | | |
| 137-206 | 50 - 150 | 0.01 | 13 | 3 | 13, 25, 50 | 50 - 63 |
| 137-207 | 50 - 300 | | | 5 | 13, 25, 50 (2 pcs.), 100 | |
| 137-208 | 50 - 500 | | | 6 | 13, 25, 50 (2 pcs.), 100, 200 | |
| 137-209 | 50 - 1000 | | | 8 | 13, 25, 50 (2 pcs.), 100, 200 (2 pcs.), 300 | |
| 137-210 | 50 - 1500 | | | 10 | 13, 25, 50 (2 pcs.), 100, 200 (3 pcs.), 300 (2 pcs.) | |

| Inch / Metric | | | | | | |
|-----------------|------------|------------------------|-----------------------------|-----|--------------------------|-------------------|
| Order No. | Range (in) | Resolution | Micrometer head stroke (in) | Qty | Extension rods Size (in) | Display unit (in) |
| Digimatic (LCD) | | | | | | |
| 337-102 | 8 - 9 | 0.0001 in/ 0.001 mm | 1 | — | — | 8 - 9 |
| 337-303 | 8 - 40 | | | 6 | 1, 2, 4 (2 pcs.), 8, 12 | |
| 337-304 | 8 - 60 | | | 7 | 1, 2, 4, 8, 12 (3 pcs.) | |

| Inch | | | | | | |
|--------------------------------------|------------|-----------------|-----------------------------|-----|--|----------------|
| Order No. | Range (in) | Graduation (in) | Micrometer head stroke (in) | Qty | Extension rods Size (in) | Main unit (in) |
| Analog | | | | | | |
| 137-211 | 2 - 6 | 0.001 | 0.5 | 3 | 0.5, 1, 2 | 2 - 2.5 |
| 137-212 | 2 - 12 | | | 5 | 0.5, 1, 2 (2 pcs.), 4 | |
| 137-213 | 2 - 20 | | | 6 | 0.5, 1, 2 (2 pcs.), 4, 8 | |
| 137-214 | 2 - 40 | | | 8 | 0.5, 1, 2 (2 pcs.), 4, 8 (2 pcs.), 12 | |
| 137-215 | 2 - 60 | | | 10 | 0.5, 1, 2 (2 pcs.), 4, 8 (3 pcs.), 12 (2 pcs.) | |
| Analog (With carbide measuring face) | | | | | | |
| 137-216 | 2 - 6 | 0.001 | 0.5 | 3 | 0.5, 1, 2 | 2 - 2.5 |
| 137-217 | 2 - 12 | | | 5 | 0.5, 1, 2 (2 pcs.), 4 | |
| 137-218 | 2 - 20 | | | 6 | 0.5, 1, 2 (2 pcs.), 4, 8 | |
| 137-219 | 2 - 40 | | | 8 | 0.5, 1, 2 (2 pcs.), 4, 8 (2 pcs.), 12 | |
| | | | | 10 | 0.5, 1, 2 (2 pcs.), 4, 8 (3 pcs.), 12 (2 pcs.) | |

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



IP Codes

Level 6: Dust-proof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Spindle feed error: 3 µm/0.00015 in

Note: "Spindle feed error" refers to the difference between the maximum and minimum indication error values within the measuring range of the micrometer head



Functions

(for 337-101/301/302/102/303/304)

- Zero-setting
- Origin restoration
- Data hold
- 2-point Preset
- Function lock
- Automatic power ON/OFF
- Error alarm
- Data output

Technical Data

- Battery and Scale Type (for 337-101/301/302/102/303/304) SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 1.2 years under normal use
- Scale type: Electromagnetic induction-type rotary encoder

Optional Accessories

Refer to page A-27 for details.

- Connecting cables with **IT/DP/MUX**, etc.
1 m: **05CZA662**
2 m: **05CZA663**
- **USB** Input Tool Direct (2 m): **06AFM380B**
- Connecting cables for **U-WAVE-T**
For standard (160 mm): **02AZD790B**
For foot switch: **02AZE140B**

Tubular Inside Micrometers SERIES 137 — Extension Rod Type (main unit)

Technical Data

- Spindle feed error 3 μm /0.00015 in
- Note: "Spindle feed error" refers to the difference between the maximum and minimum indication error values within the specification range of the micrometer head

- Micrometer head for Extension Rod Type inside micrometer.
- The sleeve is rotated to adjust the reference point adjustment when setting to a length standard.
- Optional Setting Rings and Gauge Block Accessory Sets are available as reference gages for datum adjustment. (Refer to pages C-47 and E-17 to E-20 for details)

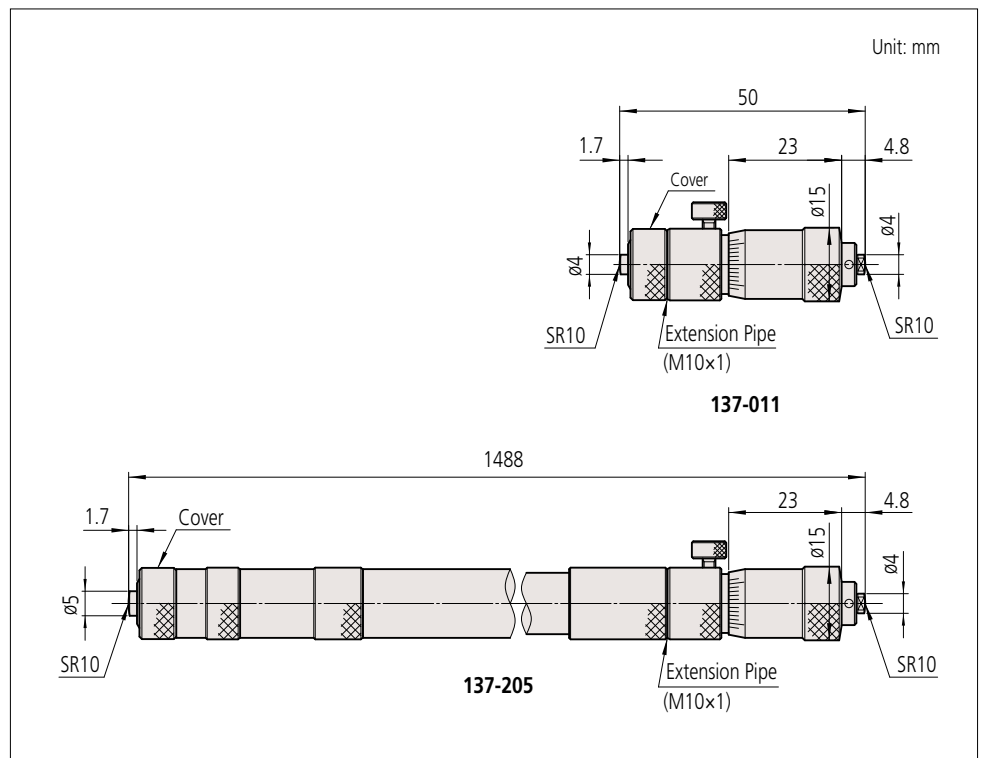


137-011

SPECIFICATIONS

| Metric | | | |
|---------------------------|------------|-----------------|-----------------------------|
| Order No. | Range (mm) | Graduation (mm) | Micrometer head stroke (mm) |
| 137-011 | 50 - 63 | 0.01 | 13 |
| Carbide-tipped 137-013 | | | |
| Inch | | | |
| Order No. | Range (in) | Graduation (in) | Micrometer head stroke (in) |
| 137-012 | 2 - 2.5 | 0.001 | 0.5 |
| Carbide-tipped 137-014 | | | |

DIMENSIONS



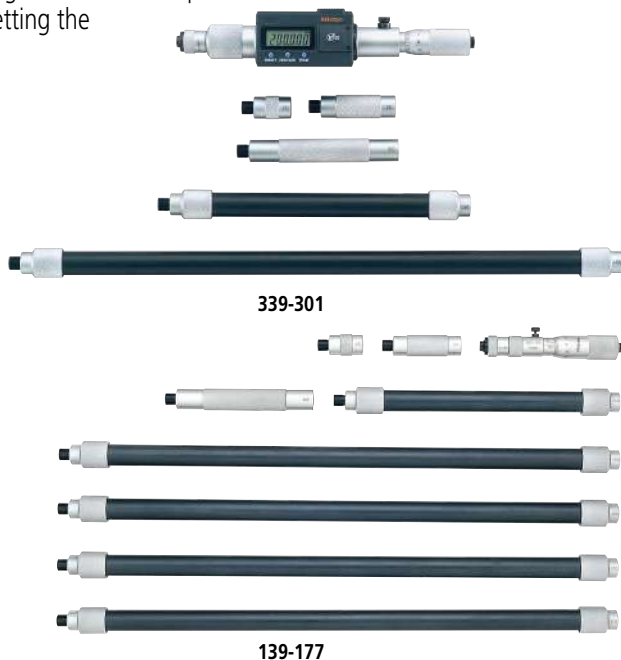
Inside Micrometers

For easy and accurate measurement of inside size and diameter

Tubular Inside Micrometers SERIES 139, 339, 140 — Extension Pipe Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Wide range of inside measurements possible by combining Extension Pipes and anvils with the micrometer head.
- Carbide measuring faces.
- The sleeve is rotated to adjust the reference point adjustment when setting to a length standard.
- An inside length standard is required for accurately setting the micrometer.
- Order No. 339-101/301/302/102/303/304 features:
 - IP65 (water-proof) protection level that enables use in the presence of cutting fluid.
 - A large-character LCD display.
 - Storage of 2 preset values for use when setting to an inside length standard.
 - A function lock that prevents accidental changing of the reference setting during measurement.



SPECIFICATIONS

140-158

| Metric | | | | | | |
|-----------------|------------|-----------------|-----------------------------|-----------------|---|-------------------|
| Order No. | Range (mm) | Resolution (mm) | Micrometer head stroke (mm) | Extension pipes | | Display unit (mm) |
| | | | | Qty | Size (mm) | |
| Digimatic (LCD) | | | | | | |
| 339-101 | 200 - 225 | 0.001 | 25 | — | — | 200 - 225 |
| 339-301 | 200 - 1000 | | | 5 | 25, 50, 100, 200, 400 | |
| 339-302 | 200 - 2000 | | | 8 | 25, 50, 100, 200 (2 pcs.), 400 (3 pcs.) | |

| Metric | | | | | | |
|-----------|-------------|-----------------|---|-----------------|---|----------------|
| Order No. | Range (mm) | Graduation (mm) | Micrometer head stroke (mm) | Extension pipes | | Main unit (mm) |
| | | | | Qty | Size (mm) | |
| Analog | | | | | | |
| 139-173 | 100 - 500 | 0.01 | 25 | 4 | 25, 50, 100, 200 | 100 - 125 |
| 139-174 | 100 - 900 | | | 5 | 25, 50, 100, 200, 400 | |
| 139-175 | 100 - 1300 | | | 6 | 25, 50, 100, 200, 400 (2 pcs.) | |
| 139-176 | 100 - 1700 | | | 7 | 25, 50, 100, 200, 400 (3 pcs.) | |
| 139-177 | 100 - 2100 | | | 8 | 25, 50, 100, 200, 400 (4 pcs.) | |
| 140-157 | 1000 - 2000 | | | 5 | 50, 100 (2 pcs.), 200, 500 | 1000 - 1050 |
| 140-158 | 1000 - 3000 | | | 6 | 50, 100 (2 pcs.), 200, 500, 1000 | |
| 140-159 | 1000 - 4000 | | | 7 | 50, 100 (2 pcs.), 200, 500, 1000 (2 pcs.) | |
| 140-160 | 1000 - 5000 | 8 | 50, 100 (2 pcs.), 200, 500, 1000 (3 pcs.) | | | |

| Inch/Metric | | | | | | |
|-----------------|------------|------------------------|-----------------------------|-----------------|----------------------------------|-------------------|
| Order No. | Range (in) | Resolution | Micrometer head stroke (in) | Extension pipes | | Display unit (in) |
| | | | | Qty | Size (in) | |
| Digimatic (LCD) | | | | | | |
| 339-102 | 8 - 9 | 0.0001 in/ 0.001 mm | 1 | — | — | 8 - 9 |
| 339-303 | 8 - 40 | | | 5 | 1, 2, 4, 8, 16 | |
| 339-304 | 8 - 80 | | | 8 | 1, 2, 4, 8 (2 pcs.), 16 (3 pcs.) | |

| Inch | | | | | | |
|-----------|------------|-----------------|-----------------------------------|-----------------|-----------------------------------|----------------|
| Order No. | Range (in) | Graduation (in) | Micrometer head stroke (in) | Extension pipes | | Main unit (in) |
| | | | | Qty | Size (in) | |
| Analog | | | | | | |
| 139-178 | 4 - 20 | 0.001 | 1 | 4 | 1, 2, 4, 8 | 4 - 5 |
| 139-179 | 4 - 36 | | | 5 | 1, 2, 4, 8, 16 | |
| 139-180 | 4 - 52 | | | 6 | 1, 2, 4, 8, 16 (2 pcs.) | |
| 139-181 | 4 - 68 | | | 7 | 1, 2, 4, 8, 16 (3 pcs.) | |
| 139-182 | 4 - 84 | | | 8 | 1, 2, 4, 8, 16 (4 pcs.) | |
| 140-161 | 40 - 80 | | | 5 | 2, 4 (2 pcs.), 8, 20 | 40 - 42 |
| 140-162 | 40 - 120 | | | 6 | 2, 4 (2 pcs.), 8, 20, 40 | |
| 140-163 | 40 - 160 | | | 7 | 2, 4 (2 pcs.), 8, 20, 40 (2 pcs.) | |
| 140-164 | 40 - 200 | 8 | 2, 4 (2 pcs.), 8, 20, 40 (3 pcs.) | | | |

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Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

IP65

These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



IP Codes

- Level 6:** Dust-proof. No ingress of dust allowed.
- Level 5:** Protected against water jets. Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

- Spindle feed error 3 μm/0.00015 in (139, 339 Series) 6 μm/0.0003 in (140 Series)
- Note: "Spindle feed error" refers to the difference between the maximum and minimum indication error values within the measuring range of the micrometer head



Functions (for 339-101/301/302/102/303/304)

- Zero-setting
- Origin restoration
- Data hold
- Function lock
- Automatic power ON/OFF
- 2-point Preset
- Error alarm
- Data output

Technical Data

- Battery and Scale Type (for 339-101/301/302/102/303/304) SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 1.2 years under normal use
- Scale type: Electromagnetic induction-type rotary encoder

Optional Accessories

- Refer to page A-27 for details.
- Connecting cables with **IT/DP/MUX**, etc.
 - 1 m: **05CZA662**
 - 2 m: **05CZA663**
 - **USB** Input Tool Direct (2 m): **06AFM380B**
 - Connecting cables for **U-WAVE-T**
 - For standard (160 mm): **02AZD790B**
 - For foot switch: **02AZE140B**

Tubular Inside Micrometers SERIES 139 — Extension Pipe Type (main unit)

Technical Data

- Spindle feed error 3 μm /0.00015 in
- Note: "Spindle feed error" refers to the difference between the maximum and minimum indication error values within the specification range of the micrometer head

- Micrometer head for Extension Pipe Type inside micrometer.
- The sleeve is rotated to adjust the reference point adjustment when setting to a length standard.
- Optional Setting Rings, CERA Inside Micro Checker and Gauge Block Accessory Sets are available as reference gages for datum adjustment. (Refer to pages C-47, C-26, and E-17 to E-20 for details)



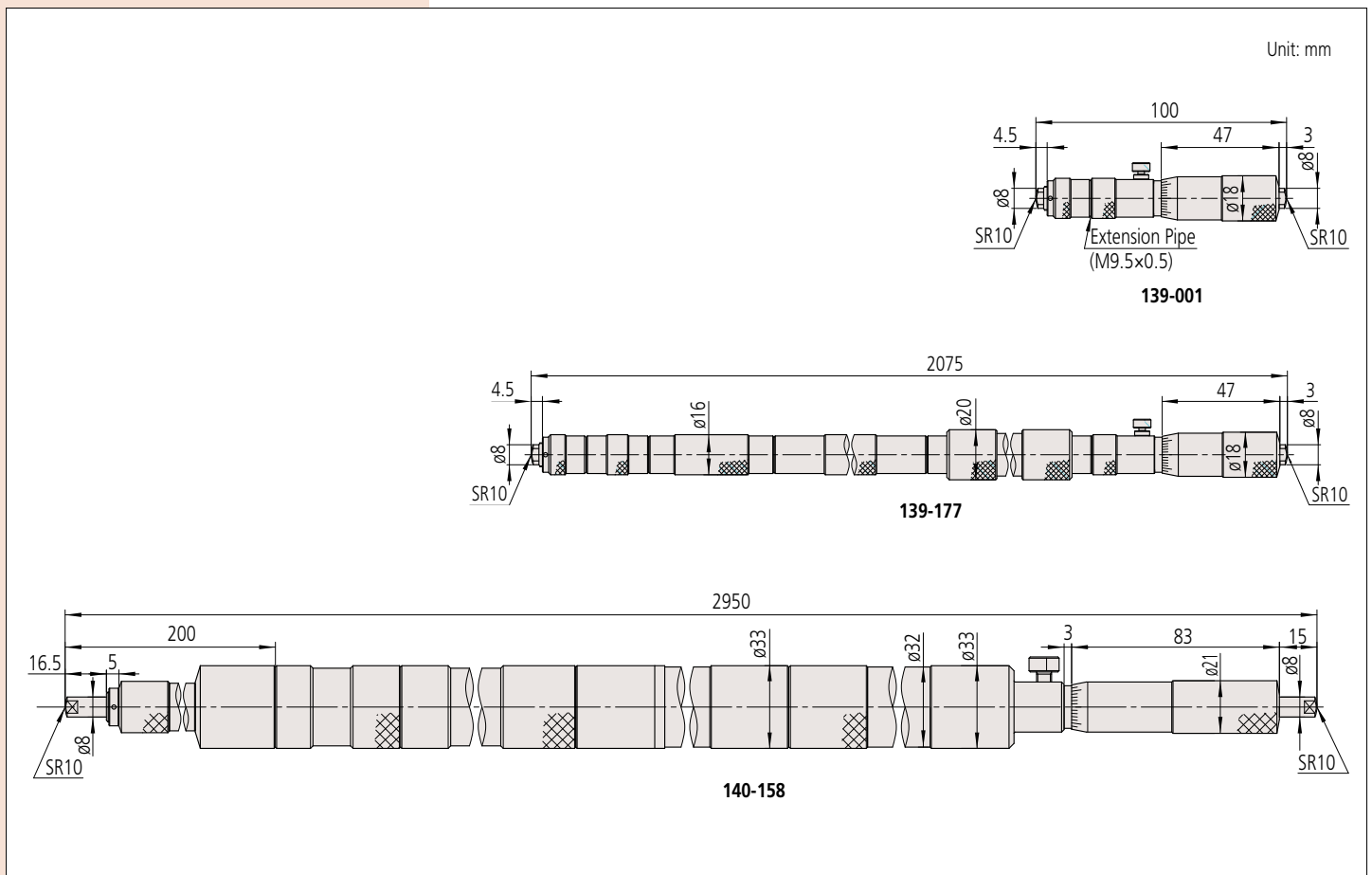
139-001

SPECIFICATIONS

| Metric | | | |
|-----------|------------|-----------------|-----------------------------|
| Order No. | Range (mm) | Graduation (mm) | Micrometer head stroke (mm) |
| 139-001 | 100 - 125 | 0.01 | 25 |

| Inch | | | |
|-----------|------------|-----------------|-----------------------------|
| Order No. | Range (in) | Graduation (in) | Micrometer head stroke (in) |
| 139-002 | 4 - 5 | 0.001 | 1 |

DIMENSIONS



Inside Micrometers

For easy and accurate measurement of inside size and diameter

Inside Micrometers SERIES 345, 145 — Caliper Type

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Data Management Software by Mitutoyo

- Caliper type inside micrometer equipped with round pin or anvil type jaws, according to model.
- Carbide measuring faces.
- Equipped with a constant measuring-force device.
- Optional Setting Rings (nominal size below 300 mm), CERA Inside Micro Checker (more than 25 mm) and Gauge Block Accessory Sets are available as reference gages for datum adjustment. (Refer to pages C-47, C-26, and E-17 to E-20 for details)



345-250-30



145-185



145-187

SPECIFICATIONS

| Metric | | | | | | |
|-----------------|------------|-----------------|--|-------|----------|--|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error J_{MPE} (μm) | Jaw | Mass (g) | |
| Digimatic (LCD) | | | | | | |
| 345-250-30 | 5 - 30 | 0.001 | ±5 | Pin | 320 | |
| 345-251-30 | 25 - 50 | | ±6 | Anvil | 325 | |

| Inch/Metric | | | | | | |
|-----------------|------------|-------------------------|--|-------|----------|--|
| Order No. | Range (in) | Resolution | Maximum permissible error J_{MPE} (in) | Jaw | Mass (g) | |
| Digimatic (LCD) | | | | | | |
| 345-350-30 | 0.2 - 1.2 | 0.00005 in/ 0.001 mm | ±0.00025 | Pin | 320 | |
| 345-351-30 | 1 - 2 | | ±0.0003 | Anvil | 325 | |

Note: For the functions, refer to **293** Series with SPC data output on page B-8.
This model is NOT water-proof. Also, the origin setting is the free preset type.

| Metric | | | | | | |
|-----------|------------|-----------------|--|-------|----------|--|
| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Jaw | Mass (g) | |
| Analog | | | | | | |
| 145-185 | 5 - 30 | 0.01 | ±5 | Pin | 130 | |
| 145-186 | 25 - 50 | | ±6 | Anvil | 140 | |
| 145-187 | 50 - 75 | | ±7 | Anvil | 160 | |
| 145-188 | 75 - 100 | | ±8 | Anvil | 180 | |
| 145-189 | 100 - 125 | | ±9 | Anvil | 210 | |
| 145-190 | 125 - 150 | | | Anvil | 230 | |
| 145-191 | 150 - 175 | | ±10 | Anvil | 250 | |
| 145-192 | 175 - 200 | | | Anvil | 270 | |
| 145-217 | 200 - 225 | | ±11 | Anvil | 310 | |
| 145-218 | 225 - 250 | | | Anvil | 330 | |
| 145-219 | 250 - 275 | | ±12 | Anvil | 350 | |
| 145-220 | 275 - 300 | | | Anvil | 370 | |

| Inch | | | | | | |
|-----------|------------|-----------------|--|-------|----------|--|
| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Jaw | Mass (g) | |
| Analog | | | | | | |
| 145-193 | 0.2 - 1.2 | 0.001 | ±0.00025 | Pin | 130 | |
| 145-194 | 1 - 2 | | ±0.0003 | Anvil | 140 | |
| 145-195 | 2 - 3 | | ±0.00035 | Anvil | 160 | |
| 145-196 | 3 - 4 | | ±0.0004 | Anvil | 180 | |

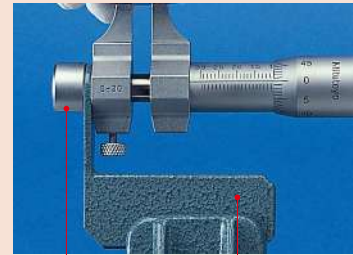
Note: The minimum pitch circle measurement is $\varnothing 5$ mm with pin types (145-185 and 345-250-30).

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Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Accessories for 145-185/186/193/194 (optional)



Cap (300401) Holder (300400)

Note 1: This instrument requires the cap and the holder for mounting on a micrometer stand.
Note 2: It may not be applicable to a custom specification.

Technical Data

- Battery and Scale Type (for 345-250-30/251-30/350-30/351-30) SR44 (1 pc.), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 2.4 years under normal use
- Scale type: Electromagnetic induction-type rotary encoder

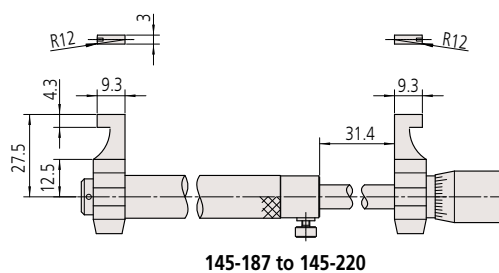
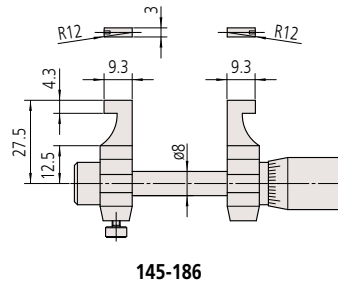
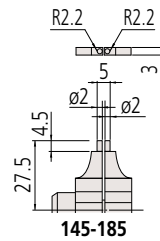
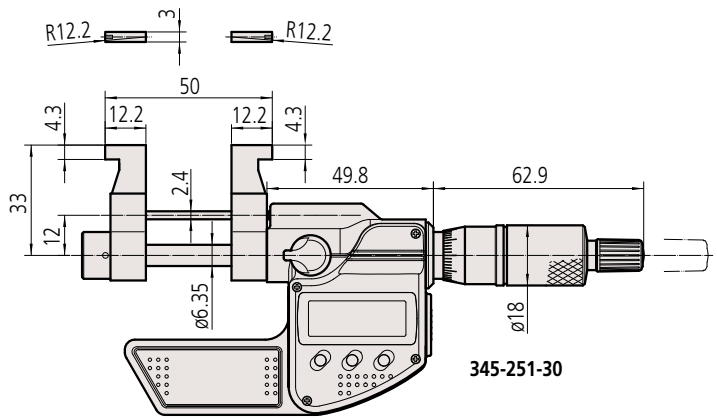
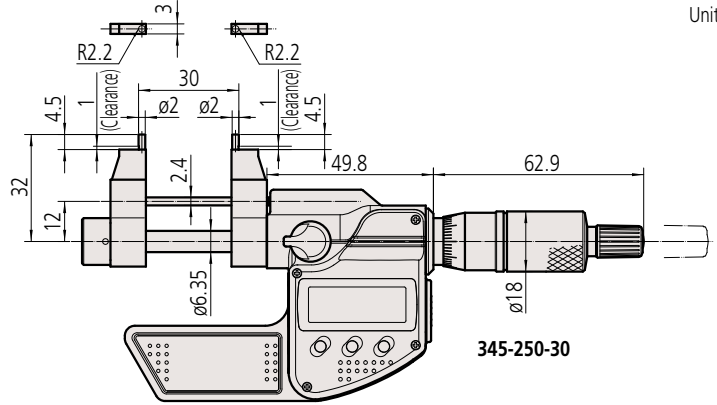
Optional Accessories

Refer to page A-27 for details.

- Connecting cables with **IT/DP/MUX**, etc.
 - 1 m: **05CZA662**
 - 2 m: **05CZA663**
- **USB** Input Tool Direct (2 m): **06AFM380B**
- Connecting cables for **U-WAVE-T** For standard (160 mm): **02AZD790B** For foot switch: **02AZE140B**

DIMENSIONS

Unit: mm



Inside Micrometers

For easy and accurate measurement of inside size and diameter

Inside Micrometers SERIES 141 — Interchangeable Rod Type

- Wide range of inside measurements possible by combining one or more interchangeable rods.
- For models supplied with more than one interchangeable rod, the full measuring range is achieved by combining spacing collars with the rods.
- The sleeve is rotated to adjust the reference point adjustment when setting to a length standard.
- Optional Setting Rings (nominal size below 300 mm), CERA Inside Micro Checker and Gauge Block Accessory Sets are available as reference gages for datum adjustment. (Refer to pages C-47, C-26, and E-17 to E-20 for details)



141-101



When using one of the extension rods supplied
(Measuring range 43 to 50 mm)

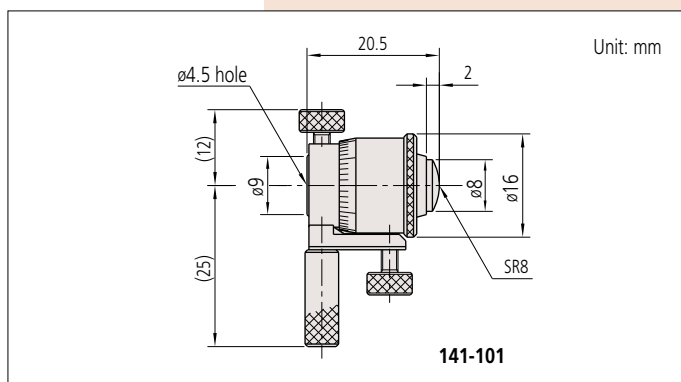
When using one of the extension rods supplied
(Measuring range 25 to 32 mm)

Technical Data

- Spindle feed error 3 μm/0.00015 in
- Note: "Spindle feed error" refers to the difference between the maximum and minimum indication error values within the specification range of the micrometer head



DIMENSIONS



SPECIFICATIONS

| Metric | | | | |
|--------------------|------------|-----------------|-----------------------------|-------------|
| Order No. | Range (mm) | Graduation (mm) | Micrometer head stroke (mm) | Remarks |
| 141-101 / 141-103* | 25 - 50 | 0.01 | 7 | with 2 rods |
| 141-205 / 141-211* | 50 - 200 | | 13 | with 3 rods |
| 141-206 / 141-212* | 50 - 300 | | with 5 rods | |
| 141-117 | 200 - 500 | | with 3 rods | |
| 141-118 | 200 - 1000 | | 25 | with 8 rods |

* With carbide measuring face

| Inch | | | | |
|--------------------|------------|-----------------|-----------------------------|-------------|
| Order No. | Range (in) | Graduation (in) | Micrometer head stroke (in) | Remarks |
| 141-102 / 141-104* | 1 - 2 | 0.001 | 0.25 | with 2 rods |
| 141-208 / 141-214* | 2 - 8 | | with 3 rods | |
| 141-233 / 141-215* | 2 - 12 | | with 5 rods | |
| 141-121 | 8 - 20 | | with 3 rods | |
| 141-122 | 8 - 40 | | 1 | with 8 rods |

* With carbide measuring face

| Metric | | | |
|----------------------------|------------|-----------------|-----------------------------|
| Micrometer head only model | | | |
| Order No. | Range (mm) | Graduation (mm) | Micrometer head stroke (mm) |
| 141-001 / 141-003* | 25 - 32 | 0.01 | 7 |
| 141-025 / 141-027* | 50 - 63 | | 13 |
| 141-009 / 141-011* | 200 - 225 | | 25 |

* With carbide measuring face

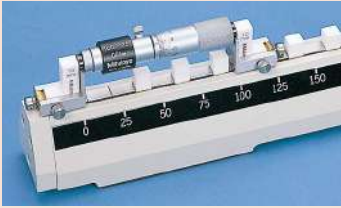
| Inch | | | |
|----------------------------|------------|-----------------|-----------------------------|
| Micrometer head only model | | | |
| Order No. | Range (in) | Graduation (in) | Micrometer head stroke (in) |
| 141-002 / 141-004* | 1 - 1.25 | 0.001 | 0.25 |
| 141-026 / 141-028* | 2 - 2.5 | | 0.5 |
| 141-010 / 141-012* | 8 - 9 | | 1 |

* With carbide measuring face



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Typical application



Optional Accessory

- Wooden box
For 515-585: 602160
For 515-586: 602163

CERA Inside Micro Checker SERIES 515

- The Inside Micro Checker is designed to act as a setting standard for inside micrometers.
- Applicable for SERIES 133, 139 and 145 (over 50 mm). Not applicable for SERIES 137, 141, 337 and 339.



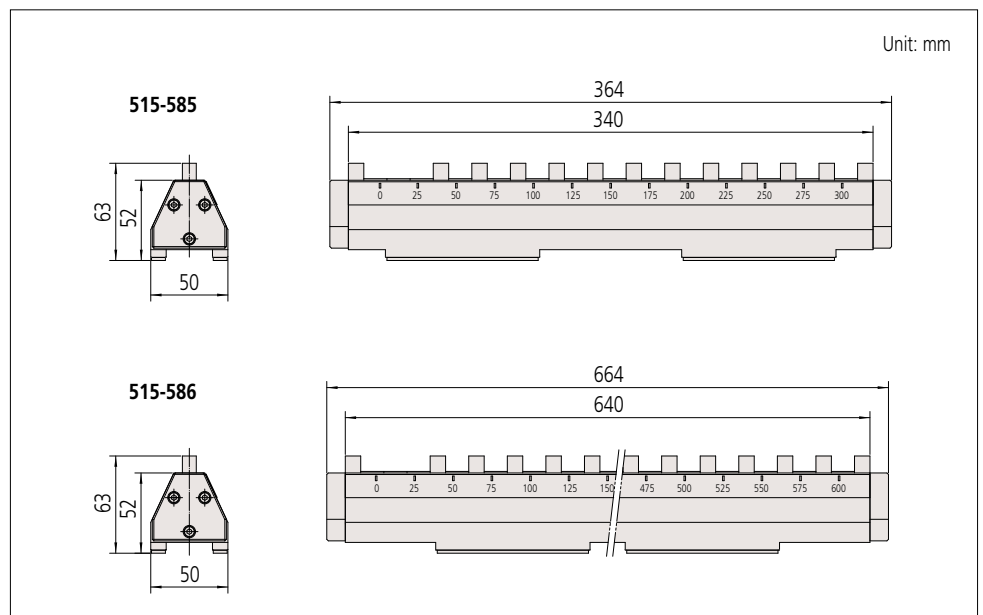
- Standard accessory set
- Support clamps **940286*** Pair
 - Auxiliary block 10 mm **602195** 2 pcs.
 - Collar **602195** 2 pcs.
 - Clamp screwdriver **600324** 1 pc.
- * Order No. is equivalent to a pair (2 pcs.)

SPECIFICATIONS

| Order No. | Length to check (mm) | Block pitch accuracy |
|-----------|----------------------|--|
| 515-585 | 25 - 300 | $\pm(1 + L/150) \mu\text{m}$ L: Length to check (mm) |
| 515-586 | 25 - 600 | |

Note: Please note that the bottom surface and the contact faces are not precisely perpendicular to each other.

DIMENSIONS



Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 526 — for Extra Small Holes

- These gages are designed to measure the diameters of very small holes.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- An optional stand (**215-120-10**) is available for efficient measurement of multiple small holes. (Refer to page C-30 for details)



526-170-11

Note: The dial indicator and the protection cover are optional.

SPECIFICATIONS

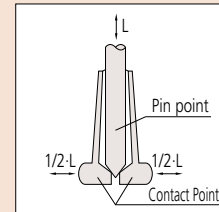
| Metric | | | | | | | |
|------------|-------------|---------------|--------------------|------------|-------------------------------------|-----------------------|--------------|
| Order No. | Range (mm) | Accuracy (μm) | Repeatability (μm) | Bore gage | Dial indicator | Dial protection cover | Setting ring |
| 526-170-10 | 0.95 - 1.55 | 4 | 1 | 526-170-10 | Not supplied | Not supplied | Not supplied |
| 526-160-10 | 1.50 - 3.95 | 4 | | 526-160-10 | | | |
| 526-150-10 | 3.70 - 7.30 | 6 | | 526-150-10 | | | |
| 526-172-10 | 0.95 - 1.55 | 4 | | 526-170-10 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | |
| 526-162-10 | 1.50 - 3.95 | 4 | | 526-160-10 | | | |
| 526-152-10 | 3.70 - 7.30 | 6 | | 526-150-10 | | | |
| 526-173-10 | 0.95 - 1.55 | 4 | | 526-170-10 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | |
| 526-163-10 | 1.50 - 3.95 | 4 | | 526-160-10 | | | |
| 526-153-10 | 3.70 - 7.30 | 6 | | 526-150-10 | | | |
| 526-170-11 | 0.95 - 1.55 | 4 | | 526-170-10 | Not supplied | Not supplied | Supplied |
| 526-160-11 | 1.50 - 3.95 | 4 | | 526-160-10 | | | |
| 526-150-11 | 3.70 - 7.30 | 6 | | 526-150-10 | | | |
| 526-172-11 | 0.95 - 1.55 | 4 | | 526-170-10 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | |
| 526-162-11 | 1.50 - 3.95 | 4 | | 526-160-10 | | | |
| 526-152-11 | 3.70 - 7.30 | 6 | | 526-150-10 | | | |
| 526-173-11 | 0.95 - 1.55 | 4 | | 526-170-10 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | |
| 526-163-11 | 1.50 - 3.95 | 4 | 526-160-10 | | | | |
| 526-153-11 | 3.70 - 7.30 | 6 | 526-150-10 | | | | |

| Inch | | | | | | | |
|------------|---------------|---------------|--------------------|------------|--------------------------------------|-----------------------|--------------|
| Order No. | Range (in) | Accuracy (in) | Repeatability (in) | Bore gage | Dial indicator | Dial protection cover | Setting ring |
| 526-175-10 | 0.037 - 0.061 | 0.00016 | 0.00004 | 526-175-10 | Not supplied | Not supplied | Not supplied |
| 526-165-10 | 0.059 - 0.156 | 0.00016 | | 526-165-10 | | | |
| 526-155-10 | 0.146 - 0.287 | 0.00024 | | 526-155-10 | | | |
| 526-176-10 | 0.037 - 0.061 | 0.00016 | | 526-175-10 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | |
| 526-166-10 | 0.059 - 0.156 | 0.00016 | | 526-165-10 | | | |
| 526-156-10 | 0.146 - 0.287 | 0.00024 | | 526-155-10 | | | |
| 526-175-11 | 0.037 - 0.061 | 0.00016 | | 526-175-10 | Not supplied | Not supplied | Supplied |
| 526-165-11 | 0.059 - 0.156 | 0.00016 | | 526-165-10 | | | |
| 526-155-11 | 0.146 - 0.287 | 0.00024 | | 526-155-10 | | | |
| 526-176-11 | 0.037 - 0.061 | 0.00016 | | 526-175-10 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | |
| 526-166-11 | 0.059 - 0.156 | 0.00016 | | 526-165-10 | | | |
| 526-156-11 | 0.146 - 0.287 | 0.00024 | | 526-155-10 | | | |

Note: Setting rings are not supplied with some models. Please purchase them separately if necessary. For details of setting rings, refer to page C-47.



Measurement Principle



Setting Rings (Metric models)

Nominal size

- Order No. 526-170-11 etc.

177-220: 1.0 mm
177-222: 1.1 mm
177-225: 1.2 mm
177-227: 1.3 mm
177-230: 1.4 mm

- Order No. 526-160-11 etc.

177-236: 1.75 mm
177-239: 2.00 mm
177-242: 2.25 mm
177-208: 2.50 mm
177-246: 2.75 mm
177-248: 3.00 mm
177-250: 3.25 mm
177-252: 3.50 mm
177-255: 3.75 mm

- Order No. 526-150-11 etc.

177-204: 4.0 mm
177-257: 4.5 mm
177-205: 5.0 mm
177-263: 5.5 mm
177-267: 6.0 mm
177-271: 6.5 mm
177-275: 7.0 mm

Setting Rings (Inch models)

Nominal size

- Order No. 526-175-11 etc.

177-350: 0.040 in
177-351: 0.045 in
177-352: 0.050 in
177-353: 0.055 in
177-354: 0.060 in

- Order No. 526-165-11 etc.

177-355: 0.07 in
177-356: 0.08 in
177-357: 0.09 in
177-358: 0.10 in
177-359: 0.11 in
177-360: 0.12 in
177-361: 0.13 in
177-362: 0.14 in
177-363: 0.15 in

- Order No. 526-155-11 etc.

177-364: 0.16 in
177-365: 0.18 in
177-366: 0.20 in
177-367: 0.22 in
177-368: 0.24 in
177-369: 0.26 in
177-370: 0.28 in

DIMENSIONS

Optional Accessories

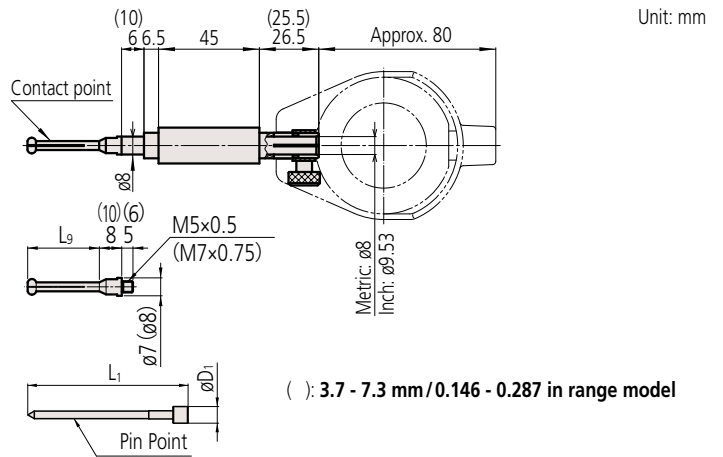
- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)
- Setting ring (See page C-47)
- Bore gage stand: **215-120-10** (See page C-30)

Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Recommended Digimatic Indicators (see page F-14)

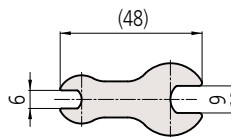
- Metric models: **543-310B** (0.001 mm)
 - Inch models: **543-312B** (0.001 mm/0.0005 in)
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.



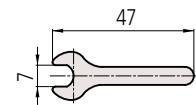
| Bore gage (Main body) | Contact point | | | | Pin point | | |
|--|------------------|-------------------------------|---------------------------------|----------------|----------------|-----------------|---------------|
| | Marked No. | Order No. | Range | L ₉ | L ₁ | ∅D ₁ | Order No. |
| 526-170-10 526-175-10 | 1.0 | 21DAA601A | 0.95 - 1.15 mm/0.037 - 0.045 in | 11.5 | 27.5 | 2.5 | 201435 |
| | 1.1 | 21DAA601B | 1.07 - 1.25 mm/0.042 - 0.049 in | | | | |
| | 1.2 | 21DAA601C | 1.17 - 1.35 mm/0.046 - 0.053 in | | | | |
| | 1.3 | 21DAA601D | 1.27 - 1.45 mm/0.050 - 0.057 in | | | | |
| | 1.4 | 21DAA601E | 1.37 - 1.55 mm/0.054 - 0.061 in | | | | |
| 526-160-10 526-165-10 | 1.75 | 21DAA602A | 1.50 - 1.90 mm/0.059 - 0.075 in | 17.5 | 33.8 | 3.5 | 201436 |
| | 2.00 | 21DAA602B | 1.80 - 2.20 mm/0.071 - 0.087 in | | | | |
| | 2.25 | 21DAA602C | 2.05 - 2.45 mm/0.081 - 0.096 in | | | | |
| | 2.50 | 21DAA602D | 2.30 - 2.70 mm/0.091 - 0.106 in | | | | |
| | 2.75 | 21DAA602E | 2.55 - 2.95 mm/0.100 - 0.116 in | | | | |
| | 3.00 | 21DAA602F | 2.80 - 3.20 mm/0.110 - 0.126 in | | | | |
| | 3.25 | 21DAA602G | 3.05 - 3.45 mm/0.120 - 0.136 in | | | | |
| | 3.50 | 21DAA602H | 3.30 - 3.70 mm/0.130 - 0.146 in | | | | |
| 526-150-10 526-155-10 | 3.75 | 21DAA602J | 3.55 - 3.95 mm/0.140 - 0.156 in | 22.5 | 39.3 | 3.5 | 201437 |
| | 4.0 | 21DAA603A | 3.7 - 4.3 mm/0.146 - 0.169 in | | | | |
| | 4.5 | 21DAA603B | 4.2 - 4.8 mm/0.165 - 0.189 in | | | | |
| | 5.0 | 21DAA603C | 4.7 - 5.3 mm/0.185 - 0.209 in | | | | |
| | 5.5 | 21DAA603D | 5.2 - 5.8 mm/0.205 - 0.228 in | | | | |
| | 6.0 | 21DAA603E | 5.7 - 6.3 mm/0.224 - 0.248 in | | | | |
| | 6.5 | 21DAA603F | 6.2 - 6.8 mm/0.244 - 0.268 in | | | | |
| 7.0 | 21DAA603G | 6.7 - 7.3 mm/0.264 - 0.287 in | | | | | |

Note: Pin point and contact point are consumable parts. Please replace them with new one when degrading of accuracy, operation, or measuring range.

Spanner 210188

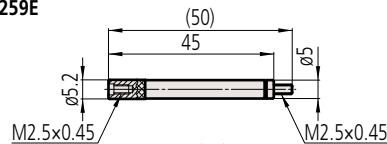


102148

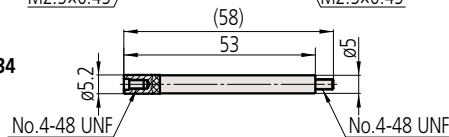


Thickness: 1.5

Extension rod 21AAA259E



213634



(): 3.7 - 7.3 mm/0.146 - 0.287 in range model

| Bore gage | Spanner | Extension rod |
|-------------------|---------------|------------------|
| 526-170-10 | 210188 | 21AAA259E |
| 526-160-10 | | |
| 526-150-10 | 102148 | 213634 |
| 526-175-10 | 210188 | |
| 526-165-10 | 102148 | |
| 526-155-10 | | |

Note: This is not a component for extending the probing depth. (Standard Accessory)

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 526 — for Extra Small Holes

- These gages are designed to measure the diameters of very small holes.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- An optional stand (**215-120-10**) is available for efficient measurement of multiple small holes. (Refer to page C-30 for details)



526-101

Note: The dial indicator and the protection cover are optional.



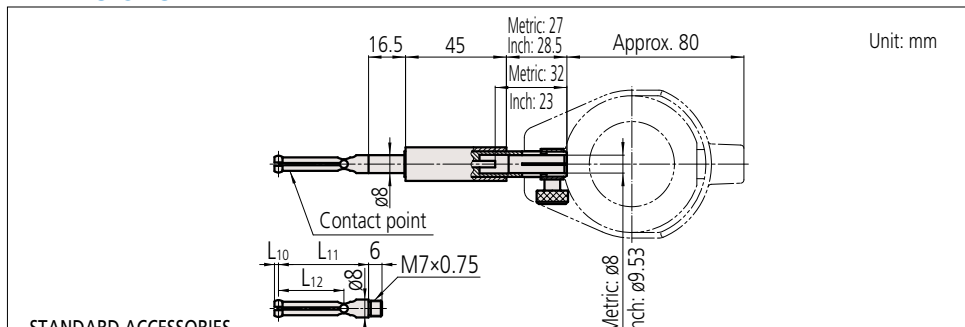
SPECIFICATIONS

| Metric | | | | | | | |
|-----------|------------|---------------|--------------------|-----------|-------------------------------------|-----------------------|--------------|
| Order No. | Range (mm) | Accuracy (μm) | Repeatability (μm) | Bore gage | Dial indicator | Dial protection cover | Setting ring |
| 526-101 | 7 - 10 | 4 | 2 | 526-101 | Not supplied | Not supplied | Not supplied |
| 526-102 | 10 - 18 | 6 | | 526-102 | | | |
| 526-124 | 7 - 10 | 4 | | 526-101 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | |
| 526-125 | 10 - 18 | 6 | | 526-102 | | | |
| 526-126 | 7 - 10 | 4 | | 526-101 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | |
| 526-127 | 10 - 18 | 6 | | 526-102 | | | |

| Inch | | | | | | | |
|-----------|------------|---------------|--------------------|-----------|--------------------------------------|-----------------------|--------------|
| Order No. | Range (in) | Accuracy (in) | Repeatability (in) | Bore gage | Dial indicator | Dial protection cover | Setting ring |
| 526-103 | 0.3 - 0.4 | 0.00016 | 0.00008 | 526-103 | Not supplied | Not supplied | Not supplied |
| 526-104 | 0.4 - 0.7 | 0.00024 | | 526-104 | | | |
| 526-122 | 0.3 - 0.4 | 0.00016 | | 526-103 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | |
| 526-123 | 0.4 - 0.7 | 0.00024 | | 526-104 | | | |
| 526-119 | 0.3 - 0.4 | 0.00016 | | 526-103 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | |
| 526-120 | 0.4 - 0.7 | 0.00024 | | 526-104 | | | |

Note: Setting rings are not supplied.
Please purchase them separately if necessary. For details of the setting rings, refer to page C-47.

DIMENSIONS

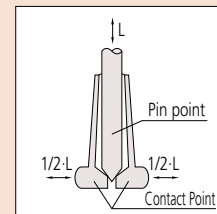


STANDARD ACCESSORIES

| Bore gage (Main body) | Contact point | | | | | | Spanner Order No. |
|-----------------------|---------------|-----------|------------------------------|-----|-----|------|----------------------|
| | Marked No. | Order No. | Range | L10 | L11 | L12 | |
| 526-101 526-103 | 1 | 102469 | 7.0 - 7.5 mm/0.28 - 0.30 in | 1.8 | 40 | 29.2 | 102148 |
| | 2 | 102470 | 7.5 - 8.0 mm/0.30 - 0.32 in | | | | |
| | 3 | 102471 | 8.0 - 8.5 mm/0.32 - 0.34 in | | | | |
| | 4 | 102472 | 8.5 - 9.0 mm/0.34 - 0.36 in | | | | |
| | 5 | 102473 | 9.0 - 9.5 mm/0.36 - 0.38 in | | | | |
| | 6 | 102474 | 9.5 - 10.0 mm/0.38 - 0.40 in | | | | |
| 526-102 526-104 | 1 | 102454 | 10 - 11 mm/0.40 - 0.44 in | 2.7 | 46 | 38 | 102148 |
| | 2 | 102455 | 11 - 12 mm/0.44 - 0.48 in | | | | |
| | 3 | 102456 | 12 - 13 mm/0.48 - 0.52 in | | | | |
| | 4 | 102457 | 13 - 14 mm/0.52 - 0.56 in | | | | |
| | 5 | 102458 | 14 - 15 mm/0.56 - 0.60 in | | | | |
| | 6 | 102459 | 15 - 16 mm/0.60 - 0.64 in | | | | |
| | 7 | 102460 | 16 - 17 mm/0.64 - 0.68 in | | | | |
| | 8 | 102461 | 17 - 18 mm/0.68 - 0.72 in | | | | |

Note: Contact point is consumable part. Please replace it with new one when degrading of accuracy, operation, or measuring range.

Measurement Principle



Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)
- Setting ring (See page C-47)
- Bore gage stand: **215-120-10** (See page C-30)

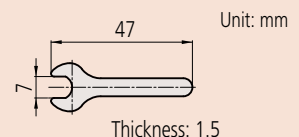
Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Recommended Digimatic Indicators (see Chapter F)

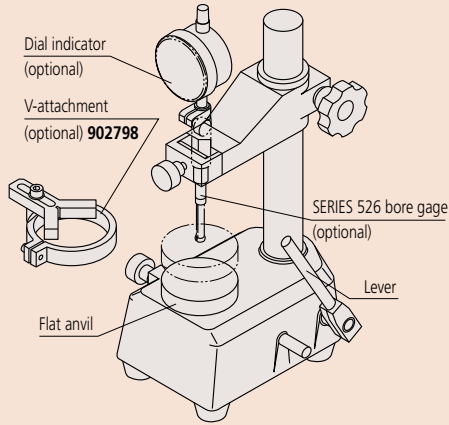
- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
 - Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm/0.00005 in
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

Spanner
102148



Operating Method

- Pulling the lever forwards moves the platen upwards and the instrument goes into measurement mode.
- The V-attachment (optional) aids positioning the workpiece on the platen and is useful when measuring a large number of the same size of workpiece.



Optional Accessory

- V-attachment: 902798

Bore Gage Stand SERIES 215

- Optimal for efficient measurement of multiple small holes with a bore gage. (SERIES 526)

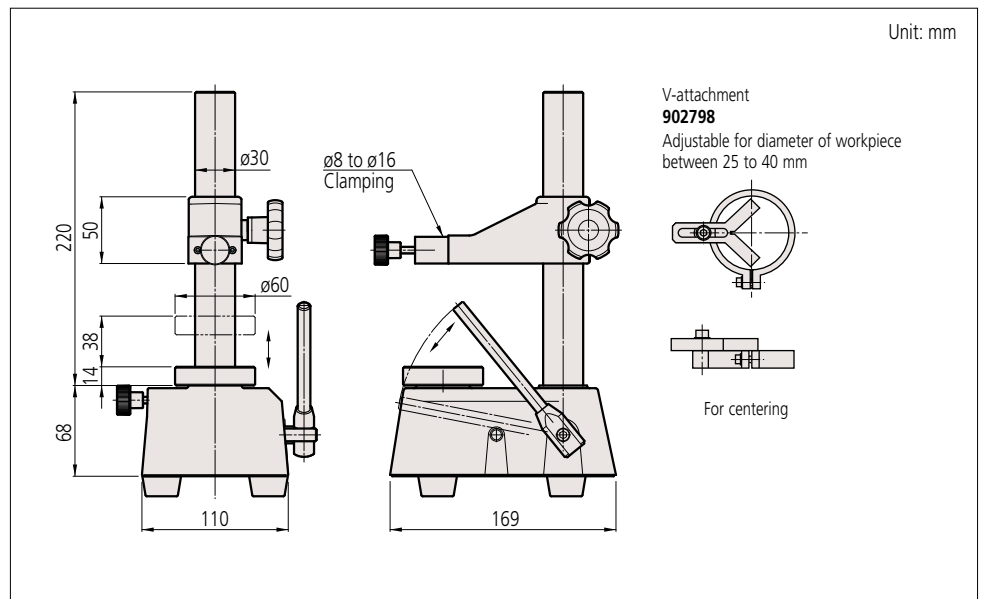


215-120-10

SPECIFICATIONS

| Order No. | Measuring table displacement (mm) | Measuring table |
|------------|-----------------------------------|-----------------|
| 215-120-10 | 38 | Anvil (ø60 mm) |

DIMENSIONS



Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — for Small Holes

- These gages are designed to measure the diameters of very small holes.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to page C-47)



511-201

Note: The dial indicator and protection cover are optional.

SPECIFICATIONS

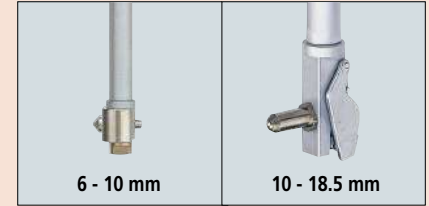
Metric

| Order No. | Range (mm) | Stroke of contact point (mm) | Measuring force (N) | Guide force (N) | Content of set | | | | | Probing depth (mm) |
|-----------|------------|------------------------------|---------------------|-----------------|----------------|-------------------------------------|-----------------------|--------|------------------------|--------------------|
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Interchangeable Washer | |
| 511-209 | 6 - 10 | 0.5 | 2 or less | — | 511-209 | Not supplied | Not supplied | 9 pcs. | Not supplied | 50 |
| 511-201 | 10 - 18.5 | 0.6 | | 6 or less | 511-201 | | | | | 1 pc. |
| 511-210 | 6 - 10 | 0.5 | 2 or less | — | 511-209 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | 9 pcs. | Not supplied | 50 |
| 511-203 | 10 - 18.5 | 0.6 | | 6 or less | 511-201 | | | | | 1 pc. |
| 511-211 | 6 - 10 | 0.5 | 2 or less | — | 511-209 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | 9 pcs. | Not supplied | 50 |
| 511-204 | 10 - 18.5 | 0.6 | | 6 or less | 511-201 | | | | | 1 pc. |

Inch

| Order No. | Range (in) | Stroke of contact point (in) | Measuring force (N) | Guide force (N) | Content of set | | | | | Probing depth (in) |
|-----------|------------|------------------------------|---------------------|-----------------|----------------|--------------------------------------|-----------------------|--------|------------------------|--------------------|
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Interchangeable Washer | |
| 511-214 | 0.24 - 0.4 | 0.020 | 2 or less | — | 511-214 | Not supplied | Not supplied | 9 pcs. | Not supplied | 2 |
| 511-205 | 0.4 - 0.74 | 0.024 | | 6 or less | 511-205 | | | | | 1 pc. |
| 511-212 | 0.24 - 0.4 | 0.020 | 2 or less | — | 511-214 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | 9 pcs. | Not supplied | 2 |
| 511-206 | 0.4 - 0.74 | 0.024 | | 6 or less | 511-205 | | | | | 1 pc. |
| 511-213 | 0.24 - 0.4 | 0.020 | 2 or less | — | 511-214 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 9 pcs. | Not supplied | 2 |
| 511-207 | 0.4 - 0.74 | 0.024 | | 6 or less | 511-205 | | | | | 1 pc. |

Contact Points



Technical Data

- Accuracy: Metric models: 5 μm
Inch models: 0.0002 in
- Repeatability: Metric models: 2 μm
Inch models: 0.00008 in
- Adjacent error: Metric models: 2 μm
Inch models: 0.00008 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

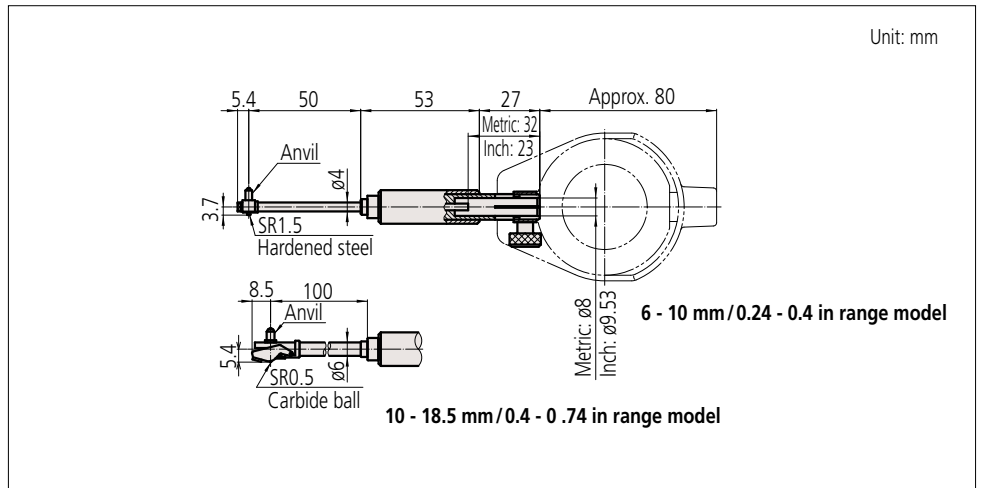
Recommended Digimatic Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

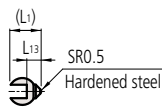
Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
 - Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm/0.00005 in
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

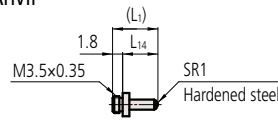
DIMENSIONS



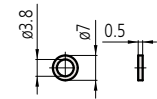
511-209/511-214
Anvil



511-201/511-205
Anvil



Interchangeable washer
(Supplied only with 511-201/511-205)



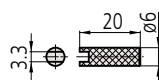
204355

STANDARD ACCESSORIES

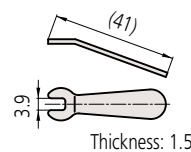
| Bore gage (Main body) | Anvil | | | | | Interchangeable Washer | Spanner |
|--------------------------|------------|-----------|------------------------------|----------------|-----------------|------------------------|-----------|
| | Marked No. | Order No. | Indication of measuring size | L ₁ | L ₁₃ | Order No. | Order No. |
| 511-209 511-214 | 1 | 952168 | 6.0 mm/0.24 in | 4.7 | 1.2 | Not supplied | 206709 |
| | 2 | 952169 | 6.5 mm/0.26 in | 5.3 | 1.7 | | |
| | 3 | 952170 | 7.0 mm/0.28 in | 5.8 | 2.2 | | |
| | 4 | 952414 | 7.5 mm/0.30 in | 6.3 | 2.7 | | |
| | 5 | 952415 | 8.0 mm/0.32 in | 6.8 | 3.2 | | |
| | 6 | 952416 | 8.5 mm/0.34 in | 7.3 | 3.7 | | |
| | 7 | 952417 | 9.0 mm/0.36 in | 7.8 | 4.2 | | |
| | 8 | 952418 | 9.5 mm/0.38 in | 8.3 | 4.7 | | |
| | 9 | 952419 | 10.0 mm/0.40 in | 8.8 | 5.2 | | |

| Bore gage (Main body) | Anvil | | | | | Interchangeable Washer | Spanner |
|--------------------------|------------|-----------|------------------------------|----------------|-----------------|------------------------|-----------|
| | Marked No. | Order No. | Indication of measuring size | L ₁ | L ₁₄ | Order No. | Order No. |
| 511-201 511-205 | 1 | 204356 | 10 mm/0.40 in | 3.8 | 2 | 204355 | 204354 |
| | 2 | 204357 | 11 mm/0.44 in | 4.8 | 3 | | |
| | 3 | 204358 | 12 mm/0.48 in | 5.8 | 4 | | |
| | 4 | 204359 | 13 mm/0.52 in | 6.8 | 5 | | |
| | 5 | 204360 | 14 mm/0.56 in | 7.8 | 6 | | |
| | 6 | 204361 | 15 mm/0.60 in | 8.8 | 7 | | |
| | 7 | 204362 | 16 mm/0.64 in | 9.8 | 8 | | |
| | 8 | 204363 | 17 mm/0.68 in | 10.8 | 9 | | |
| | 9 | 204364 | 18 mm/0.72 in | 11.8 | 10 | | |

Spanner
206709



204354



Unit: mm

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511

- Longer plunger stroke with no effect on accuracy.
- Carbide is used for the contact point ensuring high durability and wear resistance.
- This model reduces the influence of heat from the operator's hand by 50 % by increasing the grip size and making the grip hollow-structured, thereby retaining high-accuracy measurement.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Optional Extension Rods can be attached for measuring deep holes. (For details, refer to page C-45)
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-702

511-703

Note: The dial indicator and the protection cover are optional.

SPECIFICATIONS

| Metric | | | | | | | | | | | | |
|------------|-------------|------------------------------|---------------------|-----------------|----------------|--------------------------------------|-----------------------|---------|------------------------|--------------|---------|--------------------|
| Order No. | Range (mm) | Stroke of contact point (mm) | Measuring force (N) | Guide force (N) | Content of set | | | | | | | Probing depth (mm) |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Interchangeable Washer | Sub-Anvil | Spanner | |
| 511-701 | 18 - 35 | 1.2 | 4 or less | 6 or less | 511-701 | Not supplied | Not supplied | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 100 |
| 511-702 | 35 - 60 | | | | 511-702 | | | 6 pcs. | | | | |
| 511-703 | 50 - 150 | | | | 511-703 | | | 11 pcs. | | | | |
| 511-704 | 100 - 160 | | 5 or less | 10 or less | 511-704 | | | 13 pcs. | 4 pcs. | 1 pc. | | |
| 511-705 | 160 - 250 | | | | 511-705 | | | 6 pcs. | | | | |
| 511-706 | 250 - 400 | | | | 511-706 | | | 5 pcs. | | | | |
| 511-701 | 18 - 35 | 1.6 | 4 or less | 6 or less | 511-701 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 150 |
| 511-702 | 35 - 60 | | | | 511-702 | | | 6 pcs. | | | | |
| 511-703 | 50 - 150 | | | | 511-703 | | | 11 pcs. | | | | |
| 511-704 | 100 - 160 | | 5 or less | 10 or less | 511-704 | | | 13 pcs. | 4 pcs. | 1 pc. | | |
| 511-705 | 160 - 250 | | | | 511-705 | | | 6 pcs. | | | | |
| 511-706 | 250 - 400 | | | | 511-706 | | | 5 pcs. | | | | |
| 511-701 | 18 - 35 | 1.2 | 4 or less | 6 or less | 511-701 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 100 |
| 511-702 | 35 - 60 | | | | 511-702 | | | 6 pcs. | | | | |
| 511-703 | 50 - 150 | | | | 511-703 | | | 11 pcs. | | | | |
| 511-704 | 100 - 160 | | 5 or less | 10 or less | 511-704 | | | 13 pcs. | 4 pcs. | 1 pc. | | |
| 511-705 | 160 - 250 | | | | 511-705 | | | 6 pcs. | | | | |
| 511-706 | 250 - 400 | | | | 511-706 | | | 5 pcs. | | | | |
| 511-921 | 18 - 150 | — | — | — | 511-701 | 2046SB | 21DZA000 | — | — | — | — | — |
| 511-922 | | | | | 511-702 | 2109SB-10 | | | | | | |
| 511-925-10 | | | | | 511-703 | 543-310B | | | | | | |
| Inch | | | | | | | | | | | | |
| Order No. | Range (in) | Stroke of contact point (in) | Measuring force (N) | Guide force (N) | Content of set | | | | | | | Probing depth (in) |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Interchangeable Washer | Sub-Anvil | Spanner | |
| 511-731 | 0.7 - 1.4 | 0.047 | 4 or less | 6 or less | 511-731 | Not supplied | Not supplied | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 4 |
| 511-732 | 1.4 - 2.5 | | | | 511-732 | | | 6 pcs. | | | | |
| 511-733 | 2.0 - 6.0 | | | | 511-733 | | | 11 pcs. | | | | |
| 511-734 | 4.0 - 6.5 | | 5 or less | 10 or less | 511-734 | | | 13 pcs. | 4 pcs. | 1 pc. | | |
| 511-735 | 6.5 - 10.0 | | | | 511-735 | | | 6 pcs. | | | | |
| 511-736 | 10.0 - 16.0 | | | | 511-736 | | | 5 pcs. | | | | |
| 511-731 | 0.7 - 1.4 | 0.063 | 4 or less | 6 or less | 511-731 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 6 |
| 511-732 | 1.4 - 2.5 | | | | 511-732 | | | 6 pcs. | | | | |
| 511-733 | 2.0 - 6.0 | | | | 511-733 | | | 11 pcs. | | | | |
| 511-734 | 4.0 - 6.5 | | 5 or less | 10 or less | 511-734 | | | 13 pcs. | 4 pcs. | 1 pc. | | |
| 511-735 | 6.5 - 10.0 | | | | 511-735 | | | 6 pcs. | | | | |
| 511-736 | 10.0 - 16.0 | | | | 511-736 | | | 5 pcs. | | | | |
| 511-731 | 0.7 - 1.4 | 0.047 | 4 or less | 6 or less | 511-731 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 4 |
| 511-732 | 1.4 - 2.5 | | | | 511-732 | | | 6 pcs. | | | | |
| 511-733 | 2.0 - 6.0 | | | | 511-733 | | | 11 pcs. | | | | |
| 511-734 | 4.0 - 6.5 | | 5 or less | 10 or less | 511-734 | | | 13 pcs. | 4 pcs. | 1 pc. | | |
| 511-735 | 6.5 - 10.0 | | | | 511-735 | | | 6 pcs. | | | | |
| 511-736 | 10.0 - 16.0 | | | | 511-736 | | | 5 pcs. | | | | |
| 511-931 | 0.7 - 6.0 | — | — | — | 511-731 | 2922SB | 21DZA000 | — | — | — | — | — |
| 511-932 | | | | | 511-732 | 2923SB-10 | | | | | | |
| 511-935-10 | | | | | 511-733 | 543-312B | | | | | | |

Note 1: A 50 mm sub-anvil is supplied with 511-703, and a 75 mm sub-anvil is supplied with 511-706.

Note 2: A 2 in sub-anvil is supplied with 511-733, and a 3 in sub-anvil is supplied with 511-736.

Note 3: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

Anvil

A carbide ball is used for the contact point. It is more abrasion resistant than a hardened steel ball and, as its surface is smoother than that of a carbide tip, the workpiece is less liable to be marked.

Comparison of abrasion resistance

Hardened steel ball
(conventional model)

Carbide ball
(current model)



Abrasion depth: 0.1 mm
750 HV or more



Abrasion depth: 0.001 mm
1350 HV or more

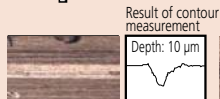
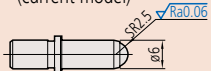
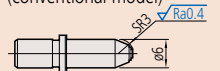
Inspection method

- Load a 0.5 N weight on the anvil, and slide for 1,000 m on abrasive paper of 9 µm (#2000) particle size.

Comparison of marks on the workpiece

Carbide tip
(conventional model)

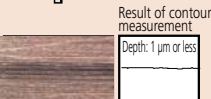
Carbide ball
(current model)



Result of contour measurement

Depth: 10 µm

Vertical magnification: 2,000
Horizontal magnification: 200



Result of contour measurement

Depth: 1 µm or less

Vertical magnification: 2,000
Horizontal magnification: 200

Inspection method

- Load a 4 N weight on the anvil, and slide on the aluminum plate back and forth for 20 times.



The grip is highly resistant to heat transfer from the operator's hand.

Technical Data

- Accuracy: Metric models 2 µm
Inch models 0.00008 in
- Repeatability: Metric models 0.5 µm
Inch models 0.00002 in
- Adjacent error: Metric models 1 µm
Inch models 0.00004 in

Optional Accessories

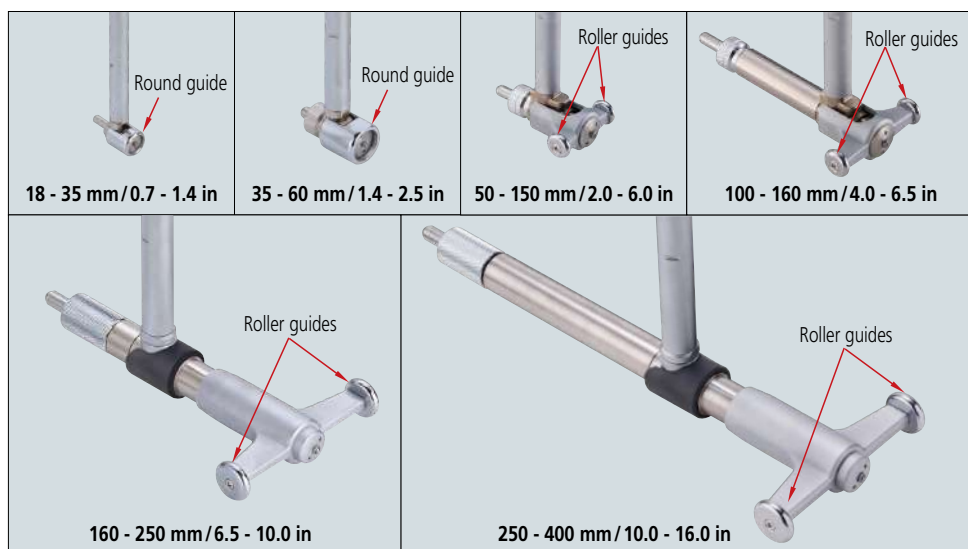
- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000**
(See page C-45)

Recommended Dial Indicators (see Chapter F)

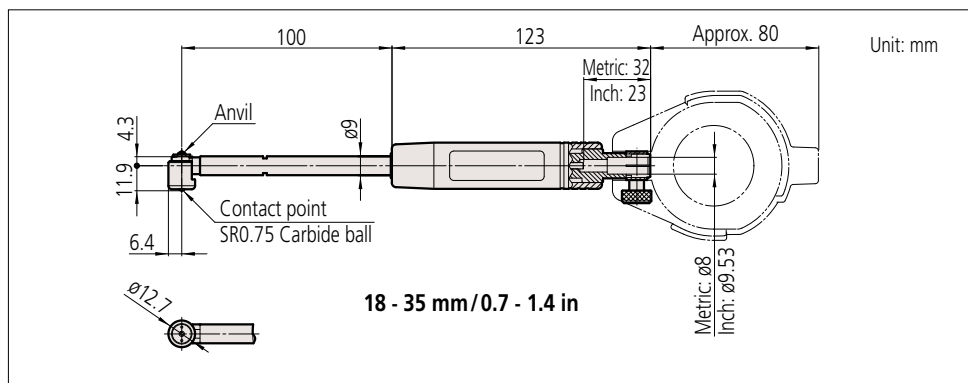
- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Note: Indicators equipped with rubber bellows, such as waterproof types, cannot be used.

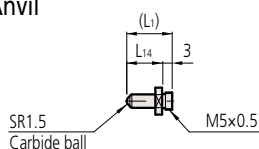
Contact Points



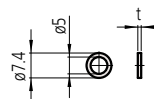
DIMENSIONS



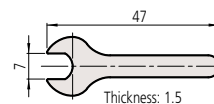
Anvil



Interchangeable washer



Spanner 102148



STANDARD ACCESSORIES

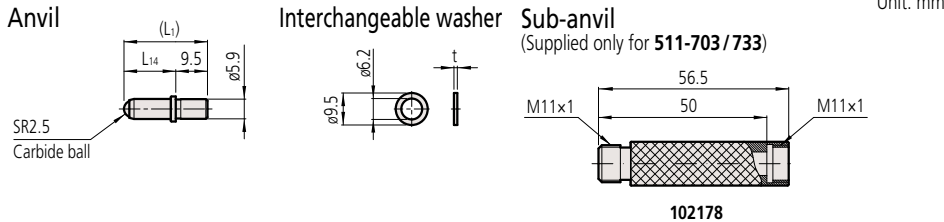
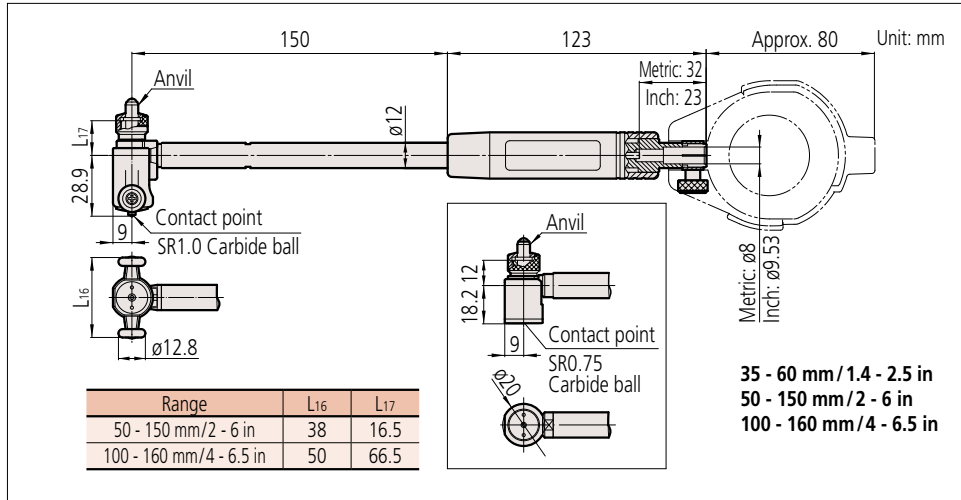
| Bore gage (Main body) | Anvil | | | | | Interchangeable washer | | Spanner |
|----------------------------------|------------|------------------|------------------------------|----------------|-----------------|--------------------------------|----------------------------------|---------------|
| | Marked No. | Order No. | Indication of measuring size | L ₁ | L ₁₄ | Order No. | t | Order No. |
| 511-701 511-731 | 1 | 21DZA213A | 18 mm/0.71 in | 5.5 | 2.5 | 205623 205624 | 0.5 mm/0.02 in 1.0 mm/0.04 in | 102148 |
| | 2 | 21DZA213B | 20 mm/0.79 in | 7.5 | 4.5 | | | |
| | 3 | 21DZA213C | 22 mm/0.87 in | 9.5 | 6.5 | | | |
| | 4 | 21DZA213D | 24 mm/0.94 in | 11.5 | 8.5 | | | |
| | 5 | 21DZA213E | 26 mm/1.02 in | 13.5 | 10.5 | | | |
| | 6 | 21DZA213F | 28 mm/1.10 in | 15.5 | 12.5 | | | |
| | 7 | 21DZA213G | 30 mm/1.18 in | 17.5 | 14.5 | | | |
| | 8 | 21DZA213H | 32 mm/1.26 in | 19.5 | 16.5 | | | |
| | 9 | 21DZA213J | 34 mm/1.34 in | 21.5 | 18.5 | | | |

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511

DIMENSIONS



Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

STANDARD ACCESSORIES

| Bore gage (Main body) | Anvil | | | | | Interchangeable washer | | Sub-Anvil |
|--|------------|-----------|-------------------------------------|----|------|--------------------------------------|--|--------------------------|
| | Marked No. | Order No. | Indication of measuring size | L1 | L14 | Order No. | t | Order No. |
| 511-702 511-732 | 1 | 21DZA232A | 35 mm / 1.38 in | 15 | 5.5 | 205457 205458 205459 205460 | 0.5 mm / 0.02 in 1.0 mm / 0.04 in 2.0 mm / 0.08 in 3.0 mm / 0.12 in | 102178 (50 mm / 2 in) |
| | 2 | 21DZA232B | 40 mm / 1.57 in | 20 | 10.5 | | | |
| | 3 | 21DZA232C | 45 mm / 1.77 in | 25 | 15.5 | | | |
| | 4 | 21DZA232D | 50 mm / 1.97 in | 30 | 20.5 | | | |
| | 5 | 21DZA232E | 55 mm / 2.17 in | 35 | 25.5 | | | |
| | 6 | 21DZA232F | 60 mm / 2.36 in | 40 | 30.5 | | | |
| 511-703 511-733 () Using 50 mm / 2 in Sub-Anvil | 1 | 21DZA232A | 50 mm (100 mm) / 1.97 in (3.94 in) | 15 | 5.5 | | | |
| | 2 | 21DZA232B | 55 mm (105 mm) / 2.17 in (4.13 in) | 20 | 10.5 | | | |
| | 3 | 21DZA232C | 60 mm (110 mm) / 2.36 in (4.33 in) | 25 | 15.5 | | | |
| | 4 | 21DZA232D | 65 mm (115 mm) / 2.55 in (4.53 in) | 30 | 20.5 | | | |
| | 5 | 21DZA232E | 70 mm (120 mm) / 2.74 in (4.72 in) | 35 | 25.5 | | | |
| | 6 | 21DZA232F | 75 mm (125 mm) / 2.93 in (4.92 in) | 40 | 30.5 | | | |
| 511-704 511-734 | 7 | 21DZA232G | 80 mm (130 mm) / 3.12 in (5.12 in) | 45 | 35.5 | | | |
| | 8 | 21DZA232H | 85 mm (135 mm) / 3.31 in (5.31 in) | 50 | 40.5 | | | |
| | 9 | 21DZA232J | 90 mm (140 mm) / 3.50 in (5.51 in) | 55 | 45.5 | | | |
| | 10 | 21DZA232L | 95 mm (145 mm) / 3.69 in (5.71 in) | 60 | 50.5 | | | |
| | 11 | 21DZA232M | 100 mm (150 mm) / 3.88 in (5.91 in) | 65 | 55.5 | | | |
| | 12 | 21DZA232N | 155 mm / 6.10 in | 70 | 60.5 | | | |
| | 13 | 21DZA232P | 160 mm / 6.30 in | 75 | 65.5 | | | |

Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
- Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm / 0.00005 in



- The ID measurement can be performed easily since the minimum value is detected automatically.
- Up to three combinations of master value and tolerance value can be set.
- Nine measurement results (maximum) can be saved and recalled from memory (when no external device is connected). Refer to page F-14 for details.

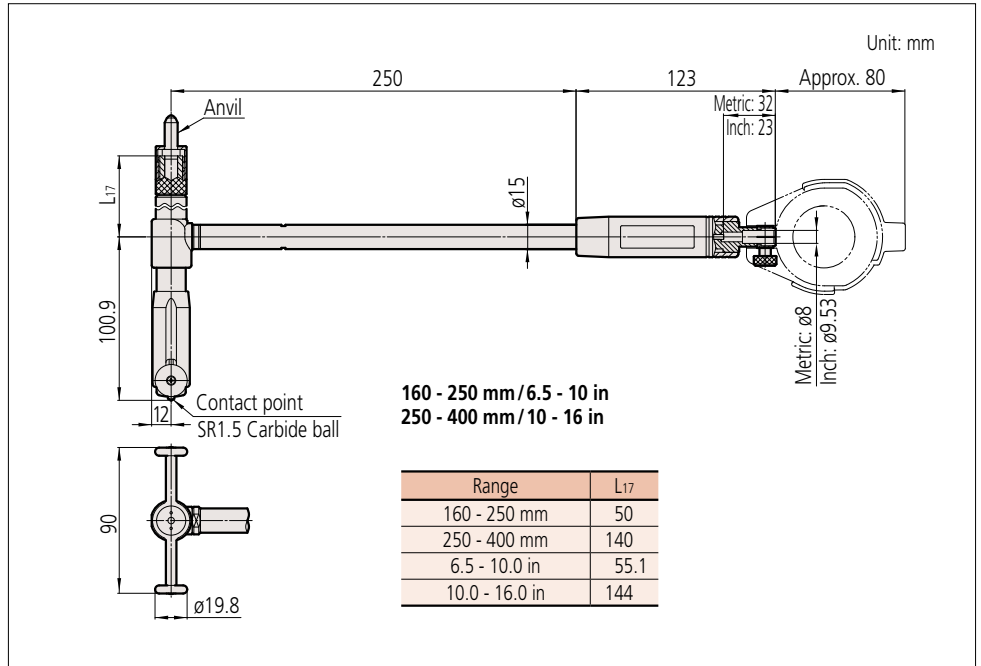
Bore Gage Checker 515-590

- The Bore Gage Checker allows easy setting of dial bore gages with ranges of 18 mm (0.7 in) through 400 mm (16 in) using gauge blocks. Refer to page C-46 for details.

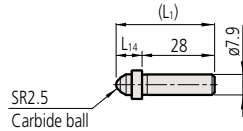


Standard configuration: Stand, Attachment A, B, C 1 pc. for each, Parallel Jaw (2 pcs.)

DIMENSIONS

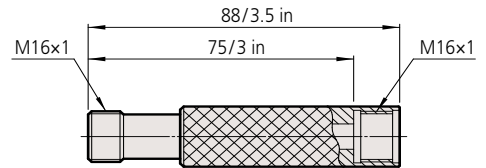
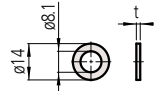


Anvil



Interchangeable washer Sub-anvil

Supplied only for **511-706 (202974)** and **511-736 (202975)**



202974 (511-706)
202975 (511-736)

Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

STANDARD ACCESSORIES

| Bore gage (Main body) | Anvil | | | | | Interchangeable washer | | Sub-Anvil |
|--|---------------|------------------|-------------------------------------|----------------|-----------------|---|--|---|
| | Marked No. | Order No. | Indication of measuring size | L ₁ | L ₁₄ | Order No. | t | Order No. |
| 511-705 511-735 | 1 | 21DZA241A | 160 mm/6.50 in | 38 | 10 | 205467 205461 205462 205463 205464 205465 205466 | 0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in 4.0 mm/0.16 in 5.0 mm/0.20 in 6.0 mm/0.24 in | Metric: 202974 (75 mm) Inch: 202975 (3.0 in) |
| | 2 | 21DZA241B | 175 mm/7.09 in | 53 | 25 | | | |
| | 3 | 21DZA241C | 190 mm/7.68 in | 68 | 40 | | | |
| | 4 | 21DZA241D | 205 mm/8.27 in | 83 | 55 | | | |
| | 5 | 21DZA241E | 220 mm/8.86 in | 98 | 70 | | | |
| | 6 | 21DZA241F | 235 mm/9.45 in | 113 | 85 | | | |
| 511-706 511-736 () Using 75 mm/3 in Sub-Anvil | 1 | 21DZA241A | 250 mm (325 mm)/10.00 in (13.00 in) | 38 | 10 | 205467 205461 205462 205463 205464 205465 205466 | 0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in 4.0 mm/0.16 in 5.0 mm/0.20 in 6.0 mm/0.24 in | Metric: 202974 (75 mm) Inch: 202975 (3.0 in) |
| | 2 | 21DZA241B | 265 mm (340 mm)/10.59 in (13.59 in) | 53 | 25 | | | |
| | 3 | 21DZA241C | 280 mm (355 mm)/11.18 in (14.18 in) | 68 | 40 | | | |
| | 4 | 21DZA241D | 295 mm (370 mm)/11.77 in (14.77 in) | 83 | 55 | | | |
| | 5 | 21DZA241E | 310 mm (385 mm)/12.36 in (15.36 in) | 98 | 70 | | | |

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — Short Leg Type

- Compact and lightweight due to the short length below the grip.
- Longer plunger stroke with no effect on accuracy.
- Carbide contact point ensures high durability and wear resistance.
- This model reduces the influence of heat from the operator's hand by approx. 50 % by increasing the grip size and making the grip hollow-structured, thereby retaining high-accuracy measurement.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-761



511-762



511-763



511-761

Note: The dial indicator and the protection cover are optional.



511-763

Note: The dial indicator and the protection cover are optional.



Technical Data

- Accuracy: Metric models 2 μ m
Inch models 0.00008 in
- Repeatability: Metric models 0.5 μ m
Inch models 0.00002 in
- Adjacent error: Metric models 1 μ m
Inch models 0.00004 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000**
(See page C-45)

Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

SPECIFICATIONS

| Metric | | | | | | | | | | | | |
|-----------|------------|------------------------------|---------------------|-----------------|----------------|-------------------------------------|-----------------------|---------|------------------------|--------------|--------------|--------------------|
| Order No. | Range (mm) | Stroke of contact point (mm) | Measuring force (N) | Guide force (N) | Content of set | | | | | | | Probing depth (mm) |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Interchangeable Washer | Sub-Anvil | Spanner | |
| 511-761 | 18 - 35 | 1.2 | 4 or less | 6 or less | 511-761 | Not supplied | Not supplied | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 50 |
| 511-762 | 35 - 60 | | | | 511-762 | | | 6 pcs. | | | | |
| 511-763 | 50 - 150 | 1.6 | 5 or less | 10 or less | 511-763 | Not supplied | Not supplied | 11 pcs. | 4 pcs. | 1 pc. | Not supplied | |
| 511-764 | 100 - 160 | | | | 511-764 | | | 13 pcs. | | | | |
| 511-771 | 18 - 35 | 1.2 | 4 or less | 6 or less | 511-761 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | |
| 511-772 | 35 - 60 | | | | 511-762 | | | 6 pcs. | | | | |
| 511-773 | 50 - 150 | 1.6 | 5 or less | 10 or less | 511-763 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | 11 pcs. | 4 pcs. | 1 pc. | Not supplied | |
| 511-774 | 100 - 160 | | | | 511-764 | | | 13 pcs. | | | | |
| 511-766 | 18 - 35 | 1.2 | 4 or less | 6 or less | 511-761 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | |
| 511-767 | 35 - 60 | | | | 511-762 | | | 6 pcs. | | | | |
| 511-768 | 50 - 150 | 1.6 | 5 or less | 10 or less | 511-763 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | 11 pcs. | 4 pcs. | 1 pc. | Not supplied | |
| 511-769 | 100 - 160 | | | | 511-764 | | | 13 pcs. | | | | |

| Inch | | | | | | | | | | | | |
|-----------|------------|------------------------------|---------------------|-----------------|----------------|--------------------------------------|-----------------------|---------|------------------------|--------------|--------------|--------------------|
| Order No. | Range (in) | Stroke of contact point (in) | Measuring force (N) | Guide force (N) | Content of set | | | | | | | Probing depth (in) |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Interchangeable Washer | Sub-Anvil | Spanner | |
| 511-781 | 0.7 - 1.4 | 0.047 | 4 or less | 6 or less | 511-781 | Not supplied | Not supplied | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | 2 |
| 511-782 | 1.4 - 2.5 | | | | 511-782 | | | 6 pcs. | | | | |
| 511-783 | 2.0 - 6.0 | 0.063 | 5 or less | 10 or less | 511-783 | Not supplied | Not supplied | 11 pcs. | 4 pcs. | 1 pc. | Not supplied | |
| 511-784 | 4.0 - 6.5 | | | | 511-784 | | | 13 pcs. | | | | |
| 511-791 | 0.7 - 1.4 | 0.047 | 4 or less | 6 or less | 511-781 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | |
| 511-792 | 1.4 - 2.5 | | | | 511-782 | | | 6 pcs. | | | | |
| 511-793 | 2.0 - 6.0 | 0.063 | 5 or less | 10 or less | 511-783 | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | 11 pcs. | 4 pcs. | 1 pc. | Not supplied | |
| 511-794 | 4.0 - 6.5 | | | | 511-784 | | | 13 pcs. | | | | |
| 511-786 | 0.7 - 1.4 | 0.047 | 4 or less | 6 or less | 511-781 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 9 pcs. | 2 pcs. | Not supplied | 1 pc. | |
| 511-787 | 1.4 - 2.5 | | | | 511-782 | | | 6 pcs. | | | | |
| 511-788 | 2.0 - 6.0 | 0.063 | 5 or less | 10 or less | 511-783 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 11 pcs. | 4 pcs. | 1 pc. | Not supplied | |
| 511-789 | 4.0 - 6.5 | | | | 511-784 | | | 13 pcs. | | | | |

Note 1: A 50 mm sub-anvil is supplied with **511-763**.

Note 2: A 2 in sub-anvil is supplied with **511-783**.

Note 3: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-avils. (The measurement accuracy in such cases is not guaranteed.)

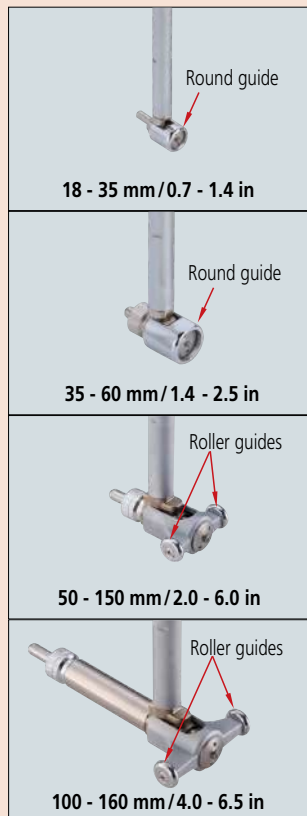
Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B** (ID-C112GXB: 0.001 mm)
- Inch models: **543-312B** (ID-C112GEXB: 0.001 mm/0.00005 in)

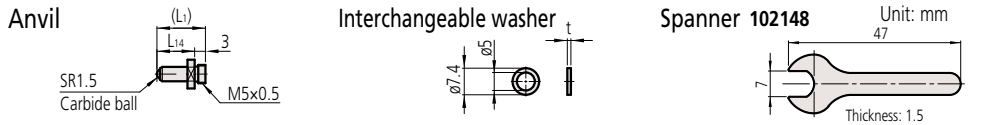
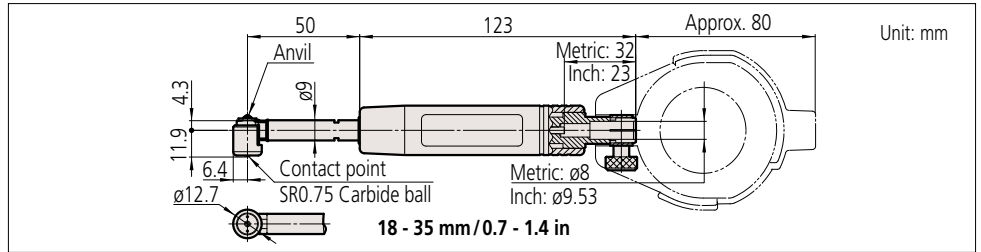


- The ID measurement can be performed easily since the minimum value is detected automatically.
- Up to three combinations of master value and tolerance value can be set.
- Nine measurement results (maximum) can be saved and recalled from memory (when no external device is connected). Refer to page F-14 for details.

Contact Points



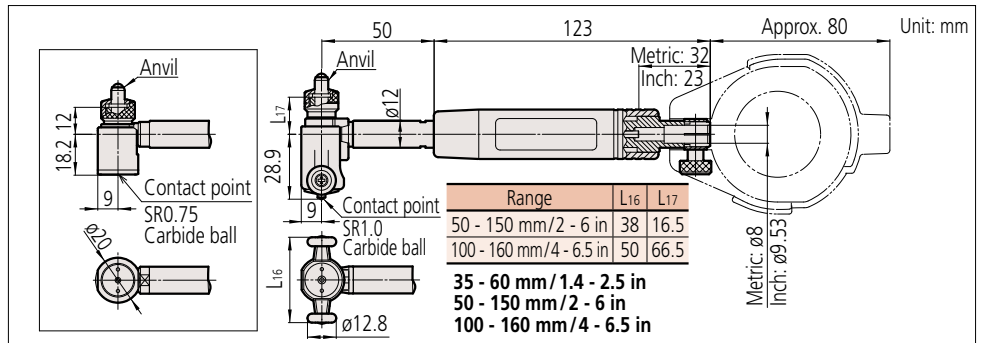
DIMENSIONS



STANDARD ACCESSORIES

| Bore gage (Main body) | Anvil | | | | | Interchangeable washer | Spanner | |
|-----------------------|------------|-----------|------------------------------|-----------------|-----------------|------------------------|----------------------------------|-----------|
| | Marked No. | Order No. | Indication of measuring size | L ₁ | L ₁₄ | | | Order No. |
| 511-761 511-781 | 1 | 21DZA213A | 18 mm/0.71 in | 5.5 mm/0.22 in | 2.5 mm/0.10 in | 205623 205624 | 0.5 mm/0.02 in 1.0 mm/0.04 in | 102148 |
| | 2 | 21DZA213B | 20 mm/0.79 in | 7.5 mm/0.30 in | 4.5 mm/0.18 in | | | |
| | 3 | 21DZA213C | 22 mm/0.87 in | 9.5 mm/0.37 in | 6.5 mm/0.26 in | | | |
| | 4 | 21DZA213D | 24 mm/0.94 in | 11.5 mm/0.45 in | 8.5 mm/0.33 in | | | |
| | 5 | 21DZA213E | 26 mm/1.02 in | 13.5 mm/0.53 in | 10.5 mm/0.41 in | | | |
| | 6 | 21DZA213F | 28 mm/1.10 in | 15.5 mm/0.61 in | 12.5 mm/0.49 in | | | |
| | 7 | 21DZA213G | 30 mm/1.18 in | 17.5 mm/0.69 in | 14.5 mm/0.57 in | | | |
| | 8 | 21DZA213H | 32 mm/1.26 in | 19.5 mm/0.77 in | 16.5 mm/0.65 in | | | |
| | 9 | 21DZA213J | 34 mm/1.34 in | 21.5 mm/0.85 in | 18.5 mm/0.73 in | | | |

DIMENSIONS



Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

STANDARD ACCESSORIES

| Bore gage (Main body) | Anvil | | | | | Interchangeable washer | Sub-Anvil | |
|--|------------|-----------|----------------------------------|----------------|-----------------|--------------------------------------|--|------------------------|
| | Marked No. | Order No. | Indication of measuring size | L ₁ | L ₁₄ | | | Order No. |
| 511-762 511-782 | 1 | 21DZA232A | 35 mm/1.38 in | 15 | 5.5 | 205457 205458 205459 205460 | 0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in | 102178 (50 mm/2 in) |
| | 2 | 21DZA232B | 40 mm/1.57 in | 20 | 10.5 | | | |
| | 3 | 21DZA232C | 45 mm/1.77 in | 25 | 15.5 | | | |
| | 4 | 21DZA232D | 50 mm/1.97 in | 30 | 20.5 | | | |
| | 5 | 21DZA232E | 55 mm/2.17 in | 35 | 25.5 | | | |
| | 6 | 21DZA232F | 60 mm/2.36 in | 40 | 30.5 | | | |
| 511-763 511-783 () Using 50 mm/2 in Sub-Anvil | 1 | 21DZA232A | 50 mm (100 mm)/1.97 in (3.94 in) | 15 | 5.5 | | | |
| | 2 | 21DZA232B | 55 mm (105 mm)/2.17 in (4.13 in) | 20 | 10.5 | | | |
| | 3 | 21DZA232C | 60 mm (110 mm)/2.36 in (4.33 in) | 25 | 15.5 | | | |
| | 4 | 21DZA232D | 65 mm (115 mm)/2.55 in (4.53 in) | 30 | 20.5 | | | |
| | 5 | 21DZA232E | 70 mm (120 mm)/2.74 in (4.72 in) | 35 | 25.5 | | | |
| | 6 | 21DZA232F | 75 mm (125 mm)/2.93 in (4.92 in) | 40 | 30.5 | | | |
| | 7 | 21DZA232G | 80 mm (130 mm)/3.12 in (5.12 in) | 45 | 35.5 | | | |
| | 8 | 21DZA232H | 85 mm (135 mm)/3.31 in (5.31 in) | 50 | 40.5 | | | |
| | 9 | 21DZA232J | 90 mm (140 mm)/3.50 in (5.51 in) | 55 | 45.5 | | | |
| | 10 | 21DZA232L | 95 mm (145 mm)/3.69 in (5.71 in) | 60 | 50.5 | | | |
| 511-764 511-784 | 1 | 21DZA232A | 100 mm/3.94 in | 15 | 5.5 | | | |
| | 2 | 21DZA232B | 105 mm/4.13 in | 20 | 10.5 | | | |
| | 3 | 21DZA232C | 110 mm/4.33 in | 25 | 15.5 | | | |
| | 4 | 21DZA232D | 115 mm/4.53 in | 30 | 20.5 | | | |
| | 5 | 21DZA232E | 120 mm/4.72 in | 35 | 25.5 | | | |
| | 6 | 21DZA232F | 125 mm/4.92 in | 40 | 30.5 | | | |
| | 7 | 21DZA232G | 130 mm/5.12 in | 45 | 35.5 | | | |
| | 8 | 21DZA232H | 135 mm/5.31 in | 50 | 40.5 | | | |
| | 9 | 21DZA232J | 140 mm/5.51 in | 55 | 45.5 | | | |
| | 10 | 21DZA232L | 145 mm/5.71 in | 60 | 50.5 | | | |
| | 11 | 21DZA232M | 150 mm/5.91 in | 65 | 55.5 | | | |
| | 12 | 21DZA232N | 155 mm/6.10 in | 70 | 60.5 | | | |
| | 13 | 21DZA232P | 160 mm/6.30 in | 75 | 65.5 | | | |

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — with Micrometer Head

- Micrometer head is attached to the anvil for accurate dimensional setting.
- Longer plunger stroke with no effect on accuracy.
- Carbide is used for the contact point ensuring high durability and wear resistance.
- This model reduces the influence of heat from the operator's hand by approx. 50 % by increasing the grip size and making the grip hollow-structured, thereby retaining high-accuracy measurement.
- Wide measuring range with sub-anvils.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Optional Extension Rods can be attached for measuring deep holes. (For details, refer to page C-45)
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-804

Note: The dial indicator and the protection cover are optional.



511-806

Note: The dial indicator and the protection cover are optional.

SPECIFICATIONS

| Metric | | | | | | | | | | | | | | | | | | | | | |
|-----------|------------|------------------------------|---------------------|-----------------|----------------|---------------------------------|-----------------------|-----------------|---------------------------------|----------|--------------------|-------------------------------------|----------|----------|--------|--------|--------|--------|-----|--------|-----|
| Order No. | Range (mm) | Stroke of contact point (mm) | Measuring force (N) | Guide force (N) | Content of set | | | | | | Probing depth (mm) | | | | | | | | | | |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Micrometer head | Sub-Anvil | Spanner | | | | | | | | | | | |
| 511-803 | 60 - 100 | 1.6 | 5 or less | 10 or less | 511-803 | Not supplied | Not supplied | 1 pc. | 2 pcs. | 3 pcs. | 150 | | | | | | | | | | |
| 511-804 | 100 - 160 | | | | 3 pcs. | | | | | | | | | | | | | | | | |
| 511-805 | 150 - 250 | | | | 4 pcs. | | | | | | | | | | | | | | | | |
| 511-806 | 250 - 400 | | | | 3 pcs. | | | | | | | | | | | | | | | | |
| 511-807 | 400 - 600 | | 2 pcs. | 2 pcs. | 250 | | | | | | | | | | | | | | | | |
| 511-808 | 600 - 800 | | 2 pcs. | | | | | | | | | | | | | | | | | | |
| 511-823 | 60 - 100 | | 5 or less | | | | | | 10 or less | 511-803 | | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | 1 pc. | 2 pcs. | 3 pcs. | 150 | | | | |
| 511-824 | 100 - 160 | | | | | | | | | 3 pcs. | | | | | | | | | | | |
| 511-825 | 150 - 250 | 6 or less | 15 or less | 511-805 | | 2046SB (Graduation: 0.01 mm) | 21DZA000 | 1 pc. | 4 pcs. | 2 pcs. | 250 | | | | | | | | | | |
| 511-826 | 250 - 400 | | | 3 pcs. | | | | | | | | | | | | | | | | | |
| 511-827 | 400 - 600 | | | 2 pcs. | | | | | | | | | | | | | | | | | |
| 511-828 | 600 - 800 | | | 2 pcs. | | | | | | | | | | | | | | | | | |
| 511-813 | 60 - 100 | 1.6 | 5 or less | 10 or less | 511-803 | | | | 2046SB (Graduation: 0.01 mm) | 21DZA000 | | | | | 1 pc. | 2 pcs. | | 3 pcs. | 150 | | |
| 511-814 | 100 - 160 | | | | 3 pcs. | | | | | | | | | | | | | | | | |
| 511-815 | 150 - 250 | | | | 6 or less | | | | | | | 15 or less | 511-805 | 21DZA000 | | 1 pc. | 4 pcs. | | | 2 pcs. | 250 |
| 511-816 | 250 - 400 | | | | | | | | | | | | 3 pcs. | | | | | | | | |
| 511-817 | 400 - 600 | | 2 pcs. | | | | | | | | | | | | | | | | | | |
| 511-818 | 600 - 800 | | 2 pcs. | | | | | | | | | | | | | | | | | | |

| Inch | | | | | | | | | | | | | | | | | | | | | | |
|-----------|-------------|------------------------------|---------------------|-----------------|-----------------------------------|----------------|-----------------------|-----------------|--------------------------------------|----------|--------------------|------------|------------|--------|----|---------|-----------------------------------|----------|-------|--------|--------|---|
| Order No. | Range (in) | Stroke of contact point (in) | Measuring force (N) | Guide force (N) | Content of set | | | | | | Probing depth (in) | | | | | | | | | | | |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Micrometer head | Sub-Anvil | Spanner | | | | | | | | | | | | |
| 511-833 | 2.4 - 4.0 | 0.063 | 5 or less | 10 or less | 511-833 | Not supplied | Not supplied | 1 pc. | 2 pcs. | 3 pcs. | 6 | | | | | | | | | | | |
| 511-834 | 4.0 - 6.4 | | | | 3 pcs. | | | | | | | | | | | | | | | | | |
| 511-835 | 6.0 - 10.0 | | | | 4 pcs. | | | | | | | | | | | | | | | | | |
| 511-836 | 10.0 - 16.0 | | | | 3 pcs. | | | | | | | | | | | | | | | | | |
| 511-837 | 16.0 - 24.0 | | 6 or less | 15 or less | 511-837 | | | | 2923SB-10 (Graduation: 0.0001 in) | 21DZA000 | | 1 pc. | 2 pcs. | 2 pcs. | 10 | | | | | | | |
| 511-838 | 24.0 - 32.0 | | | | 2 pcs. | | | | | | | | | | | | | | | | | |
| 511-853 | 2.4 - 4.0 | | | | 5 or less | | | | | | | | 10 or less | | | 511-833 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 1 pc. | 2 pcs. | 3 pcs. | 4 |
| 511-854 | 4.0 - 6.4 | | | | | | | | | | | | | | | 3 pcs. | | | | | | |
| 511-855 | 6.0 - 10.0 | 6 or less | 15 or less | 511-835 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 1 pc. | 4 pcs. | | | 2 pcs. | | 6 | | | | | | | | | |
| 511-856 | 10.0 - 16.0 | | | 3 pcs. | | | | | | | | | | | | | | | | | | |
| 511-857 | 16.0 - 24.0 | | | 2 pcs. | | | | | | | | | | | | | | | | | | |
| 511-858 | 24.0 - 32.0 | | | 2 pcs. | | | | | | | | | | | | | | | | | | |
| 511-843 | 2.4 - 4.0 | 0.063 | 5 or less | 10 or less | | | | 511-833 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 1 pc. | 2 pcs. | | 3 pcs. | 4 | | | | | | | |
| 511-844 | 4.0 - 6.4 | | | | | | | 3 pcs. | | | | | | | | | | | | | | |
| 511-845 | 6.0 - 10.0 | | | | | | | 6 or less | | | | 15 or less | | | | 511-835 | 2922SB (Graduation: 0.0005 in) | 21DZA000 | 1 pc. | 4 pcs. | 2 pcs. | 6 |
| 511-846 | 10.0 - 16.0 | | | | | | | | | | | | | | | 3 pcs. | | | | | | |
| 511-847 | 16.0 - 24.0 | | 2 pcs. | | | | | | | | | | | | | | | | | | | |
| 511-848 | 24.0 - 32.0 | | 2 pcs. | | | | | | | | | | | | | | | | | | | |

Note 1: Storage boxes for 511-807/808/837/838 models are made of wood. The boxes of other models are made of plastic.

Note 2: It is not permissible to expand measuring range using sub-anvils other than as supplied as standard accessories. (The measurement accuracy in such cases is not guaranteed.)

Contact Points

Technical Data

- Accuracy: Metric models 2 µm
Inch models 0.00008 in
- Repeatability: Metric models 0.5 µm
Inch models 0.00002 in
- Adjacent error: Metric models 1 µm
Inch models 0.00004 in

Optional Accessories

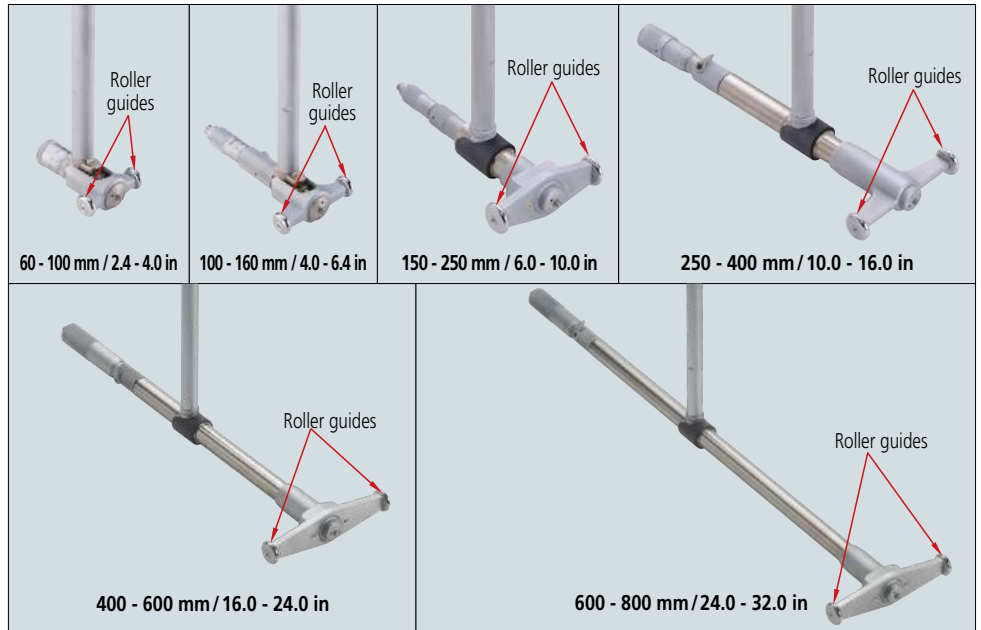
- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

Recommended Dial Indicators (see Chapter F)

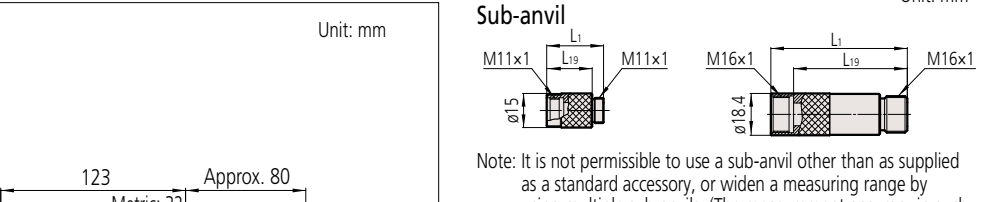
- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
 - Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm/0.00005 in
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.



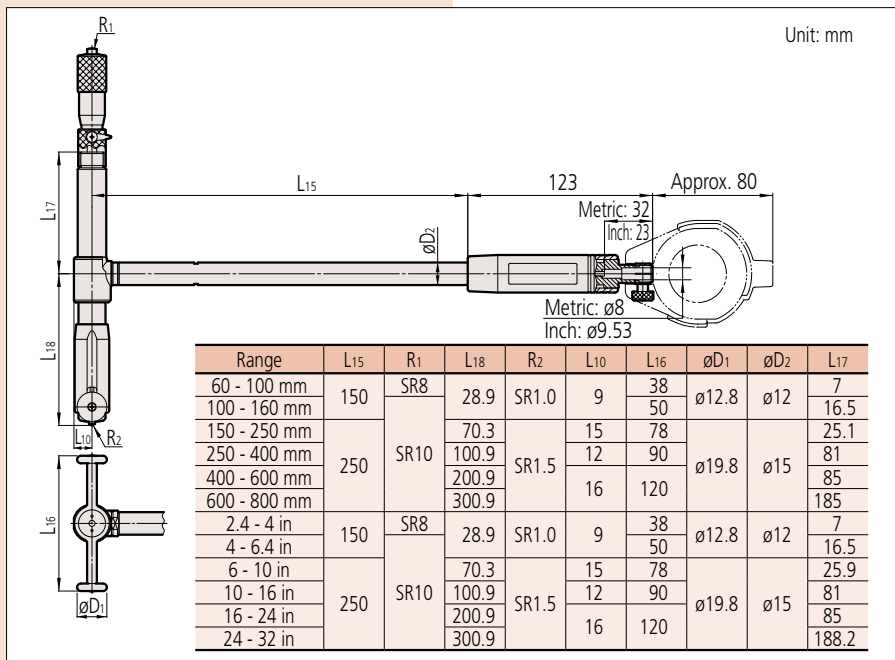
60 - 100 mm / 2.4 - 4.0 in 100 - 160 mm / 4.0 - 6.4 in 150 - 250 mm / 6.0 - 10.0 in 250 - 400 mm / 10.0 - 16.0 in



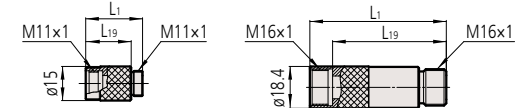
400 - 600 mm / 16.0 - 24.0 in 600 - 800 mm / 24.0 - 32.0 in

Unit: mm

DIMENSIONS



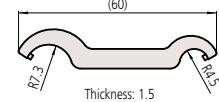
Sub-anvil



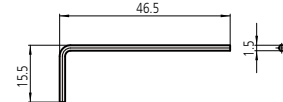
Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

Spanner

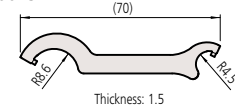
301336



202863



200154



STANDARD ACCESSORIES

| Metric | | Micrometer head | | Sub-Anvil | | | | Spanner |
|-----------------------|-----------|-----------------|------------|-----------------|-----------------|---------|----------|-----------------------------------|
| Bore gage (Main body) | Order No. | Stroke (mm) | Screw size | Marked No. (mm) | Order No. | L1 (mm) | L19 (mm) | Order No. |
| 511-803 | 21DZA267 | 10 | M11x1 | 10 | 208892 | 15 | 10 | 301336 (2 pcs.) 202863 (1 pc.) |
| | | | | 20 | 208894 | 25 | 20 | |
| 511-804 | 21DZA268 | 13 | M11x1 | 10 | 208892 | 15 | 10 | 301336 (2 pcs.) |
| | | | | 20 | 208894 (2 pcs.) | 25 | 20 | |
| 511-805 | 21DZA268 | 13 | M11x1 | 10 | 208892 | 15 | 10 | 301336 (2 pcs.) |
| | | | | 20 | 208894 (2 pcs.) | 25 | 20 | |
| | | | | 50 | 21DAA492 | 55 | 50 | |
| 511-806 | 953118 | 25 | M16x1 | 25 | 208926 | 35 | 25 | 200154 (2 pcs.) |
| | | | | 50 | 208928 (2 pcs.) | 60 | 50 | |
| 511-807 | 953120 | 50 | M16x1 | 50 | 208928 | 60 | 50 | 200154 (2 pcs.) |
| | | | | 100 | 208932 | 110 | 100 | |
| 511-808 | 953120 | 50 | M16x1 | 50 | 208928 | 60 | 50 | 200154 (2 pcs.) |
| | | | | 100 | 208932 | 110 | 100 | |

| Inch | | Micrometer head | | Sub-Anvil | | | | Spanner |
|-----------------------|-----------|-----------------|------------|-----------------|-----------------|---------|----------|-----------------------------------|
| Bore gage (Main body) | Order No. | Stroke (in) | Screw size | Marked No. (in) | Order No. | L1 (in) | L19 (in) | Order No. |
| 511-833 | 21DZA272 | 0.4 | M11x1 | 0.4 | 208893 | 0.6 | 0.4 | 301336 (2 pcs.) 202863 (1 pc.) |
| | | | | 0.8 | 208895 | 1.0 | 0.8 | |
| 511-834 | 21DZA273 | 0.5 | M11x1 | 0.4 | 208893 | 0.6 | 0.4 | 301336 (2 pcs.) |
| | | | | 0.8 | 208895 (2 pcs.) | 1.0 | 0.8 | |
| 511-835 | 21DZA273 | 0.5 | M11x1 | 0.4 | 208893 | 0.6 | 0.4 | 301336 (2 pcs.) |
| | | | | 0.8 | 208895 (2 pcs.) | 1.0 | 0.8 | |
| | | | | 2 | 21DAA493 | 2.2 | 2 | |
| 511-836 | 21DZA275 | 1.0 | M16x1 | 1 | 208927 | 1.4 | 1 | 200154 (2 pcs.) |
| | | | | 2 | 208929 (2 pcs.) | 2.4 | 2 | |
| 511-837 | 902313 | 2.0 | M16x1 | 2 | 208929 | 2.4 | 2 | 200154 (2 pcs.) |
| | | | | 4 | 208933 | 4.4 | 4 | |
| 511-838 | 902313 | 2.0 | M16x1 | 2 | 208929 | 2.4 | 2 | 200154 (2 pcs.) |
| | | | | 4 | 208933 | 4.4 | 4 | |

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — for Blind Holes

- Capable of ID (inside diameter) measurement close to the bottom of a hole.
- Carbide contact point ensuring high durability and wear resistance.
- Grip is large and hollow to reduce effect of body heat on high-accuracy measurements.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Optional Extension Rods can be attached for measuring deep holes. (For details, refer to page C-45)
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



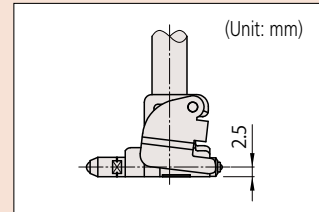
511-416

Note: The dial indicator and protection cover are optional.



511-417

Note: The dial indicator and protection cover are optional.



Technical Data

- Accuracy: Metric models 4 μ m
Inch models 0.00016 in
- Repeatability: Metric models 1 μ m
Inch models 0.00004 in
- Adjacent error: Metric models 1 μ m
Inch models 0.00004 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Recommended Digimatic Indicators (see Chapter F-14)

- Metric models: **543-310B** (0.001 mm)
 - Inch models: **543-312B** (0.001 mm/0.00005 in)
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

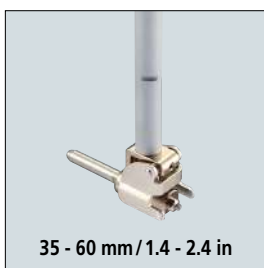
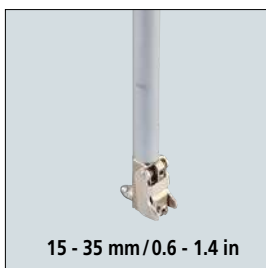
SPECIFICATIONS

| Metric | | | | | | | | | | |
|-----------|------------|------------------------------|---------------------|-----------------|----------------|-------------------------------------|-----------------------|---------|--------|--------------------|
| Order No. | Range (mm) | Stroke of contact point (mm) | Measuring force (N) | Guide force (N) | Content of set | | | | | Probing depth (mm) |
| | | | | | Bore gage | Dial indicator | Dial protection cover | Anvil | Washer | |
| 511-415 | 15 - 35 | 1.2 | 4 or less | 6 or less | 511-415 | Not supplied | Not supplied | 11 pcs. | 1 pc. | 150 |
| 511-416 | 35 - 60 | | | | 511-416 | | | | | |
| 511-417 | 50 - 150 | 5 or less | 10 or less | 511-417 | 11 pcs. | 4 pcs. | 11 pcs. | 1 pc. | 150 | |
| 511-425 | 15 - 35 | 1.2 | 4 or less | 6 or less | 511-415 | 2046SB (Graduation: 0.01 mm) | 21DZA000 | 6 pcs. | 4 pcs. | 150 |
| 511-426 | 35 - 60 | | | | 511-416 | | | | | |
| 511-427 | 50 - 150 | 5 or less | 10 or less | 511-417 | 11 pcs. | 4 pcs. | 11 pcs. | 1 pc. | 150 | |
| 511-435 | 15 - 35 | 1.2 | 4 or less | 6 or less | 511-415 | 2109SB-10 (Graduation: 0.001 mm) | 21DZA000 | 6 pcs. | 4 pcs. | 150 |
| 511-436 | 35 - 60 | | | | 511-416 | | | | | |
| 511-437 | 50 - 150 | 5 or less | 10 or less | 511-417 | 11 pcs. | 4 pcs. | 11 pcs. | 1 pc. | 150 | |

Note 1: A 10 mm (0.4 in) sub-anvil is supplied with **511-415/425/435/418/428/438** and a 50 mm (2 in) sub-anvil is supplied with **511-417/427/437/420/430/440**.

Note 2: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-ansils. (The measurement accuracy in such cases is not guaranteed.)

Contact Points

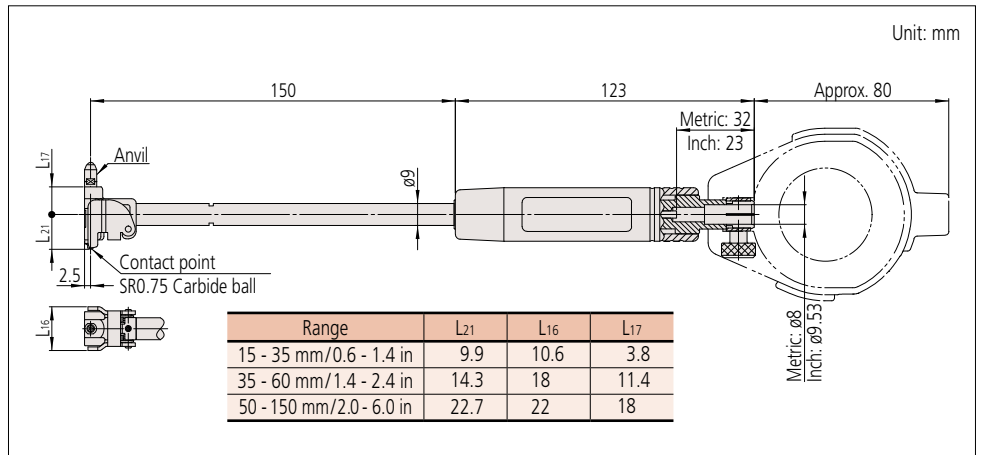


Recommended Digimatic Indicators (see Chapter F)

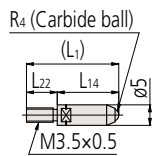
- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm)
- Inch models: **543-312B (ID-C112GXB)**: 0.001 mm/0.00005 in)
- The ID measurement can be performed easily since the minimum value is detected automatically.
- Up to three combinations of master value and the tolerance value can be set.
- Nine measurement results (maximum) can be saved and recalled from memory (when no external device is connected).
- Refer to page F-14 for details.



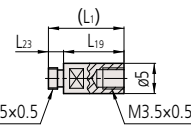
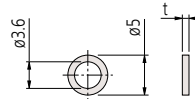
DIMENSIONS



Anvil

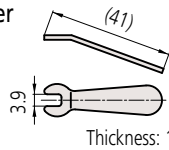


Interchangeable washer



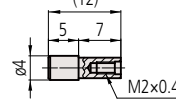
Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

Spanner 204354

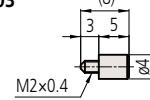


Thickness: 1.5

Washer holder 212202



Locking screw 212203



STANDARD ACCESSORIES

| Bore gage (Main body) | Anvil | | | | | | | Interchangeable washer | | Sub-Anvil | | |
|--|------------|-----------|-----------------------------------|------|-----|-------|-------|--------------------------------------|--|-----------|-----|--------------|
| | Marked No. | Order No. | Indication of measuring size | L1 | L22 | R4 | L14 | Order No. | t | Order No. | L23 | L19 |
| 511-415 511-418 () Using 10 mm/0.4 in Sub-Anvil | 1 | 21DZA376A | 15 mm (25 mm)/0.59 in (0.98 in) | 4.5 | 2.5 | SR1 | 2 | 212127 | 0.5 mm/0.02 in | 21DAA563 | 2.5 | 10 mm/0.4 in |
| | 2 | 21DZA376B | 16 mm (26 mm)/0.63 in (1.02 in) | 5.5 | | | 3 | | | | | |
| | 3 | 21DZA376C | 17 mm (27 mm)/0.67 in (1.06 in) | 6.5 | | | 4 | | | | | |
| | 4 | 21DZA376D | 18 mm (28 mm)/0.71 in (1.10 in) | 7.5 | | | 5 | | | | | |
| | 5 | 21DZA376E | 19 mm (29 mm)/0.75 in (1.14 in) | 8.5 | | | 6 | | | | | |
| | 6 | 21DZA376F | 20 mm (30 mm)/0.79 in (1.18 in) | 9.5 | | | 7 | | | | | |
| | 7 | 21DZA376G | 21 mm (31 mm)/0.83 in (1.22 in) | 10.5 | | SR1.5 | 8 | | | | | |
| | 8 | 21DZA376H | 22 mm (32 mm)/0.87 in (1.26 in) | 11.5 | | | 9 | | | | | |
| | 9 | 21DZA376J | 23 mm (33 mm)/0.91 in (1.30 in) | 12.5 | | | 10 | | | | | |
| | 10 | 21DZA376L | 24 mm (34 mm)/0.94 in (1.34 in) | 13.5 | | | 11 | | | | | |
| | 11 | 21DZA376M | 25 mm (35 mm)/0.98 in (1.38 in) | 14.5 | | | 12 | | | | | |
| 511-416 511-419 | 1 | 21DZA404A | 35 mm/1.38 in | 17.5 | | 7.5 | SR1.5 | | | | | |
| | 2 | 21DZA404B | 40 mm/1.57 in | 22.5 | 15 | | | | | | | |
| | 3 | 21DZA404C | 45 mm/1.77 in | 27.5 | 20 | | | | | | | |
| | 4 | 21DZA404D | 50 mm/1.97 in | 32.5 | 25 | | | | | | | |
| | 5 | 21DZA404E | 55 mm/2.17 in | 37.5 | 30 | | | | | | | |
| | 6 | 21DZA404F | 60 mm/2.36 in | 42.5 | 35 | | | | | | | |
| 511-417 511-420 () Using 50 mm/2 in Sub-Anvil | 1 | 21DZA404A | 50 mm (100 mm)/1.97 in (3.94 in) | 17.5 | 7.5 | SR1.5 | 10 | 212127 212128 212129 212130 | 0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in | 21DAA596 | 7.5 | 50 mm/2 in |
| | 2 | 21DZA404B | 55 mm (105 mm)/2.17 in (4.13 in) | 22.5 | | | 15 | | | | | |
| | 3 | 21DZA404C | 60 mm (110 mm)/2.36 in (4.33 in) | 27.5 | | | 20 | | | | | |
| | 4 | 21DZA404D | 65 mm (115 mm)/2.56 in (4.53 in) | 32.5 | | | 25 | | | | | |
| | 5 | 21DZA404E | 70 mm (120 mm)/2.76 in (4.72 in) | 37.5 | | | 30 | | | | | |
| | 6 | 21DZA404F | 75 mm (125 mm)/2.95 in (4.92 in) | 42.5 | | | 35 | | | | | |
| | 7 | 21DZA404G | 80 mm (130 mm)/3.15 in (5.12 in) | 47.5 | | | 40 | | | | | |
| | 8 | 21DZA404H | 85 mm (135 mm)/3.35 in (5.31 in) | 52.5 | | | 45 | | | | | |
| | 9 | 21DZA404J | 90 mm (140 mm)/3.54 in (5.51 in) | 57.5 | | | 50 | | | | | |
| | 10 | 21DZA404L | 95 mm (145 mm)/3.74 in (5.71 in) | 62.5 | | | 55 | | | | | |
| | 11 | 21DZA404M | 100 mm (150 mm)/3.94 in (5.91 in) | 67.5 | | | 60 | | | | | |

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — ABSOLUTE Digimatic Bore Gages

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- These ABSOLUTE Digimatic bore gages are exclusively designed for inside diameter measurement.
- ABS (ABSOLUTE) type bore gages are not subject to overspeed error.
- Up to four Extension Rods (optional) can be connected for measuring at the bottom of a hole 2 m deep.

- The display and grip can be rotated up to 320° and the display can be inclined up to 90°, so that it is easily readable from any direction.
- The minimum value holding function provides easy measurement of hole diameter.
- The gauge block set for master setting allows quick and accurate zero-point setting.
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-501



SPECIFICATIONS

| Metric | | |
|---------------------------------|---|------------------|
| Order No. | 511-501 | 511-502 |
| Range | 45 - 100 mm | 100 - 160 mm |
| Stroke of contact point | 1.2 mm | |
| Resolution | 0.001 mm | |
| Accuracy | Overall*1 | 0.003 mm or less |
| | Adjacent error | 0.002 mm or less |
| | Repeatability | 0.002 mm or less |
| Measuring force | 5 N or less | |
| Guide force | 10 N or less | |
| Battery | SR44 (2 pcs.), 938882 For initial operational checks (standard accessory) | |
| Battery life*2 | Approx. 2,000 hours under normal use. | |
| Scale type | ABSOLUTE electrostatic linear encoder | |
| Sampling frequency*3 | 50 times/s | |
| Dust / Water protection level*4 | IP53 (IEC60529/JIS D0207, C0920) | |
| Display | <ul style="list-style-type: none"> • 7 segments 6 digits decimal numeric with minus sign, in/mm • Tolerance judge indication • Analog indication | |
| Net weight | 500 g | 570 g |

| Inch | | |
|---------------------------------|---|-----------------------------|
| Order No. | 511-521 | 511-522 |
| Range | 1.8 - 4.0 in | 4.0 - 6.5 in |
| Stroke of contact point | 0.048 in/1.2 mm | |
| Resolution | 0.00005 in/0.001 mm | |
| Accuracy | Overall*1 | 0.0001 in/0.003 mm or less |
| | Adjacent error | 0.00008 in/0.002 mm or less |
| | Repeatability | 0.0001 in/0.002 mm or less |
| Measuring force | 5 N or less | |
| Guide force | 10 N or less | |
| Battery | SR44 (2 pcs.), 938882 For initial operational checks (standard accessory) | |
| Battery life*2 | Approx. 2,000 hours under normal use. | |
| Scale type | ABSOLUTE electrostatic linear encoder | |
| Sampling frequency*3 | 50 times/s | |
| Dust / Water protection level*4 | IP53 (IEC60529/JIS D0207, C0920) | |
| Display | <ul style="list-style-type: none"> • 7 segments 6 digits decimal numeric with minus sign, in/mm • Tolerance judge indication • Analog indication | |
| Net weight | 500 g | 570 g |

*1 A quantizing error is excluded.

*2 When the usage time per day is eight hours.

*3 If the contact point detecting speed is over 50 μm/s, the peak value may not be displayed correctly.

*4 The level indicated is valid only if the output connector cap is installed.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™



Function

- Preset function
- Master value registration (3 values maximum)
- Tolerance judgment
- Upper/lower limit registration (3 values maximum)
- Minimum value holding
- Data output
- Display rotation (320°)
- Display inclination (90°, 7 steps)
- Low battery alarm display
- Error display

Optional Accessories

- Extension rod
250 mm (10 in): **21DZA089**
500 mm (20 in): **21DZA081**
Up to four extension rods can be jointed, and a maximum length of 2 m is allowed.
- Example of Connection
Using four 500 mm extension rods
- SPC Cable:
1 m: **905338**
2 m: **905409**
Refer to pages A-27 to A-29
- USB Input Tool Direct (2 m): **06AFM380F**
Refer to page A-28
- USB Keyboard Signal Conversion Type
Communication Conversion Type: **264-016**
- RS-232C Communication Conversion Type: **264-007**
Refer to page A-14
- Connecting Cables for U-WAVE-T (160 mm): **02AZD790F**
For foot switch: **02AZE140F**
Refer to page A-20
- Digimatic Mini-Processor **DP-1VA LOGGER: 264-505**

Gauge Blocks and Block Sets for Setting the Origin or Master Value (optional)

- Typical application



- Rectangular gauge blocks
- Note: Available only for 511-501/521
516-118-10
516-118-60 with calibration certificate

| Description* | Order No. | Qty | |
|---------------------------|-------------------|-------------------|---|
| Nominal length (mm) | 1 | 611611-021 | 1 |
| | 2 | 611612-021 | 1 |
| | 3 | 611613-021 | 1 |
| | 5 | 611615-021 | 1 |
| | 10 | 611671-021 | 1 |
| | 20 | 611672-021 | 1 |
| | 30 | 611673-021 | 1 |
| 40 | 611674-021 | 1 | |
| Flat jaw | 630030 | 1 pair (2 pcs.) | |
| Holder 160 mm | 619004 | 1 | |
| Certificate of inspection | | 1 | |

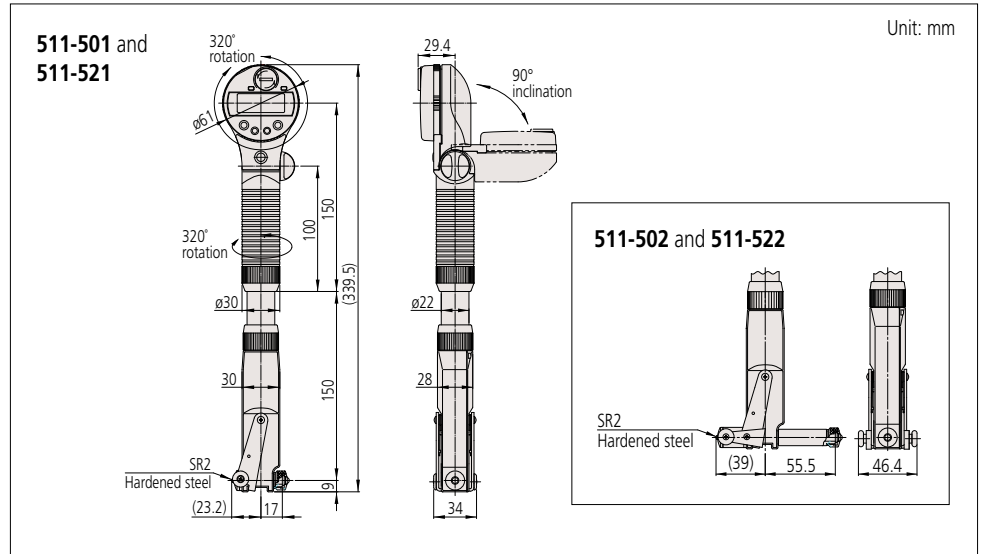
* Equivalent to JIS B 7506 Grade 0

- Square gauge blocks
- Note: Available only for 511-501/521
516-119-10
516-119-60 with calibration certificate

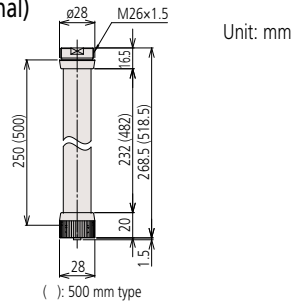
| Description* | Order No. | Qty | |
|---------------------------|---------------|-------------------|---|
| Nominal length (mm) | 1 | 614611-021 | 1 |
| | 2 | 614612-021 | 1 |
| | 3 | 614613-021 | 1 |
| | 5 | 614615-021 | 1 |
| | 10 | 614671-021 | 1 |
| | 20 | 614672-021 | 1 |
| | 30 | 614673-021 | 1 |
| | 40 | 614674-021 | 1 |
| Flat jaw | 619072 | 1 pair (2 pcs.) | |
| Tie rod 3 in | 619062 | 1 | |
| Tie rod 2 1/4 in | 619063 | 1 | |
| Tie rod 1 1/2 in | 619064 | 1 | |
| Flat head screw 1 1/4 in | 619057 | 2 | |
| Flat head screw 5/8 in | 619058 | 2 | |
| Certificate of inspection | | 1 | |

* Equivalent to JIS B 7506 Grade 0

DIMENSIONS

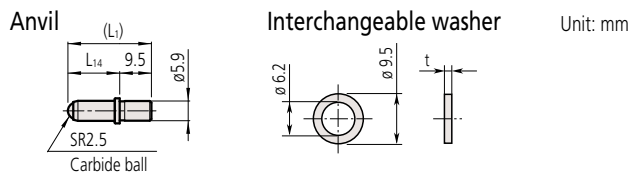


Extension rod (optional)



STANDARD ACCESSORIES

| Bore gage | Anvil | | | | | Interchangeable washer | |
|--------------------|------------|------------------|------------------------------|---------------------|----------------------|--|--|
| (Main body) | Marked No. | Order No. | Indication of measuring size | L ₁ (mm) | L ₁₄ (mm) | Order No. | t |
| 511-501 511-521 | 1 | 21DZA232A | 45 mm/1.8 in | 15 | 5.5 | 205457 205458 205459 205460 | 0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in |
| | 2 | 21DZA232B | 50 mm/2.0 in | 20 | 10.5 | | |
| | 3 | 21DZA232C | 55 mm/2.2 in | 25 | 15.5 | | |
| | 4 | 21DZA232D | 60 mm/2.4 in | 30 | 20.5 | | |
| | 5 | 21DZA232E | 65 mm/2.6 in | 35 | 25.5 | | |
| | 6 | 21DZA232F | 70 mm/2.8 in | 40 | 30.5 | | |
| | 7 | 21DZA232G | 75 mm/3.0 in | 45 | 35.5 | | |
| | 8 | 21DZA232H | 80 mm/3.2 in | 50 | 40.5 | | |
| | 9 | 21DZA232J | 85 mm/3.4 in | 55 | 45.5 | | |
| | 10 | 21DZA232L | 90 mm/3.6 in | 60 | 50.5 | | |
| | 11 | 21DZA232M | 95 mm/3.8 in | 65 | 55.5 | | |
| | 12 | 21DZA232N | 100 mm/4.0 in | 70 | 60.5 | | |
| 511-502 511-522 | 1 | 21DZA232A | 100 mm/4.0 in | 15 | 5.5 | 205457 205458 205459 205460 | 0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in |
| | 2 | 21DZA232B | 105 mm/4.2 in | 20 | 10.5 | | |
| | 3 | 21DZA232C | 110 mm/4.4 in | 25 | 15.5 | | |
| | 4 | 21DZA232D | 115 mm/4.6 in | 30 | 20.5 | | |
| | 5 | 21DZA232E | 120 mm/4.8 in | 35 | 25.5 | | |
| | 6 | 21DZA232F | 125 mm/5.0 in | 40 | 30.5 | | |
| | 7 | 21DZA232G | 130 mm/5.2 in | 45 | 35.5 | | |
| | 8 | 21DZA232H | 135 mm/5.4 in | 50 | 40.5 | | |
| | 9 | 21DZA232J | 140 mm/5.6 in | 55 | 45.5 | | |
| | 10 | 21DZA232L | 145 mm/5.8 in | 60 | 50.5 | | |
| | 11 | 21DZA232M | 150 mm/6.0 in | 65 | 55.5 | | |
| | 12 | 21DZA232N | 155 mm/6.2 in | 70 | 60.5 | | |
| | 13 | 21DZA232P | 160 mm/6.4 in | 75 | 65.5 | | |

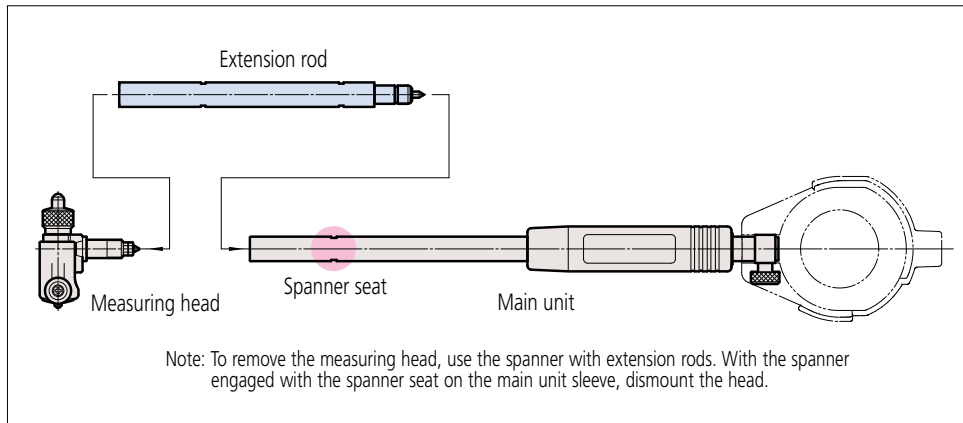


Bore Gages

For easy and accurate measurement of inside diameters

Extension Rod SERIES 511 — Accessories for Bore Gages

- Extension Rods (optional) are available to assist in deep-hole measurement.
- If two or more Extension Rods are connected together, measurement errors may occur due to flexure of the rod assembly. Therefore it is best to use no more than a single Extension Rod.
- Extension Rods are available up to 1,000 mm in length.
- Cannot be connected to products with special sizes or special specifications.
- When using a 500 mm (or longer) Extension Rod, use the bore gage in an upright position.
- The accuracy and security of the assembly should be confirmed after connecting an Extension Rod.



SPECIFICATIONS

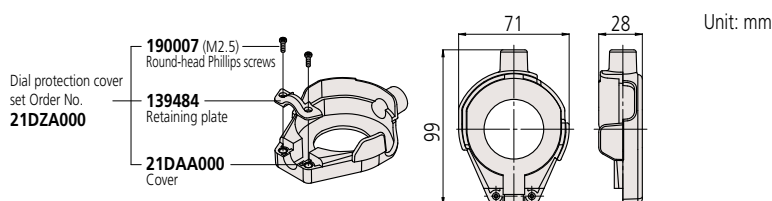
| Applicable model Order No. | Extension rod length (mm) | | | | | Extension rod diameter (mm) | Spanner Order No. |
|--|---------------------------|--------|--------|--------|--------|-----------------------------|--------------------|
| | 125 | 250 | 500 | 750 | 1000 | | |
| 511-701/511-731 511-415/511-418 511-416/511-419 511-417/511-420 | 953549 | 953550 | 953551 | — | — | ø9 | 102148 (2 pcs.) |
| 511-702/511-732 511-703/511-733 511-704/511-734 511-803/511-833 511-804/511-834 | 953552 | 953553 | 953554 | 953555 | 953556 | ø12 | 212556 (2 pcs.) |
| 511-705/511-735 511-706/511-736 511-805/511-835 511-806/511-836 511-807/511-837 511-808/511-838 | 953557 | 952361 | 953558 | 953559 | 953560 | ø15 | 212556 (2 pcs.) |

Note 1: If an extension rod is attached, the measuring accuracy may degrade due to factors such as rod deflection.

Note 2: Spanner is supplied as standard.

Protection cover

- Both the flat backplate of a dial indicator and backplate with a lug can be attached to a protection cover. It can also be attached to Digimatic Indicators (**543-310B**, **543-312B**).



Typical application



Technical Data

- Flatness of parallel jaw
0.5 μm (Parallelism 1 μm)

Standard Accessories

| | |
|---------------------|---------------|
| Parallel jaw 2 pcs. | 630030 |
| Attachment A | 940088 |
| Attachment B | 940089 |
| Attachment C | 940090 |

Bore Gage Checker SERIES 515

- The Bore Gage Checker allows easy setting of dial bore gages with ranges of 18 mm (0.7 in) through 400 mm (16 in) using gauge blocks.
- Can be used in both vertical and horizontal positions.



Standard configuration: Stand
Attachment A, B, C 1 pc. for each
Parallel jaw (2 pcs.)

SPECIFICATIONS

| Order No. | Applicable range |
|-----------|---------------------------|
| 515-590 | 18 - 400 mm (0.7 - 16 in) |

Bore Gages

For easy and accurate measurement of inside diameters

Setting Rings

SERIES 177 — Accessories for Inside Micrometers, Holtest and Dial Bore Gages

- Used for quick and accurate setting of dial bore gages, Holtest, and inside micrometers.
- Actual diameter is marked in 0.001 mm increments. (Dimension measuring position is the center of the height T.)

Steel Setting Rings



177-146



177-300

CERA Setting Rings

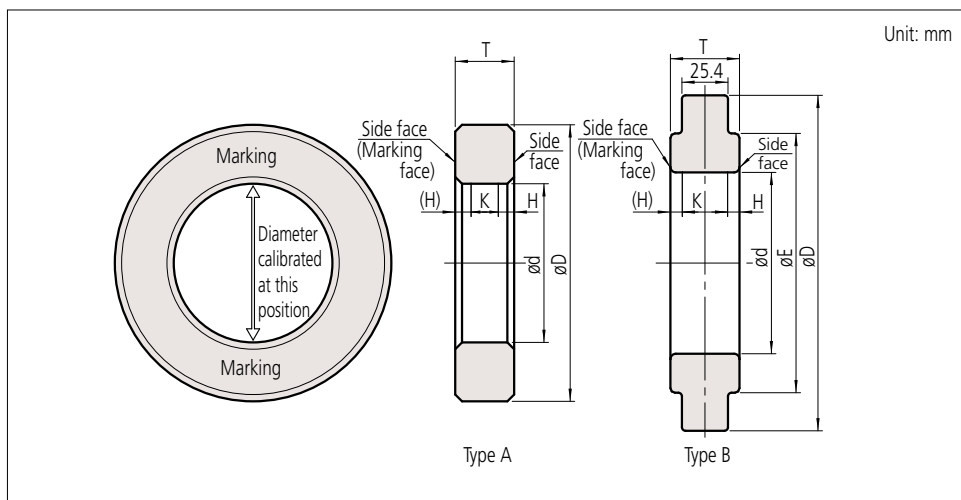


177-429



177-432

DIMENSIONS



Suffix

177-*-62:** With Inspection Certificate (provides a record of the calibrated diameter) and Calibration Certificate

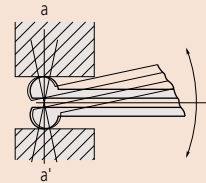
177-*-82:** With Inspection Certificate (provides a record of the calibrated diameter), Calibration Certificate, and Traceability System Chart

Note 1: The Inspection Certificate is not a substitute for a calibration certificate as it is undated.

Note 2: A more detailed inspection certificate describing roundness and cylindricity is available on request.

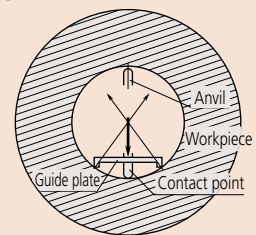
How to Read the Indicated Value

• SERIES 526



The **526** Series contact points have high curvature. Alignment with the diameter (a-a') is achieved by rotating the gage head in the direction indicated by the arrow, and the reading is the maximum value read from the dial indicator.

• SERIES 511



The **511** Series provides a guide plate to align the setting ring diameter with the measurement axis of the bore gage.



SPECIFICATIONS

Steel Setting Rings

Metric

| Order No. | Nominal size ϕD (mm) | Dimensions (mm) | | | Type | Accuracy | | | | |
|-----------|----------------------------|-----------------|----------|----|------|--|--|--------------------------------------|------------------------------------|--|
| | | ϕD | ϕE | T | | Tolerance between the nominal size and the actual diameter (μm) | Uncertainty of marked diameter value*1 (μm) | Roundness/Cylindricity*2 (μm) | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| 177-220 | 1 | 20 | — | 4 | A | ± 10 | 1.5 | 1.0 | 1.6 | 0.8 |
| 177-222 | 1.1 | 20 | — | 4 | A | ± 10 | 1.5 | 1.0 | 1.6 | 0.8 |
| 177-225 | 1.2 | 20 | — | 4 | A | ± 10 | 1.5 | 1.0 | 1.6 | 0.8 |
| 177-227 | 1.3 | 20 | — | 4 | A | ± 10 | 1.5 | 1.0 | 1.6 | 0.8 |
| 177-230 | 1.4 | 20 | — | 4 | A | ± 10 | 1.5 | 1.0 | 1.6 | 0.8 |
| 177-236 | 1.75 | 25 | — | 5 | A | ± 10 | 1.5 | 1.0 | 1.6 | 1.8 |
| 177-239 | 2 | 25 | — | 5 | A | ± 10 | 1.5 | 1.0 | 1.6 | 1.8 |
| 177-242 | 2.25 | 25 | — | 5 | A | ± 10 | 1.5 | 1.0 | 1.6 | 1.8 |
| 177-208 | 2.5 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-246 | 2.75 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-248 | 3 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-250 | 3.25 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-252 | 3.5 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-255 | 3.75 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-204 | 4 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-257 | 4.5 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-205 | 5 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-263 | 5.5 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-267 | 6 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-271 | 6.5 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-275 | 7 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-125 | 8 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-279 | 9 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-126 | 10 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-284 | 12 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-132 | 14 | 38 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |

Inch

| Order No. | Nominal size ϕD (in) | Dimensions (mm) | | | Type | Accuracy | | | | |
|-----------|----------------------------|-----------------|----------|----|------|---|---|-------------------------------|------------------------------------|--|
| | | ϕD | ϕE | T | | Tolerance between the nominal size and the actual diameter (in) | Uncertainty of marked diameter value*1 (in) | Roundness/Cylindricity*2 (in) | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| 177-209 | 0.1 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 1.7 | 3.6 |
| 177-206 | 0.16 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 1.7 | 3.6 |
| 177-207 | 0.24 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 1.7 | 3.6 |
| 177-281 | 0.275 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 3.0 |
| 177-179 | 0.35 | 32 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-283 | 0.425 | 32 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-180 | 0.5 | 32 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-181 | 0.6 | 38 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-182 | 0.65 | 45 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-183 | 0.7 | 45 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-287 | 0.8 | 45 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-184 | 1 | 53 | — | 15 | A | ± 0.0004 | 0.00006 | 0.00004 | 3.2 | 8.6 |
| 177-289 | 1.2 | 71 | — | 15 | A | ± 0.0004 | 0.00006 | 0.00004 | 3.2 | 8.6 |
| 177-185 | 1.4 | 71 | — | 15 | A | ± 0.0004 | 0.00006 | 0.00004 | 3.2 | 8.6 |
| 177-291 | 1.6 | 71 | — | 15 | A | ± 0.0004 | 0.00006 | 0.00004 | 3.2 | 8.6 |
| 177-186 | 1.8 | 85 | — | 15 | A | ± 0.0004 | 0.00006 | 0.00004 | 3.7 | 7.6 |

CERA Setting Rings

Metric

| Order No. | Nominal size ϕD (mm) | Dimensions (mm) | | | Type | Accuracy | | | | |
|-----------|----------------------------|-----------------|----------|----|------|--|--|--------------------------------------|------------------------------------|--|
| | | ϕD | ϕE | T | | Tolerance between the nominal size and the actual diameter (μm) | Uncertainty of marked diameter value*1 (μm) | Roundness/Cylindricity*2 (μm) | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| 177-418 | 4 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-420 | 6 | 25 | — | 7 | A | ± 10 | 1.5 | 1.0 | 1.7 | 3.6 |
| 177-423 | 8 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-424 | 10 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-425 | 12 | 32 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-427 | 16 | 45 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-429 | 20 | 45 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-430 | 25 | 53 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-431 | 30 | 71 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-432 | 35 | 71 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-433 | 40 | 71 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-434 | 45 | 85 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.7 | 7.6 |

*1 Actual diameter is marked in 0.001 mm increments. (Dimension measuring position is the center of the height T.)

*2 Cylindricity is defined as per JIS B 0621 Definitions and designations of geometrical deviations, Section 4.4 "Cylindricity." Cylindricity is measured using three cross-sections between the top and bottom face of a ring, namely, close to the face near each side and the center.

| Order No. | Nominal size ϕD (mm) | Dimensions (mm) | | | Type | Accuracy | | | | |
|-----------|----------------------------|-----------------|----------|----------------|------|--|--|--------------------------------------|------------------------------------|--|
| | | ϕD | ϕE | T | | Tolerance between the nominal size and the actual diameter (μm) | Uncertainty of marked diameter value*1 (μm) | Roundness/Cylindricity*2 (μm) | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| 177-177 | 16 | 45 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-133 | 17 | 45 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-285 | 18 | 45 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-286 | 20 | 45 | — | 10 | A | ± 10 | 1.5 | 1.0 | 2.0 | 6.0 |
| 177-139 | 25 | 53 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-288 | 30 | 71 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-140 | 35 | 71 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-290 | 40 | 71 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.2 | 8.6 |
| 177-178 | 45 | 85 | — | 15 | A | ± 10 | 1.5 | 1.0 | 3.7 | 7.6 |
| 177-146 | 50 | 85 | — | 20 | A | ± 20 | 1.5 | 1.0 | 3.7 | 12.6 |
| 177-292 | 60 | 112 | — | 20 | A | ± 20 | 1.5 | 1.0 | 3.7 | 12.6 |
| 177-314 | 62 | 112 | — | 20 | A | ± 20 | 1.5 | 1.5 | 3.7 | 12.6 |
| 177-147 | 70 | 112 | — | 20 | A | ± 20 | 1.5 | 1.5 | 3.7 | 12.6 |
| 177-316 | 75 | 125 | — | 25 | A | ± 20 | 1.5 | 1.5 | 4.2 | 16.6 |
| 177-294 | 80 | 125 | — | 25 | A | ± 20 | 1.5 | 1.5 | 4.2 | 16.6 |
| 177-318 | 87 | 140 | — | 25 | A | ± 20 | 1.5 | 1.5 | 4.2 | 16.6 |
| 177-148 | 90 | 140 | — | 25 | A | ± 20 | 1.5 | 1.5 | 4.2 | 16.6 |
| 177-296 | 100 | 160 | — | 25 | A | ± 20 | 1.5 | 2.0 | 4.2 | 16.6 |
| 177-298 | 125 | 210 | 168 | | B | ± 20 | 2.5 | 2.0 | 5.3 | 27.5 |
| 177-300 | 150 | 235 | 187 | | B | ± 20 | 2.5 | 2.0 | 5.3 | 27.5 |
| 177-302 | 175 | 260 | 215 | | B | ± 20 | 2.5 | 2.5 | 5.3 | 27.5 |
| 177-304 | 200 | 311 | 244 | 38.1 (25.4) | B | ± 20 | 2.5 | 2.5 | 5.3 | 27.5 |
| 177-306 | 225 | 337 | 264 | | B | ± 20 | 2.5 | 2.5 | 5.3 | 27.5 |
| 177-308 | 250 | 362 | 290 | | B | ± 20 | 2.5 | 3.0 | 5.3 | 27.5 |
| 177-310 | 275 | 413 | 321 | | B | ± 20 | 2.5 | 3.0 | 5.3 | 27.5 |
| 177-312 | 300 | 438 | 340 | | B | ± 20 | 2.5 | 3.0 | 5.3 | 27.5 |

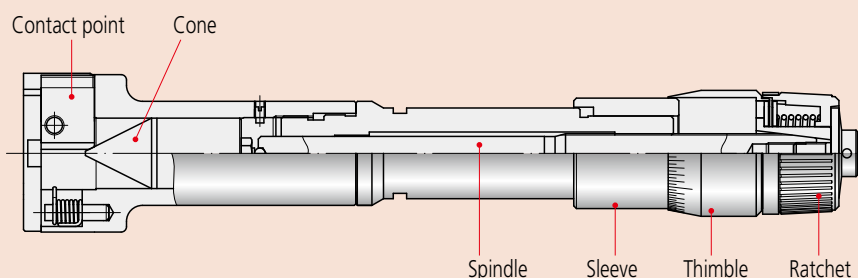
| Order No. | Nominal size ϕD (in) | Dimensions (mm) | | | Type | Accuracy | | | | |
|-----------|----------------------------|-----------------|----------|------|------|---|---|-------------------------------|------------------------------------|--|
| | | ϕD | ϕE | T | | Tolerance between the nominal size and the actual diameter (in) | Uncertainty of marked diameter value*1 (in) | Roundness/Cylindricity*2 (in) | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| 177-187 | 2 | 85 | — | 20 | A | ± 0.0008 | 0.00006 | 0.00004 | 3.7 | 12.6 |
| 177-293 | 2.4 | 112 | — | 20 | A | ± 0.0008 | 0.00006 | 0.00004 | 3.7 | 12.6 |
| 177-315 | 2.5 | 112 | — | 20 | A | ± 0.0008 | 0.00006 | 0.00006 | 4.2 | 11.6 |
| 177-188 | 2.8 | 112 | — | 20 | A | ± 0.0008 | 0.00006 | 0.00006 | 4.2 | 11.6 |
| 177-317 | 3 | 125 | — | 25 | A | ± 0.0008 | 0.00006 | 0.00006 | 4.2 | 16.6 |
| 177-295 | 3.2 | 125 | — | 25 | A | ± 0.0008 | 0.00006 | 0.00006 | 4.2 | 16.6 |
| 177-319 | 3.5 | 140 | — | 25 | A | ± 0.0008 | 0.00006 | 0.00006 | 4.2 | 16.6 |
| 177-189 | 3.6 | 140 | — | 25 | A | ± 0.0008 | 0.00006 | 0.00006 | 4.2 | 16.6 |
| 177-297 | 4 | 160 | — | 25 | A | ± 0.0008 | 0.00006 | 0.00008 | 4.2 | 16.6 |
| 177-299 | 5 | 210 | 168 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00008 | 5.3 | 27.5 |
| 177-301 | 6 | 235 | 187 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00008 | 5.3 | 27.5 |
| 177-303 | 7 | 260 | 215 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00010 | 5.3 | 27.5 |
| 177-305 | 8 | 311 | 244 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00010 | 5.3 | 27.5 |
| 177-307 | 9 | 337 | 264 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00010 | 5.3 | 27.5 |
| 177-309 | 10 | 362 | 290 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00012 | 5.3 | 27.5 |
| 177-311 | 11 | 413 | 321 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00012 | 5.3 | 27.5 |
| 177-313 | 12 | 438 | 340 | 38.1 | B | ± 0.0008 | 0.00010 | 0.00012 | 5.3 | 27.5 |

Inch

| Order No. | Nominal size ϕD (in) | Dimensions (mm) | | | Type | Accuracy | | | | |
|-----------|----------------------------|-----------------|----------|----|------|---|---|-------------------------------|------------------------------------|--|
| | | ϕD | ϕE | T | | Tolerance between the nominal size and the actual diameter (in) | Uncertainty of marked diameter value*1 (in) | Roundness/Cylindricity*2 (in) | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| 177-518 | 0.16 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 1.7 | 3.6 |
| 177-520 | 0.24 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 1.7 | 3.6 |
| 177-522 | 0.275 | 25 | — | 7 | A | ± 0.0004 | 0.00006 | 0.00004 | 1.7 | 3.6 |
| 177-523 | 0.35 | 32 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-524 | 0.425 | 32 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-525 | 0.5 | 32 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-527 | 0.65 | 45 | — | 10 | A | ± 0.0004 | 0.00006 | 0.00004 | 2.0 | 6.0 |
| 177-529 | 0.8 | 45 | — | 10 | A | ± 0.0004 | | | | |

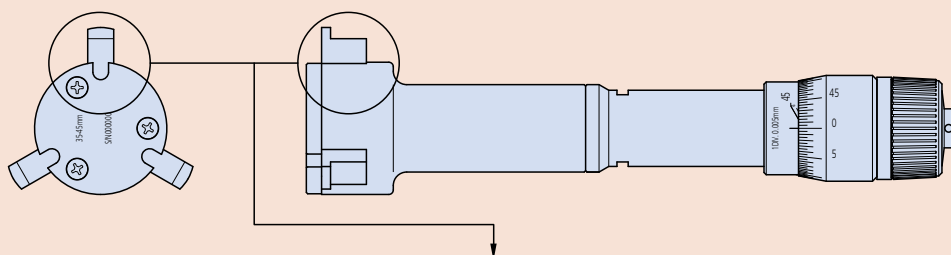
Quick Guide to Precision Measuring Instruments Inside Micrometers

Nomenclature (Holtest)



Custom-ordered Products (Holtest / Borematic)

Mitutoyo can custom-build an inside micrometer best suited to your special application. Please feel free to contact Mitutoyo about the possibilities - even if only one custom-manufactured piece is required. Please note that, depending on circumstances, such a micrometer will usually need to be used with a master setting ring for accuracy assurance. (A custom-ordered micrometer can be made compatible with a master ring supplied by the customer. Please consult Mitutoyo.)

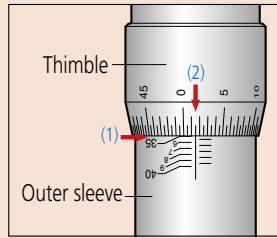


| Type of feature | Workpiece profile (example) | Contact point tip profile (example) | Remarks |
|-----------------|-----------------------------|-------------------------------------|---|
| Square groove | | | <ul style="list-style-type: none"> Allows measurement of the diameter of variously shaped inside grooves and splines. Minimum measurable groove diameter is approximately 16 mm (differs depending on the workpiece profile.) Dimension l should be as follows: For W=less than 2 mm: l=less than 2 mm For W=2 mm or more: l=2 mm as the standard value which can be modified according to circumstances. The number of splines or serrations is limited to a multiple of 3. Details of the workpiece profile should be provided at the time of placing a custom-order. If your application needs a measuring range different from that of the standard inside micrometer an additional initial cost for the master ring gauge will be required. |
| Round groove | | | |
| Spline | | | |
| Serration | | | |
| Threaded hole | | | |

How to Read the Scale

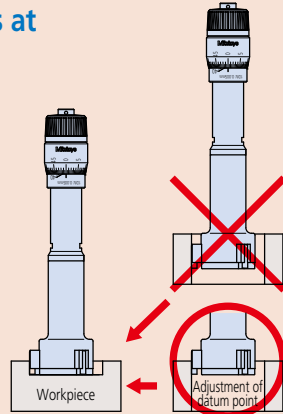
Graduation 0.005 mm

| | |
|------------------|-----------|
| (1) Outer sleeve | 35 mm |
| (2) Thimble | 0.015 mm |
| Reading | 35.015 mm |



Changes in measured values at different measuring points

The accuracy of a Holtest is maximized if the same part of the anvils is used for measurement as was used for standardizing the instrument with a setting ring.

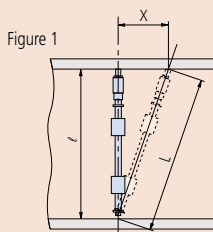


When you use the tip of the anvil for measurement, adjust the datum point using the tip of the anvil.

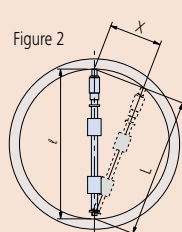
Measurement error due to temperature effects on an inside micrometer

The accuracy of an inside micrometer is degraded if its temperature is significantly different from. To help prevent this situation occurring wear gloves and only hold the micrometer by the heat insulators to reduce the transfer of heat from the operator's hands.

Effect of misalignment on accuracy (Inside Micrometer)

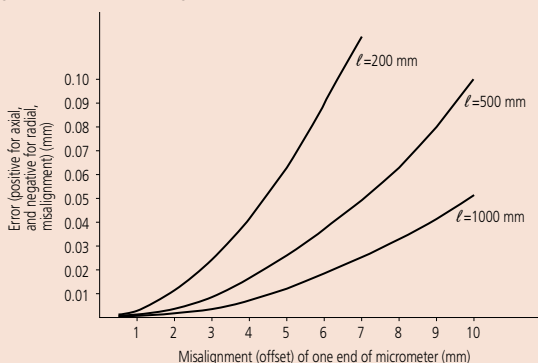


l : Inside diameter to be measured
 L : Length measured with axial offset X
 X : Offset in axial direction
 Δl : Error in measurement
 Δl : $L - l = \sqrt{L^2 + X^2} - l$



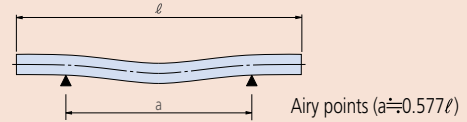
l : Inside diameter to be measured
 L : Length measured with radial offset X
 X : Offset in radial direction
 Δl : Error in measurement
 Δl : $L - l = \sqrt{L^2 - X^2} - l$

If the Inside Micrometer is misaligned in the axial or radial direction by an offset distance X when a measurement is taken, as in Figures 1 and 2, then that measurement will be in error as shown in the graph below (constructed from the formulae given above). The error is positive for axial misalignment and negative for radial misalignment.

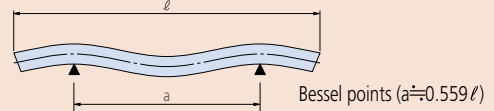


Airy and Bessel Points

When a length standard bar or inside micrometer lies horizontally, supported as simply as possible at two points, it bends under its own weight into a shape that depends on the spacing of those points. There are two distances between the points that control this deformation in useful ways, as shown below.



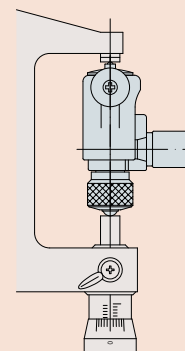
The ends of a bar (or micrometer) can be made exactly horizontal by spacing the two supports symmetrically as shown above. These points are known as the 'Airy Points' and are commonly used to ensure that the ends of a length bar are parallel to one another, so that the length is well defined.



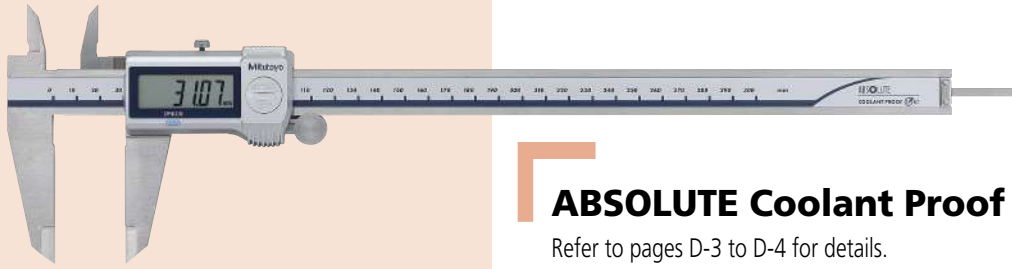
The change in length of a bar (or micrometer) due to bending can be minimized by spacing the two supports symmetrically as shown above. These points are known as the 'Bessel Points' and may be useful when using a long inside micrometer.

Reference point setting (2-point gages)

- Reference point setting with a ring gage or cylinder master gage
 Insert the bore gage into the ring gage, vertically or horizontally swing the bore gage, and set the zero point to the point where the indicator reads the maximum value. (Rotate the dial face for a dial gage and perform presetting or zero setting for a Digimatic indicator.)
- Reference point setting with outside micrometer and gauge block
 Hold a gauge block (of the reference dimension) between a micrometer's measuring faces as if measuring the block. Clamp the micrometer's spindle and then pull out the gauge block. Insert the bore gage between the micrometer's measuring faces. Maneuver the bore gage to the position where the indicator reads a minimum and then set the pointer to read zero (or a preset value required) by rotating the bezel.
- Reference point setting with outside micrometer only
 Fix the micrometer in a vertical attitude with its head side (spindle side) downward (see illustration below), and then adjust the distance between the measuring faces to the reference dimension. At this time, do not clamp the micrometer spindle. Insert the bore gage between the micrometer's measuring faces. Maneuver the bore gage to the position where the indicator reads a minimum and then set the pointer to read zero (or a preset value required) by rotating the bezel. Zero-setting with a micrometer requires a certain degree of dexterity because no self-centering action is available, as is the case when using a setting gage.
 Zero-setting is also possible by performing the same procedure using the gauge block, height master, or bore gage zero checker in addition to the outside micrometer.

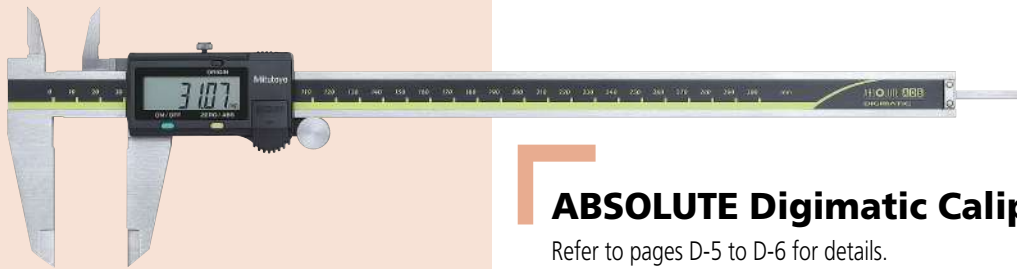


New Products



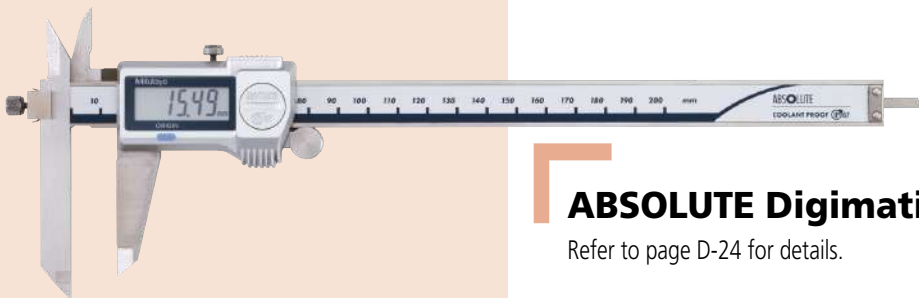
ABSOLUTE Coolant Proof Caliper

Refer to pages D-3 to D-4 for details.



ABSOLUTE Digimatic Caliper

Refer to pages D-5 to D-6 for details.



ABSOLUTE Digimatic Offset Caliper

Refer to page D-24 for details.



High-Performance Height Gage QM-Height

Refer to pages D-53 to D-54 for details.

D

Small Tool Instruments Calipers Height Gages Depth Gages

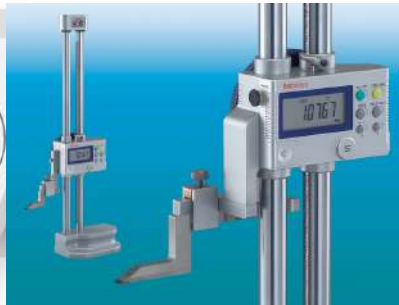
Calipers

Coolant Proof Digimatic Caliper



Height Gages

Digimatic Height Gage



High-performance Height Gage



Depth Gages

Depth Micrometer



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Calipers

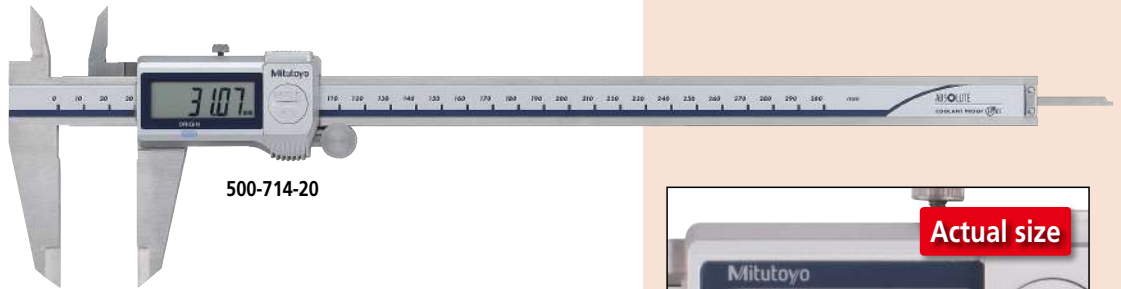
An industry standard measuring tool

ABSOLUTE Coolant Proof Caliper SERIES 500 — with Dust/Water Protection Conforming to IP67 Level

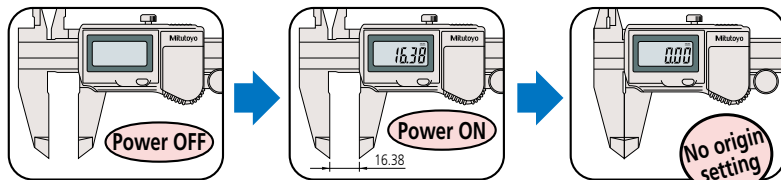
MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- ABS Coolant Proof Caliper with Dust/Water Protection conforming to IP67 Level. Can be used in workshop conditions exposed to coolant, water, dust or oil. 100 % air-leak test ensures every caliper conforms to IP67.
- Large characters on the display provide better visibility, and high-contrast LCD reduces eyestrain.
- Easy to use — advanced ergonomic design uses only 1 button.
- The automatic power-on/off function shuts down the LCD display after 20 minutes inactivity, but the ABS scale origin is unaffected. Power is restored to the display when the slider is moved.

- Incorporates Mitutoyo's ABSOLUTE measurement system. No need to reset the origin.
- Allows step measurement.
- Battery cap does not require a screw driver for battery replacement (except for 0 to 300 mm/0 to 12 inch models).
- Extended battery life of Approx. 5 years due to low current integrated circuit (except for 0 to 300 mm/0 to 12 inch models).
- Can be integrated into statistical process control and measurement systems. (Refer to page A-3.)
- An inspection certificate is supplied as standard. (However, this cannot be used as a calibration certificate as it is undated.)



No need to reset the origin after switching on



Optional accessories



Connecting cables for IT/DP/MUX*

- 05CZA624: SPC cable with data button (1 m)
- 05CZA625: SPC cable with data button (2 m)

* Cannot be used for other than water resistant type Digital calipers with external output function.



USB Input Tool Direct

- 06AFM380A: SPC cable for USB-ITN-A (2 m)
- U-WAVE-T: 02AZD730G (IP67 type)
- 02AZD880G (Buzzer type)
- Wireless data output U-WAVE/fit
- U-WAVE-TC: 264-620 (IP67 type)
- 264-621 (Buzzer type)

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE[™]

IP67



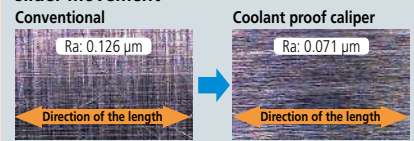
www.tuv.com
ID 000045942



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Smooth slider movement makes for comfortable operation.

High quality guide surface finish for smooth slider movement



Technical Data

- Resolution: 0.01 mm or 0.0005 in/0.01 mm
 - Repeatability: 0.01 mm or 0.0005 in/0.01 mm
 - Quantizing error: Excluding ±1 count
 - Dust/Water protection level: IP67 (IEC60529)*
 - Scale type: ABSOLUTE electromagnetic induction linear encoder
 - Max. response speed: Unlimited
 - Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
 - Battery life: Approx. 5 years under normal use
- * Although these models are IP67 rated, care should be taken to dry tool after use.



Remarkably easy to read display

U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)

- 264-624 (IP type)
 - 264-625 (Buzzer type)
- Refer to page A-15 for details.

Connecting unit for U-WAVE-TC/TCB

- 02AZF310 (IP67 type)
- 02AZF300 (Buzzer type*)

* IP67 model is water/dust-proofed suitable for the factory floor. Buzzer type is not water/dust-proofed. Refer to pages A-16 and A-18 for details.

Functions

Origin-set: Absolute origin position can be changed.

Data output*: Measurement data output connector allows integration into statistical process control and measurement systems.

* Excludes **500-702-20** and **500-703-20**.

Automatic power on/off: LCD display will turn off after 20 minutes inactivity, but the ABS scale unit origin is stored. Power is restored when the slider is moved.

Alarm: Error message is displayed if error in calculation is found and measurement is stopped. Measurement will not be continued while error is displayed. Also, if the battery voltage becomes low, "B" appears to alert the user before measurement is no longer possible.



IP67 protection level

IP67

| First characteristic number | Protection from solid objects (people or things) | | Second characteristic number | Protection from liquids (water, etc.) | |
|-----------------------------|--|-----------------------------|------------------------------|---------------------------------------|--|
| | Brief description | Description | | Brief description | Description |
| 6 | Dust-proof | No ingress of dust allowed. | 7 | Protected against water penetration. | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time. |

Note: For details of the test conditions used in evaluating each degree of protection, please refer to the original standard.

SPECIFICATIONS

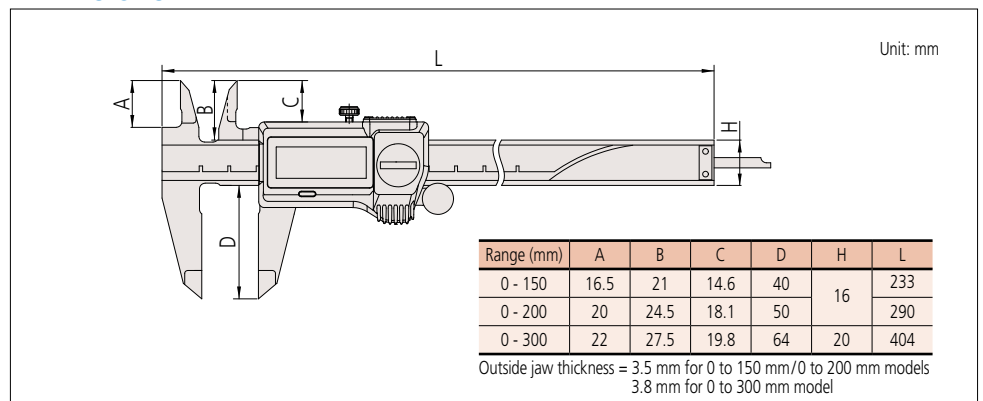
| Metric | | | | | | |
|-------------------|------------|----------------|------------------------------|----------|--------------|---------|
| Order No. | Range (mm) | Accuracy (mm)* | Measurement data output port | Mass (g) | Thumb roller | Remarks |
| 500-702-20 | 0 - 150 | ±0.02 | — | 168 | ✓ | — |
| 500-703-20 | 0 - 200 | | | 198 | | |
| 500-706-20 | 0 - 150 | | | 168 | | |
| 500-707-20 | 0 - 200 | | | 198 | | |
| 500-716-20 | 0 - 150 | | | 168 | | |
| 500-717-20 | 0 - 200 | | | 198 | | |
| 500-712-20 | 0 - 150 | | | 168 | | |
| 500-713-20 | 0 - 200 | | | 198 | | |
| 500-719-20 | 0 - 150 | | | 168 | | |
| 500-721-20 | 0 - 150 | | | 168 | | |
| 500-722-20 | 0 - 200 | | | 198 | | |
| 500-723-20 | 0 - 150 | | | 168 | | |
| 500-724-20 | 0 - 200 | | | 198 | | |
| 500-714-20 | 0 - 300 | | | ±0.03 | | |
| 500-718-20 | | — | 345 | | — | |
| 500-704-20 | | — | 350 | | ✓ | |
| 500-708-20 | | — | 345 | | — | |

* Excluding quantizing error of ±1 count in LSD

| Inch/Metric | | | | | | |
|-------------------|------------|-------------------------|------------------------------|----------|--------------|--|
| Order No. | Range (in) | Accuracy* | Measurement data output port | Mass (g) | Thumb roller | Remarks |
| 500-731-20 | 0 - 6 | ±0.001 in/ ±0.02 mm | — | 168 | ✓ | Carbide-tipped jaws for outside measurement |
| 500-732-20 | 0 - 8 | | | 198 | | Carbide-tipped jaws for outside and inside measurement |
| 500-733-20 | 0 - 6 | | | 168 | | Carbide-tipped jaws for outside measurement |
| 500-734-20 | 0 - 8 | | | 198 | | Carbide-tipped jaws for outside and inside measurement |
| 500-735-20 | 0 - 6 | | | 168 | | Carbide-tipped jaws for outside measurement |
| 500-736-20 | 0 - 8 | | | 198 | | Carbide-tipped jaws for outside and inside measurement |
| 500-737-20 | 0 - 6 | | | 168 | | Carbide-tipped jaws for outside and inside measurement |
| 500-738-20 | 0 - 8 | | | 198 | | — |
| 500-752-20 | 0 - 6 | | | 168 | | — |
| 500-753-20 | 0 - 8 | | | 198 | | — |
| 500-762-20 | 0 - 6 | | | 168 | | — |
| 500-763-20 | 0 - 8 | | | 198 | | — |
| 500-768-20 | 0 - 6 | | | 168 | | Depth bar ø1.9 mm |
| 500-769-20 | 0 - 6 | | | 168 | | Depth bar ø1.9 mm |
| 500-764-20 | 0 - 12 | ±0.0015 in/ ±0.03 mm | ✓ | 350 | ✓ | — |
| 500-754-20 | | | — | 350 | | |

* Excluding quantizing error of ±1 count in LSD

DIMENSIONS



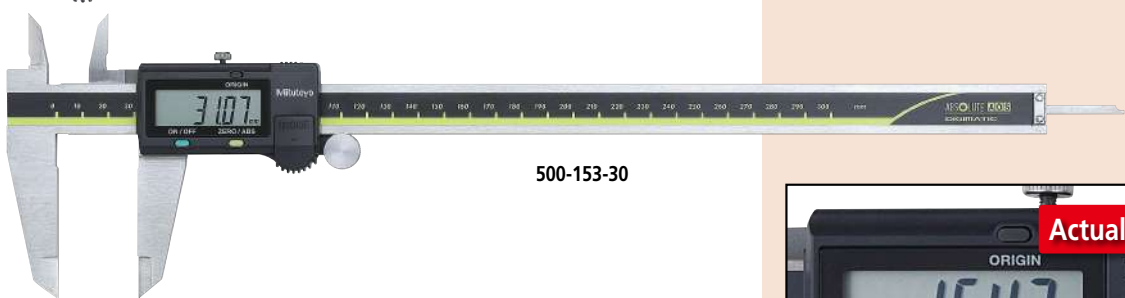
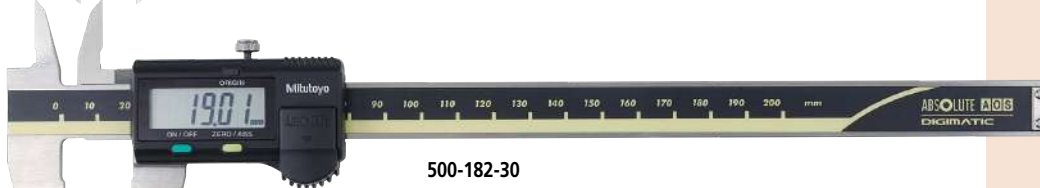
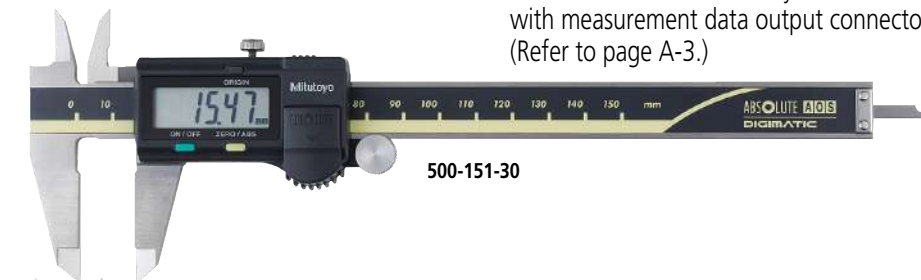
Calipers

An industry standard measuring tool

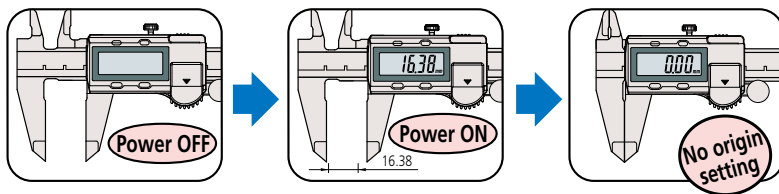
ABSOLUTE Digimatic Caliper SERIES 500 — with exclusive ABSOLUTE Encoder Technology

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- An ABSOLUTE electromagnetic induction linear encoder system is incorporated.
- New ergonomic design with finger rest.
- The ZERO/ABS button allows the display to be Zero-Set at any slider position along the scale for comparison measurements. Scale overspeed-error has been eliminated for maximum reliability.
- Large and clear LCD readout.
- Smooth slider movement makes for comfortable operation.
- Extended battery life of Approx. 5 years due to low current integrated circuit (except for 0 to 300 mm/0 to 12 inch models).
- Allows step measurement.
- Carbide-tipped jaw calipers are optimal for rough finished parts, castings, grinding stones, etc.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



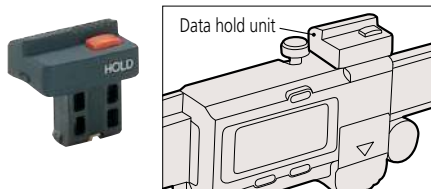
No need to reset the origin after switching on



Optional accessories

Dedicated for the models equipped with a digimatic output function. For details, refer to page A-27.

959143: Data hold unit



Connecting cables for IT / DP / MUX

- 959149: SPC cable with data button (1 m)
- 959150: SPC cable with data button (2 m)

USB Input Tool Direct

- 06AFM380C: SPC cable for USB-ITN-C (2 m)

Connecting cables for U-WAVE-T

- 02AZD790C: SPC cable with data button (160 mm)
- 02AZE140C: SPC cable for foot switch

Wireless data output **U-WAVE™**
U-WAVE-TC: 264-621 (Buzzer type)

- U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE) 264-625 (Buzzer type)

Refer to page A-15 for details.

Connecting unit for U-WAVE-TC/TCB 02AZF300 (Buzzer type)



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

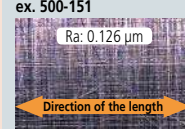
Technical Data

- Accuracy: ± 0.02 mm (≤ 200 mm), ± 0.03 mm (≤ 300 mm) (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Repeatability: 0.01 mm
- Scale type: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5 years under normal use

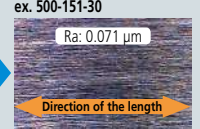
Smooth slider movement makes for comfortable operation.

High quality guide surface finish for smooth slider movement

Conventional ex. 500-151



ABSOLUTE Digimatic Caliper ex. 500-151-30



Remarkably easy to read display

Functions

Absolute measurement: After power is turned ON, measurement can be started without zero-setting if origin-setting was previously performed. The Absolute origin position can be changed by the ORIGIN button.

Incremental measurement: Display can be set to zero at any arbitrary position for comparative measurements.

Low-voltage alert: If the battery voltage becomes low, a "B" appears in the display to alert the user before measurement is no longer possible. A battery change advisory alert precedes this alert.

Data output: By using the connecting cable (optional), measurement data can be output.

Data hold: By using the data hold unit (optional), the displayed value can be held. This cannot be used with the data output function.

SPECIFICATIONS

| Metric | | | | | | |
|--------------|------------|-----------------|----------|-------------|-------------------|--|
| Order No. | Range (mm) | Accuracy (mm)*2 | Mass (g) | Depth bar | Fine adjustment | Remarks |
| 500-150-30 | 0 - 100 | ±0.02 | 143 | ø1.9 mm rod | with thumb roller | — |
| 500-180-30*1 | | | | | — | |
| 500-151-30 | | | | | with thumb roller | |
| 500-154-30 | 0 - 150 | ±0.02 | 168 | Blade | with thumb roller | Carbide-tipped jaws for outside measurement |
| 500-155-30 | | | | | — | Carbide-tipped jaws for outside and inside measurement |
| 500-158-30 | | | | | ø1.9 mm rod | — |
| 500-181-30*1 | | | | | — | — |
| 500-152-30 | 0 - 200 | ±0.02 | 198 | Blade | with thumb roller | Carbide-tipped jaws for outside measurement |
| 500-156-30 | | | | | — | Carbide-tipped jaws for outside and inside measurement |
| 500-157-30 | | | | | — | — |
| 500-182-30*1 | | | | | — | — |
| 500-153-30 | 0 - 300 | ±0.03 | 350 | — | with thumb roller | — |

*1 Without SPC data output

*2 Excluding quantizing error of ±1 count in LSD

| Inch / Metric | | | | | | | |
|---------------|------------|-------------------------|----------|----------------|-------------------|--|--|
| Order No. | Range (in) | Accuracy*2 | Mass (g) | Depth bar | Fine adjustment | Remarks | |
| 500-170-30 | 0 - 4 | ±0.001 in/ ±0.02 mm | 137 | 0.075 inch rod | with thumb roller | — | |
| 500-195-30*1 | | | | | | | — |
| 500-171-30 | | | | | | | Blade |
| 500-174-30 | 0 - 6 | ±0.001 in/ ±0.02 mm | 162 | 0.075 inch rod | with thumb roller | Carbide-tipped jaws for outside and inside measurement | |
| 500-175-30 | | | | | | — | — |
| 500-178-30 | | | | | | — | — |
| 500-196-30*1 | | | | | | — | — |
| 500-159-30*1 | 0 - 8 | ±0.001 in/ ±0.02 mm | 192 | Blade | with thumb roller | Carbide-tipped jaws for outside measurement | |
| 500-160-30*1 | | | | | | — | Carbide-tipped jaws for outside and inside measurement |
| 500-172-30 | | | | | | — | — |
| 500-176-30 | | | | | | — | — |
| 500-177-30 | 0 - 8 | ±0.001 in/ ±0.02 mm | 192 | Blade | with thumb roller | Carbide-tipped jaws for outside measurement | |
| 500-197-30*1 | | | | | | — | Carbide-tipped jaws for outside and inside measurement |
| 500-163-30*1 | | | | | | — | — |
| 500-164-30*1 | | | | | | — | — |
| 500-173-30 | 0 - 12 | ±0.0015 in/ ±0.03 mm | 350 | — | with thumb roller | Carbide-tipped jaws for outside measurement | |
| 500-167-30 | | | | | | — | Carbide-tipped jaws for outside and inside measurement |
| 500-168-30 | | | | | | — | — |
| 500-193-30*1 | | | | | | — | — |
| 500-165-30*1 | 0 - 12 | ±0.0015 in/ ±0.03 mm | 350 | — | with thumb roller | Carbide-tipped jaws for outside measurement | |
| 500-166-30*1 | | | | | | — | Carbide-tipped jaws for outside and inside measurement |

*1 Without SPC data output

*2 Excluding quantizing error of ±1 count in LSD

DIMENSIONS

With thumb roller

Unit: mm

Without thumb roller

| Range (mm) | A | B | C | D | H | L |
|------------|------|------|------|----|----|-----|
| 0 - 100 | 16.5 | 21 | 14.5 | 40 | 16 | 182 |
| 0 - 150 | 16.5 | 21 | 14.5 | 40 | 16 | 233 |
| 0 - 200 | 20 | 24.5 | 18 | 50 | 16 | 290 |
| 0 - 300 | 22 | 27.5 | 19.8 | 64 | 20 | 404 |

Jaw thickness: 3.5 mm for 0 to 100 mm/0 to 150 mm/0 to 200 mm models and 3.8 mm for 0 to 300 mm model

Calipers

An industry standard measuring tool

Long ABSOLUTE Digimatic Caliper SERIES 500 — with Exclusive ABSOLUTE Encoder Technology

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™

- Long Digital caliper incorporating an ABSOLUTE scale and available with a measuring range from 450 mm to 1000 mm.
- Allows step measurement.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- For details of the Absolute scale and its function, refer to page D-6.



500-502-10

500-501-10

500-500-10

SPECIFICATIONS

Metric

| Order No. | Range (mm) | Accuracy* (mm) | Resolution (mm) | Repeatability (mm) | Mass (g) |
|------------|------------|----------------|-----------------|--------------------|----------|
| 500-500-10 | 0 - 450 | ±0.05 | 0.01 | 0.01 | 1170 |
| 500-501-10 | 0 - 600 | | | | 1350 |
| 500-502-10 | 0 - 1000 | ±0.07 | | | 3300 |

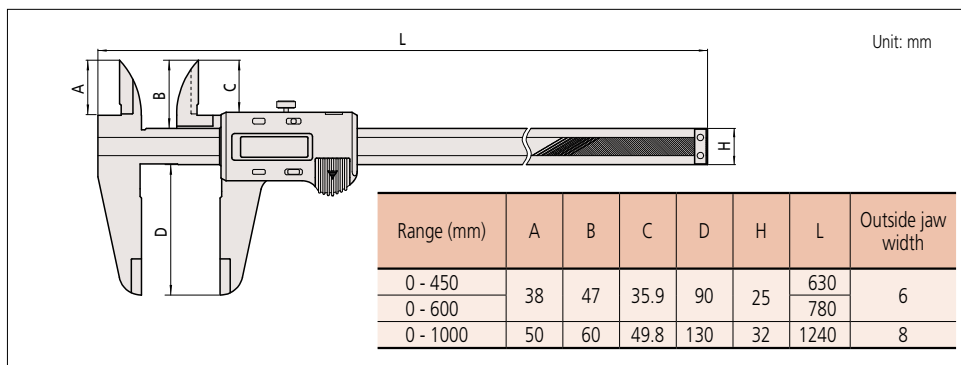
* Excluding quantizing error.
Note: Without SPC data output

Inch/Metric

| Order No. | Range (in) | Accuracy* (mm) | Resolution | Repeatability (mm) | Mass (g) |
|------------|------------|----------------|-------------------|--------------------|----------|
| 500-505-10 | 0 - 18 | ±0.05 | 0.0005 in/0.01 mm | 0.01 | 1170 |
| 500-506-10 | 0 - 24 | | | | 1350 |
| 500-507-10 | 0 - 40 | ±0.07 | | | 3300 |

* Excluding quantizing error.
Note: Without SPC data output

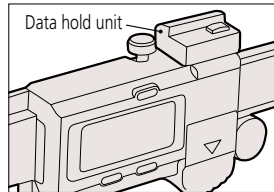
DIMENSIONS



Optional accessories

Dedicated for the models equipped with a digimatic output function. For details, refer to page A-27.

959143: Data hold unit



Connecting cables for IT/DP/MUX

959149: SPC cable with data button (1 m)

959150: SPC cable with data button (2 m)



USB Input Tool Direct

06AFM380C: SPC cable for USB-ITN-C (2 m)

Connecting cables for U-WAVE-T

02AZD790C: SPC cable with data button (160 mm)

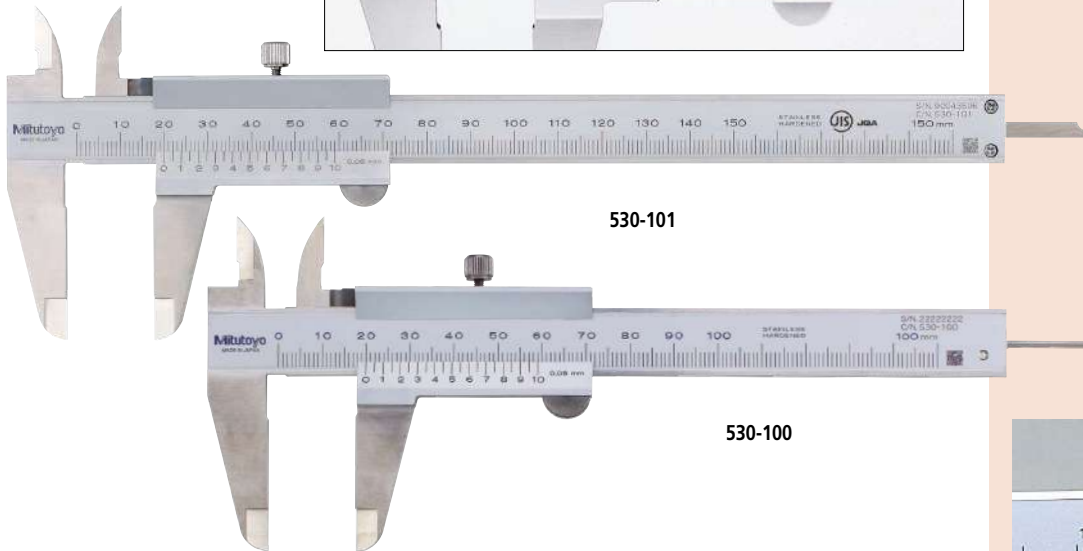
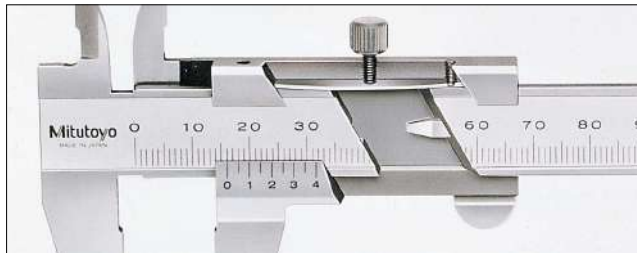
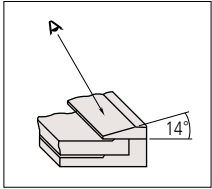
02AZE140C: SPC cable for foot switch

Calipers

An industry standard measuring tool

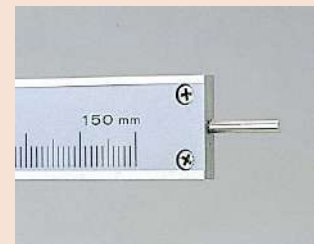
Vernier Caliper SERIES 530 — Standard model

- Plain and basic design.
- Stepped graduation face prevents dust ingress between the main scale and slider.
- The small vernier face angle (14°) provides easy reading.
- Can measure steps, since the end faces of the beam and slider are the zero reference point (measuring face). Standard calipers allow four types of measurement, i.e. outside, inside, depth, and step.
- Carbide-tipped jaw calipers are optimal for rough finished parts, castings, grinding stones, etc.
- Decimal and fractional graduated scales (metric/inch and inch models only).



530-101

530-100



530-102 (Round depth bar type)



530-320
(Carbide-tipped jaws for outside measurement)

DIMENSIONS

Unit: mm

| Range (mm) | A | B | D | E | F | H | L |
|------------|------|------|-----|------|----|----|------|
| 0 - 100 | 17 | 21.5 | 40 | 53.5 | 30 | 16 | 182 |
| 0 - 150 | 17 | 21.5 | 40 | 53.5 | 30 | 16 | 229 |
| 0 - 200 | 20.5 | 25 | 50 | 53.5 | 30 | 16 | 288 |
| 0 - 300 | 22 | 27.5 | 64 | 66.5 | 36 | 20 | 404 |
| 0 - 600 | 38 | 47 | 90 | 89 | 50 | 25 | 780 |
| 0 - 1000 | 50 | 60 | 130 | 111 | 61 | 32 | 1240 |

| Range (mm) | Outside jaw thickness |
|------------|-----------------------|
| 0 - 100 | 3 |
| 0 - 150 | |
| 0 - 200 | |
| 0 - 300 | 3.8 |
| 0 - 600 | 6 |
| 0 - 1000 | 8 |

Note: 530-100 and 530-102 incorporate a round depth bar ($\varnothing 1.9$ mm).
The depth bar shown in the illustration above is a different type.

SPECIFICATIONS

| Metric | | | | | |
|-----------|------------|--|-----------|-----------------|---------------------|
| Order No. | Range (mm) | Maximum Permissible Error* (mm) • EMPE (outside measurement) • SMPE (inside measurement) | Depth bar | Graduation (mm) | Remarks |
| 530-101 | 0 - 150 | ±0.05 | Blade | 0.05 | — |
| 530-102 | | ±0.03 | | 0.02 | High accuracy model |
| 530-108 | 0 - 200 | ±0.05 | | 0.05 | — |
| 530-123 | | ±0.03 | | 0.02 | High accuracy model |
| 530-109 | 0 - 300 | ±0.08 | | 0.05 | — |
| 530-124 | | ±0.04 | | 0.02 | High accuracy model |

| Order No. | Range (mm) | Accuracy (mm) | Depth bar | Graduation (mm) | Remarks |
|-----------|------------|--|-------------|-----------------|---|
| 530-100 | 0 - 100 | ±0.05 | ø1.9 mm rod | 0.05 | — |
| 530-102 | 0 - 150 | ±0.05 | | | — |
| 530-320 | | ±0.05 | Blade | | Carbide-tipped jaws for outside measurement |
| 530-335 | ±0.05 | Carbide-tipped jaws for outside and inside measurement | | | |
| 530-321 | 0 - 200 | ±0.05 | | | Carbide-tipped jaws for outside measurement |
| 530-322 | 0 - 300 | ±0.08 | — | | Carbide-tipped jaws for outside measurement |
| 530-501 | 0 - 600 | ±0.10 | | — | |
| 530-502 | 0 - 1000 | ±0.15 | | — | |

* Partial Measuring Face Contact Error EMPE/Scale Shift Error SMPE are terms (notations) used in JIS B 7507: 2016, revised based on ISO 13385-1: 2011. The measurement method is the same as before. Refer to page D-40 for details.

Metric/Inch with metric/inch double scale

| Order No. | Range (mm) | Accuracy (mm) | Depth bar | Graduation | Remarks |
|-----------|------------|---------------|--------------------|-------------------------------|---------------------------------|
| 530-104 | 0 - 150 | ±0.05 | Blade | 0.05 mm (1/128 in) | — |
| 530-316 | | ±0.03 | | 0.02 mm (0.001 in) | Clamping screw below the slider |
| 530-312 | | | | 0.05 mm (1/128 in) | High accuracy model: ±0.03 mm |
| 530-114 | 0 - 200 | ±0.05 | | 0.05 mm (1/128 in) | — |
| 530-118 | | ±0.03 | | 0.02 mm (0.001 in) | High accuracy model: ±0.03 mm |
| 530-115 | 0 - 300 | ±0.08 | | 0.05 mm (1/128 in) | — |
| 530-119 | | ±0.04 | 0.02 mm (0.001 in) | High accuracy model: ±0.04 mm | |

Inch with inch/inch double scale

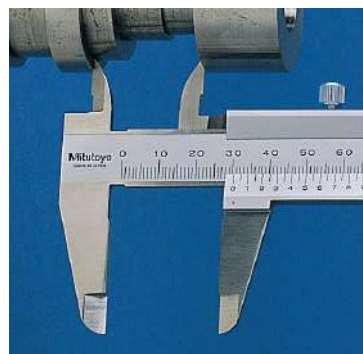
| Order No. | Range (in) | Accuracy (in) | Depth bar | Graduation (in) | Remarks |
|-----------|------------|---------------|-----------|-----------------|---------|
| 530-105 | 0 - 6 | ±0.5/128 | Blade | 0.001 | — |
| 530-116 | 0 - 8 | ±0.5/128 | | | |

Measurement Applications

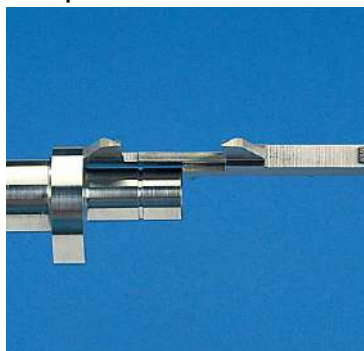
1. Outside measurement



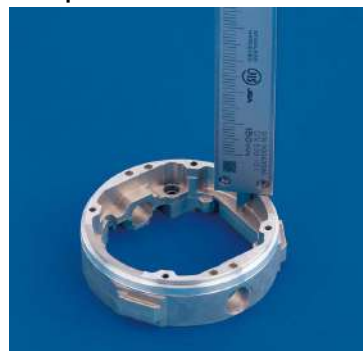
2. Inside measurement



3. Step measurement



4. Depth measurement

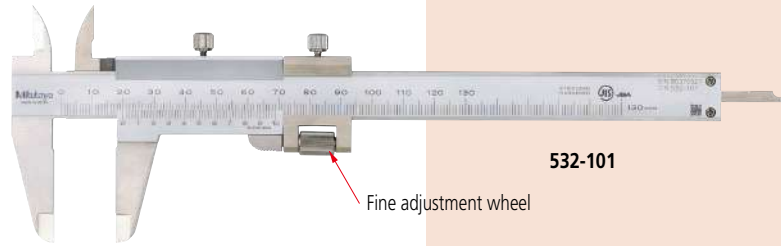


Calipers

An industry standard measuring tool

Vernier Caliper SERIES 532 — with fine adjustment

- Fine-adjustment aids slider positioning.
- Allows step measurement.



532-101

Fine adjustment wheel

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|---|-----------|----------------------|
| Order No. | Range (mm) | Maximum Permissible Error*1 (mm) • EMPE (outside measurement) • SMPE (inside measurement) | Depth bar | Remarks |
| 532-101*2 | 0 - 130 | ±0.03 | Blade | with fine adjustment |
| 532-102*2 | 0 - 180 | ±0.03 | | |
| 532-103*2 | 0 - 280 | ±0.04 | | |

| Metric/Inch with metric/inch double scale | | | | | |
|---|------------|---------------|-----------|--------------------|----------------------|
| Order No. | Range (mm) | Accuracy (mm) | Depth bar | Graduation | Remarks |
| 532-119 | 0 - 130 | ±0.03 | Blade | 0.02 mm (0.001 in) | with fine adjustment |
| 532-120 | 0 - 180 | ±0.03 | | | |
| 532-121 | 0 - 280 | ±0.04 | | | |

*1 Partial Measuring Face Contact Error EMPE/Scale Shift Error SMPE are terms (notations) used in JIS B 7507: 2016, revised based on ISO 13385-1: 2011. The measurement method is the same as before. Refer to page D-40 for details.

*2 Graduation: 0.02 mm

DIMENSIONS

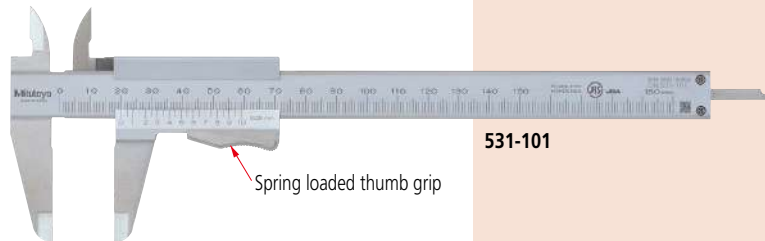
Unit: mm

| Range | A | B | D | E | F | H | L |
|----------------------|------|------|----|------|------|----|-----|
| 0 - 130 mm/0 - 5 in | 17 | 21.5 | 40 | 53.5 | 31.2 | 16 | 229 |
| 0 - 180 mm/0 - 7 in | 20.5 | 25 | 50 | 53.5 | 31.2 | 16 | 288 |
| 0 - 280 mm/0 - 11 in | 22 | 27.5 | 64 | 66.5 | 38 | 20 | 404 |

Jaw thickness: 3 mm for 0 to 130 mm/0 to 5 inch and 0 to 180 mm/0 to 7 inch models
3.8 mm for 0 to 280 mm/0 to 11 inch model

Vernier Caliper 531 Series — with thumb grip

- The slider moves only when the spring-loaded thumb grip is depressed.
- Allows step measurement.



531-101

Spring loaded thumb grip

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|---|-----------|---------|
| Order No. | Range (mm) | Maximum Permissible Error*1 (mm) • EMPE (outside measurement) • SMPE (inside measurement) | Depth bar | Remarks |
| 531-101*2 | 0 - 150 | ±0.05 | Blade | — |
| 531-102*2 | 0 - 200 | | | |
| 531-103*2 | 0 - 300 | | | |

| Metric/Inch with metric/inch double scale | | | | | |
|---|------------|---------------|-----------|--------------------|-------------------------------|
| Order No. | Range (mm) | Accuracy (mm) | Depth bar | Graduation | Remarks |
| 531-122 | 0 - 150 | ±0.05 | Blade | 0.05 mm (1/128 in) | with inch/mm conversion label |
| 531-128 | | ±0.03 | | 0.02 mm (0.001 in) | High accuracy model |
| 531-108 | 0 - 200 | ±0.05 | | 0.05 mm (1/128 in) | — |
| 531-129 | | ±0.03 | | 0.02 mm (0.001 in) | High accuracy model |
| 531-109 | 0 - 300 | ±0.08 | | 0.05 mm (1/128 in) | — |
| 531-112 | | ±0.04 | | 0.02 mm (0.001 in) | High accuracy model |

*1 Partial Measuring Face Contact Error EMPE/Scale Shift Error SMPE are terms (notations) used in JIS B 7507: 2016, revised based on ISO 13385-1: 2011. The measurement method is the same as before. Refer to page D-40 for details.

*2 Graduation: 0.05 mm

DIMENSIONS

Unit: mm

| Range | A | B | D | H | L |
|----------------------|------|------|----|----|-----|
| 0 - 150 mm/0 - 6 in | 17 | 21.5 | 40 | 16 | 229 |
| 0 - 200 mm/0 - 8 in | 20.5 | 25 | 50 | 16 | 288 |
| 0 - 300 mm/0 - 12 in | 22 | 27.5 | 64 | 20 | 404 |

Jaw thickness: 3 mm for 0 to 150 mm/0 to 6 inch and 0 to 200 mm/0 to 8 inch models
3.8 mm for 0 to 300 mm/0 to 12 inch model

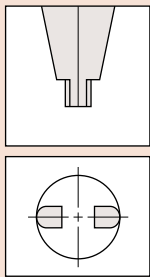
(): Dimension in 0 to 300 mm/0 to 12 inch model

ABSOLUTE™

IP67



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ID 0000045042



Radiused jaws for accurate ID measurement

Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Display: LCD
- Scale type: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)

Optional Accessories

For details, refer to page A-27.

- **959143**: Data hold unit
- Connecting cables for **IT/DP/MUX**
 - **05CZA624**: SPC cable with data button (1 m)*
 - **05CZA625**: SPC cable with data button (2 m)*
 - **959149**: SPC cable with data button (1 m)
 - **959150**: SPC cable with data button (2 m)
- USB Input Tool Direct
 - **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)*
 - **06AFM380C**: SPC cable for **USB-ITN-C** (2 m)
- Connecting cables for **U-WAVE-T**
 - **02AZD790A**: SPC cable with data button (160 mm)
 - **02AZE140A**: SPC cable for foot switch

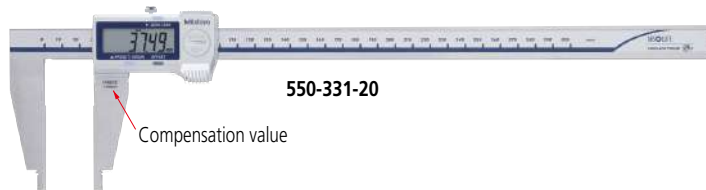
Wireless Data Output U-WAVE™

- **U-WAVE-TC**: **264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth® U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
02AZF310 (IP67 type)
Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.
* For IP67 models (up to 300 mm)

ABSOLUTE Digimatic Caliper SERIES 550 — with Nib Style Jaws

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Offers a resolution of 0.01 mm with corresponding accuracy.
- Incorporates an Absolute measurement system. No need to reset the origin after switching on. (Refer to page D-4 and D-6 for details on the Absolute function.)
- **Order No. 550-301-20, 550-331-20, 550-311-20 and 550-341-20**: IP67 (Rustproofing shall be applied after use if caliper was in contact with coolant.)
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- ID measurement value: displayed value + (a compensation value displayed on the main unit). OFFSET switch allows to input a compensation value so that the measurement value can be read directly (**Order No. 550-301-20, 550-331-20, 550-311-20 and 550-341-20**). Preset function allows to set a desired starting point (**550-331-20 and 550-341-20**).



SPECIFICATIONS

| Metric | | | |
|-------------------|------------------------|---------------|---|
| Order No. | Range (mm)* | Accuracy (mm) | Remarks |
| 550-301-20 | 0 - 200 (10.1 - 210) | ±0.03 | IP67, with offset |
| 550-331-20 | 0 - 300 (10.1 - 310) | ±0.04 | IP67, with offset/preset function for easy inside measurement |
| 550-203-10 | 0 - 450 (20.1 - 470) | ±0.05 | — |
| 550-205-10 | 0 - 600 (20.1 - 620) | ±0.05 | — |
| 550-207-10 | 0 - 1000 (20.1 - 1020) | ±0.07 | — |

* () : Inside measurement

Note: Series 550 is not equipped with a depth bar.

| Inch / Metric | | | |
|-------------------|-----------------------|---------------|---|
| Order No. | Range (in)* | Accuracy (in) | Remarks |
| 550-311-20 | 0 - 8 (0.404 - 8.4) | ±0.0015 | IP67, with offset |
| 550-341-20 | 0 - 12 (0.404 - 12.4) | ±0.002 | IP67, with offset/preset function for easy inside measurement |
| 550-223-10 | 0 - 18 (0.504 - 18.5) | | — |
| 550-225-10 | 0 - 24 (0.504 - 24.5) | | — |
| 550-227-10 | 0 - 40 (1.004 - 41) | ±0.003 | — |

* () : Inside measurement

Note: Series 550 is not equipped with a depth bar.

DIMENSIONS

| Range (mm) | D | G | S | W | H | t | R |
|-----------------------|-----|------------|----|-----|----|-----|------------|
| 0 - 200 (0 - 8 in)* | 60 | 5 (5.08)* | 8 | 76 | 16 | 3 | 5 (5.08)* |
| 0 - 300 (0 - 12 in)* | 75 | | 12 | 95 | 20 | 3.8 | |
| 0 - 450 (0 - 18 in)* | 100 | 10 (6.35)* | 18 | 125 | 25 | 6 | 10 (6.35)* |
| 0 - 600 (0 - 24 in)* | | | 24 | 172 | 32 | 8 | 10 (12.7)* |
| 0 - 1000 (0 - 40 in)* | 140 | 10 (12.7)* | 24 | 172 | 32 | 8 | 10 (12.7)* |

* Inch model

Calipers

An industry standard measuring tool

ABSOLUTE Digimatic Caliper SERIES 551 - with Nib Style and Standard Jaws

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Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

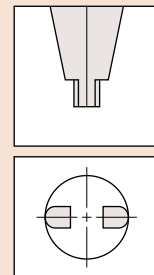
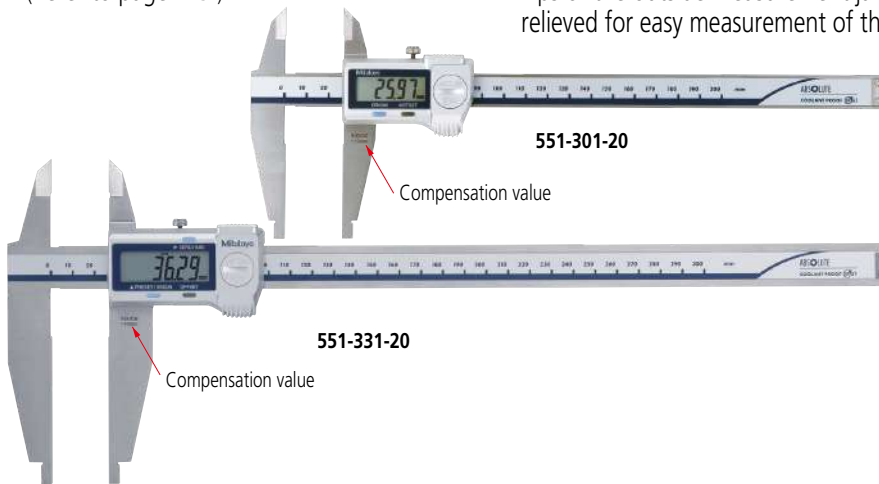
ABSOLUTE[™]

IP 67



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- Offers a resolution of 0.01 mm with corresponding accuracy.
- Incorporates an Absolute measurement system. No need to reset the origin after switching on. (Refer to page D-4 and D-6 for details on the Absolute function.)
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- ID measurement value: displayed value + (a compensation value displayed on the main unit). OFFSET switch allows to input a compensation value so that the measurement value can be read directly (**Order No. 551-301-20, 551-331-20, 551-311-20 and 551-341-20**). Preset function allows to set a desired starting point (**Order No. 551-331-20 and 551-341-20**).
- Tips of the outside measurement jaw are relieved for easy measurement of thin parts.



Radiused jaws for accurate ID measurement

SPECIFICATIONS

| Metric | | | |
|------------|------------------------|---------------|---|
| Order No. | Range (mm)* | Accuracy (mm) | Remarks |
| 551-301-20 | 0 - 200 (10.1 - 210) | ±0.03 | IP67, with offset |
| 551-331-20 | 0 - 300 (10.1 - 310) | ±0.04 | IP67, with offset/preset function for easy inside measurement |
| 551-204-10 | 0 - 500 (20.1 - 520) | ±0.06 | — |
| 551-206-10 | 0 - 750 (20.1 - 770) | ±0.06 | |
| 551-207-10 | 0 - 1000 (20.1 - 1020) | ±0.07 | |

* () : inside measurement
Note: **Series 551** is not equipped with a depth bar.

| Inch / Metric | | | |
|---------------|-----------------------|---------------|---|
| Order No. | Range (in)* | Accuracy (in) | Remarks |
| 551-311-20 | 0 - 8 (0.404 - 8.4) | ±0.0015 | IP67, with offset |
| 551-341-20 | 0 - 12 (0.404 - 12.4) | ±0.002 | IP67, with offset/preset function for easy inside measurement |
| 551-224-10 | 0 - 20 (0.504 - 20.5) | ±0.0025 | — |
| 551-226-10 | 0 - 30 (0.504 - 30.5) | ±0.0025 | |
| 551-227-10 | 0 - 40 (1.004 - 41) | ±0.003 | |

* () : inside measurement
Note: **Series 551** is not equipped with a depth bar.

DIMENSIONS

| Range (mm) | B | C | D | G | S | H | t | R |
|--------------------------|----|------|-----|------------|----|----|-----|------------|
| 0 - 200 (0 - 8 in)* | 30 | 23.6 | 60 | 5 (5.08)* | 8 | 16 | 3 | 5 (5.08)* |
| 0 - 300 (0 - 12 in)* | 40 | 32.2 | 90 | | 10 | 20 | 3.8 | |
| 0 - 500 (0 - 20 in)* | 56 | 44.9 | 150 | 10 (6.35)* | 18 | 25 | 6 | 10 (6.35)* |
| 0 - 750 (0 - 30 in)* | | | | 10 (6.35)* | 20 | 32 | 8 | 10 (12.7)* |
| 0 - 1000 (0 - 40 in)* | 56 | 43.8 | | 10 (12.7)* | 20 | 32 | 8 | 10 (12.7)* |

* Inch model

Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
 - Resolution: 0.01 mm or 0.0005 in/0.01 mm
 - Display: LCD
 - Scale type: ABSOLUTE electromagnetic induction linear encoder
 - Max. response speed: Unlimited
 - Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
 - Dust/Water protection level: IP67* (models up to 300 mm)
- * Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories

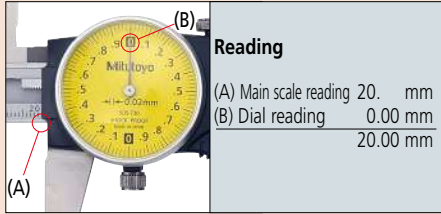
- For details, refer to page A-27.
- **959143**: Data hold unit
 - Connecting cables for **IT / DP / MUX**
 - **05CZA624**: SPC cable with data button (1 m)*
 - **05CZA625**: SPC cable with data button (2 m)*
 - **959149**: SPC cable with data button (1 m)
 - **959150**: SPC cable with data button (2 m)
 - USB Input Tool Direct
 - **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)*
 - **06AFM380C**: SPC cable for **USB-ITN-C** (2 m)
 - Connecting cables for **U-WAVE-T**
 - **02AZD790A**: SPC cable with data button (160 mm)
 - **02AZE140A**: SPC cable for foot switch

Wireless Data Output **U-WAVE[™]**

- **U-WAVE-TC: 264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC / TCB**
02AZF310 (IP67 type)
Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.
* For IP67 models (up to 300 mm)



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Reading
 (A) Main scale reading 20. mm
 (B) Dial reading 0.00 mm
 20.00 mm

Dial Caliper SERIES 505

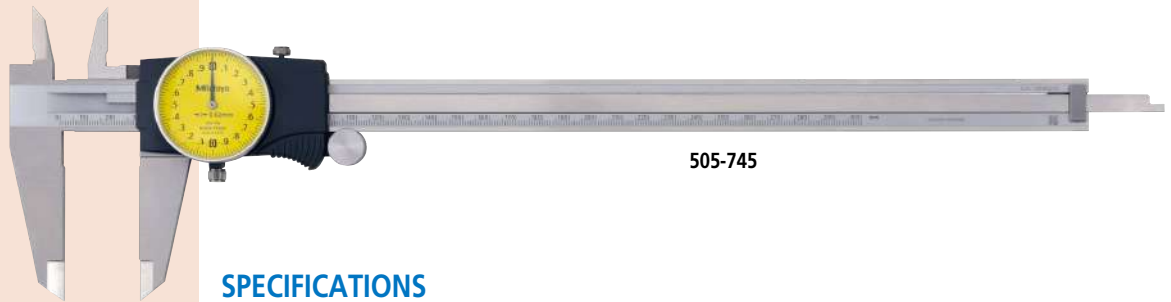
- Newly designed dial movement for ultra-smooth sliding.
- Easy-to-read yellow dial.
- Large finger-rest aids ease-of-use.
- Jaw tips are relieved for easy measurement of thin parts.
- Allows step measurement.



505-730

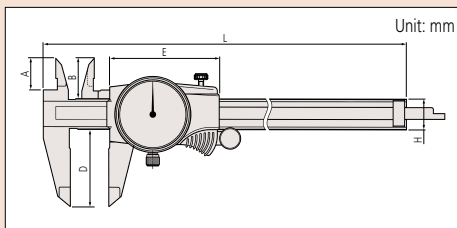


505-731



505-745

DIMENSIONS



| Range (mm) | A | B | D | E | H | L |
|------------|------|------|----|------|----|-----|
| 0 - 150 | 16.5 | 21 | 40 | 57.2 | 16 | 231 |
| 0 - 200 | 20 | 24.5 | 50 | | | 288 |
| 0 - 300 | 22 | 27.5 | 64 | 70.2 | 20 | 404 |

SPECIFICATIONS

| Metric | | | | |
|-----------|------------|-----------------|---------------|---|
| Order No. | Range (mm) | Graduation (mm) | Accuracy (mm) | Remarks |
| 505-730 | 0 - 150 | 0.02, 2/rev | ±0.03 | Carbide-tipped jaws for outside measurement |
| 505-734 | | | | |
| 505-735 | | | | |
| 505-732* | 0 - 200 | 0.01, 1/rev | ±0.02 | — |
| 505-731 | | 0.02, 2/rev | ±0.03 | |
| 505-733* | | 0.01, 1/rev | | |
| 505-745 | 0 - 300 | 0.02, 2/rev | ±0.04 | — |

* Silver cover type

| Inch | | | | |
|-------------|------------|-----------------|---------------|--|
| Order No. | Range (in) | Graduation (in) | Accuracy (in) | Remarks |
| 505-740J | 0 - 6 | 0.001, 0.2/rev | ±0.001 | — |
| 505-742J* | | | ±0.001 | |
| 505-742-56J | | | ±0.001 | |
| 505-742-51J | 0 - 8 | 0.001, 0.1/rev | ±0.001 | — |
| 505-736* | | | ±0.001 | |
| 505-738* | | | ±0.001 | |
| 505-744 | 0 - 12 | 0.001, 0.2/rev | ±0.001 | Carbide-tipped jaws for outside measurement |
| 505-741J | | 0.001, 0.2/rev | ±0.002 | |
| 505-743J* | | 0.001, 0.1/rev | ±0.002 | |
| 505-737* | 0 - 12 | 0.001, 0.2/rev | ±0.002 | Carbide-tipped jaws for outside measurement |
| 505-739* | | | ±0.002 | |
| 505-749 | | | ±0.002 | |
| 505-746* | 0 - 12 | 0.001, 0.1/rev | ±0.002 | — |
| 505-750 | | 0.001, 0.2/rev | ±0.002 | |
| 505-747* | | 0.001, 0.1/rev | ±0.002 | |
| 505-748* | 0 - 12 | 0.001, 0.1/rev | ±0.002 | Carbide-tipped jaws for outside and inside measurement |

* Silver cover type

Calipers

An industry standard measuring tool

ABSOLUTE Coolant Proof Carbon Fiber Caliper SERIES 552 — with Standard jaws

- IP66 Absolute Digital Caliper (Refer to page D-6 for details on the Absolute function.)
- Lightweight Digimatic Calipers that employ CFRP (Carbon Fiber Reinforced Plastics) in the beam.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



552-303-10

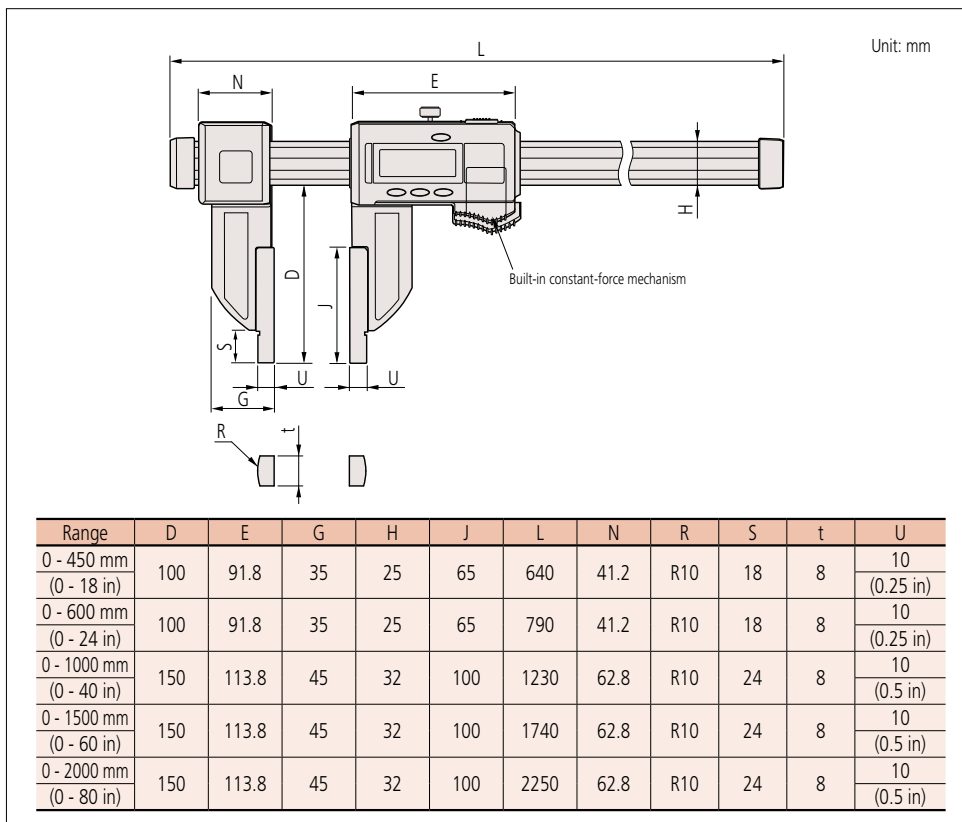
SPECIFICATIONS

| Metric | | | Inch / Metric | | |
|------------|------------------------|---------------|---------------|-----------------------|---------------|
| Order No. | Range (mm)* | Accuracy (mm) | Order No. | Range (in)* | Accuracy (in) |
| 552-302-10 | 0 - 450 (20.1 - 470) | ±0.04 | 552-312-10 | 0 - 18 (0.504 - 18.5) | ±0.002 |
| 552-303-10 | 0 - 600 (20.1 - 620) | ±0.04 | 552-313-10 | 0 - 24 (0.504 - 24.5) | ±0.002 |
| 552-304-10 | 0 - 1000 (20.1 - 1020) | ±0.05 | 552-314-10 | 0 - 40 (1.004 - 40.5) | ±0.002 |
| 552-305-10 | 0 - 1500 (20.1 - 1520) | ±0.09 | 552-315-10 | 0 - 60 (1.004 - 60.5) | ±0.004 |
| 552-306-10 | 0 - 2000 (20.1 - 2020) | ±0.12 | 552-316-10 | 0 - 80 (1.004 - 80.5) | ±0.005 |

* (): Dimension in inside measurement

Note: A constant-force mechanism is used in the finger rest; however, this is only an auxiliary mechanism to avoid measurement error caused by excessive measuring force. To measure with good accuracy, use the minimum necessary measuring force for the caliper measuring faces to make sufficient contact with the workpiece. Refer to page D-40 for details.

DIMENSIONS



MeasurLink ENABLED
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Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

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IP66

TÜVRheinland
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Technical Data

- Repeatability: 0.01 mm
- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Material of jaws: Stainless Steel Hardened
- Display: LCD
- Scale type: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5,000 hours in continuous use
- Dust/Water protection level: IP66 (IEC60529)*
- Standard accessory: Jaw clamps (2 pcs.), 05GZA033
- * Rustproofing shall be applied after use if caliper was in contact with coolant.

Functions

- Zero-setting
- Data hold
- Offsetting
- Presetting
- Data output
- Low-power and low-voltage alert
- Counting value composition error
- Automatic power on/off, inch/mm reading (inch/mm models)

Note: LCD display turns off after 20 minutes inactivity but the ABS scale unit origin is stored. Moving the slider restores the display.

Optional Accessories

For details, refer to page A-27.

- Connecting cables for **IT/DP/MUX**

05CZA624: SPC cable with data button (1 m)

05CZA625: SPC cable with data button (2 m)



- USB Input Tool Direct

06AFM380A: SPC cable for **USB-ITN-A** (2 m)

- Connecting cables for **U-WAVE-T**

02AZD790A: SPC cable with data button (160 mm)

02AZE140A: SPC cable for foot switch

Optional accessories

| Metric | 552-302-10, 552-155-10, 552-303-10 and 552-156-10 | 552-304-10, 552-305-10 and 552-306-10 |
|-----------------------------------|--|--|
| Clamp box (1 pair) | 914053 | 914054 |
| Distance measurement jaw (1 pair) | 914055 | |
| Point ID measurement jaw (1 pair) | 914057 | |

| Inch/Metric | 552-312-10, 552-165-10, 552-313-10 and 552-166-10 | 552-314-10, 552-315-10 and 552-316-10 |
|-----------------------------------|--|--|
| Clamp box (1 pair) | 914053 | 914054 |
| Distance measurement jaw (1 pair) | 914056 | |
| Point ID measurement jaw (1 pair) | 914058 | |

| | |
|---------------------------------|---|
| <p>Distance measurement jaw</p> | <p>Clamp box</p> |
| <p>Point ID measurement jaw</p> | <p>Distance measurement jaw Accuracy: ± 0.03 mm*</p> <p>Point ID measurement jaw Accuracy: ± 0.02 mm*</p> |

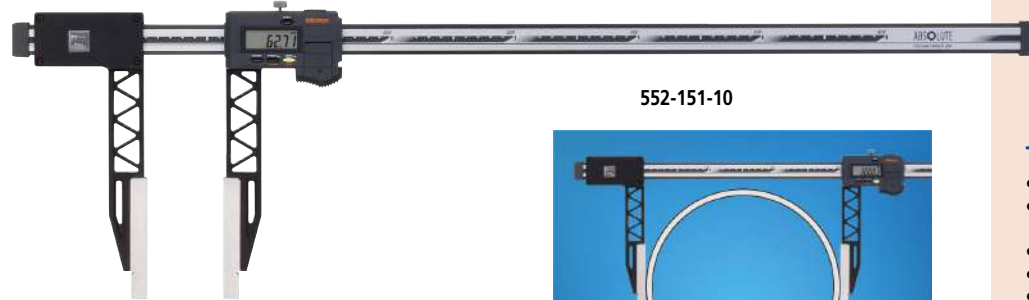
* Accuracies shown in the diagrams are of each accessory and accuracy resulting in mounting them on the main body is not guaranteed.

Calipers

An industry standard measuring tool

ABSOLUTE Coolant Proof Carbon Fiber Caliper SERIES 552 - with Long Jaws

- IP66 Absolute Digital Caliper (Refer to page D-6 for details on the Absolute function.)
- Lightweight Digimatic Calipers that employ CFRP (Carbon Fiber Reinforced Plastics) in the beam.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



552-151-10

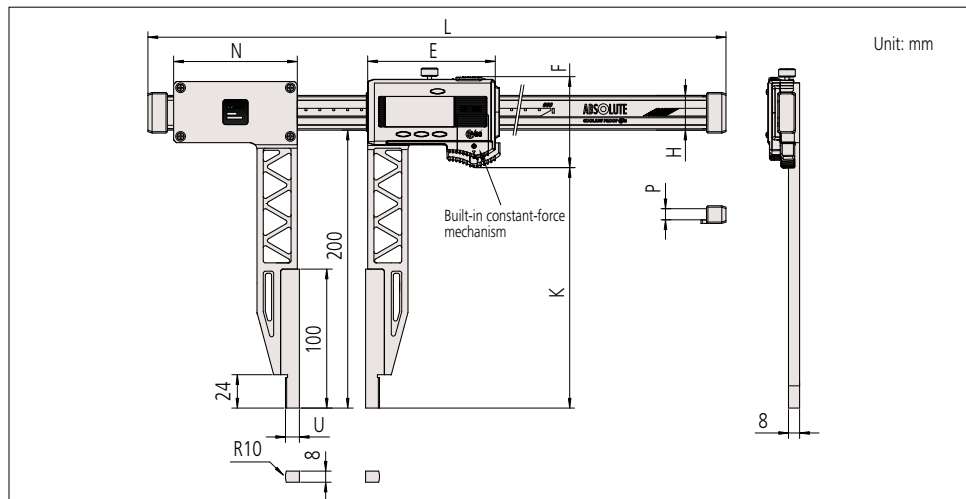
SPECIFICATIONS

| Metric | | | Inch / Metric | | |
|------------|------------------------|---------------|---------------|-----------------------|---------------|
| Order No. | Range (mm)* | Accuracy (mm) | Order No. | Range (in)* | Accuracy (in) |
| 552-150-10 | 0 - 450 (20.1 - 470) | ±0.06 | 552-160-10 | 0 - 18 (0.504 - 18.5) | ±0.0025 |
| 552-151-10 | 0 - 600 (20.1 - 620) | | 552-161-10 | 0 - 24 (0.504 - 24.5) | |
| 552-152-10 | 0 - 1000 (20.1 - 1020) | ±0.07 | 552-162-10 | 0 - 40 (1.004 - 40.5) | ±0.003 |
| 552-153-10 | 0 - 1500 (20.1 - 1520) | ±0.11 | 552-163-10 | 0 - 60 (1.004 - 60.5) | ±0.0045 |
| 552-154-10 | 0 - 2000 (20.1 - 2020) | ±0.14 | 552-164-10 | 0 - 80 (1.004 - 80.5) | ±0.0055 |

* () : Dimension in inside measurement

Note: A constant-force mechanism is used in the finger rest; however, this is only an auxiliary mechanism to avoid measurement error caused by excessive measuring force. To measure with good accuracy, use the minimum necessary measuring force for the caliper measuring faces to make sufficient contact with the workpiece. Refer to page D-40 for details.

DIMENSIONS



Unit: mm

| Range | E | F | H | K | L | N | P | U |
|-------------------------|-------|------|----|-------|------|-----|----|-----------|
| 0 - 450 mm (0 - 18 in) | 91.8 | 65.5 | 25 | 173 | 680 | 89 | 8 | 10 |
| 0 - 600 mm (0 - 24 in) | | | | | 830 | | | (0.25 in) |
| 0 - 1000 mm (0 - 40 in) | 113.8 | 73 | 32 | 170.5 | 1280 | 110 | 12 | 10 |
| 0 - 1500 mm (0 - 60 in) | | | | | 1790 | | | |
| 0 - 2000 mm (0 - 80 in) | | | | | 2300 | | | |

() : Inch/Metric type

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

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Technical Data

- Repeatability: 0.01 mm
- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Material of jaws: Stainless Steel Hardened
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5,000 hours in continuous use
- Dust/Water protection level: IP66 (IEC 60529)*
- Standard accessory: Jaw clamps (2 pcs.), 05GZA033
- * Rustproofing shall be applied after use if caliper was in contact with coolant.

Functions

- Zero-setting
- Data hold
- Offsetting
- Presetting
- Data output
- Low-power and low-voltage alert
- Counting value composition error
- Automatic power on/off, inch/mm reading (inch/mm models)

Optional Accessories

For details, refer to page A-27.

- Connecting cables for **IT / DP / MUX**
- 05CZA624**: SPC cable with data button (1 m)
- 05CZA625**: SPC cable with data button (2 m)



- USB Input Tool Direct
- 06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- 02AZD790A**: SPC cable with data button (160 mm)
- 02AZE140A**: SPC cable for foot switch

ABSOLUTE™

IP66



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ID 0000022582

Technical Data

- Repeatability: 0.01 mm
- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Material of jaws: Ceramic
- Display: LCD
- Scale type: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5,000 hours in continuous use
- Dust/Water protection level: IP66 (IEC 60529)*
- Standard accessory: Jaw clamps (2 pcs.), 05GZA033
- * Rustproofing shall be applied after use if caliper was in contact with coolant.

Functions

- Zero-setting
- Data hold
- Offsetting
- Presetting
- Data output
- Low-power and low-voltage alert
- Counting value composition error
- Automatic power on/off, inch/mm reading (inch/mm models)

Optional Accessories

For details, refer to page A-27.

- Connecting cables for **IT/DP/MUX**
- 05CZA624**: SPC cable with data button (1 m)
- 05CZA625**: SPC cable with data button (2 m)



- USB Input Tool Direct
- 06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- 02AZD790A**: SPC cable with data button (160 mm)
- 02AZE140A**: SPC cable for foot switch

ABSOLUTE Coolant Proof Carbon Fiber Caliper SERIES 552 - with Ceramic Jaws

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- IP66 Absolute Digital Caliper (Refer to page D-6 for details on the Absolute function.)
- Lightweight Digimatic Calipers that employ CFRP (Carbon Fiber Reinforced Plastics) in the beam.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- The zirconia-ceramic jaws make this caliper suitable for measuring moderately magnetic workpieces. However, since steel is used in the main unit, it may not be suitable for measuring strongly magnetic workpieces.



SPECIFICATIONS

| Metric | | |
|-------------------|----------------------|---------------|
| Order No. | Range (mm)* | Accuracy (mm) |
| 552-155-10 | 0 - 450 (20.1 - 470) | ±0.04 |
| 552-156-10 | 0 - 600 (20.1 - 620) | |

* (): Dimension in inside measurement

Note: A constant-force mechanism is used in the finger rest; however, this is only an auxiliary mechanism to avoid measurement error caused by excessive measuring force. To measure with good accuracy, use the minimum necessary measuring force for the caliper measuring faces to make sufficient contact with the workpiece. Refer to page D-40 for details.

| Inch / Metric | | |
|-------------------|-----------------------|---------------|
| Order No. | Range (in)* | Accuracy (in) |
| 552-165-10 | 0 - 18 (0.504 - 18.5) | ±0.002 |
| 552-166-10 | 0 - 24 (0.504 - 24.5) | |

* (): Dimension in inside measurement

Note: A constant-force mechanism is used in the finger rest; however, this is only an auxiliary mechanism to avoid measurement error caused by excessive measuring force. To measure with good accuracy, use the minimum necessary measuring force for the caliper measuring faces to make sufficient contact with the workpiece. Refer to page D-40 for details.

DIMENSIONS

Unit: mm

| Range | D | E | G | H | J | L | N | R | S | t |
|------------------------|-----|------|----|----|----|-----|------|-----|----|---|
| 0 - 450 mm (0 - 18 in) | 100 | 91.8 | 35 | 25 | 65 | 640 | 41.2 | R10 | 18 | 8 |
| 0 - 600 mm (0 - 24 in) | 100 | 91.8 | 35 | 25 | 65 | 790 | 41.2 | R10 | 18 | 8 |

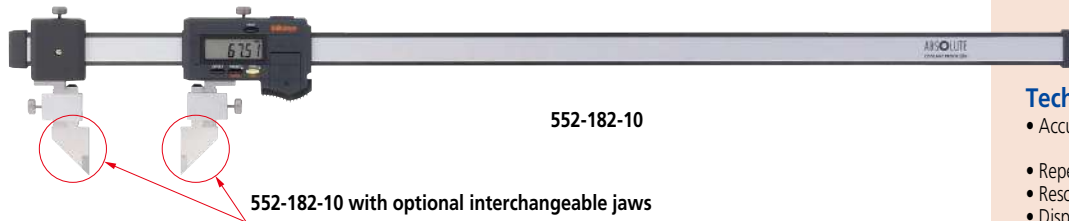
(): Inch/Metric type

Calipers

An industry standard measuring tool

ABSOLUTE Coolant Proof Carbon Fiber Caliper SERIES 552 - with Interchangeable Jaws

- IP66 Absolute Digital Caliper (Refer to page D-6 for a description of Absolute measurement.)
- The range of applications can be expanded by using interchangeable jaws (optional).
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- The PRESET function enables quick and easy scale resetting to match the jaws when they are changed.



SPECIFICATIONS

| Metric | | | Inch / Metric | | |
|------------|------------|---------------|---------------|------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) | Order No. | Range (in) | Accuracy (in) |
| 552-181-10 | 0 - 450 | ±0.04 | 552-191-10 | 0 - 18 | ±0.002 |
| 552-182-10 | 0 - 600 | | 552-192-10 | 0 - 24 | |
| 552-183-10 | 0 - 1000 | ±0.05 | 552-193-10 | 0 - 40 | |
| 552-184-10 | 0 - 1500 | ±0.09 | 552-194-10 | 0 - 60 | ±0.004 |
| 552-185-10 | 0 - 2000 | ±0.12 | 552-195-10 | 0 - 80 | ±0.005 |

Note: A constant-force mechanism is used in the finger rest; however, this is only an auxiliary mechanism to avoid measurement error caused by excessive measuring force. To measure with good accuracy, use the minimum necessary measuring force for the caliper measuring faces to make sufficient contact with the workpiece. Refer to page D-40 for details.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™

IP 66



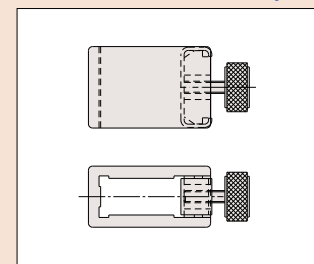
Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Repeatability: 0.01 mm
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Display: LCD
- Scale type: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5,000 hours in continuous use
- Dust/Water protection level: IP66 (IEC 60529)*
- Standard accessory: Jaw clamps (2 pcs.), 05GZA033
- * Rustproofing shall be applied after use if caliper was in contact with coolant.

Functions

- Zero-setting
- Data hold
- Offsetting
- Presetting
- Data output
- Low-power and low-voltage alert
- Counting value composition error
- Automatic power on/off, inch/mm reading (inch/mm models)

Standard Accessories (2 pcs.)



Jaw clamps: 05GZA033

Optional Accessories

For details, refer to page A-27.

- Connecting cables for **IT / DP / MUX**
- **05CZA624**: SPC cable with data button (1 m)
- **05CZA625**: SPC cable with data button (2 m)

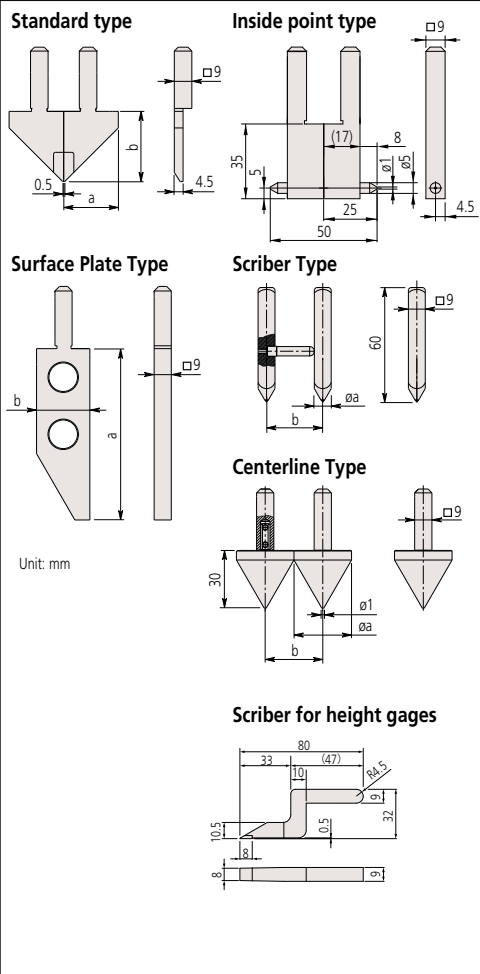


- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- **02AZD790A**: SPC cable with data button (160 mm)
- **02AZE140A**: SPC cable for foot switch

Optional accessories

Interchangeable jaws

SPECIFICATIONS



Standard Type

| Order No. | Components | a | b |
|-----------------|--|-------------------|-------------------|
| 07CZA056 | Right (07CAA044), Left (07CAA045) | 28 mm (1.1 in) | 36 mm (1.2 in) |

Note: 1 set

Inside Point Type

| Order No. | Components | a | b |
|-----------------|-------------------------|-------|-------|
| 07CZA058 | 07CZA041 ×2 pcs. | 25 mm | 50 mm |
| 07CZA059 | 07CZA048 ×2 pcs. | 1 in | 2 in |

Scriber Type

| Order No. | Components | a | b |
|-----------------|--|---------|--------|
| 07CZA055 | Right (07CZA042), Left (07CZA043) | 8 mm | 30 mm |
| 07CZA061 | Right (07CZA042), Left (07CZA049) | 0.31 in | 1.2 in |

Surface Plate Type

| Order No. | a | b |
|-----------------|----------------|----------------|
| 07CZA044 | 90 mm (3.5 in) | 28 mm (1.1 in) |

Centerline Type

| Order No. | Components | a | b |
|-----------------|-------------------------|--------|--------|
| 07CZA057 | 07CZA039 ×2 pcs. | 30 mm | 30 mm |
| 07CZA060 | 07CZA047 ×2 pcs. | 1.2 in | 1.2 in |

Note: Entering the appropriate offset value enables the display to indicate the correct measurement value inscribed on the jaws, which should be installed so that this inscription is visible from the display side of the caliper.

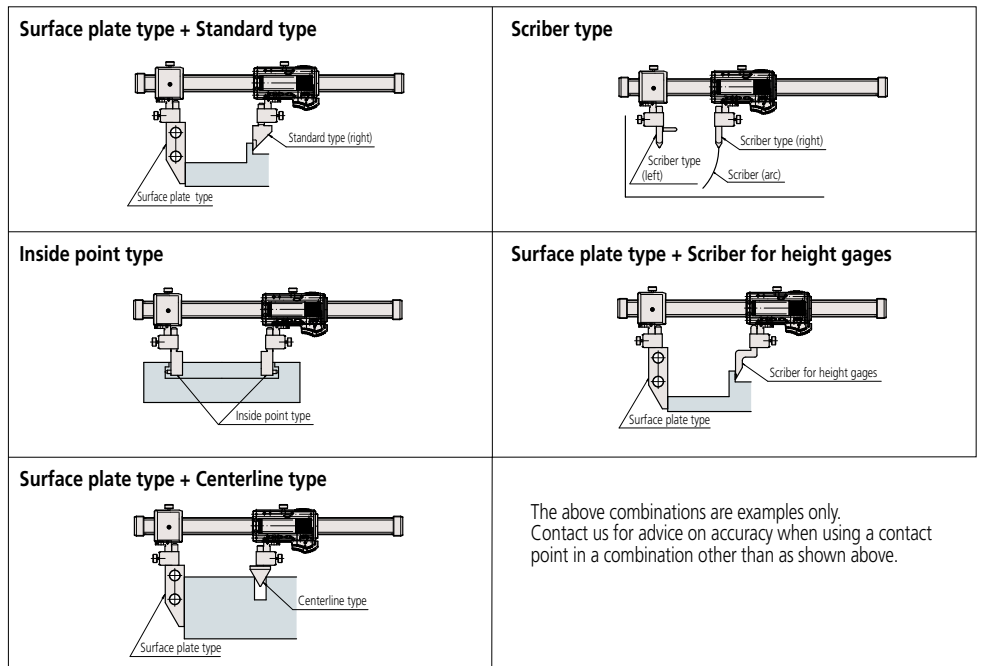
Scriber for height gages

| Order No. |
|-----------------|
| 07GZA000 |

| Type | Applicable calipers | Range | Accuracy when attached to the caliper |
|--|--------------------------------|--|---------------------------------------|
| Standard type | 552-181-10 (552-191-10) | 0 - 450 mm (0 - 18 in) | ±0.06 mm (±0.0025 in) |
| | 552-182-10 (552-192-10) | 0 - 600 mm (0 - 24 in) | ±0.07 mm (±0.0030 in) |
| | 552-184-10 (552-194-10) | 0 - 1500 mm (0 - 60 in) | ±0.11 mm (±0.0045 in) |
| | 552-185-10 (552-195-10) | 0 - 2000 mm (0 - 80 in) | ±0.14 mm (±0.0055 in) |
| Inside point type | 552-181-10 (552-191-10) | Inside: 50.1 - 500 mm (2.004 - 20 in) Outside: 0 - 450 mm (0 - 18 in) | ±0.09 mm (±0.0035 in) |
| | 552-182-10 (552-192-10) | Inside: 50.1 - 650 mm (2.004 - 26 in) Outside: 0 - 600 mm (0 - 24 in) | ±0.10 mm (±0.0040 in) |
| | 552-183-10 (552-193-10) | Inside: 50.1 - 1050 mm (2.004 - 42 in) Outside: 0 - 1000 mm (0 - 40 in) | ±0.14 mm (±0.0055 in) |
| | 552-184-10 (552-194-10) | Inside: 50.1 - 1550 mm (2.004 - 62 in) Outside: 0 - 1500 mm (0 - 60 in) | ±0.17 mm (±0.0070 in) |
| Centerline type | 552-181-10 (552-191-10) | 30.1 - 480 mm (1.204 - 19.2 in) | ±0.08 mm (±0.0030 in) |
| | 552-182-10 (552-192-10) | 30.1 - 630 mm (1.204 - 25.2 in) | ±0.09 mm (±0.0035 in) |
| | 552-183-10 (552-193-10) | 30.1 - 1030 mm (1.204 - 41.2 in) | ±0.13 mm (±0.0055 in) |
| | 552-185-10 (552-195-10) | 30.1 - 2030 mm (1.204 - 81.2 in) | ±0.16 mm (±0.0065 in) |
| Scriber type | 552-181-10 (552-191-10) | 30.1 - 480 mm (1.204 - 19.2 in) | ±0.10 mm (±0.0040 in) |
| | 552-182-10 (552-192-10) | 30.1 - 630 mm (1.204 - 25.2 in) | ±0.11 mm (±0.0045 in) |
| | 552-184-10 (552-194-10) | 30.1 - 1530 mm (1.204 - 61.2 in) | ±0.15 mm (±0.0060 in) |
| | 552-185-10 (552-195-10) | 30.1 - 2030 mm (1.204 - 81.2 in) | ±0.18 mm (±0.0070 in) |
| Surface plate type + Scriber type for height gages | 552-181-10 (552-191-10) | 0 - 450 mm (0 - 17.7 in) | ±0.10 mm (±0.0040 in) |
| | 552-182-10 (552-192-10) | 0 - 600 mm (0 - 23.7 in) | ±0.11 mm (±0.0045 in) |
| | 552-184-10 (552-194-10) | 0 - 1500 mm (0 - 59.4 in) | ±0.15 mm (±0.0060 in) |
| | 552-185-10 (552-195-10) | 0 - 2000 mm (0 - 79.6 in) | ±0.18 mm (±0.0070 in) |
| Surface plate type + Inside point type | 552-181-10 (552-191-10) | Inside: 60 - 450 mm (1.004 - 19 in) Outside: 0 - 450 mm (1 - 18 in) | ±0.12 mm (±0.0050 in) |
| | 552-182-10 (552-192-10) | Inside: 60 - 600 mm (1.004 - 25 in) Outside: 0 - 600 mm (1 - 24 in) | ±0.13 mm (±0.0055 in) |
| | 552-183-10 (552-193-10) | Inside: 60 - 1000 mm (1.004 - 41 in) Outside: 0 - 1000 mm (1 - 40 in) | ±0.17 mm (±0.0070 in) |
| | 552-184-10 (552-194-10) | Inside: 60 - 1500 mm (1.004 - 62 in) Outside: 0 - 1500 mm (1 - 60 in) | ±0.20 mm (±0.0080 in) |
| Surface plate type + Centerline type | 552-181-10 (552-191-10) | 15.1 - 465 mm (0.6 - 18.6 in) | ±0.11 mm (±0.0045 in) |
| | 552-182-10 (552-192-10) | 15.1 - 615 mm (0.6 - 24.6 in) | ±0.12 mm (±0.0050 in) |
| | 552-184-10 (552-194-10) | 15.1 - 1515 mm (0.6 - 60.6 in) | ±0.16 mm (±0.0065 in) |
| | 552-185-10 (552-195-10) | 15.1 - 2015 mm (0.6 - 80.6 in) | ±0.19 mm (±0.0075 in) |

(): Inch/Metric models

Typical applications



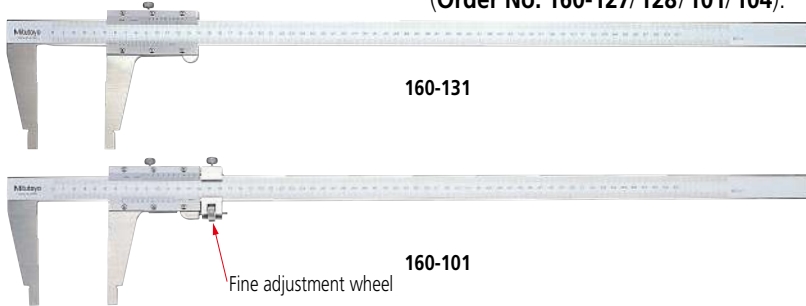
The above combinations are examples only. Contact us for advice on accuracy when using a contact point in a combination other than as shown above.

Calipers

An industry standard measuring tool

Vernier Caliper SERIES 160 — with Nib Style Jaws and Fine Adjustment

- Inside and outside measurements can be read directly from the upper and lower vernier scales.
- The jaws have radiused measuring faces for accurate inside diameter (ID) measurement.
- With fine adjustment (Order No. 160-127/128/101/104).

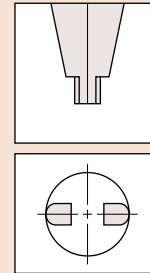


SPECIFICATIONS

Metric _____ with inside measurement vernier scale

| Order No. | Range (mm)* | Minimum reading (mm) | Accuracy (mm) | Remarks |
|-----------|-----------------|----------------------|---------------|-------------------------|
| 160-130 | 0 (20.1) - 450 | 0.05 | ±0.10 | without fine adjustment |
| 160-131 | 0 (20.1) - 600 | | ±0.10 | |
| 160-132 | 0 (20.1) - 1000 | | ±0.15 | |

* () : Minimum dimension in ID measurement



Radiused jaws for accurate ID measurement

Metric _____ with inside measurement vernier scale

| Order No. | Range (mm)* | Minimum reading (mm) | Accuracy (mm) | Remarks |
|-----------|-----------------|----------------------|---------------|----------------------|
| 160-127 | 0 (10.1) - 300 | 0.02 | ±0.04 | with fine adjustment |
| 160-128 | 0 (20.1) - 450 | | ±0.05 | |
| 160-101 | 0 (20.1) - 600 | | ±0.05 | |
| 160-104 | 0 (20.1) - 1000 | | ±0.07 | |

* () : Minimum dimension in ID measurement



Metric/Inch _____ with metric/inch double scale

| Order No. | Range (mm)* | Minimum reading | Accuracy (mm) | Remarks |
|-----------|-----------------|------------------|---------------|--|
| 160-150 | 0 (10.1) - 300 | 0.02 mm/0.001 in | ±0.04 | +10 mm/0.394 in to reading in inside measurement |
| 160-151 | 0 (20.1) - 450 | | ±0.05 | +20 mm/0.787 in to reading in inside measurement |
| 160-153 | 0 (20.1) - 600 | | ±0.05 | |
| 160-155 | 0 (20.1) - 1000 | | ±0.07 | |

* () : Minimum dimension in ID measurement

Inch _____ with inside measurement vernier scale

| Order No. | Range (in)* | Minimum reading (in) | Accuracy (in) | Remarks |
|-----------|----------------|----------------------|---------------|---------|
| 160-124 | 0 (0.304) - 12 | 0.001 | ±0.0015 | — |
| 160-116 | 0 (0.504) - 18 | | ±0.002 | |
| 160-102 | 0 (0.504) - 24 | | ±0.002 | |
| 160-105 | 0 (1.004) - 40 | | ±0.003 | |

* () : Minimum dimension in ID measurement

Inch/Metric _____ with inch/metric double scale

| Order No. | Range (in)* | Minimum reading | Accuracy (in) | Remarks |
|-----------|----------------|------------------|---------------|--|
| 160-125 | 0 (0.304) - 12 | 0.001 in/0.02 mm | ±0.0015 | +0.3 in/7.62 mm to reading in inside measurement |
| 160-119 | 0 (0.504) - 18 | | ±0.002 | +0.5 in/12.7 mm to reading in inside measurement |
| 160-103 | 0 (0.504) - 24 | | ±0.002 | |
| 160-106 | 0 (1.004) - 40 | | ±0.003 | |

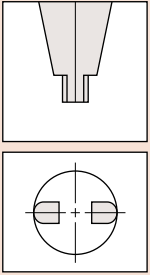
* () : Minimum dimension in ID measurement

DIMENSIONS

Unit: mm

| Range | D | E | F | H | L | M | R | S | t |
|-----------------------|-----|-----|------|----|------|------|-----|----|-----|
| 0 - 300 mm/0 - 12 in | 75 | 103 | 38 | 20 | 445 | 10 | R5 | 12 | 3.8 |
| 0 - 450 mm* | 89 | — | — | 25 | 630 | 14.8 | R10 | 18 | 6 |
| 0 - 450 mm/0 - 18 in | 100 | 112 | 51 | — | — | — | R10 | — | — |
| 0 - 600 mm* | 89 | — | — | 25 | 780 | 14.8 | R10 | 18 | 6 |
| 0 - 600 mm/0 - 24 in | 100 | 112 | 51 | — | — | — | R10 | — | — |
| 0 - 1000 mm* | 111 | — | — | 32 | 1240 | 17 | R10 | 24 | 8 |
| 0 - 1000 mm/0 - 40 in | 140 | 150 | 62.5 | — | — | — | R10 | — | — |

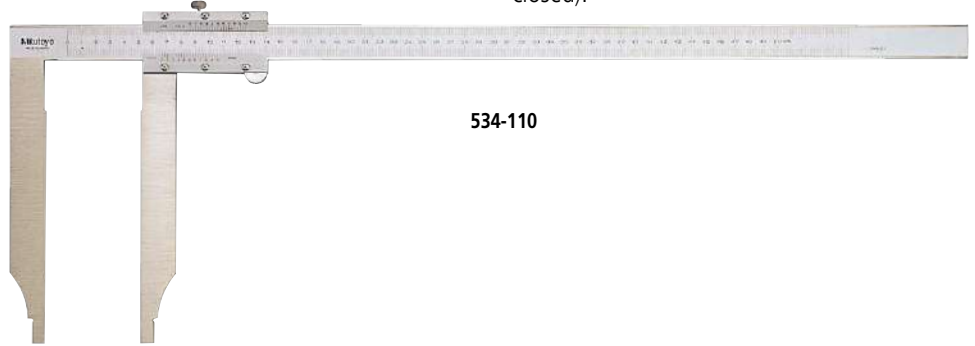
* Without fine adjustment



Round jaws for accurate ID measurement

Long Jaw Vernier Caliper SERIES 534

- Long jaws for measuring hard-to-reach workpiece features.
- Inside and outside measurements can be read directly from the upper and lower vernier scales.
- Inside measurement is possible upwards from the minimum inside measuring length (jaws closed).



534-110

SPECIFICATIONS

Metric with inside measurement vernier scale

| Order No. | Range (mm)* | Graduation (mm) | Accuracy (mm) | Remarks |
|-----------|----------------|-----------------|---------------|-------------------------|
| 534-109 | 0 (10.1) - 300 | 0.05 | ±0.07 | without fine adjustment |
| 534-110 | 0 (20.1) - 500 | | ±0.13 | |

* (): Minimum dimension in inside measurement

Metric/Inch with metric/inch double scale

| Order No. | Range (mm)* | Graduation | Accuracy (mm) | Remarks |
|-----------|-----------------|------------------|---------------|--|
| 534-101 | 0 (10.1) - 300 | 0.05 mm/1/128 in | ±0.07 | +10 mm/0.394 in to reading in inside measurement without fine adjustment |
| 534-105 | | 0.02 mm/0.001 in | ±0.04 | |
| 534-102 | 0 (20.1) - 500 | 0.05 mm/1/128 in | ±0.13 | +20 mm/0.787 in to reading in inside measurement without fine adjustment |
| 534-106 | | 0.02 mm/0.001 in | ±0.06 | |
| 534-103 | 0 (20.1) - 750 | 0.05 mm/1/128 in | ±0.16 | |
| 534-107 | | 0.02 mm/0.001 in | ±0.08 | |
| 534-104 | 0 (20.1) - 1000 | 0.05 mm/1/128 in | ±0.20 | |
| 534-108 | | 0.02 mm/0.001 in | ±0.10 | |

* (): Minimum dimension in inside measurement

Note: For external dimensions, refer to the series 534 on page D-23.

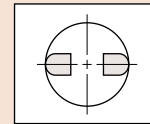
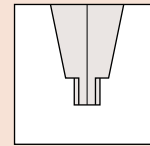
D

Calipers

An industry standard measuring tool

Long Jaw Vernier Caliper SERIES 534

- Long jaws for measuring hard-to-reach workpiece features.
- Inside and outside measurements can be read directly from the upper and lower vernier scales.
- The fine-adjustment wheel enables precise feed and adjustment.
- Inside measurement is possible upwards from the minimum inside measuring length (jaws closed).



Radiused jaws for accurate ID measurement

SPECIFICATIONS

| Metric with inside measurement vernier scale | | | | |
|--|-----------------|-----------------|---------------|----------------------|
| Order No. | Range (mm)* | Graduation (mm) | Accuracy (mm) | Remarks |
| 534-113 | 0 (10.1) - 300 | 0.02 | ±0.04 | with fine adjustment |
| 534-114 | 0 (20.1) - 500 | | ±0.06 | |
| 534-115 | 0 (20.1) - 750 | | ±0.08 | |
| 534-116 | 0 (20.1) - 1000 | | ±0.10 | |

* (): Minimum dimension in inside measurement

| Inch with inside measurement vernier scale | | | | |
|--|----------------|-----------------|---------------|----------------------|
| Order No. | Range (in)* | Graduation (in) | Accuracy (in) | Remarks |
| 534-117 | 0 (0.304) - 12 | 0.001 | ±0.002 | with fine adjustment |
| 534-118 | 0 (0.804) - 20 | | ±0.003 | |
| 534-119 | 0 (0.804) - 30 | | ±0.004 | |
| 534-120 | 0 (0.804) - 40 | | | |

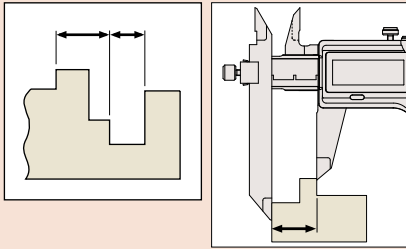
* (): Minimum dimension in inside measurement

DIMENSIONS

Unit: mm

| Range | D | E | F | H | L | M | R | S | t |
|-----------------------|-----|------|----|----|------|----|------|------|-----|
| 0 - 300 mm* | 90 | 76.5 | — | 20 | 445 | 7 | R5 | 12 | 3.8 |
| 0 - 300 mm/0 - 12 in | | 103 | 38 | | | | R5 | | |
| 0 - 500 mm* | 200 | 89 | — | 25 | 682 | 12 | R10 | 18.5 | 6 |
| 0 - 500 mm/0 - 20 in | | 112 | 51 | | | | R10 | | |
| 0 - 750 mm* | 150 | — | — | 32 | 995 | 12 | R10 | 18.5 | 6 |
| 0 - 750 mm/0 - 30 in | | | | | | | 62.5 | | |
| 0 - 1000 mm* | 150 | — | — | 32 | 1230 | 12 | R10 | 18.5 | 8 |
| 0 - 1000 mm/0 - 40 in | | | | | | | 62.5 | | |

* Without fine adjustment



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution*¹: 0.01 mm or 0.0005 in/0.01 mm
- Graduation*²: 0.05 mm
- Display*¹: LCD
- Scale type*¹: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed*¹: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*¹: Approx. 5 years under normal use
- Dust/Water protection level*¹: IP67 (IEC 60529)*³
 - *¹ Digimatic models
 - *² Analog models
 - *³ Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories for Digimatic Models

For details, refer to page A-27.

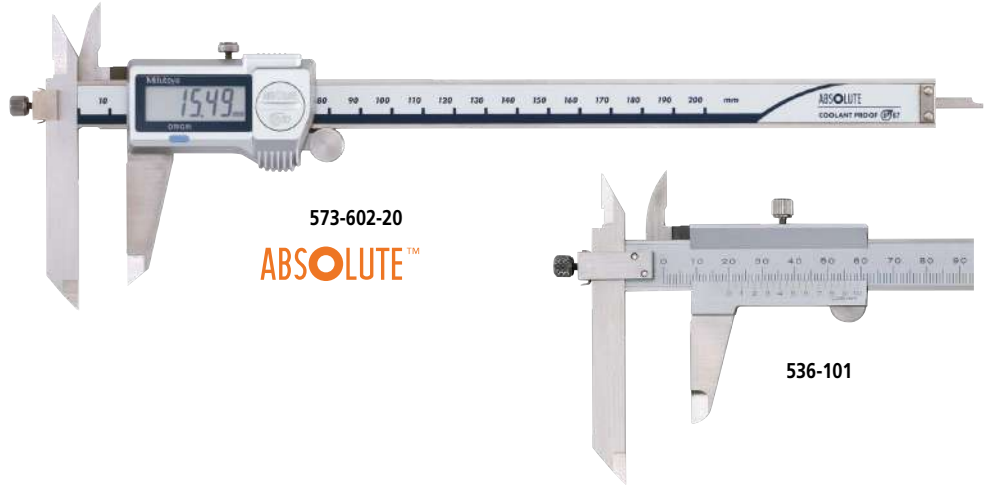
- **959143**: Data hold unit
- Connecting cables for **IT/DP/MUX**
 - 05CZA624**: SPC cable with data button (1 m)
 - 05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
 - 02AZD790A**: SPC cable with data button (160 mm)
 - 02AZE140A**: SPC cable for foot switch

Wireless Data Output **U-WAVE[®] fit**

- **U-WAVE-TC**: **264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
02AZF310 (IP67 type)
Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.
Note: Cannot be used with **573-611-20**, **573-612-20** and **573-614**

Offset Caliper SERIES 573, 536 — ABSOLUTE Digimatic and vernier types

- The beam-mounted jaw can be adjusted to facilitate measurement of stepped sections and hard-to-get-at workpiece features.
- Digimatic models are IP67 Absolute type. Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



SPECIFICATIONS

| Metric | Digimatic model | |
|--------------------|-----------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-601-20 | 0 - 150 | ±0.02 |
| 573-611-20* | 0 - 150 | ±0.02 |
| 573-602-20 | 0 - 200 | ±0.02 |
| 573-612-20* | 0 - 200 | ±0.02 |
| 573-604-20 | 0 - 300 | ±0.03 |
| 573-614-20* | 0 - 300 | ±0.03 |

* Without thumb roller

| Metric | Analog model | |
|----------------|--------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 536-101 | 0 - 150 | ±0.05 |
| 536-102 | 0 - 200 | ±0.05 |
| 536-103 | 0 - 300 | ±0.08 |

| Inch / Metric | Digimatic model | |
|-------------------|-----------------|---------------|
| Order No. | Range (in) | Accuracy (in) |
| 573-701-20 | 0 - 6 | ±0.001 |
| 573-702-20 | 0 - 8 | ±0.001 |
| 573-704-20 | 0 - 12 | ±0.0015 |

DIMENSIONS

Unit: mm

Analog model

Digimatic model

| Order No. | Model | Range (mm) | A | B | C | D | G | H | N | W | t |
|-------------------|-----------------|------------|------|------|------|----|----|----|--------|----|-----|
| 573-601-20 | Digimatic model | 0 - 150 | 16.5 | 21 | 14.6 | 40 | 10 | 16 | (18) | 95 | 3.5 |
| 573-602-20 | | 0 - 200 | 20 | 24.5 | 18.1 | 50 | | | (4) | | |
| 573-604-20 | | 0 - 300 | 22 | 27.5 | 19.8 | 64 | | | (23.5) | | |
| 536-101 | Analog model | 0 - 150 | 17 | 21.5 | 17 | 40 | 10 | 16 | (18) | 95 | 3 |
| 536-102 | | 0 - 200 | 20.5 | 25 | 20.5 | 50 | | | (4) | | |
| 536-103 | | 0 - 300 | 22 | 27.5 | 22 | 64 | | | (23.5) | | |

Calipers

An industry standard measuring tool

Offset Centerline Caliper SERIES 573, 536 — ABSOLUTE Digimatic and vernier types

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

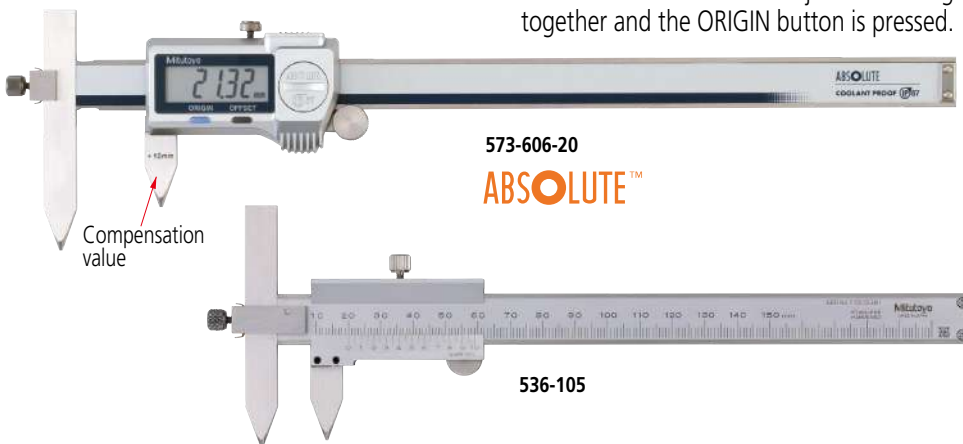
MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

IP67



- Specially designed for hole Center-to-Center measurements on the same, or offset, planes.
- Digimatic models are IP67 Absolute type. Slider action is smooth, firm and comfortable.
- Direct reading of pitch measurements is available due to the offset-value setting function.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Dedicated calibration and inspection tool can be made to order.
- Digimatic models need the compensation value (engraved on the moving jaw) added to the displayed value for correct measurement. However, the featured Offset function enables this to be done easily just by pressing the OFFSET button after the jaws are brought together and the ORIGIN button is pressed.



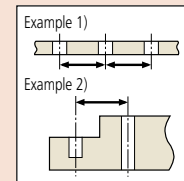
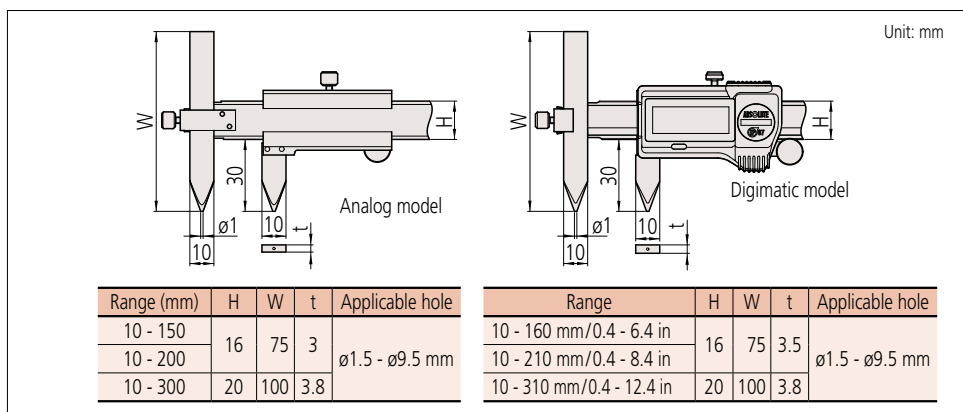
SPECIFICATIONS

| Metric | Digimatic model | |
|-------------|-----------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-605-20 | 10.1 - 160 | ±0.03 |
| 573-615-20* | 10.1 - 160 | ±0.03 |
| 573-606-20 | 10.1 - 210 | ±0.03 |
| 573-616-20* | 10.1 - 210 | ±0.03 |
| 573-608-20 | 10.1 - 310 | ±0.04 |
| 573-618-20* | 10.1 - 310 | ±0.04 |

* Without thumb roller

| Metric | Analog model | |
|-----------|--------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 536-105 | 10.1 - 150 | ±0.05 |
| 536-106 | 10.1 - 200 | ±0.05 |
| 536-107 | 10.1 - 300 | ±0.08 |

DIMENSIONS



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution*1: 0.01 mm or 0.0005 in/0.01 mm
- Graduation*2: 0.05 mm
- Display*1: LCD
- Scale type*1: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed*1: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*1: Approx. 5 years under normal use
- Dust/Water protection level*1: IP67 (IEC 60529)*3
- *1 Digimatic models
- *2 Analog models
- *3 Rustproofing shall be applied after use if caliper was in contact with coolant.

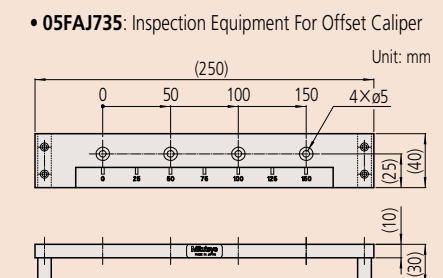
Optional Accessories for Digimatic Models

For details, refer to page A-27.

- **959143**: Data hold unit
- Connecting cables for **IT/DP/MUX**
- **05CZA624**: SPC cable with data button (1 m)
- **05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- **02AZD790A**: SPC cable with data button (160 mm)
- **02AZE140A**: SPC cable for foot switch

Wireless Data Output U-WAVE™

- **U-WAVE-TC: 264-620** (IP67 type)
- **264-621** (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth® U-WAVE)**
- **264-624** (IP type)
- **264-625** (Buzzer type)
- Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
- **02AZF310** (IP67 type)
- Note: IP67 model is water/dust-proofed suitable for the factory floor.
- Buzzer type is not water/dust-proofed.
- Refer to pages A-16 and A-18 for details.
- Note: Cannot be used with **573-708-20**



ABSOLUTE Back-Jaw Centerline Caliper SERIES 573 - Center-to-Center & Edge-to-Center Types

Technical Data

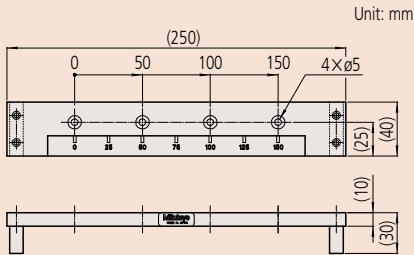
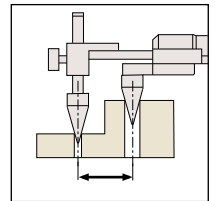
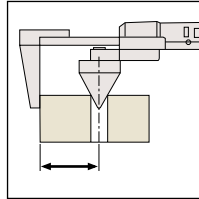
- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Scale type: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 5 years under normal use

Optional Accessories

For details, refer to page A-27.

- **959143**: Data hold unit
- Connecting cables for **IT/DP/MUX**
 - **05CZA624**: SPC cable with data button (1 m)
 - **05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
 - **06AFM380A**: SPC cable for **USB-ITN-C** (2 m)
- Connecting cables for **U-WAVE-T**
 - **02AZD790A**: SPC cable with data button (160 mm)
 - **02AZE140A**: SPC cable for foot switch
- **05FAJ735**: Inspection Equipment For Offset Caliper

- Specially designed to measure hole Center-to-Center and Edge-to-Center distances. Provided with jaws on the back of the slider, measurements can be read easily from above.
- Direct reading of pitch measurements is available due to the offset value setting function.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Dedicated calibration inspection tools are available.



SPECIFICATIONS

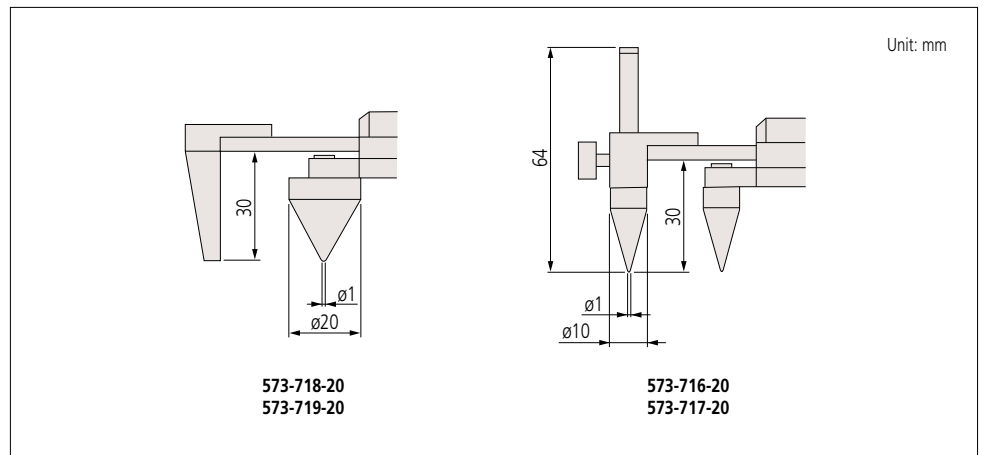
| Metric | Edge-to-center distance type | |
|----------------------|------------------------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-718-20 *1 | 10.1 - 200 | ±0.10 |
| 573-719-20 *1 | 10.1 - 300 | ±0.15 |

| Metric | Center-to-center distance type | |
|----------------------|--------------------------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-716-20 *2 | 10.1 - 200 | ±0.10 |
| 573-717-20 *2 | 10.1 - 300 | ±0.15 |

*1 Applicable hole diameter: ø1.5 - ø19.5 mm

*2 Applicable hole diameter: ø1.5 - ø9.5 mm

DIMENSIONS



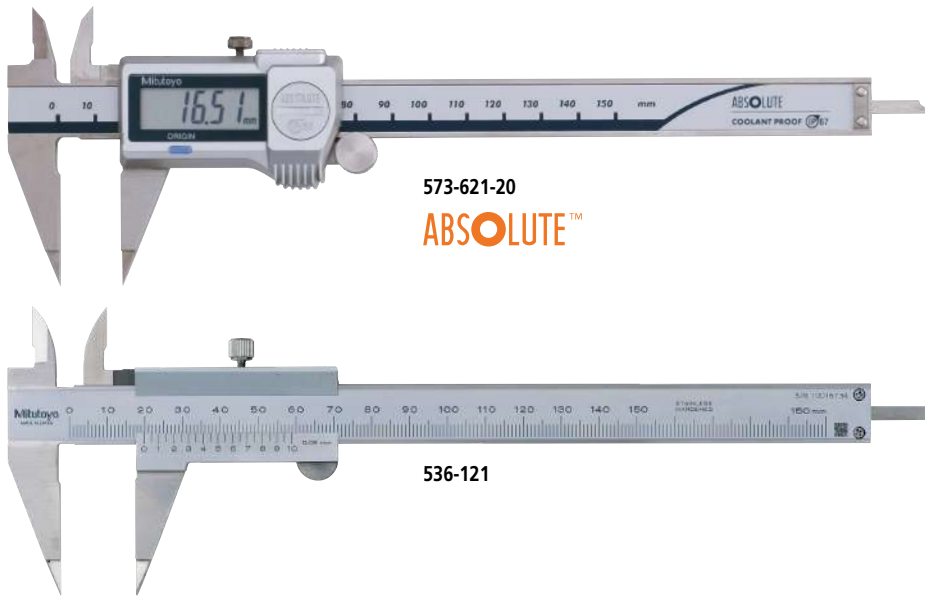
Calipers

An industry standard measuring tool

Point Caliper SERIES 573, 536 — ABSOLUTE Digimatic and vernier types

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Narrow-tip jaws fit into very small grooves and tracks, making many previously difficult outside measurements far easier to obtain.
- Allows step measurement.
- Digimatic models are IP67 Absolute type. Slider action is smooth, firm and comfortable.
- SPC output models allow integration into statistical process control and measurement systems. (Refer to page A-3.)



573-621-20
ABSOLUTE™

536-121

SPECIFICATIONS

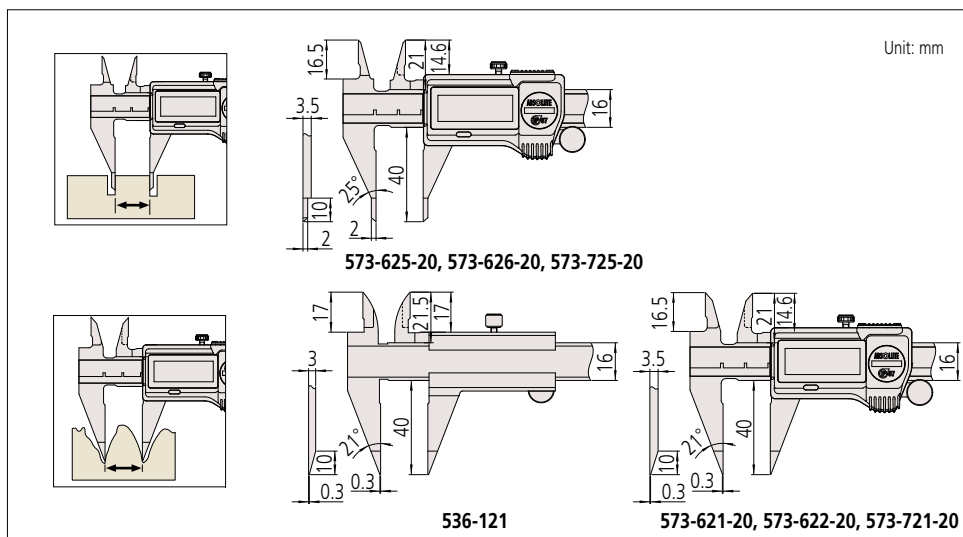
| Metric | Digimatic model | |
|-------------|-----------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-621-20 | 0 - 150 | ±0.02 |
| 573-625-20 | 0 - 150 | ±0.02 |
| 573-622-20* | 0 - 150 | ±0.02 |
| 573-626-20* | 0 - 150 | ±0.02 |

* Without thumb roller

| Metric | Analog model | |
|-----------|--------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 536-121 | 0 - 150 | ±0.05 |

| Inch / Metric | Digimatic model | |
|---------------|-----------------|---------------|
| Order No. | Range (in) | Accuracy (in) |
| 573-721-20 | 0 - 6 | ±0.001 |
| 573-725-20 | 0 - 6 | ±0.001 |

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution*¹: 0.01 mm or 0.0005 in/0.01 mm
- Graduation*²: 0.05 mm
- Display*¹: LCD
- Scale type*¹: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed*¹: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*¹: Approx. 5 years under normal use
- Dust/Water protection level*¹: IP67 (IEC 60529)*³
- *¹ Digimatic models
- *² Analog models
- *³ Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories for Digimatic Models

For details, refer to page A-27.

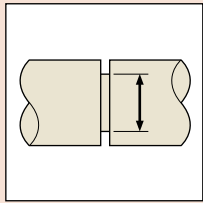
- Connecting cables for **IT / DP / MUX**
- **05CZA624**: SPC cable with data button (1 m)
- **05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- **02AZD790A**: SPC cable with data button (160 mm)
- **02AZE140A**: SPC cable for foot switch

Wireless Data Output **U-WAVE™**

- **U-WAVE-TC**: **264-620** (IP67 type)
- **264-621** (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
- **264-624** (IP type)
- **264-625** (Buzzer type)
- Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC / TCB**
- **02AZF310** (IP67 type)
- Note: IP67 model is water/dust-proofed suitable for the factory floor.
- Buzzer type is not water/dust-proofed.
- Refer to pages A-16 and A-18 for details.



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Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution*¹: 0.01 mm or 0.0005 in/0.01 mm
- Graduation*²: 0.05 mm
- Display*¹: LCD
- Scale type*¹: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed*¹: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*¹: Approx. 5 years under normal use
- Dust/Water protection level*¹: IP67 (IEC 60529)*³
- *¹ Digimatic models
- *² Analog models
- *³ Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories for Digimatic Models

For details, refer to page A-27.

- Connecting cables for **IT/DP/MUX**
- **05CZA624**: SPC cable with data button (1 m)
- **05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- **02AZD790A**: SPC cable with data button (160 mm)
- **02AZE140A**: SPC cable for foot switch

Wireless Data Output **U-WAVE fit**

- **U-WAVE-TC**: **264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
02AZF310 (IP67 type)
Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.

Blade Type Caliper SERIES 573, 536 — ABSOLUTE Digimatic and vernier types

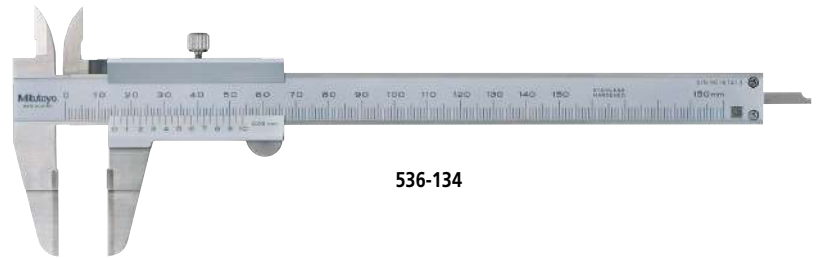
MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The thin blade-type jaws fit into very small grooves and make previously difficult outside measurements far easier to obtain.
- The outside measuring faces are carbide tipped.
- Allows step measurement.
- Digimatic models are IP67 Absolute type. Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



573-634-20

ABSOLUTE™



536-134

SPECIFICATIONS

| Metric | Digimatic model | |
|--------------------|-----------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-634-20 | 0 - 150 | ±0.02 |
| 573-635-20* | 0 - 150 | ±0.02 |

| Inch / Metric | Digimatic model | |
|-------------------|-----------------|---------------|
| Order No. | Range (in) | Accuracy (in) |
| 573-734-20 | 0 - 6 | ±0.001 |

* Without thumb roller

| Metric | Analog model | |
|----------------|--------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 536-134 | 0 - 150 | ±0.05 |
| 536-135 | 0 - 200 | ±0.05 |
| 536-136 | 0 - 300 | ±0.08 |

DIMENSIONS

Analog model

Digimatic model

Unit: mm

| Range (mm) | A | B | C | D | d | e | H | t |
|------------|------|------|------|----|----|------|----|-----|
| 0 - 150 | 17 | 21.5 | 17 | 40 | 20 | 0.75 | 16 | 3 |
| 0 - 200 | 20.5 | 25 | 20.5 | 50 | 25 | | | |
| 0 - 300 | 22 | 27.5 | 22 | 64 | 30 | 1 | 20 | 3.8 |

Calipers

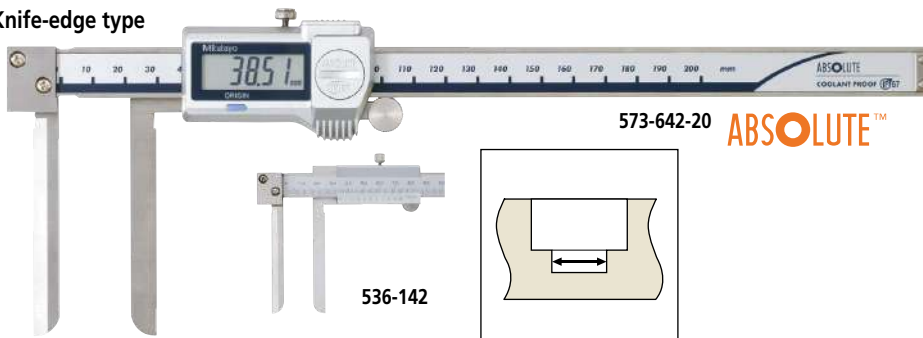
An industry standard measuring tool

ABSOLUTE Inside Caliper SERIES 573, 536 — Knife-edge/Inside Groove/Point Jaw Type

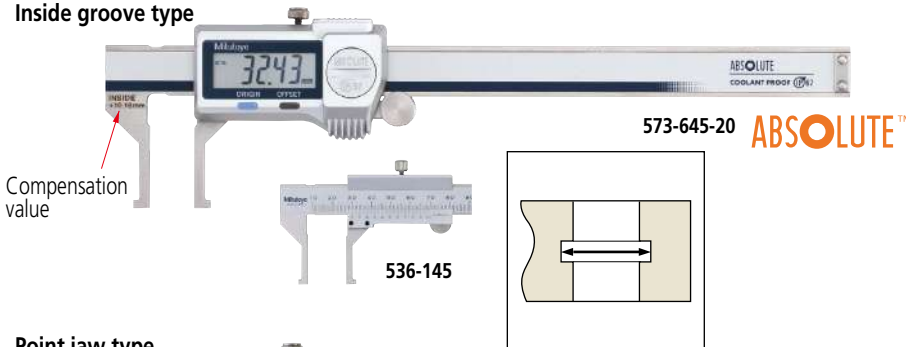
MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Dedicated caliper for inside measurement.
- Digimatic models are IP67 Absolute type. Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Digimatic models **573-645-20** and **573-646-20** need the compensation value (engraved on the fixed jaw) added to the displayed value for correct measurement. However, the featured Offset function enables this to be done easily just by pressing the OFFSET button after the jaws are brought together and the ORIGIN button is pressed.

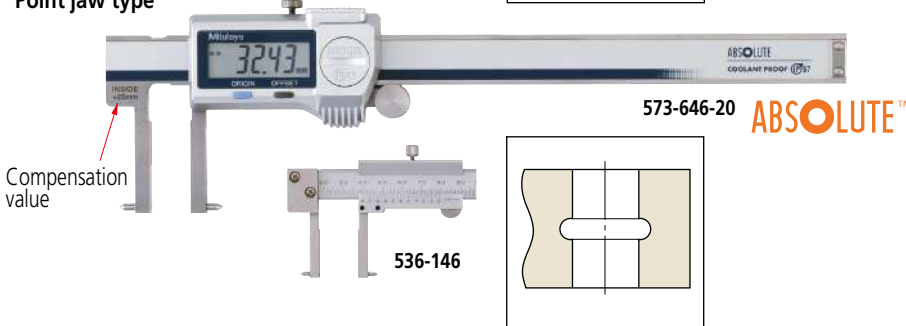
Knife-edge type



Inside groove type



Point jaw type



SPECIFICATIONS

| Metric | Digimatic model | | |
|----------------------|-----------------|---------------|-------------------------------------|
| Order No. | Range (mm) | Accuracy (mm) | Remarks |
| 573-642-20 | 10 - 200 | ±0.05 | Knife-edge type, Measurable min. |
| 573-643-20 *1 | 10 - 200 | ±0.05 | Knife-edge type, Measurable min. |
| 573-645-20 *2 | 10.1 - 160 | ±0.05 | Inside groove type, Measurable min. |
| 573-647-20 *1 | 10.1 - 160 | ±0.05 | Inside groove type, Measurable min. |
| 573-646-20 *2 | 20.1 - 170 | ±0.05 | Point jaw type, Measurable min. |
| 573-648-20 *1 | 20.1 - 170 | ±0.05 | Point jaw type, Measurable min. |

*1 Without thumb roller

*2 Includes the offsetting function, which indicates the actual measurement value.

| Metric | Analog model | | |
|----------------|--------------|---------------|-------------------------------------|
| Order No. | Range (mm) | Accuracy (mm) | Remarks |
| 536-142 | 10 - 200 | ±0.12 | Knife-edge type, Measurable min. |
| 536-145 | 10.1 - 150 | ±0.05 | Inside groove type, Measurable min. |
| 536-146 | 20.1 - 150 | ±0.05 | Point jaw type, Measurable min. |
| 536-147 | 30.1 - 300 | ±0.08 | Point jaw type, Measurable min. |
| 536-148 | 70.1 - 450 | ±0.10 | Point jaw type, Measurable min. |
| 536-149 | 70.1 - 600 | ±0.12 | Point jaw type, Measurable min. |

| Inch / Metric | Digimatic model | | |
|---------------------|-----------------|---------------|-------------------------------------|
| Order No. | Range (in) | Accuracy (in) | Remarks |
| 573-742-20 | 0.4 - 8 | ±0.002 | Knife-edge type, Measurable min. |
| 573-745-20 * | 0.404 - 6.4 | ±0.002 | Inside groove type, Measurable min. |
| 573-746-20 * | 0.804 - 6.8 | ±0.002 | Point jaw type, Measurable min. |

* Includes the offsetting function, which indicates the actual measurement value.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution*1: 0.01 mm or 0.00005 in/0.01 mm
- Graduation*2: 0.05 mm
- Display*1: LCD
- Scale type*1: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed*1: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*1: Approx. 5 years under normal use
- Dust/Water protection level*1: IP67 (IEC 60529)*3
- *1 Digimatic models
- *2 Analog models
- *3 Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories for Digimatic Models

For details, refer to page A-27.

- Connecting cables for **IT/DP/MUX**
 - 05CZA624**: SPC cable with data button (1 m)
 - 05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
 - 06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
 - 02AZD790A**: SPC cable with data button (160 mm)
 - 02AZE140A**: SPC cable for foot switch

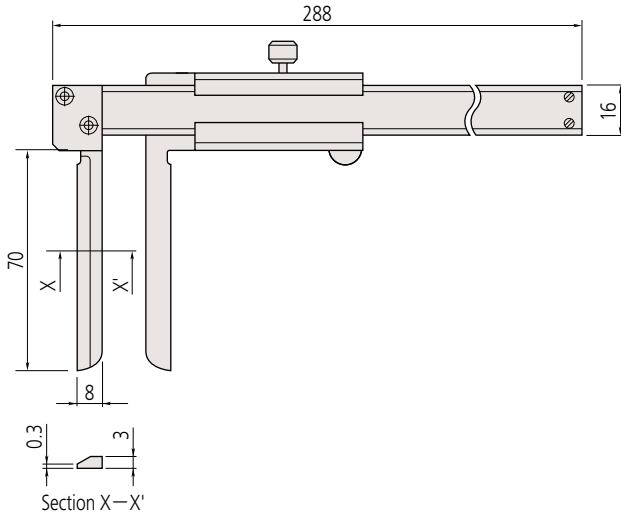
Wireless Data Output **U-WAVE**

- **U-WAVE-TC**: **264-620** (IP67 type)
- **264-621** (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
 - 264-624** (IP type)
 - 264-625** (Buzzer type)
- Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
 - 02AZF310** (IP67 type)
- Note: IP67 model is water/dust-proofed suitable for the factory floor.
- Buzzer type is not water/dust-proofed.
- Refer to pages A-16 and A-18 for details.
- Note: Cannot be used with **573-642-20**, **573-643-20** and **573-742-20**

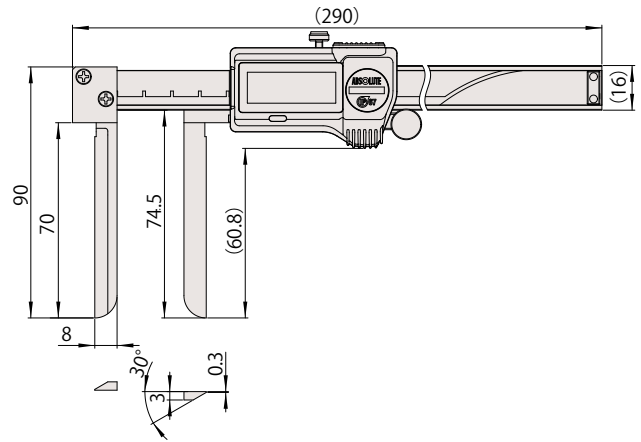
DIMENSIONS

Unit: mm

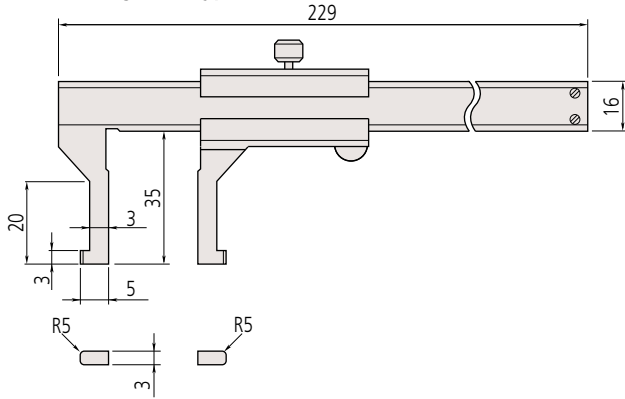
Knife-edge type: 536-142



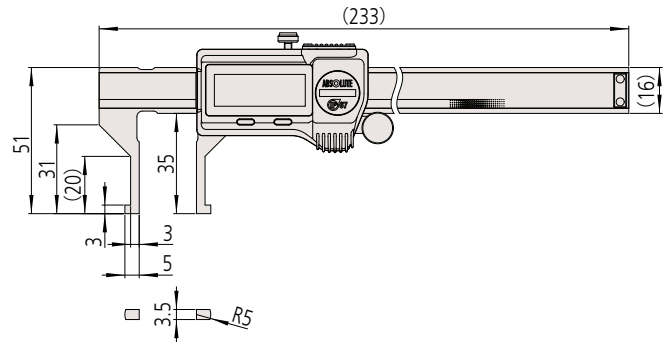
Knife-edge type: 573-642-20, 573-643-20, 573-742-20



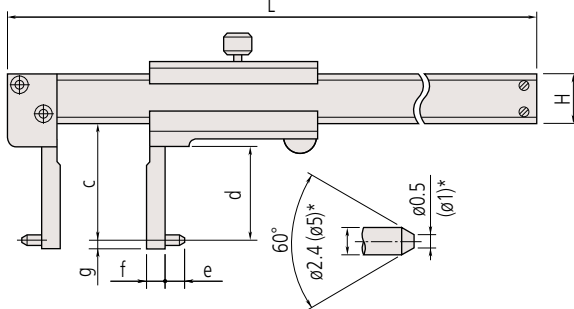
Inside groove type: 536-145



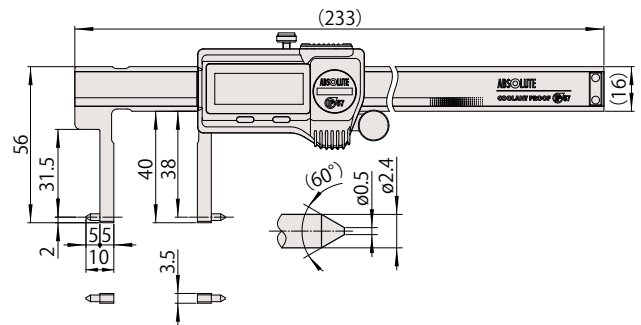
Inside groove type: 573-645-20, 573-647-20, 573-745-20



Point jaw type: 536-146, 147, 148, 149



Point jaw type: 573-646-20, 573-648-20, 573-746-20



*Applies to 536-148 or 149

| Range (mm) | c | d | e | f | g | H | L |
|------------|-----|-----|----|----|---|----|-----|
| 150 | 38 | 31 | 5 | 5 | 2 | 16 | 229 |
| 300 | 98 | 89 | 5 | 10 | 2 | 20 | 403 |
| 450 | 145 | 136 | 10 | 25 | 5 | 25 | 610 |
| 600 | 145 | 136 | 10 | 25 | 5 | 25 | 750 |

Note: Models with a measuring range of more than 300 mm have slightly different appearance. For details, contact our Customer Support Center.

D

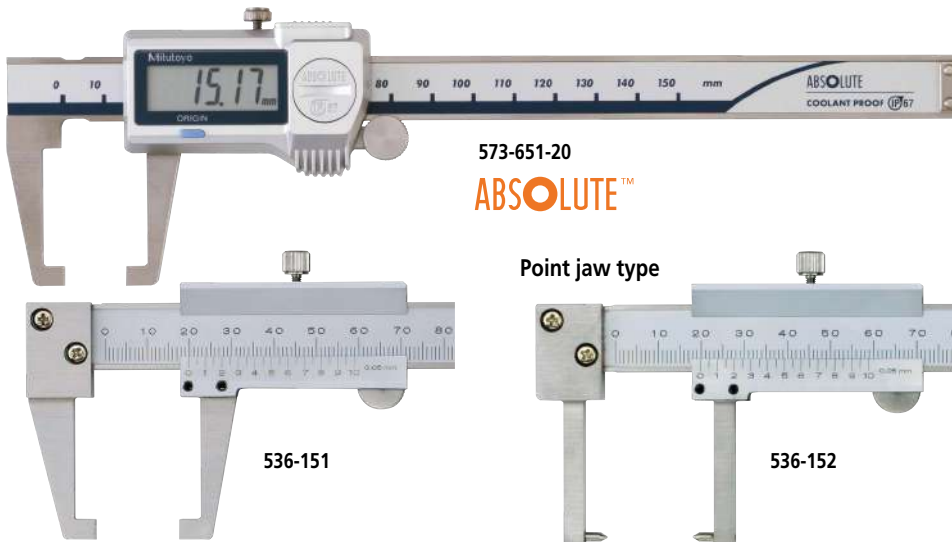
Calipers

An industry standard measuring tool

Neck Caliper SERIES 573, 536 — ABSOLUTE Digimatic and vernier types

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Can measure wall thickness inside bores and recesses.
- Digimatic models are an IP67 Absolute type. Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



SPECIFICATIONS

| Metric | Digimatic model | |
|----------------------------|-----------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-651-20 | 0 - 150 | ±0.03 |
| 573-652-20* ¹ | 0 - 150 | ±0.03 |
| 573-653-20* ² | 0 - 150 | ±0.03 |
| 573-654-20* ¹⁺² | 0 - 150 | ±0.03 |

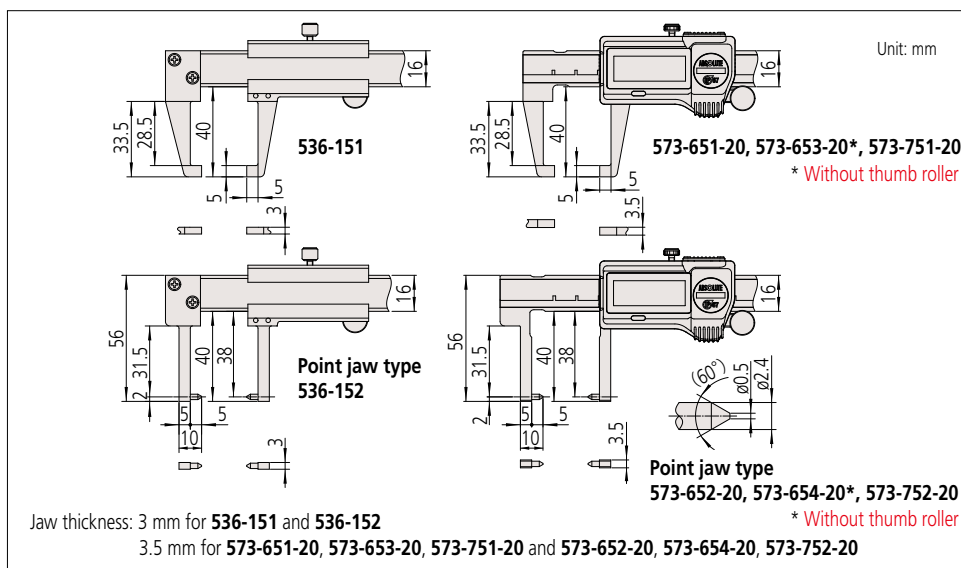
*1 Point jaw type

*2 Without thumb roller

| Metric | Analog model | |
|-----------|--------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 536-151 | 0 - 150 | ±0.05 |
| 536-152* | 0 - 150 | ±0.05 |

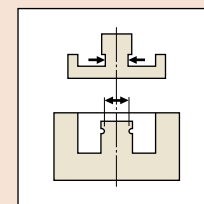
* Point jaw type

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
- Resolution*¹: 0.01 mm or 0.0005 in/0.01 mm
- Graduation*²: 0.05 mm
- Display*¹: LCD
- Scale type*¹: ABSOLUTE electromagnetic induction linear encoder
- Max. response speed*¹: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*¹: Approx. 5 years under normal use
- Dust/Water protection level*¹: IP67 (IEC 60529)*³
 - *1 Digimatic models
 - *2 Analog models
 - *3 Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories for Digimatic Models

For details, refer to page A-27.

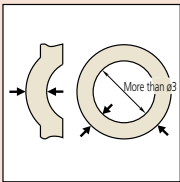
- Connecting cables for **IT/DP/MUX**
 - 05CZA624**: SPC cable with data button (1 m)
 - 05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
 - 02AZD790A**: SPC cable with data button (160 mm)
 - 02AZE140A**: SPC cable for foot switch

Wireless Data Output **u-WAVE[®] fit**

- **U-WAVE-TC: 264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
02AZF310 (IP67 type)
Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.



www.mitutoyo.com
ID 0000645042



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error for Digimatic models)
 - Resolution*¹: 0.01 mm or 0.0005 in/0.01 mm
 - Graduation*²: 0.05 mm
 - Display*¹: LCD
 - Scale type*¹: ABSOLUTE electromagnetic induction linear encoder
 - Max. response speed*¹: Unlimited
 - Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
 - Battery life*¹: Approx. 5 years under normal use
 - Dust/Water protection level*¹: IP67 (IEC 60529)*³
- *1 Digimatic models
*2 Analog models
*3 Rustproofing shall be applied after use if caliper was in contact with coolant.

Optional Accessories for Digimatic Models

For details, refer to page A-27.

- Connecting cables for **IT/DP/MUX**
- **05CZA624**: SPC cable with data button (1 m)
- **05CZA625**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
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Wireless Data Output **U-WAVE^{fit}**

- **U-WAVE-TC**: **264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
02AZF310 (IP67 type)
Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.

Tube Thickness Caliper SERIES 573, 536 — ABSOLUTE Digimatic and vernier types

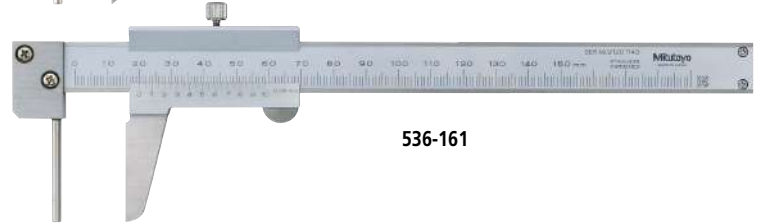
MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The beam-mounted jaw is a round bar that facilitates measurements of tube wall thickness.
- Digimatic models are IP67 Absolute type. Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



573-661-20

ABSOLUTE™



536-161

SPECIFICATIONS

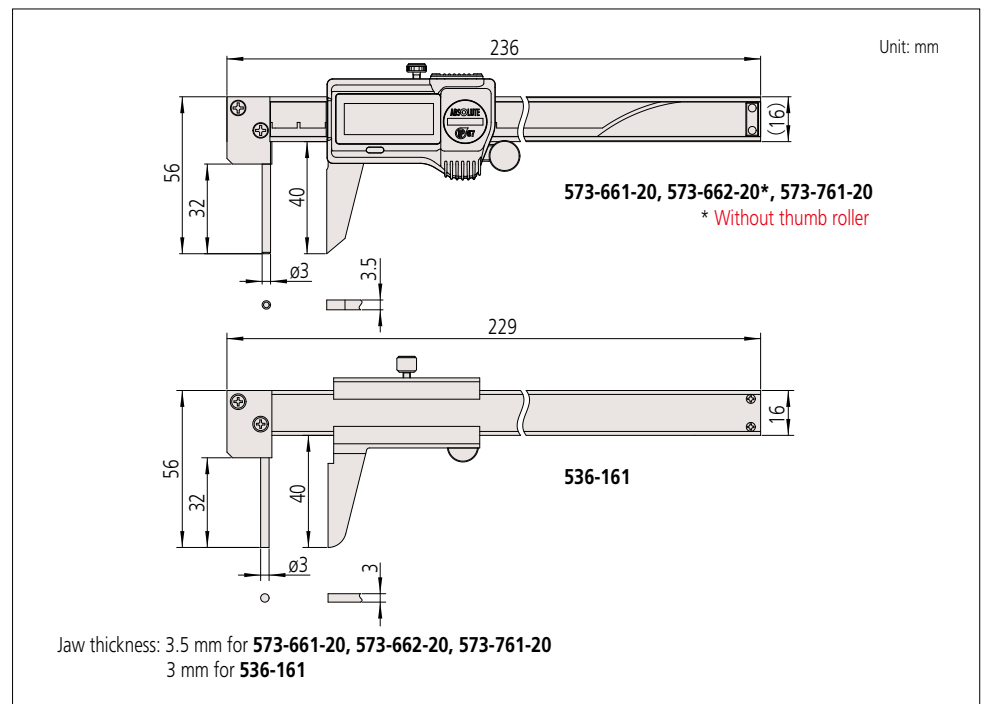
| Metric | Digimatic model | |
|--------------------|-----------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 573-661-20 | 0 - 150 | ±0.05 |
| 573-662-20* | 0 - 150 | ±0.05 |

* Without thumb roller

| Metric | Analog model | |
|----------------|--------------|---------------|
| Order No. | Range (mm) | Accuracy (mm) |
| 536-161 | 0 - 150 | ±0.05 |

| Inch / Metric | Digimatic model | |
|-------------------|-----------------|---------------|
| Order No. | Range (in) | Accuracy (in) |
| 573-761-20 | 0 - 6 | ±0.002 |

DIMENSIONS

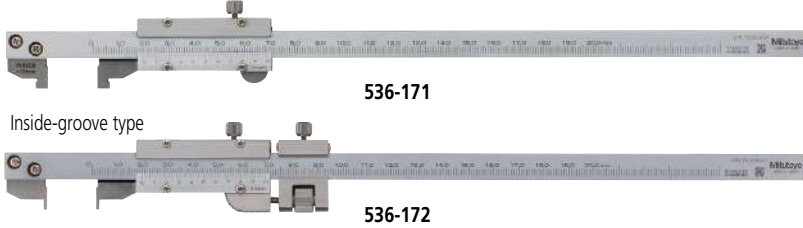


Calipers

An industry standard measuring tool

Hook Type Vernier Caliper SERIES 536

- Allows measurement of stepped inside diameter section of cylinders.
- **536-172** is equipped with a fine-adjustment wheel to enable precise feed and adjustment.



SPECIFICATIONS

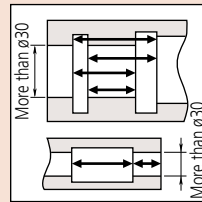
| Metric | | | | |
|----------------|----------------------|-----------------|---------------|----------------------|
| Order No. | Range (mm)* | Graduation (mm) | Accuracy (mm) | Remarks |
| 536-171 | 0 - 200 (10.1 - 200) | 0.02 | ±0.03 | — |
| 536-172 | 0 - 200 (2.1 - 200) | | ±0.03 | with fine adjustment |

* () : Dimension in inside measurement

DIMENSIONS

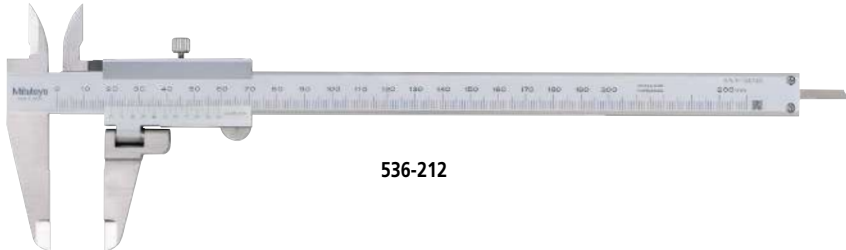
| Order No. | D | F | L | N | P | S | t | W |
|-------------------|----|------|-----|----|---|---|-----|----|
| 536-171 *1 | 12 | — | 320 | — | 5 | 4 | 3.5 | 28 |
| 536-172 *2 | — | 28.5 | — | 20 | 1 | | | |

Unit: mm
 *1 Inside measuring face is R5.
 *2 Inside measuring face is flat.



Swivel Vernier Caliper SERIES 536 — Moving Jaw type

- The moving jaw can be rotated to measure sectioned shafts.
- Allows step measurement.



SPECIFICATIONS

| Metric | | | | |
|----------------|------------|-----------------|---------------|----------------|
| Order No. | Range (mm) | Graduation (mm) | Accuracy (mm) | Remarks |
| 536-212 | 0 - 200 | 0.05 | ±0.05 | with depth bar |

DIMENSIONS

| Order No. | D | F | L | N | P | S | t | W |
|-------------------|----|------|-----|----|---|---|-----|----|
| 536-212 | 12 | — | 320 | — | 5 | 4 | 3.5 | 28 |
| 536-172 *2 | — | 28.5 | — | 20 | 1 | | | |

Unit: mm



Technical Explanation

Measurement procedure



A consistently low measuring force can be guaranteed by only taking measurements when the pointer is between the two fiducial lines.

Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Display: LCD
- Scale type: ABSOLUTE electromagnetic inductive linear encoder
- Jaw retraction: 0.3 mm
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 3.5 years under normal use

Optional Accessories

For details, refer to page A-27.

- **959143**: Data hold unit
- Connecting cables for **IT/DP/MUX**
 - **959149**: SPC cable with data button (1 m)
 - **959150**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380C**: SPC cable for **USB-ITN-C** (2 m)
- Connecting cables for **U-WAVE-T**
 - **02AZD790A**: SPC cable with data button (160 mm)
 - **02AZE140A**: SPC cable for foot switch

Wireless Data Output U-WAVE™

- **U-WAVE-TC**: **264-620** (IP67 type)
264-621 (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth® U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)

Refer to page A-15 for details.

- Connecting unit for **U-WAVE-TC/TCB**
02AZF300 (Buzzer type)

Note: IP67 model is water/dust-proofed suitable for the factory floor.

Buzzer type is not water/dust-proofed. Refer to pages A-16 and A-18 for details.

ABSOLUTE Low Force Caliper SERIES 573

- An ABSOLUTE electromagnetic induction linear encoder system is incorporated.
- Enables accurate measurement of plastic parts and other workpieces that are difficult to measure with conventional calipers due to deformation.
- Allows fine feeding easily by using thumb roller.
- Displacement of main scale jaw is 0.3 mm.
- Measuring force: 0.5 N to 1.0 N
- Absolute type. (Refer to page D-6 for a description of Absolute measurement.) Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)



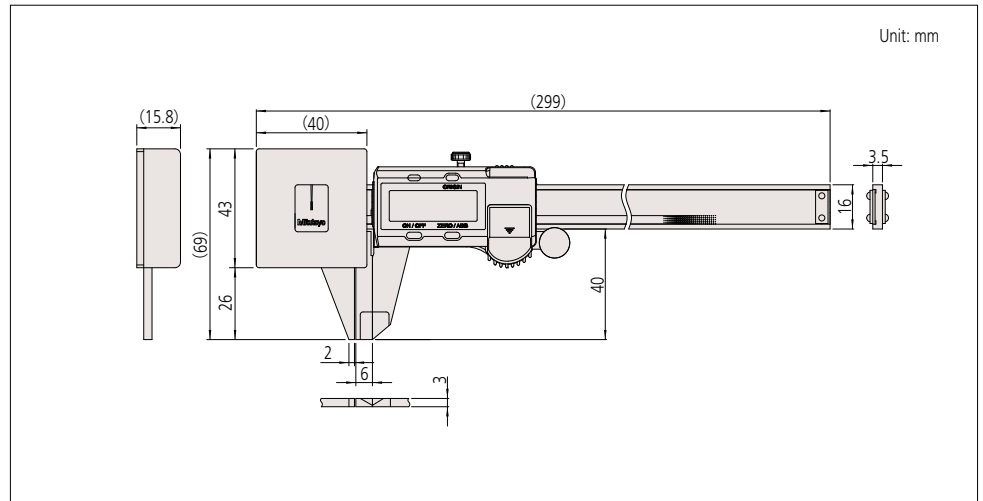
SPECIFICATIONS

| Metric | | |
|-------------------|------------|----------------|
| Order No. | Range (mm) | Accuracy (mm)* |
| 573-191-30 | 0 - 180 | ±0.05 |

| Inch / Metric | | |
|-------------------|------------|----------------|
| Order No. | Range (in) | Accuracy (in)* |
| 573-291-30 | 0 - 7 | ±0.002 |

* Excluding quantizing error.
Note: Dedicated for outside measurement (depth bar is not fitted).

DIMENSIONS



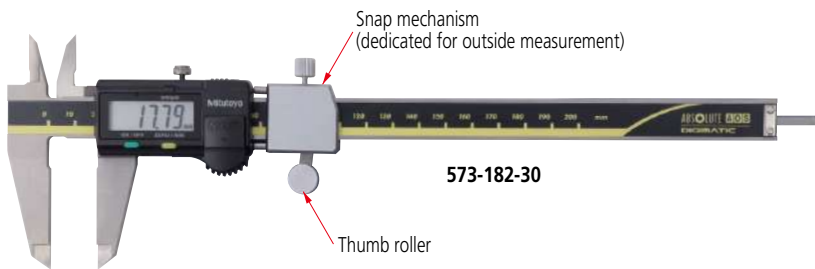
Calipers

An industry standard measuring tool

ABSOLUTE Snap Caliper SERIES 573

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- An ABSOLUTE electromagnetic induction linear encoder system is incorporated.
- Snap mechanism allows continuous and easy measurement without moving the slider by using the lever.
- Allows efficient continuous measurement of workpieces during acceptance inspection or mass production.
- Allows step measurement
- Displacement of snap part is 2 mm.
- Measuring force: 7 N to 14 N
- Absolute type. (Refer to page D-6 for details on the Absolute function.)
- Slider action is smooth, firm and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)

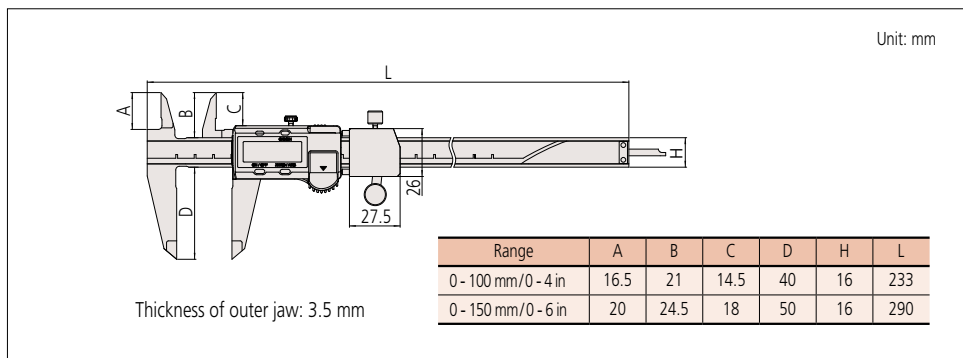


SPECIFICATIONS

| Metric | | | Inch / Metric | | |
|------------|------------|----------------|---------------|------------|----------------|
| Order No. | Range (mm) | Accuracy (mm)* | Order No. | Range (in) | Accuracy (in)* |
| 573-181-30 | 0 - 100 | ±0.02 | 573-281-30 | 0 - 4 | ±0.001 |
| 573-182-30 | 0 - 150 | ±0.02 | 573-282-30 | 0 - 6 | ±0.001 |

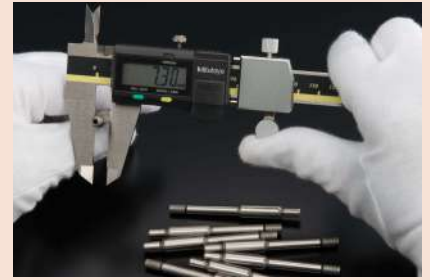
* Excluding quantizing error.
Note: Dedicated for outside measurement (depth bar is not fitted).

DIMENSIONS



Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE[™]



Technical Data

- Accuracy: Refer to the list of specifications. (excluding quantizing error)
- Resolution: 0.01 mm or 0.0005 in/0.01 mm
- Repeatability: 0.01 mm
- Display: LCD
- Scale type: ABSOLUTE electromagnetic inductive linear encoder
- Jaw retraction: 2 mm
- Max. response speed: Unlimited
- Battery: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life: Approx. 3.5 years under normal use

Optional Accessories

For details, refer to page A-27.

- **959143**: Data hold unit
- Connecting cables for **IT / DP / MUX**
- **959149**: SPC cable with data button (1 m)
- **959150**: SPC cable with data button (2 m)
- USB Input Tool Direct
- **06AFM380C**: SPC cable for **USB-ITN-C** (2 m)
- Connecting cables for **U-WAVE-T**
- **02AZD790C**: SPC cable with data button (160 mm)
- **02AZE140C**: SPC cable for foot switch

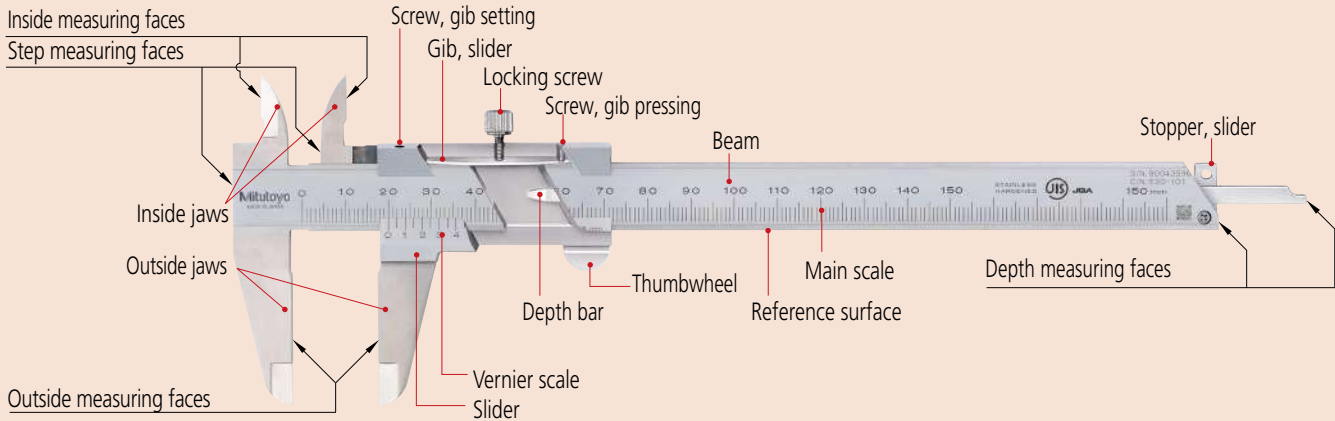
Wireless Data Output **U-WAVE^{fit}**

- **U-WAVE-TC: 264-620** (IP67 type)
- **264-621** (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth[®] U-WAVE)**
- **264-624** (IP type)
- **264-625** (Buzzer type)
- Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB: 02AZF300** (Buzzer type)
- Note: IP67 model is water/dust-proofed suitable for the factory floor.
- Buzzer type is not water/dust-proofed.
- Refer to pages A-16 and A-18 for details.

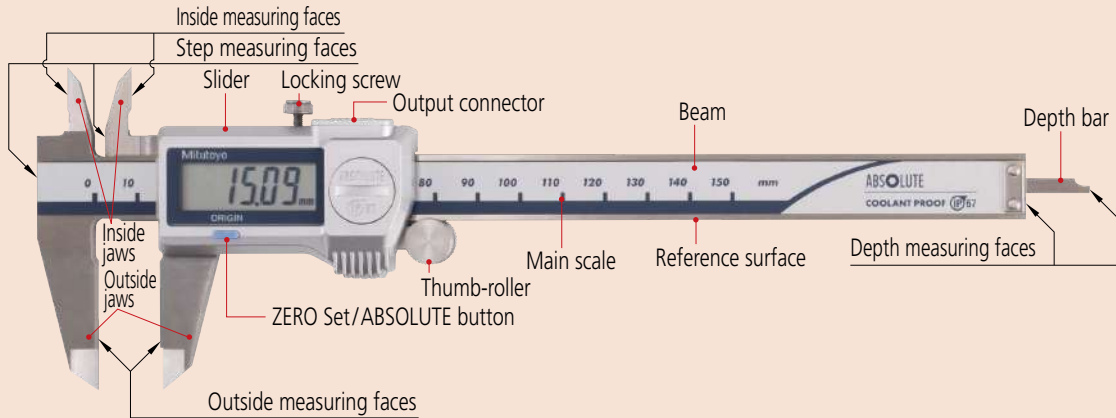
Quick Guide to Precision Measuring Instruments Calipers

Nomenclature

Vernier Caliper

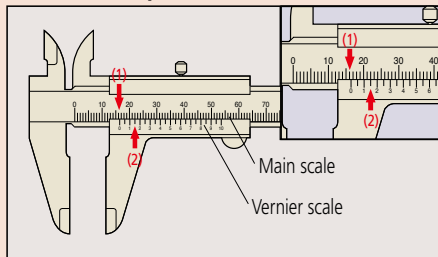


Absolute Digimatic Caliper



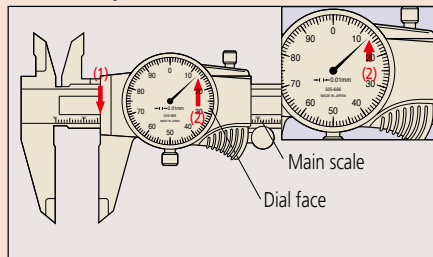
How to Read the Scale

• Vernier Calipers



| | |
|-------------------|-----------------|
| Graduation | 0.05 mm |
| (1) Main scale | 16 mm |
| (2) Vernier | 0.15 mm |
| Reading | 16.15 mm |

• Dial Calipers



| | |
|-------------------|-----------------|
| Graduation | 0.01 mm |
| (1) Main scale | 16 mm |
| (2) Dial face | 0.13 mm |
| Reading | 16.13 mm |

Note: Above left, 0.15 mm (2) is read at the position where a main scale graduation line corresponds with a vernier graduation line.

Measurement examples

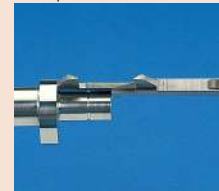
1. Outside measurement



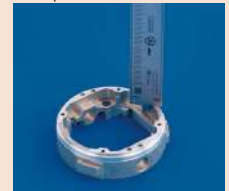
2. Inside measurement



3. Step measurement

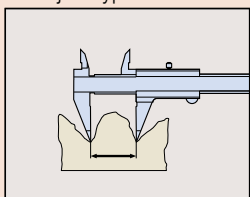


4. Depth measurement



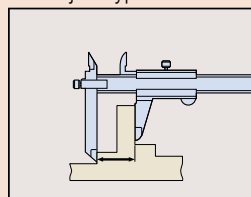
Special Purpose Caliper Applications

Point jaw type



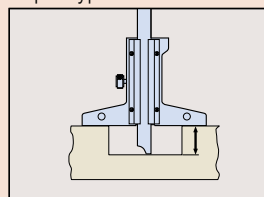
For uneven surface measurement

Offset jaw type



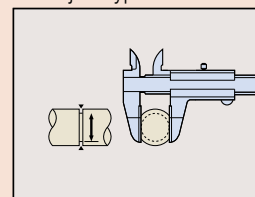
For stepped feature measurement

Depth type



For depth measurement

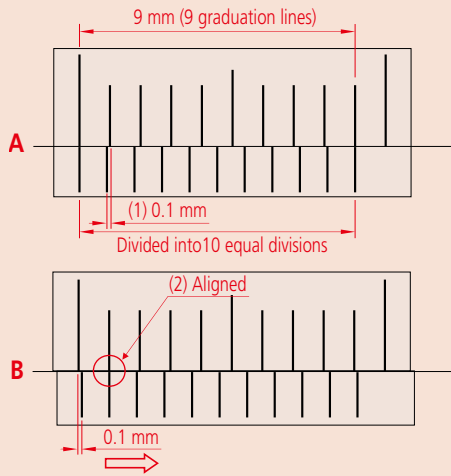
Blade jaw type



For diameter of narrow groove measurement

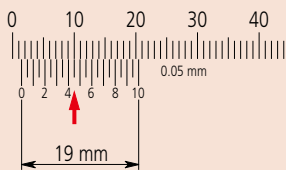
Vernier scale

This is a short auxiliary scale that enables accurate interpolation between the divisions of a longer scale without using mechanical magnification. The principle of operation is that each vernier scale division is slightly smaller than a main scale division, so that successive vernier graduations successively coincide with main scale graduations as one is moved relative to the other. Specifically, n divisions on a vernier scale are the same length as $n-1$ divisions on the main scale it works with, and n defines the division (or interpolation) ratio. Although n may be any number, in practice it is typically 10, 20, 25, etc., so that the division is a useful decimal fraction. The example below is for $n = 10$. The main scale is graduated in mm, and so the vernier scale is 9 mm (10 divisions) long, the same as 9 mm (9 divisions) on the main scale. This produces a difference in length of 0.1 mm (1) as shown in figure A (the 1st vernier graduation is aligned with the first main scale graduation). If the vernier scale is slid 0.1 mm to the right as shown in figure B, the 2nd graduation line on the vernier scale moves into alignment with the 2nd line on the main scale (2), and so enables easy reading of the 0.1 mm displacement.



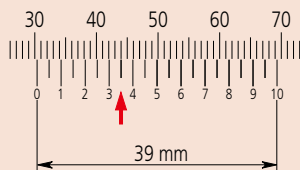
Some early calipers divided 19 divisions on the main scale by 20 vernier divisions to provide 0.05 mm resolution. However, the closely spaced lines proved difficult to read and so, since the 1970s, a long vernier scale that uses 39 main scale divisions to spread the lines is generally used instead, as shown below.

• 19 mm Vernier scale



Scale reading 1.45 mm

• 39 mm vernier scale (long vernier scale)



Scale reading 30.35 mm

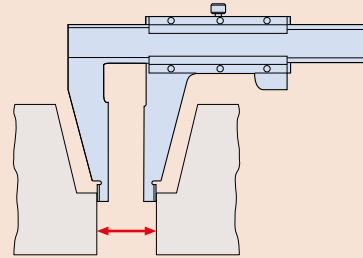
Calipers were made that gave an even finer resolution of 0.02 mm. These required a 49-division vernier scale dividing 50 main scale divisions. However, they were difficult to read and are now hard to find since Digital calipers with an easily read display and resolution of 0.01 mm appeared.

About Long Calipers

Steel rules are commonly used to roughly measure large workpieces but if a little more accuracy is needed then a long caliper is suitable for the job. A long caliper is very convenient for its user friendliness but does require some care in use. In the first place it is important to realize there is no relationship between resolution and accuracy. For details, refer to the values in our catalog.

Resolution is constant whereas the accuracy obtainable varies dramatically according to how the caliper is used.

The measuring method with this instrument is a concern since distortion of the main beam causes a large amount of the measurement error, so accuracy will vary greatly depending on the method used for supporting the caliper at the time. Also, be careful not to use too much measuring force when using the outside measuring faces as they are furthest away from the main beam so errors will be at a maximum here. This precaution is also necessary when using the tips of the outside measuring faces of a long-jaw caliper.



Small hole measurement with an M-type caliper

A structural error d occurs when you measure the internal diameter of a small hole.

$\varnothing D$: True internal diameter

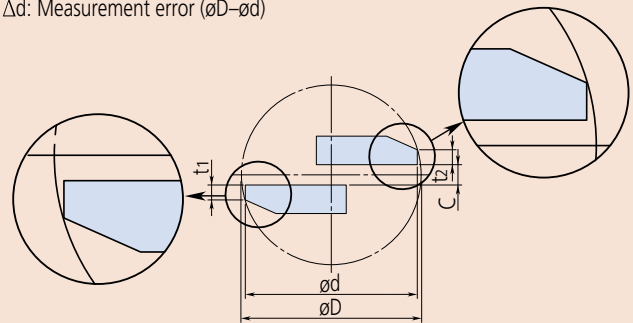
$\varnothing d$: Measured diameter

t_1, t_2 : Thickness of the inside jaw

C : Distance between the inside jaws

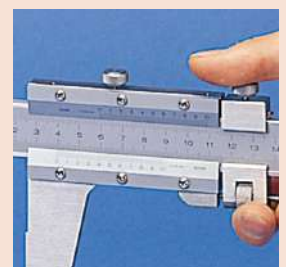
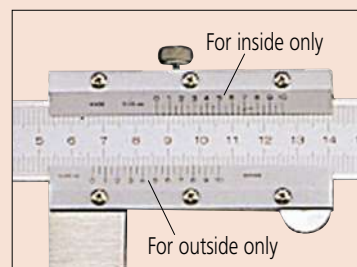
Δd : Measurement error ($\varnothing D - \varnothing d$)

| True internal diameter ($\varnothing D$: 5 mm) Unit: mm | 0.3 | 0.5 | 0.7 |
|---|-------|-------|-------|
| t_1+t_2+C | 0.3 | 0.5 | 0.7 |
| Δd | 0.009 | 0.026 | 0.047 |



Inside Measurement with a CM-type Caliper

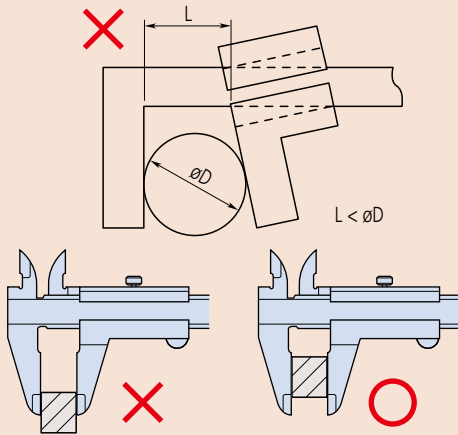
Because the inside measuring faces of a CM-type caliper are at the tips of the jaws the measuring face parallelism is heavily affected by measuring force, and this becomes a large factor in the measurement accuracy attainable. In contrast to an M-type caliper, a CM-type caliper cannot measure a very small hole diameter because it is limited to the size of the stepped jaws, although normally this is no inconvenience as it would be unusual to have to measure a very small hole with this type of caliper. Of course, the radius of curvature on the inside measuring faces is always small enough to allow correct hole diameter measurements right down to the lowest limit (jaw closure). Mitutoyo CM-type calipers are provided with an extra scale on the slider for inside measurements so they can be read directly without the need for calculation, just as for an outside measurement. This useful feature eliminates the possibility of error that occurs when having to add the inside-jaw-thickness correction on a single-scale caliper.



General notes on use of the caliper

1. Potential causes of error

A variety of factors can cause errors when measuring with a caliper. Major factors include parallax effects, excessive measuring force due to the fact that a caliper does not conform to Abbe's Principle, differential thermal expansion due to a temperature difference between the caliper and workpiece, and the effect of the thickness of the knife-edge jaws and the clearance between these jaws during measurement of the diameter of a small hole. Although there are also other error factors such as graduation accuracy, reference edge straightness, main scale flatness on the main blade, and squareness of the jaws, these factors are included within the $EMPE$ error tolerances. Therefore, these factors do not cause problems as long as the caliper satisfies the $EMPE$ error tolerances. Handling notes have been added to the JIS so that consumers can appreciate the error factors caused by the structure of the caliper before use. These notes relate to the measuring force and stipulate that "as the caliper does not have a constant-force device, you must measure a workpiece with an appropriate even measuring force. Take extra care when you measure it with the root or tip of the jaw because a large error could occur in such cases."



2. Inside measurement

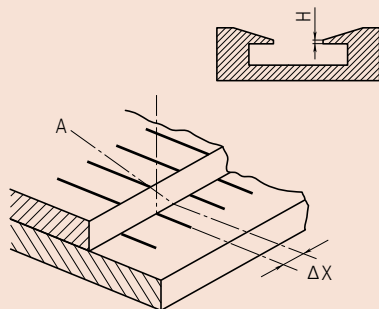
Insert the inside jaw as deeply as possible before measurement.
Read the maximum indicated value during inside measurement.
Read the minimum indicated value during groove width measurement.

3. Depth measurement

Read the minimum indicated value during depth measurement.

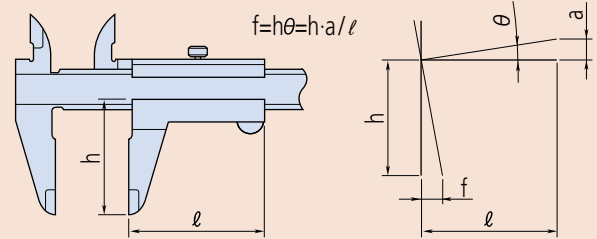
4. Parallax error when reading the scales

Look straight at the vernier graduation line when checking the alignment of vernier graduation lines to the main scale graduation lines.
If you look at a vernier graduation line from an oblique direction (A), the apparent alignment position is distorted by ΔX as shown in the figure below due to a parallax effect caused by the step height (H) between the planes of the vernier graduations and the main scale graduations, resulting in a reading error of the measured value. To avoid this error, the JIS stipulates that the step height should be no more than 0.3 mm.



5. Moving Jaw Tilt Error

If the moving jaw becomes tilted out of parallel with the fixed jaw, either through excessive force being used on the slider or lack of straightness in the reference edge of the beam, a measurement error will occur as shown in the figure. This error may be substantial due to the fact that a caliper does not conform to Abbe's Principle.



Example: Assume that the error slope of the jaws due to tilt of the slider is 0.01 mm in 50 mm and the outside measuring jaws are 40 mm deep, then the error (at the jaw tip) is calculated as $(40/50) \times 0.01 \text{ mm} = 0.008 \text{ mm}$.
If the guide face is worn then an error may be present even using the correct measuring force.

6. Relationship between measurement and temperature

The main scale of a caliper is engraved (or mounted on) stainless steel, and although the linear thermal expansion coefficient is equal to that of the most common workpiece material, steel, i.e. $(10.2 \pm 1) \times 10^{-6} / \text{K}$, note that other workpiece materials, the room temperature and the workpiece temperature may affect measurement accuracy.

7. Handling

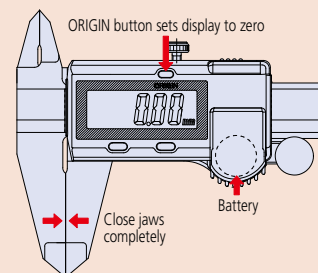
Caliper jaws are sharp, and therefore the instrument must be handled with care to avoid personal injury.
Avoid damaging the scale of a digital caliper and do not engrave an identification number or other information on it with an electric marker pen.
Avoid damaging a caliper by subjecting it to impact with hard objects or by dropping it on a bench or the floor.

8. Maintenance of beam sliding surfaces and measuring faces

Wipe away dust and dirt from the sliding surfaces and measuring faces with a dry soft cloth before using the caliper.

9. Checking and setting the origin before use

Clean the measuring surfaces by gripping a sheet of clean paper between the outside jaws and then slowly pulling it out. Close the jaws and ensure that the vernier scale (or display) reads zero before using the caliper. When using a Digimatic caliper, reset the origin (ORIGIN button) after replacing the battery.



10. Handling after use

After using the caliper, completely wipe off any water and oil. Then, lightly apply anti-corrosion oil and let it dry before storage.
Wipe off water from a waterproof caliper as well because it may also rust.

11. Notes on storage

Avoid direct sunlight, high temperatures, low temperatures, and high humidity during storage.
If a digital caliper will not be used for more than three months, remove the battery before storage.
Do not leave the jaws of a caliper completely closed during storage.

Performance evaluation method for the caliper

JIS B 7507 was revised and issued in 2016 as the Japanese Industrial Standards of the caliper, and the "Instrumental error" indicating the indication error of the caliper has been changed to "Maximum Permissible Error (MPE) of indication".

The "Instrumental error" of the old JIS adopts acceptance criteria that the specification range (precision specification) equals acceptance range, and the OK/NG judgment does not include measurement uncertainty. (Fig. 1)

The "Maximum Permissible Error (MPE) of indication" of the new JIS adopts the basic concept of the OK/NG judgment taking into account the uncertainty adopted in the ISO standard (ISO 14253-1).

The verification of conformity and nonconformity to the specifications is clearly stipulated to use the internationally recognized acceptance criteria (simple acceptance) when the specification range equals the acceptance range, and it is accepted that the specification range equals the acceptance range if a given condition considering uncertainty is met.

In this case, the internationally recognized acceptance criterion is ISO/TR 14253-6: 2012. (Fig. 2)

The following describes the standard inspection method including the revised content of JIS 2016.

Fig. 1 Old JIS Instrumental error
JIS B 7507-1993

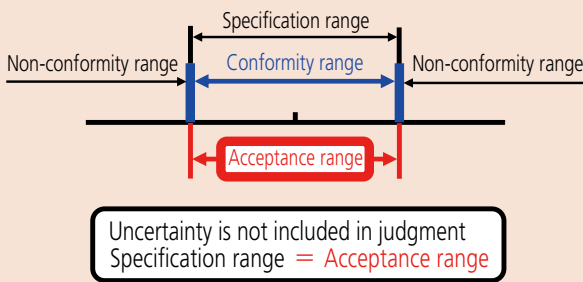
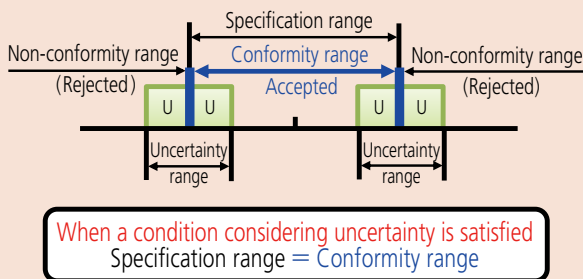


Fig. 2 New JIS Maximum Permissible Error (MPE)
JIS B 7507: 2016 (ISO/TR 14253-6: 2012)



Maximum Permissible Error of partial measuring surface contact error E_{MPE} [JIS B 7507: 2016]

The partial measuring surface contact error of a caliper is an indication error applied to outside measurement.

Table 1 shows the Maximum Permissible Error E_{MPE} for various measuring ranges and graduation/resolution of a caliper.

The value can be obtained by inserting a gauge block (or an equivalent standard) between the outside measuring surfaces (Fig. 3), measuring it at arbitrary positions between the jaws and then subtracting the dimension of the gauge from the maximum or minimum indicated value.

Scale Shift Error S_{MPE} [JIS B 7507: 2016]

The scale shift error in a caliper is an indication error of the inside measurement, depth measurement, etc., if measuring surfaces other than the outside measuring surfaces are used.

The Maximum Permissible Error S_{MPE} of the indication value for inside measurement is given in Table 1. The Maximum Permissible Error S_{MPE} of depth measurement is obtained by adding 0.02 mm to a value in Table 1. The indication error for inside measurement can be obtained by using gauge blocks (or equivalent standards) and standard jaws from an accessory set to form accurate inside dimensions for calibration (Fig. 4), with the error being given by the indicated value minus the gauge block size.

Unit: mm

| Measurement range | Scale interval, graduation or resolution | |
|-----------------------|--|-------|
| | 0.05 | 0.02 |
| 50 or less | ±0.05 | ±0.02 |
| Over 50, 100 or less | ±0.06 | ±0.03 |
| Over 100, 200 or less | ±0.07 | |
| Over 200, 300 or less | ±0.08 | ±0.04 |

Note: E_{MPE} includes the measurement error arising from the straightness, flatness and parallelism of the measuring surfaces.

Table 1: Maximum Permissible Error E_{MPE} of partial measuring surface contact error in a conventional caliper

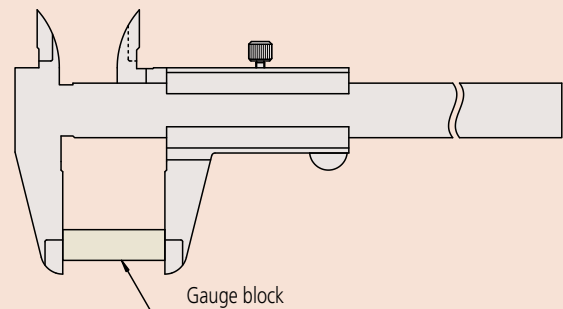


Fig. 3: Determining partial measuring surface contact error

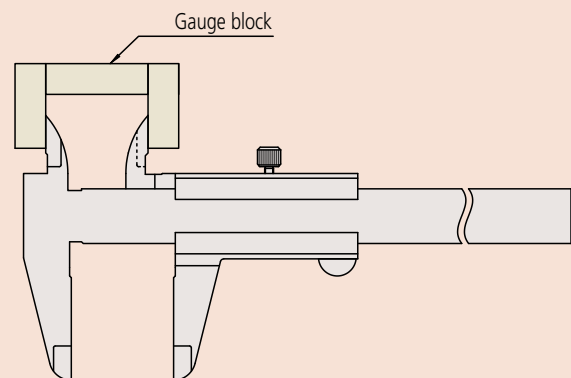


Fig. 4: Determining inside measurement indication error

The "Instrumental error" indicating the indication error of JIS has been changed to "Maximum Permissible Error (MPE) of indication" for the following three models:

- Vernier Caliper 530 SERIES — Standard model described on page D-9 (530-101 530-108 530-109)
- Vernier Caliper 532 SERIES — with fine adjustment described on page D-11 (All models)
- Vernier Caliper 531 SERIES — with thumb grip described on page D-11 (All models)

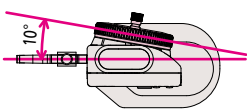
Height Gage

A standard measuring tool of industry

Digimatic Height Gage SERIES 192 — Multi-function Type with SPC Data Output

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Double-column structure ensures high measuring accuracy.
- Ergonomic base fits comfortably in the hand.
- A bidirectional touch-trigger probe is available as an optional accessory for **192-663-10, 192-664-10, 192-665-10, 192-670-10, 192-671-10, 192-672-10** and **192-673-10**.
- Better readability is provided thanks to display of measurement result with a large character height (11 mm) and high-contrast LCD.
- The drive handle is inclined to improve slider operability.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Battery: SR44 (1 pc), **938882**. For initial operational checks (standard accessory)
- Battery life is 3,500 hours in continuous use.
- **192-663-10, 192-664-10** and **192-665-10** are provided with a long scribe (overall length of 150 mm).
- For precision Black Granite Surface Plates, refer to page E-49.



192-663-10



192-613-10

SPECIFICATIONS

| Metric | | | | | | |
|------------|------------|-------------------------|--|----------------------------|-------------|-----------|
| Order No. | Range (mm) | Resolution (mm) | Maximum Permissible Error* (mm)/E _{MPE} | Max. response speed (mm/s) | Height (mm) | Mass (kg) |
| 192-663-10 | 0 - 300 | 0.01/0.005 (selectable) | ±0.02 | 500 | 510 | 5.7 |
| 192-664-10 | 0 - 600 | | ±0.04 | | 802 | 8.3 |
| 192-665-10 | 0 - 1000 | | ±0.06 | | 1228 | 15.7 |
| 192-613-10 | 0 - 300 | | ±0.02 | | 475 | 4.7 |
| 192-614-10 | 0 - 600 | | ±0.05 | | 802 | 8.3 |
| 192-615-10 | 0 - 1000 | ±0.07 | 1228 | 15.7 | | |

* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

| Inch/Metric | | | | | | |
|-------------|------------|-------------------------------|--|----------------------------|-------------|-----------|
| Order No. | Range (in) | Resolution | Maximum Permissible Error* (in)/E _{MPE} | Max. response speed (mm/s) | Height (mm) | Mass (kg) |
| 192-670-10 | 0 - 12 | 0.01 mm/0.005 mm (selectable) | ±0.001 | 500 | 510 | 5.7 |
| 192-671-10 | 0 - 18 | | ±0.0015 | | 649 | 7.5 |
| 192-672-10 | 0 - 24 | | ±0.0015 | | 802 | 8.3 |
| 192-673-10 | 0 - 40 | | ±0.0025 | | 1228 | 15.7 |
| 192-630-10 | 0 - 12 | | 0.0005 in/0.0002 in (selectable) | | ±0.001 | 475 |
| 192-631-10 | 0 - 18 | ±0.002 | 649 | 7.5 | | |
| 192-632-10 | 0 - 24 | ±0.002 | 802 | 8.3 | | |
| 192-633-10 | 0 - 40 | ±0.003 | 1228 | 15.7 | | |

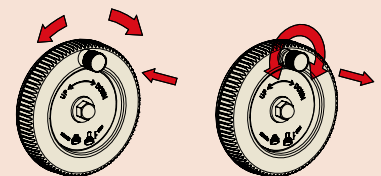
* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Functions

- Origin-setting (ABS measurement mode): Any arbitrary value can be stored as the origin point.
- Zero-setting (INC measurement mode): Displayed value can be set to zero at any arbitrary position of the slider.
- Origin restoration: Previously set origin is restored when switching back to ABS mode.
- Presetting (ABS INC measurement mode): Displayed value can be set to any arbitrary value, including negative values.
- Measuring direction: Measuring direction can be switched at the press of a button.
- Data hold: Display value can be held. Reverts to ABS or INC mode when cancelled.
- Alarm: Error message is displayed when overflow or overspeed of displayed value arises and measurement is stopped.
- Data output: Allows integration into statistical process control and measurement systems. (Refer to page A-3.)
- Fine and coarse height adjustment through knob and wheel combination. Slider height adjustment wheel allows fine and coarse height adjustment.



Coarse adjustment

Fine adjustment

Push the small fine-adjustment knob in to disengage gearing and then turn the large wheel.

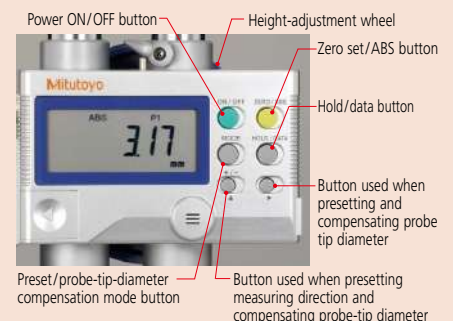
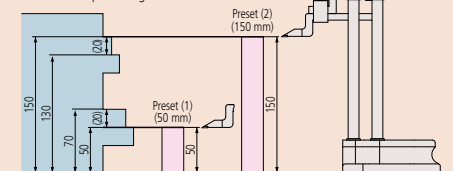
Pull the fine-adjustment knob out to engage gearing and then turn this knob, which then slowly turns the wheel.

- Low-voltage alert: When battery voltage becomes low, a warning appears in the display.
- Probe-tip diameter compensation: An adjustment is applied to the raw measurement data to compensate for the effect of the size of the spherical contact point used by the bidirectional touch-trigger probe.

Presetting (2 positions)

- With two preset functions, two reference heights can be used relative to a surface plate.

- **Example of preset (1)**
To measure a height of 70 mm, with a reference plane height of 50 mm
- **Example of preset (2)**
To measure a height of 130 mm, with a reference plane height of 150 mm

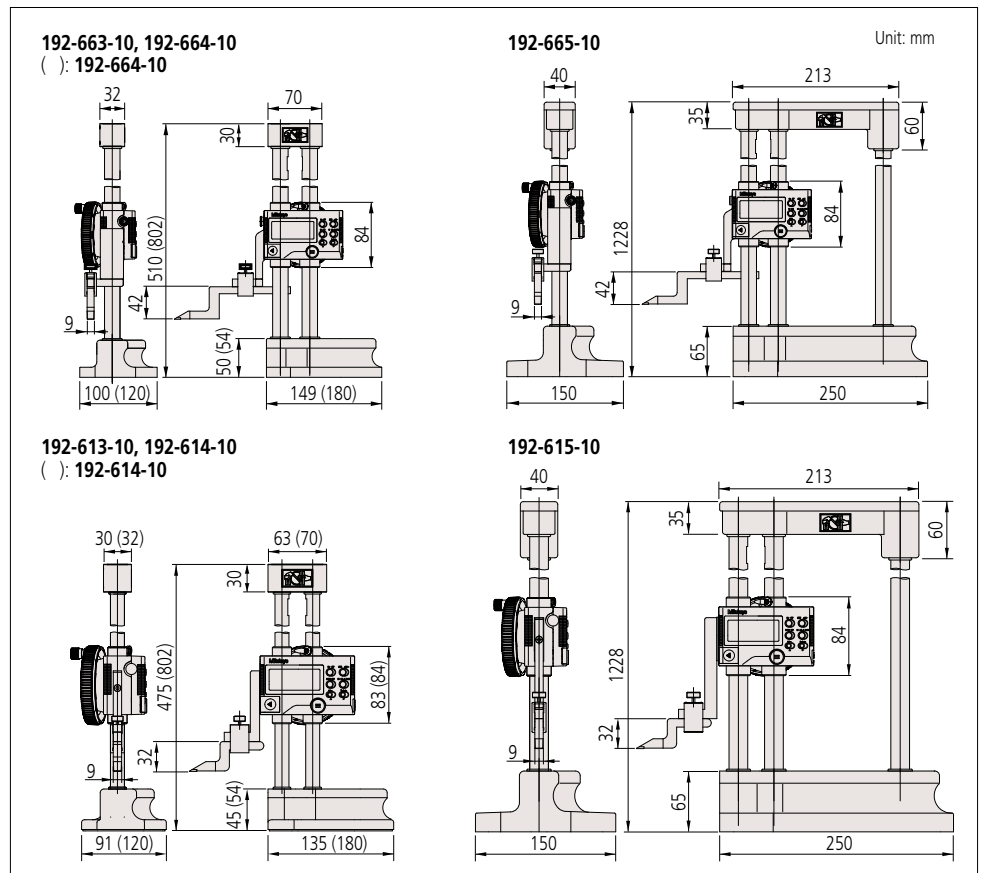


Note: Probe-tip-diameter compensation mode is a function provided for **192-663-10/192-664-10/192-665-10/192-670-10/192-671-10/192-672-10/192-673-10**.

Standard Accessories

- Scriber
192-663-10, 192-664-10,
192-665-10: 905200
192-613-10, 192-614-10,
192-615-10: 07GZA000
- Scriber clamp
05GZA033

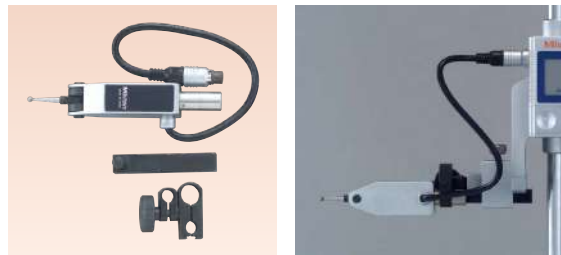
DIMENSIONS



Optional Accessory

• Bidirectional touch-trigger probe

Improves accuracy in step, internal thickness, and outside width measurement by minimizing reproducibility error. A bidirectional touch-trigger probe is available as an optional accessory for **192-663-10, 192-664-10, 192-665-10, 192-670-10, 192-671-10, 192-672-10** and **192-673-10**.



SPECIFICATIONS

| Metric | | | | | | | |
|-----------|---------------------|--------------------|-----------------------|-----------------|--------------------|---------------------|----------------------|
| Order No. | Measuring direction | Relay contact type | Probe overtravel (mm) | Probe size (mm) | Repeatability (μm) | Measuring force (N) | Standard accessories |
| 192-007 | Bidirectional | Normally Open | 1.5 | ø3 | σ: 2 | 0.4 | Holder arm, Clamp |

| Inch | | | | | | | |
|-----------|---------------------|--------------------|-----------------------|-----------------|--------------------|---------------------|----------------------|
| Order No. | Measuring direction | Relay contact type | Probe overtravel (mm) | Probe size (mm) | Repeatability (μm) | Measuring force (N) | Standard accessories |
| 192-008 | Bidirectional | Normally Open | 1.5 | ø3 | σ: 2 | 0.4 | Holder arm, Clamp |

For details of the connecting cable, refer to page A-27, and for the holder arm and clamp, refer to page F-75.

• Connecting cables for IT/DP/MUX

- 905338:** SPC cable (1 m)
- 905409:** SPC cable (2 m)



• USB Input Tool Direct

- 06AFM380F:** SPC cable for USB-ITN-F (2 m)

• Connecting cables for U-WAVE-T

- 02AZD790F:** SPC cable (160 mm)
- 02AZE140F:** SPC cable for foot switch

- **953638:** Holding bar*
- **902053:** Swivel clamp*

* A test indicator can be mounted on a height gage using a holding bar and clamp.

Height Gage

A standard measuring tool of industry

ABSOLUTE Digimatic Height Gage SERIES 570 — with Ergonomic Base

MeasurLink ENABLED

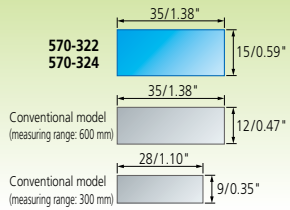
Data Management Software by Mitutoyo

- Allows smooth elevation by the slider adjustment wheel, which is the same as the well-established double-column structure height gage.
- Large slider-clamp lever ensures positive and accurate clamping action.
- High durability and high accuracy are ensured by an improved column design (35x15 mm).

- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Battery: SR44 (1 pc), **938882**. For initial operational checks (standard accessory)
- Battery life is 20,000 hours under normal use.
- For precision Black Granite Surface Plates, refer to page E-49.

Note: Do not hold the height gage by the column as this can affect the accuracy.

Dimensions of column cross section



- Character height of the LCD display is 10 mm.
- Ergonomic and stylish base fits comfortably in the hand.
- Due to the built-in ABSOLUTE scale function, origin setting is not required each time power is turned ON.



SPECIFICATIONS

Metric

| Order No. | Range (mm) | Resolution (mm) | Maximum Permissible Error* (mm)/EMPE | Max. response speed | Mass (kg) |
|----------------|------------|-----------------|--------------------------------------|---------------------|-----------|
| 570-322 | 0 - 300 | 0.01 | ±0.03 | Unlimited | 4.6 |
| 570-324 | 0 - 600 | | ±0.05 | | 6.4 |

* Maximum Permissible Error, EMPE, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

Inch/Metric

| Order No. | Range (in) | Resolution | Maximum Permissible Error* (in)/EMPE | Max. response speed | Mass (kg) |
|----------------|------------|-------------------|--------------------------------------|---------------------|-----------|
| 570-312 | 0 - 12 | 0.0005 in/0.01 mm | ±0.0015 | Unlimited | 4.6 |
| 570-313 | 0 - 18 | | ±0.002 | | 5.9 |
| 570-314 | 0 - 24 | | ±0.002 | | 6.4 |

* Maximum Permissible Error, EMPE, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™

Functions

- Origin-setting: Any convenient reference surface, such as a surface plate, etc., can be stored as the absolute origin point.
- Absolute measurement: After power is turned ON, measurement can be started without zero-setting if origin-setting was previously performed. Absolute origin position can be changed by ORIGIN button.
- Incremental measurement: Allows origin setting at any arbitrary position. In this case, the origin point is not stored after turning off the power.
- Data hold: Display value can be held.
- Data output: Allows integration into statistical process control and measurement systems. (Refer to page A-3.)
- Low-voltage alert: Low-voltage alert: If the battery voltage becomes low, a "B" appears in the display to alert the user before measurement is no longer possible so that the battery can be changed in good time.

Standard Accessories

For **570-322, 324**

07GZA000 Scriber

05GZA033 Scriber clamp

For **570-312** and **570-313, 570-314**

900258 Scriber

901385 Scriber clamp

05GZA033



07GZA000

(Refer to page F-75 for details)



Optional Accessories

For details, refer to page A-25.

- Connecting cables for **IT/DP/MUX**

905338: SPC cable with data button (1 m)

905409: SPC cable with data button (2 m)

- USB Input Tool Direct

06AFM380F: SPC cable for **USB-ITN-F** (2 m)

- Connecting cables for **U-WAVE-T**

02AZD790F: SPC cable with data button (160 mm)

02AZE140F: SPC cable for foot switch



Slider height adjustment wheel

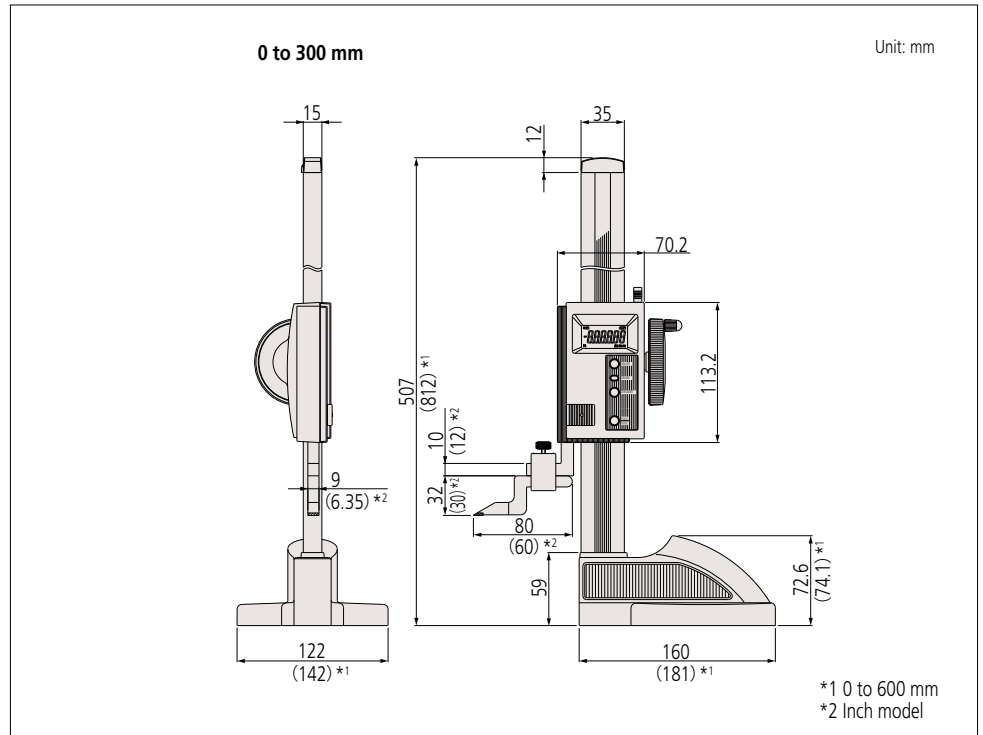


Large clamp lever



Base that fits the hand comfortably

DIMENSIONS



Height Gage

A standard measuring tool of industry

ABSOLUTE Digimatic Height Gage SERIES 570 — Standard model

MeasurLink ENABLED

Data Management Software by Mitutoyo

- ABS and INC measurement modes allow efficient operation.
- Rigid structure makes instrument suitable for use in severe work environments.
- The +/- measurement function widens the application range.
- Allows integration into statistical process control and measurement systems. (Refer to page A-3.)
- Battery: SR44 (1 pc), **938882**. For initial operational checks (standard accessory)
- Battery life is 5,000 hours under normal use.
- Carbide-tipped scriber (**900173** for **570-227** and **244**, and **905200** for **570-230** and **248**) is provided as a standard accessory. (Standard accessory: scriber clamp **901338** for **570-227** and **244**, and **05GZA033** for **570-230** and **248**)
- When a dial indicator or test indicator is used with **570-227** and **244**, the dedicated holding bar (**953639**, overall length 50 mm) is recommended for use. However, MPE (Maximum Permissible Error) may be larger because the measurement point is further from the beam.
- For precision Black Granite Surface Plates, refer to page E-49.



570-227

SPECIFICATIONS

Metric

| Order No. | Range (mm) | Resolution (mm) | Fine feed (mm) | Maximum Permissible Error* (mm)/ <i>E_{MPE}</i> | Height (mm) | Mass (kg) |
|----------------|------------|-----------------|----------------|---|-------------|-----------|
| 570-227 | 0 - 200 | 0.01 | 4 | ±0.03 | 355 | 1.4 |
| 570-230 | 0 - 1000 | | 6 | ±0.07 | 1260 | 16.8 |

* Maximum Permissible Error, *E_{MPE}*, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

Inch / Metric

| Order No. | Range (in) | Resolution | Fine feed (in) | Maximum Permissible Error* (in)/ <i>E_{MPE}</i> | Height (mm) | Mass (kg) |
|----------------|------------|-------------------|----------------|---|-------------|-----------|
| 570-244 | 0 - 8 | 0.0005 in/0.01 mm | 0.16 | ±0.002 | 355 | 1.4 |
| 570-248 | 0 - 40 | | 0.24 | ±0.003 | 1260 | 16.8 |

* Maximum Permissible Error, *E_{MPE}*, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

MeasurLink ENABLED

Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™

Functions

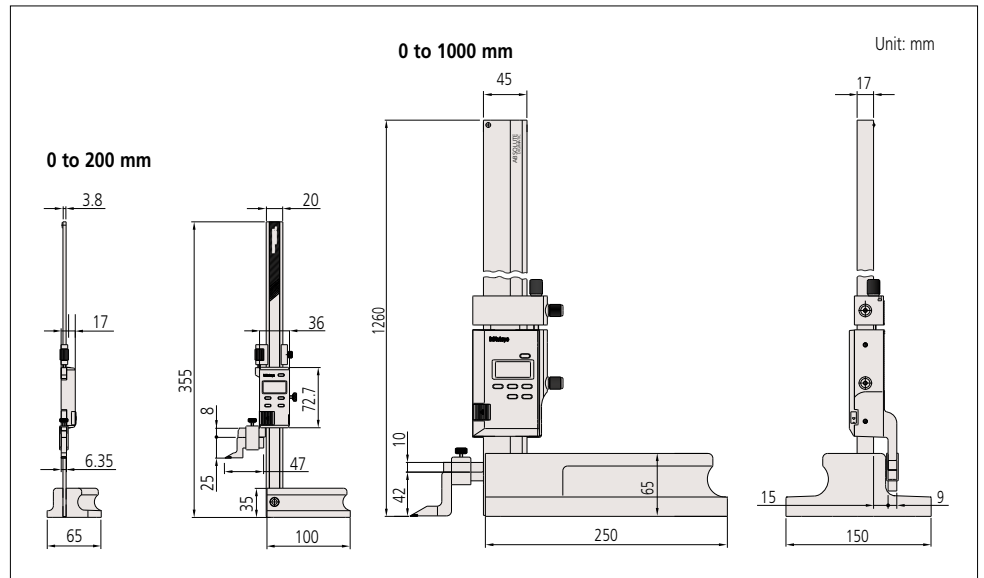
Zero-setting
 +/- directional measurement
 Data hold
 Data output
 Presetting
 inch/mm reading (inch/mm models)
 Preset value memory
 Origin restoration
 Low battery voltage alert
 Counting value composition error alert

Optional Accessories

For details, refer to page A-25.

- Connecting cables for **IT/DP/MUX**
905338: SPC cable with data button (1 m)
905409: SPC cable with data button (2 m)
- USB Input Tool Direct
06AFM380F: SPC cable for **USB-ITN-F** (2 m)
- Connecting cables for **U-WAVE-T**
02AZD790F: SPC cable with data button (160 mm)
02AZE140F: SPC cable for foot switch

DIMENSIONS



D

Height Gage

A standard measuring tool of industry

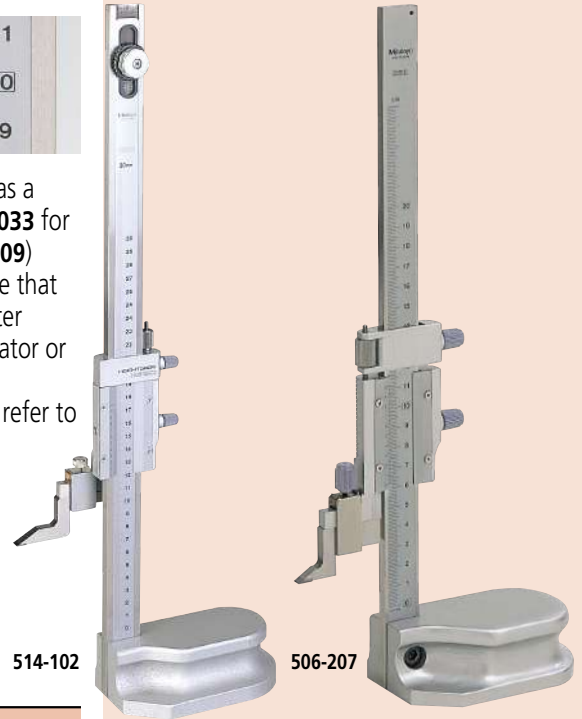
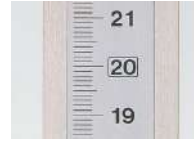
Vernier Height Gage

SERIES 514, 506 — Standard Height Gage with Adjustable Main Scale

- Fits comfortably in the hand and moves easily on the surface plate.
- The main scale slides and clamps within the column for quick and convenient zero-setting.
- Large locking knobs are used both for the slider and fine adjustment clamps to make clamping easy and secure.
- Operability of slider has been improved.



- Large main-scale engraving for fatigue-free working.
- Carbide-tipped scriber (07GZA000 for 514-102/104/106/103/105/107, 905200 for 514-108 and 109) is provided as a standard accessory. (Scriber clamp 05GZA033 for 514-102/104/106/108/103/105/107/109)
- It is important for personal safety to ensure that any height gage remains stable in use after attaching an accessory such as a test indicator or probe.
- For precision Black Granite Surface Plates, refer to page E-49.



SPECIFICATIONS

Metric

| Order No. | Range (mm) | Minimum reading (mm) | Scale adjustment (mm) | Fine feed (mm) | Maximum Permissible Error* (mm)/E _{MPE} | Height (mm) | Mass (kg) | Remarks |
|-----------|------------|----------------------|-----------------------|----------------|--|-------------|-----------|---------|
| 506-207 | 0 - 200 | 0.02 | — | 4 | ±0.03 | 341 | 1.4 | — |
| 514-102 | 0 - 300 | | 15 | | ±0.04 | 525 | 3.1 | — |
| 514-104 | 0 - 450 | | 7 | 25 | ±0.05 | 675 | 3.4 | — |
| 514-106 | 0 - 600 | | | | 870 | 7.4 | — | |
| 514-108 | 0 - 1000 | | 6 | ±0.07 | 1340 | 20 | — | |

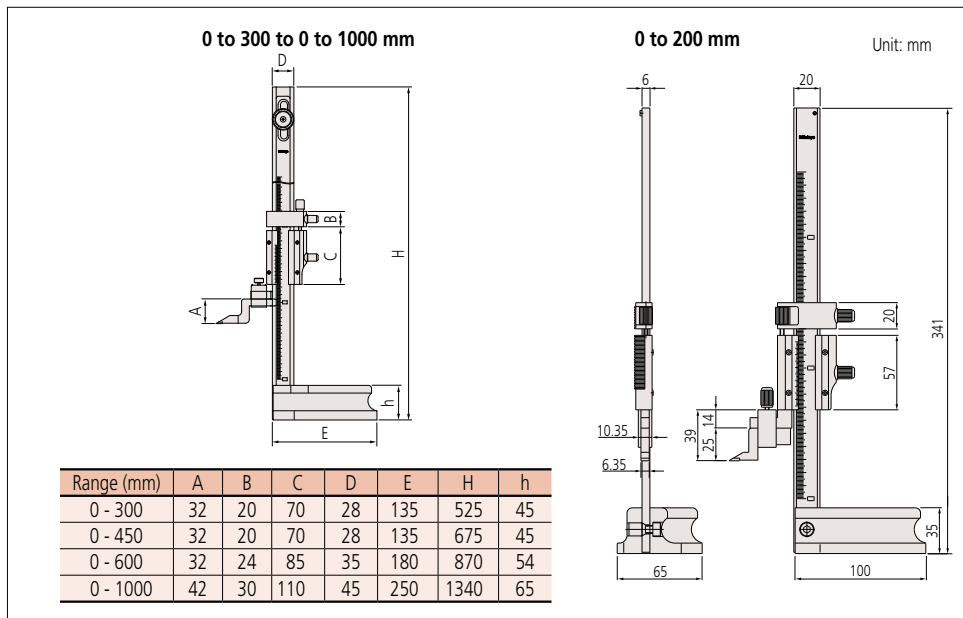
* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

Inch / Metric

| Order No. | Range (in) | Minimum reading | Scale adjustment (in) | Fine feed (in) | Maximum Permissible Error* (in)/E _{MPE} | Height (mm) | Mass (kg) | Remarks |
|-----------|------------|------------------|-----------------------|----------------|--|-------------|-----------|---------|
| 506-208 | 0 - 8 | 0.001 in/0.02 mm | — | 0.16 | ±0.001 | 341 | 1.4 | — |
| 514-103 | 0 - 12 | | 0.6 | | ±0.002 | 525 | 3.1 | — |
| 514-105 | 0 - 18 | | 0.27 | 1 | ±0.002 | 675 | 3.4 | — |
| 514-107 | 0 - 24 | | | | 870 | 7.4 | — | |
| 514-109 | 0 - 40 | | 0.24 | ±0.003 | 1340 | 20 | — | |

* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

DIMENSIONS



Optional Accessories

- **07GZA000**: Scriber
 - **953638**: Holding bar for test indicator (length: 50 mm)
 - **900209**: Holding bar for test indicator (length: 100 mm)
 - **953639**: Holding bar for test indicator (length: 2 in)
 - **900306**: Holding bar for test indicator (length: 4 in)
 - **900321**: Swivel clamp used with holding bar (metric)
 - **900322**: Swivel clamp used with holding bar (inch)
 - **902053**: Clamp (with dovetail groove, $\varnothing 6$ and $\varnothing 8$ holes)
- Note: A test indicator can be mounted on a height gage using a holding bar and clamp.

Dial Height Gage SERIES 192 — With digital counter

- Easy and error-free reading with both up and down digital counters as well as a dial.

- Fits comfortably in the hand and moves easily on the surface plate.



- Can be zero-set at any arbitrary position.
- Provided with a large adjustment wheel for easy height adjustment.
- Clamp can be operated easily and securely.



192-130

- Carbide tipped scriber (**07GZA000**) is attached as standard. (Standard accessory: Scriber clamp **05GZA033**)
- For precision Black Granite Surface Plates, refer to page E-49.

Note: Do not hold the height gage by the column as this can affect the accuracy.

SPECIFICATIONS

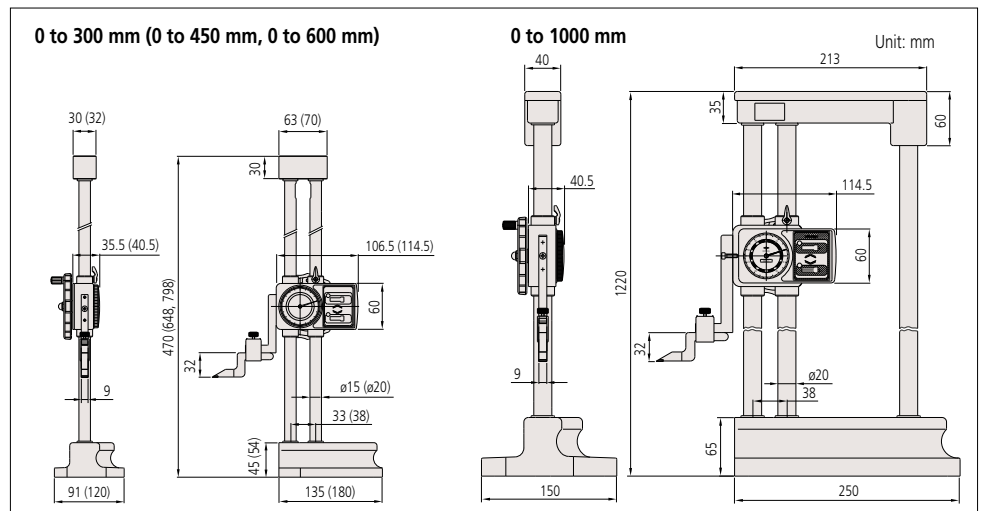
| Metric | | | | | |
|-----------|------------|-----------------|--|-------------|-----------|
| Order No. | Range (mm) | Graduation (mm) | Maximum Permissible Error* (mm)/E _{MPE} | Height (mm) | Mass (kg) |
| 192-130 | 0 - 300 | 0.01 | ±0.03 | 470 | 4.2 |
| 192-131 | 0 - 450 | | ±0.05 | 648 | 9.2 |
| 192-132 | 0 - 600 | | ±0.05 | 798 | 9.8 |
| 192-133 | 0 - 1000 | | ±0.07 | 1220 | 17.0 |

* Maximum Permissible Error, E_{MPE} , is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

| Inch | | | | | |
|-----------|------------|-----------------|--|-------------|-----------|
| Order No. | Range (in) | Graduation (in) | Maximum Permissible Error* (in)/E _{MPE} | Height (mm) | Mass (kg) |
| 192-150 | 0 - 12 | 0.001 | ±0.0015 | 470 | 4.2 |
| 192-151 | 0 - 18 | | ±0.002 | 648 | 9.2 |
| 192-152 | 0 - 24 | | ±0.002 | 798 | 9.8 |
| 192-153 | 0 - 40 | | ±0.003 | 1220 | 17.0 |

* Maximum Permissible Error, E_{MPE} , is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

DIMENSIONS



Height Gage

A standard measuring tool of industry

CERA Caliper Checker SERIES 515

- Enables efficient setting and inspection of calipers and height gages.



515-555

SPECIFICATIONS

Metric

| Order No. | Range (mm) | Block pitch accuracy* | | Parallelism of blocks* | | Mass (kg) |
|-----------|------------|-----------------------|--------------|------------------------|--------------|-----------|
| | | 20 - 300 mm | 350 - 600 mm | 20 - 300 mm | 350 - 600 mm | |
| 515-555 | 0 - 300 | ±5.0 μm | — | 2.0 μm | — | 4 |
| 515-556-2 | 0 - 600 | | ±7.0 μm | 4.0 μm | 8.5 | |

* The block accuracy and the parallelism of blocks are based on the following:

- Outside caliper and height gage: lower end reference plane
- Inside caliper: inside reference plane

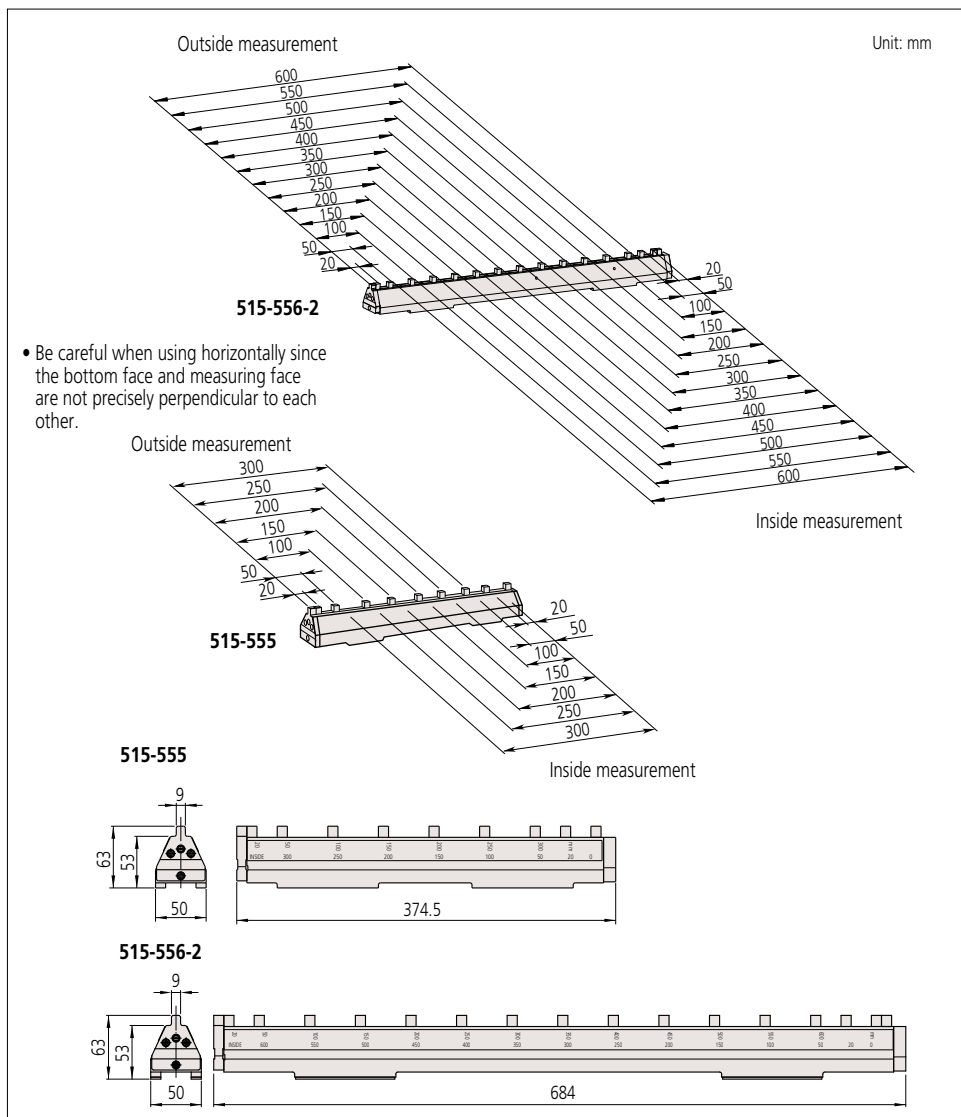
Inch

| Order No. | Range (in) | Block pitch accuracy* | | Parallelism of blocks* | | Mass (kg) |
|-----------|------------|-----------------------|-----------|------------------------|-----------|-----------|
| | | 1 - 12 in | 1 - 12 in | 1 - 12 in | 1 - 12 in | |
| 515-565 | 0 - 12 | ±0.0002 in | | 0.00008 in | | 4 |

* The block accuracy and the parallelism of blocks are based on the following:

- Outside caliper and height gage: lower end reference plane
- Inside caliper: inside reference plane

DIMENSIONS



- Be careful when using horizontally since the bottom face and measuring face are not precisely perpendicular to each other.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

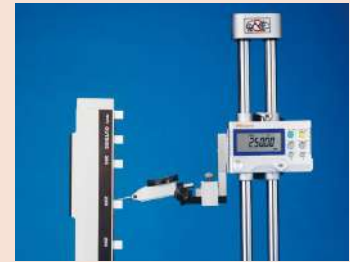
Typical applications



Checking accuracy of caliper (outside measurement)



Checking accuracy of caliper (inside measurement)



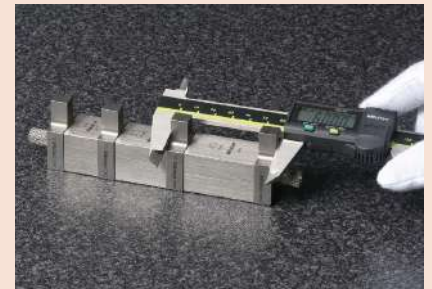
Checking accuracy of height gage

Optional Accessories

- 602162: Wooden case for 300 mm, 12 inch model
- 602164: Wooden case for 600 mm model

Square Gauge Block Accessories Set

Refer to page E-25 for details.

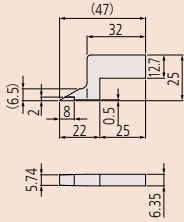


Using plain jaws, a tie rod, knurled-head screws and square gauge blocks to construct a temporary caliper checker.

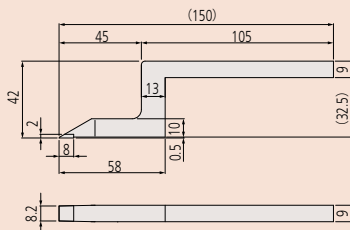
Scriber DIMENSIONS

900173

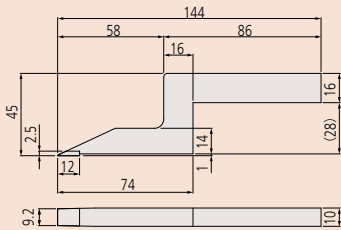
Unit: mm



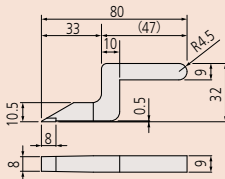
905200



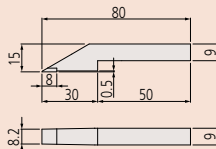
900390



07GZA000



900168



Height Gage Optional accessories for height gages

SPECIFICATIONS

| Metric | |
|-----------|--|
| Order No. | Applicable Height Gages |
| 07GZA000 | 192 Series Digimatic Height Gages (192-613-10, 192-614-10, 192-615-10) |
| | 570 Series Digimatic Height Gages (570-302, 570-304) |
| | 192 Series Dial Height Gages (192-130, 192-131, 192-132, 192-133) |
| | 514 Series Vernier Height Gages (514-102, 514-104, 514-106, 514-103, 514-105, 514-107) |
| | 574 Series Heightmatic (574-112-1, 574-111-1, 574-110-1) |
| 900168 | 570 Series Digimatic Height Gages (570-322/324) |
| 900168 | 514 Series Vernier Height Gages (514-160/172) |
| | 192 Series Digimatic Height Gages (192-663-10, 192-664-10, 192-665-10) |
| 905200 | 570 Series Digimatic Height Gages (570-230) |
| | 514 Series Vernier Height Gages (514-108, 514-109) |
| 900390 | 514 Series Vernier Height Gage (514-170) |

| Inch | |
|-----------|--|
| Order No. | Applicable Height Gages |
| 900173 | 570 Series Digimatic Height Gages (570-227, 570-244) |
| | 506 Series Vernier Height Gages (506-201/207/204, 506-208) |
| 900258 | 192 Series Digimatic Height Gages (192-630-10, 192-631-10, 192-632-10, 192-633-10) |
| | 570 Series Digimatic Height Gages (570-312, 570-313, 570-314) |
| | 574 Series Heightmatic (574-212-1, 574-211-1, 574-210-1) |
| 905201 | 192 Series Digimatic Height Gages (192-670-10, 192-671-10, 192-672-10, 192-673-10) |
| | 570 Series Digimatic Height Gages (570-248) |

Dial Test Indicators

- For information about the attachment of test indicators, refer to page F-75.

Contact Sensor



- 900872
- Attached to both the workpiece*1 and height gage*2 when measuring heights using a height gauge with a scriber, the contact sensor is a convenient detector that gives a lamp display when the scriber touches the workpiece.
- *1 Conductive workpieces only.
- *2 Attach to a conductive part.
- Magnet is incorporated.
- Battery (PR44, 2 pcs required) is not included.
- For precision Black Granite Surface Plates, refer to page E-49.

Center Probe



- 951144
- Allows quick measurement of center-to-center distance between holes.
- Measurable hole diameters: 1 to 38 mm
- Mounting bar section: 9x9 mm

Depth Gage Attachment



- 900764
- Attaches to a height gage for measuring groove and hole depth.
- Minimum hole diameter: 5.5 mm
- Maximum distance from the bottom of the holding bar to the contact point: 80 mm (metric type), 2.95 in (inch type)
- Dial indicator contact points are usable. (Refer to pages F-57 and F-58.)
- Mounting bar section: 9x9 mm
- Holding bar length: 100 mm

Height Gage

A standard measuring tool of industry

Linear Height SERIES 518 — High Performance 2D Measurement System

- Achieves indication accuracy of $(1.1 + 0.6L/600) \mu\text{m}$.
- High-accuracy Height Gage incorporating a wide range of measurement functions.
- To achieve best-in-class accuracy, a high-accuracy reflective-type linear encoder and high-accuracy guide are used.
- Measurement can be implemented by icon-based commands that also support easy one-key operation.
- The TFT LCD provides excellent visibility and operability.
- Pneumatic full/semi-floating system allows adjustment of air-cushion height.
- Equipped with various interfaces for RS-232C communication in addition to connectability to printers and Digimatic measuring instruments.
- For precision Black Granite Surface Plates, refer to page E-49.
- Backup/Restore of data and measurement part programs can be implemented using USB storage devices (FAT16/32 format compatible).



LH-600E

SPECIFICATIONS

| Metric | | LH-600E*3 (without power grip) | LH-600EG*3 (with power grip) |
|---------------------------------------|---|--|---------------------------------|
| Model | | | |
| Measuring range (Stroke) | | 0 to 977 mm (600 mm) 0 to 38 in (24 in) | |
| Resolution | | 0.0001/0.001/0.01/0.1 mm (selectable) 0.000001/0.00001/0.0001/0.001 in (selectable) | |
| Accuracy at 20 °C | Indication accuracy*1 | $(1.1 + 0.6L/600) \mu\text{m}$, L=Measured length (mm) | |
| | Repeatability*1 | Plane: 0.4 μm (2 σ), Hole: 0.9 μm (2 σ) | |
| | Perpendicularity (forward and backward)*2 | 5 μm (after compensation) | |
| | Straightness (forward and backward)*2 | 4 μm (mechanical accuracy) | |
| Guiding method | | Roller bearing | |
| Driving method | | Motor-driven (5, 10, 15, 20, 25, 30, 40 mm/s: 7 steps)/Manual | |
| Scale unit | | Reflective-type linear encoder | |
| Measuring force | | 1 N (automatic constant-force function) | |
| Balancing method | | Counter weight balance | |
| Main unit moving mode | | Full-floating (moving)/Semi-floating (measuring) air bearing | |
| Air source | | Built-in compressor | |
| Monitor | | 5.7 inch COLOR TFT LCD | |
| Max. number of programs | | 50 | |
| Max. number of measured data | | 60,000 (Max. number of data is 30,000/per program) | |
| Power supply | | AC adapter/Battery (NiMH) | |
| Battery operation time | | Approx. 5 hours (compressor duty cycle 25 % max.) | |
| Battery charging time | | Approx. 3 hours (usable during charge) | |
| Dimensions (WxDxH) | | 237x438x1013 mm | 247x438x1013 mm |
| Mass | | 24 kg | 24.5 kg |
| Operating temperature/humidity ranges | | 5 to 40 °C / 20 to 80 % RH (non-condensing) | |
| Storage temperature/humidity ranges | | -10 to 50 °C / 5 to 90 % RH (non-condensing) | |

*1 Guaranteed when using the standard eccentric $\phi 5$ probe.

*2 Guaranteed when using the Lever Head (519-521), Mu-Checker (519-561).

*3 Order No. depends on the destination as shown in the table on the right.

Note: To obtain maximum measurement accuracy, please note the following:

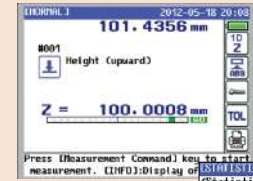
- Use in an environment that is as close as possible to 20 °C, and subject to minimal temperature change over time.
- Use in conjunction with a surface plate of JIS 1 class, or higher, flatness specification.



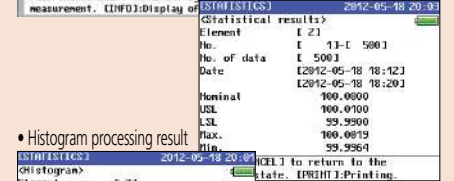
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Screenshot examples

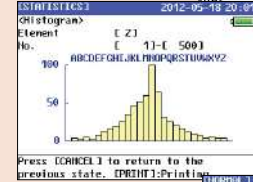
- Measurement screen



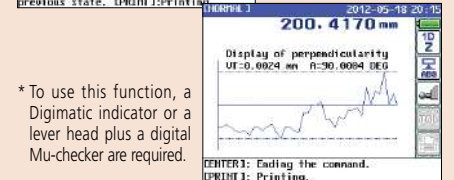
- Statistical processing result



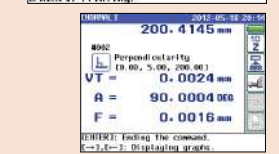
- Histogram processing result



- Squareness measurement result: Graphical display*



* To use this function, a Digimatic indicator or a lever head plus a digital Mu-checker are required.



- Squareness measurement result: Numeric display*

Standard Accessories

- **12AAF634** $\phi 5$ mm stepped probe
- **12AAA715** Ball-diameter corrected block
Note: When the correction is performed by using the taper type contact point, the ball-diameter corrected block **12AAA787** (for taper type contact point) is required.
- **12AAF674** Auxiliary weight*
* Two auxiliary weights come with the main unit.

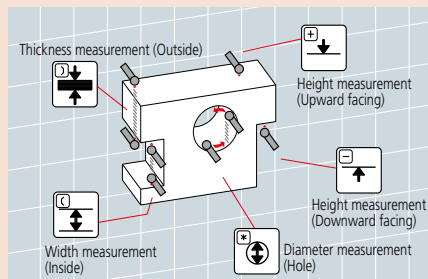
Model without power grip

| Order No. | Remarks |
|--------------------|---|
| 518-351-10 | Model for Japan, Japanese manual |
| 518-351A-21 | Model for North America, English manual |
| 518-351A-22 | Model for South America, Spanish manual |
| 518-351D-21 | Model for EU, English manual |
| 518-351E-21 | Model for U.K., English manual |
| 518-351DC | Model for China, Chinese manual |
| 518-351K | Model for Korea, Korean manual |

Model with power grip (Power grip pre-installed model)

| Order No. | Remarks |
|--------------------|---|
| 518-352-10 | Model for Japan, Japanese manual |
| 518-352A-21 | Model for North America, English manual |
| 518-352A-22 | Model for South America, Spanish manual |
| 518-352D-21 | Model for EU, English manual |
| 518-352E-21 | Model for U.K., English manual |
| 518-352DC | Model for China, Chinese manual |
| 518-352K | Model for Korea, Korean manual |

Example of measurements

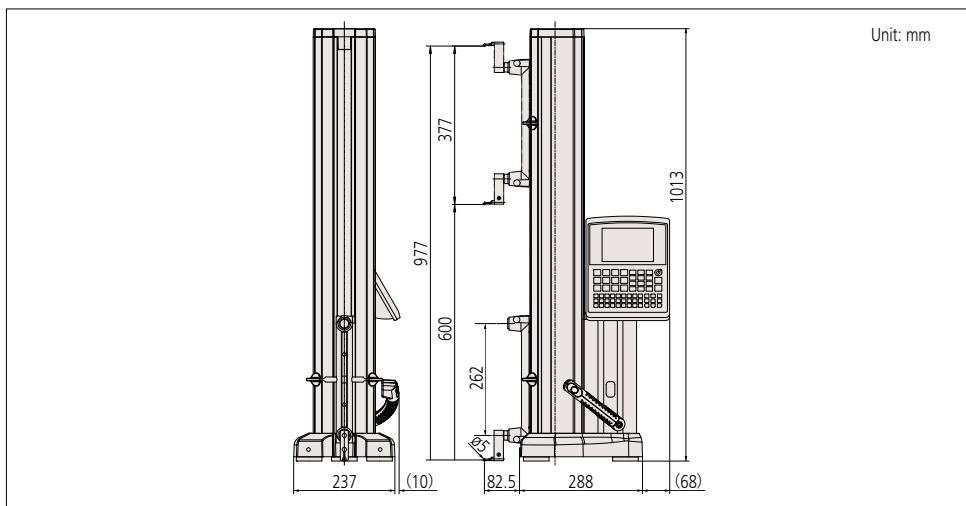


The power grip makes it easy to approach the workpiece.



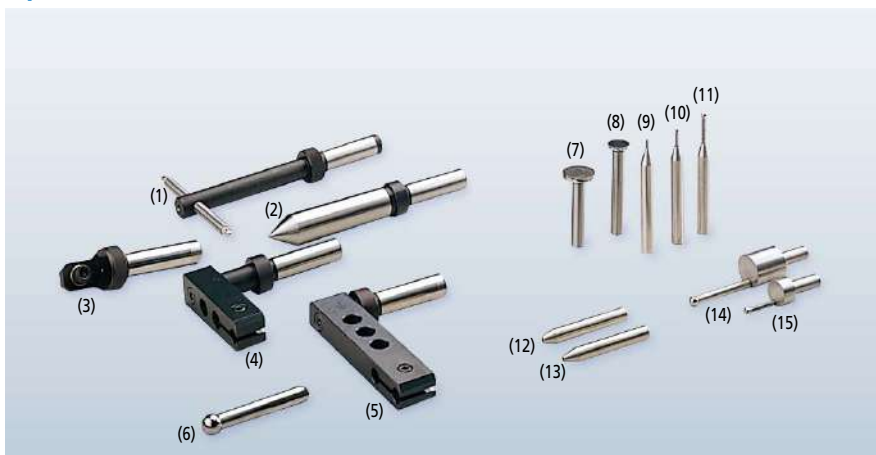
The sample workpiece shown in the above photo is an optional accessory (12AAA879).

DIMENSIONS



Unit: mm

Optional Accessories



| No. | Order No. | Item | Order No. | Item |
|------|-----------|---|-----------|--|
| (1) | 12AAC072 | Depth probe | 12AAB136 | ø10 mm cylindrical probe |
| (2) | 12AAC073 | Taper probe | 12AAF666 | ø1 mm ball probe (coaxial type) |
| (3) | 932361 | Mu-checker lever head holder* ¹ *1 Two additional pieces of auxiliary weights required (total 4 pcs.) | 12AAF667 | ø2 mm ball probe (coaxial type) Ruby ball |
| (4) | 12AAA792 | Dial indicator holder | 12AAF668 | ø10 mm ball probe (coaxial type) L: 82 mm |
| (5) | 12AAA793 | Probe extension holder | 12AAF669 | ø10 mm ball probe (coaxial type) L: 120 mm |
| (6) | 12AAB552 | ø10 mm ball probe (coaxial type) | 12AAF670 | ø5 mm disk probe |
| (7) | 957265 | ø20 mm disk probe | 12AAF671 | ø10 mm disk probe |
| (8) | 957264 | ø14 mm disk probe | 12AAF672 | ø1 mm ball offset probe |
| (9) | 957261 | ø2 mm ball probe (coaxial type) | 05HAA394 | ø5 mm ball offset probe |
| (10) | 957262 | ø3 mm ball probe (coaxial type) | 12AAA879 | Sample workpiece |
| (11) | 957263 | ø4 mm ball probe (coaxial type) | 932377A | ø2 mm CMM ball probes |
| (12) | 226118 | M3 CMM stylus adapter* ² | 932378A | ø3 mm CMM ball probes |
| (13) | 226117 | M2 CMM stylus adapter* ² | 932379A | ø5 mm CMM ball probes |
| (14) | 12AAA789 | ø6 mm ball offset probe | 932380A | ø6 mm CMM ball probes |
| (15) | 12AAA788 | ø4 mm ball offset probe | 532328 | ø10 mm CMM ball probes |
| | | | 532345 | ø20 mm CMM disk probes |
| | | | 930803 | ø30 mm CMM disk probes |
| | | | 12AAF712 | Battery pack |

*2 For enabling CMM stylus to be used.

Note: A gauge block may be required for zero-setting depending on the probe and contact point.

Various peripheral devices

| Order No. | Item |
|-----------|---|
| 12AAN048* | Receipt printer (for Japan) |
| 12AAN049* | Receipt printer (for North America) |
| 12AAN050* | Receipt printer (for EU; excluded U.K.) |
| 12AAN051* | Receipt printer (for U.K.) |
| 12AAN052 | Receipt paper (10-roll set) |
| 12AAA804 | Cable for page printer (2 m) |
| 12AAA807 | RS-232C cable (2 m/80 in) |
| 936937 | Digimatic cable (1 m) |
| 965014 | Digimatic cable (2 m) |

* Attachment for fixing the connecting cable is provided as standard.

Height Gage

A standard measuring tool of industry

QM-Height SERIES 518 — High-Performance Height Gage

MeasurLink® ENABLED

Data Management Software by Mitutoyo



- Best-in-class accuracy $\pm(2.4 + 2.1L/600) \mu\text{m}$
- Built-in air-suspension feature mechanism enables smooth movement over a surface plate. (Lower-cost version **AX** type without air suspension also available.)
- Easy-to-view, simple control panel enables most measurements to be made with a single keystroke.
- Eco-friendly product, operable for approximately 1,200 hours with four AA alkaline batteries. (Four commercially available nickel hydride batteries can also be used.)
- By installing the **U-WAVE-T** measurement data wireless communication system or USB communication driver in your PC, the optional functions that enhance operability, including output of measurement data to your PC, become available. The USB communication driver can be downloaded from the Mitutoyo website. (Communication software is separately required.) <https://www.mitutoyo.co.jp/eng/contact/products/usb/index.html>

SPECIFICATIONS

| Order No. | Metric Inch / Metric | 518-240 518-241 | 518-242 518-243 | 518-244 518-245 | 518-246 518-247 |
|---|-------------------------|---|---------------------------------|-----------------------------------|---------------------------------|
| Measuring range (stroke) | | 0 to 465 mm (350 mm / 14 in) | 0 to 715 mm (600 mm / 24 in) | 0 to 465 mm (350 mm / 14 in) | 0 to 715 mm (600 mm / 24 in) |
| Resolution | Metric | 0.001 mm / 0.005 mm | | | |
| | Inch / Metric | 0.001 / 0.005 mm 0.00005 / 0.0001 / 0.0002 in | | | |
| Accuracy at 20 °C | Measurement*1 | $\pm(2.4 + 2.1L/600) \mu\text{m}$ | | | |
| | Repeatability*1 | $2\sigma \leq 1.8 \mu\text{m}$ | | | |
| Perpendicularity*2 (20 °C) | | 7 μm | 12 μm | 7 μm | 12 μm |
| Guiding method | | Roller bearing | | | |
| Drive method | | Manual (wheel) | | | |
| Measurement principle | | Electromagnetic induction absolute encoder | | | |
| Measuring force | | 1.5 \pm 0.5 N | | | |
| Data output ports | | Digimatic / USB*3 | | | |
| Air-suspension feature | | Not included | | Included (for positioning only)*4 | |
| Power supply | | Alkaline AA / LR6 batteries \times 4 (standard accessories) / AC adapter (optional accessory)*5 / Supports NiMH (HR6) rechargeable batteries \times 4 | | | |
| Battery life guidelines*6 | | Approx. 1,200 hours (without using the air-suspension feature) | | | |
| | | Approx. 90 hours (when using the air-suspension feature) | | | |
| Mass | | 25 kg | 29 kg | 26 kg | 30 kg |
| Dimensions (WxDxH) | | Stroke 350 mm type: 280 \times 273 \times 784 mm | | | |
| | | Stroke 600 mm type: 280 \times 273 \times 1016 mm | | | |
| Operating temperature range (recommended) | | 0 to 40 °C (10 to 30 °C) | | | |
| Operating humidity range | | 20 to 80 % RH (non-condensing) | | | |
| Storage temperature range | | -10 °C to 50 °C | | | |
| Storage humidity range | | 5 to 90 % RH (non-condensing) | | | |

*1 The indication accuracy and repeatability represent the values obtained from the height measurement of a flat surface using the standard holder with $\phi 5$ ball contact point. In the case of diameter, minimum (maximum) value, circle pitch or difference measurement, measuring errors may be larger than the accuracy ratings listed in the table due to variations in measuring force during a scanning measurement, which differs from height measurement.

*2 Indicates the value obtained from the measurement of a straight surface placed perpendicular to the the base reference surface using the Lever Head (519-521) and Mu-checker (519-551).

*3 Requires special communication driver. Consult your local Mitutoyo Sales Office for details.

These can be downloaded from the Mitutoyo web site. <https://www.mitutoyo.co.jp/eng/contact/products/usb/index.html>

*4 When using a model with the air-suspension feature, it is advisable to use a JIS 1 class, or higher, surface plate. Using on surfaces with scratches or unevenness may prevent the system operating to the specified performance.

*5 The AC adapter cannot be used to recharge rechargeable batteries.

*6 Battery life depends on the operating conditions. In particular, it is more economical to use the optional AC adapter to power the instrument if the application requires prolonged use of the air-suspension feature.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Standard Accessories

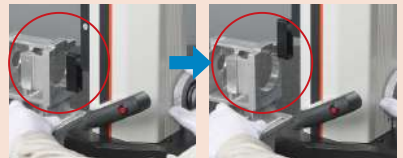
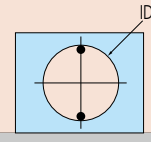
- **05HZA148** $\phi 5$ mm stepped probe
- **12AAA715** Probe diameter calibration block
- Alkaline batteries \times 4 (AA/LR6)

Measurement example

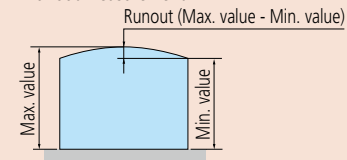
- Height measurement



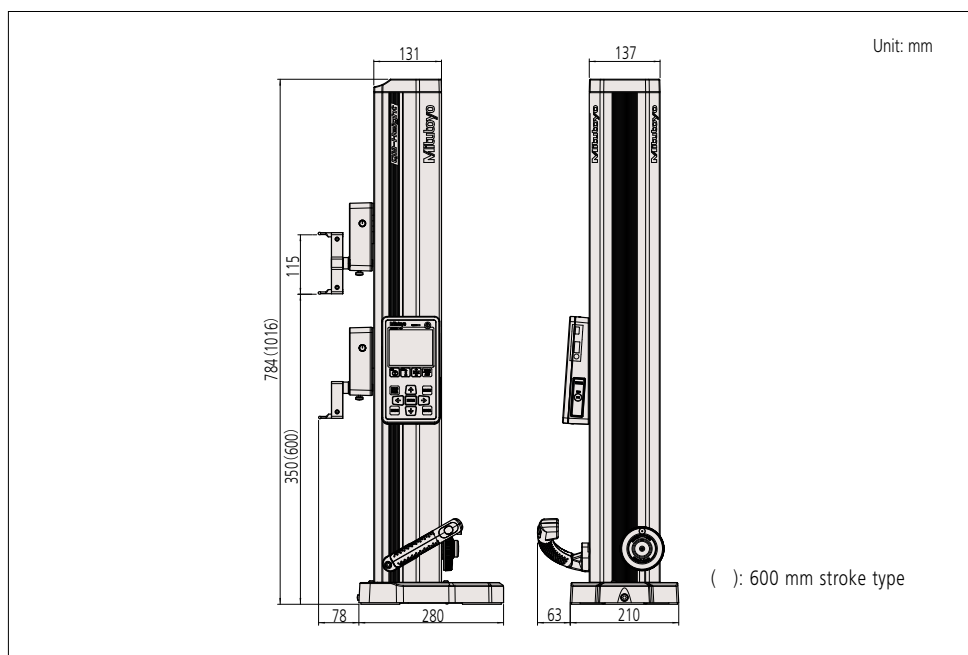
- ID measurement



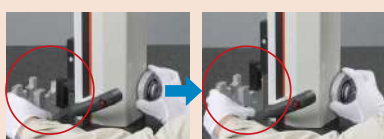
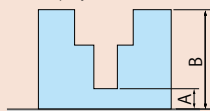
- Runout measurement



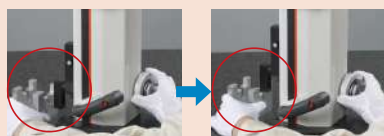
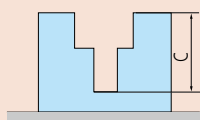
DIMENSIONS



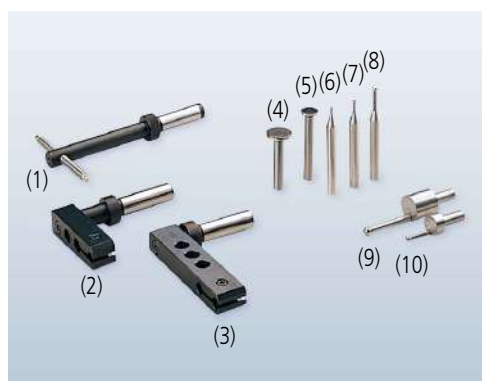
- Height difference measurement (1)
Height A and height B from the surface plate will be displayed.



- Height difference measurement (2)
After measuring heights A and B, the height difference C between them can be shown in the bottom row of the display.



Optional Accessories



Contact points for a wide range of measurements

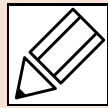
| Item | Order No. | Description |
|------|-------------------|--|
| | | Depth probe |
| (1) | 12AAC072 | Depth probe |
| | | Special holder |
| (2) | 12AAA792 | Holder for dial indicator |
| (3) | 12AAA793 | Holder (Long) |
| | | Interchangeable contact points for $\phi 5$ mm stepped probe |
| (4) | 957265 | $\phi 20$ mm disk |
| (5) | 957264 | $\phi 14$ mm disk |
| (6) | 957261 | $\phi 2$ mm ball (coaxial type) |
| (7) | 957262 | $\phi 3$ mm ball (coaxial type) |
| (8) | 957263 | $\phi 4$ mm ball (coaxial type) |
| (9) | 12AAA789 | $\phi 6$ mm ball (eccentric type) |
| (10) | 12AAA788 | $\phi 4$ mm ball (eccentric type) |
| | | AC Adapter |
| | 06AFZ950JA | AD620JA for Japan/U.S. |
| | 06AFZ950D | AD620D for the EU |
| | 06AFZ950E | AD620E for the UK |
| | 06AFZ950K | AD620K for Korea |
| | 06AEG180DC | AD620DC for China |
| | | Others |
| | 05HZA143 | 9x9 mm adapter (clamp underneath is required) |
| | 05GZA033 | Clamp (for 9x9 mm adapter) |
| | 05HZA144 | 6.35x12.7 mm adapter (clamp underneath is required) |
| | 901385 | Clamp (for 6.35x12.7 mm adapter) |
| | 05HZA173 | Scriber* |

* Used for measurements, cannot be used for scribing.
Note: A gauge block may be required for zero-setting depending on the probe or contact point to be used.

Optional accessories that enable centralized data management

| Order No. | Item name |
|------------------|---|
| | Small printer equipped with Data Logger |
| 264-505 | DP-1VA LOGGER |
| 936937 | Digimatic connecting cable (1 m) |
| 965014 | Digimatic connecting cable (2 m) |
| 06AFZ050 | USB cable (A-microB) |
| | Measurement Data Input Unit |
| 06AFM380D | USB Input Tool Direct USB-ITN-D |
| | Measurement data wireless communication system |
| 02AZD730G | U-WAVE-T (Transmission unit) (IP67 type) |
| 02AZD880G | U-WAVE-T (Transmission unit) (Buzzer type) |
| 02AZD790D | U-WAVE-T dedicated cable (Standard use) |
| 02AZE140D | U-WAVE-T dedicated cable (For foot switch) |
| 02AZD810D | U-WAVE-R receiver |
| 02AZE990 | U-WAVE mounting plate |
| | Measurement data collection software for Excel USB-IT PAK V2.1 |
| | Measurement data network system MeasurLink |

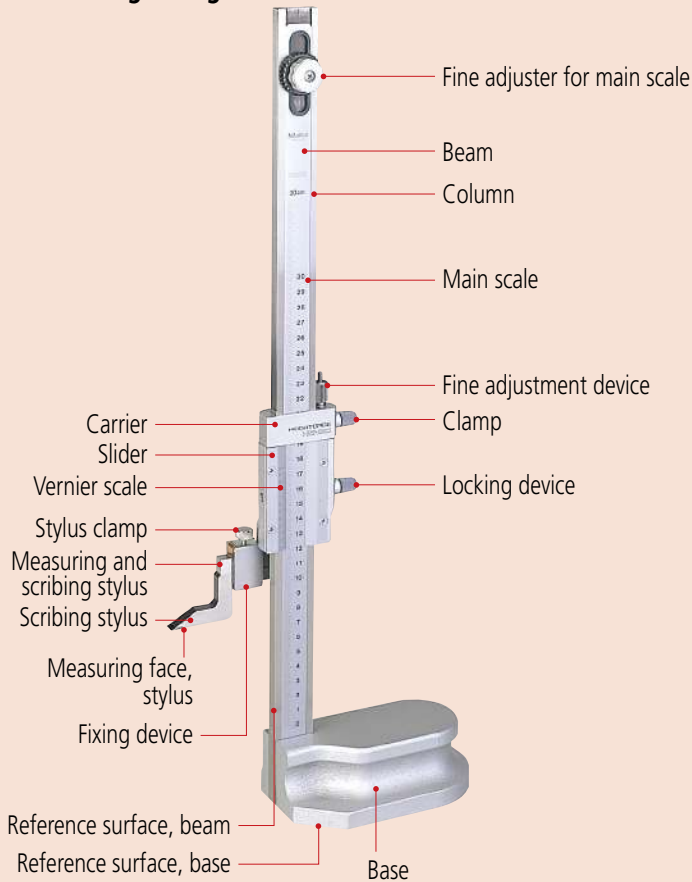
Quick Guide to Precision Measuring Instruments



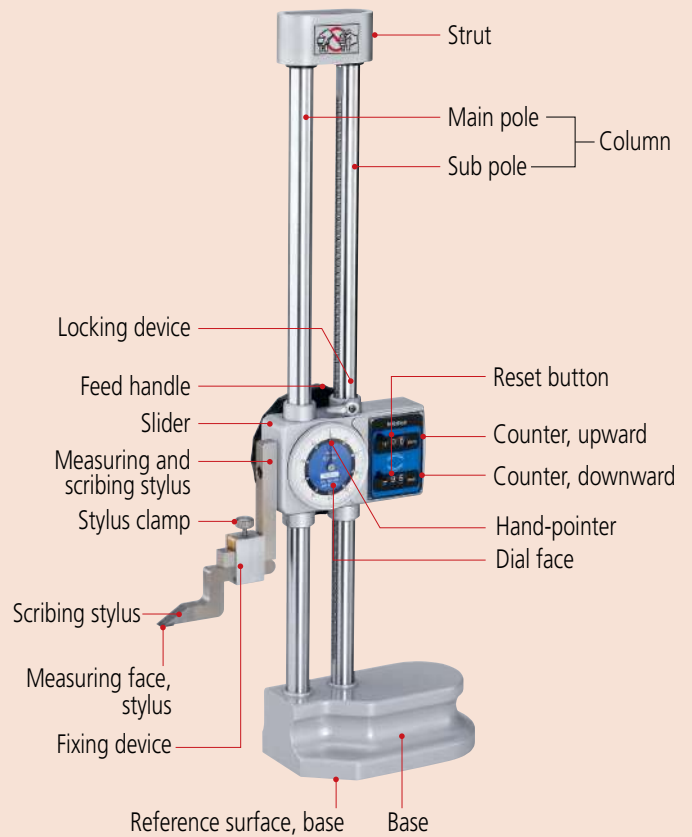
Height Gages

Nomenclature

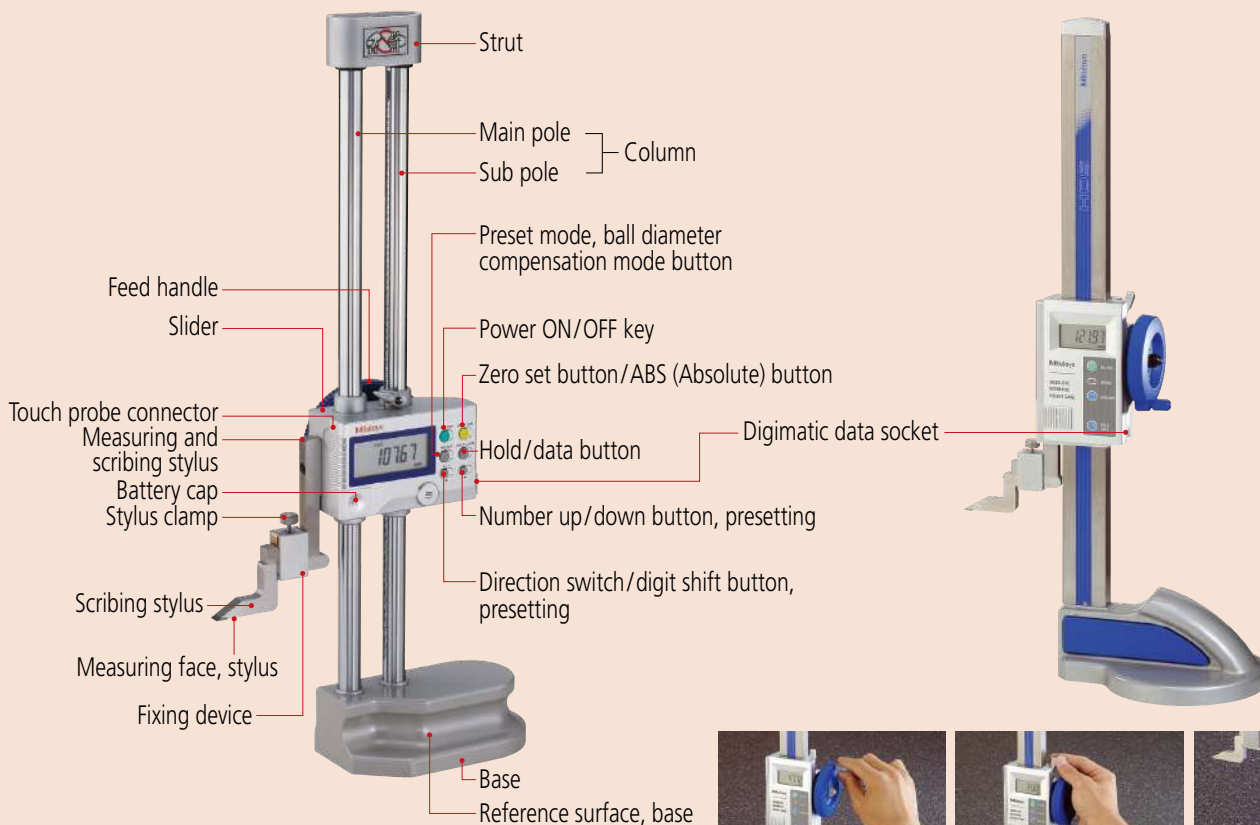
Vernier Height Gage



Mechanical Digit Height Gage



Digimatic Height Gages



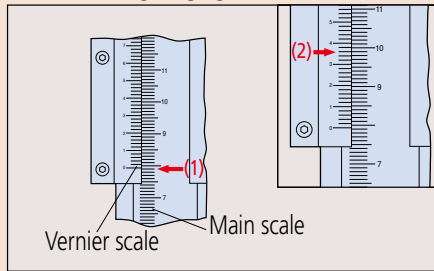
Slider handwheel

Slider clamping lever

Ergonomic base

How to read

Vernier Height gage



Graduation 0.02 mm

| | |
|----------------|----------|
| (1) Main scale | 79 mm |
| (2) Vernier | 0.36 mm |
| Reading | 79.36 mm |

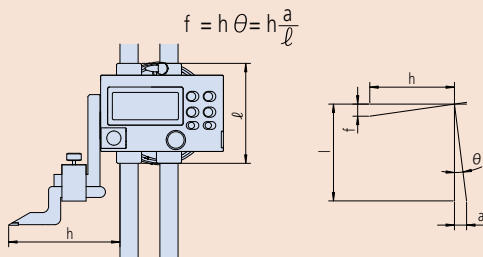
General notes on use of Height Gages

1. Potential causes of error

Like the caliper, the error factors involved include parallax effects, error caused by excessive measuring force due to the fact that a height gage does not conform to Abbe's Principle, and differential thermal expansion due to a temperature difference between the height gage and workpiece. There are also other error factors caused by the structure of the height gage. In particular, the error factors related to a warped reference edge and scriber installation described below should be studied before use.

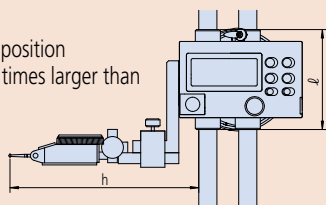
2. Reference edge (column) warping and scriber installation

Like the caliper, and as shown in the following figure, measurement errors result when using the height gage if the reference column, which guides the slider, becomes warped. This error can be represented by the same calculation formula for errors caused by nonconformance to Abbe's Principle.



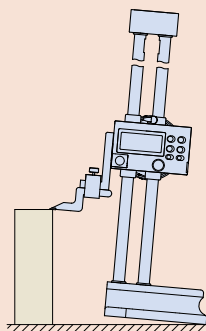
Installing the scriber (or a lever-type dial indicator) requires careful consideration because it affects the size of any error due to a warped reference column by increasing dimension h in the above formula. In other words, if an optional long scriber or lever-type dial indicator is used, the measurement error becomes larger.

Example: Effect of measuring point position
When h is 150 mm, the error is 1.5 times larger than when h is 100 mm.



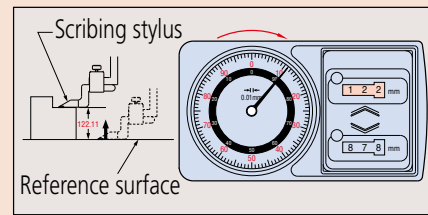
3. Lifting of the base from the reference surface

When setting the scriber height from a gauge block stack, or from a workpiece feature, the base may lift from the surface plate if excessive downwards force is used on the slider, and this results in measurement error. For accurate setting, move the slider slowly downwards while moving the scriber tip to and fro over the gauge block surface (or feature). The correct setting is when the scriber is just felt to lightly touch as it moves over the edge of the surface. It is also necessary to make sure that the surface plate and height gage base reference surface are free of dust or burrs before use.



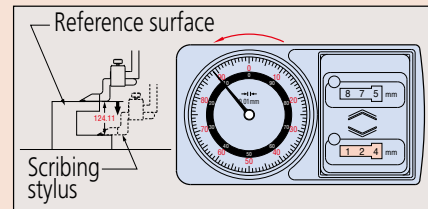
Mechanical Digit Height gage

Measuring upwards from a reference surface



| | |
|---------|-----------|
| Counter | 122 mm |
| Dial | 0.11 mm |
| Reading | 122.11 mm |

Measuring downwards from a reference surface



| | |
|---------|-----------|
| Counter | 124 mm |
| Dial | 0.11 mm |
| Reading | 124.11 mm |

4. Error due to inclination of the main scale (column)

According to JIS standards, the perpendicularity of the column reference edge to the base reference surface should be better than:

$$\left(0.01 + \frac{L}{1000}\right) \text{ mm} \quad L \text{ indicates the measuring length (unit: mm)}$$

This is not a very onerous specification. For example, the perpendicularity limit allowable is 0.61 mm when L is 600 mm. This is because this error factor has a small influence and does not change the inclination of the slider, unlike a warped column.

5. Relationship between accuracy and temperature

Height gages are made of several materials. Note that some combinations of workpiece material, room temperature, and workpiece temperature may affect measuring accuracy if this effect is not allowed for by performing a correction calculation.

- The tip of a height gage scriber is very sharp and must be handled carefully if personal injury is to be avoided.
- Do not damage a digital height gage scale by engraving an identification number or other information on it with an electric marker pen.
- Carefully handle a height gage so as not to drop it or bump it against anything.

Notes on using the height gage

- Keep the column, which guides the slider, clean. If dust or dirt accumulates on it, sliding becomes difficult, leading to errors in setting and measuring.
- When scribing, securely lock the slider in position using the clamping arrangements provided. It is advisable to confirm the setting after clamping because the act of clamping on some height gages can alter the setting slightly. If this is so, allowance must be made when setting to allow for this effect.
- Parallelism between the scriber measuring face and the base reference surface should be 0.01 mm or better. Remove any dust or burrs on the mounting surface when installing the scriber or lever-type dial indicator before measurement. Keep the scriber and other parts securely fixed in place during measurement.
- If the main scale of the height gage can be moved, move it as required to set the zero point, and securely tighten the fixing nuts.
- Errors due to parallax error are not negligible. When reading a value, always look straight at the graduations.
- Handling after use: Completely wipe away any water and oil. Lightly apply a thin coating of anti-corrosion oil and let dry before storage.
- Notes on storage:
 - Avoid direct sunlight, high temperatures, low temperatures, and high humidity during storage.
 - If a digital height gage will not be used for more than three months, remove the battery before storage.
 - If a protective cover is provided, use the cover during storage to prevent dust from adhering to the column.

Height Gage Performance Evaluation Method

JIS B 7517 was revised and issued in 2018 as the Japanese Industrial Standards of the height gage, and the "Instrumental error" indicating the indication error of the height gage has been changed to "Maximum Permissible Error (MPE) of indication".

The "Instrumental error" of the old JIS adopts acceptance criteria that the specification range (precision specification) equals acceptance range, and the OK/NG judgment does not include measurement uncertainty (Fig. 1).

The "Maximum Permissible Error (MPE) of indication" of the new JIS employs the basic concept of the OK/NG judgment taking into account the uncertainty adopted in the ISO standard (ISO 14253-1).

The verification of conformity and nonconformity to the specifications is clearly stipulated to use the internationally recognized acceptance criteria (simple acceptance) when the specification range equals the acceptance range, and it is accepted that the specification range equals the acceptance range if a given condition considering uncertainty is met.

The above said internationally recognized acceptance criterion is ISO/TR 14253-6: 2012 (Fig. 2).

The following describes the standard inspection method including the revised content of JIS 2018.

Fig. 1 **Old JIS** Instrumental error
JIS B 7517-1993

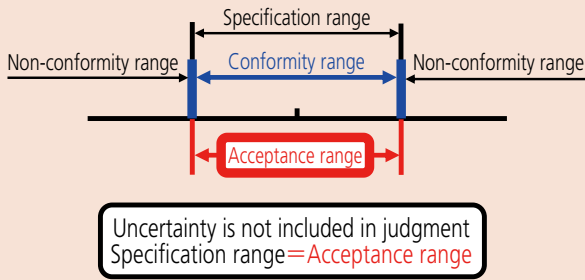
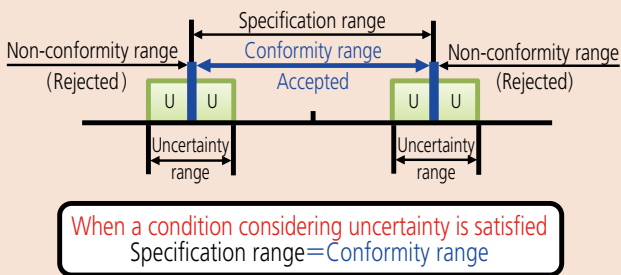


Fig. 2 **New JIS** Maximum Permissible Error (MPE)
JIS B 7517: 2018 (ISO/TR 14253-6: 2012)



Maximum Permissible Error of height measurement E_{MPE} [JIS B 7517: 2018]

The height measurement error in a height gage is the indication error when the reference edge (column) is perpendicular to the base reference surface and the direction of contact is downward. Table 1 shows the maximum permissible height measurement error E_{MPE} .

E_{MPE} for any desired height is obtained by measuring a gauge block, or equivalent, with a height gage on a precision surface plate (Fig. 3) and then subtracting the gauge block size from the measured size.

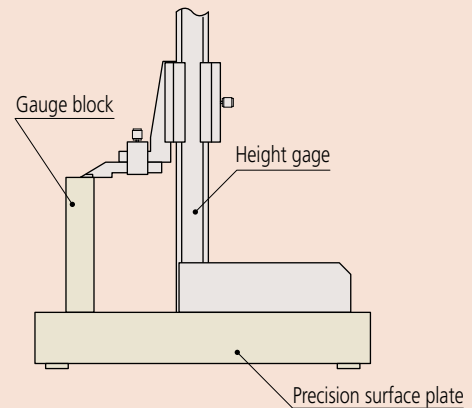
Table 1: Maximum permissible height measurement error E_{MPE} of a conventional height gage

Unit: mm

| Measurement height | Scale interval, graduation or resolution | |
|------------------------|--|--------------|
| | 0.05 | 0.02 or 0.01 |
| 50 or less | ±0.05 | ±0.02 |
| Over 50, 100 or less | ±0.06 | ±0.03 |
| Over 100, 200 or less | ±0.07 | |
| Over 200, 300 or less | ±0.08 | ±0.04 |
| Over 300, 400 or less | ±0.09 | |
| Over 400, 500 or less | ±0.10 | ±0.05 |
| Over 500, 600 or less | ±0.11 | |
| Over 600, 700 or less | ±0.12 | ±0.06 |
| Over 700, 800 or less | ±0.13 | |
| Over 800, 900 or less | ±0.14 | ±0.07 |
| Over 900, 1000 or less | ±0.15 | |

Note: E_{MPE} includes the measurement error arising from straightness, flatness of the measuring surface and parallelism with the reference surface.

Fig. 3: Determination of height measurement error



The "Instrumental error" indicating the indication error of JIS has been changed to "Maximum Permissible Error (MPE) of indication" for the following models:

- **192 Series Digimatic Height Gage** described on page D-41 (All models)
- **570 Series ABSOLUTE Digimatic Height Gage** described on page D-43 (All models)
- **570 Series Digimatic Height Gage** described on page D-45 (All models)
- **514, 506 Series Standard Height Gage with Adjustable Main Scale** described on page D-47 (All models)
- **192 Series With digital counter** described on page D-48 (All models)

Depth Gage

A standard measuring tool of industry

Depth Micrometer SERIES 329, 129 — Interchangeable Rod Type

MeasurLink ENABLED

Data Management Software by Mitutoyo

- This type uses interchangeable rods to enable wide-range measurement.
- **Order No. 329-250-30, 329-251-30, 329-350-30, and 329-351-30** allow integration into statistical process control and measurement systems.
- Measuring rod diameter: 4 mm
- Measuring rod lock.
- Ratchet stop provides constant measuring force.



SPECIFICATIONS

| Metric | | | | | | | |
|-----------------|------------|-----------------|-----------|-------------------------|--|-------------------------------------|-------------|
| Order No. | Range (mm) | Resolution (mm) | Base (mm) | Spindle feed error (μm) | Flatness of reference face | Flatness of measuring rod face (μm) | No. of rods |
| Digimatic (LCD) | | | | | | | |
| 329-250-30 | 0 - 150 | 0.001 | 101.6×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 6 |
| 329-251-30 | 0 - 300 | | | | | | 12 |

| Inch / Metric | | | | | | | |
|-----------------|------------|---------------------|-----------|---------------------|--|--------------------------------|-------------|
| Order No. | Range (in) | Resolution | Base (in) | Spindle feed error | Flatness of reference face | Flatness of measuring rod face | No. of rods |
| Digimatic (LCD) | | | | | | | |
| 329-350-30 | 0 - 6 | 0.00005 in/0.001 mm | 4×0.63 | 0.00015 in/ 3 μm | 0.00005 in/1.3 μm for 63.5 mm (2.5 in) length base, 0.00008 in/2 μm for 101.6 mm (4 in) length base | 0.000012 in/ 0.3 μm | 6 |
| 329-351-30 | 0 - 12 | 0.0001 in/0.001 mm | | | | | 12 |

| Metric | | | | | | | |
|-----------|------------|-----------------|-----------|-------------------------|--|-------------------------------------|-------------|
| Order No. | Range (mm) | Graduation (mm) | Base (mm) | Spindle feed error (μm) | Flatness of reference face | Flatness of measuring rod face (μm) | No. of rods |
| Analog | | | | | | | |
| 129-154 | 0 - 25 | 0.01 | 63.5×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 1 |
| 129-155 | | | 101.6×16 | | | | 2 |
| 129-109 | 0 - 50 | 0.01 | 63.5×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 2 |
| 129-113 | | | 101.6×16 | | | | 3 |
| 129-110 | 0 - 75 | 0.01 | 63.5×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 3 |
| 129-114 | 101.6×16 | 4 | | | | | |
| 129-111 | 0 - 100 | 0.01 | 63.5×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 4 |
| 129-115 | 101.6×16 | 6 | | | | | |
| 129-112 | 0 - 150 | 0.01 | 63.5×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 6 |
| 129-116 | 101.6×16 | 12 | | | | | |
| 129-152 | 0 - 300 | 0.01 | 63.5×16 | 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 12 |
| 129-153 | 101.6×16 | | | | | | |

| Inch | | | | | | | |
|-----------|------------|-----------------|-----------|-------------------------|---|-------------------------------------|-------------|
| Order No. | Range (in) | Graduation (in) | Base (in) | Spindle feed error (in) | Flatness of reference face | Flatness of measuring rod face (in) | No. of rods |
| Analog | | | | | | | |
| 129-129 | 0 - 2 | 0.001 | 4×0.63 | 0.00015 | 0.00005 in for 2.5 in length base, 0.00008 in for 4 in length base | 0.000012 | 2 |
| 129-126 | 0 - 3 | | 2.5×0.63 | | | | 3 |
| 129-130 | 0 - 4 | 0.001 | 4×0.63 | 0.00015 | 0.00005 in for 2.5 in length base, 0.00008 in for 4 in length base | 0.000012 | 4 |
| 129-127 | | | 2.5×0.63 | | | | 4 |
| 129-131 | 0 - 6 | 0.001 | 4×0.63 | 0.00015 | 0.00005 in for 2.5 in length base, 0.00008 in for 4 in length base | 0.000012 | 6 |
| 129-128 | 2.5×0.63 | 6 | | | | | |
| 129-132 | 0 - 12 | 0.001 | 4×0.63 | 0.00015 | 0.00005 in for 2.5 in length base, 0.00008 in for 4 in length base | 0.000012 | 12 |
| 129-149 | 2.5×0.63 | | | | | | |
| 129-150 | 4×0.63 | | | | | | |

Note: For the function of Digimatic models **329-250-30, 329-251-30, 329-350-30, and 329-351-30**, refer to page D-60. These models are not waterproof.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Technical Data

- Parallelism between reference face and measuring rod face: (4+R/50) μm, R=Max. measuring length (mm) [0.0002+0.00005(R/2)] in
Fraction rounded up
±(2+R/75) μm for interchangeable rod, [0.0001+0.00005(R/3)] in
R=Max. range (mm)
Fraction rounded up
- Battery*: SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
- Battery life*: Approx. 2.4 years under normal use
* Digimatic models
- Scale type: Electromagnetic induction absolute encoder
- Standard Accessories: **301336** Spanner
04GAA274 Spanner
202863 Hex-Spanner

Optional Accessories for 329-250-30, 329-251-30, 329-350-30, and 329-351-30.

For details, refer to page A-27.

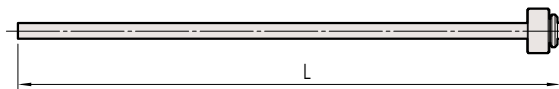
- Connection cable
05CZA662: SPC cable with data button (1 m)
05CZA663: SPC cable with data button (2 m)
- USB Input Tool Direct
06AFM380B: SPC cable for **USB-ITN-B** (2 m)
- Connecting cables for **U-WAVE-T**
02AZD790B: SPC cable with data button (160 mm)
02AZE140B: SPC cable for foot switch

Wireless Data Output **U-WAVE**™

- **U-WAVE-TM: 264-622** (IP67 type)
264-623 (Buzzer type)
- **U-WAVE-TMB** Transmitter
(Mitutoyo Bluetooth® U-WAVE)
264-626 (IP type)
264-627 (Buzzer type)
Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TM / TMB**
02AZF310 (IP67 type/buzzer type common specification)
Refer to pages A-16 and A-18 for details.

Interchangeable rod (Optional Accessories)

(Check and adjust the origin point before measurement)



| Range (mm) | | 0 - 25 | 25 - 50 | 50 - 75 | 75 - 100 | 100 - 125 | 125 - 150 | 150 - 175 | 175 - 200 | 200 - 225 | 225 - 250 | 250 - 275 | 275 - 300 |
|------------------|-----------|--------|---------|---------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Analog models | Order No. | 983501 | 983503 | 983505 | 983507 | 983509 | 983511 | 983525 | 983527 | 983529 | 983531 | 983533 | 983535 |
| | L (mm) | 104 | 129 | 154 | 179 | 204 | 229 | 254 | 279 | 304 | 329 | 354 | 379 |
| Digimatic models | Order No. | 983505 | 983507 | 983509 | 983511 | 983525 | 983527 | 983529 | 983531 | 983533 | 983535 | 981781 | 981782 |
| | L (mm) | 154 | 179 | 204 | 229 | 254 | 279 | 304 | 329 | 354 | 379 | 404 | 429 |

| Range (in) | | 0 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 6 | 6 - 7 | 7 - 8 | 8 - 9 | 9 - 10 | 10 - 11 | 11 - 12 |
|------------------|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
| Analog models | Order No. | 983502 | 983504 | 983506 | 983508 | 983510 | 983512 | 983526 | 983528 | 983530 | 983532 | 983534 | 983536 |
| | L (mm) | 104.3 | 129.7 | 155.1 | 180.5 | 205.9 | 231.3 | 256.7 | 282.1 | 307.5 | 332.9 | 358.3 | 383.7 |
| Digimatic models | Order No. | 983506 | 983508 | 983510 | 983512 | 983526 | 983528 | 983530 | 983532 | 983534 | 983536 | 981783 | 981784 |
| | L (mm) | 155.1 | 180.5 | 205.9 | 231.3 | 256.7 | 282.1 | 307.5 | 332.9 | 358.3 | 383.7 | 409.1 | 434.5 |

Functions of 329-250-30, 329-251-30, 329-350-30, and 329-351-30

Origin point setting (ABS measurement system):

Resets the ABS origin at the current spindle position to the minimum value of the measuring range and switches to ABS mode.

Zero-setting (INC measurement system):

A brief press on the ZERO/ABS button sets display to zero at the current spindle position and switches to the incremental (INC) measuring mode. A longer press resets to the ABS measuring mode.

Hold:

Pressing the HOLD button freezes the current value in the display. This function is useful for preserving a measurement in situations of poor visibility where the instrument must be moved away from the workpiece before the reading can be recorded.

Data output:

Models equipped with this function have an output port for transferring measurement data to a Statistical Process Control (SPC) system.

Auto power ON/OFF:

The reading on the LCD disappears after this instrument is idle for about 20 minutes, but the reading and measurement mode are retained. Turning the spindle causes the reading to reappear.

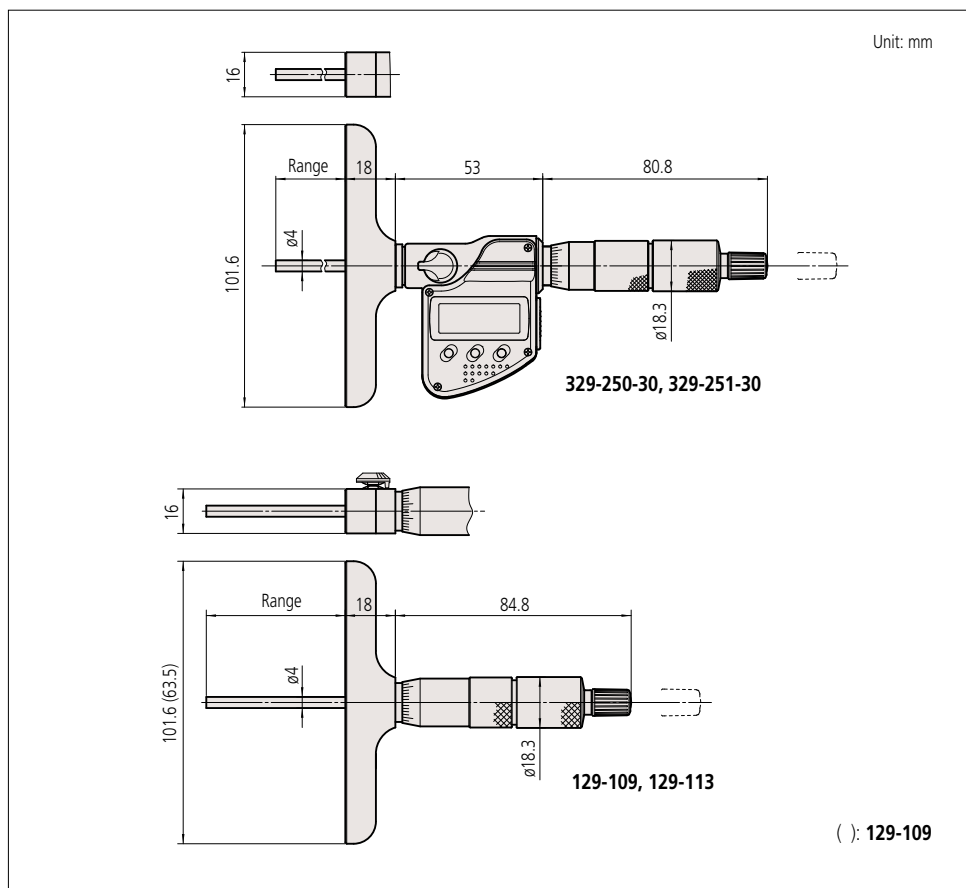
Error alarm:

In case of an overflow on the LCD or a computing error, an error message appears on the LCD, and the measuring function stops. This prevents an instrument from giving an erroneous reading. Also, when the battery voltage drops to a certain level, the low-battery-voltage alarm annunciator appears well before the micrometer becomes unusable.

Function lock:

This function allows the PRESET (origin point setting) function and the ZERO (zero-setting) function to be locked to prevent these points being reset accidentally.

DIMENSIONS



Depth Gage

A standard measuring tool of industry

Depth Micrometer SERIES 128

- Measuring rod diameter: 4 mm
- Measuring rod lock is attached.
Note: Measuring rod is attached on the rear side of the micrometer.
- Carbide-tipped measuring rod model is available.
- Ratchet stop provides constant measuring force.



SPECIFICATIONS

Metric

| Order No. | Range (mm) | Graduation (mm) | Maximum permissible error J_{MPE} (μm) | Flatness of reference face | Flatness of measuring spindle face (μm) | Base (mm) |
|-----------|------------|-----------------|---|--|--|-----------|
| 128-101 | 0 - 25 | 0.01 | ± 3 | 1.3 μm for 63.5 mm length base, 2 μm for 101.6 mm length base | 0.3 | 63.5x16 |
| 128-103* | | | | | | 101.6x16 |
| 128-102 | | | | | | |
| 128-104* | | | | | | |

* With carbide-tipped measuring rod

Inch

| Order No. | Range (in) | Graduation (in) | Maximum permissible error J_{MPE} (in) | Flatness of reference face | Flatness of measuring spindle face (in) | Base (in) |
|-----------|------------|-----------------|--|---|---|-----------|
| 128-105 | 0 - 1 | 0.001 | ± 0.00015 | 0.00005 in for 2.5 in length base, 0.00008 in for 4 in length base | 0.000012 | 2.5x0.63 |
| 128-106 | | | | | | 4x0.63 |

Depth Micro Checker SERIES 515

- The Depth Micro Checker is designed to check and help set the range-end points of a depth micrometer.



SPECIFICATIONS

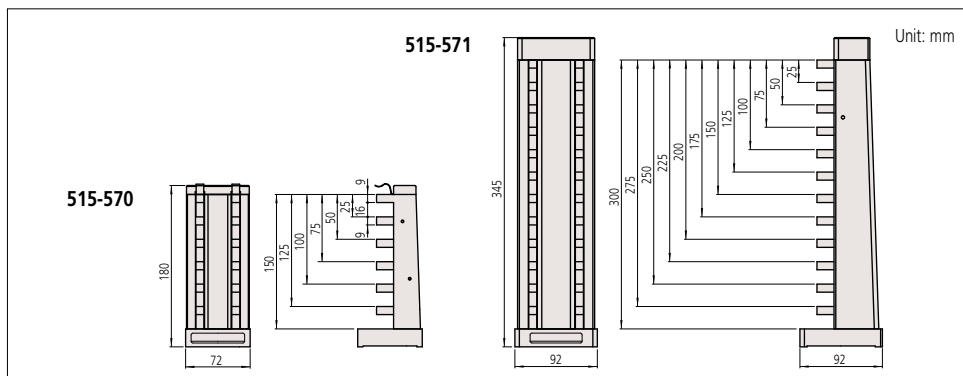
Metric

| Order No. | Range (mm) | Block pitch accuracy | Anvil block accuracy (μm) |
|-----------|------------|---|--|
| 515-570 | 0 - 150 | $\pm(1 + L/150) \mu\text{m}$, L=Length to check (mm) | ± 0.5 |
| 515-571 | 0 - 300 | | |

Inch

| Order No. | Range (in) | Block pitch accuracy | Anvil block accuracy (μin) |
|-----------|------------|--|---|
| 515-575 | 0 - 6 | $\pm(40 + L/0.15) \mu\text{in}$, L=Length to check (in) | ± 20 |

DIMENSIONS

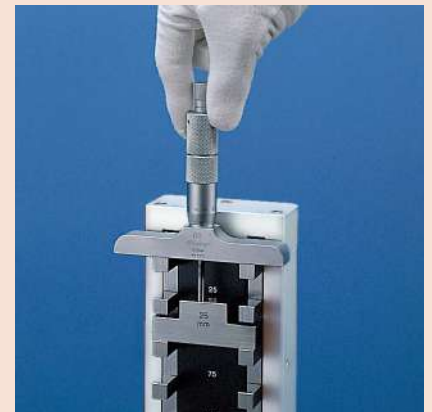


Standard Accessories

- 301336: Spanner



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Optional Accessories for IP67 coolant proof models

For details, refer to page A-25.

- Connecting cables
 - **05CZA624**: SPC cable with data button (1 m)
 - **05CZA625**: SPC cable with data button (2 m)
 Note: Optional connecting cable is available only for water-proof type.
- USB Input Tool Direct
 - **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)

Optional Accessories for other than IP67 coolant proof models

For details, refer to page A-27.

- **959143**: Data hold unit
- Connecting cables for **IT/DP/MUX**
 - **959149**: SPC cable with data button (1 m)
 - **959150**: SPC cable with data button (2 m)
- USB Input Tool Direct
 - **06AFM380C**: SPC cable for **USB-ITN-C** (2 m)
- Connecting cables for **U-WAVE-T**
 - **02AZD790A**: SPC cable with data button (160 mm)
 - **02AZE140A**: SPC cable for foot switch

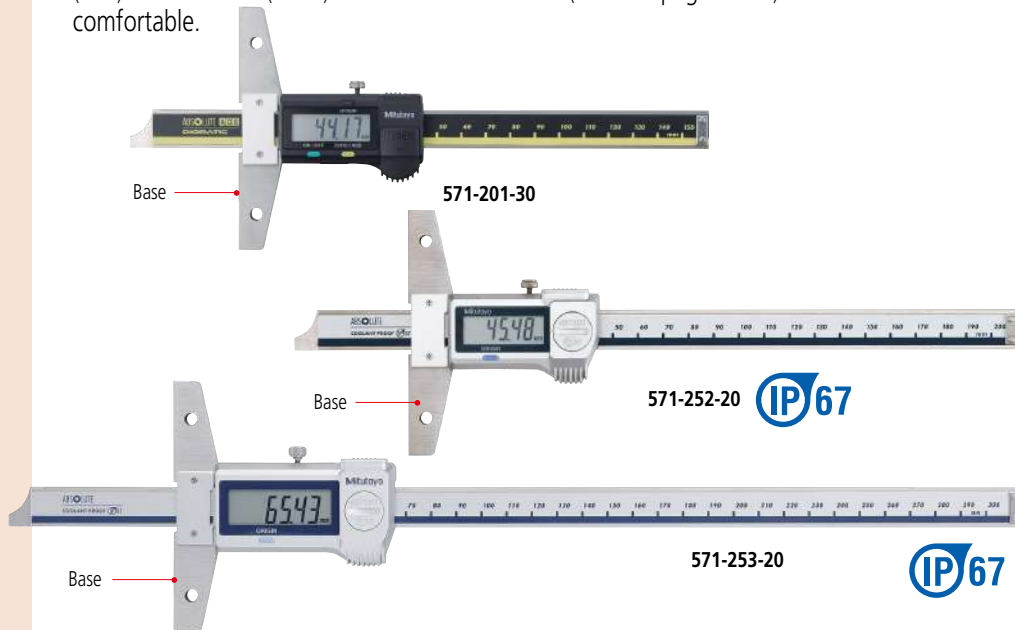
Wireless Data Output

U-WAVE fit

- **U-WAVE-TC**: **264-620** (IP67 type)
264-621 (Buzzer type)
 - **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth® U-WAVE)**
264-624 (IP type)
264-625 (Buzzer type)
- Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
02AZF310 (IP67 type)
- Note: IP67 model is water/dust-proofed suitable for the factory floor.
Buzzer type is not water/dust-proofed.
Refer to pages A-16 and A-18 for details.

ABSOLUTE Digimatic Depth Gauge SERIES 571

- Coolant proof models achieve IP67 protection level.
- Enables stable depth measurement with a resolution of 0.01 mm.
- ABSOLUTE Digital Caliper (Refer to page D-6 for ABSOLUTE function).
- Sliding operation of models with the measuring ranges 150 mm (6 in), 200 mm (8 in) and 300 mm (12 in) is smooth and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Battery: SR44 (1 pc), **938882**. For initial operational checks (standard accessory).
- Optional longer extension bases are available. (Refer to page D-66.)



SPECIFICATIONS

| Metric | | | | | |
|--------------|------------|-----------------|--------------|-----------------|---------------------------------------|
| Order No. | Range (mm) | Resolution (mm) | Battery life | Base (W×T) (mm) | Maximum Permissible Error*1 (mm)/EMPE |
| 571-201-30 | 0 - 150 | 0.01 | 5 years | 100×6 | ±0.02 |
| 571-202-30 | 0 - 200 | | | | |
| 571-203-30 | 0 - 300 | | | | |
| 571-251-20*2 | 0 - 150 | 0.01 | 3 years | 250×10 | ±0.05 |
| 571-252-20*2 | 0 - 200 | | | | |
| 571-253-20*2 | 0 - 300 | | | | |
| 571-204-10*3 | 0 - 450 | 0.01 | 3 years | 250×10 | ±0.06 |
| 571-205-10*3 | 0 - 600 | | | | |
| 571-206-10*3 | 0 - 750 | | | | |
| 571-207-10*3 | 0 - 1000 | | | | ±0.07 |

| Inch / Metric | | | | | |
|---------------|------------|--------------|-----------------|---------------------------------------|--|
| Order No. | Range (in) | Battery life | Base (W×T) (in) | Maximum Permissible Error*1 (mm)/EMPE | |
| 571-211-30 | 0 - 6 | 5 years | 3.93×0.23 | ±0.001 in/±0.02 mm | |
| 571-212-30 | 0 - 8 | | | ±0.0015 in/±0.02 mm | |
| 571-213-30 | 0 - 12 | | | ±0.0015 in/±0.03 mm | |
| 571-261-20*2 | 0 - 6 | 3 years | 9.8×0.39 | ±0.001 in/±0.02 mm | |
| 571-262-20*2 | 0 - 8 | | | ±0.001 in/±0.02 mm | |
| 571-263-20*2 | 0 - 12 | | | ±0.0015 in/±0.03 mm | |
| 571-214-10*3 | 0 - 18 | 3 years | 9.8×0.39 | ±0.002 in/±0.05 mm | |
| 571-215-10*3 | 0 - 24 | | | ±0.002 in/±0.05 mm | |
| 571-216-10*3 | 0 - 30 | | | ±0.0025 in/±0.06 mm | |
| 571-217-10*3 | 0 - 40 | | | ±0.0025 in/±0.07 mm | |

*1 Maximum Permissible Error, EMPE, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.
*2 IP67 Coolant Proof model
*3 Cannot be used with **U-WAVE-TC**

*1 Maximum Permissible Error, EMPE, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.
*2 IP67 Coolant Proof model
*3 Cannot be used with **U-WAVE-TC**

DIMENSIONS

Unit: mm

| Range (mm) | L | W | Base thickness |
|------------|-----------|------|----------------|
| 0 - 150 | 239 | 59.2 | 6 |
| 0 - 200 | 289 | | 6 |
| 0 - 300 | 403 (404) | 94 | 6 (6.3) |
| 0 - 450 | 635 | | 10 |
| 0 - 600 | 785 | | 10 |
| 0 - 750 | 935 | | 10 |
| 0 - 1000 | 1200 | | 10 |

() : Coolant Proof models

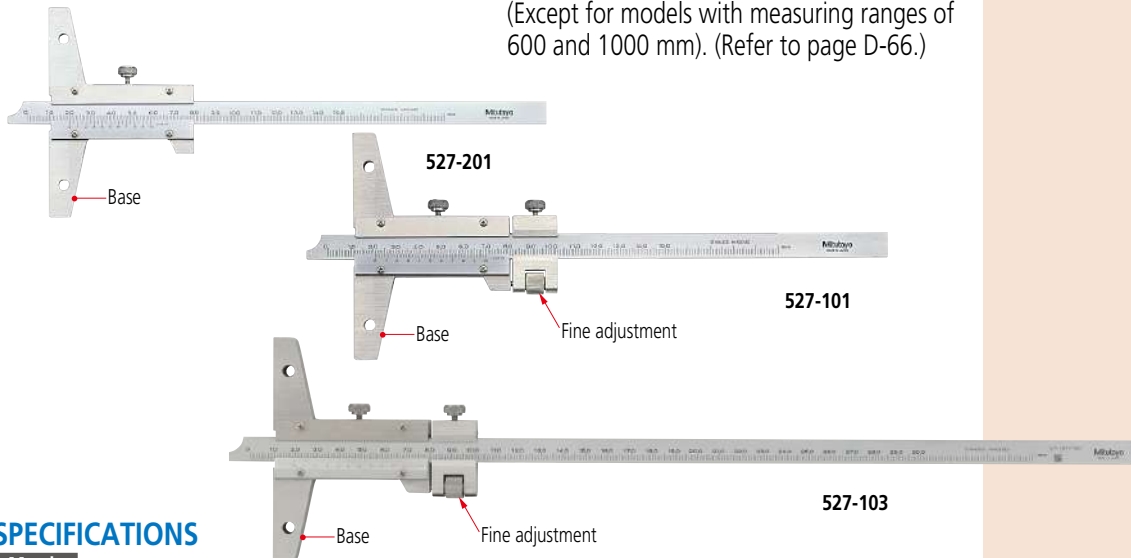
571-204-10, 571-205-10, 571-206-10, 571-207-10

Depth Gage

A standard measuring tool of industry

Vernier Depth Gage SERIES 527

- Standard gage for depth measurement.
- Optional longer extension bases are available. (Except for models with measuring ranges of 600 and 1000 mm). (Refer to page D-66.)



SPECIFICATIONS

| Metric | | | | | |
|-----------|------------|----------------------|-----------------|--|---------|
| Order No. | Range (mm) | Minimum reading (mm) | Base (W×T) (mm) | Maximum Permissible Error* (mm)/E _{MPE} | Remarks |
| 527-201 | 0 - 150 | 0.05 | 100×6.5 | ±0.05 | — |
| 527-202 | 0 - 200 | | | ±0.08 | — |
| 527-203 | 0 - 300 | | | ±0.10 | — |
| 527-204 | 0 - 600 | | 250×10 | ±0.10 | — |
| 527-205 | 0 - 1000 | | | ±0.15 | — |

* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

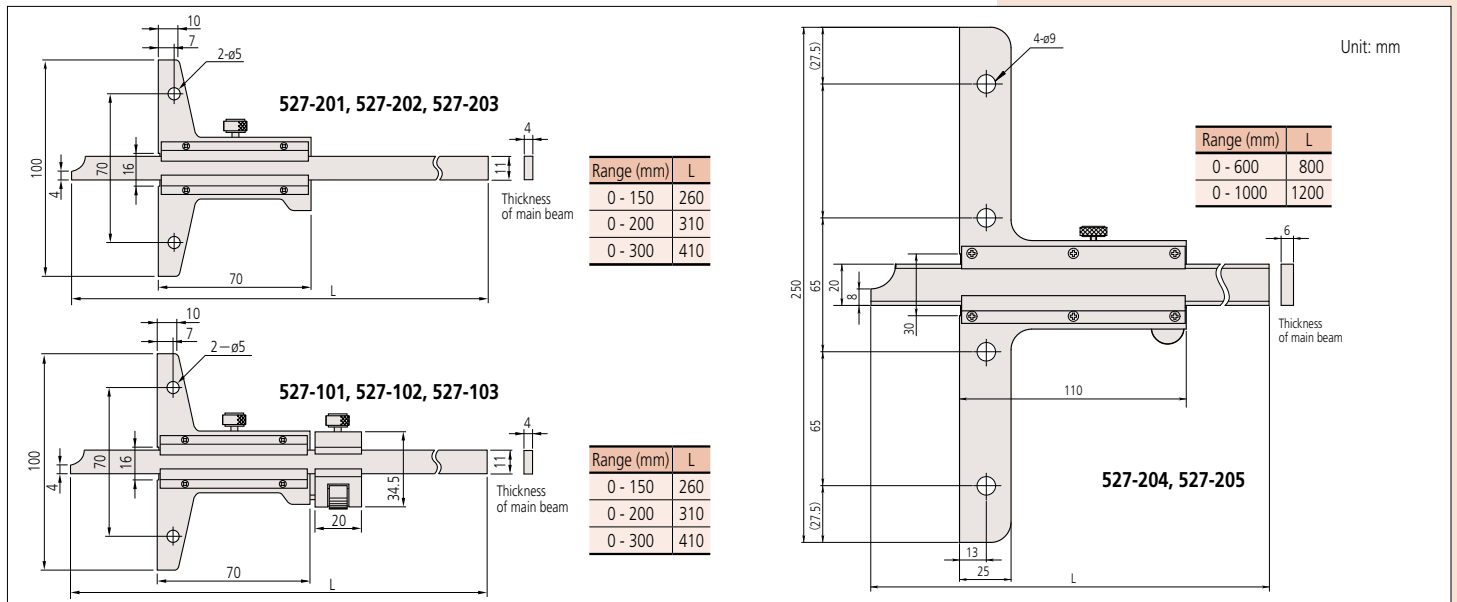
| Metric | | | | | |
|-----------|------------|----------------------|-----------------|--|----------------------|
| Order No. | Range (mm) | Minimum reading (mm) | Base (W×T) (mm) | Maximum Permissible Error* (mm)/E _{MPE} | Remarks |
| 527-101 | 0 - 150 | 0.02 | 100×6.5 | ±0.03 | with fine adjustment |
| 527-102 | 0 - 200 | | | ±0.04 | |
| 527-103 | 0 - 300 | | | ±0.04 | |

* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

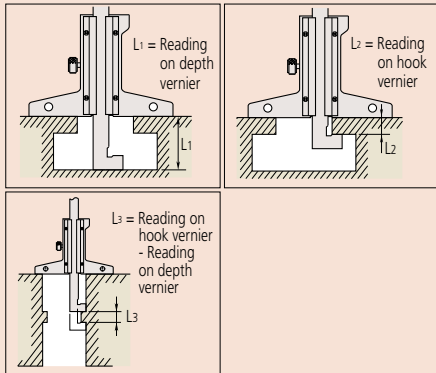
| Inch | | | | | |
|-----------|------------|----------------------|-----------------|--|----------------------|
| Order No. | Range (in) | Minimum reading (in) | Base (W×T) (in) | Maximum Permissible Error* (in)/E _{MPE} | Remarks |
| 527-111 | 0 - 6 | 0.001 | 3.93×0.25 | ±0.001 | with fine adjustment |
| 527-112 | 0 - 8 | | | ±0.0015 | |
| 527-113 | 0 - 12 | | | ±0.002 | |
| 527-114 | 0 - 24 | | 9.8×0.39 | ±0.003 | |
| 527-115 | 0 - 40 | | | ±0.003 | |

* Maximum Permissible Error, E_{MPE}, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

DIMENSIONS



Typical applications



Optional Accessories for Digimatic Models

For details, refer to page A-27.

• Connection cables for **IT/DP/MUX**

05CZA624: SPC cable with data button (1 m)

05CZA625: SPC cable with data button (2 m)

Note: Optional connecting cable is available only for water-proof type.

• USB Input Tool Direct

06AFM380A: SPC cable for **USB-ITN-A** (2 m)

• Connecting cables for **U-WAVE-T**

02AZD790A: SPC cable with data button (160 mm)

02AZE140A: SPC cable for foot switch

Wireless Data Output U-WAVE™

• **U-WAVE-TC**: **264-620** (IP67 type)

264-621 (Buzzer type)

• **U-WAVE-TCB Transmitter**

(Mitutoyo **Bluetooth®** U-WAVE)

264-624 (IP type)

264-625 (Buzzer type)

Refer to page A-15 for details.

• Connecting unit for **U-WAVE-TC/TCB**

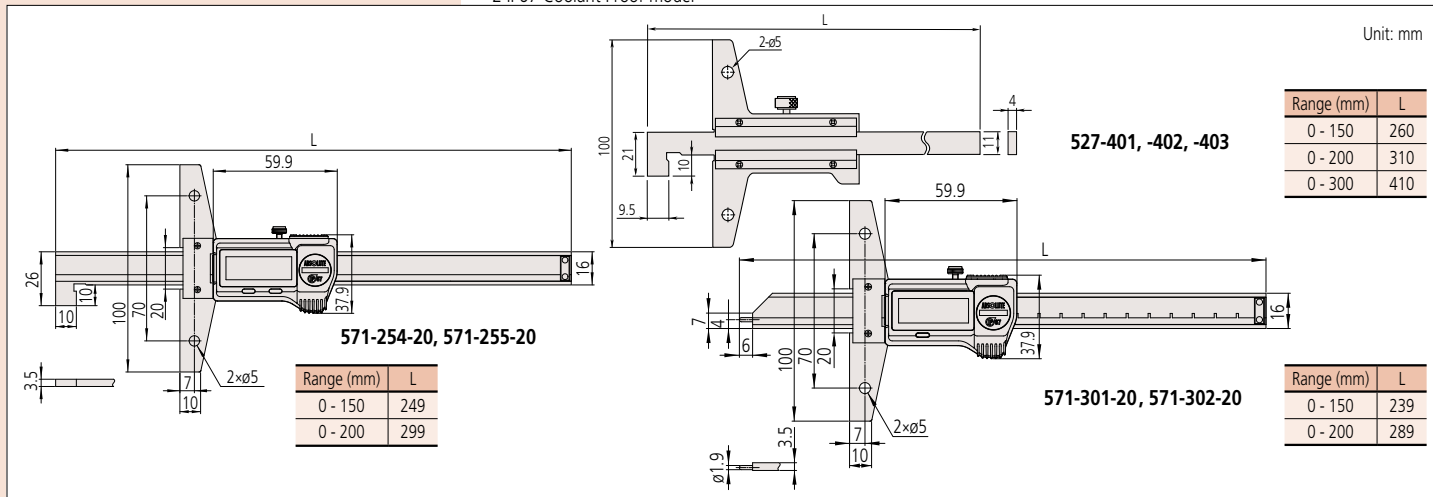
02AZF310 (IP67 type)

Note: IP67 model is water/dust-proofed suitable for the factory floor.

Buzzer type is not water/dust-proofed.

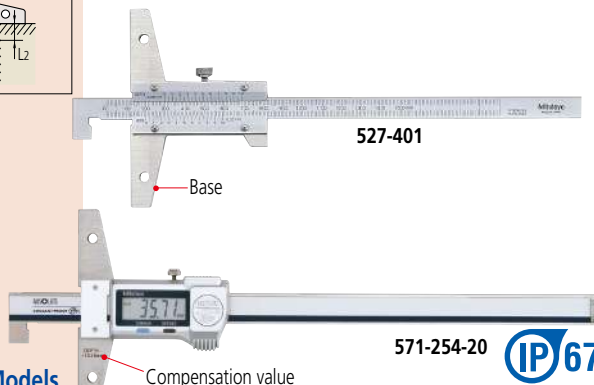
Refer to pages A-16 and A-18 for details.

DIMENSIONS



Depth Gauge
SERIES 527, 571 — Hook End Type
Pin End Type

- The end of the main beam is hook-shaped to allow depth and thickness measurements of a projected portion or lip in a hole, in addition to standard depth measurement.
- Coolant proof models achieve IP67 protection level.
- Enables stable depth measurement with a resolution of 0.01 mm.
- ABSOLUTE Digital Caliper (Refer to page D-6 for ABSOLUTE function.)
- Digimatic models **571-254-20** and **571-255-20** need the compensation value (engraved on the base) added to the displayed value for correct depth measurement. However, the featured Offset function enables this to be done easily just by pressing the OFFSET button after the hook jaw is brought in contact with the base and the ORIGIN button is pressed.
- Slider operation of the Digimatic models is smooth and comfortable.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Battery: SR44 (1 pc), **938882**. For initial operational checks (standard accessory)
- Battery life: Approx. 5 years under normal use (for Digimatic models)
- Optional longer extension bases are available. (Refer to page D-66.)



SPECIFICATIONS

| Metric | | | | |
|----------------------|----------------------------|----------------------------|-----------------|---------------------------------------|
| Order No. | Range (mm): L1 (L2 and L3) | Resolution/Graduation (mm) | Base (WxT) (mm) | Maximum Permissible Error*1 (mm)/EMPE |
| Digimatic (LCD) | | | | |
| 571-254-20 *2 | 10.1 - 160 (0 - 150) | 0.01 | 100x6 | ±0.03 |
| 571-255-20 *2 | 10.1 - 210 (0 - 200) | | | |
| 571-301-20 *2 | 0 - 150 | | | |
| 571-302-20 *2 | 0 - 200 | | | ±0.02 |
| Analog | | | | |
| 527-401 | 10 - 150 (0 - 150) | 0.05 | 100x6.5 | ±0.05 |
| 527-402 | 10 - 200 (0 - 200) | | | |
| 527-403 | 10 - 300 (0 - 300) | | | |
| 527-411 | 10 - 150 (0 - 150) | 0.02 | | ±0.03 |
| 527-412 | 10 - 200 (0 - 200) | | | |
| 527-413 | 10 - 300 (0 - 300) | | | |

*1 Maximum Permissible Error, EMPE, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

*2 IP67 Coolant Proof model

| Inch/Metric | | | | |
|----------------------|----------------------------|-------------------|-----------------|----------------------------------|
| Order No. | Range: L1 (L2 and L3) | Resolution | Base (WxT) (mm) | Maximum Permissible Error*1/EMPE |
| Digimatic (LCD) | | | | |
| 571-264-20 *2 | 0.4 in - 6.4 in (0 - 6 in) | 0.0005 in/0.01 mm | 100x6 | ±0.0015 in/±0.03 mm |
| 571-265-20 *2 | 0.4 in - 8.4 in (0 - 8 in) | | | |
| 571-311-20 *2 | 0 - 150 mm/0 - 6 in | 0.0005 in/0.01 mm | | ±0.001 in/±0.02 mm |
| 571-312-20 *2 | 0 - 200 mm/0 - 8 in | | | |

*1 Maximum Permissible Error, EMPE, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

*2 IP67 Coolant Proof model

Depth Gage

A standard measuring tool of industry

Mini Depth Gage SERIES 571

- This is a compact depth gage.
- Enables measurement of depth of tire groove.
- Digital display with 0.01 mm resolution enables measurement without misreading.
- ABSOLUTE Digital Depth Gage.
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)
- Battery: SR44 (1 pc), **938882**. For initial operational checks (standard accessory)
- Battery life: Approx. 5 years under normal use.



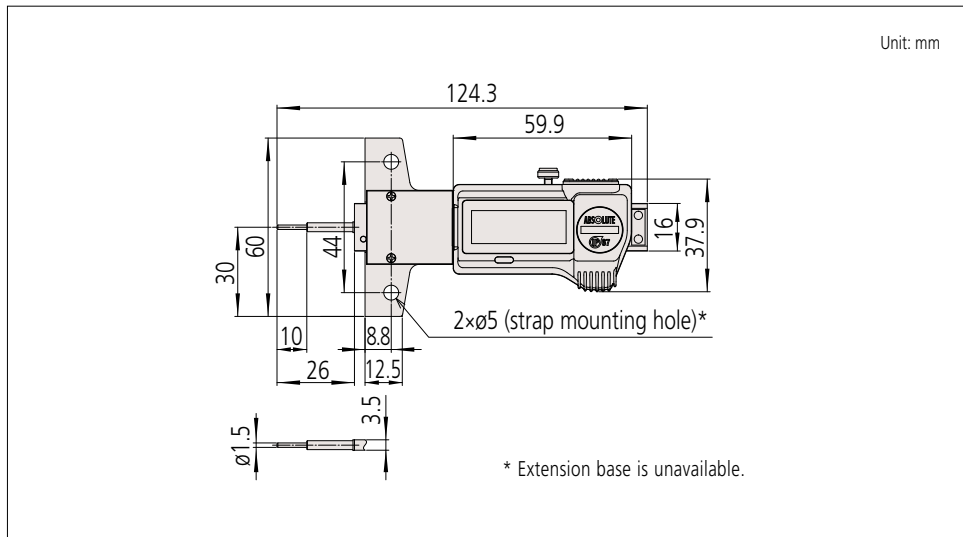
571-100-20

SPECIFICATIONS

| Order No. | Range (mm) | Resolution (mm) | Base (mm) | Maximum Permissible Error* (mm)/ <i>E_{MPE}</i> |
|------------|------------|-----------------|-----------|---|
| 571-100-20 | 0 - 25 | 0.01 | 60 | ±0.02 |

* Maximum Permissible Error, *E_{MPE}*, is the term (notation) used in JIS B 7517: 2018, revised based on ISO/TR 14253-6: 2012.

DIMENSIONS



Unit: mm

* Extension base is unavailable.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™

IP67



Optional Accessories

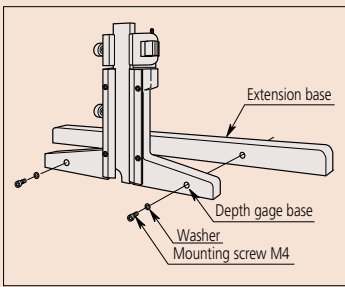
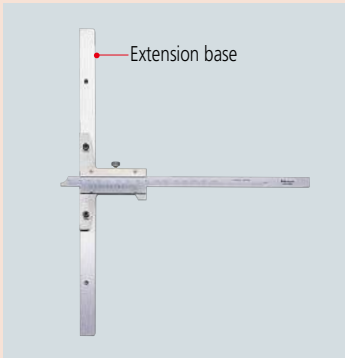
For details, refer to page A-27.

- Connection cables for **IT/DP/MUX**
- **05CZA624**: SPC cable with data button (1 m)
- **05CZA625**: SPC cable with data button (2 m)
- Note: Optional connecting cable is available only for water-proof type.
- USB Input Tool Direct
- **06AFM380A**: SPC cable for **USB-ITN-A** (2 m)
- Connecting cables for **U-WAVE-T**
- **02AZD790A**: SPC cable with data button (160 mm)
- **02AZE140A**: SPC cable for foot switch

Wireless Data Output U-WAVE™

- **U-WAVE-TC: 264-620** (IP67 type)
- **264-621** (Buzzer type)
- **U-WAVE-TCB Transmitter (Mitutoyo Bluetooth® U-WAVE)**
- **264-624** (IP type)
- **264-625** (Buzzer type)
- Refer to page A-15 for details.
- Connecting unit for **U-WAVE-TC/TCB**
- **02AZF310** (IP67 type)
- Note: IP67 model is water/dust-proofed suitable for the factory floor.
- Buzzer type is not water/dust-proofed.
- Refer to pages A-16 and A-18 for details.

Example of attaching the extension base



Note: Align reference planes of the depth gage base and extension base using a surface plate and then tighten mounting screws.

Extension Bases Optional accessory for Depth Gage

- Attaches to the base (reference face) plate of a depth gage to extend its span.
- Refer to the illustrations at left for attachment details.
- Extension base is three times the length of the base for models of less than 300 mm range.
- These extension bases cannot be attached to 0 to 600 mm, 0 to 1,000 mm, 0 to 24 inch and 0 to 40 inch range models.



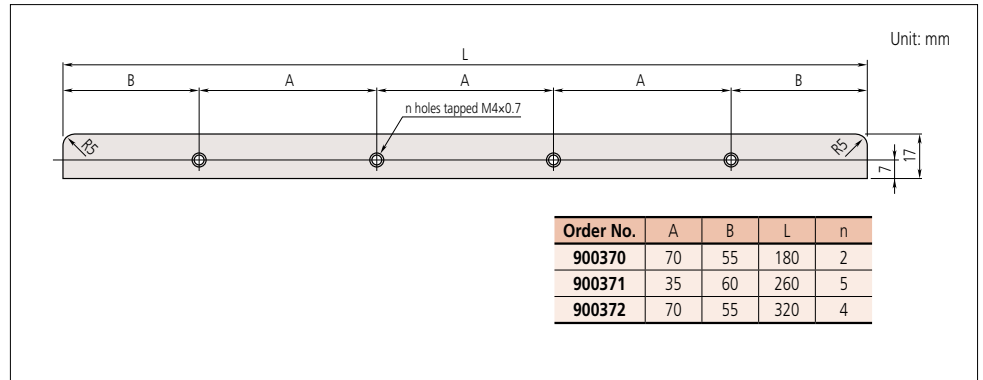
900372

SPECIFICATIONS

| Metric | | |
|-----------|-------------|---|
| Order No. | Size L (mm) | n |
| 900370 | 180 | 2 |
| 900371 | 260 | 5 |
| 900372 | 320 | 4 |

| Inch | | |
|-----------|-------------|---|
| Order No. | Size L (in) | n |
| 900367 | 7 | 2 |
| 900368 | 10 | 5 |
| 900369 | 12 | 4 |

DIMENSIONS



Example of attaching the depth gage attachment



Note: Align reference planes of the depth gage base and extension base using a surface plate and then tighten mounting screws.

Depth Gage Attachment Optional Accessory for Calipers

- Attaching this depth gage attachment to the depth measurement face of the caliper makes depth measurement accurate and secure.

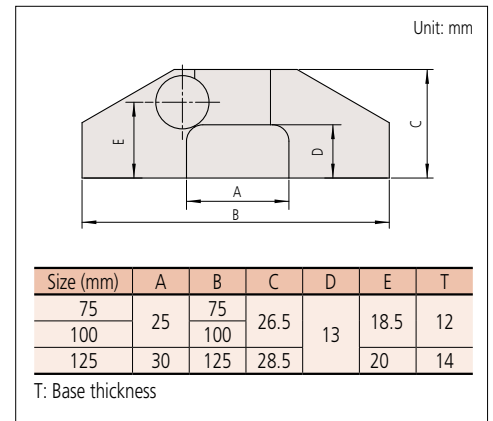


050084-10

SPECIFICATIONS

| Metric | | |
|-----------|-----------|---|
| Order No. | Size (mm) | Applicable measuring range of caliper |
| 050083-10 | 75 | 100 mm, 150 mm, 200 mm, 4 in, 6 in and 8 in |
| 050084-10 | 100 | 100 mm, 150 mm, 200 mm, 4 in, 6 in and 8 in |
| 050085-10 | 125 | 300 mm (12 in) |

DIMENSIONS

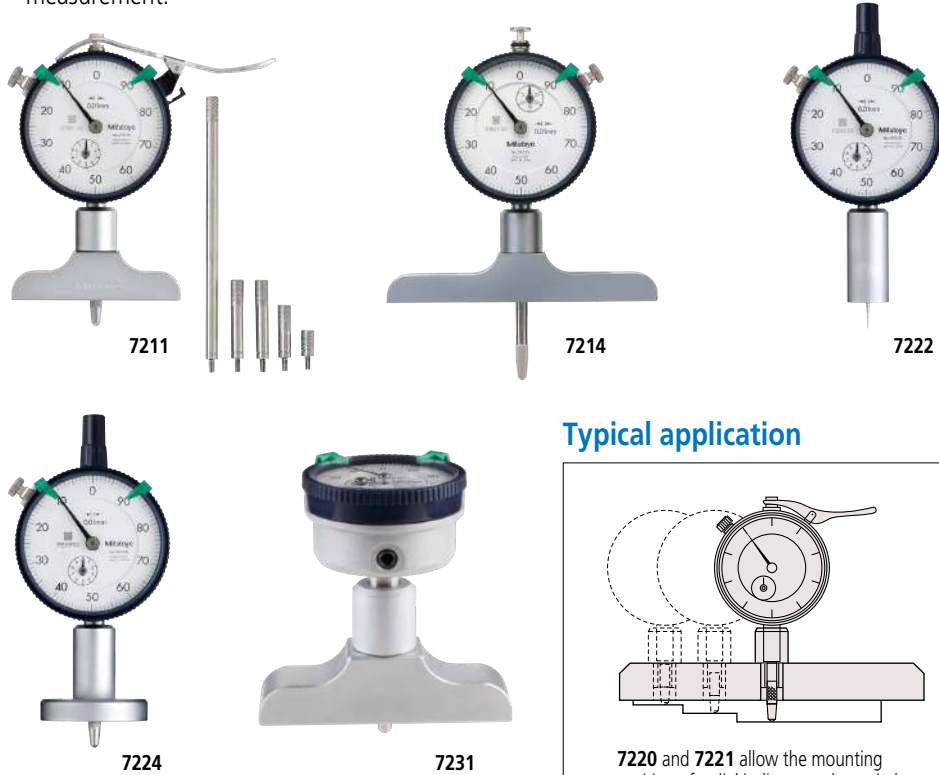


Depth Gage

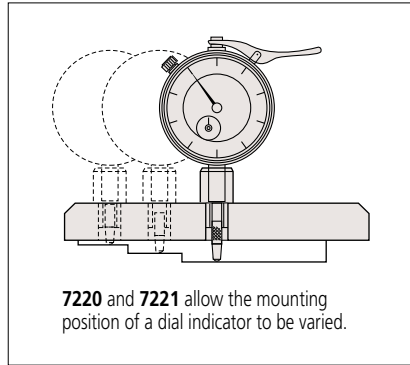
A standard measuring tool of industry

Dial Depth Gage SERIES 7

- Optimal for hole, narrow groove and step measurement.



Typical application



Precautions

Note 1

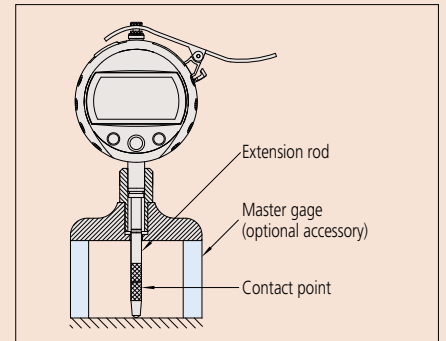
Caution should be exercised when exchanging a contact point of a Depth Gage (Dial/Digimatic Indicator):

- If a different size contact point is mounted, displacement of the contact point from the base contact surface will be changed and as a result, measurement range may not be maintained.
- A contact point cannot be mounted to a Depth Gage if its diameter is too large for the hole diameter of the base.
- Parallelism adjustment with the bottom face of the base is required when mounting a flat contact point such as the flat/needle or carbide-tipped contact point.

Note 2

Caution should be exercised when using an extension rod:

- If the total length of the extension rod exceeds 110 mm (4.5 in) use the instrument in a vertical position (contact point downward).
- Use a master gage (such as gauge blocks) to perform zero-setting when the extension rod is mounted. (Master gage is an optional accessory.)



Note 3

Caution should be exercised when indicators are used on a Depth Gage:

- When the indicator is exchanged and a longer extension rod is connected, the contact-point may deflect significantly with an adverse effect on measuring accuracy.
- Order No.543-400B/543-402B for Depth Gage has a measuring force less than 1.5 N.

SPECIFICATIONS

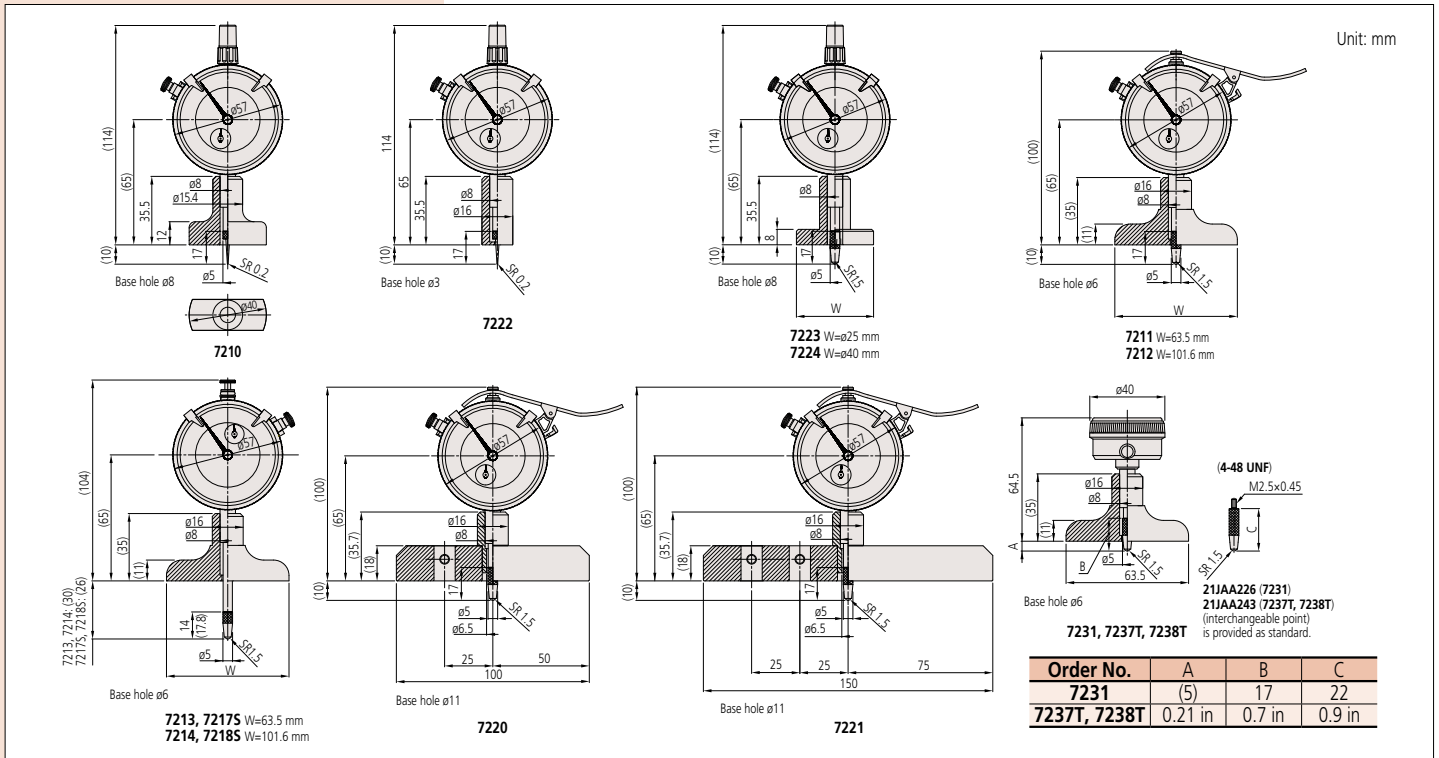
Metric

| Order No. | Range (mm) | Graduation (mm) | Stroke (mm) | Accuracy (μm) | Measuring force (N) | Base | | | | Contact point ^{Note 1} | Extension rod ^{Note 2} | Indicator ^{Note 3} (dial indicator) |
|-----------|------------|-----------------|-------------|---------------|---------------------|--|--------|---------------|---|--|--|--|
| | | | | | | W (mm) | T (mm) | Flatness (μm) | Mounting position of a dial indicator | | | |
| 7210 | 0 - 10 | 0.01 | 10 | ±15 | 1.4 | 40 | 16 | 5 | 1 | Provided with a needle point (137413) | — | 2902SB for Depth Gage |
| 7211 | 63.5 | | | | | Provided with a carbide-tipped ball point (21JAA224) | | | | | | |
| 7212 | 101.6 | | 30 | ±30 | 2.5 | 63.5 | 3 | | Provided with a carbide-tipped ball point (21JAA225) | 3 pcs. (30, 60, 90 mm) | 2952SB for Depth Gage | |
| 7213 | 101.6 | | | | | Provided with a carbide-tipped ball point (21JAA224) | | | 5 pcs. (10, 20, 30, 30, 100 mm) | 2902SB for Depth Gage | | |
| 7214 | 0 - 210 | 10 | 10 | ±15 | 1.4 | 100 | 18 | 2 | Provided with a carbide-tipped ball point (21JAA224) | 5 pcs. (10, 20, 30, 30, 100 mm) | 2902SB for Depth Gage | |
| 7220 | 150 | | | | | 3 | | | | | | |
| 7221 | 0 - 200 | | | | | | | ∅16 | 1 | Provided with a needle point (137413) | | — |
| 7222 | 0 - 10 | | | | | ∅25 | | | | | | |
| 7223 | ∅40 | | | | | | | | | | | |
| 7224 | 0 - 10 | 5 | 5 | ±15 | 1.4 | 63.5 | 16 | 1 | Provided with a carbide-tipped ball point (21JAA224: 17 mm) | 5 pcs. (10, 20, 30, 30, 100 mm) Interchangeable contact point (21JAA226: 22 mm) | 1162T for Depth Gage (Back plunger type) | |
| 7231 | 0 - 200 | | | | | | | | | | | |

Inch

| Order No. | Range (in) | Graduation (in) | Stroke (in) | Accuracy (in) | Measuring force (N) | Base | | | | Contact point ^{Note 1} | Extension rod ^{Note 2} | Indicator ^{Note 3} (dial indicator) |
|-----------|------------|-----------------|-------------|---------------|---------------------|--------|--------|---------------|---------------------------------------|--|---|--|
| | | | | | | W (in) | T (in) | Flatness (in) | Mounting position of a dial indicator | | | |
| 7217S | 0 - 8 | 0.001 | 1 | ±0.002 | 2.5 | 2.5 | 0.63 | 0.0002 | 1 | Carbide ball point (21JZA242) | 3 pcs. (1 in, 2 in, 4 in) | 2904SB for Depth Gage |
| 7218S | | | | | | 4 | | | | Provided with a carbide-tipped ball point (21JZA242: 0.7 in) | 4 pcs. (0.5 in, 1 in, 2 in, 4 in) Interchangeable contact point (21JZA243: 0.9 in) | 1168T for Depth Gage (Back plunger type) |
| 7237T | | | 0.2 | | 4 | | | | | | | |
| 7238T | | | | | | | | | | | | |

DIMENSIONS



MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE Digimatic Depth Gage SERIES 547

MeasurLink ENABLED
Data Management Software by Mitutoyo

- Easy-to-read dial effectively prevents misreading.

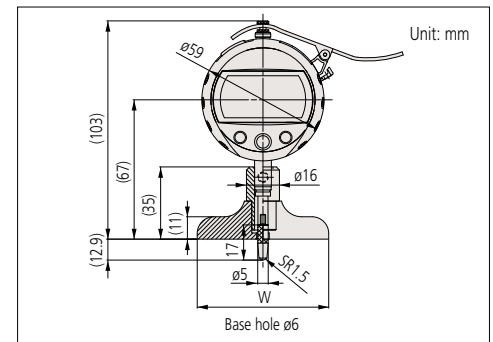
- Allows integration into statistical process control and measurement systems for models with measurement data output connector. (Refer to page A-3.)

ABSOLUTE™



547-211

DIMENSIONS



SPECIFICATIONS

Metric

| Order No. | Range (mm) | Resolution (mm) | Stroke (mm) | Accuracy* ¹ (μm) | Measuring force (N) | Base | | | Contact point* ² | Extension rod* ² | Indicator* ² |
|-----------|------------|-----------------|-------------|-----------------------------|---------------------|--------|--------|---------------|--|---------------------------------|-------------------------|
| | | | | | | W (mm) | T (mm) | flatness (μm) | | | |
| 547-211 | 0 - 200 | 0.01 | 12.7 | ±20 | 1.5 | 63.5 | 16 | 5 | Provided with a carbide-tipped ball point (21JAA224) | 5 pcs. (10, 20, 30, 30, 100 mm) | 543-400B |
| 547-212 | | | | | | 101.6 | | | | | |
| 547-251 | | 0.001 | | 63.5 | | | | | | | |
| 547-252 | | | | 101.6 | | | | | | | |

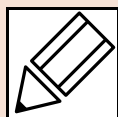
Inch / Metric

| Order No. | Range (in) | Resolution | Stroke (in) | Accuracy* ¹ (in) | Measuring force (N) | Base | | | Contact point* ² | Extension rod* ² | Indicator* ² |
|-----------|------------|---------------------|-------------|-----------------------------|---------------------|---------|--------|---------------|--|-----------------------------------|-------------------------|
| | | | | | | W (in) | T (in) | flatness (in) | | | |
| 547-217S | 0 - 8 | 0.0005 in/0.01 mm | 0.5 | ±0.001 | 1.5 | 2.5 | 0.63 | 0.0002 | Provided with a carbide-tipped ball point (21JAA242) | 4 pcs. (0.5 in, 1 in, 2 in, 4 in) | 543-402B |
| 547-218S | | | | | | 4 | | | | | |
| 547-257S | | 0.00005 in/0.001 mm | | 2.5 | | | | | | | |
| 547-258S | | | | 4 | | 0.00008 | | | | | |

*1 Excluding quantizing error of ±1 count

*2 Refer to corresponding notes on page D-67.

Quick Guide to Precision Measuring Instruments



Depth Gages

Depth Gage Performance Evaluation Method

JIS B 7518 was revised and issued in 2018 as the Japanese Industrial Standards of the depth gage, and the “Instrumental error” indicating the indication error of the depth gage has been changed to “Maximum Permissible Error (MPE) of indication”.

The “Instrumental error” of the old JIS adopts acceptance criteria that the specification range (precision specification) equals acceptance range, and the OK/NG judgment does not include measurement uncertainty (Fig. 1).

The “Maximum Permissible Error (MPE) of indication” of the new JIS employs the basic concept of the OK/NG judgment taking into account the uncertainty adopted in the ISO standard (ISO 14253-1).

The verification of conformity and nonconformity to the specifications is clearly stipulated to use the internationally recognized acceptance criteria (simple acceptance) when the specification range equals the acceptance range, and it is accepted that the specification range equals the acceptance range if a given condition considering uncertainty is met.

The above said internationally recognized acceptance criterion is ISO/TR 14253-6: 2012 (Fig. 2).

The following describes the standard inspection method including the revised content of JIS 2018.

Fig. 1 Old JIS Instrumental error
JIS B 7518-1993

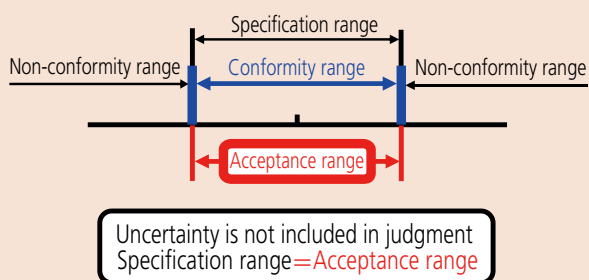
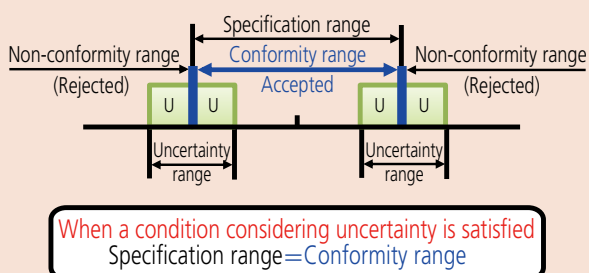


Fig. 2 New JIS Maximum Permissible Error (MPE)
JIS B 7518: 2018 (ISO/TR 14253-6: 2012)



Maximum Permissible Error of depth measurement E_{MPE} [JIS B 7518: 2018]

The Maximum Permissible Error E_{MPE} of a depth gage is an indication error applied to depth measurement.

Table 1 shows the Maximum Permissible Error E_{MPE} of the indication value of the partial measuring surface contact error.

E_{MPE} for any desired height is obtained by measuring the height of two equal length gauge blocks, or equivalent, with a height gage on a precision surface plate (Fig. 3) and then subtracting the gauge block size from the measured size.

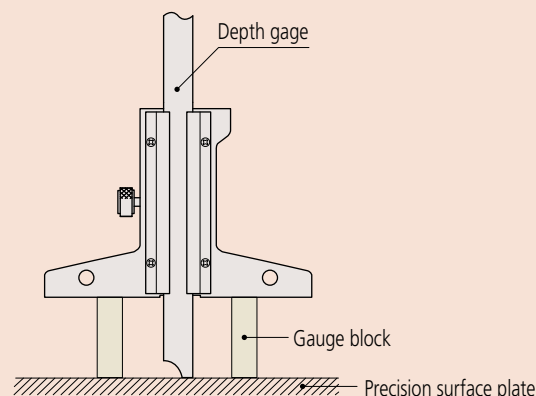
Table 1: Maximum Permissible Error E_{MPE} of a conventional depth gage

Unit: mm

| Measurement depth | Scale interval, graduation or resolution | |
|-----------------------|--|--------------|
| | 0.05 | 0.02 or 0.01 |
| 50 or less | ±0.05 | ±0.02 |
| Over 50, 100 or less | ±0.06 | ±0.03 |
| Over 100, 200 or less | ±0.07 | |
| Over 200, 300 or less | ±0.08 | ±0.04 |
| Over 300, 400 or less | ±0.09 | |
| Over 400, 500 or less | ±0.10 | ±0.05 |
| Over 500, 600 or less | ±0.11 | |

Note: E_{MPE} includes the measurement error arising from straightness, flatness of the measuring surface and parallelism with the reference surface.

Fig. 3: Determination of depth measurement error



The “Instrumental error” indicating the indication error of JIS has been changed to “Maximum Permissible Error (MPE) of indication” for the following models:

- **571 Series ABSOLUTE Digimatic Depth Gage** described on page D-62 (All models)
- **527 Series Vernier Depth Gage** described on page D-63 (All models)
- **527, 571 Series Hook End Type** described on page D-64 (All models)
- **571 Series Mini Depth Gage** described on page D-65 (All models)

New Products



Ultra Low Expansion Ceramic Gauge Blocks (ZERO CERA Blocks)

Refer to page E-6 for details.

Gauge Block Comparator GBCD-100A

Refer to page E-31 for details.

Digital Height Master

Refer to page E-35 for details.

High Precision Square

Refer to page E-41 for details.

Gauge Blocks

Gauge Block



Height Master & Reference Gages

Height Master



Reference Gages



Granite Surface Plates



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Gauge Blocks

Length Standards Brought to You by Mitutoyo

Features and Accuracies

Features of Mitutoyo Gauge Blocks

Mitutoyo offers 3 types of gauge block for use as length standards: rectangular steel, rectangular ceramic (CERA Blocks) and square steel gauge blocks. In addition, rectangular and square protection blocks (1 mm and 2 mm for each) are available in tungsten carbide. Mitutoyo gauge blocks are recognized to be of the highest quality both here in Japan and abroad, and are available in various grades to meet every need in respect of working conditions, environment and application.

Accuracy

As a world-leading precision measuring equipment manufacturer, Mitutoyo is certified by the Japanese government as an accredited calibration laboratory, which means that the accuracy of its gauge blocks is guaranteed through traceability to the Metrology Management Center of the National Institute of Advanced Industrial Science and Technology (AIST).

Wringing

Lapping measuring surfaces is one of Mitutoyo's specialties. Our advanced technique, developed over more than half a century, enables us to achieve the optimum flatness and surface finish needed for gauge blocks and thus maximize the wringing force.

Abrasion Resistance and Dimensional Stability of Steel Blocks

High-carbon high-chrome steel is employed to satisfy a variety of the material characteristics required for gauge blocks. Our advanced heat treatment technology for steel blocks, which involves repeated temperature cycling, simultaneously achieves excellent abrasion resistance and minimizes any change in length over time.

CERA Blocks

CERA blocks are made of a ceramic material with a superior surface finish, created by Mitutoyo's ultra-precision machining techniques, that provides a premium quality block with significant advantages:

(1) Corrosion Resistant

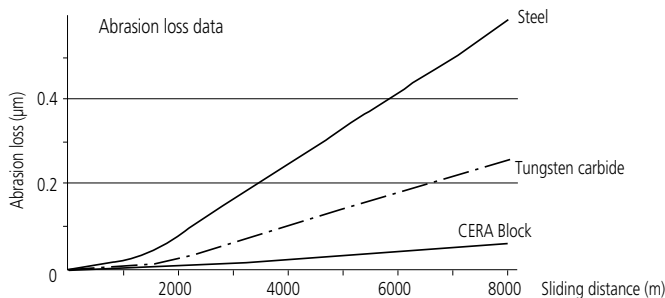
Anti-corrosion treatment is not required when handled normally (i.e. with fingers), resulting in simple maintenance and storage.

(2) No Burrs Caused by Accidental Mishandling

Since the CERA Block is very hard, it will not scratch easily and is highly resistant to burrs. If a burr is formed, it can easily be removed with a ceramic deburring stone (Ceraston).

(3) Abrasion Resistant

CERA Blocks have 10 times the abrasion resistance of steel gauge blocks.



(4) Dimensionally Stable

CERA Blocks are free from dimensional change over time.

(5) Clearly Marked Sizes

Black characters, indicating the nominal length, are inscribed by laser and are clearly visible against the white surface of the block.

(6) Non-magnetic Nature Prevents Steel Swarf Contamination

(7) High Wringing Force

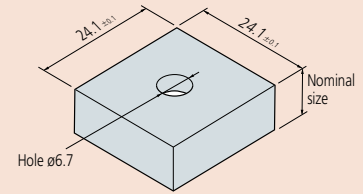
Superior flatness and surface finish provides maximum wringing force.



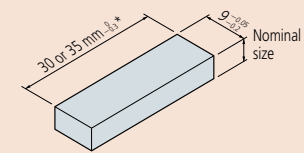
Classification of Gauge Blocks by Shape

Mitutoyo broadly divides gauge blocks into two categories according to the block shape.

Square gauge blocks

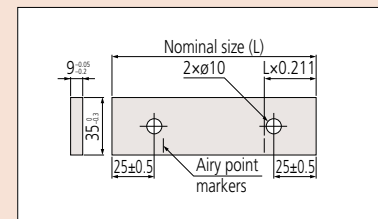


Rectangular gauge blocks



* Depends on the nominal size.
More than 10 mm: 35 mm
10 mm or less: 30 mm

Long rectangular gauge blocks



Two coupling holes are provided in this type of block for the purpose of joining two long blocks together and/or attaching accessories using special connectors. (See page E-19 for connector types available.)

Selecting Gauge Blocks

- Select gauge blocks in accordance with the combination range required.
If a large length is required, use one or more blocks from a long-block set.
- Select gauge blocks in accordance with the minimum length step required. Add a wear block at each end of the stack if the workpiece material is abrasive, or the stack will be used frequently.
- If a set containing a large number of gauge blocks is selected, the number of gauge blocks required for any particular length is reduced and the number of combinations is increased. Accuracy of the blocks in the set will be retained longer because normal wear will be spread over a larger number of blocks.
- Gauge block sets dedicated to micrometer and caliper inspection are available (refer to page E-11 for details).
- If using only one length repeatedly, it is a good idea to purchase discrete gauge blocks (refer to pages E-13, E-14, E-15, E-16, E-23, and E-24 for details).
- Products can be provided in combinations other than those in our standard sets. When placing such orders, please specify whether a storage box is required. Feel free to consult us if you need gauge blocks compliant with British (BS), American, or other standards.
The U.S. Federal Specification for gauge blocks was replaced by ASME B89.1.9 in 2002. Please contact your local Mitutoyo sales office for further information.
- 2 mm-based gauge blocks, which take the base of the minimum length step as 2 mm, are available and many people find them easier to handle than 1 mm-based gauge blocks.
- All Mitutoyo gauge blocks, whether sold in sets or individually, come with a measurement inspection certificate.

Mitutoyo Gauge Blocks and Inspection Certificates

A Certificate of Inspection is furnished with all Mitutoyo gauge blocks with a serial number on the box (in the case of sets) and an identification number on each block. The deviation of each block from nominal length, at the time of inspection, is stated. For this inspection, each gauge block is measured relative to the upper level master using a gauge block comparator. Grade K gauge blocks are measured by a primary measurement method using an interferometer.



Grade and Application

The following table can be used to select the gauge block grade according to usage (specified by DIN861, BS4311, and JIS B 7506).

| | Applications | Grade |
|-----------------|--|--------|
| Workshop use | • Mounting tools and cutters | 2 |
| | • Manufacturing gages • Calibrating instruments | 1 or 2 |
| Inspection use | • Inspecting mechanical parts, tools, etc. | 1 or 2 |
| | • Checking the accuracy of gages • Calibrating instruments | 0 or 1 |
| Calibration use | • Checking the accuracy of gauge blocks for workshop • Checking the accuracy of gauge blocks for inspection • Checking the accuracy of instruments | K or 0 |
| Reference use | • Checking the accuracy of gauge blocks for calibration • For academic research | K |

Constructing a Gauge Block Stack

The following points should be noted when constructing a gauge block stack:

- (1) Use as few gauge blocks as possible to obtain the required length by selecting thick blocks wherever possible.
- (2) Select the block for the least significant digit first, then work back through the more significant digits until the required length is attained.
- (3) There are multiple combinations for the integer part of a length. To prevent wear as much as possible, do not always use the same gauge blocks.

Example: Required length = 45.6785 mm
• For a 1 mm-based gauge block set

$$\begin{array}{r}
 1.0005 \\
 1.008 \\
 1.17 \\
 17.5 \\
 + \quad 25 \\
 \hline
 45.6785 \text{ mm}
 \end{array}$$

• For a 2 mm-based gauge block set

$$\begin{array}{r}
 2.0005 \\
 2.008 \\
 2.17 \\
 14.5 \\
 + \quad 25 \\
 \hline
 45.6785 \text{ mm}
 \end{array}$$

Note: Regarding the method for wringing, refer to "Quick Guide to Precision Measuring Instruments" on page E-33.



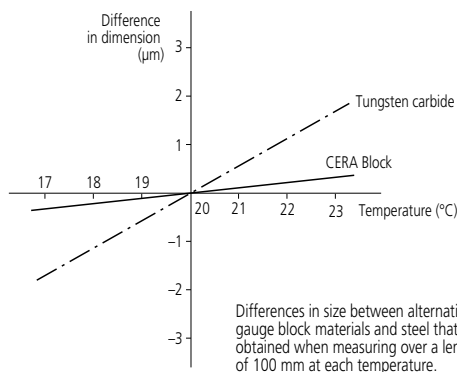
(8) Superior Material Characteristics of CERA Block

| Property | Material | CERA Block (ZrO ₂) | Steel (Fe) | Tungsten Carbide (WC-Co) | ZERO CERA Blocks (Low thermal expansion) |
|--|----------|--------------------------------|------------|--------------------------|--|
| Hardness (HV) | | 1350 | 800 | 1650 | 826 |
| Coefficient of thermal expansion (10 ⁻⁶ /K) | | 9.3±0.5 | 10.8±0.5 | 5.5±1.0 | 0±0.02 |
| Flexural strength by 3-point bending (MPa) | | 1270 | 1960 | 1960 | 210 |
| Fracture toughness K _{1c} (MPa·m ^{1/2}) | | 7 | 120 | 12 | 1.2 |
| Young's modulus ×10 ⁴ (MPa) | | 20.6 | 20.6 | 61.8 | 130 |
| Poisson's ratio | | 0.3 | 0.3 | 0.2 | 0.3 |
| Specific gravity | | 6.0 | 7.8 | 14.8 | 2.5 |
| Thermal conductivity (W/m·k) | | 2.9 | 54.4 | 79.5 | 3.7 |

Note: Ceramics have the advantage of a slow response to temperature changes due to the low thermal conductivity. However, caution is required when using CERA blocks under conditions of rapid temperature change.

(9) Difference in expansion coefficient between steel and CERA blocks is just 1.5×10⁻⁶/K

The thermal expansion coefficient of a CERA Block is quite similar to that of a steel gauge block.



(10) Highly Resistant to Dropping and Impact Damage

The CERA Block material is one of the toughest ceramics. It is extremely difficult to crack a CERA Block in normal use.

Features of Square Gauge Blocks



(1) Gauge blocks in a stack can be clamped together

After wringing square gauge blocks, a tie rod can be inserted through the center hole to clamp the blocks together for extra security.



(2) A height reference standard can easily be made

A precision height reference standard can be made easily and inexpensively using accessories such as the plain jaw and block base.



(3) A dedicated inspection jig can easily be made

A dedicated inspection jig for periodic inspection of instruments can be made easily and inexpensively.



(4) A wide measuring surface with cross-sectional dimensions of 24.1×24.1 mm is available.

A square gauge block retains stable orientation both longitudinally and laterally. A wide range of applications is covered, including cutting tool positioning, angle measurement with a sine bar, taper measurement with a roller, and inspection of depth micrometers.

Long and Ultra-Thin Gauge Blocks

Mitutoyo offers extra-thin gauge blocks from 0.10 mm to 0.99 mm (increments of 0.01 mm) as well as long gauge blocks up to 1,000 mm as standard products.

Gauge Blocks

Length Standards Brought to You by Mitutoyo

ACCURACY SPECIFICATIONS: JIS B 7506-2004 (JAPAN)

| Nominal length (mm) | | Grade K | | Grade 0 | |
|---------------------|------------|---|--|---|--|
| | | Limit deviation of length at any point (μm) | Tolerance for the variation in length (μm) | Limit deviation of length at any point (μm) | Tolerance for the variation in length (μm) |
| from 0.5 | up to 10 | ±0.20 | 0.05 | ±0.12 | 0.10 |
| over 10 | up to 25 | ±0.30 | 0.05 | ±0.14 | 0.10 |
| over 25 | up to 50 | ±0.40 | 0.06 | ±0.20 | 0.10 |
| over 50 | up to 75 | ±0.50 | 0.06 | ±0.25 | 0.12 |
| over 75 | up to 100 | ±0.60 | 0.07 | ±0.30 | 0.12 |
| over 100 | up to 150 | ±0.80 | 0.08 | ±0.40 | 0.14 |
| over 150 | up to 200 | ±1.00 | 0.09 | ±0.50 | 0.16 |
| over 200 | up to 250 | ±1.20 | 0.10 | ±0.60 | 0.16 |
| over 250 | up to 300 | ±1.40 | 0.10 | ±0.70 | 0.18 |
| over 300 | up to 400 | ±1.80 | 0.12 | ±0.90 | 0.20 |
| over 400 | up to 500 | ±2.20 | 0.14 | ±1.10 | 0.25 |
| over 500 | up to 600 | ±2.60 | 0.16 | ±1.30 | 0.25 |
| over 600 | up to 700 | ±3.00 | 0.18 | ±1.50 | 0.30 |
| over 700 | up to 800 | ±3.40 | 0.20 | ±1.70 | 0.30 |
| over 800 | up to 900 | ±3.80 | 0.20 | ±1.90 | 0.35 |
| over 900 | up to 1000 | ±4.20 | 0.25 | ±2.00 | 0.40 |

ISO 3650: 1998

(at 20 °C)

| Nominal length (mm) | | Grade 1 | | Grade 2 | |
|---------------------|------------|---|--|---|--|
| | | Limit deviation of length at any point (μm) | Tolerance for the variation in length (μm) | Limit deviation of length at any point (μm) | Tolerance for the variation in length (μm) |
| from 0.5 | up to 10 | ±0.20 | 0.16 | ±0.45 | 0.30 |
| over 10 | up to 25 | ±0.30 | 0.16 | ±0.60 | 0.30 |
| over 25 | up to 50 | ±0.40 | 0.18 | ±0.80 | 0.30 |
| over 50 | up to 75 | ±0.50 | 0.18 | ±1.00 | 0.35 |
| over 75 | up to 100 | ±0.60 | 0.20 | ±1.20 | 0.35 |
| over 100 | up to 150 | ±0.80 | 0.20 | ±1.60 | 0.40 |
| over 150 | up to 200 | ±1.00 | 0.25 | ±2.00 | 0.40 |
| over 200 | up to 250 | ±1.20 | 0.25 | ±2.40 | 0.45 |
| over 250 | up to 300 | ±1.40 | 0.25 | ±2.80 | 0.50 |
| over 300 | up to 400 | ±1.80 | 0.30 | ±3.60 | 0.50 |
| over 400 | up to 500 | ±2.20 | 0.35 | ±4.40 | 0.60 |
| over 500 | up to 600 | ±2.60 | 0.40 | ±5.00 | 0.70 |
| over 600 | up to 700 | ±3.00 | 0.45 | ±6.00 | 0.70 |
| over 700 | up to 800 | ±3.40 | 0.50 | ±6.50 | 0.80 |
| over 800 | up to 900 | ±3.80 | 0.50 | ±7.50 | 0.90 |
| over 900 | up to 1000 | ±4.20 | 0.60 | ±8.00 | 1.00 |

ACCURACY SPECIFICATIONS: BS 4311: 2007 (UK)

(at 20 °C)

| Nominal length (in) | | Grade K | | Grade 0 | |
|---------------------|-----------|--|---|--|---|
| | | Limit deviation of length at any point (μin) | Tolerance for the variation in length (μin) | Limit deviation of length at any point (μin) | Tolerance for the variation in length (μin) |
| over 0 | up to 0.4 | ±8 | 2 | ±5 | 4 |
| over 0.4 | up to 1 | ±12 | 2 | ±6 | 4 |
| over 1 | up to 2 | ±16 | 3 | ±8 | 4 |
| over 2 | up to 3 | ±20 | 3 | ±10 | 5 |
| over 3 | up to 4 | ±24 | 3 | ±12 | 5 |

| Nominal length (in) | | Grade 1 | | Grade 2 | |
|---------------------|-----------|--|---|--|---|
| | | Limit deviation of length at any point (μin) | Tolerance for the variation in length (μin) | Limit deviation of length at any point (μin) | Tolerance for the variation in length (μin) |
| over 0 | up to 0.4 | ±8 | 6 | ±18 | 12 |
| over 0.4 | up to 1 | ±12 | 6 | ±24 | 12 |
| over 1 | up to 2 | ±16 | 7 | ±32 | 12 |
| over 2 | up to 3 | ±20 | 7 | ±40 | 14 |
| over 3 | up to 4 | ±24 | 8 | ±48 | 14 |

ACCURACY SPECIFICATIONS: ASME B89.1.9-2002 (USA)

(at 20 °C)

| Nominal length (in) | | Grade K | | Grade 00 | | Grade 0 | | Grade 1 | | Grade 2 | |
|---------------------|------------|---|---|---|---|---|---|---|---|---|---|
| | | Limit deviations of length at any point (μin) | Tolerance for the variation in length (μin) | Limit deviations of length at any point (μin) | Tolerance for the variation in length (μin) | Limit deviations of length at any point (μin) | Tolerance for the variation in length (μin) | Limit deviations of length at any point (μin) | Tolerance for the variation in length (μin) | Limit deviations of length at any point (μin) | Tolerance for the variation in length (μin) |
| | up to 0.05 | ±12 | 2 | ±4 | 2 | ±6 | 4 | ±12 | 6 | ±24 | 12 |
| over 0.05 | up to 0.4 | ±10 | 2 | ±3 | 2 | ±5 | 4 | ±8 | 6 | ±18 | 12 |
| over 0.45 | up to 1 | ±12 | 2 | ±3 | 2 | ±6 | 4 | ±12 | 6 | ±24 | 12 |
| over 1 | up to 2 | ±16 | 2 | ±4 | 2 | ±8 | 4 | ±16 | 6 | ±32 | 12 |
| over 2 | up to 3 | ±20 | 2 | ±5 | 3 | ±10 | 4 | ±20 | 6 | ±40 | 14 |
| over 3 | up to 4 | ±24 | 3 | ±6 | 3 | ±12 | 5 | ±24 | 8 | ±48 | 14 |
| over 4 | up to 5 | ±32 | 3 | ±8 | 3 | ±16 | 5 | ±32 | 8 | ±64 | 16 |
| over 5 | up to 6 | ±32 | 3 | ±8 | 3 | ±16 | 5 | ±32 | 8 | ±64 | 16 |
| over 6 | up to 7 | ±40 | 4 | ±10 | 4 | ±20 | 6 | ±40 | 10 | ±80 | 16 |
| over 7 | up to 8 | ±40 | 4 | ±10 | 4 | ±20 | 6 | ±40 | 10 | ±80 | 16 |
| over 8 | up to 10 | ±48 | 4 | ±12 | 4 | ±24 | 6 | ±48 | 10 | ±104 | 18 |
| over 10 | up to 12 | ±56 | 4 | ±14 | 4 | ±28 | 7 | ±56 | 10 | ±112 | 20 |
| over 12 | up to 16 | ±72 | 5 | ±18 | 5 | ±36 | 8 | ±72 | 12 | ±144 | 20 |
| over 16 | up to 20 | ±88 | 6 | ±20 | 6 | ±44 | 10 | ±88 | 14 | ±176 | 24 |
| over 20 | up to 24 | ±104 | 6 | ±25 | 6 | ±52 | 10 | ±104 | 16 | ±200 | 28 |
| over 24 | up to 28 | ±120 | 7 | ±30 | 7 | ±60 | 12 | ±120 | 18 | ±240 | 28 |
| over 28 | up to 32 | ±136 | 8 | ±34 | 8 | ±68 | 12 | ±136 | 20 | ±260 | 32 |
| over 32 | up to 36 | ±152 | 8 | ±38 | 8 | ±76 | 14 | ±152 | 20 | ±300 | 36 |
| over 36 | up to 40 | ±160 | 10 | ±40 | 10 | ±80 | 16 | ±168 | 24 | ±320 | 40 |

| Nominal length (mm) | | Grade K | | Grade 00 | | Grade 0 | | Grade 1 | | Grade 2 | |
|---------------------|------------|--|--|--|--|--|--|--|--|--|--|
| | | Limit deviations of length at any point (μm) | Tolerance for the variation in length (μm) | Limit deviations of length at any point (μm) | Tolerance for the variation in length (μm) | Limit deviations of length at any point (μm) | Tolerance for the variation in length (μm) | Limit deviations of length at any point (μm) | Tolerance for the variation in length (μm) | Limit deviations of length at any point (μm) | Tolerance for the variation in length (μm) |
| | up to 0.5 | ±0.30 | 0.05 | ±0.10 | 0.05 | ±0.14 | 0.10 | ±0.30 | 0.16 | ±0.60 | 0.30 |
| over 0.5 | up to 10 | ±0.20 | 0.05 | ±0.07 | 0.05 | ±0.12 | 0.10 | ±0.20 | 0.16 | ±0.45 | 0.30 |
| over 10 | up to 25 | ±0.30 | 0.05 | ±0.07 | 0.05 | ±0.14 | 0.10 | ±0.30 | 0.16 | ±0.60 | 0.30 |
| over 25 | up to 50 | ±0.40 | 0.06 | ±0.10 | 0.06 | ±0.20 | 0.10 | ±0.40 | 0.18 | ±0.80 | 0.30 |
| over 50 | up to 75 | ±0.50 | 0.06 | ±0.12 | 0.06 | ±0.25 | 0.12 | ±0.50 | 0.18 | ±1.00 | 0.35 |
| over 75 | up to 100 | ±0.60 | 0.07 | ±0.15 | 0.07 | ±0.30 | 0.12 | ±0.60 | 0.20 | ±1.20 | 0.35 |
| over 100 | up to 150 | ±0.80 | 0.08 | ±0.20 | 0.08 | ±0.40 | 0.14 | ±0.80 | 0.20 | ±1.60 | 0.40 |
| over 150 | up to 200 | ±1.00 | 0.09 | ±0.25 | 0.09 | ±0.50 | 0.16 | ±1.00 | 0.25 | ±2.00 | 0.40 |
| over 200 | up to 250 | ±1.20 | 0.10 | ±0.30 | 0.10 | ±0.60 | 0.16 | ±1.20 | 0.25 | ±2.40 | 0.45 |
| over 250 | up to 300 | ±1.40 | 0.10 | ±0.35 | 0.10 | ±0.70 | 0.18 | ±1.40 | 0.25 | ±2.80 | 0.50 |
| over 300 | up to 400 | ±1.80 | 0.12 | ±0.45 | 0.12 | ±0.90 | 0.20 | ±1.80 | 0.30 | ±3.60 | 0.50 |
| over 400 | up to 500 | ±2.20 | 0.14 | ±0.50 | 0.14 | ±1.10 | 0.25 | ±2.20 | 0.35 | ±4.40 | 0.60 |
| over 500 | up to 600 | ±2.60 | 0.16 | ±0.65 | 0.16 | ±1.30 | 0.25 | ±2.60 | 0.40 | ±5.00 | 0.70 |
| over 600 | up to 700 | ±3.00 | 0.18 | ±0.75 | 0.18 | ±1.50 | 0.30 | ±3.00 | 0.45 | ±6.00 | 0.70 |
| over 700 | up to 800 | ±3.40 | 0.20 | ±0.85 | 0.20 | ±1.70 | 0.30 | ±3.40 | 0.50 | ±6.50 | 0.80 |
| over 800 | up to 900 | ±3.80 | 0.20 | ±0.95 | 0.20 | ±1.90 | 0.35 | ±3.80 | 0.50 | ±7.50 | 0.90 |
| over 900 | up to 1000 | ±4.20 | 0.25 | ±1.00 | 0.25 | ±2.00 | 0.40 | ±4.20 | 0.60 | ±8.00 | 1.00 |

Note 1: The accuracy of nominal lengths from 0.1 mm up to less than 0.5 mm follows that of nominal lengths from 0.5 mm up to 10 mm.

Note 2: Grade K gauge blocks are only available as made-to-order rectangular gauge blocks.

Note 3: Grade K gauge blocks are supplied with a JCSS calibration certificate. When ordering, kindly provide your formal name and contact information.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

*1: Suffix No. (-■■■) for Selecting Standard Required

| ISO/DIN/JIS | | | |
|-------------|-------|------------------------|-------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate |
| -01B | K | ✓ | ✓ |

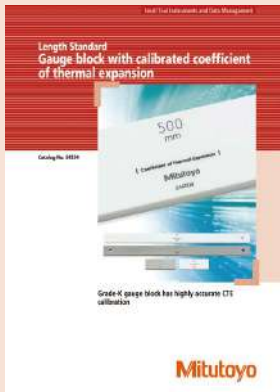
| ASME | | | |
|------------|-------|------------------------|-------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate |
| -51B | K | ✓ | ✓ |

| BS | | | |
|------------|-------|------------------------|-------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate |
| -11B | K | ✓ | ✓ |

Note: Only for 100 mm type



Inspection Certificate



Refer to the Gauge Block with calibrated coefficient of thermal expansion Brochure (E4334) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the ZERO CERA BLOCK Brochure (E4331) for more details.

Gauge Blocks with Calibrated Coefficient of Thermal Expansion

- Mitutoyo offers top-quality gauge blocks (steel and ceramic), superior to K class blocks due to their advanced manufacturing technologies.
- Features an accurately calibrated thermal expansion coefficient measured with a proprietary double-faced interferometer (DFI). Each gauge block is calibrated for length on a highly accurate gauge block interferometer (GBI) system.
- Available as rectangular gauge blocks in the range 100 to 500 mm.



SPECIFICATIONS

| Metric Blocks with CTE | | | Inch Blocks with CTE | | |
|------------------------|--------------------|-------------|----------------------|--------------------|-------------|
| Order No. (steel)*1 | Order No. (CERA)*1 | Length (mm) | Order No. (steel)*1 | Order No. (CERA)*1 | Length (in) |
| 611681 | 613681 | 100 | 611204 | 613204 | 4 |
| 611802 | 613802 | 125 | 611205 | 613205 | 5 |
| 611803 | 613803 | 150 | 611206 | 613206 | 6 |
| 611804 | 613804 | 175 | 611207 | 613207 | 7 |
| 611682 | 613682 | 200 | 611208 | 613208 | 8 |
| 611805 | 613805 | 250 | 611222 | 613222 | 10 |
| 611683 | 613683 | 300 | 611223 | 613223 | 12 |
| 611684 | 613684 | 400 | 611224 | 613224 | 16 |
| 611685 | 613685 | 500 | 611225 | 613225 | 20 |

| | |
|--|--------------------------------|
| Grade | K class in JIS/DIN/ISO, ASME |
| Uncertainty of thermal expansion coefficient | $0.035 \times 10^{-6}/K$ (k=2) |
| Uncertainty of length measurement | 30 nm (k=2), for 100 mm block |

Note: An inspection certificate and a JCSS calibration certificate are supplied as standard.

A calibration report and a calibration certificate for the thermal expansion coefficient are also supplied as standard.

ZERO CERA Blocks

- Zero Cera Block is a next-generation gauge block made from a special lightweight ceramic having extremely low thermal expansion ($0 \pm 0.02 \times 10^{-6}/K$ (20 °C)) and exhibiting almost no secular change, both in dimension and coefficient of thermal expansion.
- Available as rectangular gauge blocks in the range 30 to 1000 mm.

SPECIFICATIONS

| Metric Blocks | | | Length (mm) |
|---------------|------------|------------|-------------|
| Order No. | | | |
| JIS/ISO/DIN | BS | ASME | |
| 617673-016 | 617673-116 | 617673-516 | 30 |
| 617675-016 | 617675-116 | 617675-516 | 50 |
| 617681-016 | 617681-116 | 617681-516 | 100 |
| 617682-016 | 617682-116 | 617682-516 | 200 |
| 617683-016 | 617683-116 | 617683-516 | 300 |
| 617684-016 | 617684-116 | 617684-516 | 400 |
| 617685-016 | 617685-116 | 617685-516 | 500 |
| 617840-016 | 617840-116 | 617840-516 | 600 |
| 617841-016 | 617841-116 | 617841-516 | 700 |
| 617843-016 | 617843-116 | 617843-516 | 800 |
| 617844-016 | 617844-116 | 617844-516 | 900 |
| 617845-016 | 617845-116 | 617845-516 | 1000 |
| 516-771-60 | 516-771-61 | 516-771-66 | Above set |



Gauge Blocks

Length Standards Brought to You by Mitutoyo



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Metric/Inch Rectangular Gauge Block Sets SERIES 516

- Mitutoyo provides a wide selection of boxed sets of gauge blocks to meet the various needs of industry. Selecting the best set, or sets, to acquire usually depends on the accuracy required by the target applications, the level of convenience desired and the environmental conditions in which they will be used.

Steel 1 mm Base Block Sets



Steel 112-block set



Steel 103-block set



Steel 76-block set



Steel 56-block set



Steel 47-block set



Steel 46-block set



Steel 34-block set



Steel 32-block set

Steel 0.001 mm Step Block Sets



Steel 9-block set
(1.001 to 1.009 mm)



Steel 9-block set
(0.991 to 0.999 mm)



Steel 18-block set

Steel Long Block Sets



Steel 8-block set

Steel Wear Block Sets



Steel (1 mm)

Steel Thin Block Sets



Steel 9-block set

Note: Details of the contents of any particular set are given on page E-9.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

CERA 1 mm Base Block Sets



CERA 112-block set



CERA 103-block set



CERA 76-block set



CERA 56-block set



CERA 47-block set



CERA 46-block set



CERA 34-block set



CERA 32-block set

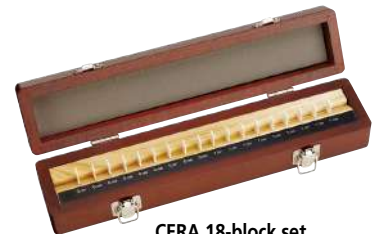
CERA 0.001 mm Step Block Sets



CERA 9-block set
(1.001 to 1.009 mm)



CERA 9-block set
(0.991 to 0.999 mm)

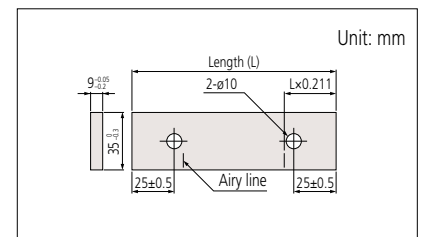


CERA 18-block set

CERA Long Block Sets



CERA 8-block set



CERA Wear Block Sets



CERA (1 mm)

Note: Details of the contents of any particular set are given on page E-10.

Gauge Blocks

Length Standards Brought to You by Mitutoyo

SPECIFICATIONS

1 mm Base Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|---------|--------|----------------------------------|-----------|--------------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (mm) | Step (mm) | Qty. |
| 122 | — | — | — | — | — | 1.0005 | — | 1 |
| | 516-596 | — | K: -#0 | — | — | 1.001 - 1.009 | 0.001 | 9 |
| | 516-597 | — | O: -#0 | — | — | 1.01 - 1.49 | 0.01 | 49 |
| | 516-598 | — | 1: -#0 | — | — | 1.6 - 1.9 | 0.1 | 4 |
| | 516-599 | — | 2: -#0 | — | — | 0.5 - 24.5 30 - 100 25, 75 | 0.5 10 | 49 8 2 |
| 112 | 516-531 | 516-541 | — | — | — | 1.0005 | — | 1 |
| | 516-937 | 516-337 | K: -#0 | 00: -#6 | K: -#1 | 1.001 - 1.009 | 0.001 | 9 |
| | 516-938 | 516-338 | O: -#0 | 0: -#6 | O: -#1 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-939 | 516-339 | 1: -#0 | 1: -#6 | 1: -#1 | 0.5 - 24.5 | 0.5 | 49 |
| | 516-940 | 516-340 | 2: -#0 | 2: -#6 | 2: -#1 | 25 - 100 | 25 | 4 |
| 103 | 516-533 | 516-542 | — | — | — | 1.005 | — | 1 |
| | 516-941 | 516-341 | K: -#0 | 00: -#6 | K: -#1 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-942 | 516-342 | O: -#0 | 0: -#6 | O: -#1 | 0.5 - 24.5 | 0.5 | 49 |
| | 516-943 | 516-343 | 1: -#0 | 1: -#6 | 1: -#1 | 25 - 100 | 25 | 4 |
| | 516-944 | 516-344 | 2: -#0 | 2: -#6 | 2: -#1 | — | — | — |
| 88 | — | — | — | — | — | 1.0005 | — | 1 |
| | 516-969 | 516-369 | — | — | K: -#1 | 1.001 - 1.009 | 0.001 | 9 |
| | 516-970 | 516-370 | O: -#0 | — | O: -#1 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-971 | 516-371 | 1: -#0 | — | 1: -#1 | 0.5 - 9.5 | 0.5 | 19 |
| | 516-972 | 516-372 | 2: -#0 | — | 2: -#1 | 10 - 100 | 10 | 10 |
| 87 | 516-535 | 515-543 | — | — | — | 1.001 - 1.009 | 0.001 | 9 |
| | 516-945 | 516-345 | K: -#0 | 00: -#6 | K: -#1 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-946 | 516-346 | O: -#0 | 0: -#6 | O: -#1 | 0.5 - 9.5 | 0.5 | 19 |
| | 516-947 | 516-347 | 1: -#0 | 1: -#6 | 1: -#1 | 10 - 100 | 10 | 10 |
| | 516-948 | 516-348 | 2: -#0 | 2: -#6 | 2: -#1 | — | — | — |
| 76 | — | — | — | — | — | 1.005 | — | 1 |
| | 516-949 | 516-349 | K: -#0 | — | — | 1.01 - 1.49 | 0.01 | 49 |
| | 516-950 | 516-350 | O: -#0 | — | — | 0.5 - 9.5 | 0.5 | 19 |
| | 516-951 | 516-351 | 1: -#0 | — | — | 10 - 40 | 10 | 4 |
| | 516-952 | 516-352 | 2: -#0 | — | — | 50 - 100 | 25 | 3 |
| 56 | 516-536 | 516-544 | — | — | — | 0.5 | — | 1 |
| | 516-953 | 516-353 | K: -#0 | 00: -#6 | — | 1.001 - 1.009 | 0.001 | 9 |
| | 516-954 | 516-354 | O: -#0 | 0: -#6 | — | 1.01 - 1.09 | 0.01 | 9 |
| | 516-955 | 516-355 | 1: -#0 | 1: -#6 | — | 1.1 - 1.9 | 0.1 | 9 |
| | 516-956 | 516-356 | 2: -#0 | 2: -#6 | — | 1 - 24 25 - 100 | 1 25 | 24 4 |
| 47 | 516-537 | 516-545 | — | — | — | 1.005 | — | 1 |
| | 516-957 | 516-357 | K: -#0 | 00: -#6 | — | 1.01 - 1.09 | 0.01 | 9 |
| | 516-958 | 516-358 | O: -#0 | 0: -#6 | — | 1.1 - 1.9 | 0.1 | 9 |
| | 516-959 | 516-359 | 1: -#0 | 1: -#6 | — | 1 - 24 | 1 | 24 |
| | 516-960 | 516-360 | 2: -#0 | 2: -#6 | — | 25 - 100 | 25 | 4 |
| 47 | — | — | — | — | — | 1.005 | — | 1 |
| | 516-961 | 516-361 | K: -#0 | — | K: -#1 | 1.01 - 1.19 | 0.01 | 19 |
| | 516-962 | 516-362 | O: -#0 | — | O: -#1 | 1.2 - 1.9 | 0.1 | 8 |
| | 516-963 | 516-363 | 1: -#0 | — | 1: -#1 | 1 - 9 | 1 | 9 |
| | 516-964 | 516-364 | 2: -#0 | — | 2: -#1 | 10 - 100 | 10 | 10 |
| 46 | 516-994 | 516-394 | K: -#0 | — | — | 1.001 - 1.009 | 0.001 | 9 |
| | 516-995 | 516-395 | O: -#0 | — | — | 1.01 - 1.09 | 0.01 | 9 |
| | 516-996 | 516-396 | 1: -#0 | — | — | 1.1 - 1.9 | 0.1 | 9 |
| | 516-997 | 516-397 | 2: -#0 | — | — | 1 - 9 10 - 100 | 1 10 | 9 10 |
| | 34 | — | — | — | — | — | 1.0005 | — |
| 516-128 | | 516-178 | K: -#0 | — | K: -#1 | 1.001 - 1.009 | 0.001 | 9 |
| 516-129 | | 516-179 | O: -#0 | — | O: -#1 | 1.01 - 1.09 | 0.01 | 9 |
| 516-130 | | 516-180 | 1: -#0 | — | 1: -#1 | 1.1 - 1.9 | 0.1 | 9 |
| 516-131 | | 516-181 | 2: -#0 | — | 2: -#1 | 1 - 5 10 | 1 1 | 5 1 |
| 32 | — | — | — | — | — | 1.005 | — | 1 |
| | 516-965 | 516-365 | K: -#0 | — | K: -#1 | 1.01 - 1.09 | 0.01 | 9 |
| | 516-966 | 516-366 | O: -#0 | — | O: -#1 | 1.1 - 1.9 | 0.1 | 9 |
| | 516-967 | 516-367 | 1: -#0 | — | 1: -#1 | 1 - 9 | 1 | 9 |
| | 516-968 | 516-368 | 2: -#0 | — | 2: -#1 | 10 - 30 60 | 10 1 | 3 1 |

Thin Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|------|---|------|----|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (mm) | Step (mm) | Qty. |
| 9 | 516-990 | — | O: -#0 | — | — | 0.10 - 0.50 | 0.05 | 9 |
| | 516-991 | — | 1: -#0 | — | — | — | — | — |
| | 516-992 | — | 2: -#0 | — | — | — | — | — |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

*1: Suffix No. (■) for Selecting Standard and Certificate Provided

| ISO/DIN/JIS | | |
|-------------|------------------------|------------------------------|
| Suffix No. | Inspection Certificate | Calibration Certificate JCSS |
| 1 | ✓ | |
| 6 | ✓ | ✓ |

Suffix No. 1: Not available for Grade K sets.

| ASME | | |
|------------|------------------------|------------------------------|
| Suffix No. | Inspection Certificate | Calibration Certificate JCSS |
| 1 | ✓ | |
| 6 | ✓ | ✓ |

Suffix No. 1: Not available for Grade K sets.
Suffix No. 6: Only for Grade K sets.

| BS | | |
|------------|------------------------|------------------------------|
| Suffix No. | Inspection Certificate | Calibration Certificate JCSS |
| 1 | ✓ | |
| 6 | ✓ | ✓ |

Suffix No. 1: Not available for Grade K sets.
Suffix No. 6: Only for Grade K sets.

Inspection Certificate





An inspection certificate is supplied as standard.
Refer to page U-11 for details.

SPECIFICATIONS

0.001 mm Step Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|------|--------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (mm) | Step (mm) | Qty. |
| 18 | 516-973 | 516-373 | K: -#0 | — | — | 0.991 - 0.999 | 0.001 | 9 |
| | 516-974 | 516-374 | 0: -#0 | — | — | 1.001 - 1.009 | 0.001 | 9 |
| | 516-975 | 516-375 | 1: -#0 | — | — | — | — | — |
| | 516-976 | 516-376 | 2: -#0 | — | — | — | — | — |
| 9 | 516-981 | 516-381 | K: -#0 | — | K: -#1 | 1.001 - 1.009 | 0.001 | 9 |
| | 516-982 | 516-382 | 0: -#0 | — | 0: -#1 | — | — | — |
| | 516-983 | 516-383 | 1: -#0 | — | 1: -#1 | — | — | — |
| | 516-984 | 516-384 | 2: -#0 | — | 2: -#1 | — | — | — |
| 9 | 516-985 | 516-385 | K: -#0 | — | — | 0.991 - 0.999 | 0.001 | 9 |
| | 516-986 | 516-386 | 0: -#0 | — | — | — | — | — |
| | 516-987 | 516-387 | 1: -#0 | — | — | — | — | — |
| | 516-988 | 516-388 | 2: -#0 | — | — | — | — | — |

Long Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|---------|----|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (mm) | Step (mm) | Qty. |
| 8 | 516-540 | 516-546 | — | K: -#6 | — | 125 - 175 | 25 | 3 |
| | 516-701 | 516-731 | K: -#0 | 00: -#6 | — | 200 - 250 | 50 | 2 |
| | 516-702 | 516-732 | 0: -#0 | 0: -#6 | — | 300 - 500 | 100 | 3 |
| | 516-703 | 516-733 | 1: -#0 | 1: -#6 | — | — | — | — |
| | 516-704 | 516-734 | 2: -#0 | 2: -#6 | — | — | — | — |

Wear Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|--------|----|------------------------|-----------|------|
| | Carbide | CERA | ISO/DIN/JIS | ASME | BS | Size (mm) | Step (mm) | Qty. |
| 2 | 516-807 | 516-832 | 0: -#0 | 0: -#6 | — | 1 | — | 2 |
| | 516-806 | 516-833 | 1: -#0 | 1: -#6 | — | — | — | — |
| 2 | 516-803 | 516-830 | 0: -#0 | 0: -#6 | — | 2 | — | 2 |
| | 516-802 | 516-831 | 1: -#0 | 1: -#6 | — | — | — | — |

Inch Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|---------|--------------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (in) | Step (in) | Qty. |
| 82 | 516-548 | 516-556 | — | K: -#6 | — | 0.10005 | — | 1 |
| | 516-905 | 516-305 | — | 00: -#6 | — | 0.1001 - 0.1009 | 0.0001 | 9 |
| | 516-906 | 516-306 | — | 0: -#6 | 0: -#1 | 0.101 - 0.149 | 0.001 | 49 |
| | 516-907 | 516-307 | — | 1: -#6 | 1: -#1 | 0.05 - 0.95 | 0.05 | 19 |
| | 516-908 | 516-308 | — | 2: -#6 | 2: -#1 | 1 - 4 | 1 | 4 |
| 81 | 516-549 | 516-557 | — | K: -#6 | — | 0.1001 - 0.1009 | 0.0001 | 9 |
| | 516-901 | 516-301 | — | 00: -#6 | — | 0.101 - 0.149 | 0.001 | 49 |
| | 516-902 | 516-302 | — | 0: -#6 | 0: -#1 | 0.05 - 0.95 | 0.05 | 19 |
| | 516-903 | 516-303 | — | 1: -#6 | 1: -#1 | 1 - 4 | 1 | 4 |
| | 516-904 | 516-304 | — | 2: -#6 | 2: -#1 | — | — | — |
| 49 | — | — | — | — | — | 0.1001 - 0.1009 | 0.0001 | 9 |
| | 516-910 | — | — | — | 0: -#1 | 0.101 - 0.109 | 0.001 | 9 |
| | 516-911 | — | — | — | 1: -#1 | 0.01 - 0.19 | 0.01 | 19 |
| | 516-912 | — | — | — | 2: -#1 | 0.2 - 0.9 | 0.1 | 8 |
| | — | — | — | — | — | 1 - 4 | 1 | 4 |
| 35 | 516-550 | 516-558 | — | K: -#6 | — | 0.10005 | — | 1 |
| | 516-913 | 516-313 | — | 00: -#6 | — | 0.1001 - 0.1009 | 0.0001 | 9 |
| | 516-914 | 516-314 | — | 0: -#6 | 0: -#1 | 0.101 - 0.109 | 0.001 | 9 |
| | 516-915 | 516-315 | — | 1: -#6 | 1: -#1 | 0.11 - 0.19 | 0.01 | 9 |
| | 516-916 | 516-316 | — | 2: -#6 | 2: -#1 | 0.1 - 0.3 | 0.1 | 3 |
| — | — | — | — | — | 0.5, 1, 2, 4 | — | 4 | |

Thin Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|------|---|---------|--------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (in) | Step (in) | Qty. |
| 28 | 516-551 | — | — | K: -#6 | — | 0.02005 | — | 1 |
| | 516-917 | — | — | 00: -#6 | — | 0.0201 - 0.0209 | 0.0001 | 9 |
| | 516-918 | — | — | 0: -#6 | — | 0.021 - 0.029 | 0.001 | 9 |
| | 516-919 | — | — | 1: -#6 | — | 0.01 - 0.09 | 0.01 | 9 |
| | 516-920 | — | — | 2: -#6 | — | — | — | — |
| 10 | 516-926 | — | — | 0: -#6 | 0: -#1 | 0.005 - 0.050 | 0.005 | 10 |
| | 516-927 | — | — | 1: -#6 | 1: -#1 | — | — | — |
| | 516-928 | — | — | — | 2: -#1 | — | — | — |

Long Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|---------|----|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | Size (in) | Step (in) | Qty. |
| 8 | — | 516-564 | — | K: -#6 | — | 5 - 7 | 1 | 3 |
| | — | 516-741 | — | 00: -#6 | — | 8, 10, 12 | 2 | 3 |
| | 516-712 | 516-742 | — | 0: -#6 | — | 16, 20 | 4 | 2 |
| | 516-713 | 516-743 | — | 1: -#6 | — | — | — | — |

Wear Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set | | |
|----------------|-----------|---------|---|--------|----|------------------------|-----------|------|
| | Carbide | CERA | ISO/DIN/JIS | ASME | BS | Size (in) | Step (in) | Qty. |
| 2 | 516-809 | 516-836 | — | 0: -#6 | — | 0.05 | — | 2 |
| | 516-808 | 516-837 | — | 1: -#6 | — | — | — | — |
| 2 | 516-805 | 516-834 | — | 0: -#6 | — | 0.1 | — | 2 |
| | 516-804 | 516-835 | — | 1: -#6 | — | — | — | — |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.

Gauge Blocks

Length Standards Brought to You by Mitutoyo



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Micrometer Inspection Gauge Block Sets SERIES 516

- Dedicated gauge block sets for micrometer inspection.
Sets **516-106/7/8** and **516-322/3** are recommended for checking the maximum permissible error of micrometers due to the choice of block sizes ensuring that the instrument is checked through a full rotation of the spindle over the range 0 to 25 mm (or 0 to 1 in).
Sets **516-115/6/7**, **516-165/6** and **516-177** contain blocks in 25 mm (or 1 in) steps for aiding inspection of large micrometers in conjunction with one of the abovementioned sets.
Sets **516-580/1/2**, **516-390/1/2** are dedicated to the QuantuMike with its 2 mm/rev spindle feed.

Steel

CERA



Steel 10-block set



Steel 10-block set



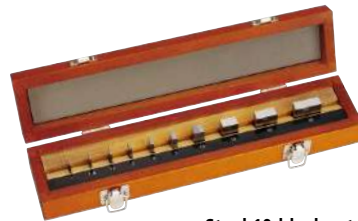
CERA 10-block set



CERA 10-block set



Steel 8-block set



Steel 10-block set



CERA 8-block set



CERA 10-block set



Gauge Block Sets for Micrometer Inspection

A set consisting of a Micro Checker and gauge blocks for micrometer inspection.

(516-132/3/4/5/6/7)

• Micro Checker

Can clamp a stack of gauge blocks to be used for micrometer inspection.

516-607



Typical application



(The gauge block and optical parallel shown are optional accessories.)

SPECIFICATIONS

| Metric | Micro Checker (holder only) |
|-----------------------------------|---|
| Order No. | 516-607 |
| Applicable gauge block sets | 516-106/107/108, 516-156/157/158 |
| Applicable gauge block sizes (mm) | 2.5, 5.1, 7.7, 10.3, 12.9, 15, 17.6, 20.2, 22.8, 25 |

| Inch | Micro Checker (holder only) |
|-----------------------------------|--|
| Order No. | 516-608 |
| Applicable gauge block sets | 516-921/922/923, 516-321/322/323 |
| Applicable gauge block sizes (in) | 0.105, 0.210, 0.315, 0.420, 0.5, 0.605, 0.710, 0.815, 0.920, 1 |



An inspection certificate is supplied as standard. Refer to page U-11 for details.

***1: Suffix No. (■) for Selecting Standard and Certificate Provided**

| ISO/DIN/JIS | | |
|-------------|------------------------|-------------------------|
| Suffix No. | Inspection Certificate | Calibration Certificate |
| 1 | ✓ | |
| 6 | ✓ | ✓ |

Suffix No. 1: Not available for Grade K sets.

| ASME | | |
|------------|------------------------|-------------------------|
| Suffix No. | Inspection Certificate | Calibration Certificate |
| 1 | ✓ | |
| 6 | ✓ | ✓ |

Suffix No. 1: Not available for Grade K sets.
Suffix No. 6: Only for Grade K sets.

| BS | | |
|------------|------------------------|-------------------------|
| Suffix No. | Inspection Certificate | Calibration Certificate |
| 1 | ✓ | |

Inspection Certificate



SPECIFICATIONS

| Metric Block Sets | | | | | | |
|-------------------|-----------|---------|---|---------|----|---|
| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set |
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | |
| 16 | 516-111 | 516-161 | 0: -■0 | — | — | 1.00, 1.25, 1.5, 2, 3, 5, 10, 15, 20, 25, 25.25, 30, 35, 40, 45, 50 mm, Cerastone, Optical parallels (t=12 mm, 25 mm) |
| | 516-112 | 516-162 | 1: -■0 | — | — | |
| | 516-113 | 516-163 | 2: -■0 | — | — | |
| 10 | 516-977 | — | K: -■0 | — | — | 1.00, 1.25, 1.50, 2, 3, 5, 10, 15, 20, 25 mm, Optical parallel (t=12 mm) |
| | 516-978 | 516-378 | 0: -■0 | — | — | |
| | 516-979 | 516-379 | 1: -■0 | — | — | |
| | 516-980 | 516-380 | 2: -■0 | — | — | |
| 10 | 516-103 | 516-152 | 0: -■0 | 0: -■6 | — | 1.00, 1.25, 1.50, 2, 3, 5, 10, 15, 20, 25 mm |
| | 516-101 | 516-153 | 1: -■0 | 1: -■6 | — | |
| | — | 516-154 | 2: -■0 | — | — | |
| 10 | 516-580 | 516-390 | 0: -■0 | — | — | 2.2, 4.8, 7.8, 10.4, 12, 15.2, 17.4, 19.6, 22.6, 25 mm |
| | 516-581 | 516-391 | 1: -■0 | — | — | |
| | 516-582 | 516-392 | 2: -■0 | — | — | |
| 10 | 516-106 | 516-156 | 0: -■0 | — | — | 2.5, 5.1, 7.7, 10.3, 12.9, 15, 17.6, 20.2, 22.8, 25 mm, Optical parallel (t=12 mm) |
| | 516-107 | 516-157 | 1: -■0 | — | — | |
| | 516-108 | 516-158 | 2: -■0 | — | — | |
| 10 | 516-132 | 516-182 | 0: -■0 | — | — | 1.25, 1.50, 1, 2, 3, 5, 10, 15, 20, 25 mm, Micro Checker, Optical parallel (t=12 mm) |
| | 516-133 | 516-183 | 1: -■0 | — | — | |
| | 516-134 | 516-184 | 2: -■0 | — | — | |
| 10 | 516-135 | 516-185 | 0: -■0 | — | — | 2.5, 5.1, 7.7, 10.3, 12.9, 15, 17.6, 20.2, 22.8, 25 mm, Micro Checker, Optical parallel (t=12 mm) |
| | 516-136 | 516-186 | 1: -■0 | — | — | |
| | 516-137 | 516-187 | 2: -■0 | — | — | |
| 8 | — | 516-547 | — | K: -■6 | — | 25, 50, 75, 100, 125, 150, 175, 200 mm |
| | — | 516-164 | K: -■0 | 00: -■6 | — | |
| | 516-115 | 516-165 | 0: -■0 | 0: -■6 | — | |
| | 516-116 | 516-166 | 1: -■0 | 1: -■6 | — | |
| | 516-117 | 516-167 | 2: -■0 | 2: -■6 | — | |
| | — | — | — | — | — | |

| Inch Block Sets | | | | | | |
|-----------------|-----------|---------|---|---------|--------|---|
| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | | Blocks included in set |
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | |
| 10 | 516-528 | 516-318 | — | 00: -■6 | 0: -■1 | 0.087, 0.189, 0.307, 0.409, 0.472, 0.598, 0.669, 0.772, 0.890, 1 in |
| | 516-529 | 516-319 | — | 0: -■6 | 1: -■1 | |
| | 516-530 | 516-320 | — | 1: -■6 | 2: -■1 | |
| 10 | 516-552 | 516-559 | — | K: -■6 | — | 0.105, 0.210, 0.315, 0.420, 0.500, 0.605, 0.710, 0.815, 0.920, 1 in, Optical parallel (t=0.5 in) |
| | 516-921 | 516-321 | — | 00: -■6 | 0: -■1 | |
| | 516-922 | 516-322 | — | 0: -■6 | 1: -■1 | |
| | 516-923 | 516-323 | — | 1: -■6 | 2: -■1 | |
| 10 | 516-553 | 516-560 | — | K: -■6 | — | 0.105, 0.210, 0.315, 0.420, 0.500, 0.605, 0.710, 0.815, 0.920, 1 in, Micro checker, Optical parallel (t=0.5 in) |
| | 516-138 | 516-188 | — | 00: -■6 | 0: -■1 | |
| | 516-139 | 516-189 | — | 0: -■6 | 1: -■1 | |
| | 516-140 | 516-190 | — | 1: -■6 | 2: -■1 | |
| 9 | 516-554 | 516-561 | — | K: -■6 | — | 0.0625, 0.100, 0.125, 0.200, 0.250, 0.300, 0.500, 1, 2 in, Optical parallel (t=0.5 in) |
| | 516-929 | 516-333 | — | 00: -■6 | — | |
| | 516-930 | 516-334 | — | 0: -■6 | — | |
| | 516-931 | 516-335 | — | 1: -■6 | — | |
| | 516-932 | 516-336 | — | 2: -■6 | — | |
| 9 | 516-555 | 516-562 | — | K: -■6 | — | 0.0625, 0.100, 0.125, 0.200, 0.250, 0.300, 0.500, 1, 2 in, Micro Checker, Optical parallel (t=0.5 in) |
| | 516-141 | 516-191 | — | 00: -■6 | — | |
| | 516-142 | 516-192 | — | 0: -■6 | — | |
| | 516-143 | 516-193 | — | 1: -■6 | — | |
| | 516-144 | 516-194 | — | 2: -■6 | — | |
| 9 | — | 516-563 | — | K: -■6 | — | 0.0625, 0.100, 0.125, 0.200, 0.250, 0.300, 0.500, 1, 2 in |
| | — | 516-329 | — | 00: -■6 | — | |
| | 516-934 | 516-330 | — | 0: -■6 | — | |
| | 516-935 | 516-331 | — | 1: -■6 | — | |
| 8 | 516-126 | 516-176 | — | 0: -■6 | — | 1, 2, 3, 4, 5, 6, 7, 8 in |
| | 516-127 | 516-177 | — | 1: -■6 | — | |

SERIES 516 – Caliper Inspection Gauge Block Sets

SPECIFICATIONS

| Metric Block Sets | | | | | | |
|-------------------|-----------|---------|---|------|----|--|
| Blocks per set | Order No. | | Standard/grade available and Suffix No. | | | Blocks included in set |
| | Steel | CERA | ISO/DIN/JIS | ASME | BS | |
| 5 | — | 516-174 | 2: -10 | — | — | 5 pcs.: 10.3, 24.5, 50, 75, 100 mm, Ceramic plain jaws, Holder (250 mm), Glove |
| 4 | 516-526 | 516-566 | 1: -10 | — | — | 4 pcs.: 10, 30, 50, 125 mm, Setting ring (ø4 mm, ø10 mm), Pin gage (ø10 mm), Glove |
| | 516-527 | 516-567 | 2: -10 | — | — | |
| 3 | 516-124 | 516-150 | 1: -10 | — | — | 3 pcs.: 30, 41.3, 131.4 mm, Setting ring (ø4 mm, ø25 mm), Glove |
| | 516-125 | 516-151 | 2: -10 | — | — | |
| 2 | 516-122 | 516-172 | 1: -10 | — | — | 2 pcs.: 41.3, 131.4 mm, Setting ring (ø20 mm), Glove |
| | 516-123 | 516-173 | 2: -10 | — | — | |

Gauge Blocks

Length Standards Brought to You by Mitutoyo

Individual Metric Rectangular Gauge Blocks

- If using only one length repeatedly, it is suggested to purchase individual gauge blocks.
- Nominal sizes which are not included in the chart below can be supplied custom-made on request.
- Each Grade K gauge block to ISO/DIN/JIS, BS or ASME standard is supplied with a Certificate of Calibration which certifies that the gauge block was calibrated by interferometry.



SPECIFICATIONS

Metric Blocks

| Length (mm) | Order No.*1 | | Length (mm) | Order No.*1 | | Length (mm) | Order No.*1 | |
|-------------|-------------|--------|-------------|-------------|------|-------------|-------------|--------|
| | Steel | CERA | | Steel | CERA | | Steel | CERA |
| 0.1 | 611821 | — | 0.53 | 611894 | — | 0.96 | 611937 | — |
| 0.11 | 611860 | — | 0.54 | 611895 | — | 0.97 | 611938 | — |
| 0.12 | 611861 | — | 0.55 | 611896 | — | 0.98 | 611939 | — |
| 0.13 | 611862 | — | 0.56 | 611897 | — | 0.99 | 611940 | — |
| 0.14 | 611863 | — | 0.57 | 611898 | — | 0.991 | 611551 | 613551 |
| 0.15 | 611822 | — | 0.58 | 611899 | — | 0.992 | 611552 | 613552 |
| 0.16 | 611864 | — | 0.59 | 611900 | — | 0.993 | 611553 | 613553 |
| 0.17 | 611865 | — | 0.6 | 611901 | — | 0.994 | 611554 | 613554 |
| 0.18 | 611866 | — | 0.61 | 611902 | — | 0.995 | 611555 | 613555 |
| 0.19 | 611867 | — | 0.62 | 611903 | — | 0.996 | 611556 | 613556 |
| 0.2 | 611823 | — | 0.63 | 611904 | — | 0.997 | 611557 | 613557 |
| 0.21 | 611868 | — | 0.64 | 611905 | — | 0.998 | 611558 | 613558 |
| 0.22 | 611869 | — | 0.65 | 611906 | — | 0.999 | 611559 | 613559 |
| 0.23 | 611870 | — | 0.66 | 611907 | — | 1 | 611611 | 613611 |
| 0.24 | 611871 | — | 0.67 | 611908 | — | 1.0005 | 611520 | 613520 |
| 0.25 | 611824 | — | 0.68 | 611909 | — | 1.001 | 611521 | 613521 |
| 0.26 | 611872 | — | 0.69 | 611910 | — | 1.002 | 611522 | 613522 |
| 0.27 | 611873 | — | 0.7 | 611911 | — | 1.003 | 611523 | 613523 |
| 0.28 | 611874 | — | 0.71 | 611912 | — | 1.004 | 611524 | 613524 |
| 0.29 | 611875 | — | 0.72 | 611913 | — | 1.005 | 611525 | 613525 |
| 0.3 | 611825 | — | 0.73 | 611914 | — | 1.006 | 611526 | 613526 |
| 0.31 | 611876 | — | 0.74 | 611915 | — | 1.007 | 611527 | 613527 |
| 0.32 | 611877 | — | 0.75 | 611916 | — | 1.008 | 611528 | 613528 |
| 0.33 | 611878 | — | 0.76 | 611917 | — | 1.009 | 611529 | 613529 |
| 0.34 | 611879 | — | 0.77 | 611918 | — | 1.01 | 611561 | 613561 |
| 0.35 | 611826 | — | 0.78 | 611919 | — | 1.02 | 611562 | 613562 |
| 0.36 | 611880 | — | 0.79 | 611920 | — | 1.03 | 611563 | 613563 |
| 0.37 | 611881 | — | 0.8 | 611921 | — | 1.04 | 611564 | 613564 |
| 0.38 | 611882 | — | 0.81 | 611922 | — | 1.05 | 611565 | 613565 |
| 0.39 | 611883 | — | 0.82 | 611923 | — | 1.06 | 611566 | 613566 |
| 0.4 | 611827 | — | 0.83 | 611924 | — | 1.07 | 611567 | 613567 |
| 0.41 | 611884 | — | 0.84 | 611925 | — | 1.08 | 611568 | 613568 |
| 0.42 | 611885 | — | 0.85 | 611926 | — | 1.09 | 611569 | 613569 |
| 0.43 | 611886 | — | 0.86 | 611927 | — | 1.1 | 611570 | 613570 |
| 0.44 | 611887 | — | 0.87 | 611928 | — | 1.11 | 611571 | 613571 |
| 0.45 | 611828 | — | 0.88 | 611929 | — | 1.12 | 611572 | 613572 |
| 0.46 | 611888 | — | 0.89 | 611930 | — | 1.13 | 611573 | 613573 |
| 0.47 | 611889 | — | 0.9 | 611931 | — | 1.14 | 611574 | 613574 |
| 0.48 | 611890 | — | 0.91 | 611932 | — | 1.15 | 611575 | 613575 |
| 0.49 | 611891 | — | 0.92 | 611933 | — | 1.16 | 611576 | 613576 |
| 0.5 | 611506 | 613506 | 0.93 | 611934 | — | 1.17 | 611577 | 613577 |
| 0.51 | 611892 | — | 0.94 | 611935 | — | 1.18 | 611578 | 613578 |
| 0.52 | 611893 | — | 0.95 | 611936 | — | 1.19 | 611579 | 613579 |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

*1: Suffix No. (-■■■■) for Selecting Standard and Certificate Provided

| ISO/DIN/JIS | | | | |
|-------------|-------|------------------------|-------------------------|-----|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate | |
| | | | JCSS | RvA |
| -016 | K | ✓ | ✓ | |
| -021 | 0 | ✓ | | |
| -026 | 0 | ✓ | ✓ | |
| -031 | 1 | ✓ | | |
| -036 | 1 | ✓ | ✓ | |
| -041 | 2 | ✓ | | |
| -046 | 2 | ✓ | ✓ | |

| ASME | | | | |
|------------|-------|------------------------|-------------------------|---|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate | |
| | | | JCSS | |
| -516 | K | ✓ | | ✓ |
| -521 | 00 | ✓ | | |
| -531 | 0 | ✓ | | |
| -541 | 1 | ✓ | | |
| -551 | 2 | ✓ | | |

| BS | | | | |
|------------|-------|------------------------|-------------------------|---|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate | |
| | | | JCSS | |
| -116 | K | ✓ | | ✓ |
| -121 | 0 | ✓ | | |
| -126 | 0 | ✓ | | ✓ |
| -131 | 1 | ✓ | | |
| -136 | 1 | ✓ | | ✓ |
| -141 | 2 | ✓ | | |
| -146 | 2 | ✓ | | ✓ |



Inspection Certificate

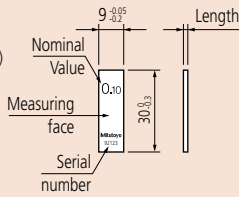


An inspection certificate is supplied as standard. Refer to page U-11 for details.

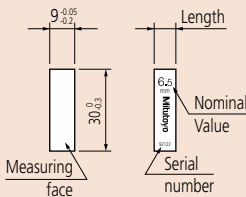
Dimensions

Unit: mm

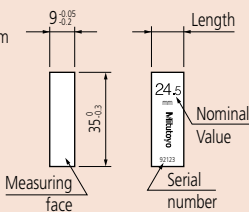
Nominal length:
0.1 mm to 5.5 mm
(0.004 in to 0.25 in)



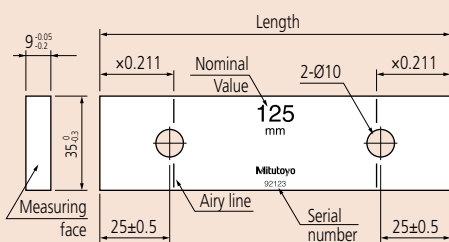
Nominal length:
6 mm to 10 mm
(0.3 in to 0.4 in)



Nominal length:
10.3 mm to 100 mm
(0.45 in to 4 in)



Nominal length 125 mm to 1000 mm (5 in to 20 in)



| Length (mm) | Order No.*1 | |
|-------------|-------------|--------|
| | Steel | CERA |
| 1.2 | 611580 | 613580 |
| 1.21 | 611581 | 613581 |
| 1.22 | 611582 | 613582 |
| 1.23 | 611583 | 613583 |
| 1.24 | 611584 | 613584 |
| 1.25 | 611585 | 613585 |
| 1.26 | 611586 | 613586 |
| 1.27 | 611587 | 613587 |
| 1.28 | 611588 | 613588 |
| 1.29 | 611589 | 613589 |
| 1.3 | 611590 | 613590 |
| 1.31 | 611591 | 613591 |
| 1.32 | 611592 | 613592 |
| 1.33 | 611593 | 613593 |
| 1.34 | 611594 | 613594 |
| 1.35 | 611595 | 613595 |
| 1.36 | 611596 | 613596 |
| 1.37 | 611597 | 613597 |
| 1.38 | 611598 | 613598 |
| 1.39 | 611599 | 613599 |
| 1.4 | 611600 | 613600 |
| 1.41 | 611601 | 613601 |
| 1.42 | 611602 | 613602 |
| 1.43 | 611603 | 613603 |
| 1.44 | 611604 | 613604 |
| 1.45 | 611605 | 613605 |
| 1.46 | 611606 | 613606 |
| 1.47 | 611607 | 613607 |
| 1.48 | 611608 | 613608 |
| 1.49 | 611609 | 613609 |
| 1.5 | 611641 | 613641 |
| 1.6 | 611516 | 613516 |
| 1.7 | 611517 | 613517 |
| 1.8 | 611518 | 613518 |
| 1.9 | 611519 | 613519 |
| 2 | 611612 | 613612 |
| 2.0005 | 611690 | — |
| 2.001 | 611691 | — |
| 2.002 | 611692 | — |
| 2.003 | 611693 | — |
| 2.004 | 611694 | — |
| 2.005 | 611695 | — |
| 2.006 | 611696 | — |
| 2.007 | 611697 | — |
| 2.008 | 611698 | — |
| 2.009 | 611699 | — |
| 2.01 | 611701 | — |
| 2.02 | 611702 | — |
| 2.03 | 611703 | — |
| 2.04 | 611704 | — |
| 2.05 | 611705 | — |
| 2.06 | 611706 | — |
| 2.07 | 611707 | — |
| 2.08 | 611708 | — |
| 2.09 | 611709 | — |
| 2.1 | 611710 | — |
| 2.11 | 611711 | — |
| 2.12 | 611712 | — |
| 2.13 | 611713 | — |
| 2.14 | 611714 | — |
| 2.15 | 611715 | — |
| 2.16 | 611716 | — |

| Length (mm) | Order No.*1 | |
|-------------|-------------|--------|
| | Steel | CERA |
| 2.17 | 611717 | — |
| 2.18 | 611718 | — |
| 2.19 | 611719 | — |
| 2.2 | 611720 | — |
| 2.21 | 611721 | — |
| 2.22 | 611722 | — |
| 2.23 | 611723 | — |
| 2.24 | 611724 | — |
| 2.25 | 611725 | — |
| 2.26 | 611726 | — |
| 2.27 | 611727 | — |
| 2.28 | 611728 | — |
| 2.29 | 611729 | — |
| 2.3 | 611730 | — |
| 2.31 | 611731 | — |
| 2.32 | 611732 | — |
| 2.33 | 611733 | — |
| 2.34 | 611734 | — |
| 2.35 | 611735 | — |
| 2.36 | 611736 | — |
| 2.37 | 611737 | — |
| 2.38 | 611738 | — |
| 2.39 | 611739 | — |
| 2.4 | 611740 | — |
| 2.41 | 611741 | — |
| 2.42 | 611742 | — |
| 2.43 | 611743 | — |
| 2.44 | 611744 | — |
| 2.45 | 611745 | — |
| 2.46 | 611746 | — |
| 2.47 | 611747 | — |
| 2.48 | 611748 | — |
| 2.49 | 611749 | — |
| 2.5 | 611642 | 613642 |
| 2.6 | 611750 | — |
| 2.7 | 611751 | — |
| 2.8 | 611752 | — |
| 2.9 | 611753 | — |
| 3 | 611613 | 613613 |
| 3.5 | 611643 | 613643 |
| 4 | 611614 | 613614 |
| 4.5 | 611644 | 613644 |
| 5 | 611615 | 613615 |
| 5.1 | 611850 | 613850 |
| 5.5 | 611645 | 613645 |
| 6 | 611616 | 613616 |
| 6.5 | 611646 | 613646 |
| 7 | 611617 | 613617 |
| 7.5 | 611647 | 613647 |
| 7.7 | 611851 | 613851 |
| 8 | 611618 | 613618 |
| 8.5 | 611648 | 613648 |
| 9 | 611619 | 613619 |
| 9.5 | 611649 | 613649 |
| 10 | 611671 | 613671 |
| 10.3 | 611852 | 613852 |
| 10.5 | 611650 | 613650 |
| 11 | 611621 | 613621 |
| 11.5 | 611651 | 613651 |
| 12 | 611622 | 613622 |
| 12.5 | 611652 | 613652 |
| 12.9 | 611853 | 613853 |

| Length (mm) | Order No.*1 | |
|-------------|-------------|--------|
| | Steel | CERA |
| 13 | 611623 | 613623 |
| 13.5 | 611653 | 613653 |
| 14 | 611624 | 613624 |
| 14.5 | 611654 | 613654 |
| 15 | 611625 | 613625 |
| 15.5 | 611655 | 613655 |
| 16 | 611626 | 613626 |
| 16.5 | 611656 | 613656 |
| 17 | 611627 | 613627 |
| 17.5 | 611657 | 613657 |
| 17.6 | 611854 | 613854 |
| 18 | 611628 | 613628 |
| 18.5 | 611658 | 613658 |
| 19 | 611629 | 613629 |
| 19.5 | 611659 | 613659 |
| 20 | 611672 | 613672 |
| 20.2 | 611855 | 613855 |
| 20.5 | 611660 | 613660 |
| 21 | 611631 | 613631 |
| 21.5 | 611661 | 613661 |
| 22 | 611632 | 613632 |
| 22.5 | 611662 | 613662 |
| 22.8 | 611856 | 613856 |
| 23 | 611633 | 613633 |
| 23.5 | 611663 | 613663 |
| 24 | 611634 | 613634 |
| 24.5 | 611664 | 613664 |
| 25 | 611635 | 613635 |
| 25.25 | 611754 | 613754 |
| 30 | 611673 | 613673 |
| 35 | 611755 | 613755 |
| 40 | 611674 | 613674 |
| 41.3 | 611857 | 613857 |
| 45 | 611756 | 613756 |
| 50 | 611675 | 613675 |
| 60 | 611676 | 613676 |
| 70 | 611677 | 613677 |
| 75 | 611801 | 613801 |
| 80 | 611678 | 613678 |
| 90 | 611679 | 613679 |
| 100 | 611681 | 613681 |
| 125 | 611802 | 613802 |
| 131.4 | 611858 | 613858 |
| 150 | 611803 | 613803 |
| 175 | 611804 | 613804 |
| 200 | 611682 | 613682 |
| 250 | 611805 | 613805 |
| 300 | 611683 | 613683 |
| 400 | 611684 | 613684 |
| 500 | 611685 | 613685 |
| 600 | 611840 | — |
| 700 | 611841 | — |
| 750 | 611842 | — |
| 800 | 611843 | — |
| 900 | 611844 | — |
| 1000 | 611845 | — |

Metric Wear Blocks

| Length (mm) | Order No.*1 |
|-------------|------------------|
| | Tungsten carbide |
| 1 | 612611 |
| 2 | 612612 |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.

Gauge Blocks

Length Standards Brought to You by Mitutoyo

Individual Inch Rectangular Gauge Blocks

SPECIFICATIONS

Inch Blocks

| Length (inch) | Order No.*1 | | Length (inch) | Order No.*1 | | Length (inch) | Order No.*1 | |
|---------------|-------------|------|-----------------|-------------|--------|-----------------|-------------|--------|
| | Steel | CERA | | Steel | CERA | | Steel | CERA |
| 0.004 | 611304 | — | 0.024 | 611324 | — | 0.0625 | 611303 | 613303 |
| 0.005 | 611305 | — | 0.025 | 611325 | — | 0.07 | 611107 | — |
| 0.006 | 611306 | — | 0.026 | 611326 | — | 0.078125 (5/64) | 611103 | 613100 |
| 0.007 | 611307 | — | 0.027 | 611327 | — | 0.08 | 611108 | — |
| 0.008 | 611308 | — | 0.028 | 611328 | — | 0.09 | 611109 | — |
| 0.009 | 611309 | — | 0.029 | 611329 | — | 0.09375 (3/32) | 611104 | 613101 |
| 0.01 | 611310 | — | 0.03 | 611330 | — | 0.1 | 611191 | 613191 |
| 0.011 | 611311 | — | 0.031 | 611331 | — | 0.100025 | 611111 | 613110 |
| 0.012 | 611312 | — | 0.03125 (1/32) | 611101 | 613103 | 0.10005 | 611135 | 613135 |
| 0.013 | 611313 | — | 0.032 | 611332 | — | 0.100075 | 611112 | 613111 |
| 0.014 | 611314 | — | 0.033 | 611333 | — | 0.1001 | 611121 | 613121 |
| 0.015 | 611315 | — | 0.034 | 611334 | — | 0.1002 | 611122 | 613122 |
| 0.016 | 611316 | — | 0.035 | 611335 | — | 0.1003 | 611123 | 613123 |
| 0.017 | 611317 | — | 0.036 | 611336 | — | 0.1004 | 611124 | 613124 |
| 0.018 | 611318 | — | 0.037 | 611337 | — | 0.1005 | 611125 | 613125 |
| 0.019 | 611319 | — | 0.038 | 611338 | — | 0.1006 | 611126 | 613126 |
| 0.02 | 611320 | — | 0.039 | 611339 | — | 0.1007 | 611127 | 613127 |
| 0.02005 | 611240 | — | 0.04 | 611340 | — | 0.1008 | 611128 | 613128 |
| 0.0201 | 611231 | — | 0.041 | 611341 | — | 0.1009 | 611129 | 613129 |
| 0.0202 | 611232 | — | 0.042 | 611342 | — | 0.101 | 611141 | 613141 |
| 0.0203 | 611233 | — | 0.043 | 611343 | — | 0.102 | 611142 | 613142 |
| 0.0204 | 611234 | — | 0.044 | 611344 | — | 0.103 | 611143 | 613143 |
| 0.0205 | 611235 | — | 0.045 | 611345 | — | 0.104 | 611144 | 613144 |
| 0.0206 | 611236 | — | 0.046 | 611346 | — | 0.105 | 611145 | 613145 |
| 0.0207 | 611237 | — | 0.046875 (3/64) | 611102 | 613104 | 0.106 | 611146 | 613146 |
| 0.0208 | 611238 | — | 0.047 | 611347 | — | 0.107 | 611147 | 613147 |
| 0.0209 | 611239 | — | 0.048 | 611348 | — | 0.108 | 611148 | 613148 |
| 0.021 | 611321 | — | 0.049 | 611349 | — | 0.109 | 611149 | 613149 |
| 0.022 | 611322 | — | 0.05 | 611105 | 613105 | 0.109375 (7/64) | 611110 | 613102 |
| 0.023 | 611323 | — | 0.06 | 611106 | — | | | |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

*1: Suffix No. (-■■■■) for Selecting Standard and Certificate Provided

| ASME | | | |
|------------|-------|------------------------|-------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate |
| -516 | K | ✓ | ✓ |
| -521 | 00 | ✓ | |
| -531 | 0 | ✓ | |
| -541 | 1 | ✓ | |
| -551 | 2 | ✓ | |

| BS | | | |
|------------|-------|------------------------|-------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate |
| -121 | 0 | ✓ | |
| -131 | 1 | ✓ | |
| -141 | 2 | ✓ | |



Inspection Certificate

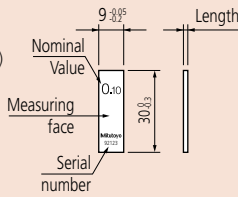


An inspection certificate is supplied as standard. Refer to page U-11 for details.

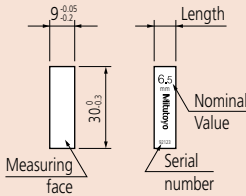
Dimensions

Unit: mm

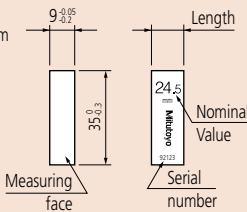
Nominal length:
0.1 mm to 5.5 mm
(0.004 in to 0.25 in)



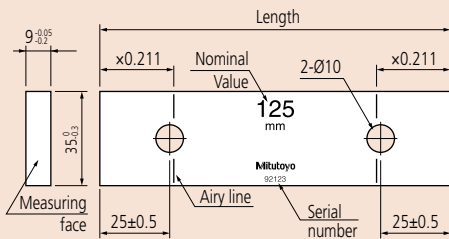
Nominal length:
6 mm to 10 mm
(0.3 in to 0.4 in)



Nominal length:
10.3 mm to 100 mm
(0.45 in to 4 in)



Nominal length 125 mm to 1000 mm (5 in to 20 in)



SPECIFICATIONS

Inch Blocks

| Length (inch) | Order No.*1 | |
|---------------|-------------|--------|
| | Steel | CERA |
| 0.11 | 611150 | 613150 |
| 0.111 | 611151 | 613151 |
| 0.112 | 611152 | 613152 |
| 0.113 | 611153 | 613153 |
| 0.114 | 611154 | 613154 |
| 0.115 | 611155 | 613155 |
| 0.116 | 611156 | 613156 |
| 0.117 | 611157 | 613157 |
| 0.118 | 611158 | 613158 |
| 0.119 | 611159 | 613159 |
| 0.12 | 611160 | 613160 |
| 0.121 | 611161 | 613161 |
| 0.122 | 611162 | 613162 |
| 0.123 | 611163 | 613163 |
| 0.124 | 611164 | 613164 |
| 0.125 | 611165 | 613165 |
| 0.126 | 611166 | 613166 |
| 0.127 | 611167 | 613167 |
| 0.128 | 611168 | 613168 |
| 0.129 | 611169 | 613169 |
| 0.13 | 611170 | 613170 |
| 0.131 | 611171 | 613171 |
| 0.132 | 611172 | 613172 |
| 0.133 | 611173 | 613173 |
| 0.134 | 611174 | 613174 |
| 0.135 | 611175 | 613175 |
| 0.136 | 611176 | 613176 |
| 0.137 | 611177 | 613177 |
| 0.138 | 611178 | 613178 |

| Length (inch) | Order No.*1 | |
|---------------|-------------|--------|
| | Steel | CERA |
| 0.139 | 611179 | 613179 |
| 0.14 | 611180 | 613180 |
| 0.141 | 611181 | 613181 |
| 0.142 | 611182 | 613182 |
| 0.143 | 611183 | 613183 |
| 0.144 | 611184 | 613184 |
| 0.145 | 611185 | 613185 |
| 0.146 | 611186 | 613186 |
| 0.147 | 611187 | 613187 |
| 0.148 | 611188 | 613188 |
| 0.149 | 611189 | 613189 |
| 0.15 | 611115 | 613115 |
| 0.16 | 611116 | 613116 |
| 0.17 | 611117 | 613117 |
| 0.18 | 611118 | 613118 |
| 0.19 | 611119 | 613119 |
| 0.2 | 611192 | 613192 |
| 0.21 | 611221 | 613221 |
| 0.25 | 611212 | 613212 |
| 0.3 | 611193 | 613193 |
| 0.315 | 611209 | 613209 |
| 0.35 | 611213 | 613213 |
| 0.375 (3/8) | 611113 | 613112 |
| 0.4 | 611194 | 613194 |
| 0.420 | 611210 | 613210 |
| 0.45 | 611214 | 613214 |
| 0.5 | 611195 | 613195 |
| 0.55 | 611215 | 613215 |
| 0.6 | 611196 | 613196 |

| Length (inch) | Order No.*1 | |
|---------------|-------------|--------|
| | Steel | CERA |
| 0.605 | 611211 | 613211 |
| 0.65 | 611216 | 613216 |
| 0.7 | 611197 | 613197 |
| 0.710 | 611220 | 613220 |
| 0.75 | 611217 | 613217 |
| 0.8 | 611198 | 613198 |
| 0.815 | 611226 | 613226 |
| 0.85 | 611218 | 613218 |
| 0.9 | 611199 | 613199 |
| 0.920 | 611227 | 613227 |
| 0.95 | 611219 | 613219 |
| 1 | 611201 | 613201 |
| 2 | 611202 | 613202 |
| 3 | 611203 | 613203 |
| 4 | 611204 | 613204 |
| 5 | 611205 | 613205 |
| 6 | 611206 | 613206 |
| 7 | 611207 | 613207 |
| 8 | 611208 | 613208 |
| 10 | 611222 | 613222 |
| 12 | 611223 | 613223 |
| 16 | 611224 | 613224 |
| 20 | 611225 | 613225 |

Inch Wear Blocks

| Length (inch) | Order No.*1 |
|---------------|------------------|
| | Tungsten carbide |
| 0.05 | 612105 |
| 0.1 | 612191 |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.

4 inch or more is not listed in the standard of British Standards Institution.

Gauge Blocks

Length Standards Brought to You by Mitutoyo

Rectangular Gauge Block Accessories SERIES 516

- Accessory sets for extending the range of application of rectangular gauge blocks. For example, constructing temporary snap gages for small batches of product where custom gages would be uneconomical to manufacture.
- Available in 22-piece and 14-piece sets. Each accessory is also available separately for applications where a full set is not needed.
- Can be used with steel or CERA blocks.



516-601
(22 pcs.)



516-602
(14 pcs.)

SPECIFICATIONS

| Item Description | Order No. | Nominal capacity/ dimension (mm) | Set | | Quantity Supplied |
|-------------------------|---------------|--|---------------------------|---------------------------|----------------------|
| | | | 22 pcs. 516-601 | 14 pcs. 516-602 | |
| Holder | 619002 | 15 to 60 | | ✓ | 1 pc. |
| | 619003 | 5 to 100 | ✓ | ✓ | |
| | 619004 | 15 to 160 | ✓ | ✓ | |
| | 619005 | 20 to 250 | ✓ | ✓ | |
| Base | 619009 | 35 | ✓ | ✓ | |
| Half-round jaw | 619010 | 2 | ✓ | ✓ | One pair (2 pcs.) |
| | 619011 | 5 | ✓ | ✓ | |
| | 619012 | 8 | ✓ | ✓ | |
| | 619013 | 12 | ✓ | | |
| | 619014 | 20 | ✓ | | |
| Plain jaw | 619018 | 160 | ✓ | | |
| Scriber point | 619019 | — | ✓ | ✓ | 1 pc. |
| Center point | 619020 | — | ✓ | ✓ | |
| Tram point | 619021 | — | ✓ | | One pair (2 pcs.) |
| Triangular straightedge | 619022 | 100 | ✓ | ✓ | 1 pc. |
| | 619023 | 160 | ✓ | | |

Typical application 1



Accessories used in application 1:
 Half-round jaw (619013) 2 pcs.
 Holder (619002) 1 pc.
 Gauge block

Typical application 2



Accessories used in application 2:
 Base (619009) 1 pc.
 Holder (619003) 1 pc.
 Scriber point (619019) 1 pc.
 Gauge block

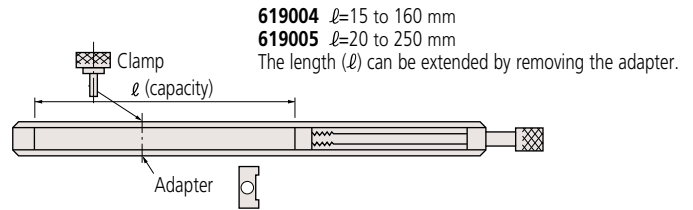
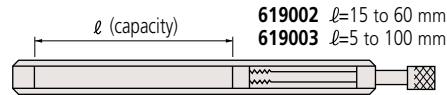
Typical application 3



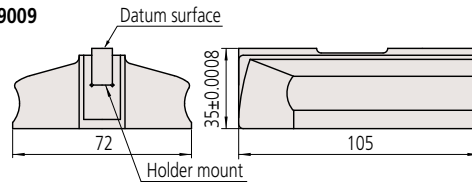
Setting a bore gage using a holder with a pair of Type I half-round jaws arranged as flat contact surfaces

Holder

Thickness=15 mm
 Width=29.5 mm



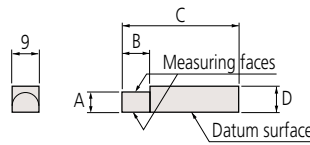
Base 619009



Flatness of the datum surface 0.5 μ m
 Parallelism 0.8 μ m
 Flatness of the bottom surface 1 μ m

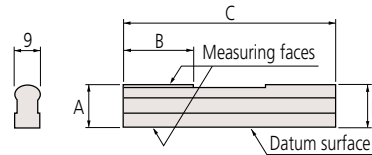
Half-round jaws

Type I



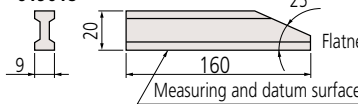
Flatness of the datum surface 0.5 μ m
 Parallelism of A 0.5 μ m

Type II



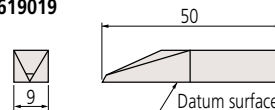
| Order No. | Type | Size (mm) | A (mm) | B (mm) | C (mm) | D (mm) |
|-----------|------|-----------|-----------|--------|--------|--------|
| 619010 | I | 2 | 2±0.0005 | 5.5 | 40 | 7.5 |
| 619011 | | 5 | 5±0.0005 | 15.5 | 45 | 7.5 |
| 619012 | | 8 | 8±0.0005 | 20 | 50 | 8.5 |
| 619013 | II | 12 | 12±0.0005 | 25 | 75 | 13 |
| 619014 | | 20 | 20±0.0005 | 25 | 125 | 20.5 |

Plain jaw (B type) 619018



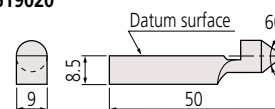
Flatness of the datum surface 1 μ m

Scriber point 619019



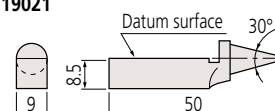
Flatness of the datum surface 0.5 μ m

Center point 619020



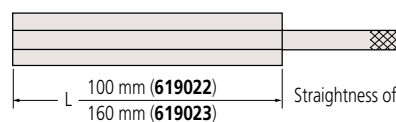
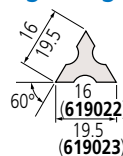
Eccentricity tolerance of the point ±10 μ m
 Flatness of the datum surface 0.5 μ m

Tram point 619021



Eccentricity tolerance of the point ±10 μ m
 Flatness of the datum surface 0.5 μ m

Triangular straightedge (for handheld use only)



Straightness of the edges 1.2 μ m

Gauge Blocks

Length Standards Brought to You by Mitutoyo

Accessories for Rectangular Gauge Blocks over 100 mm SERIES 516

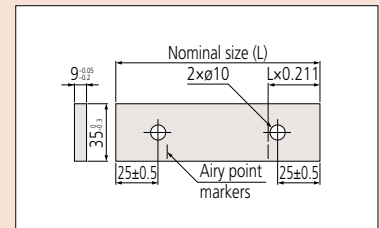
- Specially designed for long rectangular gauge blocks of 100 mm and over which have two coupling holes in the body: coupling of two long gauge blocks, a stack of regular gauge blocks and attachment of jaws is possible.
- These accessories can be used for long steel or CERA blocks.



516-605
(14 pcs.)

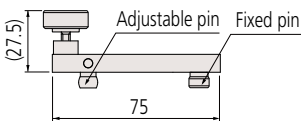
SPECIFICATIONS

| Set Order No. | Order No. | Description | Quantity Supplied |
|---------------|-----------|--------------------|-------------------|
| 516-605 | 619031 | Connector A | 1 pc. |
| | 619032 | Connector B | |
| | 619033 | Connector C | |
| | 619034 | Connector D | |
| | 619035 | Connector E | |
| | 619036 | Adapter | 3 pcs. |
| | 619009 | Base | 1 pc. |
| | 619018 | Plain jaw (B-type) | 2 pcs. |
| | 619013 | Half-round jaw | |
| | 619019 | Scriber point | 1 pc. |



Coupling holes in long gauge blocks

Connector A 619031

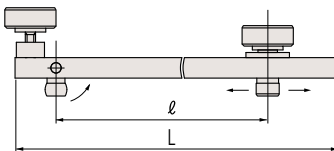


Used for directly coupling two long gauge blocks.



Using an A-type connector

Connectors B and C



Adapter (2 pcs.) 619036

In addition to connecting long gauge blocks, the holders can also connect long gauge blocks with other types of gauge blocks inserted in between. Holder B is for gauge blocks with nominal size of 40 mm or less, and holder C for gauge blocks with nominal size of 150 mm or less (holder C can also be used to connect hole-less gauge blocks of 100 mm or less with various types of jaw). Adapters can be used to attach jaws on the edges of long gauge blocks.

| Order No. | ℓ (max.) | L | Adapter Qty. |
|-----------|----------|-----|--------------|
| 619032 | 90 | 126 | 2 |
| 619033 | 200 | 236 | |

Unit: mm



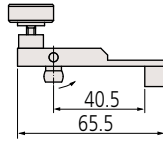
Use of B-type connectors in gage construction

Typical application



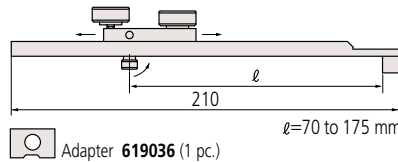
Setting a dial test indicator to a long-gauge-block stack attached to the base with a D-type connector

Connector D 619034



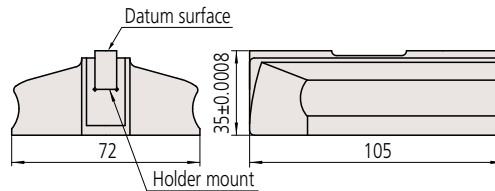
Used for attaching a long gauge block directly to the base.

Connector E 619035



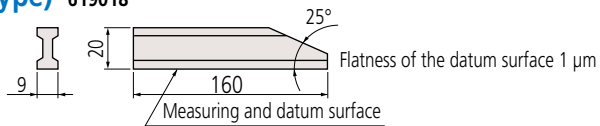
Used for attaching a long gauge block to the base over a stack of regular gauge blocks wrung between the base and long gauge block. The length l is highly adjustable to accommodate the variable length of the stack.

Base 619009

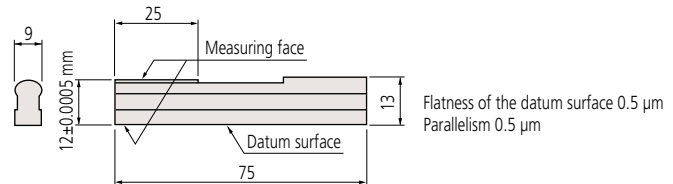


Flatness of the datum surface $0.5 \mu\text{m}$
Parallelism $0.8 \mu\text{m}$
Flatness of the bottom surface $1 \mu\text{m}$

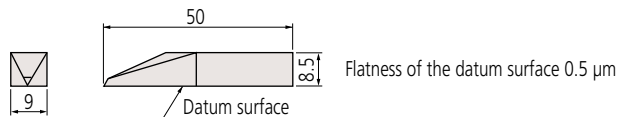
Plain jaw (B-type) 619018



Half-round jaw 619013



Scriber point 619019



Example of use of accessories with long gauge blocks

The table below shows the appropriate combination of long rectangular gauge blocks and accessories for making inside and outside measurements in the approximate range 300 mm to 1000 mm in 100 mm steps. The numbers in the table represent the number of gauge blocks or accessories in use. Note that the ranges shown do not take into account the combined thickness of the half-round jaws for inside measurement (24 mm) and the length of any regular gauge block stack used.

| Items | Order No. | 300 mm | | 400 mm | | 500 mm | | 600 mm | | 700 mm | | 800 mm | | 900 mm | | 1000 mm | |
|---|-----------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|---------|-------|
| | | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer |
| Rectangular gauge block (nominal dimension) | 200 mm | 611682 | | | | | | 1 | 1 | | | | | | | | |
| | 300 mm | 611683 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | 400 mm | 611684 | | | 1 | 1 | | | 1 | 1 | 1 | 1 | | 1 | 1 | | |
| | 500 mm | 611685 | | | | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 2 | 2 |
| Connector A | 619031 | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Connector B* | 619032 | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | |
| Half-round jaws 2 pcs/set | 619013 | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | | 2 | |
| Adapter | 619036 | (2) | | (2) | | (2) | | (2) | | (2) | | (2) | | (2) | | (2) | |

* Provided with adapters (2 pcs.).

Gauge Blocks

Length Standards Brought to You by Mitutoyo



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Metric/Inch Square Gauge Block Sets SERIES 516 — Metric Block Sets, Long Block Sets, Wear Block Sets

- Square gauge block sets have several unique characteristics (Refer to page E-4 for details). A wide choice is provided to best match the target applications: sets containing from 2 to 112 blocks are available.
- It is recommended to use only Mitutoyo accessory sets with these gauge blocks as the tolerances on the assembly hole countersinks in the blocks and mating screw heads in the sets are 5 times tighter than the applicable standard, and therefore are guaranteed to fit together correctly.



Steel 112-block set



Steel 103-block set



Steel 76-block set



Steel 47-block set



Steel 32-block set

Wear block set



Tungsten Carbide

Long block set



Steel 8-block set

These square wear gauge blocks made of cemented carbide have excellent resistance to abrasion, making them ideal for protecting the ends of a stack of blocks subject to frequent use. Available in two nominal sizes: 1 mm and 2 mm. We recommend that these wear gauge blocks of both sizes be wrung firmly to the stack when in use.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

***1: Suffix No. (■) for Selecting Standard and Certificate Provided**

ISO/DIN/JIS

| Suffix No. | Inspection Certificate | Calibration Certificate | |
|------------|------------------------|-------------------------|---|
| | | JCSS | |
| 1 | ✓ | | |
| 6 | ✓ | | ✓ |

ASME

| Suffix No. | Inspection Certificate | Calibration Certificate | |
|------------|------------------------|-------------------------|--|
| | | JCSS | |
| 1 | ✓ | | |



Inspection Certificate

SPECIFICATIONS

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | Blocks included in set | | |
|----------------|-----------|------|---|---------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | Size (mm) | Step (mm) | Qty. |
| 112 | 516-437 | — | — | 00: -■6 | 1.005 | — | 1 |
| | 516-438 | — | 0: -■0 | 0: -■6 | 1.001 - 1.009 | 0.001 | 9 |
| | 516-439 | — | 1: -■0 | 1: -■6 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-440 | — | 2: -■0 | 2: -■6 | 0.5 - 24.5 | 0.5 | 49 |
| | — | — | — | — | 25 - 100 | 25 | 4 |
| 103 | 516-441 | — | — | 00: -■6 | 1.005 | — | 1 |
| | 516-442 | — | 0: -■0 | 0: -■6 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-443 | — | 1: -■0 | 1: -■6 | 0.5 - 24.5 | 0.5 | 49 |
| | 516-444 | — | 2: -■0 | 2: -■6 | 25 - 100 | 25 | 4 |
| 76 | 516-449 | — | — | 00: -■6 | 1.005 | — | 1 |
| | 516-450 | — | 0: -■0 | 0: -■6 | 1.01 - 1.49 | 0.01 | 49 |
| | 516-451 | — | 1: -■0 | 1: -■6 | 0.5 - 9.5 | 0.5 | 19 |
| | 516-452 | — | 2: -■0 | 2: -■6 | 10 - 40 | 10 | 4 |
| | — | — | — | — | 50 - 100 | 25 | 3 |
| 47 | 516-457 | — | — | 00: -■6 | 1.005 | — | 1 |
| | 516-458 | — | 0: -■0 | 0: -■6 | 1.01 - 1.09 | 0.01 | 9 |
| | 516-459 | — | 1: -■0 | 1: -■6 | 1.1 - 1.9 | 0.1 | 9 |
| | 516-460 | — | 2: -■0 | 2: -■6 | 1 - 24 | 1 | 24 |
| | — | — | — | — | 25 - 100 | 25 | 4 |
| 32 | 516-465 | — | — | 00: -■6 | 1.005 | — | 1 |
| | 516-466 | — | 0: -■0 | 0: -■6 | 1.01 - 1.09 | 0.01 | 9 |
| | 516-467 | — | 1: -■0 | 1: -■6 | 1.1 - 1.9 | 0.1 | 9 |
| | 516-468 | — | 2: -■0 | 2: -■6 | 1 - 9 | 1 | 9 |
| | — | — | — | — | 10 - 30 | 10 | 3 |
| — | — | — | — | 60 | — | 1 | |

Metric Long Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | Blocks included in set | | |
|----------------|-----------|------|---|---------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | Size (mm) | Step (mm) | Qty. |
| 8 | 516-751 | — | — | 00: -■6 | 125, 150, 175 | 25 | 3 |
| | 516-752 | — | 0: -■0 | 0: -■6 | 200, 250 | 50 | 2 |
| | 516-753 | — | 1: -■0 | 1: -■6 | 300, 400, 500 | 100 | 3 |
| | 516-754 | — | 2: -■0 | 2: -■6 | — | — | — |
| | — | — | — | — | — | — | — |

Metric Wear Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | Blocks included in set | | |
|----------------|-----------|------|---|------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | Size (mm) | Step (mm) | Qty. |
| 2 | 516-820 | — | 0: -■0 | — | 1 | — | 2 |
| | 516-821 | — | 1: -■0 | — | — | — | — |
| 2 | 516-822 | — | 0: -■0 | — | 2 | — | 2 |
| | 516-823 | — | 1: -■0 | — | — | — | — |

Inch Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | Blocks included in set | | |
|----------------|-----------|---------|---|---------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | Size (in) | Step (in) | Qty. |
| 81 | 516-401 | 516-201 | — | 00: -■6 | 0.1001 - 0.1009 | 0.0001 | 9 |
| | 516-402 | 516-202 | — | 0: -■6 | 0.101 - 0.149 | 0.001 | 49 |
| | 516-403 | 516-203 | — | 1: -■6 | 0.05 - 0.95 | 0.05 | 19 |
| | 516-404 | 516-204 | — | 2: -■6 | 1 - 4 | 1 | 4 |
| 36 | 516-421 | 516-221 | — | 00: -■6 | 0.05 | — | 1 |
| | 516-422 | 516-222 | — | 0: -■6 | 0.1001 - 0.1009 | 0.0001 | 9 |
| | 516-423 | 516-223 | — | 1: -■6 | 0.101 - 0.109 | 0.001 | 9 |
| | 516-424 | 516-224 | — | 2: -■6 | 0.11 - 0.19 | 0.01 | 9 |
| | — | — | — | — | 0.1 - 0.5 | 0.1 | 5 |
| 28 | 516-417 | — | — | 00: -■6 | 0.02005 | — | 1 |
| | 516-418 | — | — | 0: -■6 | 0.0201 - 0.0209 | 0.0001 | 9 |
| | 516-419 | — | — | 1: -■6 | 0.021 - 0.029 | 0.001 | 9 |
| | 516-420 | — | — | 2: -■6 | 0.010 - 0.090 | 0.01 | 9 |
| | — | — | — | — | — | — | — |

Inch Long Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | Blocks included in set | | |
|----------------|-----------|------|---|--------|------------------------|-----------|------|
| | Steel | CERA | ISO/DIN/JIS | ASME | Size (in) | Step (in) | Qty. |
| 8 | 516-762 | — | — | 0: -■0 | 5 - 7 | 1 | 3 |
| | 516-763 | — | — | 1: -■0 | 8, 10, 12 | 2 | 3 |
| | — | — | — | — | 16, 20 | 4 | 2 |

Inch Wear Block Sets

| Blocks per set | Order No. | | Standard/grade available and Suffix No.*1 | | Blocks included in set | | |
|----------------|-----------|---------|---|--------|------------------------|-----------|------|
| | Carbide | CERA | ISO/DIN/JIS | ASME | Size (in) | Step (in) | Qty. |
| 2 | 516-824 | 516-846 | — | 0: -■0 | 0.05 | — | 2 |
| | 516-825 | 516-847 | — | 1: -■0 | — | — | — |
| 2 | 516-826 | 516-844 | — | 0: -■0 | 0.1 | — | 2 |
| | 516-827 | 516-845 | — | 1: -■0 | — | — | — |

Gauge Blocks

Length Standards Brought to You by Mitutoyo



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Individual Metric Square Gauge Blocks

- Purchasing individual metric square gauge blocks is a cost-effective way to replace heavily used sizes.
- Please add the Suffix No. representing the national standard and grade required at the end of the Order No. when ordering these items.
- Special sizes that are not included in the charts can be supplied custom-made on request.
- It is recommended to use only Mitutoyo accessory sets with these gauge blocks as the tolerances on the assembly hole countersinks in the blocks and mating screw heads in the sets are 5 times tighter than the applicable standard, and therefore are guaranteed to fit together correctly.



Suffix No. (- ■■■) for Selecting Standard and Certificate Provided

| ISO/DIN/JIS | | | |
|-------------|-------|------------------------|------------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate JCSS |
| -021 | 0 | ✓ | |
| -026 | 0 | ✓ | ✓ |
| -031 | 1 | ✓ | |
| -036 | 1 | ✓ | ✓ |
| -041 | 2 | ✓ | |
| -046 | 2 | ✓ | ✓ |

| ASME | | | |
|------------|-------|------------------------|------------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate JCSS |
| -521 | 00 | ✓ | |
| -531 | 0 | ✓ | |
| -541 | 1 | ✓ | |
| -551 | 2 | ✓ | |

SPECIFICATIONS

Metric Blocks

| Length (mm) | Order No. | |
|-------------|-----------|------|
| | Steel | CERA |
| 0.5 | 614506 | — |
| 1 | 614611 | — |
| 1.0005 | 614520 | — |
| 1.001 | 614521 | — |
| 1.002 | 614522 | — |
| 1.003 | 614523 | — |
| 1.004 | 614524 | — |
| 1.005 | 614525 | — |
| 1.006 | 614526 | — |
| 1.007 | 614527 | — |
| 1.008 | 614528 | — |
| 1.009 | 614529 | — |
| 1.01 | 614561 | — |
| 1.02 | 614562 | — |
| 1.03 | 614563 | — |
| 1.04 | 614564 | — |
| 1.05 | 614565 | — |
| 1.06 | 614566 | — |
| 1.07 | 614567 | — |
| 1.08 | 614568 | — |
| 1.09 | 614569 | — |
| 1.1 | 614570 | — |
| 1.11 | 614571 | — |
| 1.12 | 614572 | — |
| 1.13 | 614573 | — |
| 1.14 | 614574 | — |
| 1.15 | 614575 | — |
| 1.16 | 614576 | — |
| 1.17 | 614577 | — |
| 1.18 | 614578 | — |
| 1.19 | 614579 | — |
| 1.2 | 614580 | — |
| 1.21 | 614581 | — |
| 1.22 | 614582 | — |
| 1.23 | 614583 | — |
| 1.24 | 614584 | — |
| 1.25 | 614585 | — |
| 1.26 | 614586 | — |
| 1.27 | 614587 | — |
| 1.28 | 614588 | — |
| 1.29 | 614589 | — |
| 1.3 | 614590 | — |
| 1.31 | 614591 | — |
| 1.32 | 614592 | — |

| Length (mm) | Order No. | |
|-------------|-----------|------|
| | Steel | CERA |
| 1.33 | 614593 | — |
| 1.34 | 614594 | — |
| 1.35 | 614595 | — |
| 1.36 | 614596 | — |
| 1.37 | 614597 | — |
| 1.38 | 614598 | — |
| 1.39 | 614599 | — |
| 1.4 | 614600 | — |
| 1.41 | 614601 | — |
| 1.42 | 614602 | — |
| 1.43 | 614603 | — |
| 1.44 | 614604 | — |
| 1.45 | 614605 | — |
| 1.46 | 614606 | — |
| 1.47 | 614607 | — |
| 1.48 | 614608 | — |
| 1.49 | 614609 | — |
| 1.5 | 614641 | — |
| 1.6 | 614516 | — |
| 1.7 | 614517 | — |
| 1.8 | 614518 | — |
| 1.9 | 614519 | — |
| 2 | 614612 | — |
| 2.5 | 614642 | — |
| 3 | 614613 | — |
| 3.5 | 614643 | — |
| 4 | 614614 | — |
| 4.5 | 614644 | — |
| 5 | 614615 | — |
| 5.5 | 614645 | — |
| 6 | 614616 | — |
| 6.5 | 614646 | — |
| 7 | 614617 | — |
| 7.5 | 614647 | — |
| 8 | 614618 | — |
| 8.5 | 614648 | — |
| 9 | 614619 | — |
| 9.5 | 614649 | — |
| 10 | 614671 | — |
| 10.5 | 614650 | — |
| 11 | 614621 | — |
| 11.5 | 614651 | — |
| 12 | 614622 | — |
| 12.5 | 614652 | — |

| Length (mm) | Order No. | |
|-------------|-----------|------|
| | Steel | CERA |
| 13 | 614623 | — |
| 13.5 | 614653 | — |
| 14 | 614624 | — |
| 14.5 | 614654 | — |
| 15 | 614625 | — |
| 15.5 | 614655 | — |
| 16 | 614626 | — |
| 16.5 | 614656 | — |
| 17 | 614627 | — |
| 17.5 | 614657 | — |
| 18 | 614628 | — |
| 18.5 | 614658 | — |
| 19 | 614629 | — |
| 19.5 | 614659 | — |
| 20 | 614672 | — |
| 20.5 | 614660 | — |
| 21 | 614631 | — |
| 21.5 | 614661 | — |
| 22 | 614632 | — |
| 22.5 | 614662 | — |
| 23 | 614633 | — |
| 23.5 | 614663 | — |
| 24 | 614634 | — |
| 24.5 | 614664 | — |
| 25 | 614635 | — |
| 30 | 614673 | — |
| 40 | 614674 | — |
| 50 | 614675 | — |
| 60 | 614676 | — |
| 75 | 614801 | — |
| 100 | 614681 | — |
| 125 | 614802 | — |
| 150 | 614803 | — |
| 175 | 614804 | — |
| 200 | 614682 | — |
| 250 | 614805 | — |
| 300 | 614683 | — |
| 400 | 614684 | — |
| 500 | 614685 | — |

Metric Wear Blocks

| Length (mm) | Order No. |
|-------------|------------------|
| | Tungsten carbide |
| 1 | 615611 |
| 2 | 615612 |



Inspection Certificate

Note: Details of the overall sizes for forms of block are given on pages E-3 and E-24, and the accuracy standards to which they are manufactured are given on page E-5.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

***1: Suffix No. (-■■■) for Selecting Grade and Certificate Provided**

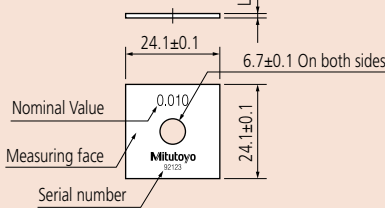
| ASME | | | |
|------------|-------|------------------------|------------------------------|
| Suffix No. | Grade | Inspection Certificate | Calibration Certificate JCSS |
| -521 | 00 | ✓ | |
| -531 | 0 | ✓ | |
| -541 | 1 | ✓ | |
| -551 | 2 | ✓ | |



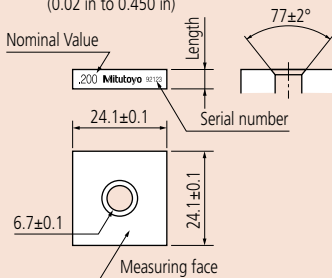
Inspection Certificate

Dimensions

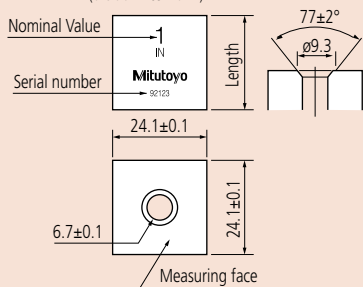
Nominal length: 0.5 mm to 4.5 mm (0.010 in to 0.19 in) Unit: mm



Nominal length: 5 mm to 14.5 mm (0.02 in to 0.450 in)



Nominal length: 15 mm to 500 mm (0.500 in to 20 in)



Individual Inch Square Gauge Blocks

SPECIFICATIONS

| Length (in) | Order No.*1 | | Length (in) | Order No.*1 | | Length (in) | Order No.*1 | |
|-----------------|-------------|--------|-----------------|-------------|--------|-------------|-------------|--------|
| | Steel | CERA | | Steel | CERA | | Steel | CERA |
| 0.01 | 614310 | — | 0.106 | 614146 | 616146 | 0.25 | 614212 | 616212 |
| 0.02005 | 614240 | — | 0.107 | 614147 | 616147 | 0.3 | 614193 | 616193 |
| 0.0201 | 614231 | — | 0.108 | 614148 | 616148 | 0.35 | 614213 | 616213 |
| 0.0202 | 614232 | — | 0.109 | 614149 | 616149 | 0.375 (3/8) | 614309 | — |
| 0.0203 | 614233 | — | 0.109375 (7/64) | 614306 | — | 0.4 | 614194 | 616194 |
| 0.0204 | 614234 | — | 0.11 | 614150 | 616150 | 0.45 | 614214 | 616214 |
| 0.0205 | 614235 | — | 0.111 | 614151 | 616151 | 0.5 | 614195 | 616195 |
| 0.0206 | 614236 | — | 0.112 | 614152 | 616152 | 0.55 | 614215 | 616215 |
| 0.0207 | 614237 | — | 0.113 | 614153 | 616153 | 0.6 | 614196 | 616196 |
| 0.0208 | 614238 | — | 0.114 | 614154 | 616154 | 0.65 | 614216 | 616216 |
| 0.0209 | 614239 | — | 0.115 | 614155 | 616155 | 0.7 | 614197 | 616197 |
| 0.02 | 614320 | — | 0.116 | 614156 | 616156 | 0.75 | 614217 | 616217 |
| 0.021 | 614321 | — | 0.117 | 614157 | 616157 | 0.8 | 614198 | 616198 |
| 0.022 | 614322 | — | 0.118 | 614158 | 616158 | 0.85 | 614218 | 616218 |
| 0.023 | 614323 | — | 0.119 | 614159 | 616159 | 0.9 | 614199 | 616199 |
| 0.024 | 614324 | — | 0.12 | 614160 | 616160 | 0.95 | 614219 | 616219 |
| 0.025 | 614325 | — | 0.121 | 614161 | 616161 | 1 | 614201 | 616201 |
| 0.026 | 614326 | — | 0.122 | 614162 | 616162 | 2 | 614202 | 616202 |
| 0.027 | 614327 | — | 0.123 | 614163 | 616163 | 3 | 614203 | 616203 |
| 0.028 | 614328 | — | 0.124 | 614164 | 616164 | 4 | 614204 | 616204 |
| 0.029 | 614329 | — | 0.125 | 614165 | 616165 | 5 | 614205 | — |
| 0.03 | 614330 | — | 0.126 | 614166 | 616166 | 6 | 614206 | — |
| 0.03125 (1/32) | 614301 | — | 0.127 | 614167 | 616167 | 7 | 614207 | — |
| 0.04 | 614340 | — | 0.128 | 614168 | 616168 | 8 | 614208 | — |
| 0.046875 (3/64) | 614302 | — | 0.129 | 614169 | 616169 | 10 | 614222 | — |
| 0.05 | 614105 | 616105 | 0.13 | 614170 | 616170 | 12 | 614223 | — |
| 0.06 | 614106 | — | 0.131 | 614171 | 616171 | 16 | 614224 | — |
| 0.0625 | 614303 | 616303 | 0.132 | 614172 | 616172 | 20 | 614225 | — |
| 0.07 | 614107 | — | 0.133 | 614173 | 616173 | | | |
| 0.078125 (5/64) | 614304 | — | 0.134 | 614174 | 616174 | | | |
| 0.08 | 614108 | — | 0.135 | 614175 | 616175 | | | |
| 0.09 | 614109 | — | 0.136 | 614176 | 616176 | | | |
| 0.09375 (3/32) | 614305 | — | 0.137 | 614177 | 616177 | | | |
| 0.1 | 614191 | 616191 | 0.138 | 614178 | 616178 | | | |
| 0.100025 | 614307 | — | 0.139 | 614179 | 616179 | | | |
| 0.10005 | 614135 | 616135 | 0.14 | 614180 | 616180 | | | |
| 0.100075 | 614308 | — | 0.141 | 614181 | 616181 | | | |
| 0.1001 | 614121 | 616121 | 0.142 | 614182 | 616182 | | | |
| 0.1002 | 614122 | 616122 | 0.143 | 614183 | 616183 | | | |
| 0.1003 | 614123 | 616123 | 0.144 | 614184 | 616184 | | | |
| 0.1004 | 614124 | 616124 | 0.145 | 614185 | 616185 | | | |
| 0.1005 | 614125 | 616125 | 0.146 | 614186 | 616186 | | | |
| 0.1006 | 614126 | 616126 | 0.147 | 614187 | 616187 | | | |
| 0.1007 | 614127 | 616127 | 0.148 | 614188 | 616188 | | | |
| 0.1008 | 614128 | 616128 | 0.149 | 614189 | 616189 | | | |
| 0.1009 | 614129 | 616129 | 0.15 | 614115 | 616115 | | | |
| 0.101 | 614141 | 616141 | 0.16 | 614116 | 616116 | | | |
| 0.102 | 614142 | 616142 | 0.17 | 614117 | 616117 | | | |
| 0.103 | 614143 | 616143 | 0.18 | 614118 | 616118 | | | |
| 0.104 | 614144 | 616144 | 0.19 | 614119 | 616119 | | | |
| 0.105 | 614145 | 616145 | 0.2 | 614192 | 616192 | | | |

Note: Details of the overall sizes for forms of block are given on page E-3 and the accuracy standards to which they are manufactured are given on page E-5.

| Inch Wear Blocks | |
|------------------|----------------------------|
| Length (in) | Order No. Tungsten carbide |
| 0.05 | 615105 |
| 0.1 | 615191 |

Gauge Blocks

Length Standards Brought to You by Mitutoyo

Square Gauge Block Accessories Set SERIES 516

- To expand the application of square gauge blocks, Mitutoyo offers the Gauge Block Accessories Set. Square gauge blocks have a much broader range of application than rectangular gauge blocks due to the central clamping hole. Also, the accessories included in the set are sold individually depending on the application.
- It is recommended to use only Mitutoyo accessory sets with these gauge blocks as the tolerances on the assembly hole countersinks in the blocks and mating screw heads in the sets are 5 times tighter than the applicable standard, and therefore are guaranteed to fit together correctly.



516-611

SPECIFICATIONS

| Metric | | | Inch | | |
|-------------------|---------------------------|-------------------|-------------------|---------------------------|-------------------|
| Order No. 516-611 | Included in set | Quantity Supplied | Order No. 516-612 | Included in set | Quantity Supplied |
| 619070 | Half-round jaw 2 mm | 2 pcs. | 619050 | Half-round jaw 2 mm | 2 pcs. |
| 619071 | Half-round jaw 5 mm | | 619051 | Half-round jaw 5 mm | |
| 619072 | Plain jaw 10 mm | 1 pc. | 619052 | Plain jaw 10 mm | 1 pc. |
| 619073 | Center point 2 mm | | 619053 | Center point 2 mm | |
| 619054 | Scriber point | 2 pcs. | 619054 | Scriber point | 2 pcs. |
| 619074 | Base 10 mm | | 619055 | Base 10 mm | |
| 619056 | Stud | 1 pc. | 619056 | Stud | 1 pc. |
| 619057 | Flat head screw 1 1/4" | | 619057 | Flat head screw 1 1/4" | |
| 619058 | Flat head screw 5/8" | 2 pcs. | 619058 | Flat head screw 5/8" | 2 pcs. |
| 619059 | Slotted head nut | | 619059 | Slotted head nut | |
| 619060 | Adjustable tie rod 6" | 1 pc. | 619060 | Adjustable tie rod 6" | 1 pc. |
| 619061 | Adjustable tie rod 4 1/2" | | 619061 | Adjustable tie rod 4 1/2" | |
| 619062 | Tie rod 3" | 2 pcs. | 619062 | Tie rod 3" | 2 pcs. |
| 619063 | Tie rod 2 1/4" | | 619063 | Tie rod 2 1/4" | |
| 619064 | Tie rod 1 1/2" | 1 pc. | 619064 | Tie rod 1 1/2" | 1 pc. |
| 619065 | Tie rod 3/4" | | 619065 | Tie rod 3/4" | |
| 619066 | Knurled head screw | 2 pcs. | 619066 | Knurled head screw | 2 pcs. |

Note: 2 pcs. of half-round jaw, plain jaw, stud, flat head screw, slotted head nut, adjustable tie rod, and knurled head screw are included in each set. Please note that the abovementioned Order No. indicates only 1 set.

Square gauge block applications

Example of a gage for checking caliper accuracy



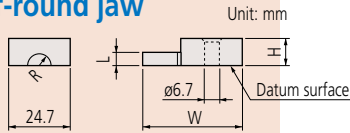
Using plain jaws, gauge blocks, a tie rod and a knurled-head screw a gage was constructed to enable rapid checking of the accuracy of a caliper at selected points.

Example of a gage for comparison measurement of a stepped workpiece



Using plain jaws, gauge blocks, a tie rod and a knurled-head screw a gage was constructed to enable rapid comparison measurement of a stepped workpiece. (Sample workpiece)

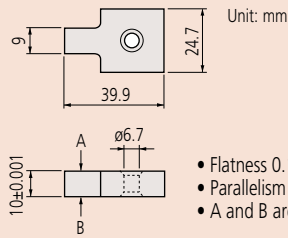
Half-round jaw



| Order No. | R (mm) | L (mm) | W (mm) | H (mm) |
|-----------|--------|--------|--------|--------|
| 619070 | 1.95 | 2 | 33.6 | 5.3 |
| 619071 | 4.95 | 5 | 39.9 | 10.3 |

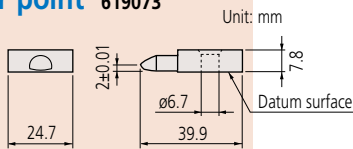
- Flatness 0.5 μm
- Parallelism of L 0.5 μm
- Tolerance of L $\pm 0.5 \mu\text{m}$

Plain jaw 619072



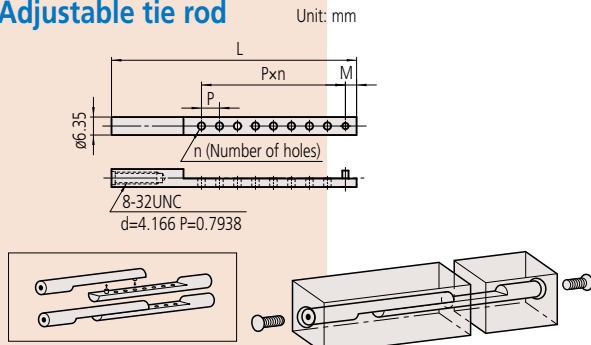
- Flatness 0.12 μm
- Parallelism 0.12 μm
- A and B are datum surfaces

Center point 619073



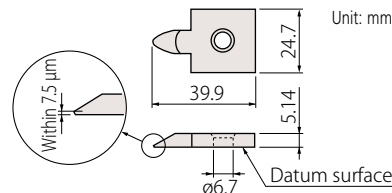
- Flatness 0.5 μm

Adjustable tie rod



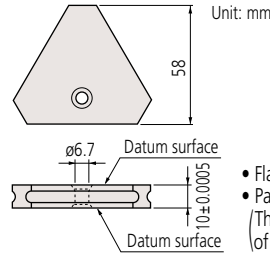
| Order No. | L (mm) | M (mm) | P (mm) | n (Number of holes) |
|-----------|--------|--------|--------|---------------------|
| 619060 | 124.5 | 3.85 | 6.35 | 14 |
| 619061 | 86.5 | 3.95 | 6.35 | 8 |

Scriber point 619054



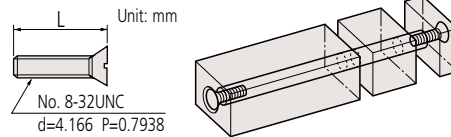
- Flatness of datum surface 0.5 μm

Base 619074



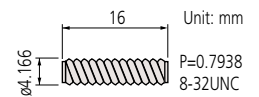
- Flatness 1.5 μm
- Parallelism 1.5 μm (The surface within 1.5 mm) of edge is excluded

Flat head screw

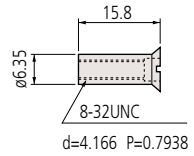


| Order No. | L (mm) |
|-----------|--------|
| 619057 | 31.6 |
| 619058 | 15.8 |

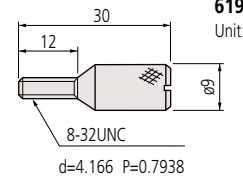
Stud 619056



Slotted head nut 619059



Knurled head screw 619066

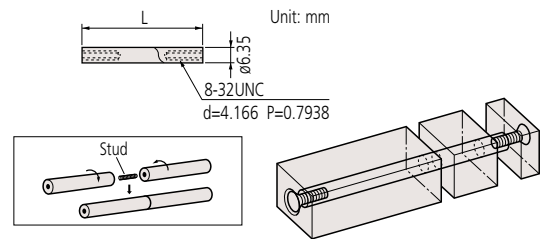


- Contraction caused by the clamping force

The minimum recommended torque to be applied to the clamping screws is approximately 600 mN·m. The chart below shows the approximate length contraction of a 100 mm gage stack using typical torque values.

| Driver | Contraction |
|------------------------------------|----------------------------------|
| Torque Driver 600 mN·m | 0.2 $\mu\text{m}/100 \text{ mm}$ |
| Ordinary Driver 700 to 800 mN·m | 0.3 $\mu\text{m}/100 \text{ mm}$ |

Tie rod



| Order No. | L (mm) |
|-----------|--------|
| 619065 | 19 |
| 619064 | 38 |
| 619063 | 57 |
| 619062 | 76 |

Accessories used for combining square gauge blocks

| Order No. | Included in set | Overall length (mm) | Min. | 21 | 36 | 34 | 41 | 45 | 58 | 64 | 72 | 77 | 82 | 91 | 95 | 109 | 117 | 130 | 148 | 121 | 167 | 143 | 160 | 205 | 180 | 223 | 240 | 258 | 295 | 375 | | | |
|-----------|--------------------|---------------------|------|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|
| 619059 | Slotted head nut | | Max. | 30 | 43 | 43 | 50 | 60 | 72 | 79 | 88 | 91 | 97 | 107 | 109 | 125 | 135 | 150 | 169 | 180 | 184 | 210 | 255 | 270 | 285 | 288 | 345 | 363 | 445 | 520 | | | |
| 619058 | Flat head screw | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619057 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619056 | Stud | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619065 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619064 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619063 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619062 | Tie rod | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619061 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619060 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619060 | Adjustable tie rod | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 619060 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Gauge Blocks

Length Standards Brought to You by Mitutoyo



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Step Master SERIES 516

- The height of each step incrementally decreases from block No. 1 to block No. 5.
- Each step is defined as the difference in height between the centers of adjacent blocks, measured to a resolution of 0.01 μm by using an interferometer with an accuracy tolerance of within $\pm 0.20 \mu\text{m}$.
- Steel and ceramic types are available to suit the application.
- Height differences are measured between the centers of adjacent steps.



Steel type
516-199



Ceramic type
516-499

SPECIFICATIONS

Steel type

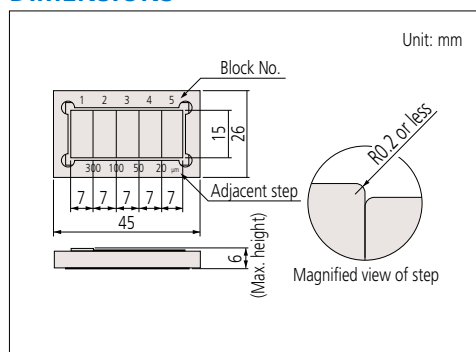
| Order No. | 516-198 | | | | | 516-199 | | | | |
|--|---------|----|----|----|----|---------|-----|-----|-----|-----|
| Block No. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Cumulative step (μm) | 0 | 10 | 15 | 17 | 18 | 0 | 300 | 400 | 450 | 470 |
| Step value between adjacent blocks (μm) | | 10 | 5 | 2 | 1 | | 300 | 100 | 50 | 20 |

Ceramic type

| Order No. | 516-498 | | | | | 516-499 | | | | |
|--|---------|----|----|----|----|---------|-----|-----|-----|-----|
| Block No. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Cumulative step (μm) | 0 | 10 | 15 | 17 | 18 | 0 | 300 | 400 | 450 | 470 |
| Step value between adjacent blocks (μm) | | 10 | 5 | 2 | 1 | | 300 | 100 | 50 | 20 |

Note: ○○○ - ○○○ -24: Provided with Calibration Certificate

DIMENSIONS



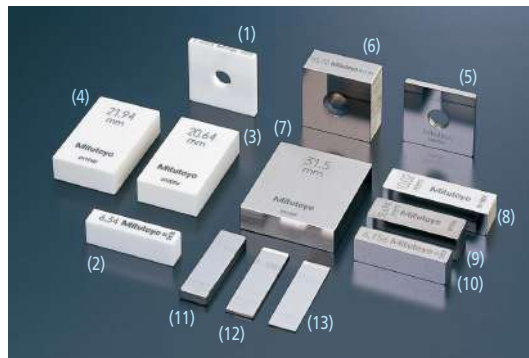
Custom-made Blocks & Gages

- Mitutoyo can manufacture Gauge Blocks and reference gages to your size and design, including precision spacers and stepped masters, which normally absorb much time and effort to manufacture in-house. Special processing including boring, step gaging and special marking is available. Consult us for details.
- Nominal size range
 - 0.1 mm to 1000 mm (steel)
 - 0.5 mm to 500 mm (ceramic)
 - 5 mm to 1000 mm (low expansion ceramic)
- Nominal size increment
 - 0.0005 mm (up to 100 mm)
 - 0.001 mm (over 100 mm)
- Cross section (same as the standard product)
 - Nominal length of 10 mm or less: 30×9 mm
 - Nominal length of more than 10 mm: 35×9 mm
 - Square types are also available.

Notes on "coupling holes" on custom gauge blocks:

- Steel, from 100 mm to less than 500 mm
Without coupling holes
(If needed, please notify.)
- Steel, from 500 mm to less than 1000 mm
With coupling holes
(If not needed, please notify.)
- Ceramic, from 100 mm to less than 500 mm
With coupling holes
(If not needed, please notify.)

Typical applications of custom-made gauge blocks and reference gages.
Please enquire for price and delivery times for your particular requirements.



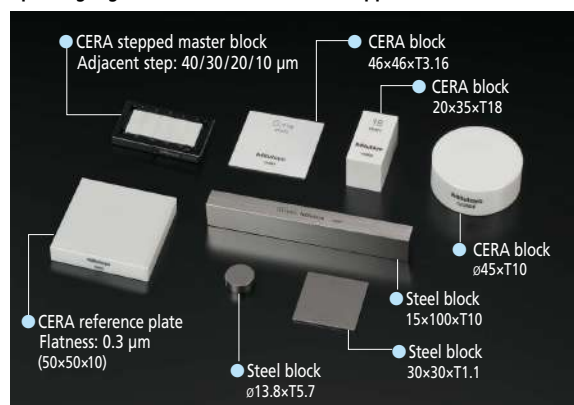
Ceramic

- (1) Square gauge block (2.1005 mm)
- (2) Rectangular gauge block (6.34 mm)
- (3) Rectangular gauge block (20.64 mm)
- (4) Rectangular gauge block (21.94 mm)

Steel

- (5) Square gauge block (2.2065 mm)
- (6) Square gauge block (10.72 mm)
- (7) Rectangular gauge block (31.5 mm)
- (8) Rectangular gauge block (10.02 mm)
- (9) Rectangular gauge block (9.694 mm)
- (10) Rectangular gauge block (6.156 mm)
- (11) Rectangular gauge block (3.603 mm)
- (12) Rectangular gauge block (1.1505 mm)
- (13) Rectangular gauge block (0.555 mm)

Special gauge blocks (T: nominal), CERA stepped master block



Unit: mm

Gauge Blocks

Length Standards Brought to You by Mitutoyo

Maintenance Kit for Gauge Blocks SERIES 516

- Maintenance kit for gauge blocks includes all the necessary maintenance tools for removing burrs and contamination, and applying anti-corrosion treatment after use.



516-650E

Order No. 516-650E

Tools and accessories included:

- (1) Ceraston (**601645**)
(both sides finished by lapping)
(100×25×12 mm)
- (2) Optical flat (**158-117**)
(ø45, 12 mm thickness, Flatness 0.2 μm)
Used to check the wringing of thin gauge blocks and for the presence of burrs.
- (3) Tweezers (**600004**)
Used for handling thin gauge blocks.
- (4) Blower brush (**600005**)
Used for blowing dust from measuring surfaces.
- (5) Cleaning paper (**600006**)
(lens paper, 82×304 mm, 500 pcs.)
Used for wiping off rust preventive oil and contamination. Lint free.
- (6) Artificial leather mat (B4 size, Artificial buckskin) (**600007**)
Used as a gauge block mat in order to avoid scratches on the work table.
- (7) Reagent bottle (**600008**)
(polyethylene container, 100 ml)
Bottle of wiping solution.
(Mitutoyo employs n-Heptane for solvent.)
- (8) Gloves (**600009**)
Used for handling large gauge blocks. Effective for the prevention of corrosion and thermal expansion.



Recommendation for Regular Calibration

As is widely known, gauge blocks are end measures based on distance measurements traceable to the wavelength of the iodine stabilized He-Ne laser. Because they serve as the standard based on which measurement devices are adjusted, even the smallest of errors can be critical; nevertheless, users often neglect to periodically calibrate them because they are so rarely used. Please calibrate your gauge blocks as described in the table below (best practices may vary according to frequency of use and grade).

| Application | Cycle (years) | Grade |
|--------------------|---------------|--------|
| Reference standard | 1 to 2 | K |
| Calibration | 2 | K or 0 |
| Inspection | 2 | 0 or 1 |
| Shop floor | 0.5 to 1 | 1 or 2 |

As an accredited calibration laboratory, Mitutoyo offers a traceable calibration service for customers' gauge blocks. Our regular calibration service features:

- Gauge blocks manufactured by any maker can be calibrated.
 - Cleansing and removal of burrs.
 - Central dimension and dimensional deviations of each block are measured.
 - Calibration results are provided for immediate use and for building a calibration history of each block.
- For detailed information, contact the nearest Mitutoyo sales office.

Ceraston SERIES 516 — Accessory for Gauge Block Maintenance



- Alumina-ceramic abrasive stone for removing burrs from hard materials such as ceramics that ordinary stones cannot handle.
- Can be used both for steel gauge blocks and CERA blocks.
- Excellent in the ease of removing burrs and durability compared with Arkansas stones.
- Both sides can be used.



601644
150 (W) x50 (D) x20 (H) mm



601645
100 (W) x25 (D) x12 (H) mm

Removing burrs

Figure 1

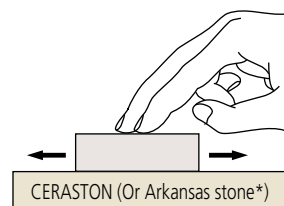
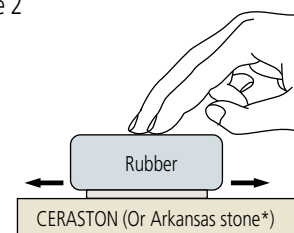


Figure 2



- (1) Wipe any dust and oil films from the gauge block and the Ceraston (or Arkansas stone*) using a solvent.
- (2) Place the gauge block on the Ceraston (or Arkansas stone*) so that the measuring face that has burrs is on the abrasive surface of the stone. While applying light pressure, move the gauge block to and fro about ten times (Fig. 1). Use a block rubber for thin gauge blocks to apply even pressure (Fig. 2).
- (3) Check the measuring face for burrs with an optical flat. If the burrs have not been removed, repeat step (2). If burrs are too large, they may not be removed with an abrasive stone. If so, discard the gauge block.

* Mitutoyo does not offer Arkansas stones.

Gauge Block Calibration

Length Standards Brought to You by Mitutoyo

Gauge Block Comparator GBCD-100A SERIES 565 - Automatic Comparator with Dual Gage Heads



SPECIFICATIONS

Metric

| Range | Resolution (μm) | Accuracy in narrow range (20 °C) $\pm(0.03 + 0.3L/1000) \mu\text{m}^*$ L=Gauge block length (mm) | Upper gaging head | | |
|-----------------|-----------------|--|-------------------|-----------------|---------------------------------------|
| | | | Type | Measuring force | Contact point |
| 0.5 mm - 100 mm | 0.01 | $\pm(0.03 + 0.3L/1000) \mu\text{m}^*$ L=Gauge block length (mm) | Mu-Checker | 1 N | Carbide contact point of radius 20 mm |

| Type | Lower gaging head | | Operating conditions 20 °C ± 1 °C Humidity: 58 % RH ± 15 % RH (Under less temperature change, and hot or cold direct air flow should be avoided.) |
|------------|-------------------|--------------------------------------|--|
| | Measuring force | Contact point | |
| Mu-Checker | 0.6 N | Carbide contact point of radius 5 mm | |

* Uncertainty of measurement at the 95 % confidence level (not including the calibration error of the reference gauge block).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Measures the length of rectangular gauge blocks in the size range 0.5 mm to 100 mm. It automatically compares a test block with an appropriate reference gauge block.
- The compensation result is not affected by any warping of thinner gauge blocks due to the use of upper and lower gage heads (dual-head system).
- Measurement configuration: 1 cycle of automatic comparison measurement with a standard gauge block.

- Gauge block set for comparator calibration (optional)
Standard type **516-145-E2**



516-145-E2



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Measures Rectangular Gauge Blocks and Square Gauge Blocks (latter requires dedicated holder - optional accessory) by manual comparison with an appropriate reference gauge block in the size range 0.1 mm to 250 mm
- Measuring method: Differential measurement between upper and lower gage heads (dual head system)

Gauge Block Comparator GBCD-250 SERIES 565 — Manual Comparator with Dual Gage Heads

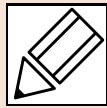


SPECIFICATIONS

| Metric | | | | | | |
|-------------------|-----------------|---------------------------------------|---|-----------------|--|---|
| Range (mm) | | Resolution | Accuracy [Comparison measurement of the same nominal length] | | Accuracy [Dimensional deviations between standard gauge block and measurement gauge block: ±3 mm] | |
| 0.1 - 250 | | 0.001 μm | ±(0.03 + 0.3L/1000) μm* L=Gauge block length (mm) | | ±(0.06 + 0.3L/1000) μm* L=Gauge block length (mm) | |
| Upper gaging head | | | Lower gaging head | | | Operating conditions |
| Type | Measuring force | Contact point | Type | Measuring force | Contact point | |
| Linear Gage | 0.4 N | Carbide contact point of radius 20 mm | Linear Gage | 0.2 N | Carbide contact point of radius 5 mm | 20 °C±1 °C Humidity: 30 % RH to 60 % RH (Under less temperature change, and hot or cold direct air flow should be avoided.) |

* Uncertainty of measurement at the 95 % confidence level (not including the calibration error of the reference gauge block).

Quick Guide to Precision Measuring Instruments



Gauge Blocks

Definition of the Meter

The 17th General Conference of Weights and Measures in 1983 decided on a new definition of the meter unit as the length of the path traveled by light in a vacuum during a time interval of $1/299792458$ of a second. The gauge block is the practical realization of this unit and as such is used widely throughout industry.

Selection, Preparation and Assembly of a Gauge Block Stack

Select gauge blocks to be combined to make up the size required for the stack.

- (1) Take the following things into account when selecting gauge blocks.
 - a. Use the minimum number of blocks whenever possible.
 - b. Select thick gauge blocks whenever possible.
 - c. Select the size from the one that has the least significant digit required, and then work back through the more significant digits.
- (2) Clean the gauge blocks with an appropriate cleaning agent.
- (3) Check the measuring faces for burrs by using an optical flat as follows:

Figure 1

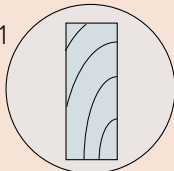
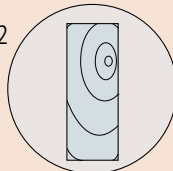


Figure 2



- a. Wipe each measuring face clean.
- b. Gently place the optical flat on the gauge block measuring face.
- c. Lightly slide the optical flat until interference fringes appear.

Judgment 1: If no interference fringes appear, it is assumed that there is a large burr or contaminant on the measuring face.

- d. Lightly press the optical flat to check that the interference fringes disappear.

Judgment 2: If the interference fringes disappear, no burr exists on the measuring face.

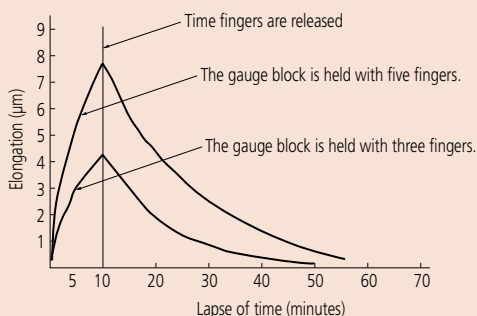
Judgment 3: If some interference fringes remain locally while the flat is gently moved to and fro, a burr exists on the measuring face. If the fringes move along with the optical flat, there is a burr on the optical flat.

- e. To remove burrs, follow the directions on page E-30.

- (4) Apply a very small amount of oil to the measuring face and spread it evenly across the face. (Wipe the face until the oil film is almost removed.) Grease, spindle oil, vaseline, etc., are commonly used.

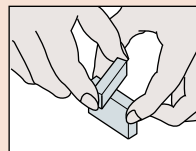
Thermal Stabilization Time

The following figure shows the degree of dimensional change when handling a 100 mm steel gauge block with bare hands.

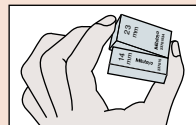


- (5) Gently overlay the faces of the gauge blocks to be wrung together. There are three methods to use (a, b and c as shown below) according to the size of blocks being wrung:

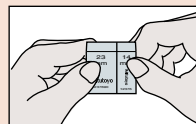
a. Wringing thick gauge blocks



Cross the gauge blocks at 90° in the middle of the measuring faces.

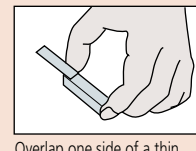


Rotate the gauge blocks while applying slight force to them. You will get a sense of wringing by sliding the blocks.

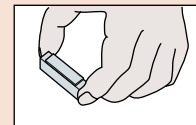


Align the measuring faces with each other.

b. Wringing a thick gauge block to a thin gauge block

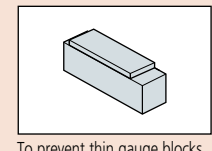


Overlap one side of a thin gauge block on one side of a thick gauge block.

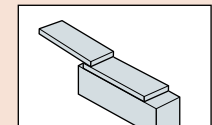


Slide the thin gauge block while pressing the entire overlapped area to align the measuring faces with each other.

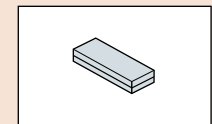
c. Wringing thin gauge blocks



To prevent thin gauge blocks from bending, first wring a thin gauge block onto a thick gauge block.

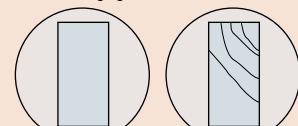


Then, wring the other thin gauge block onto the first thin gauge block.

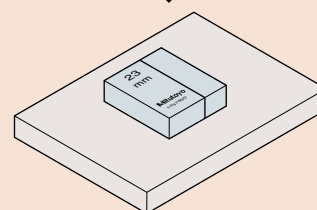


Finally, remove the thick gauge block from the stack.

Apply an optical flat to the surface of one thin gauge block to check the wringing state.



Irregular interference fringes



Wipe the exposed measuring face(s) and continue building up the stack, in the same manner as above, until complete.



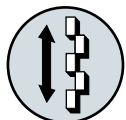
E

Reference Gages

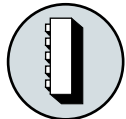
Length Standards Brought to You by Mitutoyo

Height Master SERIES 515

- Height Master is a best-selling product with a name that has become the industry standard for height reference instruments.



Staggered 20 mm blocks (movable)



Vertical orientation



Riser block

515-322

SPECIFICATIONS

| Metric | |
|---------------------------|-------------------|
| Order No. | 515-322 |
| Range (H) | 5 < H ≤ 310 mm |
| Graduation (analog scale) | 0.001 mm |
| Block step | 20 mm (staggered) |
| Micrometer adjustment | 20 mm |
| Micrometer feed | 0.5 mm/rev |
| Block pitch accuracy | ±1.5 μm |
| Parallelism of blocks | 1.0 μm |
| Feed error | ±1.0 μm |
| Retrace error | 1.0 μm |
| Mass | 23 kg |

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Note 2: Supplied with a wooden storage case as standard.

| Inch | | |
|---------------------------|----------------------|----------------------|
| Order No. | 515-310 | 515-311 |
| Range (H) | 0.2 in < H ≤ 12.2 in | 0.2 in < H ≤ 12.2 in |
| Graduation (analog scale) | 0.00001 in | |
| Block step | 0.5 in (straight) | 1 in (staggered) |
| Micrometer adjustment | 1 in | |
| Micrometer feed | 0.025 in/rev | |
| Block pitch accuracy | ±50 μin | |
| Parallelism of blocks | 40 μin | |
| Feed error | ±40 μin | |
| Retrace error | 40 μin | |
| Mass | 23 kg | |

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Note 2: Supplied with a wooden storage case as standard.

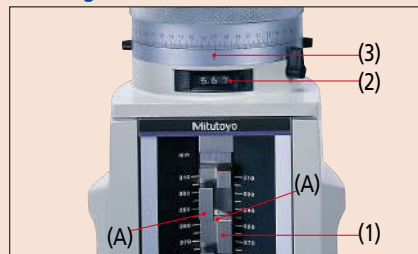


An inspection certificate is supplied as standard. Refer to page U-11 for details.

Typical application



Reading



(A) Height A

| | |
|-------------|------------|
| (1) Scale | 280. mm |
| (2) Counter | 5.67 mm |
| (3) Thimble | 0.000 mm |
| | 285.670 mm |



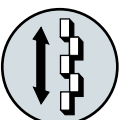
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Digital Height Master SERIES 515

MeasurLink ENABLED

Data Management Software by Mitutoyo

- Best-selling height reference standard.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to Page A-3 for details)



Staggered 20 mm blocks (movable)



Vertical orientation



Riser block

515-374

SPECIFICATIONS

| Metric | | | | |
|------------------------------|-------------------|-----------------|-----------------|--|
| Order No. | 515-374 | 515-376 | 515-378 | |
| Range (H) | 10 < H ≤ 310 mm | 10 < H ≤ 460 mm | 10 < H ≤ 610 mm | |
| Resolution (digital display) | 0.001 mm | | | |
| Block step | 20 mm (staggered) | | | |
| Micrometer adjustment | 20 mm | | | |
| Micrometer feed | 0.5 mm/rev | | | |
| Block pitch accuracy | ±1.5 μm | | | |
| of blocks | 0 < H ≤ 310 mm | — | ±2.5 μm | |
| | 310 < H ≤ 460 mm | — | ±3.5 μm | |
| | 460 < H ≤ 610 mm | — | — | |
| of blocks | 0 < H ≤ 310 mm | 2.0 μm | | |
| | 310 < H ≤ 610 mm | — | 2.5 μm | |
| Feed error | ±2.0 μm | ±2.5 μm | ±2.5 μm | |
| Retrace error | 2.0 μm | 2.5 μm | 2.5 μm | |
| Mass | 9.5 kg | 13.6 kg | 16 kg | |

Note: The block accuracy and the parallelism of blocks are based on main unit installation surface, which does not include the retrace error.

MeasurLink ENABLED

Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Technical Data

- Display: LCD 6 digits
- Battery: SR44 (2 pcs.)
- Battery life: Approx. 1.8 years under normal use

Function

Zero setting, Origin-setting, Origin restoration, Data hold, Auto power off, Data output

Optional Accessories

- 515-111: Auxiliary block kit for bore gage (mm)
- 515-120: Auxiliary block kit for bore gage (inch)
- : Riser block (see page E-36.)
- 959149: SPC cable (1 m)
- 959150: SPC cable (2 m)

| Inch | | | |
|------------------------------|--------------------|--------------------|--------------------|
| Order No. | 515-375 | 515-377 | 515-379 |
| Range (H) | 0.5 in < H ≤ 12 in | 0.5 in < H ≤ 18 in | 0.5 in < H ≤ 24 in |
| Resolution (digital display) | 0.0001 in | | |
| Block step | 1 in (staggered) | | |
| Micrometer adjustment | 1 in | | |
| Micrometer feed | 0.025 in/rev | | |
| Block pitch accuracy | ±100 μin | | |
| of blocks | 0 < H ≤ 12 in | — | ±100 μin |
| | 12 in < H ≤ 18 in | — | ±150 μin |
| | 18 in < H ≤ 24 in | — | — |
| of blocks | 0 < H ≤ 12 in | 50 μin | |
| | 12 in < H ≤ 18 in | — | 100 μin |
| Feed error | ±100 μin | ±100 μin | ±100 μin |
| Retrace error | 100 μin | 100 μin | 100 μin |
| Mass | 9.5 kg | 13.6 kg | 16 kg |

Note: The block accuracy and the parallelism of blocks are based on main unit installation surface, which does not include the retrace error.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Typical application

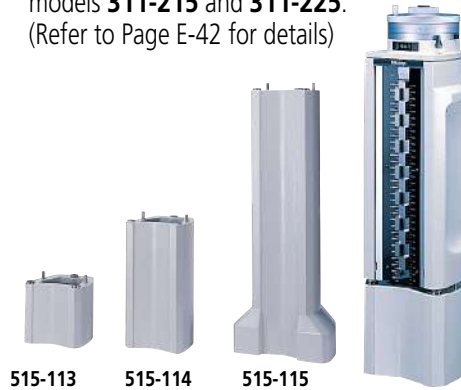


Bore gage zero-setting

Height Master SERIES 515 — Optional accessories

Riser Blocks SERIES 515

- These riser blocks are designed to increase the measurable height.
- They can also be used on Square Master models **311-215** and **311-225**. (Refer to Page E-42 for details)



Auxiliary Block Kit SERIES 515 – for Bore Gage

- Enables efficient zero point adjustment of cylinder gages using the Height Master.
- Zero point adjustment range: 18 to 150 mm.



SPECIFICATIONS

| Metric | | | | |
|----------------|-------------|---------------|--------------------------|-----------|
| Order No. | Height (mm) | Accuracy (µm) | Variation in length (µm) | Mass (kg) |
| 515-113 | 150 | ±0.6 | 0.6 | 5.7 |
| 515-114 | 300 | ±1.0 | 0.8 | 9.8 |
| 515-115 | 600 | ±2.0 | 1.0 | 26.8 |

| Inch | | | | |
|----------------|-------------|----------------|---------------------------|-----------|
| Order No. | Height (in) | Accuracy (µin) | Variation in length (µin) | Mass (kg) |
| 515-116 | 6 | ±20 | 20 | 4.8 |
| 515-117 | 12 | ±40 | 30 | 11.3 |
| 515-118 | 24 | ±80 | 40 | 31 |

SPECIFICATIONS

| Metric | |
|----------------|--|
| Order No. | Model |
| 515-110 | Universal Height Master |
| 515-111 | Digital Height Master (515-374/376/378) |
| 515-112 | Height Master (515-322) |

| Inch | |
|----------------|---|
| Order No. | Model |
| 515-119 | Universal Height Master, Height Master (515-310) |
| 515-120 | Digital Height Master (515-375/377/379) |
| 515-121 | Height Master (515-311) |

Reference Gages

Length Standards Brought to You by Mitutoyo

Universal Height Master SERIES 515 — Usable in Vertical and Horizontal Orientations

- The Universal Height Master is designed for both vertical and horizontal orientation, providing a wide range of applications such as accuracy checking of machine tool table movements.
- Analog display by the built-in counter – the appearance and specifications are the same as model **515-322**. (Refer to Page E-35 for details)



515-520

SPECIFICATIONS

| Metric | | |
|---------------------------|------------------------|----------------------|
| Order No. | 515-520 | 515-523 |
| Range (H) | $5 < H \leq 610$ mm | $5 < H \leq 1010$ mm |
| Graduation (analog scale) | 0.001 mm | |
| Block step | 10 mm (straight) | |
| Micrometer adjustment | 20 mm | |
| Micrometer feed | 0.5 mm/rev | |
| Block pitch accuracy | $H \leq 310$ mm | ± 1.5 μ m |
| | $310 < H \leq 610$ mm | ± 2.5 μ m |
| | $610 < H \leq 1010$ mm | ± 3.5 μ m |
| Parallelism of blocks | $H \leq 610$ mm | 1.5 μ m |
| | $610 < H \leq 1010$ mm | — |
| Feed error | ± 1.2 μ m | ± 1.5 μ m |
| Retrace error | 1.2 μ m | 1.5 μ m |
| Mass | 42 kg | 63.5 kg |

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Note 2: Supplied with a wooden storage case as standard.

| Inch | | | |
|---------------------------|-----------------------------|-----------------------------|-----------------------------|
| Order No. | 515-512 | 515-510 | 515-513 |
| Range (H) | 0.2 in $< H \leq 18.2$ in | 0.2 in $< H \leq 24.2$ in | 0.2 in $< H \leq 40.2$ in |
| Graduation (analog scale) | 0.00001 in | | |
| Block step | 0.5 in (straight) | | |
| Micrometer adjustment | 1 in | | |
| Micrometer feed | 0.025 in/rev | | |
| Block pitch accuracy | $H \leq 12$ in | ± 50 μ m | |
| | 12 in $< H \leq 24$ in | — | ± 100 μ m |
| | 24 in $< H \leq 40$ in | — | ± 150 μ m |
| Parallelism of blocks | $H \leq 24$ in | 60 μ m | |
| | 24 in $< H \leq 40$ in | — | 80 μ m |
| Feed error | ± 40 μ m | ± 60 μ m | |
| Retrace error | 40 μ m | 60 μ m | |
| Mass | 42 kg | 63.5 kg | |

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Note 2: Supplied with a wooden storage case as standard.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

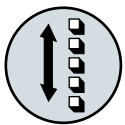
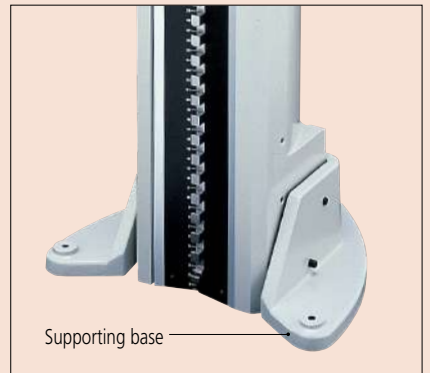


Typical application using in horizontal orientation

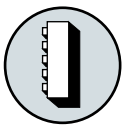
Optional Accessories

Supporting base
900574 (Dedicated for the Universal Height Master. Provided for **515-523** and **515-513** as standard.)

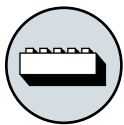
- Stable vertical orientation is available.



Single-row 10 mm blocks (movable)



Vertical orientation



Horizontal orientation



Riser block



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Check Master SERIES 515



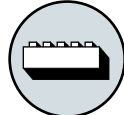
515-722



Single-row
10 mm (0.5 in) blocks



Vertical
orientation



Horizontal
orientation

- Designed to check the accuracy of table movements of machine tools and calibrate CMMs.
- Can be used in either vertical or horizontal orientation.



515-724

515-723

515-722

SPECIFICATIONS

| Metric | | | | | |
|-----------------------|-------------------------|-------------------|-------------------|-------------------|-------------------|
| Order No. | 515-720 | 515-721 | 515-722 | 515-723 | 515-724 |
| Range (H) | 310 mm | 450 mm | 610 mm | 1010 mm | 1510 mm |
| Block step | 10 mm | | | | |
| Block pitch accuracy | $H \leq 310$ mm | ± 2.5 μ m | | | |
| | $310 < H \leq 610$ mm | — | ± 3.5 μ m | | |
| | $610 < H \leq 1010$ mm | — | — | ± 5.0 μ m | |
| | $1010 < H \leq 1510$ mm | — | — | — | ± 8.0 μ m |
| Parallelism of blocks | $H \leq 310$ mm | 1.2 μ m | | | |
| | $310 < H \leq 610$ mm | — | 1.5 μ m | | |
| | $610 < H \leq 1010$ mm | — | — | 2.0 μ m | |
| | $1010 < H \leq 1510$ mm | — | — | — | 2.5 μ m |
| Mass | 7 kg | 10 kg | 13 kg | 22 kg | 30 kg |

| Inch | | | | | |
|-----------------------|-------------------------|--------------------|--------------------|--------------------|-------|
| Order No. | 515-710 | 515-711 | 515-712 | 515-713 | |
| Range (H) | 12.5 in | 18.5 in | 24.5 in | 40.5 in | |
| Block step | 0.5 in | | | | |
| Block pitch accuracy | $H \leq 12.5$ in | ± 100 μ in | | | |
| | $12.5 < H \leq 24.5$ in | — | ± 150 μ in | | |
| | $24.5 < H \leq 40.5$ in | — | — | ± 200 μ in | |
| | $H \leq 12.5$ in | 50 μ in | | | |
| Parallelism of blocks | $12.5 < H \leq 24.5$ in | 60 μ in | | | |
| | $24.5 < H \leq 40.5$ in | — | — | 80 μ in | |
| | Mass | 7 kg | 10 kg | 13 kg | 22 kg |

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Note 2: Supplied with a wooden storage case as standard.

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Note 2: Supplied with a wooden storage case as standard.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

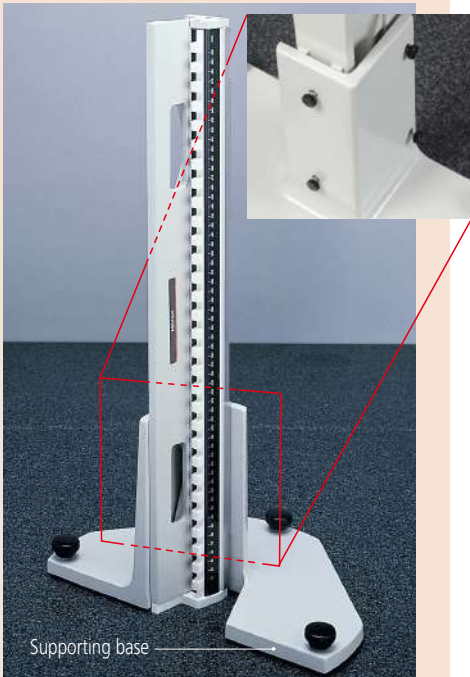


Typical application using in horizontal orientation

Optional Accessories

Supporting base

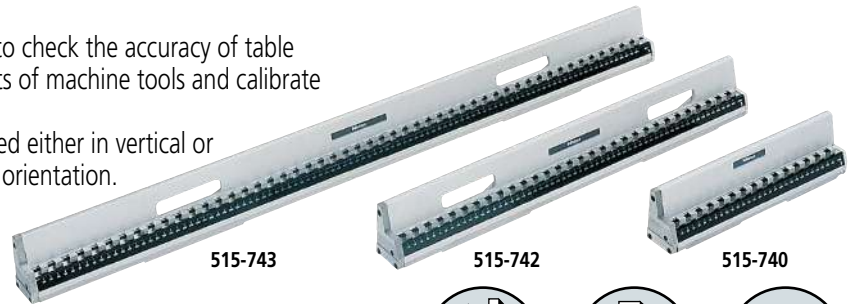
- 601167:** Supporting base for vertical operation
- Enables stable operation in the vertical orientation.



Supporting base

High Accuracy Check Master SERIES 515

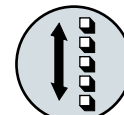
- Designed to check the accuracy of table movements of machine tools and calibrate CMMs.
- Can be used either in vertical or horizontal orientation.



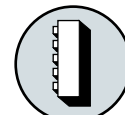
515-743

515-742

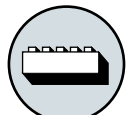
515-740



Single-row
10 mm (5 in) blocks



Vertical
orientation



Horizontal
orientation

SPECIFICATIONS

| Metric | | | | | |
|-----------------------|-------------------------|----------------------|----------------------|----------------------|----------------------|
| Order No. | 515-740/ 515-760* | 515-741/ 515-761* | 515-742/ 515-762* | 515-743/ 515-763* | 515-744/ 515-764* |
| Range (H) | 310 mm | 450 mm | 610 mm | 1010 mm | 1510 mm |
| Block step | 10 mm | | | | |
| Block pitch accuracy | $H \leq 310$ mm | ± 1.2 μ m | | | |
| | $310 < H \leq 610$ mm | — | ± 1.8 μ m | | |
| | $610 < H \leq 1010$ mm | — | — | ± 2.5 μ m | |
| | $1010 < H \leq 1510$ mm | — | — | — | ± 4.0 μ m |
| Parallelism of blocks | $H \leq 450$ mm | 1.0 μ m | | | |
| | $450 < H \leq 1010$ mm | — | — | 1.5 μ m | |
| | $1010 < H \leq 1510$ mm | — | — | — | 2.0 μ m |
| | Mass | 3.6 kg | 5.4 kg | 7.2 kg | 12 kg |

* Ceramic Check Master

Note: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

| Inch | | | | | |
|-----------------------|-------------------------|----------------------|----------------------|----------------------|----------------------|
| Order No. | 515-730/ 515-750* | 515-731/ 515-751* | 515-732/ 515-752* | 515-733/ 515-753* | 515-734/ 515-754* |
| Range (H) | 12.5 in | 18.5 in | 24.5 in | 40.5 in | 60.5 in |
| Block step | 0.5 in | | | | |
| Block pitch accuracy | $H \leq 12.5$ in | ± 50 μ in | | | |
| | $12.5 < H \leq 24.5$ in | — | ± 70 μ in | | |
| | $24.5 < H \leq 40.5$ in | — | — | ± 100 μ in | |
| | $40.5 < H \leq 60.5$ in | — | — | — | ± 158 μ in |
| Parallelism of blocks | $H \leq 18.5$ in | 40 μ in | | | |
| | $18.5 < H \leq 40.5$ in | — | 60 μ in | | |
| | $40.5 < H \leq 60.5$ in | — | — | — | 80 μ in |
| | Mass | 3.6 kg | 5.4 kg | 7.2 kg | 12 kg |

* Ceramic Check Master

Note: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Reference Gages

Length Standards Brought to You by Mitutoyo

Standard Scales SERIES 182 — Made of Low Expansion Glass

- Standard scales can be used as a traceable standard of length for calibrating measuring instruments.
- These scales are manufactured using Mitutoyo's high-definition lithography technology in an underground scale manufacturing facility dedicated to the production of high-accuracy, high-quality line standards. They are considered top-grade length standards.



Technical Data

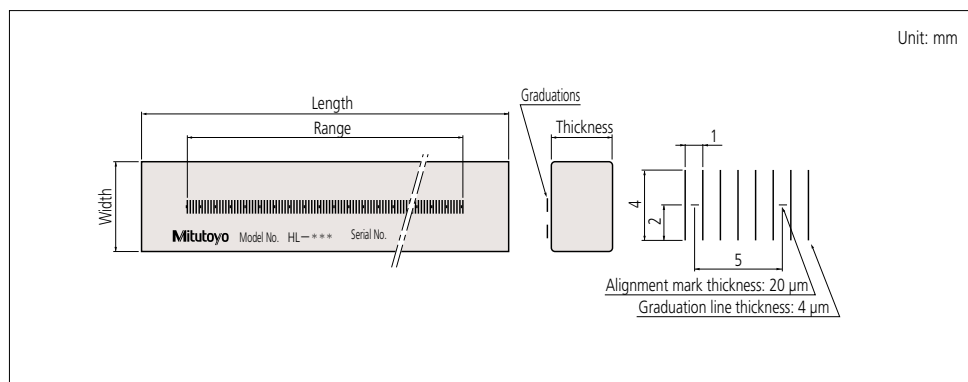
- Material: Low expansion glass
- Thermal expansion coefficient: $(0.00 \pm 0.02) \times 10^{-6} / K$
- Graduation line thickness: 4 μm
- Graduation: 1 mm
- Accuracy (at 20 °C): $(0.5 + L/1000) \mu m$,
L=Measured length (mm)

SPECIFICATIONS

| Metric | | | | |
|-------------|------------|-------------|------------|----------------|
| Order No. | Range (mm) | Length (mm) | Width (mm) | Thickness (mm) |
| 182-501-50 | 250 | 280 | 20 | 10 |
| 182-501-60* | | | | |
| 182-502-50 | 500 | 530 | 30 | 20 |
| 182-502-60* | | | | |

* With English JCSS certificate.

DIMENSIONS

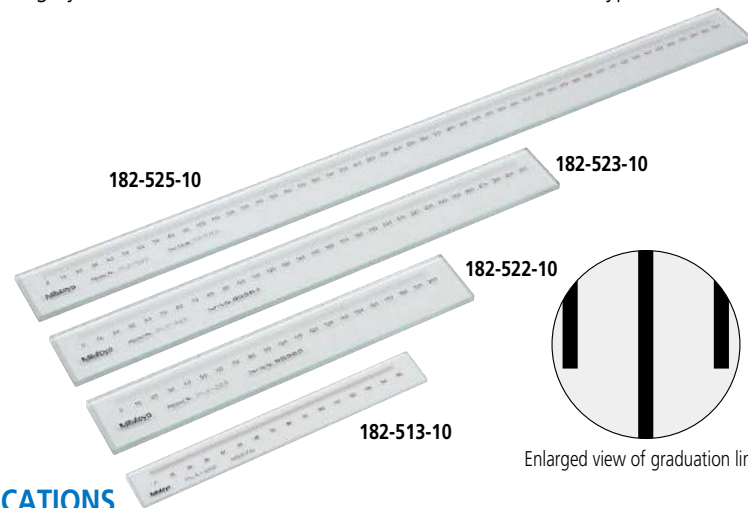


Technical Data

- Glass material: Soda-lime glass
- Thermal expansion coefficient: $8.5 \times 10^{-6}/K$
- Accuracy (at 20 °C): $(1.5 + 2L/1000) \mu m$,
L=Measured length (mm)

Working Standard Scales SERIES 182

- These standard scales can be used to calibrate various measuring instruments and to confirm traceability to upper-level calibration devices and reference instruments. For example, they can be used in daily and periodic inspections of profile projector/microscope stages and of optical length measurement systems.
- These scales are manufactured using high-accuracy lithographic technologies. Mitutoyo has developed these technologies at the dedicated underground facility which was custom-built to produce highly accurate scales. Various sizes are available for each type to suit the application.

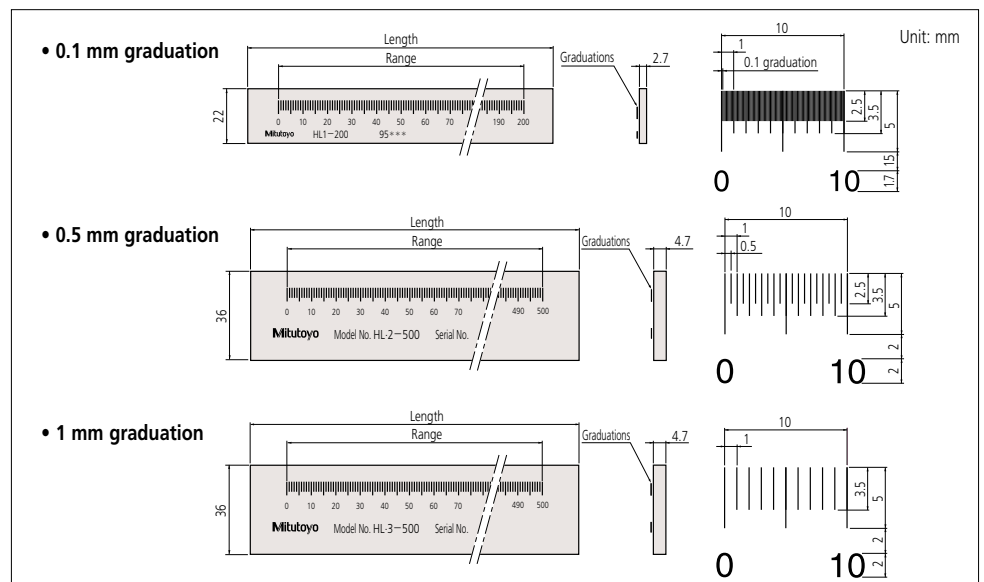


SPECIFICATIONS

| Metric | | | | | | |
|------------|------------|-----------------|-------------|-----------------------|---------------------------------------|-----------|
| Order No. | Range (mm) | Graduation (mm) | Length (mm) | Inspection pitch (mm) | Graduation line thickness (μm) | Mass (kg) |
| 182-511-10 | 50 | 0.1 | 75 | 5 | 20 | 0.23 |
| 182-512-10 | 100 | | 125 | | | 0.24 |
| 182-513-10 | 150 | | 175 | | | 0.25 |
| 182-514-10 | 200 | | 225 | | | 0.26 |
| 182-521-10 | 100 | 0.5 | 130 | 20 | 50 | 0.27 |
| 182-522-10 | 200 | | 230 | | | 0.32 |
| 182-523-10 | 300 | | 330 | | | 0.57 |
| 182-524-10 | 400 | | 430 | | | 0.71 |
| 182-525-10 | 500 | 530 | 0.86 | | | |
| 182-531-10 | 250 | 1 | 280 | 25 | 100 | 0.55 |
| 182-532-10 | 500 | | 530 | | | 1.22 |
| 182-533-10 | 750 | | 780 | | | 0.23 |
| 182-534-10 | 1000 | | 1030 | | | 1.54 |

Note: An inspection certificate produced by a standard scale automatic calibration system is supplied as standard.

DIMENSIONS



Reference Gages

Length Standards Brought to You by Mitutoyo

High Precision Square SERIES 311

- The High Precision Square is a gage used for inspecting the travel straightness and axial perpendicularity of moving elements on equipment such as machine tools, CMMs, form measuring machines and semiconductor-related equipment.
- All four surfaces, finished using ultra-precision technology built on our experience in gauge blocks and other products, can be used as reference surfaces.
- Better than 1 $\mu\text{m}/300\text{ mm}$ straightness and perpendicularity of each (four) reference surface. In addition, front and back faces are accurate to better than 5 $\mu\text{m}/300\text{ mm}$.
- Three nominal sizes are available (90x110, 160x210 and 260x310 mm) so that you can select the size that best suits the application.



311-111



311-112



311-113

SPECIFICATIONS

| Metric | | |
|-----------|------------------------|-----------|
| Order No. | Dimension (WxLxT) (mm) | Mass (kg) |
| 311-111 | 90x110x25 | 1.5 |
| 311-112 | 160x210x25 | 5.0 |
| 311-113* | 260x310x30 | 14.0 |

* Supplied with a removable handle.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

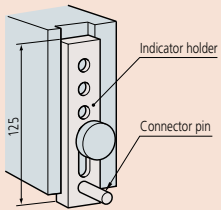
- Reference surface
 - Perpendicularity tolerance: 1 μm
 - Straightness tolerance: 1 μm
- Front/back faces
 - Perpendicularity tolerance: 5 μm
 - Straightness tolerance: 5 μm
- Dedicated wooden case is provided.

Typical application

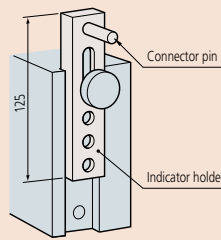


Mounting the Indicator Holder

Example 1



Example 2



Standard Accessories

- 513-401-10H (Metric)
- 902053: Clamp
- 601471: Indicator holder
- 538616: Hexagonal-head wrench (3 mm)

Note: Inspection certificate is not attached. Contact your local Mitutoyo sales office.

Optional Accessories

- 900565: Feeler
- 900571: Adjustable holder
- 900551: Extension holder

Square Master SERIES 311 — Squareness/Straightness Measuring

- Squareness (perpendicularity) and straightness measurements can be performed accurately and efficiently by just moving a lever. Use the vertical motion handle on the rear of the main unit for operation.
- Sliding force: Approx. 2 to 5 N
- Highly accurate measurement of squareness and straightness is available by calibrating a square as a master using the built-in perpendicularity adjustment mechanism. Prepare a square to be used for accuracy check/adjustment separately.



311-215



311-225



311-245

SPECIFICATIONS

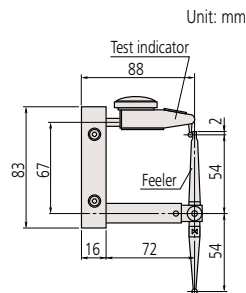
| Order No. | Vertical travel (mm) | Squareness (μm) | Straightness (μm) | Dimension (mm) | | | Mass (kg) |
|-----------|----------------------|-----------------|-------------------|----------------|-------|--------|-----------|
| | | | | Width | Depth | Height | |
| 311-215* | 150 | 3 | 2 | 180 | 200 | 420 | 13.7 |
| 311-225* | 250 | 6 | 2.5 | 180 | 200 | 520 | 16.2 |
| 311-245 | 450 | 9 | 3.5 | 220 | 220 | 720 | 24 |

* Riser blocks to extend the height of Square Masters can be used. (Refer to Page E-36 for details)

Optional accessory

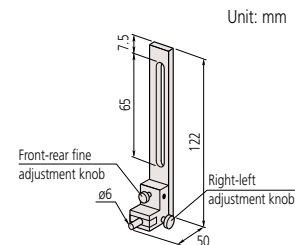
900565: Feeler

For probing surfaces that the contact point of a detector cannot reach.



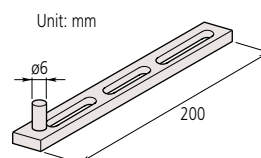
900571: Adjustable holder

Enables easy adjustment of indicator position.



900551: Extension holder

Measurement position can be extended by using this 200 mm length holder instead of the indicator holder.



Reference Gages

Length Standards Brought to You by Mitutoyo

Precision Levels SERIES 960

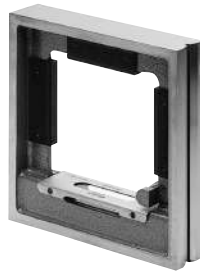
- High-precision longitudinal and transverse vials make it possible to check or level surfaces.

SPECIFICATIONS

| Order No. | Sensitivity (mm/m) | Dimensions (WxDxH) (mm) |
|-----------|--------------------|-------------------------|
| 960-603 | 0.02 | 200x44x38.2 |
| 960-703 | 0.02 | 200x44x200 |



960-603



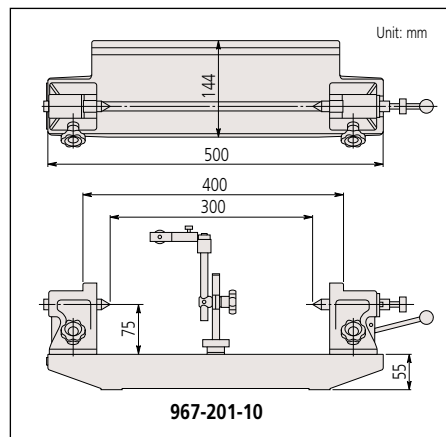
960-703

Bench Centers SERIES 967

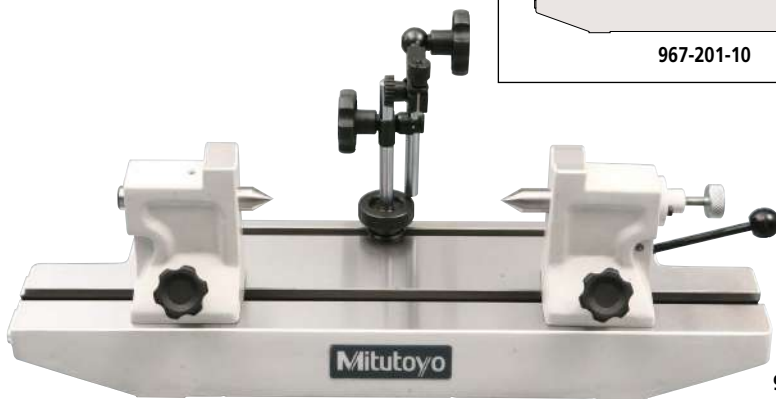
FEATURES

- Used with a dial test indicator (optional), these Bench Centers provide precision measurement of concentricity on cylindrical workpieces.
- With an indicator clamp. (Holding stem diameter: 8 mm)

Dimensions



967-201-10



967-201-10

Technical Data

- Accuracy of graduations: ± 0.7 DIV (960-603), ± 0.3 DIV (960-703)

Technical Data

- Maximum workpiece length: 300 mm
- Maximum workpiece dia.: 150 mm
- Mass: 13 kg

Steel Rules SERIES 182

- Clear graduations on satin-chrome finish.
- Stainless tempered.



182-101



182-201



182-102



182-202



182-103



182-203



182-105



182-302

SPECIFICATIONS

Metric Wide Rigid Rules

| Order No. | Graduations (mm) | Range (mm) | Width (mm) |
|-----------|---------------------------|------------|------------|
| 182-111 | 1, 0.5 (on both faces) | 150 | 19 |
| 182-131 | | 300 | 25 |
| 182-151 | | 450 | 30 |
| 182-171 | | 600 | 30 |

Metric Fully-Flexible Rules

| Order No. | Graduations (mm) | Range (mm) | Width (mm) |
|-----------|---------------------------|------------|------------|
| 182-211 | 1, 0.5 (on both faces) | 150 | 12 |
| 182-231 | | 300 | 12 |
| 182-251 | | 450 | 19 |
| 182-271 | | 600 | 19 |

Inch/Metric Semi-Flexible Rules

| Order No. | Graduations* | Range | Width (in) |
|-----------|---|---------------|------------|
| 182-302 | 1/16 in, 1/32 in, 1/64 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.51 |
| 182-303 | | 8 in/200 mm | 0.51 |
| 182-305 | | 12 in/300 mm | 0.59 |
| 182-307 | | 20 in/500 mm | 0.59 |
| 182-309 | | 40 in/1000 mm | 0.59 |

* Engraved on the front side only.

Inch/Metric Wide Rigid Rules

| Order No. | Graduations | Range | Width (in) |
|-----------|------------------------------------|-----------------------------------|------------|
| 182-105 | 1/32 in, 1/64 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.75 |
| 182-125 | | 12 in/300 mm | 0.98 |
| 182-145 | | 18 in/450 mm | 1.18 |
| 182-165 | | 24 in/600 mm | 1.18 |
| 182-106 | 1/50 in, 1/100 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.75 |
| 182-126 | | 12 in/300 mm | 0.98 |
| 182-107 | 1/10 in, 1/100 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.75 |
| 182-108 | | 1/10 in, 1/50 in, 1 mm, 0.5 mm | 0.75 |

Inch/Metric Fully-Flexible Rules

| Order No. | Graduations | Range | Width (in) |
|-----------|------------------------------------|-----------------------------------|------------|
| 182-205 | 1/32 in, 1/64 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.47 |
| 182-225 | | 12 in/300 mm | 0.47 |
| 182-245 | | 18 in/450 mm | 0.75 |
| 182-265 | | 24 in/600 mm | 0.75 |
| 182-206 | 1/50 in, 1/100 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.47 |
| 182-226 | | 12 in/300 mm | 0.47 |
| 182-207 | 1/10 in, 1/100 in, 1 mm, 0.5 mm | 6 in/150 mm | 0.47 |
| 182-208 | | 1/10 in, 1/50 in, 1 mm, 0.5 mm | 0.47 |

Inch Wide Rigid Rules

| Order No. | Graduations (in) | Range (in) | Width (in) |
|-----------|----------------------------|------------|------------|
| 182-101 | 1/8, 1/16, 1/32, 1/64 | 6 | 0.75 |
| 182-121 | | 12 | 0.98 |
| 182-141 | | 18 | 0.71 |
| 182-161 | | 24 | 1.18 |
| 182-102 | 1/50, 1/100, 1/32, 1/64 | 6 | 0.75 |
| 182-122 | | 12 | 0.98 |
| 182-142 | | 18 | 1.18 |
| 182-162 | | 24 | 1.18 |
| 182-103 | 1/10, 1/100, 1/32, 1/64 | 6 | 0.75 |
| 182-123 | | 12 | 0.98 |
| 182-143 | | 18 | 1.18 |
| 182-163 | | 24 | 1.18 |
| 182-104 | 1/10, 1/50, 1/32, 1/64 | 6 | 0.75 |
| 182-124 | | 12 | 0.98 |

Inch Fully-Flexible Rules

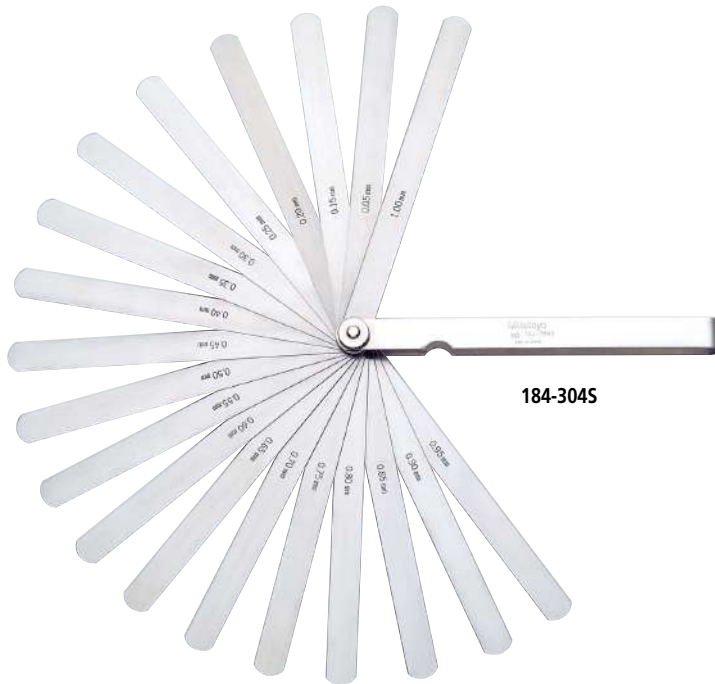
| Order No. | Graduations (in) | Range (in) | Width (in) |
|-----------|----------------------------|------------|------------|
| 182-201 | 1/8, 1/16, 1/32, 1/64 | 6 | 0.47 |
| 182-221 | | 12 | 0.47 |
| 182-241 | | 18 | 1.18 |
| 182-261 | | 24 | 0.75 |
| 182-202 | 1/50, 1/100, 1/32, 1/64 | 6 | 0.47 |
| 182-222 | | 12 | 0.47 |
| 182-242 | | 18 | 0.75 |
| 182-262 | | 24 | 0.75 |
| 182-203 | 1/10, 1/100, 1/32, 1/64 | 6 | 0.47 |
| 182-223 | | 12 | 0.47 |
| 182-243 | | 18 | 0.75 |
| 182-263 | | 24 | 0.75 |
| 182-204 | 1/10, 1/50, 1/32, 1/64 | 6 | 0.47 |
| 182-224 | | 12 | 0.47 |

Reference Gages

Length Standards Brought to You by Mitutoyo

Thickness Gages SERIES 184

- Metric thickness gages are available with tapered leaves.
- Each leaf is marked with its thickness.
- Each leaf is detachable if necessary.



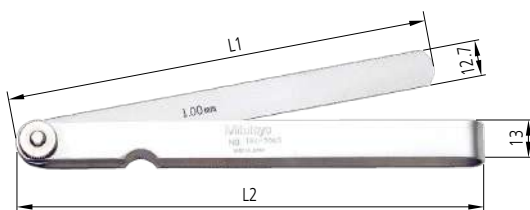
SPECIFICATIONS

Metric

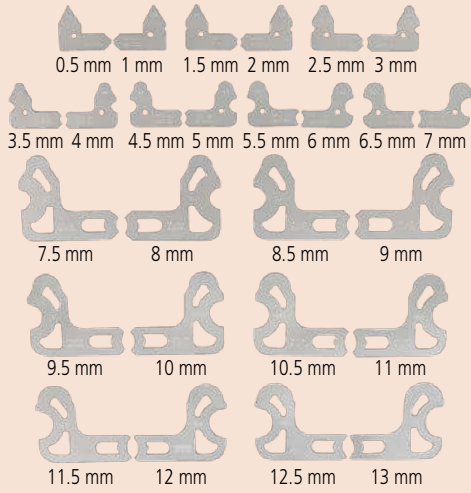
| Order No. | Range (mm) | Composition of leaves | Remarks |
|-----------|------------|--|-----------|
| 184-313S | 0.05 - 1 | 28 leaves: 0.05 - 0.15 mm by 0.01 mm, 0.2 - 1 mm by 0.05 mm | — |
| 184-303S | | 28 leaves: 0.05 - 0.15 mm by 0.01 mm, 0.2 - 1 mm by 0.05 mm | Long leaf |
| 184-304S | 0.05 - 1 | 20 leaves: 0.05 - 1 mm by 0.05 mm | Long leaf |
| 184-305S | 0.05 - 1 | 13 leaves: 0.05 - 0.3 mm by 0.05 mm, 0.4 - 1 mm by 0.1 mm | — |
| 184-301S | | 13 leaves: 0.05 - 0.3 mm by 0.05 mm, 0.4 - 1 mm by 0.1 mm | Long leaf |
| 184-306S | 0.05 - 0.8 | 10 leaves: 0.05 - 0.2 mm by 0.05 mm, 0.3 - 0.8 mm by 0.1 mm | — |
| 184-308S | | 10 leaves: 0.05 - 0.2 mm by 0.05 mm, 0.3 - 0.8 mm by 0.1 mm | Long leaf |
| 184-307S | 0.03 - 0.5 | 13 leaves: 0.03 - 0.1 mm by 0.01 mm, 0.2 - 0.5 mm by 0.1 mm, 0.15 mm | — |
| 184-302S | | 13 leaves: 0.03 - 0.1 mm by 0.01 mm, 0.2 - 0.5 mm by 0.1 mm, 0.15 mm | Long leaf |

DIMENSIONS

Unit: mm



| Order No. | L1 | L2 |
|-----------|-----|-----|
| 184-313S | 100 | 106 |
| 184-303S | 150 | 156 |
| 184-304S | 150 | 156 |
| 184-305S | 100 | 106 |
| 184-301S | 150 | 156 |
| 184-306S | 100 | 106 |
| 184-308S | 150 | 156 |
| 184-307S | 100 | 106 |
| 184-302S | 150 | 156 |

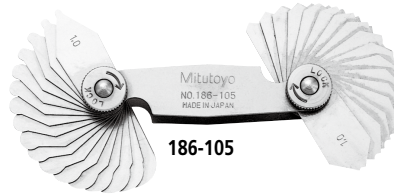


Composition of leaves for **186-902**

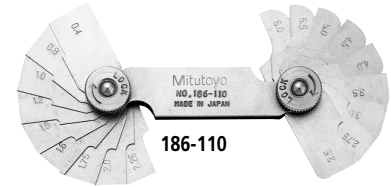
Radius Gages SERIES 186

- Radius size is stamped on each gage leaf.
- Each leaf comprises an internal and an external radius gage of the same size.

- With locking clamp.



186-105



186-110

SPECIFICATIONS

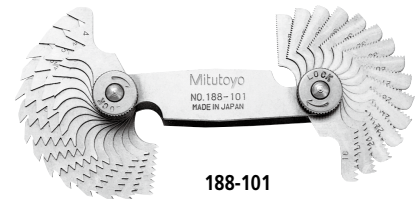
| Metric | | | | |
|----------------|------------|----------|--|-----------------------------|
| Order No. | Range (mm) | Accuracy | Composition of leaves | Remarks |
| 186-110 | 0.4 - 6 | ±0.04 mm | 18 leaves: 0.4, 0.8, 1, 1.2, 1.5, 1.6 mm, 1.75 - 3 mm by 0.25 mm, 3.5 - 6 mm by 0.5 mm | 90° arc |
| 186-902 | 0.5 - 13 | | 26 leaves: 0.5 - 13 mm by 0.5 mm | 90° arc, separate part type |
| 186-105 | 1 - 7 | | 34 leaves: 1 - 3 mm by 0.25 mm, 3.5 - 7 mm by 0.5 mm | 180° arc |
| 186-106 | 7.5 - 15 | | 32 leaves: 7.5 - 15 mm by 0.5 mm | 180° arc |
| 186-107 | 15.5 - 25 | | 30 leaves: 15.5 - 20 mm by 0.5 mm, 21 - 25 mm by 1 mm | 180° arc |

| Inch | | | | |
|-----------------|--------------|-----------|---|----------|
| Order No. | Range (in) | Accuracy | Composition of leaves | Remarks |
| 186-103 | 1/32 - 17/64 | ±0.002 in | 16 leaves: 1/32 in - 17/64 in by 64ths | 90° arc |
| 186-101 | 1/32 - 1/4 | | 30 leaves: 1/32 in - 1/4 in by 64ths | 180° arc |
| 186-102 | 17/64 - 1/2 | | 16 leaves: 17/64 in - 1/2 in by 64ths | 180° arc |
| 186-104 | 9/32 - 33/64 | | 16 leaves: 9/32 in - 33/64 in by 64ths | 90° arc |
| 186-901* | 1/64 - 1/2 | | 25 leaves: 1/64 in - 17/64 in by 64ths, 9/32 in - 1/2 in by 32nds | — |

* Each gage has five measuring locations.

Thread Pitch Gages SERIES 188

- Thread pitch is stamped on each gage.
- Metric, Unified, and Whitworth screw pitch gages.



188-101

SPECIFICATIONS

Metric Screw Pitch Gages

| Order No. | Range (mm) | Integration pitch error | Composition of leaves |
|----------------|------------|-------------------------|---|
| 188-130 | 0.35 - 6 | ±0.05 mm | 22 leaves: 0.35, 0.4, 0.45, 0.5, 0.6, 0.7, 0.75, 0.8, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6 mm and 60° angle gage |
| 188-122 | 0.4 - 7 | | 21 leaves: 0.4, 0.5, 0.7, 0.75, 0.8, 0.9, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7 mm |
| 188-121 | 0.4 - 7 | | 18 leaves: 0.4, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7 mm |

Unified Screw Pitch Gages

| Order No. | Range | Integration pitch error | Composition of leaves |
|----------------|------------|-------------------------|---|
| 188-111 | 4 - 42 TPI | ±0.002 in | 30 leaves: 4, 4 ^{1/2} , 5, 5 ^{1/2} , 6, 7, 8, 9, 10, 11, 11 ^{1/2} , 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 TPI |

Note: Metric and Unified Pitch Gage Set (**188-151**) is available.

Metric and Unified Screw Pitch Gage Set

| Order No. | Range | Integration pitch error | Composition of leaves |
|----------------|-----------------------|-------------------------|---|
| 188-151 | 0.4 - 7 mm/4 - 42 TPI | ±0.05 mm/ ±0.002 in | 51 leaves: Set of 188-122 and 188-111 |

Whitworth Screw Pitch Gages

| Order No. | Range | Integration pitch error | Composition of leaves |
|----------------|------------|-------------------------|---|
| 188-101 | 4 - 42 TPI | ±0.002 in | 30 leaves: 4, 4 ^{1/2} , 5, 5 ^{1/2} , 6, 7, 8, 9, 10, 11, 11 ^{1/2} , 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 TPI |
| 188-102 | 4 - 60 TPI | | 28 leaves: 4, 4 ^{1/2} , 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 34, 36, 40, 48, 60 TPI |

Reference Gages

Length Standards Brought to You by Mitutoyo

Digimatic Universal Protractor SERIES 187

- Data output function makes it easy to gather statistical data.
- Can be attached to height gages using a gage holder (**950750**, metric)
- Setting preset value.
- Removable blade.



Technical Data

- Battery: Lithium Battery
- Battery life: 2,000 hours

Function

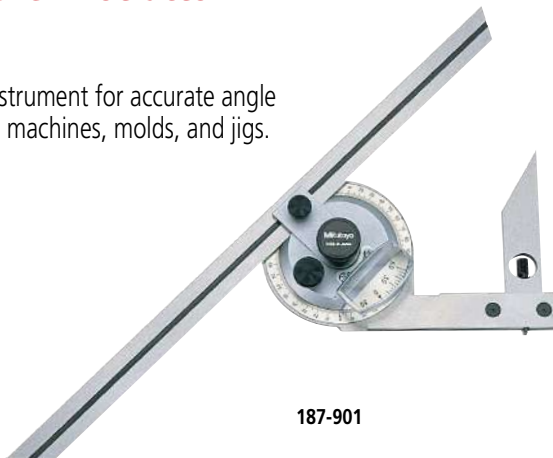
- Presetting

SPECIFICATIONS

| Order No. | Blade length | Range | Resolution | Accuracy | Repeatability | Remarks (standard accessory) |
|-----------|--------------|----------------|------------|--------------|---------------|--------------------------------------|
| 187-501 | 150 mm | -360° to +360° | 1' (0.01°) | ±2' (±0.03°) | 1' | Height gage holder (950750) |
| 187-502 | 300 mm | | | | | Height gage holder (950750) |
| 187-551 | 6 in | | | | | Height gage holder (950749) |
| 187-552 | 12 in | | | | | Height gage holder (950749) |

Universal Bevel Protractor SERIES 187

- High-precision instrument for accurate angle measurement on machines, molds, and jigs.
- Graduation: 5'

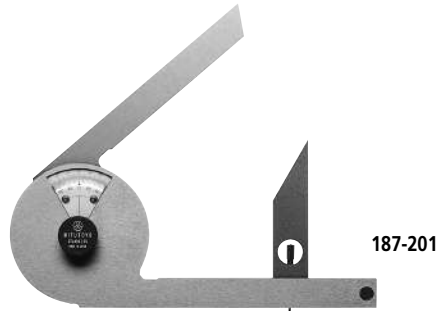


SPECIFICATIONS

| Metric | | | Inch | | |
|-----------|-------------------|-----------------------|-----------|-------------------|-----------------------|
| Order No. | Blade length (mm) | Remarks | Order No. | Blade length (in) | Remarks |
| 187-901 | 150, 300 | w/60°, 45°, 30° edges | 187-902 | 6, 12 | w/60°, 45°, 30° edges |
| 187-907 | 150 | w/60°, 45° edges | 187-904 | 6 | w/60°, 45° edges |
| 187-908 | 300 | w/60°, 45° edges | 187-906 | 12 | w/60°, 45° edges |

Bevel Protractor SERIES 187

- Consists of three sheets of stainless steel, the middle one of which is made for angle measurements.



SPECIFICATIONS

| Order No. | Blade length (mm) | Range | Graduation | Blade edge angle | Mass (g) | Remarks |
|-----------|-------------------|--------------|----------------------|------------------|----------|------------------|
| 187-201 | 137 | 90°x4 (360°) | 5' (0° to 90° to 0°) | 30° and 60° | 260 | w/60°, 30° edges |

Reference Gages

Length Standards Brought to You by Mitutoyo

Black Granite Surface Plates SERIES 517

- Natural granite is free from deterioration or dimensional change over time.
- Black Granite Plate's most distinctive feature is its hardness, twice that of cast iron.
- Free from wringing effects, so there is no interruption of work.
- Since granite is harder, finer grained, and more brittle than cast iron it does not throw up burrs or protrusions if scratched. (See Figure 1.) This ensures a high degree of flatness with no risk of damaging instruments or workpieces.
- Use these plates in a stable temperature environment. Since flatness error occurs when there is a temperature difference between the working surface and the underside, avoid working in direct sunlight. Also, do not place a plate in the vicinity of an air conditioner or heater. (Recommended environment: Temperature 20 ± 1 °C, Humidity 58 ± 2 %)



An inspection certificate is supplied as standard. Refer to page U-11 for details.

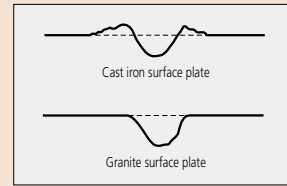


Figure 1



Custom-made Granite Products

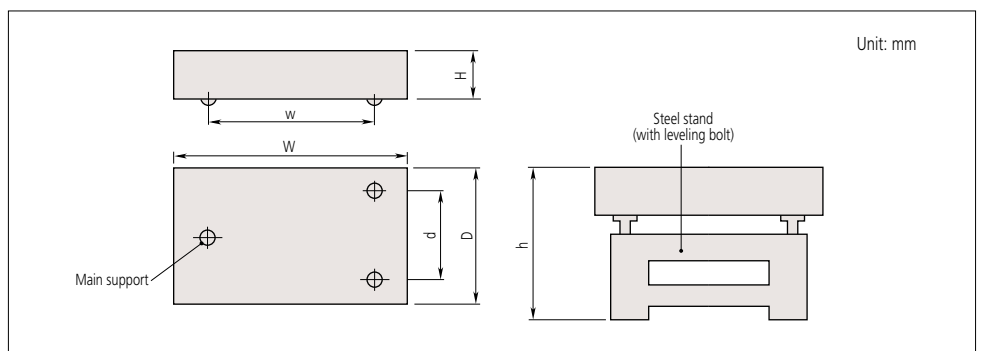
Mitutoyo can manufacture granite products to your design (such as main structural components of semiconductor instruments and process machinery). For detailed information, contact the nearest Mitutoyo sales office.

SPECIFICATIONS

| Order No. | Size (mm) | | | Flatness (μm) | Mass (kg) | Optional stands for black granite surface plates | | | h (mm) |
|-----------|---------------|------|------|---------------|-----------|--|-------------------|----------------------------------|-------------|
| | WxDxH | d | w | | | Standard type | with safety frame | with casters (with safety frame) | |
| 517-401-4 | 300x300x100 | 240 | 240 | 2 | 27 | — | — | — | — |
| 517-301 | | | | 3 | | | | | |
| 517-101 | | | | 5 | | | | | |
| 517-411-4 | 450x300x100 | 240 | 390 | 2 | 40 | — | — | — | — |
| 517-311 | | | | 3 | | | | | |
| 517-111 | | | | 6 | | | | | |
| 517-414-4 | 600x450x100 | 370 | 500 | 2.5 | 80 | 517-203-2 | 517-203R | 517-203CR | 755 to 775 |
| 517-314 | | | | 4 | | | | | |
| 517-114 | | | | 8 | | | | | |
| 517-403-4 | 600x600x130 | 500 | 500 | 2.5 | 140 | 517-204-2 | 517-204R | 517-204CR | 755 to 775 |
| 517-303 | | | | 5 | | | | | |
| 517-103 | | | | 8 | | | | | |
| 517-405-4 | 750x500x130 | 420 | 630 | 3 | 146 | 517-205-2 | 517-205R | 517-205CR | 755 to 775 |
| 517-305 | | | | 5 | | | | | |
| 517-105 | | | | 9 | | | | | |
| 517-407-4 | 1000x750x150 | 630 | 700 | 3 | 337 | 517-206-2 | 517-206R | 517-206CR | 755 to 775 |
| 517-307 | | | | 6 | | | | | |
| 517-107 | | | | 12 | | | | | |
| 517-409-4 | 1000x1000x150 | 700 | 700 | 3.5 | 450 | 517-207-2 | 517-207R | 517-207CR | 735 to 775 |
| 517-309 | | | | 7 | | | | | |
| 517-109 | | | | 13 | | | | | |
| 517-413-4 | 1500x1000x200 | 700 | 1100 | 4 | 900 | 517-208-4 | 517-208R | 517-208CR | 735 to 775 |
| 517-313-4 | | | | 8 | | | | | |
| 517-113-4 | | | | 16 | | | | | |
| 517-410-4 | 2000x1000x250 | 700 | 1500 | 4.5 | 1500 | 517-209-4 | 517-209R | 517-209CR | 735 to 775 |
| 517-310-4 | | | | 9.5 | | | | | |
| 517-110-4 | | | | 19 | | | | | |
| 517-416-4 | 2000x1500x300 | 1100 | 1500 | 5 | 2700 | 517-210-4 | 517-210R | 517-210CR | 735 to 775 |
| 517-316-4 | | | | 10 | | | | | |
| 517-116-4 | | | | 20 | | | | | |
| 517-317-4 | 2000x2000x350 | 1500 | 1500 | 11 | 4200 | — | — | — | 700 to 706* |
| 517-117-4 | | | | 22 | | | | | |
| 517-318-4 | 3000x1500x400 | 1100 | 2000 | 12.5 | 5400 | — | — | — | 700 to 706* |
| 517-118-4 | | | | 25 | | | | | |
| 517-319-4 | 3000x2000x500 | 1500 | 2000 | 13.5 | 9000 | — | — | — | 700 to 706* |
| 517-119-4 | | | | 27 | | | | | |

* Distance from the bottom of the large granite plate block mount to the granite plate top surface.

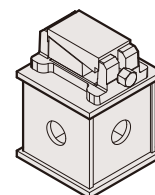
DIMENSIONS



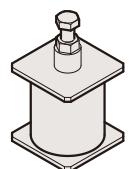
SPECIFICATIONS: Main and auxiliary supports for large surface plates

| Order No. | Support sets | | Applicable surface plates | |
|-----------|--------------|-------------------|---------------------------|-------------------|
| | Main support | Auxiliary support | Order No. | Size (WxDxH) (mm) |
| 06AAY174 | 3 pcs. | 2 pcs. | 517-317 | 2000x2000x350 |
| | | | 517-117 | |
| 06AAY175 | 3 pcs. | 3 pcs. | 517-318 | 3000x1500x400 |
| | | | 517-118 | |
| 06AAY176 | 3 pcs. | 3 pcs. | 517-319 | 3000x2000x500 |
| | | | 517-119 | |

Main support
(3 required)



Auxiliary support
(2 or 3 required)



New Products



ABSOLUTE Digimatic Indicator ID-C (Signal Output Function Type)

Refer to page F-19 for details.



Dial Test Indicator

Refer to page F-67 for details.



Inspection Instruments for Indicators (i-Checker)

Refer to page F-77 for details.



Digimatic Indicators



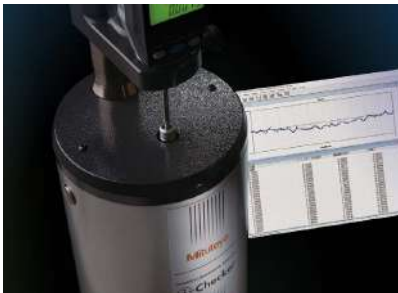
Dial Indicators



Dial Test Indicators



Dial Indicator Applications and Stands



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Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Solar-Powered Digimatic Indicator ID-SS SERIES 543

- Solar powered, this series consists of environmentally friendly measuring instruments that do not require batteries, eliminating the need for battery replacement. Their minimum operating luminance is 40 lux (lx), lower than that inside a warehouse.
- The large-capacity built-in reservoir capacitor allows you to use the indicator for long periods of time under lighting conditions below the minimum level.
- All functions can be accessed by using the two or three large buttons on the front of the indicator.
- Origin recorded even if display disappears. The indicator includes an ABS (absolute) scale that allows the previously set origin to be restored even if the display disappears due to insufficient lighting, making it easy to resume measurement. This feature makes ID-SS ideal for long-time or multi-point measurement.
- Three types of accessories (optional) are available to enable spindle lifting in various measurement settings.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)

MeasurLink ENABLED
Data Management Software by Mitutoyo



MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

- Display: 6-digit LCD, sign
- Usable orientations: All
- Power supply: Solar battery (for indoor use)
- Minimum Operating illumination: 40 lux (lx)
- Note: Rechargeable; can be used for approximately 3.5 hours when fully charged. Charging time is approximately 1.5 hours under 500 lux (lx) lighting conditions.
- Maximum response speed: No limit (scan-type measurement is not supported)

Functions

- Origin set (Zero-setting)
- Direction switching
- Data output
- Error alarm display

SPECIFICATIONS

| Metric | | | Maximum permissible error*1 (mm) | | | | Measuring force MPL (N) | Back type | Net mass (g) |
|-----------|------------|-----------------|----------------------------------|-----------------------------|--------------------------------|-------------|-------------------------|-----------|--------------|
| Order No. | Range (mm) | Resolution (mm) | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | | | |
| 543-500 | 12.7 | 0.001 | 0.003 | 0.002 | 0.002 | 1.5 or less | With lug | 150 | |
| 543-500B | | | | | | | Flat | 140 | |
| 543-505 | | 0.01 | 0.02 | 0.02 | 0.01 | | With lug | 150 | |
| 543-505B | | | | | | | Flat | 140 | |

| Inch / Metric | | | Maximum permissible error*1 | | | | Measuring force MPL (N) | Back type | Net mass (g) | | | |
|---------------|------------------|----------------------|-----------------------------|-----------------------------|--------------------------------|-------------|-------------------------|----------------------|---------------------|---------------------|----------|-----|
| Order No. | Range | Resolution | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | | | | | | |
| 543-501 | 0.5 in / 12.7 mm | 0.0005 in / 0.001 mm | ±0.0001 in / 0.003 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 1.5 or less | With lug | 150 | | | | |
| 543-501B | | | | | | | Flat | 140 | | | | |
| 543-502 | | | | | | | 0.0005 in / 0.001 mm | ±0.0010 in / 0.02 mm | 0.0010 in / 0.02 mm | 0.0005 in / 0.01 mm | With lug | 165 |
| 543-502B | | | | | | | | | | | Flat | 140 |
| 543-506 | | 0.0005 in / 0.01 mm | ±0.0010 in / 0.02 mm | 0.0010 in / 0.02 mm | 0.0005 in / 0.01 mm | | With lug | 150 | | | | |
| 543-506B | | | | | | | Flat | 140 | | | | |
| 543-507 | | | | | | | With lug | 165 | | | | |
| 543-507B | | | | | | | Flat | 140 | | | | |

*1 These values apply at 20 °C.

*2 Error of indication for the total measuring range

Note: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

Optional Accessories

Lifting lever



Lifting knob



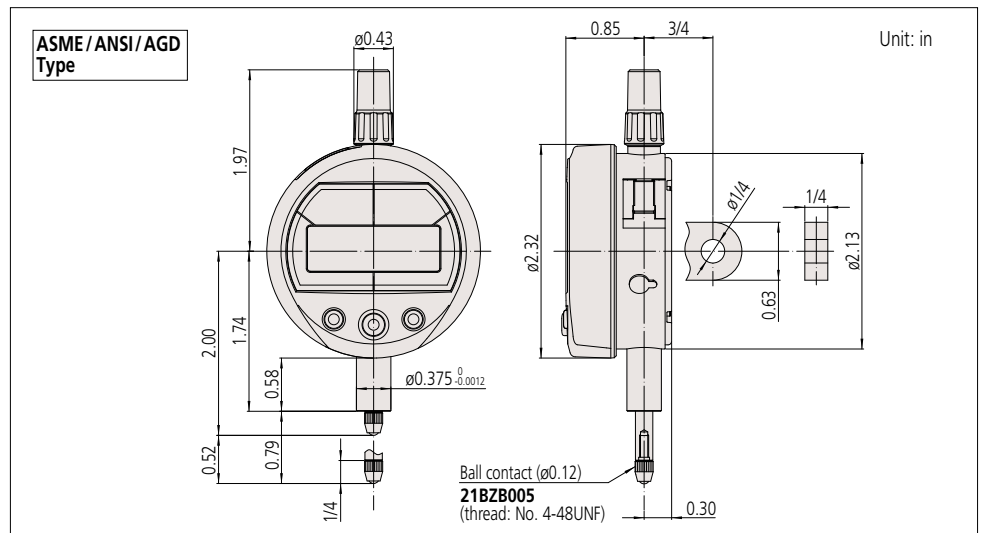
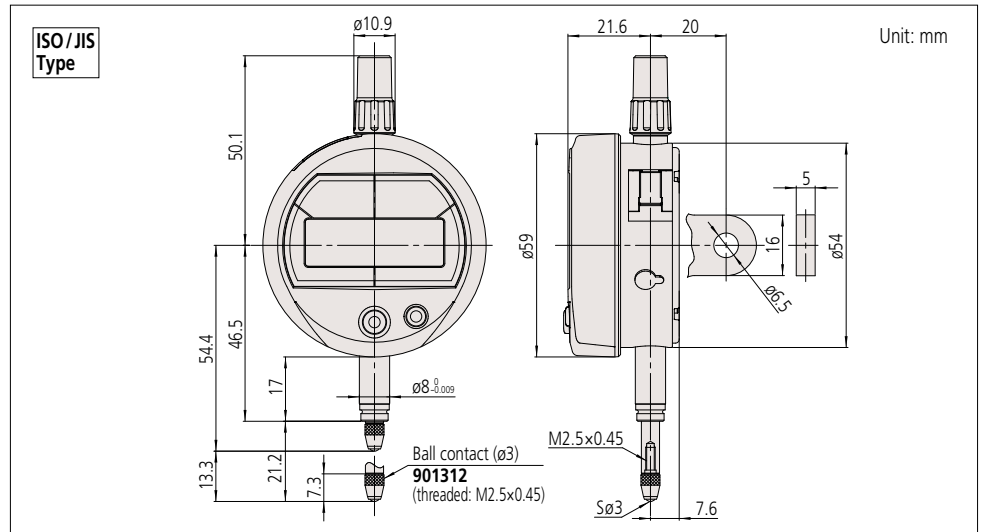
Lifting cable



- Lifting
 - Lifting lever **21EZA198** (ISO/JIS Type), **21EZA199** (ASME/ANSI/AGD Type)
 - Lifting knob **21EZA105** (ISO/JIS Type), **21EZA150** (ASME/ANSI/AGD Type)
 - Lifting cable **21JZA295**
 - SPC Cable:
 - 905338** (1 m)
 - 905409** (2 m)
 (Refer to pages A-27 to A-29 for details.)
 - USB Input Tool Direct (2 m): **06AFM380F**
- Note: Please separately purchase **USB-ITPAK** since there is no data output switch on the measurement instrument. Refer to pages A-13, A-22 to A-24 for details.
- Input Tool Series
 - IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
 - IT-007R** (RS-232C Communication Conversion Type): **264-007**
 (Refer to page A-14 for details.)
 - Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790F**
 - For foot switch: **02AZE140F**
 - (Refer to pages A-19 to A-21 for details.)
 - Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
 - Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
 - Interchangeable backs for 2 series (Refer to page F-61 for details.)
 - Measuring stands (Refer to pages F-84 to F-91 for details.)
 - **ID-SS** can be used in standard work environments. The following is excerpted from JIS Z9110: 2010 General rules of recommended lighting levels; 5.4 Factories:

| Luminance (lux) | Settings and procedures |
|-----------------|---|
| 1500 | Very detailed visual work |
| 750 | Detailed visual work; design and drawing work |
| 500 | Regular visual work such as work carried out in a factory; monitoring work such as using instrument panels and control panels |
| 300 | Administrative work carried out in a warehouse |
| 200 | Control rooms, bathrooms, and places where manual light work is carried out |
| 150 | Work such as loading, unloading, and shifting loads |
| 100 | Hallways, corridors, entrances and exits, and warehouses |
| 50 | Indoor emergency staircases |

Dimensions



Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-SX SERIES 543

MeasurLink ENABLED
Data Management Software by Mitutoyo

- Cost-effective oriented design
ID-SX indicators use a button-type battery (SR44) and come with the minimum of functionality for ease of use. There is a choice of models in the lineup allowing selection of 0.01 mm, 0.001 mm or inch-based measurement resolutions.
- IP53 dust/water protection level
The models listed below also provide IP53 dust/water protection level specifications:
543-794/94B/95/95B/96/96B

- These Digimatic indicators employ Mitutoyo's proprietary ABS (absolute) scale, which makes it possible to restore the origin point even if the power is turned off. This eliminates the need to perform origin restoration each time the power is turned on. Furthermore, this scale ensures that overspeed errors do not occur, which improves reliability.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)



SPECIFICATIONS

| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error*1 (mm) | | | Measuring force MPL (N) | Back type | Battery life*3 | Net mass (g) | Dust/Water protection level*4 |
|-----------|------------|-----------------|----------------------------------|-----------------------------|--------------------------------|-------------------------|---|---------------------------------------|--------------|-------------------------------|
| | | | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | | | | |
| 543-790 | 12.7 | 0.001 | 0.003 | 0.002 | 0.002 | 1.5 or less | With lug | Approx. 18,000 hours (Continuous use) | 150 | IP42 |
| 543-790B | | | | | | | Flat | | 140 | |
| 543-794 | | | | | | | With lug | | 150 | |
| 543-794B | | Flat | 140 | | | | | | | |
| 543-781 | | With lug | 155 | | | | | | | |
| 543-781B | 0.01 | 0.02 | 0.02 | 0.01 | 1.5 or less | Flat | Approx. 20,000 hours (Continuous use) Approx. 5 years (Normal use) | 155 | IP42 | |

| Order No. | Range | Resolution | Maximum permissible error*1 | | | Measuring force MPL (N) | Back type | Battery life*3 | Net mass (g) | Dust/Water protection level*4 |
|-----------|---------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------|-------------------------|---|---------------------------------------|--------------|-------------------------------|
| | | | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | | | | |
| 543-791 | 0.5 in / 12.7 mm | 0.00005 in / 0.001 mm | ±0.0001 in / 0.003 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 1.5 or less | With lug | Approx. 18,000 hours (Continuous use) | 150 | IP42 |
| 543-791B | | | | | | | Flat | | 140 | |
| 543-792 | | | | | | | With lug | | 165 | |
| 543-792B | | | | | | | Flat | | 140 | |
| 543-793 | | | | | | | With lug | | 165 | |
| 543-793B | | | | | | | Flat | | 140 | |
| 543-795 | | 0.00005 in / 0.001 mm | ±0.0001 in / 0.003 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 2.5 or less | With lug | Approx. 5 years (Normal use) | 155 | IP53 |
| 543-795B | | | | | | | Flat | | 155 | |
| 543-796 | | | | | | | With lug | | 155 | |
| 543-796B | | | | | | | Flat | | 155 | |
| 543-782 | 0.0005 in / 0.01 mm | ±0.0010 in / 0.02 mm | 0.0010 in / 0.02 mm | 0.0005 in / 0.01 mm | 1.5 or less | With lug | Approx. 20,000 hours (Continuous use) Approx. 5 years (Normal use) | 150 | IP42 | |
| 543-782B | | | | | | Flat | | 140 | | |
| 543-783 | | | | | | With lug | | 165 | | |
| 543-783B | | | | | | Flat | | 140 | | |

*1 These values apply at 20 °C.

*2 Error of indication for the total measuring range

*3 The battery life varies, depending on the number of times a Digimatic indicator is used as well as the way it is used.

The values listed above are approximations.

*4 This is only valid when the data socket cover is in place. Does not apply if the cover is removed, a lifting accessory is attached, or a connecting cable is attached.

Note: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

- Display: 6-digit LCD, sign
- Usable orientation: All
- Scale type: ABSOLUTE electrostatic linear encoder
- Battery: SR44 (1 pc.), **938882** for initial operational checks (standard accessory)
- Maximum response speed: No limit (except for scanning measurement)

Functions

- Origin set (Zero-setting)
- Direction switching
- Data output
- Low battery voltage alarm display
- Error alarm display

Optional Accessories

- Lifting
 - Lifting lever **21EZA198** (ISO/JIS Type), **21EZA199** (ASME/ANSI/AGD Type)
 - Lifting knob **21EZA105** (ISO/JIS Type), **21EZA150** (ASME/ANSI/AGD Type)
 - Lifting cable **21JZA295**
 - SPC Cable:
 - 905338** (1 m)
 - 905409** (2 m)
 (Refer to pages A-27 to A-29 for details.)
 - USB Input Tool Direct (2 m): **06AFM380F**
- Note: Please separately purchase **USB-ITPAK** since there is no data output switch on the measurement instrument. Refer to pages A-13, A-22 to A-24 for details.
- Input Tool Series
 - IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
 - IT-007R** (RS-232C Communication Conversion Type): **264-007**
 (Refer to page A-14 for details.)
 - Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790F**
 - For foot switch: **02AZE140F**
 - (Refer to pages A-19 to A-21 for details.)
 - Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
 - Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
 - Interchangeable backs for 2 series (Refer to page F-61 for details.)
 - Measuring stands (Refer to pages F-84 to F-91 for details.)

IP53 dust/water protection level*

Level 5: Dust protection

While complete protection against intrusion of dust is not provided, protection is adequate to prevent dust intrusion in amounts that would inhibit the prescribed operations and safety of the electronic equipment.

Level 3: Protection against spraying water

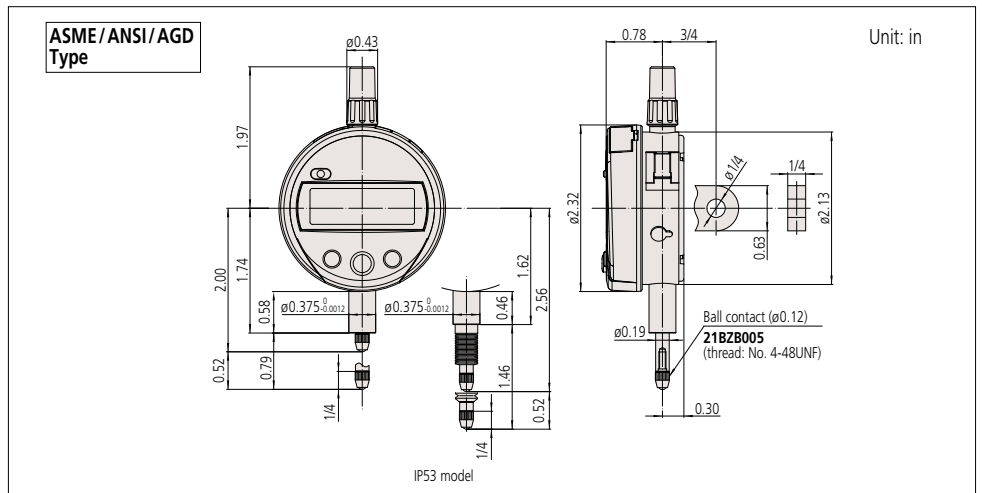
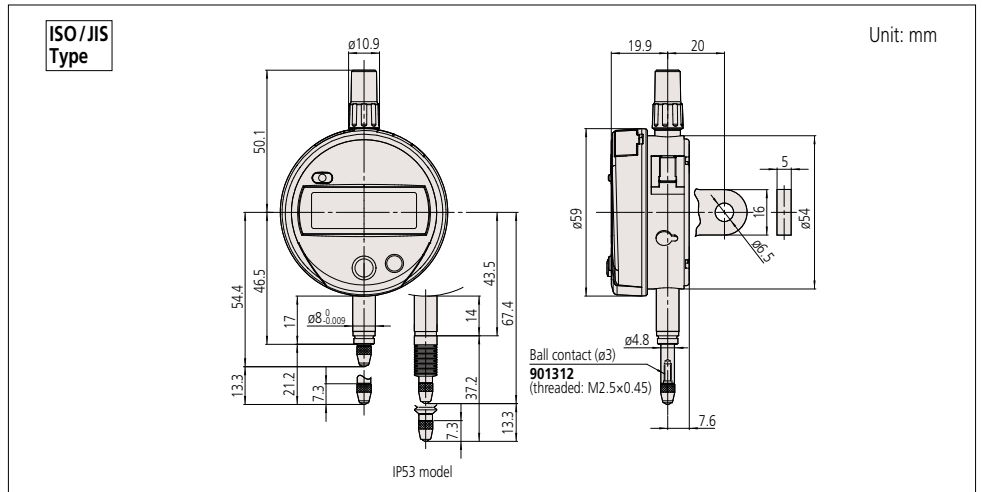
The product suffers no harmful effects when subjected to water sprayed at an angle of up to 60° on both sides.

For details on the dust/water protection level test conditions, refer to IEC 60529: 2001 and JIS C 0920: 2003.

* IP code is the degree of protection against the intrusion of solid foreign objects and water.

Mitutoyo offers a lineup of coolant proof, **ID-N/B** indicators that have excellent resistance to oil, water and dust and so are suitable for use in environments that include splashing cutting fluid. (Refer to page F-10 for details.)

Dimensions



Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-CX SERIES 543 — Standard Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The ABS (absolute) scale restores the last origin position automatically when the indicator is turned on.
- Thanks to Mitutoyo's ABSOLUTE Linear Encoder, reliability has been increased due to elimination of over-speed errors.
- Tolerance judgment can be performed by setting upper and lower tolerance limits. The judgment result (GO/NO-GO) can be displayed in full-size characters.

- Battery life of approx. 7,000 hours in continuous use has been achieved with only one battery.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)



• Large LCD

The large LCD incorporates 11 mm characters giving 1.5 times the character area of conventional products (which display 8.5 mm characters) making measurement values much easier to read.



• Three large buttons

The popular three-large button design, which is used in products such as the ABS coolant proof Digimatic indicators ID-N/B, makes buttons easier to press and operations easier to perform.



- **Parameter setting mode**
Count direction switching, tolerance judgment setting, resolution switching, scale factor setting, and function lock setting
- inch/mm conversion (inch/mm models)

- **Power switch**
- **Data output** (when connected to an external device)
- **Data hold** (when no external device is connected)

Switches between the ABS (preset) and INC (zeroset) measurement modes

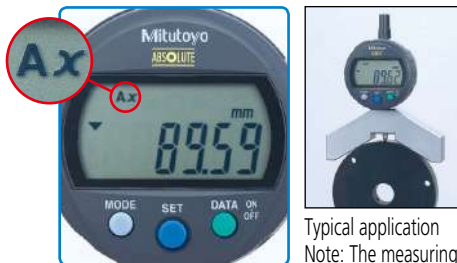
• 330° rotary display

The display can be rotated 330°, allowing use at a position where you can easily read the measurement value.



• Calculation: $f(x) = Ax$

Mounting the ID-CX on a measuring jig and setting the multiplying factor (to any practical value) allows direct indication of size (see example below) without using a conversion table and so improves measurement efficiency.



Typical application
Note: The measuring jig is not supplied with the ID-CX.

• Function Lock

Ensures reliability of measurement by locking the settings to prevent preset function settings from being changed by mistake.



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE[™]



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

- Display: 6-digit LCD, sign
 - Battery: SR44 (1 pc.), **938882** for initial operational checks (standard accessory)
 - Battery life: Approx. 7,000 hours of continuous use. Approx. 1.2 years under normal use.
- Note: Depends on use of the indicator. The above values are reference values.
- Maximum response speed: No limit (except for scanning measurement)

Functions

- Zero-setting (INC system)
- Presetting (ABS system)
- Direction switching
- Tolerance judgment
- Resolution switching (For 0.001 mm or 0.00005 inch resolution models)
- Calculation: $f(x) = Ax$
- Function Lock
- Data output
- Display value holding (when no external device is connected)
- 330° rotary display
- Low battery/voltage alarm display
- Error alarm display

Optional Accessories

- Lifting
Lifting lever:
21EZA198 (12.7 mm/0.5 inch ISO/JIS type)
21EZA199 (12.7 mm/0.5 inch ASME/ANSI/AGD type)
Lifting cable: **21JZA295**
(stroke 12.7 mm: 12.7 mm/0.5 in models)
(stroke 25.4 mm: 25.4 mm/1 in and 50.8 mm/2 in models)
Lifting knob:
21EZA105 (12.7 mm/0.5 inch ISO/JIS type)*1
21EZA150 (12.7 mm/0.5 inch ASME/ANSI/AGD type)*1
21EZA197 (25.4 mm/1 inch models)
21EZA200 (50.8 mm/2 inch models)
Lifting lever: **137693** (for measuring range: 25.4 and 50.8 mm) (supplied with 25.4 mm and 50.8 mm models as standard.)
- *1 Not available for low measuring force models.
- Auxiliary spindle spring:
02ACA571 (25.4 mm/1 inch models)*2
02ACA773 (50.8 mm/2 inch models)*2
- *2 Required when orienting the indicator upside down.
- Lug-on-Center Back:
101040 (25.4 mm/1 in and 50.8 mm/2 in, ISO/JIS type)
101306 (25.4 mm/1 in and 50.8 mm/2 in, ASME/ANSI/AGD type)
- SPC Cable:
905338 (1 m)
905409 (2 m)
(Refer to pages A-27 to A-29 for details.)
- USB Input Tool Direct (2 m): **06AFM380F**
- Input Tool Series
IT-016U (USB Keyboard Signal Conversion Type):
264-016-10
IT-007R (RS-232C Communication Conversion Type):
264-007
(Refer to page A-14 for details.)
- Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790F**
For foot switch: **02AZE140F**
(Refer to pages A-19 to A-21 for details.)
- Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
- Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
- Interchangeable backs for 2 series (Refer to page F-61 for details.)
- Measuring stands (Refer to pages F-84 to F-91 for details.)

Usable orientation

- Standard models with measuring range 12.7 mm: Usable in all orientations.
- Models with measuring range 25.4 or 50.8 mm: Usable between the contact point pointing downward and spindle in horizontal orientation. To use the contact point pointing upward, the auxiliary spindle spring (optional) is required.
- Low measuring force model: See "Setting measuring force on low measuring force models" below.

Setting measuring force on low measuring force models

The measuring force of models with low measuring force can be set by combining standard accessory springs and weights.

• 543-404 / 404B / 405 / 405B / 406 / 406B

| Spindle orientation | Spring | Weight (approximately 0.1 N) | Maximum measuring force (N) |
|------------------------------|--------|------------------------------|-----------------------------|
| Pointing vertically downward | Yes | Yes | 0.5 or less |
| | Yes | No | 0.4 or less |
| | No | Yes | 0.3 or less |
| | No | No | 0.2 or less |
| Horizontal | Yes | No | 0.3 or less |

Note: Operation using configurations other than shown above is not guaranteed.

• 543-394 / 394B / 395 / 395B / 396 / 396B

| Spindle orientation | Spring | Weight (approximately 0.1 N) | Maximum measuring force (N) |
|------------------------------|--------|------------------------------|-----------------------------|
| Pointing vertically downward | Yes | Yes | 0.7 or less |
| | Yes | No | 0.6 or less |
| | No | Yes | 0.4 or less |
| | No | No | Not guaranteed |

Note: Operation using configurations other than shown above is not guaranteed.

SPECIFICATIONS

| Metric | | ISO/JIS type | | | | | ASME/ANSI/AGD type | | | | |
|------------------------------|------------------------|-----------------|--|-----------------------------|--------------------------------|-------------------------|--------------------|--|--|--|--|
| Order No. (w/lug, flat-back) | Range (mm) | Resolution (mm) | Maximum permissible error* ¹ (mm) | | | Measuring force MPL (N) | | | | | |
| | | | MPE _E * ³ | Hysteresis MPE _H | Repeatability MPE _R | | | | | | |
| 543-390 | 543-390B | 12.7 | 0.001/0.01 (selectable) | 0.003 | 0.002 | 0.002 | 1.5 or less | | | | |
| 543-394* ² | 543-394B* ² | | | | | | 0.4 to 0.7 | | | | |
| — | 543-470B | 25.4 | 0.005 | 0.005 | 0.002 | 0.002 | 1.8 or less | | | | |
| — | 543-490B | 50.8 | | | | | 2.3 or less | | | | |
| 543-400 | 543-400B | 12.7 | 0.01 | 0.02 | 0.02 | 0.01 | 0.9 or less | | | | |
| 543-404* ² | 543-404B* ² | | | | | | 0.2 to 0.5 | | | | |
| — | 543-474B | 25.4 | 0.04 | 0.04 | 0.02 | 0.01 | 1.8 or less | | | | |
| — | 543-494B | 50.8 | | | | | 2.3 or less | | | | |

*¹ These values apply at 20 °C.

*² Low measuring force

*³ Error of indication for the total measuring range

Note: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

Inch / Metric

| Inch / Metric | | ISO/JIS type | | | | | ASME/ANSI/AGD type | | | | |
|------------------------------|------------------------|--------------|---|-----------------------------|--------------------------------|-------------------------|---------------------------|--|--|--|--|
| Order No. (w/lug, flat-back) | Range (in) | Resolution | Maximum permissible error* ¹ | | | Measuring force MPL (N) | | | | | |
| | | | MPE _E * ³ | Hysteresis MPE _H | Repeatability MPE _R | | | | | | |
| 543-391 | 543-391B | 0.5 | 0.0005 / 0.0001 / 0.00005 in / 0.00005 mm | ±0.0001 in / 0.003 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 1.5 or less | | | | |
| 543-392 | 543-392B | | | | | | 1.5 or less | | | | |
| 543-395* ² | 543-395B* ² | | | | | | 0.4 to 0.7 | | | | |
| 543-396* ² | 543-396B* ² | | | | | | 0.4 to 0.7 | | | | |
| — | 543-471B | 1 | 0.01 / 0.001 mm (selectable) | ±0.0002 in / 0.005 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 1.8 or less* ⁴ | | | | |
| — | 543-472B | | | | | | 1.8 or less* ⁴ | | | | |
| — | 543-491B | 2 | 0.01 / 0.001 mm (selectable) | ±0.0002 in / 0.005 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 2.3 or less* ⁴ | | | | |
| — | 543-492B | | | | | | 2.3 or less* ⁴ | | | | |
| 543-401 | 543-401B | 0.5 | 0.0005 in / 0.01 mm | ±0.001 in / 0.02 mm | 0.001 in / 0.02 mm | 0.0005 in / 0.01 mm | 0.9 or less | | | | |
| 543-402 | 543-402B | | | | | | 0.9 or less | | | | |
| 543-405* ² | 543-405B* ² | | | | | | 0.2 to 0.5 | | | | |
| 543-406* ² | 543-406B* ² | | | | | | 0.2 to 0.5 | | | | |
| — | 543-475B | 1 | 0.01 / 0.001 mm (selectable) | ±0.0015 in / 0.04 mm | 0.001 in / 0.02 mm | 0.0005 in / 0.01 mm | 1.8 or less* ⁴ | | | | |
| — | 543-476B | | | | | | 1.8 or less* ⁴ | | | | |
| — | 543-495B | 2 | 0.01 / 0.001 mm (selectable) | ±0.0015 in / 0.04 mm | 0.001 in / 0.02 mm | 0.0005 in / 0.01 mm | 2.3 or less* ⁴ | | | | |
| — | 543-496B | | | | | | 2.3 or less* ⁴ | | | | |

*¹ These values apply at 20 °C.

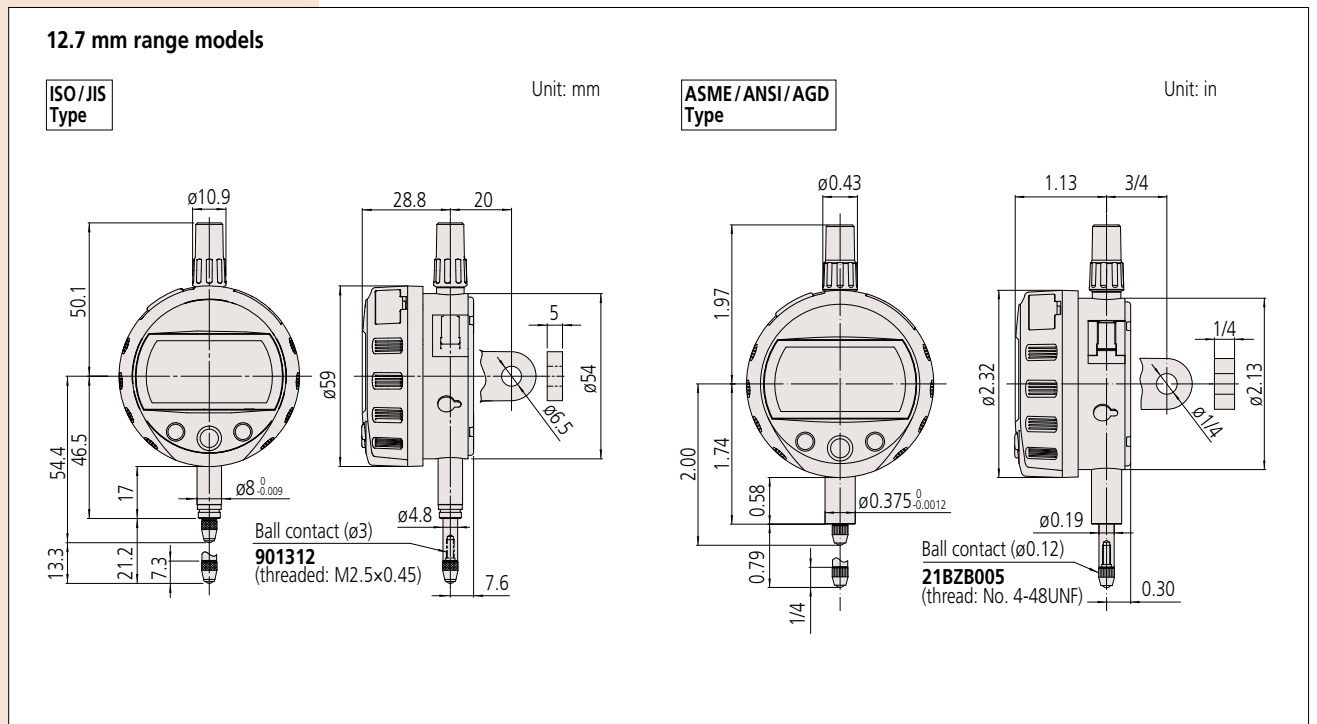
*² Low measuring force

*³ Error of indication for the total measuring range

*⁴ Applies for a spindle orientation between the spindle pointing vertically downward to the spindle horizontal.

Note: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

DIMENSIONS

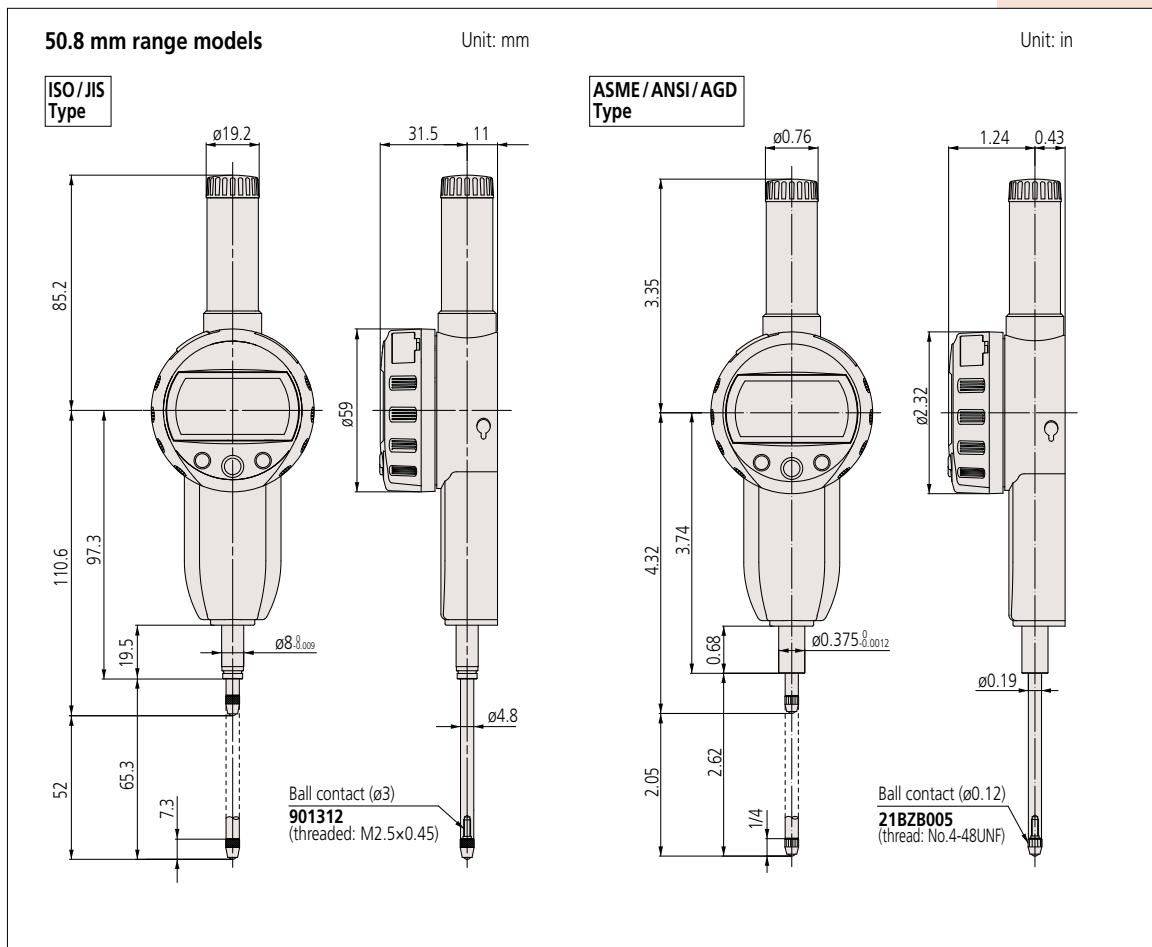
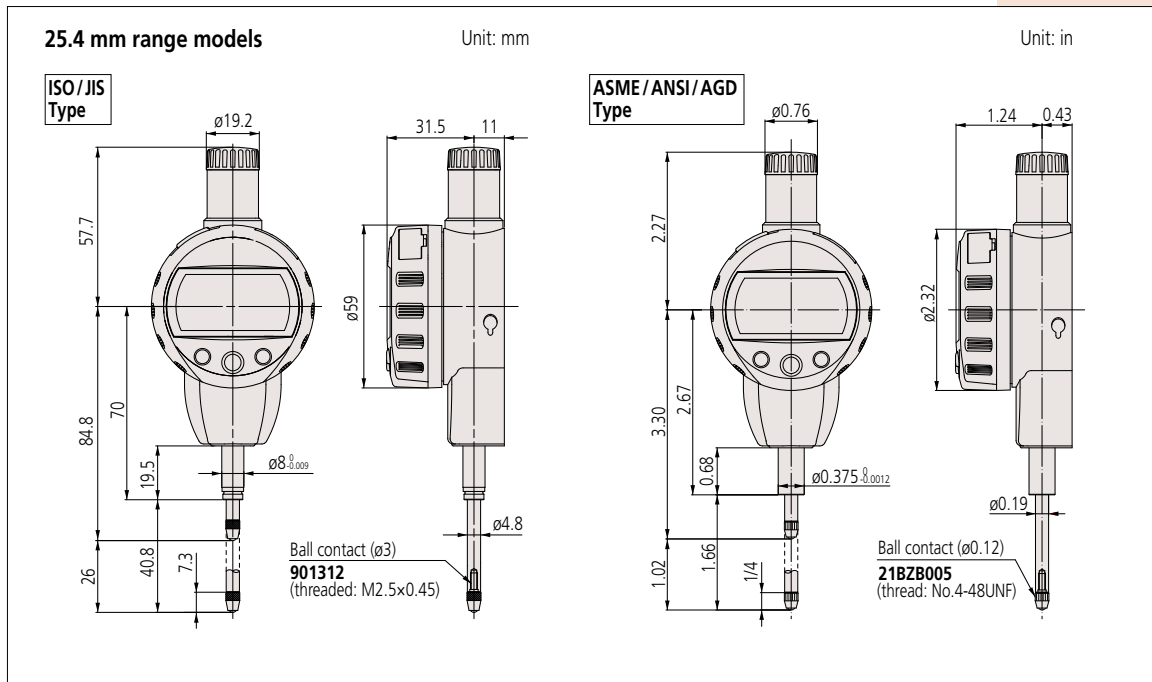


Note: Products with an Order No. suffixed "B" have a plain back, and other models have a center-lug back. Refer to page F-61 for details of the backs.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



Note: Products with an Order No. suffixed "B" have a plain back, and other models have a center-lug back. Refer to page F-61 for details of the backs.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-N/B SERIES 543 — with Dust/Water Protection Conforming to IP66

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Functions

- Zero-setting (INC system)
- Presetting (ABS system)
- Direction switching
- Tolerance judgment
- LCD readout reversal
- Resolution switching
(For 0.001 mm or 0.00005 in resolution models)
- Data output
- Display value holding
(when no external device is connected)
- Low battery voltage alarm display
- Error alarm display

- Our unique ABS scale restores the last origin position automatically when the indicator is turned on.
- The chance of overspeed errors has been eliminated thanks to the ABS scale.
- Rated to IP66: can be used satisfactorily even in adverse environments where the indicator is subject to splashing by cutting fluid or coolant.
- Slim body design (body width: only 35 mm) is advantageous in multipoint measurement situations where space is restricted. The LCD readout can also be rotated 180° to allow reading from the most convenient direction.
- Succeeded in digitalization of the Back Plunger type widely used for dial indicators for ID-B. A 5 mm-stroke plunger with a higher degree of accuracy has been implemented by adopting a direct reading scale for plunger displacement.
- Tolerance judgment can be performed by setting upper and lower tolerance limits. The judgment result (GO/NO-GO) can be displayed in full-size characters.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)

543-575



543-585



Rated to IP66 water- and dust-proofing standard and oil resistance improved.



Body width 35 mm



LCD readout reversal function

SPECIFICATIONS

Metric

| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) | Remarks |
|-----------|------------|-------------------------|--------------------------------|-----------------------------|--------------------------------|-------------------------|-------------------|
| | | | MPE _E * | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-570 | 12.7 | 0.01 | 0.02 | 0.02 | 0.01 | 2.5 or less | Slim type |
| 543-580 | 5.0 | | | | | | Back Plunger type |
| 543-575 | 12.7 | 0.01/0.001 (selectable) | 0.01/0.003 | 0.02 | 0.002 | 2.5 or less | Slim type |
| 543-585 | 5.0 | | | | | | Back Plunger type |

Inch/Metric

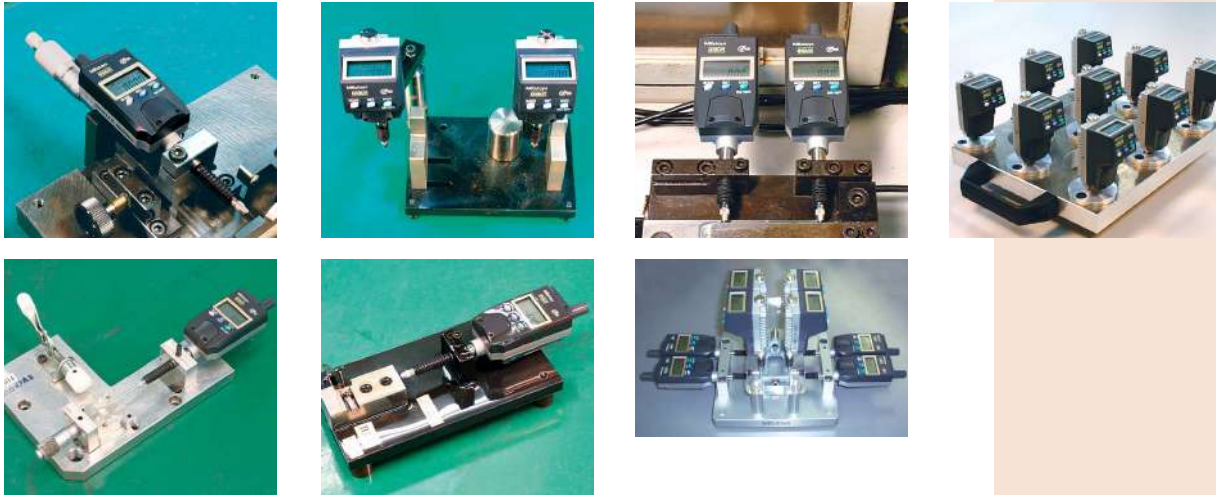
| Order No. | Range (in) | Resolution | Maximum permissible error | | | Measuring force MPL (N) | Remarks |
|-----------|------------|---|---------------------------|-----------------------------|--------------------------------|-------------------------|-------------------|
| | | | MPE _E * | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-571 | 0.5 | 0.0005 in/0.01 mm | ±0.001 in/0.02 mm | 0.001 in/0.02 mm | 0.0005 in/0.01 mm | 2.5 or less | Slim type |
| 543-581 | 0.2 | | | | | | Back Plunger type |
| 543-576 | 0.5 | 0.00005/0.0005 in 0.001/0.01 mm (selectable) | ±0.0001 in/0.003 mm | 0.0001 in/0.002 mm | 0.0001 in/0.002 mm | 2.5 or less | Slim type |
| 543-586 | 0.2 | | | | | | Back Plunger type |

* Error of indication for the total measuring range
Note: One silver oxide button cell (SR44) for monitor included

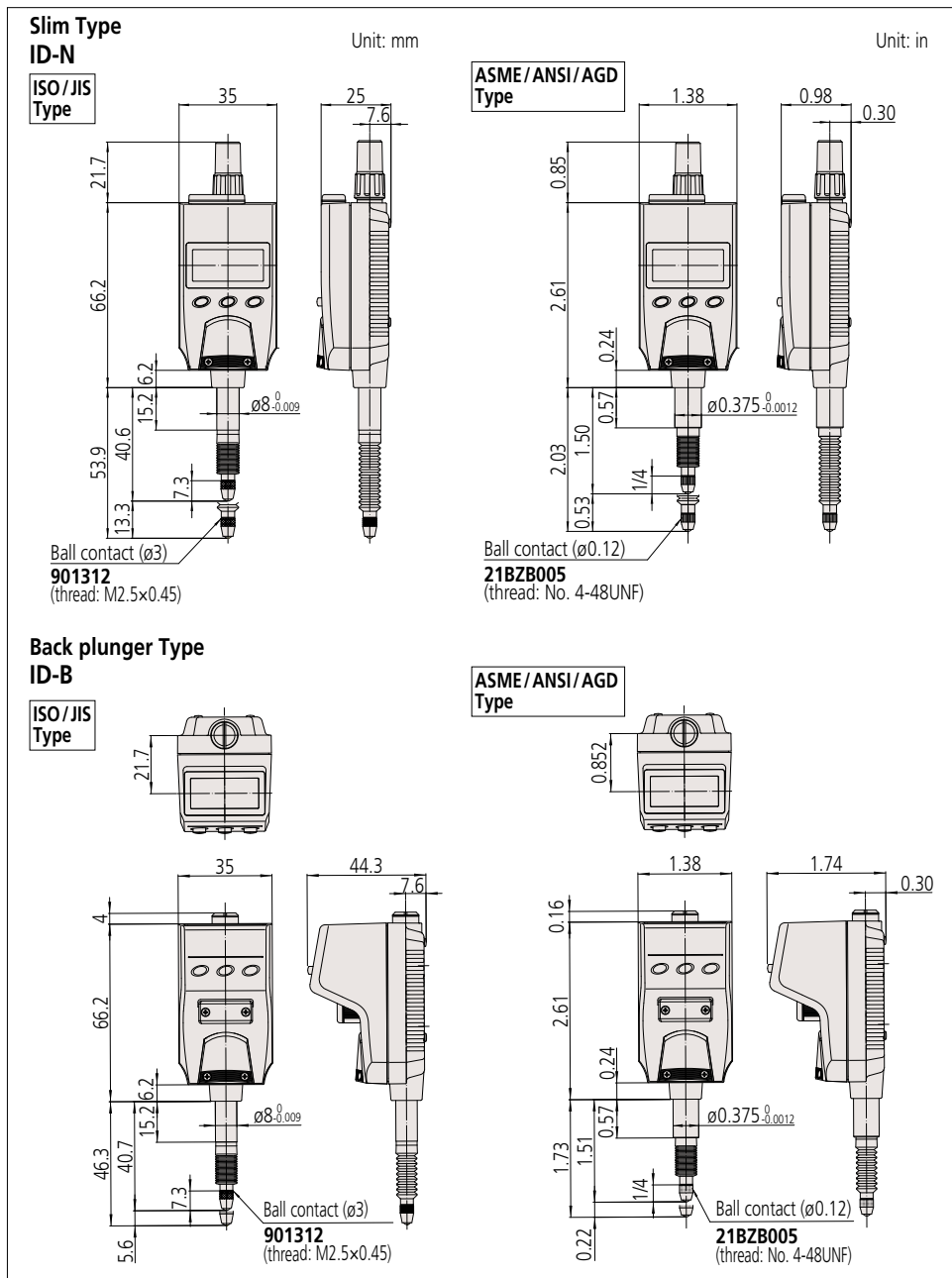
Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Typical applications



DIMENSIONS



Optional Accessories

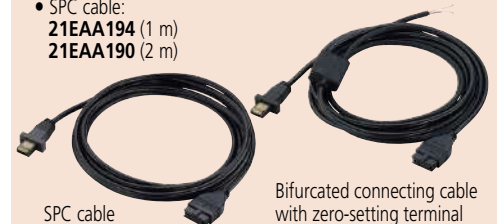
- Lifting knob (only for ID-N)
 - **21EZA105** (ISO/JIS type)
 - **21EZA150** (ASME/ANSI/AGD type)
- Spindle can be manually lifted. Remove the spindle cap for ID-N and attach the lifting knob to the spindle. Note that water resistance is not maintained in this configuration.

Typical application using the lifting knob



- Lug
 - **21EZA145** (ISO/JIS type)
 - **21EZA146** (ASME/ANSI/AGD type)
- Arm for ID-B (made-to-order)
- Rubber boot
 - For oil resistance (NBR) **21EAA423** (for ID-N)
 - 21AAB562** (for ID-B)
 - For durability (silicone) **238774** (for ID-N)
 - 21EAA212** (for ID-B)

- SPC cable:
 - 21EAA194** (1 m)
 - 21EAA190** (2 m)



- USB Input Tool Direct (2 m): **06AFM380G**
 - Input Tool Series
 - IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
 - IT-007R** (RS-232C Communication Conversion Type): **264-007** (Refer to page A-14 for details.)
 - Connecting Cables for U-WAVE-T (160 mm): **02AZD790G**
 - For foot switch: **02AZE140G** (Refer to pages A-19 to A-21 for details.)
 - Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
 - Bifurcated connecting cable with zero-setting terminal:
 - 21EAA210** (1 m)
 - 21EAA211** (2 m)
- Two of the wires inside the cable are separated for zero setting without touching the SET switch on the main body. Use these wires in combination with commercially available switches. Zero setting is performed by briefly connecting these two wires together (less than a second), and ABS preset & recall by connecting for a second or more.
- Contact points for Mitutoyo's dial indicators. (Refer to pages F-57 to F-60 for details.)



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Functions

- Peak detection (MAX/MIN)
- Runout (MAX - MIN) Hold
- Note: Peak detection
 - 1) Sampling rate: 50 readings/sec
 - 2) Capturing speed: 50 µm/sec (max.)
- Zeroret (INC system)
- Preset function (ABS system)
- Counting direction switching
- Tolerance judgment (P1, P2, P3, and INC can be stored)
- Resolution selection
- Simple calculation $f(x) = Ax$
- Analog bar resolution selection
- Key lock
- in/mm conversion (inch/mm models)
- Display hold (when no external device is connected)
- Data output
- External PC setting input
- Display rotation (330°)
- Low battery voltage alarm display
- Error alarm display

Optional Accessories

- Lifting
 - Lifting lever
 - 21EZA198 (ISO/JIS Type)
 - 21EZA199 (ASME/ANSI/AGD Type)
 - Lifting cable 21JZA295
 - Lifting knob
 - 21EZA105 (ISO/JIS Type)
 - 21EZA150 (ASME/ANSI/AGD Type)
 - SPC Cable:
 - 905338 (1 m)
 - 905409 (2 m)
 - (Refer to pages A-27 to A-29 for details.)
 - USB Input Tool Direct (2 m) : 06AFM380F
 - Input Tool Series
 - IT-016U (USB Keyboard Signal Conversion Type): 264-016-10
 - IT-007R (RS-232C Communication Conversion Type): 264-007
 - (Refer to page A-14 for details.)
 - Connecting Cables for U-WAVE-T (160 mm): 02AZD790F
 - For foot switch: 02AZE140F
 - (Refer to pages A-19 to A-21 for details.)
 - Digimatic Mini-Processor DP-1VA LOGGER: 264-505
 - Parameter setup kit: 21EZA313
- Note: Parameter setting software (can be downloaded for free from the Mitutoyo website) is also required.



Parameter setup kit

Parameter setting software



- Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
- Interchangeable backs for 2 series (Refer to page F-61 for details.)
- Measuring stands. (Refer to pages F-84 to F-91 for details.)

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Peak-Value Hold Type

- Run-out/MAX-MIN Hold function enables GO/±NG judgment*1 for peak or difference values.
- Five buttons, status icons, and clear button indications allow for easy operation of a wide variety of functions.
- Wide LCD and new analog bar graph are now standard on all models.
- The ABS (absolute) scale restores the last origin position*2 automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- By using the parameter setup kit (optional) and the dedicated software, the functions and the parameters can be configured using a computer.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)

*1 Tolerance judgment results cannot be output.
*2 Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.



543-300 / 543-300B

SPECIFICATIONS

| Metric | | ISO/JIS type | | ASME/ANSI/AGD type | | | | | |
|---------------------------------|---------------|--------------------------------|--------------------------------|--------------------------------|-----------------------------------|-------------------------|--------------|--------------------------------|-----------------|
| Order No. (w/lug, flat-back) | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) | Power supply | Battery life (normal use)*4 | Net mass (g) |
| | | | MPE _E *3 | Hysteresis MPE _H | Repeatability MPE _R | | | | |
| 543-300 | 12.7 | 0.001/ 0.01 (selectable) | 0.003 | 0.002 | 0.002 | 1.5 or less | CR2032x1 pc. | Approx. 1 year | 180 |
| 543-300B | | | | | | | | | 170 |

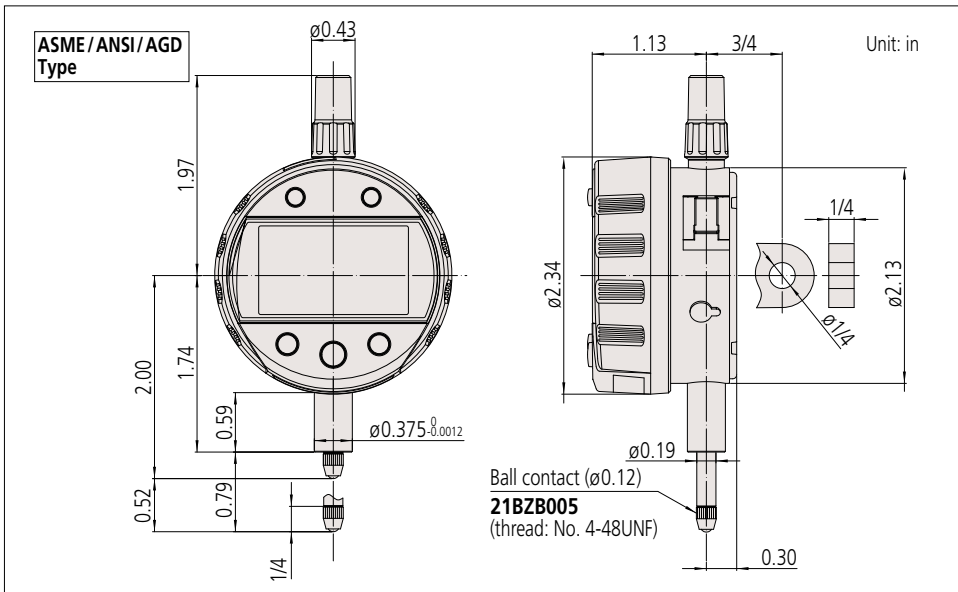
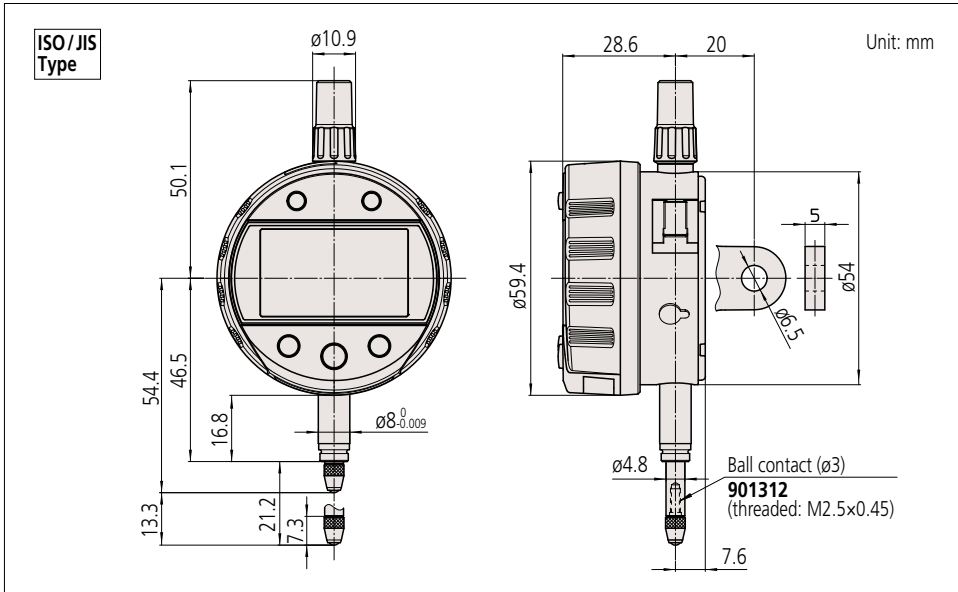
| Inch / Metric | | ISO/JIS type | | ASME/ANSI/AGD type | | | | | |
|---------------------------------|--------------------|--|---------------------------|--------------------------------|-----------------------------------|-------------------------|--------------|--------------------------------|-----------------|
| Order No. (w/lug, flat-back) | Range | Resolution | Maximum permissible error | | | Measuring force MPL (N) | Power supply | Battery life (normal use)*4 | Net mass (g) |
| | | | MPE _E *3 | Hysteresis MPE _H | Repeatability MPE _R | | | | |
| 543-301 | 0.5 in/ 12.7 mm | 0.00005/ 0.0001/ 0.0005 in, 0.001/0.01 mm (selectable) | ±0.00010 in /0.003 mm | 0.00010 in /0.002 mm | 0.00010 in /0.002 mm | 1.5 or less | CR2032x1 pc. | Approx. 1 year | 180 |
| 543-301B | | | | | | | | | 170 |
| 543-302 | | | | | | | | | 195 |
| 543-302B | | | | | | | | | 170 |

*3 Error of indication for the total measuring range
*4 Applies only if not connected to a data processor. Battery life depends on use of the indicator. Use the above value as a guide only. Note: Products with an Order No. suffixed "B" have a flat back.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS





An inspection certificate is supplied as standard. Refer to page U-11 for details.

Functions

- Minimum value detection
- Note: Peak detection
 - 1) Sampling rate: 50 readings/sec
 - 2) Capturing speed: 50 μm/sec (max.)
- Preset (3 Preset values can be stored)
- Tolerance judgment (3 sets of upper and lower limits can be stored)
- Resolution selection
- Analog bar resolution selection
- Key lock
- Display hold (when no external device is connected)
- Data saving/calling (when no external device is connected)
- Data output
- External PC setting input
- Display rotation (330°)
- Low battery voltage alarm display
- Error alarm display

Optional Accessories

- SPC Cable:
 - 905338 (1 m)
 - 905409 (2 m)
 (Refer to pages A-27 to A-29 for details.)
 - USB Input Tool Direct (2 m): 06AFM380F
 - Input Tool Series
 - IT-016U (USB Keyboard Signal Conversion Type): 264-016-10
 - IT-007R (RS-232C Communication Conversion Type): 264-007
 (Refer to page A-14 for details.)
 - Connecting Cables for U-WAVE-T (160 mm): 02AZD790F
 - For foot switch: 02AZE140F
 (Refer to pages A-19 to A-21 for details.)
 - Digimatic Mini-Processor DP-1VA LOGGER: 264-505
 - Parameter setup kit: 21EZA313
- Note: Parameter setting software (can be downloaded for free from the Mitutoyo website) is also required.

The ABSOLUTE Digimatic Bore Gage



ABSOLUTE Digimatic Bore Gages, which integrate the display with a bore gage measuring unit, are also available. Refer to pages C-43 and C-44 for details.



Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Bore Gage Type

- Dedicated to inside measurement with minimum-value Hold and tolerance judgment functions*1. Use together with a Mitutoyo bore gage (refer to pages C-27 to C-42 for details).
 - Five buttons, status icons, and clear button indications allow for easy operation of a wide variety of functions.
 - Wide LCD and new analog bar graph are now standard on all models.
 - Can store up to three sets of master reference values and tolerances, alleviating the need for multiple settings to master gages.
 - The ABS (absolute) scale restores the last origin position*2 automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
 - By using the parameter setup kit (optional) and the dedicated software, the functions and the parameters can be configured using a computer.
 - Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)
- *1 Tolerance judgment results cannot be output.
*2 Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.



543-310B
Typical application
The Bore Gage
is optional.

SPECIFICATIONS

| Metric | | ISO/JIS type | | ASME/ANSI/AGD type | | | | | |
|-----------|------------|-------------------------|--------------------------------|-----------------------------|--------------------------------|-------------------------|---------------|-----------------------------|--------------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) | Power supply | Battery life (normal use)*4 | Net mass (g) |
| | | | MPE _E *3 | Hysteresis MPE _H | Repeatability MPE _R | | | | |
| 543-310B | 12.7 | 0.001/0.01 (selectable) | 0.003 | 0.002 | 0.002 | 1.5 or less | CR2032 x1 pc. | Approx. 1 year | 170 |

| Inch / Metric | | ISO/JIS type | | ASME/ANSI/AGD type | | | | | |
|---------------|--------------------|---|---------------------------|-----------------------------|--------------------------------|-------------------------|---------------|-----------------------------|--------------|
| Order No. | Range | Resolution | Maximum permissible error | | | Measuring force MPL (N) | Power supply | Battery life (normal use)*4 | Net mass (g) |
| | | | MPE _E *3 | Hysteresis MPE _H | Repeatability MPE _R | | | | |
| 543-311B | 0.5 in/ 12.7 mm | 0.00005/0.0001/ 0.0005 in, 0.001/0.01 mm (selectable) | ±0.00010 in /0.003 mm | 0.00010 in /0.002 mm | 0.00010 in /0.002 mm | 1.5 or less | CR2032 x1 pc. | Approx. 1 year | 170 |
| 543-312B | | | | | | | | | |

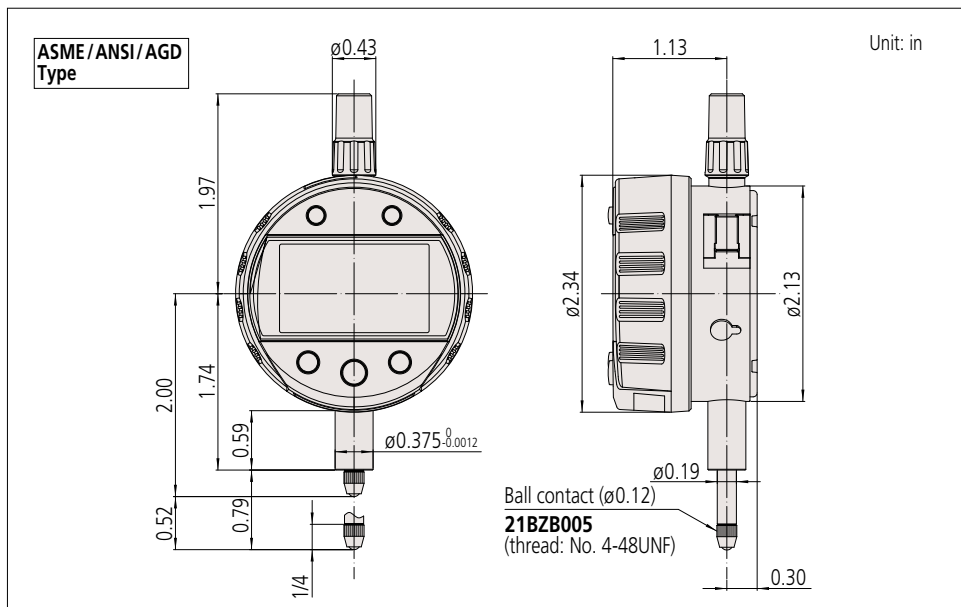
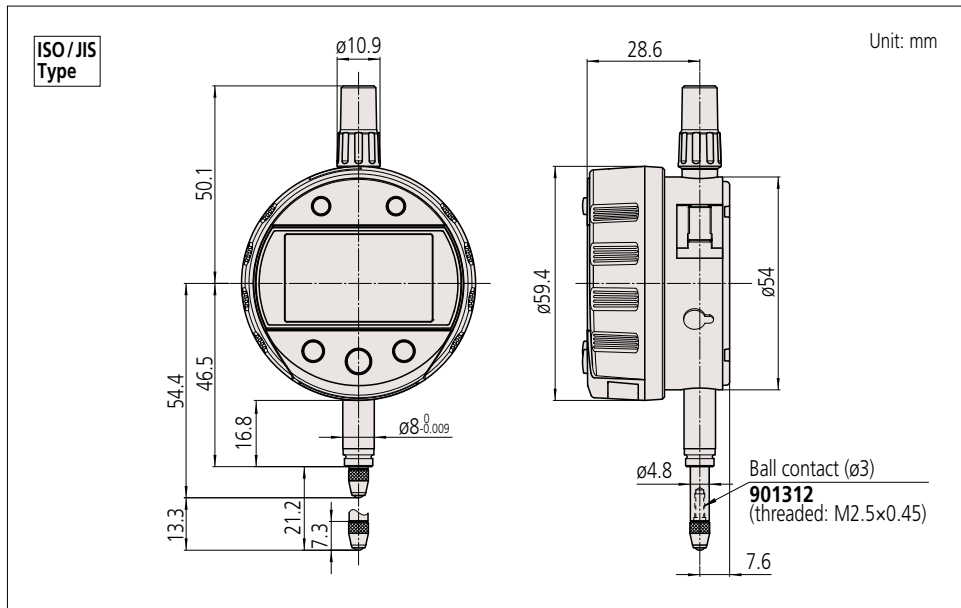
*3 Error of indication for the total measuring range

*4 Applies only if not connected to a data processor. Battery life depends on use of the indicator. Use the above value as a guide only.
Note: Flat back type only.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS





An inspection certificate is supplied as standard. Refer to page U-11 for details.

Functions

- Calculation function $f(x') = Ax' + B + Cx'^{-1}$ ($x' = x + \text{offset}$)
- Peak detection (MAX/MIN)
- Runout (MAX - MIN) Hold
Note: Peak detection
 - 1) Sampling rate: 10 readings/sec
 - 2) Capturing speed: 10 $\mu\text{m}/\text{sec}$ (max.)
- Settings can be changed to:
 - 1) Sampling rate: 50 readings/sec
 - 2) Capturing speed: 50 $\mu\text{m}/\text{sec}$ (max.)
- Zero-setting (INC system)
- Preset (ABS system)
- Tolerance judgment (P1, P2, P3, and INC can be stored)
- Analog bar resolution selectable
- Key lock
- Display hold (when no external device is connected)
- Data output
- External PC setting input
- Display rotation (330°)
- Low battery voltage alarm display
- Error alarm display
- Resolution switching*

| Resolution (mm) | | | Resolution (in) | | |
|-----------------|-------|-----|-----------------|--------|-------|
| 0.0002 | 0.005 | 0.1 | 0.00001 | 0.0002 | 0.005 |
| 0.0005 | 0.01 | 0.2 | 0.00002 | 0.0005 | 0.01 |
| 0.001 | 0.02 | 0.5 | 0.00005 | 0.001 | 0.02 |
| 0.002 | 0.05 | 1 | 0.0001 | 0.002 | 0.05 |

* Since the calculation resolution is one micrometer (0.001 mm), using sub-micrometer resolution settings may result in the 4th-place digit being unreliable, particularly when B is set to a very low value and C=0. It does not change at all with certain combinations of calculation coefficient (for example, A=1, B=C=0). The 3rd-place digit representing micrometers (if displayed) is always reliable.

Optional Accessories

- Lifting
 - Lifting lever **21EZA198** (ISO/JIS Type), **21EZA199** (ASME/ANSI/AGD Type)
 - Lifting knob **21EZA105** (ISO/JIS Type), **21EZA150** (ASME/ANSI/AGD Type)
 - Lifting cable **21JZA295**
 - SPC Cable:
 - 905338** (1 m)
 - 905409** (2 m)
 (Refer to pages A-27 to A-29 for details.)
 - USB Input Tool Direct (2 m): **06AFM380F**
 - Input Tool Series
 - IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
 - IT-007R** (RS-232C Communication Conversion Type): **264-007**
 (Refer to page A-14 for details.)
 - Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790F**
For foot switch: **02AZE140F**
(Refer to pages A-19 to A-21 for details.)
 - Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
 - Parameter setup kit: **21EZA313**
- Note: Parameter setting software (can be downloaded for free from the Mitutoyo website) is also required.
- Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
 - Measuring stands (Refer to pages F-84 to F-91 for details.)

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Calculation Type

- Calculation function operates on spindle displacement. Entering the appropriate formula factors for a fixture dedicated to the application enables direct measurement readout, thereby eliminating any need for the conversion tables previously needed for those applications where fixtures are typically used.
- Five buttons, status icons, and clear button indications allow for easy operation of a wide variety of functions.
- Wide LCD and new analog bar graph are now standard on all models.
- The ABS (absolute) scale restores the last origin position*¹ automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- By using the parameter setup kit (optional) and the dedicated software, the functions and the parameters can be configured using a computer.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)

*¹ Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.



543-342B

SPECIFICATIONS

| Metric | | | | | | | ISO/JIS type | ASME/ANSI/AGD type | | | |
|-----------------|------------|-------------------------|--|-----------------------------|--------------------------------|-------------------------|--------------|---|--------------|---------------------------|-----|
| Order No. | Range (mm) | Resolution (selectable) | Maximum permissible error* ² (mm) | | | Measuring force MPL (N) | Power supply | Battery life (normal use)* ⁵ | Net mass (g) | | |
| | | | MPE _E * ³ | Hysteresis MPE _H | Repeatability MPE _R | | | | | | |
| 543-340B | 12.7 | 12 steps* ⁵ | 0.003 | 0.002 | 0.002 | 1.5 or less | CR2032x1 pc. | Approx. 1 year | 170 | | |
| 543-590B | 25.4 | | | | | | | | | 1.8 or less* ⁴ | 190 |
| 543-595B | 50.8 | | | | | | | | | 2.3 or less* ⁴ | 260 |
| Inch / Metric | | | | | | | | | | | |
| Order No. | Range | Resolution (selectable) | Maximum permissible error* ² | | | Measuring force MPL (N) | Power supply | Battery life (normal use)* ⁵ | Net mass (g) | | |
| | | | MPE _E * ³ | Hysteresis MPE _H | Repeatability MPE _R | | | | | | |
| 543-341B | 0.5 in | 12 steps* ⁵ | ±0.0001 in / 0.003 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 1.5 or less | CR2032x1 pc. | Approx. 1 year | 170 | | |
| 543-342B | /12.7 mm | | | | | | | | | 1.8 or less* ⁴ | 190 |
| 543-591B | 1 in | | | | | | | | | 2.3 or less* ⁴ | 260 |
| 543-592B | /25.4 mm | | | | | | | | | | |
| 543-596B | 2 in | | | | | | | | | | |
| 543-597B | /50.8 mm | | | | | | | | | | |

*² Valid for resolution set to 0.001 mm/0.00005 in and coefficients A=1, B=0 and C=0.

*³ Error of indication for the total measuring range

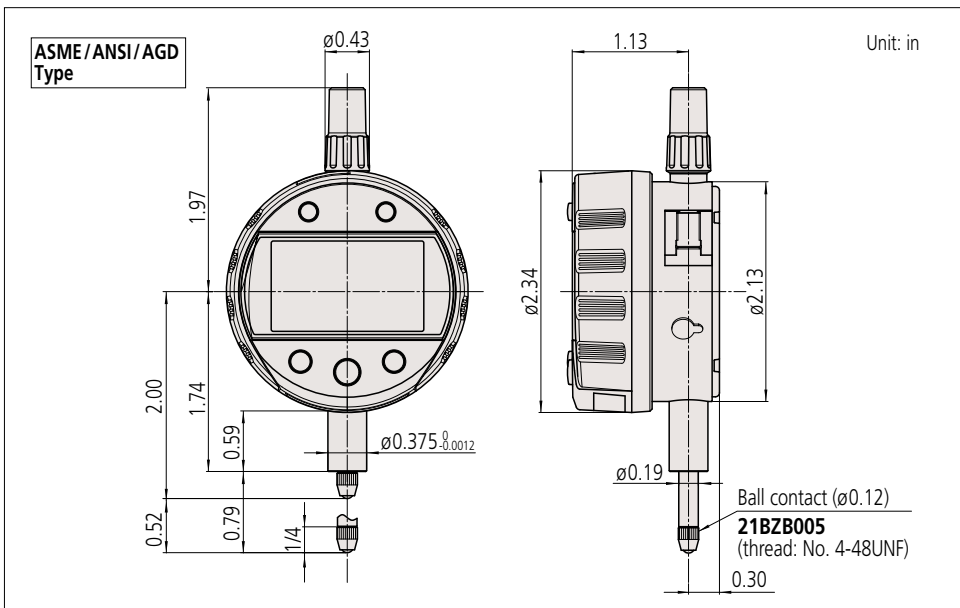
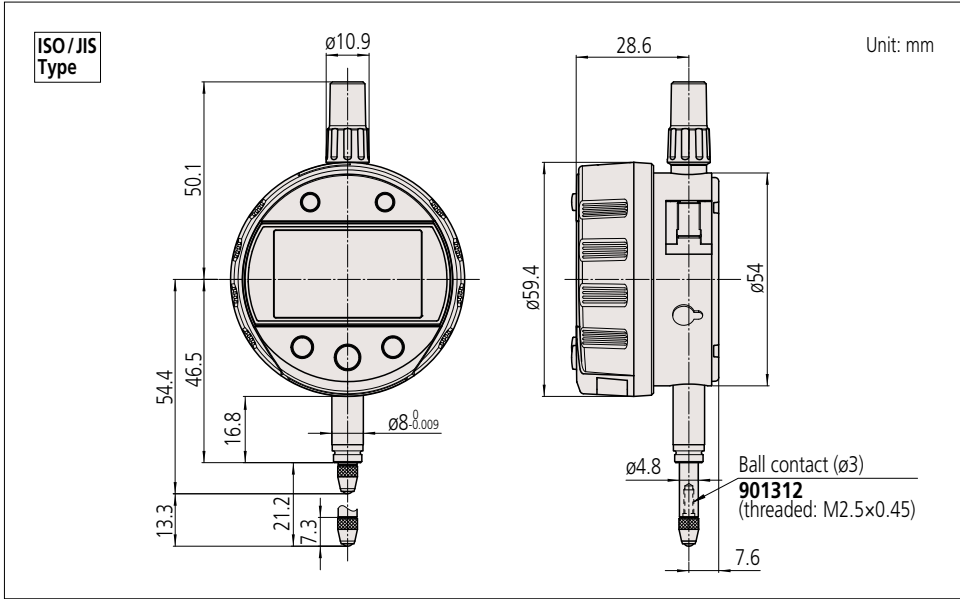
*⁴ Applies for a spindle orientation between the spindle pointing vertically downward to the spindle horizontal.

*⁵ Applies only if not connected to a data processor. Battery life depends on use of the indicator. Use the above value as a guide only. Note: Flat back type only.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



Typical applications



Examples of measuring various features

| Item | D=Countersink diameter/Groove width; H=Countersink depth/Groove depth | | | R=Outside radius of round object | | R=Inside radius of round object | R=Outside radius of round object | | |
|--|---|----------------------------|---|--|----------------------------|--|----------------------------------|---------------------------------|-----------------|
| Fixture type*1 | | | | | | | | | |
| Contact point | Cone | Ball | Cone | — | | | | | |
| Measuring method x: Spindle displacement | | | | | | | | | |
| Calculation | D=Ax | D=Ax+B | H=Ax+B | D=Ax | R=Ax | R=Ax+B+Cx ⁻¹ | | R=A(x+d)+B+C(x+d) ⁻¹ | |
| Coefficient values | A | $-2 \tan \frac{\theta}{2}$ | $-2 \tan \frac{\theta}{2}$ | -1 | $-2 \tan \frac{\theta}{2}$ | $-\frac{\sin \frac{\theta}{2}}{1 - \sin \frac{\theta}{2}}$ | $\frac{1}{2}$ | $-\frac{1}{2}$ | $\frac{1}{2}$ |
| | B | 0 | $2r \left(\frac{1}{\cos \frac{\theta}{2}} - \tan \frac{\theta}{2} \right)$ | $r \left(\frac{1}{\sin \frac{\theta}{2}} - 1 \right) - \frac{d}{2 \tan \frac{\theta}{2}}$ | 0 | 0 | -r | r | -r |
| | C | 0 | 0 | 0 | 0 | 0 | $\frac{L^2}{2}$ | $-\frac{L^2}{2}$ | $\frac{L^2}{2}$ |
| Origin offset value (function ON/OFF) | d (OFF) | 0 (OFF) | 0 (OFF) | 0 (OFF) | 0 (OFF) | 0 (OFF) | 0 (OFF) | 0 (OFF) | d (ON) |
| ORIGIN-set position (x=0 position) | | | | | | | | | |
| Displayed measurement value at ORIGIN-set position (Value displayed when x=0) | 0 | Value of coefficient B | 0 | 0 | 0 | Err 30*2 (Overflow error of Display value) | | Depends on value of d | |

*1 A dedicated fixture for a workpiece can be made to order.

*2 The error is cleared when the measured value returns to the displayable range as a result of moving the spindle.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Signal Output Function Type

- Enables a tolerance judgment to be output to external equipment for a measurement result against user-defined limits. Solid-state switching provides high reliability by avoiding metallic switch contacts.
- Output is enabled by directly connecting to external devices (sequencers, etc., for which a logical invert is available if required). The measurement and judgment results are displayed on the LCD. The judgment result is also indicated by 2 LEDs.
- A peak-detection function is equipped for measuring and judging peak values, such as runout.
- Positional detection is absolute (ABS system) relative to a set origin point*1 that does not need to be reset every time power is turned on. Furthermore, the ABS system ensures that overspeed errors do not occur.
- Provided with a 4 m cable.
- External power supply required is 5-24 VDC / 100 mA (max.).
- Dust-water protection level: Conforms to IP54.

*1 Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.



543-350



SPECIFICATIONS

Metric ISO/JIS type ASME/ANSI/AGD type

| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) | Net mass (g) |
|-----------|------------|-------------------------|--------------------------------|-----------------------------|--------------------------------|-------------------------|--------------|
| | | | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-350 | 12.7 | 0.001/0.01 (selectable) | 0.003 | 0.002 | 0.002 | 2.5 or less | 290 |
| 543-350B | | | | | | | 285 |

Inch/Metric

| Order No. | Range | Resolution | Maximum permissible error | | | Measuring force MPL (N) | Net mass (g) |
|-----------|------------------|--|---------------------------|-----------------------------|--------------------------------|-------------------------|--------------|
| | | | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-351 | 0.5 in / 12.7 mm | 0.00005/0.0001 / 0.0005 in, / 0.001/0.01 mm (selectable) | ±0.00010 in / 0.003 mm | 0.0001 in / 0.002 mm | 0.0001 in / 0.002 mm | 2.5 or less | 295 |
| 543-351B | | | | | | | 285 |
| 543-352 | | | | | | | 295 |
| 543-352B | | | | | | | 285 |

*2 Error of indication for the total measuring range

Note 1: LCD readout does not rotate.

Note 2: MAX/MIN holding: sample rate is 100 readings/s; max. rate of change of reading is 100 μm/s or less.

Note 3: Products with an Order No. suffixed "B" have a flat back

Note 4: Standard contact point: 901312 (ISO/JIS type), 21B2B005 (ANSI/AGD type)

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Functions

- Signal output (-NG/OK/+NG, N-ch open drain, logical invert is available)
- Remote control (peak start preset/zero-set)
- Peak detection (MAX/MIN)
- Runout range measurement (MAX - MIN)
- Zero-setting (INC system)
- Presetting (ABS system)
- Direction switching
- Tolerance judgment (3 pairs of ABS, INC memory function)
- Resolution switching
- Calculation: f(x) = Ax
- Key lock
- Calibration mode (Signal output in Digimatic code format)
- Error alarm display

Optional Accessories

- Lifting*1
 - Lifting lever **21EZA198** (ISO/JIS Type), **21EZA199** (ASME/ANSI/AGD Type)
 - Lifting cable **21JZA295**
 - Lifting knob **21EZA105** (ISO/JIS Type), **21EZA150** (ASME/ANSI/AGD Type)
 - Digimatic power supply unit: **21EZA345**
 - To denote your AC power cable add the following suffixes to the order No.: **A** for UL/CSA, **D** for CEE, **DC** for CCC, **E** for KC. **No suffix** is required for JIS/100VAC.
 - Used in the calibration mode when executing automatic inspection using i-Checker **IC2000**.
 - In such a case, purchase connecting cable **21EAA194** (1 m), or **21EAA190** (2 m).
- Note: It can't be used as a power supply when using in the normal mode.
- Contact points for Mitutoyo's dial indicators.*2
 - Measuring stands (Refer to pages F-84 to F-91 for details.)
- *1 Dust-water protection is not guaranteed.
*2 Refer to pages F-57 to F-60 for details.

Output signals and LCD display

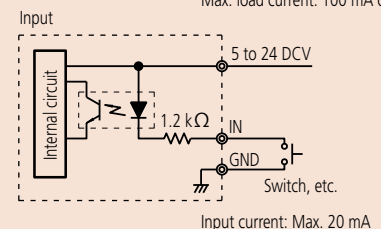
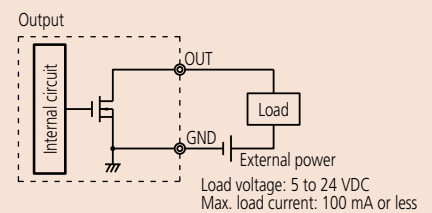
| Wire | - NG | OK | + NG | ABS data composition error |
|---------------|------|-------|------|----------------------------|
| Orange (- NG) | Low | High | High | High |
| Green (OK) | High | Low | High | High |
| Brown (+ NG) | High | High | Low | High |
| LED | Red | Green | Red | Red flashing |
| LCD | ◀ | ○ | ▶ | "x.xxE" indication |

Note: Logical invert is available.

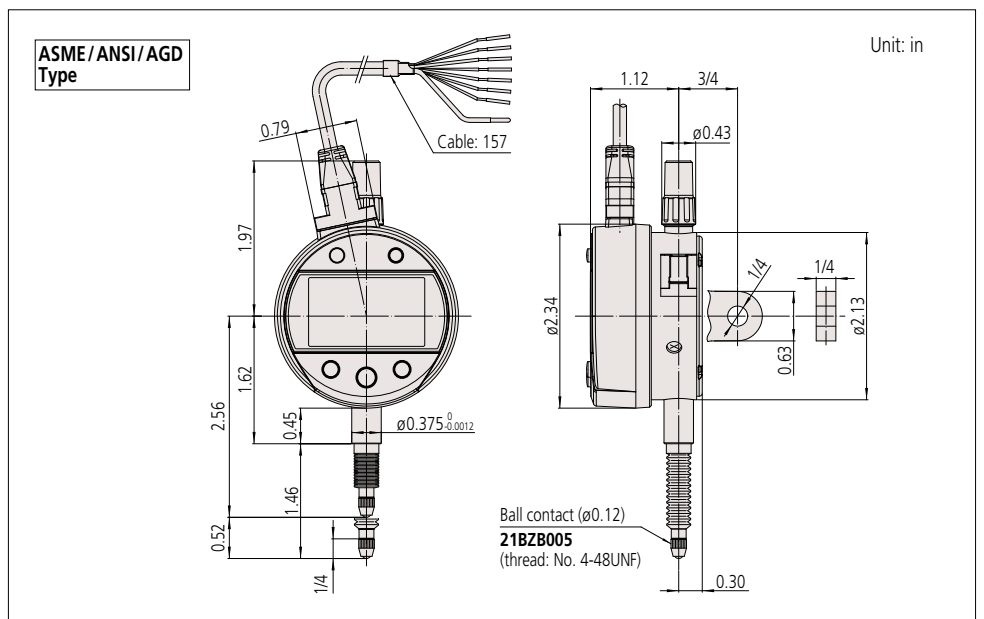
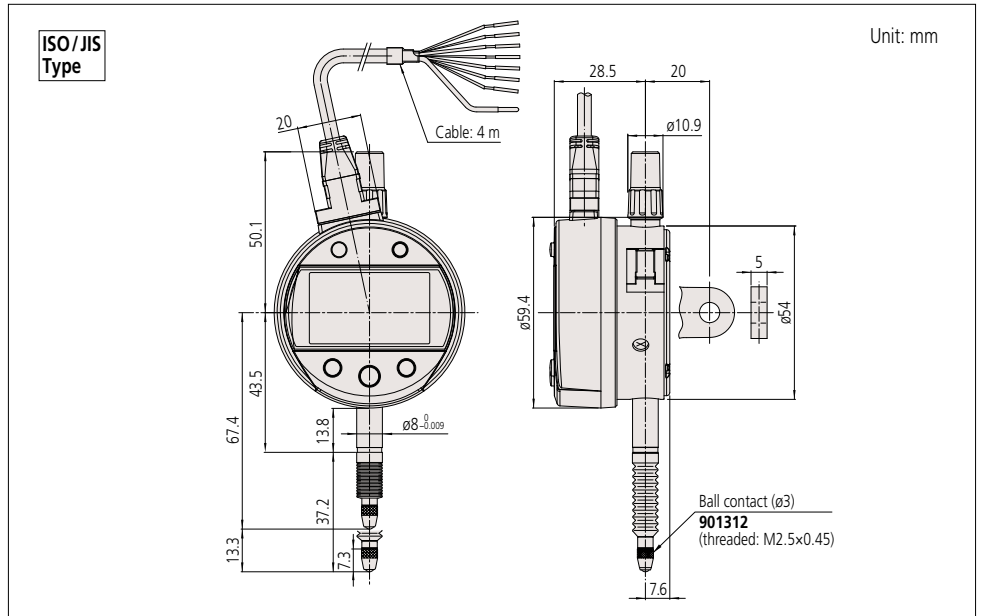
I/O Specifications

| Wire | Signal | I/O | Description |
|--------|--------------------|-----|---|
| Black | - V (GND) | — | Connected to minus (-) terminal |
| Red | + V | — | Power supply (5 to 24VDC) |
| Orange | - NG | O | Tolerance judgment |
| Green | OK | O | result output: Only the terminal corresponding to a judgment result is set to the low level. |
| Brown | + NG | O | |
| Yellow | PRESET_RECALL ZERO | I | External input terminal: If the relevant terminal is set to the low level, its signal becomes true. |
| Blue | PEAK_START | I | |
| Shield | FG | — | Connected to GND (Earth) |

Note: Measurement data cannot be output.



DIMENSIONS



Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-U SERIES 575 — Slim and Economical Design

- General-purpose indicator with a measuring range of 25.4 mm and a resolution of 0.01 mm.
- Cost-effective and user-friendly type which is equipped with only the basic functions necessary.
- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Battery life of approx. 20,000 hours in continuous use has been achieved.
- Easy-to-read large LCD readout with a character height of 8 mm.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)

* Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

General-purpose type



575-121

SPECIFICATIONS

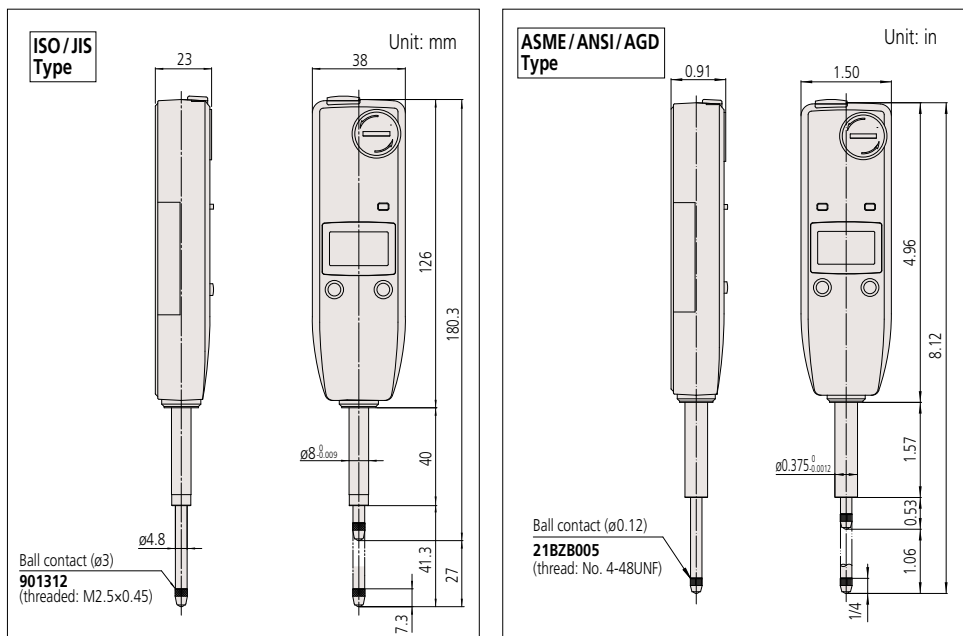
| Metric | | | | | | |
|-----------|------------|-----------------|--------------------------------|-----------------------------|--------------------------------|-------------------------|
| Order No. | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) |
| | | | MPE _E * | Hysteresis MPE _H | Repeatability MPE _R | |
| 575-121 | 25.4 | 0.01 | 0.02 | 0.02 | 0.01 | 1.8 or less |

□ ISO/JIS type □ ASME/ANSI/AGD type

| Inch/Metric | | | | | | |
|-------------|---------|------------|---------------------------|-----------------------------|--------------------------------|-------------------------|
| Order No. | Range | Resolution | Maximum permissible error | | | Measuring force MPL (N) |
| | | | MPE _E * | Hysteresis MPE _H | Repeatability MPE _R | |
| 575-122 | 1 in/ | 0.0005 in/ | ±0.001 in/0.02 mm | 0.001 in/ | 0.0005 in/ | 1.8 or less |
| 575-123 | 25.4 mm | 0.01 mm | | | | |

* Error of indication for the total measuring range

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

ABSOLUTE[™]



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

- Display: 5-digit LCD, sign
 - Battery: SR44 (1 pc.), **938882** for initial operational checks (standard accessory)
 - Battery life: Approx. 20,000 hours of continuous use. Approx. 5 years under normal use.
- Note: It varies depending on use frequency and method. Please take the values as rough indications.
- Lifting lever: **137693**

Function

- Origin set (Zero-setting)
- Direction switching
- Data output
- Low battery voltage alarm display
- Error alarm display

Optional Accessories

- Spindle lifting cable (stroke: 10 mm): **21JZA295**
 - Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
 - SPC Cable: **905338** (1 m) **905409** (2 m) (Refer to pages A-27 to A-29 for details.)
 - USB Input Tool Direct (2 m): **06AFM380F**
- Note: Please separately purchase **USB-ITPAK** since there is no data output switch on the measurement instrument. Refer to pages A-13, A-22 to A-24 for details.
- Input Tool Series **IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
 - Input Tool Series **IT-007R** (RS-232C Communication Conversion Type): **264-007** (Refer to page A-14 for details.)
 - Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790F**
 - For foot switch: **02AZE140F**
 - Refer to pages A-19 to A-21 for details.
 - Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
 - Measuring stands (Refer to pages F-84 to F-91 for details.)



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Technical Data

- Display: 7-digit LCD, sign, and analog bar with 2-color backlight
- Power supply: 6 V DC (via AC adapter) **06AFZ950***
- * To denote your AC power cable add the following suffixes to the order No.: **JA** for UL/CSA and PSE, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC, **No suffix** is required for JIS/100 V
- Positional detection method: Photoelectric-type reflection linear encoder
- Maximum response speed: 1000 mm/s
- Lifting lever: **137693**

Optional Accessories

- Remote controller: **21EZA099**
- Lifting
 - Lifting cable: **21JZA295** (stroke 30 mm)
 - Lifting knob: **21EZA101**
- SPC Cable:
 - 936937** (1 m)
 - 965014** (2 m)
 - (Refer to pages A-27 to A-29 for details.)
- USB Input Tool Direct (2 m): **06AFM380D**
- Input Tool Series
 - IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
 - IT-007R** (RS-232C Communication Conversion Type): **264-007**
 - (Refer to page A-14 for details.)
- Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790D**
- For foot switch: **02AZE140D**
- (Refer to pages A-19 to A-21 for details.)
- RS-232C Connecting cable (2 m): **21EAA131**
- Lug-on-center back:
 - 101040** (ISO/JIS type)
 - 101306** (ASME/ANSI/AGD type)
- Contact points for Mitutoyo's dial indicators (Refer to pages F-57 to F-60 for details.)
- Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**
- Granite comparator stands (Refer to page F-88 for details.)
- Comparator stands (Refer to page F-90 for details.)

Comparator stand
215-505-10



Remote controller

Lifting cable



Lifting knob

Digimatic Indicator ID-H SERIES 543 — High Accuracy and High Functionality Type

- A top-level digital indicator that supports high accuracy and multi-functional measurement.
- Take advantage of its high accuracy backed up by 0.0005 mm/0.00002 inch resolution, remote control functionality via a handheld controller (or an RS-232C interface) and easy runout measurements with the well-established analog bar display.
- Functionality meets the needs of diverse measurement applications.

Tolerance judgment

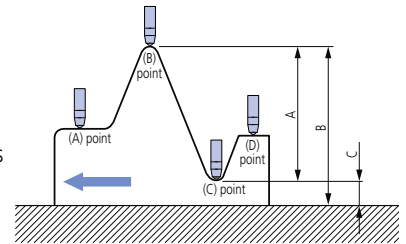


- Measuring maximum value, minimum value and runout (MAX - MIN)

Maximum value/minimum value measurement Difference/runout measurement



Example: Indicator traces between points <A> to <D>
Difference (or Total Runout) is displayed as <A>. Dimensions (maximum value) and <C> (minimum value) can be retrieved from memory with a simple key sequence or using the remote control (optional).



- With the optional remote controller, operations such as zero-setting and presetting can be made without touching the indicator body, thereby avoiding disturbance to the set-up.
- An advanced, remote control system can be implemented with the built-in RS-232C interface and a PC.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)



Remote controller (optional)



543-561



543-563

Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SPECIFICATIONS

| Metric | | | | | | | |
|-------------|------------|----------------------------------|--------------------------------|-----------------------------|--------------------------------|-------------------------|--------------|
| Order No.*1 | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) | Net mass (g) |
| | | | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-561 | 30.4 | 0.0005/ 0.001 (selectable) | 0.0015 | 0.0015 | 0.001 | 2.0 or less | 290 |
| 543-563 | 60.9 | | 0.0025 | 0.0025 | | 2.5 or less | 305 |

| Inch / Metric | | | | | | | |
|---------------|------------------|---|---------------------------|-----------------------------|--------------------------------|-------------------------|--------------|
| Order No.*1 | Range | Resolution | Maximum permissible error | | | Measuring force MPL (N) | Net mass (g) |
| | | | MPE _E *2 | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-562 | 1.2 in / 30.4 mm | 0.00002/ 0.00005/ 0.0001 in, 0.0005/ 0.001 mm (selectable) | ±0.00006 in/ 0.0015 mm | 0.00006 in/ 0.0015 mm | 0.00004 in/ 0.001 mm | 2.0 or less | 300 |
| 543-564 | 2.4 in / 60.9 mm | | ±0.0001 in/ 0.0025 mm | 0.0001 in/ 0.0025 mm | | 2.5 or less | |

*1 To denote your AC power cable add the following suffixes to the order No.: **A** for UL/CSA, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC, **No suffix** is required for JIS/100 V

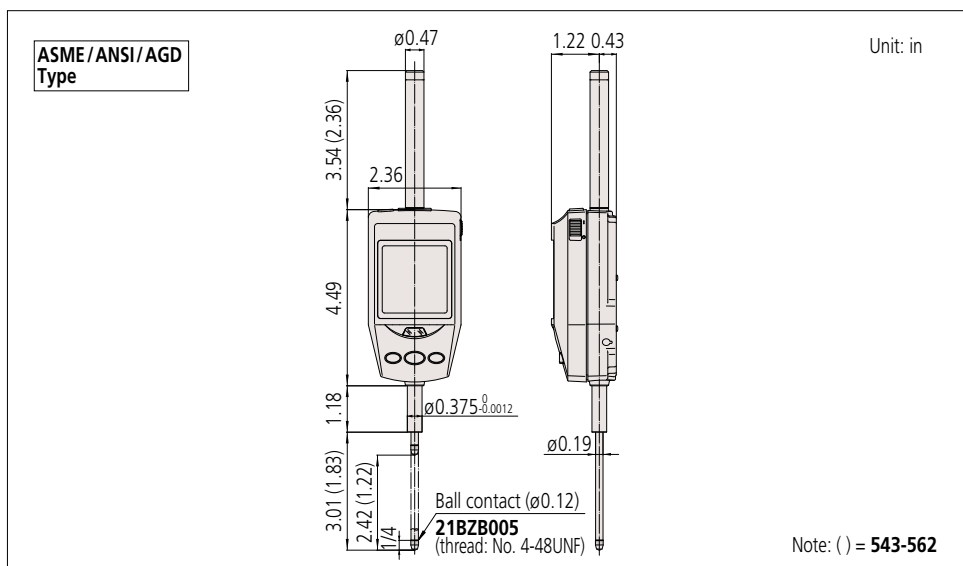
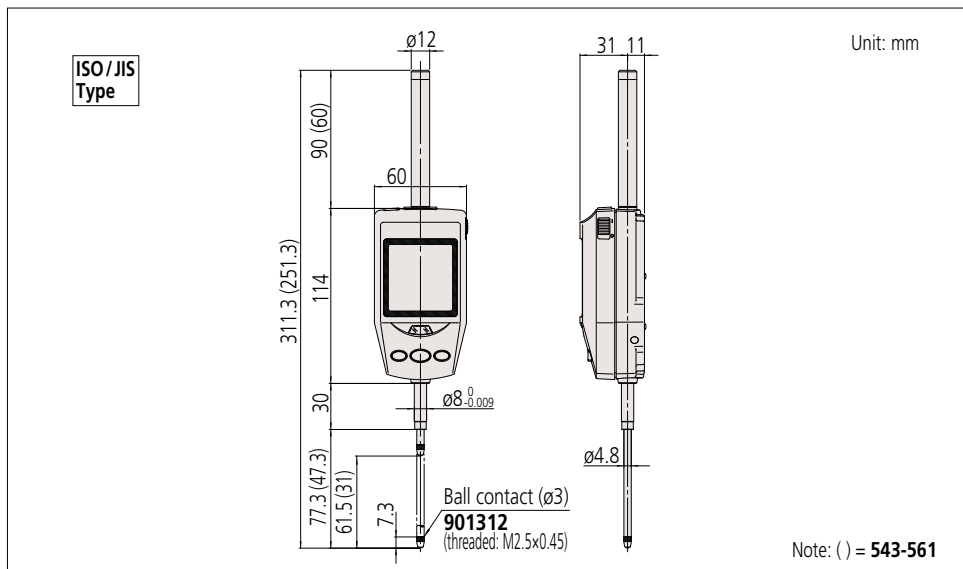
*2 Error of indication for the total measuring range

Note 1: The indicator can output SPC (Digimatic) data consisting of up to 6 digits in full. If the data consists of 7 digits the first digit is not output (example: 123.4565 mm is output as 23.4565 mm).

Note 2: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

Note 3: The orientation for use can be from vertical (contact point pointing downward) to horizontal (spindle in horizontal orientation).

DIMENSIONS





An inspection certificate is supplied as standard. Refer to page U-11 for details.

Technical Data

- Display: 6-digit LCD, sign, and analog bar with 2-color backlight
- Power supply: 9 VDC, 1.2 A (via AC adapter) **06AGC585*1**
- *1 To denote your AC power cable add the following suffixes to the order No.: **JA** for UL/CSA and PSE, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC
- Lifting lever: **137693**

Functions

- Max/Min value hold
- Runout measurement (MAX - MIN)
- Zero-setting (INC system)
- Presetting (ABS system)
- Direction switching
- Tolerance judgment
- Digital display switching (0.01 mm ↔ 0.001 mm)
- Analog resolution selection (±0.02, ±0.04, ±0.1, ±0.2, ±0.4 mm)
- Function Lock
- Data output
- Error alarm display

Optional Accessories

- Lifting cable: **21JZA295** (stroke 25.4 mm)
- Lug-on-center back: **101040** (ISO/JIS type) **101306** (ASME/ANSI/AGD type)
- Auxiliary spindle spring: **02ACA571** (25.4 mm/1 inch models) **02ACA773** (50.8 mm/2 inch models)
- SPC cable: **936937** (1 m) **965014** (2 m)

(Refer to pages A-27 to A-29 for details.)
• USB Input Tool Direct (2 m): **06AFM380D**
Note: Please separately purchase **USB-ITPAK** since there is no data output switch on the measurement instrument. (Refer to pages A-13 and A-22 to A-24 for details.)

- Input Tool Series
- IT-016U** (USB Keyboard Signal Conversion Type): **264-016-10**
- IT-007R** (RS-232C Communication Conversion Type): **264-007**
- (Refer to page A-14 for details.)
- Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790D**
- For foot switch: **02AZE140D**
- (Refer to pages A-19 to A-21 for details.)
- Contact points for Mitutoyo's dial indicators*3
- Interchangeable backs for SERIES 2 models*4
- Digimatic Mini-Processor **DP-1VA LOGGER: 264-505**
- Measuring stands*5
- *3 Refer to pages F-57 to F-60 for details.
- *4 Refer to page F-61 for details.
- *5 Refer to pages F-84 to F-91 for details.

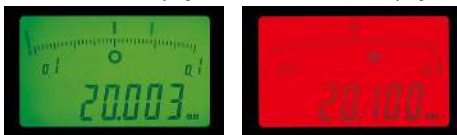
Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ABSOLUTE Digimatic Indicator ID-F SERIES 543 — with Back-lit LCD Screen

- Multi-functional.
- GO/±NG judgment function: If a judgment result shows an out of tolerance condition, the display backlighting changes from green to red.

Green indication for GO judgment Red indication for ±NG judgment



- An analog bar indicator has been integrated to make upper/lower limit and turnover point reading more comfortable.
- The ABS (absolute) scale restores the last origin position*1 automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Easy-to-read large LCD readout with the character height of 8.5 mm.

*1 Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page F-25.

- External power supply type: an AC adapter is a standard accessory. Does not require battery replacement.
- The resolution can be switched between 0.001 mm/0.01 mm (or 0.001 in/0.0005 in/0.0001 in/0.00005 in).
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to page A-3)

Multi-functional model



SPECIFICATIONS

| Order No.*2 | Range (mm) | Resolution (mm) | Maximum permissible error (mm) | | | Measuring force MPL (N) | Net mass (g) |
|-------------|------------|-----------------|--------------------------------|-----------------------------|--------------------------------|-------------------------|--------------|
| | | | MPE _E *3 | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-551 | 25.4 | 0.001/0.001 | 0.003 | 0.002 | 0.002 | 1.8 or less | Approx. 240 |
| 543-557 | 50.8 | 0.01 | 0.003 | | | 2.3 or less | |
| 543-553 | 50.8 | (selectable) | 0.006 | | | | |

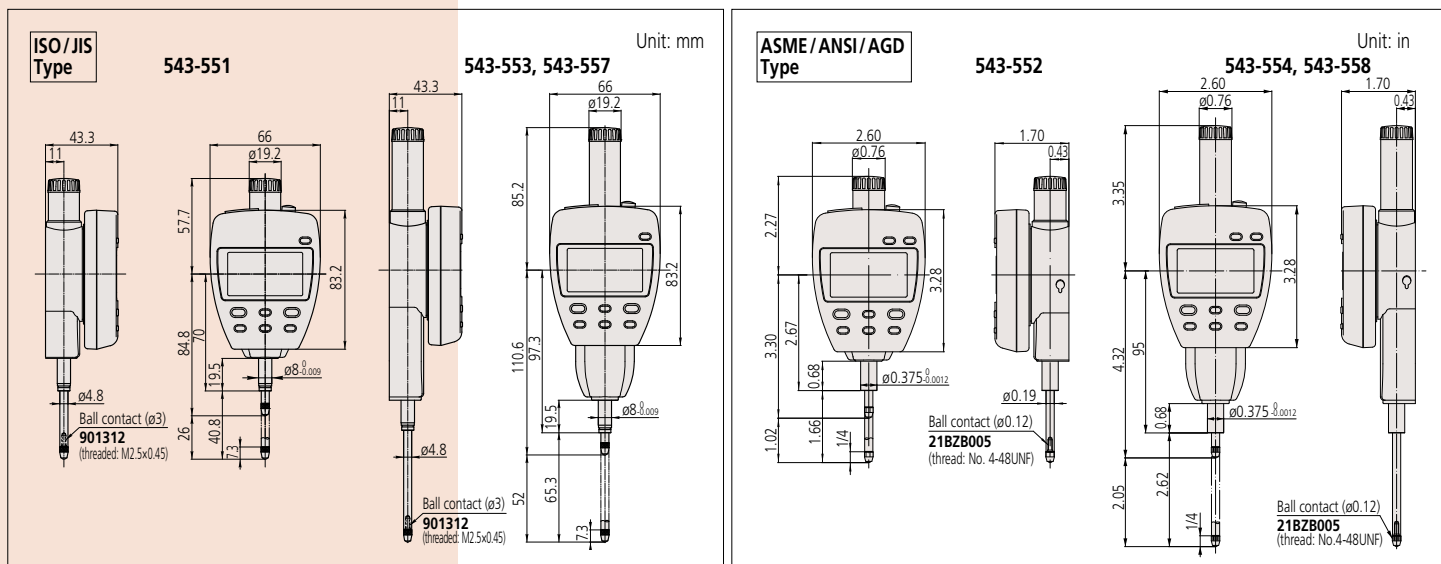
ISO/JIS type ASME/ANSI/AGD type

| Order No.*2 | Range | Resolution | Maximum permissible error | | | Measuring force MPL (N) | Net mass (g) |
|-------------|----------------|---|---------------------------|-----------------------------|--------------------------------|-------------------------|--------------|
| | | | MPE _E *3 | Hysteresis MPE _H | Repeatability MPE _R | | |
| 543-552 | 1 in / 25.4 mm | 0.00005/0.0001/0.0005/0.001 in / 0.003 mm | ±0.0001 in / 0.003 mm | 0.00010 in / 0.002 mm | 0.00010 in / 0.002 mm | 1.8 or less | Approx. 240 |
| 543-558 | 2 in / 50.8 mm | 0.001 in, 0.001/0.01 mm (selectable) | ±0.0001 in / 0.003 mm | | | 2.3 or less | |
| 543-554 | 2 in / 50.8 mm | (selectable) | ±0.00025 in / 0.006 mm | | | | |

*2 To denote your AC power cable add the following suffixes to the order No.: **A** for UL/CSA, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC, **No suffix** is required for JIS/100 V

*3 Error of indication for the total measuring range

DIMENSIONS



Digimatic Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Supplemental information on Digimatic Indicators

Origin setting of Digimatic Indicators



Repeatability in the range of 0.2 mm from the lowest rest point is not guaranteed for Digimatic indicators. When setting the origin or presetting a specific value, be sure to lift the spindle at least 0.2 mm from the lowest rest point.

EC Counter SERIES 542 — Low-cost, Modular Type Display Unit

- -NG, OK and +NG tolerance judgment results can be displayed.
- Can be set to produce either tolerance judgment output or Digimatic output.
- Small size (96×48 mm) which conforms to DIN standards.

MeasurLink ENABLED
Data Management Software by Mitutoyo



542-007

SPECIFICATIONS

| Order No. | 542-007* | |
|---|--|-------------------------------|
| Quantizing error | ±1 count | |
| Resolution () indicates maximum display range | 0.01 mm (±9999.99)/0.0005 in (±99.9995 in)/0.001 in (±999.999 in) 0.001 mm (±9999.999)/0.00005 in (±9.99995 in)/0.0001 in (±99.999 in) [automatic setting by gage] | |
| Tolerance judgment display | LED display (3 steps: Amber, Green, Red) | |
| External output (switching type) | Tolerance judgment output | -NG, OK, +NG (open-collector) |
| | Data output | Digimatic output |
| Control input | External PRESET, external HOLD | |
| Operation temperature range | 0 to 40 °C (RH 20 to 80 %, no condensation) | |
| Storage temperature range | -10 to 50 °C (RH 20 to 80 %, no condensation) | |
| External dimensions | 96 (W) ×48 (H) ×84.6 (D) mm | |
| AC adapter | AC adapter: (Japan/North America) 06AGC585JA /(EU) 06AGC585D / (UK) 06AGC585E /(Korea) 06AGC585K /(China) 06AEG302DC | |
| Standard Accessories | AC adapter, rubber feet | |
| Mass | 220 g | |

* To denote your AC power cable add the following suffixes to the order No.: **A** for UL/CSA, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC, C and **No suffix** are required for PSE.

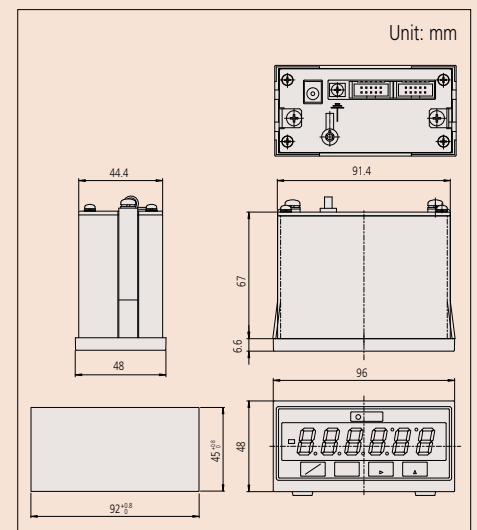
MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Functions

- Preset
- Tolerance judgment (3 steps)

DIMENSIONS



Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Dial Indicators

Mitutoyo's dial indicators have long been used by many of our customers. In full recognition of their needs, we have devoted ourselves to the research and development necessary to produce high-quality and high-accuracy dial indicators. Due to the recent re-acknowledgement of the importance of measurement technologies, the demands on dial indicators are many and varied: installation in measuring jigs, mounting in countless types of precision equipment, etc. We offer numerous models with various types of dial faces, measuring ranges, graduation styles and environmental resistance ratings. The stems, which ensure the fixture reliability, and the spindles, which are the basis of accuracy, have excellent resistance against hard use thanks to the hardened stainless steel construction. 0.01 mm resolution dial indicators have a grand gear made of stainless steel with high resistance to wear and deformation. 0.001 mm graduation dial indicators employ a sector gear made of a special alloy in order to further increase the resistance to wear. S-type dial indicators employ an O-ring to ensure the air tightness between the outer frame and the crystal case in order to prevent water or oil penetration.

Mitutoyo's dial indicators are manufactured and inspected according to JIS B 7503:2017. (Inspection orientation: vertical)

Important factors in choosing a dial indicator: the size (bezel diameter), resolution (graduation) and measuring range. Use the table on the right to help choose a suitable model for your application.

Feature icons

| Icon | Feature description |
|------|--|
| | Continuous scale |
| | Balanced scale |
| | Reverse reading type, Suitable for depth and step measurement. |
| | One revolution type for easy and error-free reading |
| | Double scale spacing type, easy-on-the-eyes |
| | Shockproof |
| | Waterproof (IP63) |
| | Waterproof (IP64) |
| | With damper at lowest rest point |
| | Jeweled bearing |
| | Peak retaining |
| | Dustproof |
| | With coaxial revolution counter |
| | Back Plunger |
| | Adjustable hand |

Note: Mitutoyo produces ASME-compatible products. Contact us for details.



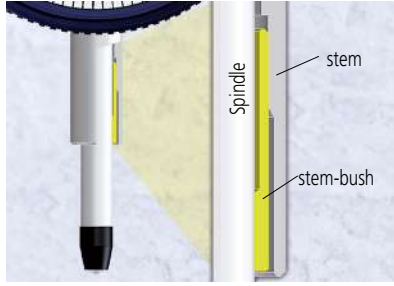
Parts of a dial indicator



Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

FEATURES: S Series (SERIES 2, 3, 4)



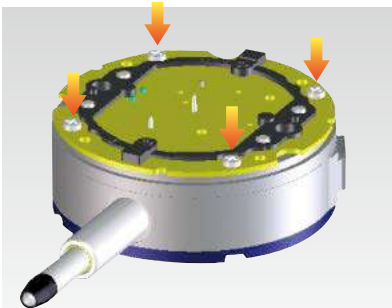
- No through screw-holes on the frame for high oil- and dust-resistance. The bezel clamp can be attached either to the right or left side.
- Improved Impact- and oil-resistant materials are employed in the bezel. Easier reading is due to the improved shape of the crystal face.

- Revolutionary stem-bush design for trouble-free stem clamping (longer clamping range; maximum tightening torque at the clamping point with M5 screw: 150 N-cm).



- The spindle lifting lever (optional: **21AZB149**) can be attached to either the right or left side providing high operability and smooth movement. This lever can be easily installed and removed without tools.

- Limit hand (1) can be moved without interfering with the bezel clamp (2).



- Greater rigidity in the bearing plate for reduced retrace error and 4-screw mounting for increased impact resistance.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Standard Type, 0.01 mm Graduation

- Standard 0.01 mm graduation dial gages having a bezel with an outside diameter of 57 mm. All types come with limit markers and a bezel clamp as standard.
- The bezel clamp and lifting lever (optional) can be attached to either the right or left side. These parts can be easily installed and removed without tools.
- Watertight assembly of bezel and crystal as well as the use of an O-ring prevents water or oil penetration.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- The grand gear is made of stainless steel with high resistance to wear and deformation.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.



20465



Continuous scale



Graduation: 0.01 mm, Measuring range: 10 mm
20465
20465-09
 Shockproof type



Balanced scale



Graduation: 0.01 mm, Measuring range: 10 mm
20475



Reverse reading type. Suitable for depth and step measurement.



Graduation: 0.01 mm, Measuring range: 10 mm
29025



Continuous scale



Graduation: 0.01 mm, Measuring range: 10 mm
23105-10
 With coaxial revolution counter
 Jeweled bearing type



Continuous scale



Graduation: 0.01 mm, Measuring range: 5 mm
20445
20445-09
 Shockproof



Balanced scale

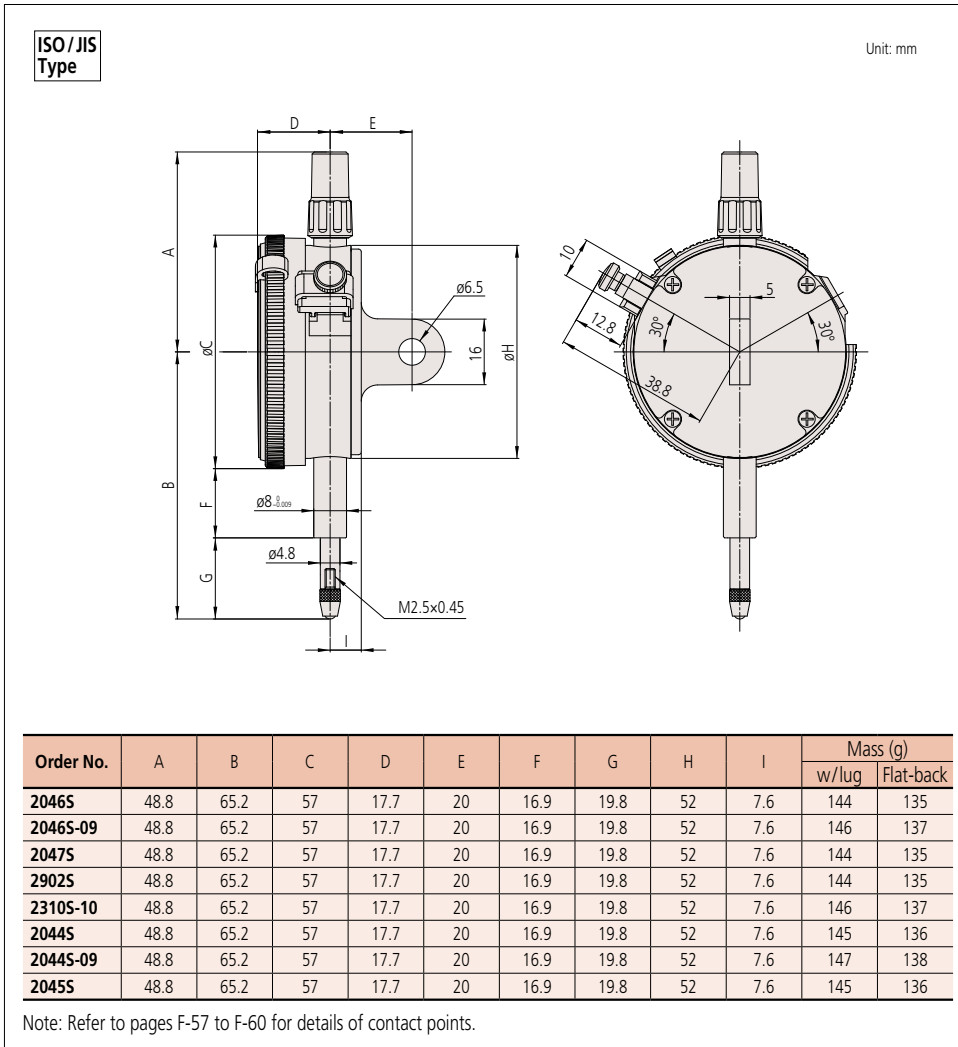


Graduation: 0.01 mm, Measuring range: 5 mm
20455

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



FEATURES

| Metric | | | | | | | | | |
|-----------|-----------|--------|--------|--------|----|----|----|----|----|
| Order No. | | 100-10 | 100-10 | 100-10 | 64 | 64 | 64 | 64 | 64 |
| w/lug | Flat-back | | | | | | | | |
| 2046S | 2046SB | ✓ | | | | | | | |
| 2046S-09 | 2046SB-09 | ✓ | | ✓ | | | | | |
| 2047S | 2047SB | | ✓ | | | | | | |
| 2902S | 2902SB | | | ✓ | | | | | |
| 2310S-10 | 2310SB-10 | ✓ | | | | | | ✓ | ✓ |
| 2044S | 2044SB | ✓ | | | | | | | |
| 2044S-09 | 2044SB-09 | ✓ | | ✓ | | | | | |
| 2045S | 2045SB | | ✓ | | | | | | |

SPECIFICATIONS

| Metric | | | | | | | | | | □ ISO / JIS type | |
|-----------|-----------|-----------------|------------------------|--------------------------------------|-----------------|----|------------|---------------|---|------------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | Hysteresis | Repeatability | | | |
| | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | | | |
| 2046S | 2046SB | 0.01 | 10 (1) | 5 | 9 | 10 | 13 | 3 | 3 | ±0-100 | 1.4 or less |
| 2046S-09 | 2046SB-09 | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | 3 | 3 | ±0-100 | 1.4 or less |
| 2047S | 2047SB | 0.01 | 10 (1) | 5 | 9 | 10 | 13 | 3 | 3 | 0-50-0 | 1.4 or less |
| 2902S | 2902SB | 0.01 | 10 (1) | 5 | 9 | 10 | 13 | 3 | 3 | 100-0 | 1.4 or less |
| 2310S-10 | 2310SB-10 | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | 3 | 3 | ±0-100 | 1.4 or less |
| 2044S | 2044SB | 0.01 | 5 (1) | 5 | 9 | 10 | 12 | 3 | 3 | ±0-100 | 1.4 or less |
| 2044S-09 | 2044SB-09 | 0.01 | 5 (1) | 5 | 9 | 10 | 12 | 3 | 3 | ±0-100 | 1.4 or less |
| 2045S | 2045SB | 0.01 | 5 (1) | 5 | 9 | 10 | 12 | 3 | 3 | 0-50-0 | 1.4 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Dial Indicators

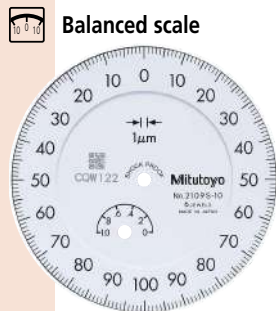
Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Standard Type, 0.001 mm & 0.005 mm Graduation

- Standard 0.001 mm and 0.005 mm graduation dial indicators having a bezel with an outside diameter of 57 mm. All types come with limit markers and a bezel clamp.
- The bezel clamp and lifting lever (optional) can be attached to either the right or left side. These parts can be easily installed and removed without tools.
- Watertight assembly of bezel and crystal as well as the use of an O-ring prevents water or oil penetration.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- A special alloy is used for the sector gears to provide improved wear resistance.
- The indicator uses jeweled bearings, providing excellent indication sensitivity and durability.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.

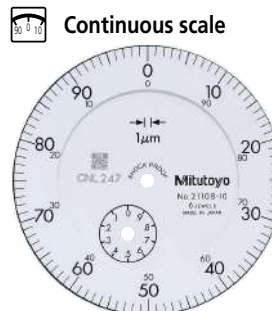


2109S-10



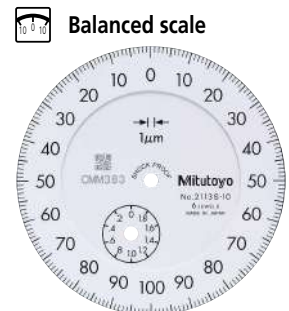
Balanced scale

Graduation: 0.001 mm, Measuring range: 1 mm
2109S-10
 Shockproof type
 Jeweled bearing type



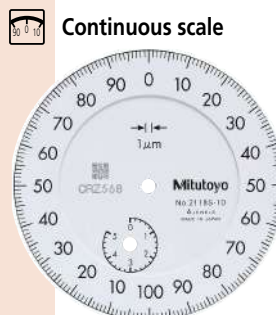
Continuous scale

Graduation: 0.001 mm, Measuring range: 1 mm
2110S-10
 Double scale spacing type
 Shockproof type
 Jeweled bearing type



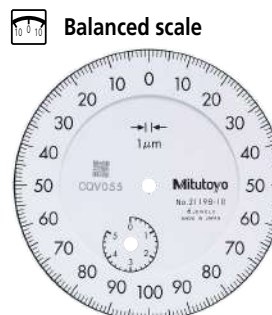
Balanced scale

Graduation: 0.001 mm, Measuring range: 2 mm
2113S-10
 Shockproof type
 Jeweled bearing type



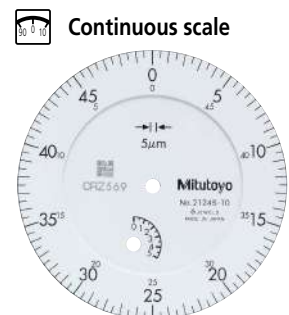
Continuous scale

Graduation: 0.001 mm, Measuring range: 5 mm
2118S-10
 Jeweled bearing



Balanced scale

Graduation: 0.001 mm, Measuring range: 5 mm
2119S-10
 Jeweled bearing



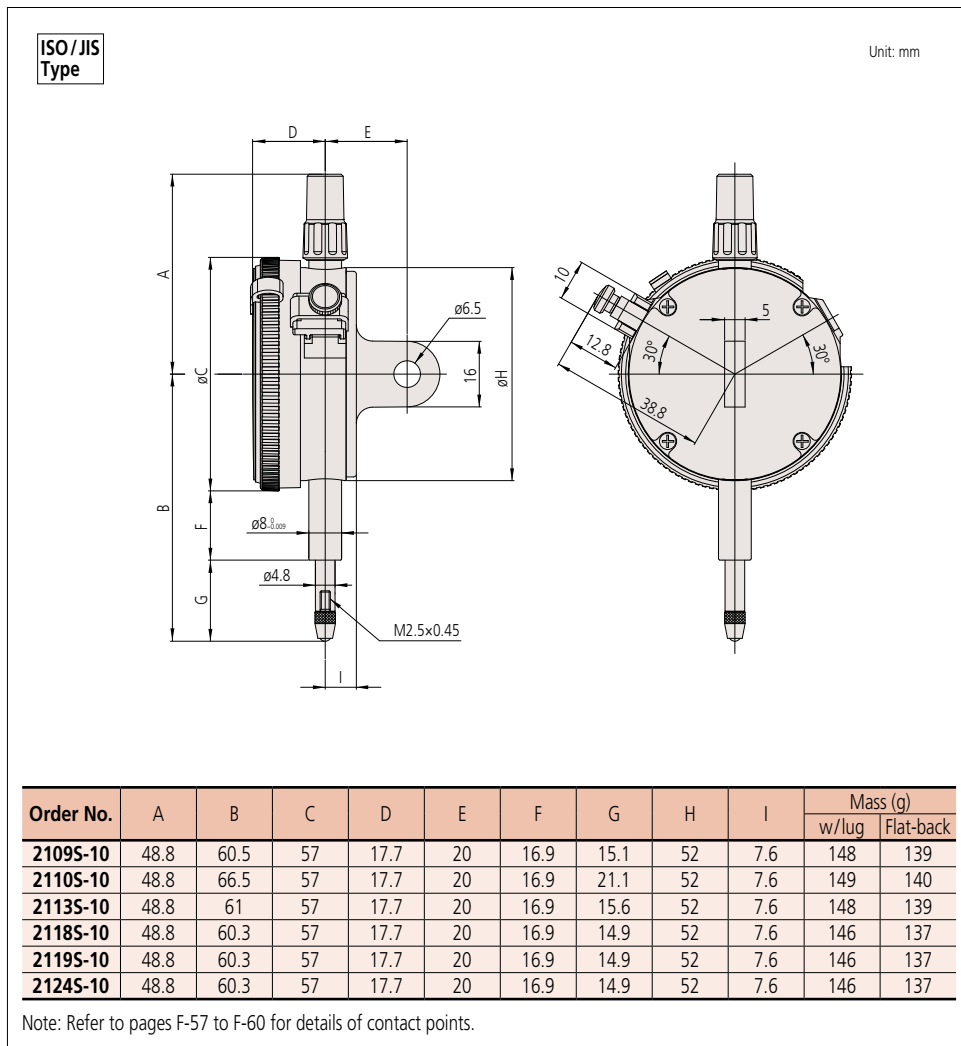
Continuous scale

Graduation: 0.005 mm, Measuring range: 5 mm
2124S-10
 Jeweled bearing

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



FEATURES

| Metric | | | | | | | |
|-----------|-----------|---|---|---|---|---|--|
| Order No. | | | | | | | |
| w/lug | Flat-back | | | | | | |
| 2109S-10 | 2109SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2110S-10 | 2110SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2113S-10 | 2113SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2118S-10 | 2118SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2119S-10 | 2119SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2124S-10 | 2124SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |

SPECIFICATIONS

| Metric | | | | | | | | | | | | □ ISO/JIS type |
|-----------|-----------|-----------------|------------------------|--------------------------------------|---------|-------|-----------------|------------|-----|----------------|--------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Repeat-ability | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | | Hysteresis | | | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | | |
| 2109S-10 | 2109SB-10 | 0.001 | 1 (0.2) | 2 | 3 | 4 | 5 | 2 | 0.5 | 0-100-0 | 1.5 or less | |
| 2110S-10 | 2110SB-10 | 0.001 | 1 (0.1) | 2 | 3 | 4 | 5 | 2 | 0.5 | ±0-100 | 1.8 or less | |
| 2113S-10 | 2113SB-10 | 0.001 | 2 (0.2) | 2 | 4 | 5 | 7 | 2 | 0.5 | 0-100-0 | 1.5 or less | |
| 2118S-10 | 2118SB-10 | 0.001 | 5 (0.2) | 3.5 | 5 | 6 | 10 | 3 | 1 | 0-100-100 | 1.5 or less | |
| 2119S-10 | 2119SB-10 | 0.001 | 5 (0.2) | 3.5 | 5 | 6 | 10 | 3 | 1 | 0-100-0 | 1.5 or less | |
| 2124S-10 | 2124SB-10 | 0.005 | 5 (0.5) | 5 | 8 | 9 | 12 | 3 | 3 | ±0-50 | 1.5 or less | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Waterproof Type, 0.01 mm & 0.001 mm Graduation

- Waterproof type dial indicators having a bezel with an outside diameter of 57 mm.
- O-rings and rubber bellows are used to prevent water and oil penetration.
- All types come with limit markers and a bezel clamp as standard.
- The bezel clamp can be attached to either the right or left side. These parts can be easily installed and removed without tools.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.



2046S-60

Continuous scale



Graduation: 0.01 mm, Measuring range: 10 mm **Waterproof**

Continuous scale



Graduation: 0.01 mm, Measuring range: 5 mm **Waterproof**



2109S-70

Balanced scale



Graduation: 0.001 mm, Measuring range: 1 mm **Waterproof**
 Shockproof
 Jeweled bearing

Continuous scale



Graduation: 0.001 mm, Measuring range: 1 mm **Waterproof**
 Double scale spacing
 Shockproof
 Jeweled bearing

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS

ISO/JIS Type

Unit: mm

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------------|------|------|----|------|----|------|------|----|-----|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 2046S-60 | 48.8 | 70 | 57 | 17.7 | 20 | 12.3 | 29.2 | 52 | 7.6 | 146 | 137 |
| 2044S-60 | 48.8 | 70 | 57 | 17.7 | 20 | 12.3 | 29.2 | 52 | 7.6 | 147 | 138 |
| 2109S-70 | 48.8 | 65.3 | 57 | 17.7 | 20 | 12.3 | 24.5 | 52 | 7.6 | 149 | 140 |
| 2110S-70 | 48.8 | 67.5 | 57 | 17.7 | 20 | 12.3 | 26.7 | 52 | 7.6 | 150 | 141 |

Note 1: Refer to pages F-57 to F-60 for details of contact points.
 Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.

FEATURES

| Metric | | | | | | | |
|-----------------|------------------|---|---|---|---|---|---|
| Order No. | | | | | | | |
| w/lug | Flat-back | | | | | | |
| 2046S-60 | 2046SB-60 | ✓ | | | ✓ | | |
| 2044S-60 | 2044SB-60 | ✓ | | | ✓ | | |
| 2109S-70 | 2109SB-70 | | ✓ | ✓ | ✓ | ✓ | |
| 2110S-70 | 2110SB-70 | ✓ | | ✓ | ✓ | ✓ | ✓ |

SPECIFICATIONS

| Metric | | □ ISO/JIS type | | | | | | | | | |
|-----------------|------------------|-----------------|------------------------|--------------------------------------|---------|-------|-----------------|------------|----------------|--------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | | Hysteresis | Repeat-ability | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | |
| 2046S-60 | 2046SB-60 | 0.01 | 10 (1) | 5 | 9 | 10 | 13 | 3 | 3 | ±0-100 | 2.5 or less |
| 2044S-60 | 2044SB-60 | 0.01 | 5 (1) | 5 | 9 | 10 | 12 | 3 | 3 | ±0-100 | 2.5 or less |
| 2109S-70 | 2109SB-70 | 0.001 | 1 (0.2) | 2 | 3 | 4 | 5 | 2 | 0.5 | 0-100-0 | 2.0 or less |
| 2110S-70 | 2110SB-70 | 0.001 | 1 (0.1) | 2 | 3 | 4 | 5 | 2 | 0.5 | ±0-100 | 2.0 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Standard Type, Inch Reading

SPECIFICATIONS

| Inch | | ANSI/AGD type | | | | | | |
|-----------|-----------|-----------------|------------------------|--|---------|---------------------|--------------|---------------------|
| Order No. | | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | Repeat-ability (in) | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | First 1 Rev/2.5 Rev/10 Rev | Retrace | | | |
| 2414S | 2414SB | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less |
| 2415S | 2415SB | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | 0.0002 | ±0.0002 | 0-50-0 | 1.8 or less |
| 2914S | 2914SB | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | 0.0002 | ±0.0002 | 100-0 | 1.8 or less |
| 2506S | 2506SB | 0.0005 | 0.125 (0.05) | ±0.0005/±0.0005/— | 0.00016 | ±0.0001 | ±0-50 | 1.8 or less |
| 2507S | 2507SB | 0.0005 | 0.125 (0.05) | ±0.0005/±0.0005/— | 0.00016 | ±0.0001 | 0-25-0 | 1.8 or less |
| 2514S | 2514SB | 0.0005 | 0.5 (0.05) | ±0.0005/±0.0005/±0.0015 | 0.00016 | ±0.0001 | ±0-50 | 1.8 or less |
| 2922S | 2922SB | 0.0005 | 0.125 (0.05) | ±0.0005/±0.0005/— | 0.00016 | ±0.0001 | 0-25-0 | 1.8 or less |
| 2356S-10 | 2356SB-10 | 0.0001 | 0.25 (0.01) | ±0.0002/±0.0002/±0.0003/±0.0004 (First 20rev)/±0.0005 (Over 20rev) | 0.0001 | ±0.00003 | 0-10 | 2.0 or less |
| 2358S-10 | 2358SB-10 | 0.0001 | 0.5 (0.01) | ±0.0002/±0.0002/±0.0003/±0.0004 (First 20rev)/±0.0008 (Over 20rev) | 0.00015 | ±0.00003 | 0-10 | 2.0 or less |
| 2802S-10 | 2802SB-10 | 0.0001 | 0.025 (0.01) | ±0.0001/±0.0001/— | 0.0001 | ±0.00003 | 0-10 | 2.0 or less |
| 2803S-10 | 2803SB-10 | 0.0001 | 0.025 (0.01) | ±0.0001/±0.0001/— | 0.0001 | ±0.00003 | 0-5-0 | 2.0 or less |
| 2804S-10 | 2804SB-10 | 0.0001 | 0.05 (0.01) | ±0.0001/±0.0001/±0.0002 | 0.0001 | ±0.00003 | 0-10 | 2.0 or less |
| 2805S-10 | 2805SB-10 | 0.0001 | 0.05 (0.01) | ±0.0001/±0.0001/±0.0002 | 0.0001 | ±0.00003 | 0-5-0 | 2.0 or less |
| 2905S-10 | 2905SB-10 | 0.0001 | 0.05 (0.01) | ±0.0001/±0.0001/±0.0002 | 0.0001 | ±0.00003 | 10-0 | 2.0 or less |
| 2923S-10 | 2923SB-10 | 0.0001 | 0.05 (0.01) | ±0.0001/±0.0001/±0.0002 | 0.0001 | ±0.00003 | 0-5-0 | 2.0 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

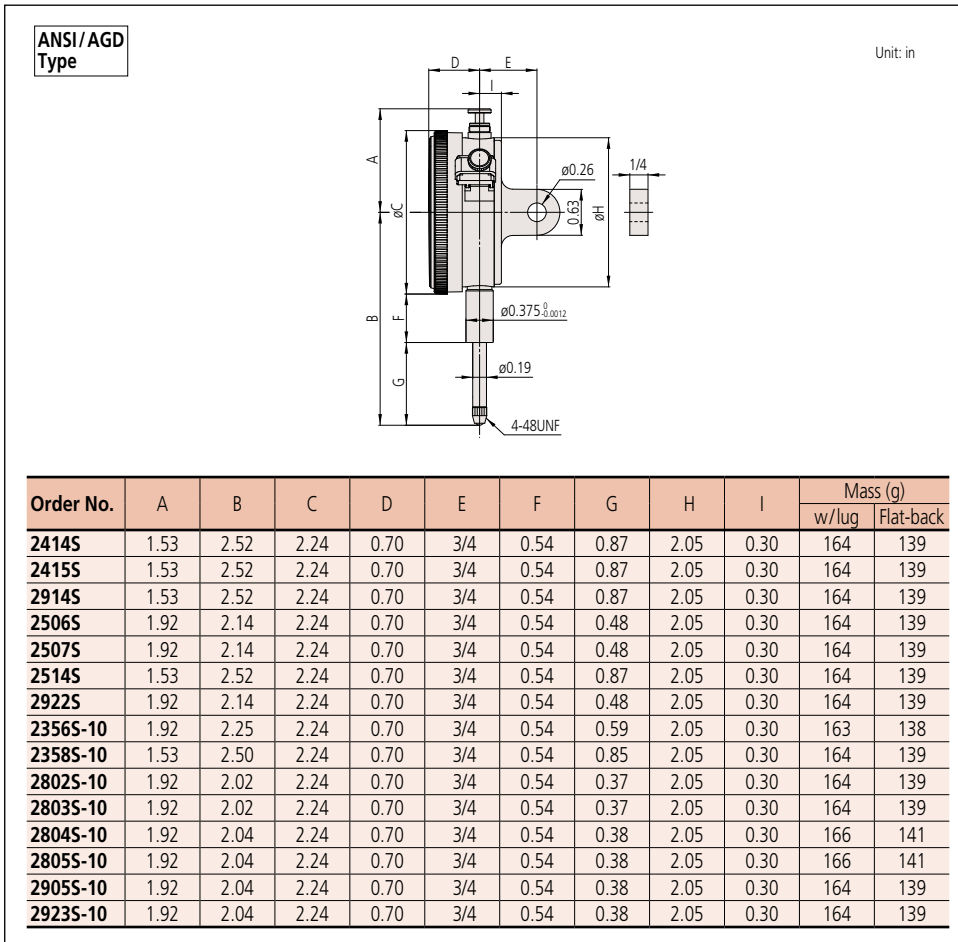
FEATURES

| Inch | | | | |
|-----------|-----------|---|---|---|
| Order No. | | | | |
| w/lug | Flat-back | | | |
| 2414S | 2414SB | | | |
| 2415S | 2415SB | | | |
| 2914S | 2914SB | | ✓ | |
| 2506S | 2506SB | | | |
| 2507S | 2507SB | | | |
| 2514S | 2514SB | | | |
| 2922S | 2922SB | | | |
| 2356S-10 | 2356SB-10 | | | ✓ |
| 2358S-10 | 2358SB-10 | | | ✓ |
| 2802S-10 | 2802SB-10 | ✓ | | ✓ |
| 2803S-10 | 2803SB-10 | ✓ | | ✓ |
| 2804S-10 | 2804SB-10 | ✓ | | ✓ |
| 2805S-10 | 2805SB-10 | ✓ | | ✓ |
| 2905S-10 | 2905SB-10 | ✓ | ✓ | ✓ |
| 2923S-10 | 2923SB-10 | ✓ | | ✓ |

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS





An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Standard One Revolution Type for Error-free Reading

- Mitutoyo's unique shock-proof mechanism is incorporated, providing improved resistance to shock due to sudden spindle retraction caused by impact.
- This series has been developed to eliminate the possibility of reading errors due to miscounting multiple revolutions.
- All types come with limit markers and a bezel clamp.
- The bezel clamp and lifting lever (optional) can be attached to either the right or left side. These parts can be easily installed and removed without tools.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.
- The dead zone in red indicates "accuracy not guaranteed".



2900S-10



2929S



Balanced scale



Graduation: 0.001 mm,
Measuring range: 0.08 mm

2900S-10

☑ One revolution

☑ Shockproof

☑ Jeweled bearing

2900S-72

☑ One revolution

☑ Shockproof

☑ Dustproof

☑ Jeweled bearing



Balanced scale



Graduation: 0.001 mm,
Measuring range: 0.16 mm

29015-10

☑ One revolution

☑ Shockproof

☑ Jeweled bearing



Balanced scale



Graduation: 0.1 mm,
Measuring range: 4 mm

2928S

☑ One revolution

☑ Shockproof



Balanced scale



Graduation: 0.01 mm,
Measuring range: 0.8 mm

2929S

☑ One revolution

☑ Shockproof

2929S-62

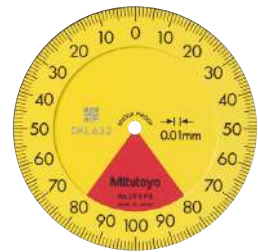
☑ One revolution

☑ Shockproof

☑ Dustproof



Balanced scale



Graduation: 0.01 mm,
Measuring range: 1.6 mm

2959S

☑ One revolution

☑ Shockproof

One revolution type Back Plunger dial gages are also available. (Refer to pages F-55 to F-56 for details.)



2990T-10

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS

ISO/JIS Type

Unit: mm

ANSI/AGD Type

Unit: in

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|----|------|----|------|------|----|-----|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 2928S | 48.8 | 65.2 | 57 | 17.7 | 20 | 16.9 | 19.8 | 52 | 7.6 | 145 | 136 |
| 2929S | 48.8 | 65.2 | 57 | 17.7 | 20 | 16.9 | 19.8 | 52 | 7.6 | 145 | 136 |
| 2929S-62 | 48.8 | 65.2 | 57 | 17.7 | 20 | 16.9 | 19.8 | 52 | 7.6 | 145 | 136 |
| 2959S | 48.8 | 65.2 | 57 | 17.7 | 20 | 16.9 | 19.8 | 52 | 7.6 | 145 | 136 |
| 2900S-10 | 48.8 | 66 | 57 | 17.7 | 20 | 16.9 | 20.6 | 52 | 7.6 | 149 | 140 |
| 2900S-72 | 48.8 | 66 | 57 | 17.7 | 20 | 16.9 | 20.6 | 52 | 7.6 | 149 | 140 |
| 2901S-10 | 48.8 | 66.1 | 57 | 17.7 | 20 | 16.9 | 20.7 | 52 | 7.6 | 149 | 140 |

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|------|------|-----|------|------|------|------|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 2909S-62 | 1.92 | 2.04 | 2.24 | 0.70 | 3/4 | 0.54 | 0.39 | 2.05 | 0.30 | 163 | 138 |
| 2910S-10 | 1.92 | 2.02 | 2.24 | 0.70 | 3/4 | 0.54 | 0.36 | 2.05 | 0.30 | 164 | 139 |

Note: Refer to pages F-57 to F-60 for details of contact points.

FEATURES

Metric

| Order No. | w/lug | Flat-back | 10 0.01 | 10 0.02 | 10 0.05 | 10 0.1 | 10 0.2 | 10 0.5 | 10 1.0 | 10 2.0 | 10 5.0 | 10 10.0 |
|-----------|-----------|-----------|---------|---------|---------|--------|--------|--------|--------|--------|--------|---------|
| 2928S | 2928SB | ✓ | ✓ | ✓ | | | | | | | | |
| 2929S | 2929SB | ✓ | ✓ | ✓ | | | | | | | | |
| 2929S-62 | 2929SB-62 | ✓ | ✓ | ✓ | | | | ✓ | | | | |
| 2959S | 2959SB | ✓ | ✓ | ✓ | | | | | | | | |
| 2900S-10 | 2900SB-10 | ✓ | ✓ | ✓ | | | | | | | | ✓ |
| 2900S-72 | 2900SB-72 | ✓ | ✓ | ✓ | | | | ✓ | | | | ✓ |
| 2901S-10 | 2901SB-10 | ✓ | ✓ | ✓ | | | | | | | | ✓ |

Inch

| Order No. | w/lug | Flat-back | 10 0.01 | 10 0.02 | 10 0.05 | 10 0.1 | 10 0.2 | 10 0.5 | 10 1.0 | 10 2.0 | 10 5.0 | 10 10.0 |
|-----------|-----------|-----------|---------|---------|---------|--------|--------|--------|--------|--------|--------|---------|
| 2909S-62 | 2909SB-62 | ✓ | ✓ | ✓ | | | | ✓ | | | | |
| 2910S-10 | 2910SB-10 | ✓ | ✓ | ✓ | | | | | | | | ✓ |

SPECIFICATIONS

Metric ☐ ISO/JIS type

| Order No. | w/lug | Flat-back | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | Dial reading | Measuring force (N) | |
|-----------|-----------|-----------|-----------------|------------------------|--------------------------------------|---------|-------|-----------------|------------|--------------|---------------------|----------------|
| | | | | | Indication error | | | | Hysteresis | | | Repeat-ability |
| | | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | |
| 2928S | 2928SB | | 0.1 | 4 (5) | 20 | — | — | 40 | 20 | 20 | 2-0-2 | 1.4 or less |
| 2929S | 2929SB | | 0.01 | 0.8 (1) | 5 | — | — | 8 | 3 | 3 | 40-0-40 | 1.4 or less |
| 2929S-62 | 2929SB-62 | | 0.01 | 0.8 (1) | 5 | — | — | 8 | 3 | 3 | 40-0-40 | 2.0 or less |
| 2959S | 2959SB | | 0.01 | 1.6 (2) | 5 | — | — | 10 | 3 | 3 | 80-0-80 | 1.4 or less |
| 2900S-10 | 2900SB-10 | | 0.001 | 0.08 (0.1) | 2 | — | — | 3 | 2 | 0.5 | 40-0-40 | 1.5 or less |
| 2900S-72 | 2900SB-72 | | 0.001 | 0.08 (0.1) | 2 | — | — | 3 | 2 | 0.5 | 40-0-40 | 2.0 or less |
| 2901S-10 | 2901SB-10 | | 0.001 | 0.16 (0.2) | 2 | — | — | 4 | 2 | 0.5 | 80-0-80 | 1.5 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

Inch ☐ ANSI/AGD type

| Order No. | w/lug | Flat-back | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) |
|-----------|-----------|-----------|-----------------|------------------------|----------------------------|-----|---------|---------------------|--------------|---------------------|
| | | | | | First 1 Rev/2.5 Rev/10 Rev | | Retrace | | | |
| | | | | | ± | —/— | | | | |
| 2909S-62 | 2909SB-62 | | 0.0005 | 0.04/0.05 | ±0.0005 | —/— | 0.00016 | ±0.0001 | 20-0-20 | 2.5 or less |
| 2910S-10 | 2910SB-10 | | 0.0001 | 0.008/0.01 | ±0.0001 | —/— | 0.0001 | ±0.00003 | 4-0-4 | 1.8 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

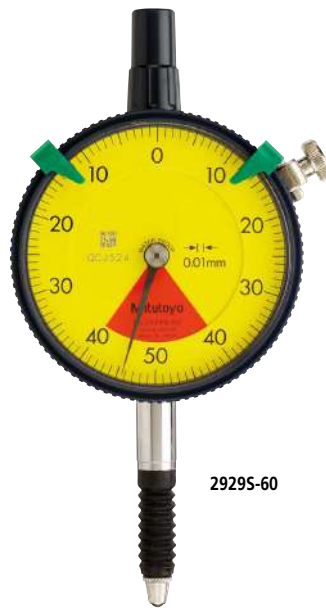
IP64

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Standard One Revolution Type for Error-free Reading, Waterproof Type

- Mitutoyo's unique shock-proof mechanism is incorporated, providing improved resistance to shock due to sudden spindle retraction caused by impact.
- This series has been developed to eliminate the possibility of reading errors due to miscounting multiple revolutions.
- All types come with limit markers and a bezel clamp.
- The bezel clamp and lifting lever (optional) can be attached to either the right or left side. These parts can be easily installed and removed without tools.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.
- The dead zone in red indicates "accuracy not guaranteed".



29295-60



Balanced scale



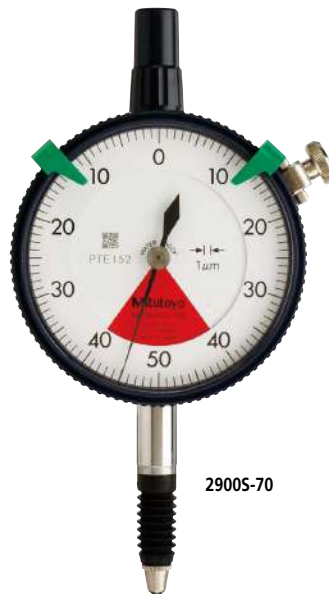
Graduation: 0.01 mm,
Measuring range: 0.8 mm

29295-60

One revolution

Shockproof

Waterproof



29005-70



Balanced scale



Graduation: 0.001 mm,
Measuring range: 0.08 mm

29005-70

One revolution

Shockproof

Waterproof

Jeweled bearing

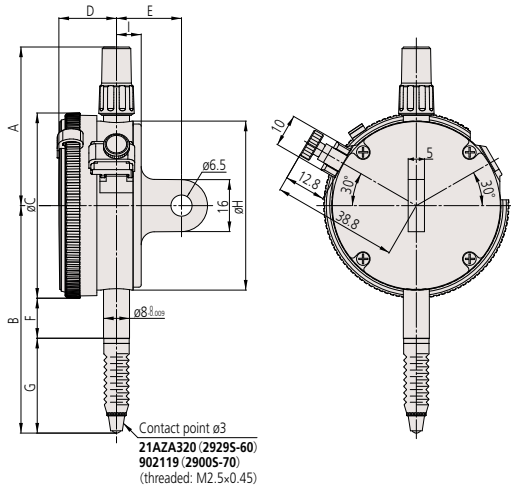
Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS

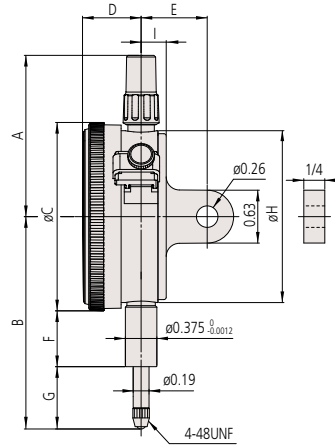
ISO / JIS
Type

Unit: mm



ANSI / AGD
Type

Unit: in



| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|----|----|------|----|------|------|----|-----|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 29295-60 | 48.8 | 70 | 57 | 17.7 | 20 | 12.3 | 29.2 | 52 | 7.6 | 146 | 137 |
| 29005-70 | 48.8 | 67 | 57 | 17.7 | 20 | 12.3 | 26.2 | 52 | 7.6 | 150 | 141 |

Note 1: Refer to pages F-57 to F-60 for details of contact points.
Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|------|------|-----|------|------|------|------|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 29105-72 | 1.92 | 2.02 | 2.24 | 0.70 | 3/4 | 0.54 | 0.36 | 2.05 | 0.30 | 150 | 141 |

Note 1: Refer to pages F-57 to F-60 for details of contact points.
Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.

FEATURES

Metric

| Order No. | | | | | | | |
|-----------|-----------|---|---|---|---|--|---|
| w/lug | Flat-back | | | | | | |
| 29295-60 | 29295B-60 | ✓ | ✓ | ✓ | ✓ | | |
| 29005-70 | 29005B-70 | ✓ | ✓ | ✓ | ✓ | | ✓ |

SPECIFICATIONS

Metric

ISO/JIS type

| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) |
|-----------|-----------|-----------------|------------------------|---|---------|-------|-----------------|------------|---------------|--------------|---------------------|
| w/lug | Flat-back | | | Indication error | | | | Hysteresis | Repeatability | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | |
| 29295-60 | 29295B-60 | 0.01 | 0.8 (1) | 5 | — | — | 8 | 3 | 3 | 40-0-40 | 2.0 or less |
| 29005-70 | 29005B-70 | 0.001 | 0.08 (0.1) | 2 | — | — | 3 | 2 | 0.5 | 40-0-40 | 2.0 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

Inch

| Order No. | | | | | | | |
|-----------|-----------|---|---|---|--|---|---|
| w/lug | Flat-back | | | | | | |
| 29105-72 | 29105B-72 | ✓ | ✓ | ✓ | | ✓ | ✓ |

Inch

ANSI/AGD type

| Order No. | | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeatability (in) | Dial reading | Measuring force (N) |
|-----------|-----------|-----------------|------------------------|----------------------------|-----|---------|--------------------|--------------|---------------------|
| w/lug | Flat-back | | | First 1 Rev/2.5 Rev/10 Rev | | Retrace | | | |
| | | | | | | | | | |
| 29105-72 | 29105B-72 | 0.0001 | 0.008/0.01 | ± 0.0001 | —/— | 0.0001 | ± 0.00003 | 4-0-4 | 2.5 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.



Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Standard One Revolution Type for Error-free Reading, Lightweight Type

- Mitutoyo's unique shock-proof mechanism is incorporated, providing improved resistance to shock due to sudden spindle retraction caused by impact.
- This series has been developed to eliminate the possibility of reading errors due to miscounting multiple revolutions.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.
- Lightweight type (70 g).
- The dead zone in red indicates "accuracy not guaranteed".



2972TB



Balanced scale



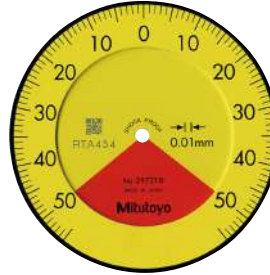
Graduation: 0.01 mm,
Measuring range: 0.5 mm

2971TB

- One revolution
- Shockproof
- Dustproof



Balanced scale



Graduation: 0.01 mm,
Measuring range: 1 mm

2972TB

- One revolution
- Shockproof
- Dustproof



Balanced scale



Graduation: 0.02 mm,
Measuring range: 1.6 mm

2973TB

- One revolution
- Shockproof
- Dustproof

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS

ISO/JIS Type

Unit: mm

ANSI/AGD Type

Unit: in

Note 1: When installing an optional back (refer to page F-61 for details) 4 retaining screws must also be obtained (546666: Self-tapping screw only for plastic).
Do not apply a tightening torque of more than 20 N-cm in order to avoid stripping the screw threads.
Note 2: An optional lifting lever, release or bezel clamp cannot be installed.

| Metric | | | | | | | | | |
|-----------|------|------|----|------|----|------|----|-----|----------|
| Order No. | A | B | C | D | F | G | H | I | Mass (g) |
| 2971TB | 43.2 | 65.6 | 57 | 16.5 | 21 | 16.8 | 55 | 7.6 | 70 |
| 2972TB | 43.2 | 66 | 57 | 16.5 | 21 | 17.2 | 55 | 7.6 | |
| 2973TB | 43.2 | 66.3 | 57 | 16.5 | 21 | 17.5 | 55 | 7.6 | |

| Inch | | | | | | | | | |
|-----------|------|------|------|------|------|------|------|------|----------|
| Order No. | A | B | C | D | F | G | H | I | Mass (g) |
| 2976TB | 1.70 | 2.55 | 2.24 | 0.65 | 0.80 | 0.63 | 2.17 | 0.30 | 70 |
| 2977TB | 1.70 | 2.56 | 2.24 | 0.65 | 0.80 | 0.64 | 2.17 | 0.30 | |
| 2978TB | 1.70 | 2.57 | 2.24 | 0.65 | 0.80 | 0.65 | 2.17 | 0.30 | |

Note: Refer to pages F-57 to F-60 for details of contact points.

FEATURES

| Metric | | | | | | |
|-----------|-------|-----------|-------|-------|------|------|
| Order No. | w/lug | Flat-back | 16/10 | 10/10 | 10/5 | 10/2 |
| 2971TB | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2972TB | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2973TB | — | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inch | | | | | | |
|-----------|-------|-----------|-------|-------|------|------|
| Order No. | w/lug | Flat-back | 16/10 | 10/10 | 10/5 | 10/2 |
| 2976TB | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2977TB | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2978TB | — | ✓ | ✓ | ✓ | ✓ | ✓ |

SPECIFICATIONS

| Metric | | | | | | | | | | □ ISO/JIS type | | |
|-----------|-------|-----------|-----------------|------------------------|--------------------------------------|-------|-----------------|----|------------|----------------|---------------------|----------------|
| Order No. | w/lug | Flat-back | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | Dial reading | Measuring force (N) | |
| | | | | | Indication error | | | | Hysteresis | | | Repeat-ability |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | | |
| 2971TB | — | — | 0.01 | 0.5 (0.7) | 5 | — | — | 8 | 3 | 3 | 25-0-25 | 1.4 or less |
| 2972TB | — | — | 0.01 | 1 (1.4) | 5 | — | — | 8 | 3 | 3 | 50-0-50 | 1.4 or less |
| 2973TB | — | — | 0.02 | 1.6 (2) | 8 | — | — | 16 | 6 | 5 | 80-0-80 | 1.4 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Inch | | | | | | | | | | □ ANSI/AGD type |
|-----------|-------|-----------|-----------------|------------------------|----------------------------|---------|---------|---------------------|--------------|---------------------|
| Order No. | w/lug | Flat-back | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) |
| | | | | | First 1 Rev/2.5 Rev/10 Rev | Retrace | | | | |
| 2976TB | — | — | 0.0005 | 0.02 (0.028) | ±0.0005/—/— | 0.00016 | ±0.0001 | 10-0-10 | 1.4 or less | |
| 2977TB | — | — | 0.0005 | 0.04 (0.055) | ±0.0005/—/— | 0.00016 | ±0.0001 | 20-0-20 | 1.4 or less | |
| 2978TB | — | — | 0.001 | 0.06 (0.079) | ±0.001/—/— | 0.0002 | ±0.0002 | 30-0-30 | 1.4 or less | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 2 — Long Stroke Type

- Long stroke dial indicators with a $\varnothing 57$ mm bezel. All the models are equipped with limit markers and a bezel clamp as standard. (inch models are exception)
- Watertight assembly of bezel and crystal as well as the use of an O-ring prevents water or oil penetration.
- The stem and the spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is employed.
- The grand gear is made of stainless steel with high resistance to wear and deformation.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.
- The bezel clamp and lifting lever* (optional) can be attached to either the right or left side. These parts can be easily installed and removed without any tools.

* These cannot be used on waterproof models and models with a measuring range of 30 mm.



2050S

Continuous scale



Graduation: 0.01 mm,
Measuring range: 20 mm

2050S

With damper at lowest rest point

2050S-19

Shockproof

Jeweled bearing

With damper at lowest rest point

2050S-60

Waterproof

Continuous scale



Graduation: 0.01 mm,
Measuring range: 30 mm

2052S

With damper at lowest rest point

2052S-19

Shockproof

Jeweled bearing

With damper at lowest rest point

Continuous scale



Graduation: 0.01 mm,
Measuring range: 30 mm

2330S-10

With coaxial revolution counter

With damper at lowest rest point

Jeweled bearing



2050S-60

Continuous scale



Graduation: 0.01 mm,
Measuring range: 20 mm

2320S-10

With coaxial revolution counter

With damper at lowest rest point

Jeweled bearing

Reverse reading



Graduation: 0.01 mm,
Measuring range: 30 mm

2952S

With damper at lowest rest point

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

FEATURES

| Metric | | | | | | | | | |
|-----------|-----------|--------------|-----------|-----|-----|-----|-----|-----|-----|
| Order No. | | ISO/JIS Type | Flat-back | 60° | 60° | 60° | 60° | 60° | 60° |
| 2050S | 2050SB | ✓ | | | | | | | ✓ |
| 2050S-60 | 2050SB-60 | ✓ | | | | | | | ✓ |
| 2050S-19 | 2050SB-19 | ✓ | | | ✓ | | | ✓ | ✓ |
| 2320S-10 | 2320SB-10 | ✓ | | | | | | ✓ | ✓ |
| 2052S | 2052SB | ✓ | | | | | | ✓ | ✓ |
| 2052S-19 | 2052SB-19 | ✓ | | | ✓ | | | ✓ | ✓ |
| 2330S-10 | 2330SB-10 | ✓ | | | | | | ✓ | ✓ |
| 2952S | 2952SB | | ✓ | | | | | ✓ | ✓ |

SPECIFICATIONS

| Metric | | ISO/JIS type | | | | | | | | | |
|-----------|------------|-----------------|------------------------|--------------------------------------|---------|-------|------------|---------------|-----------------|--------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | Hysteresis | Repeatability | | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | | | Measuring range | | |
| 2050S | 2050SB | 0.01 | 20 (1) | 8 | 10 | 15 | 20 | 5 | 4 | ±0-100 | 2.0 or less |
| 2050S-60* | 2050SB-60* | 0.01 | 20 (1) | 8 | 10 | 15 | 20 | 5 | 4 | ±0-100 | 2.5 or less |
| 2050S-19 | 2050SB-19 | 0.01 | 20 (1) | 8 | 10 | 15 | 20 | 5 | 4 | ±0-100 | 2.0 or less |
| 2320S-10 | 2320SB-10 | 0.01 | 20 (1) | 8 | 10 | 15 | 20 | 5 | 4 | ±0-100 | 2.0 or less |
| 2052S | 2052SB | 0.01 | 30 (1) | 10 | 12 | 15 | 25 | 7 | 5 | ±0-100 | 2.5 or less |
| 2052S-19 | 2052SB-19 | 0.01 | 30 (1) | 10 | 12 | 15 | 25 | 7 | 5 | ±0-100 | 2.5 or less |
| 2330S-10 | 2330SB-10 | 0.01 | 30 (1) | 10 | 12 | 15 | 25 | 7 | 5 | ±0-100 | 2.5 or less |
| 2952S | 2952SB | 0.01 | 30 (1) | 10 | 12 | 15 | 25 | 7 | 5 | 100-0 | 2.5 or less |

* 2050S-60 and 2050SB-60 are waterproof types that use a rubber bellows to cover the spindle.

Note that the outer diameter of the bellows (ø9.5) is larger than that of the stem (ø8).

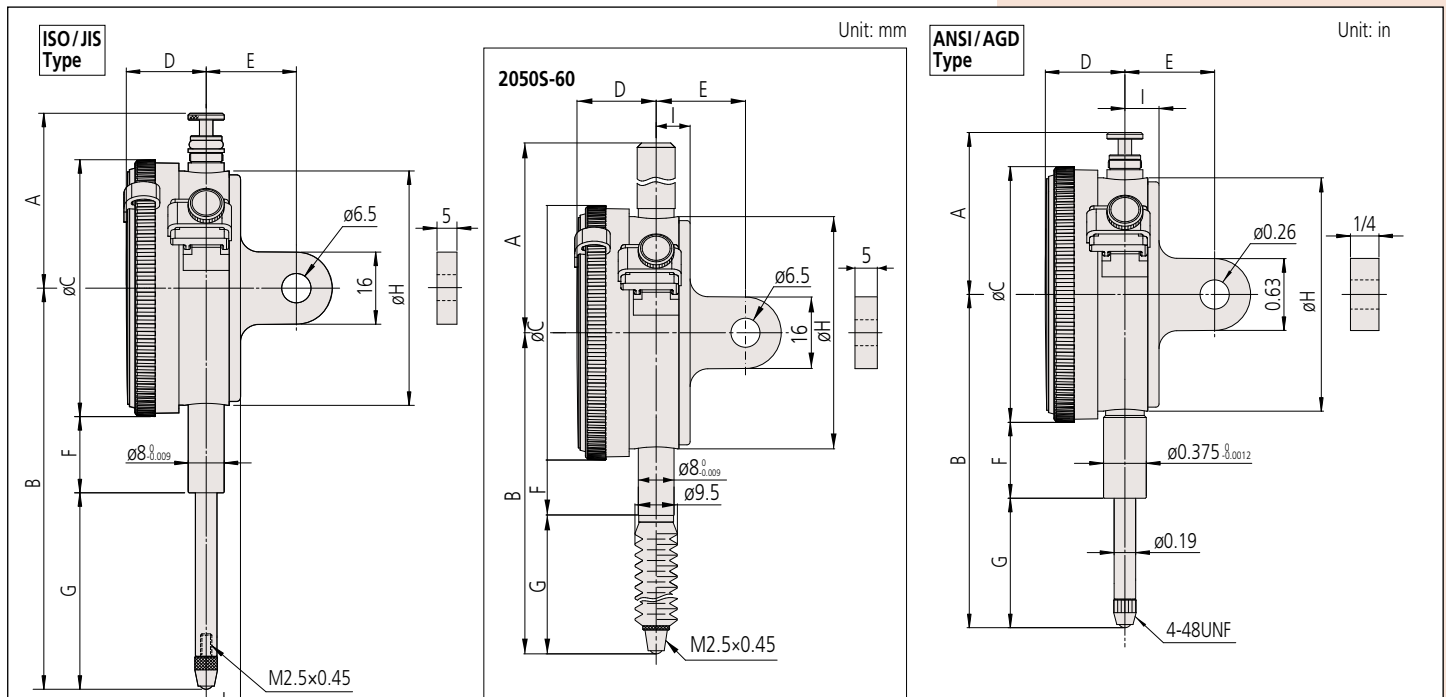
Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Inch | | | | | | | | | |
|-----------|-----------|---------------|-----------|-----|-----|-----|-----|-----|-----|
| Order No. | | ANSI/AGD Type | Flat-back | 60° | 60° | 60° | 60° | 60° | 60° |
| 2416S | 2416SB | ✓ | | | | | | | |
| 2416S-06 | 2416SB-06 | ✓ | | | | | | | |
| 2416S-10 | 2416SB-10 | ✓ | | | | | | ✓ | |
| 2417S | 2417SB | | ✓ | | | | | | |
| 2424S-19 | 2424SB-19 | ✓ | | | ✓ | | | ✓ | ✓ |
| 2776S | 2776SB | ✓ | | | | | | | |
| 2904S | 2904SB | | | | ✓ | | | | |

| Inch | | ANSI/AGD type | | | | | | | | | |
|-----------|-----------|-----------------|------------------------|---|---------|---------|---------------------|--------------|---------------------|--|--|
| Order No. | | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) | | |
| w/lug | Flat-back | | | First 1 Rev/2.5 Rev/10 Rev | Retrace | | | | | | |
| 2416S | 2416SB | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less | | | |
| 2416S-06 | 2416SB-06 | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less | | | |
| 2416S-10 | 2416SB-10 | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less | | | |
| 2417S | 2417SB | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | 0.0002 | ±0.0002 | 0-50-0 | 1.8 or less | | | |
| 2424S-19 | 2424SB-19 | 0.001 | 2 (0.1) | ±0.001/±0.001/±0.002/±0.003 (First 20 Rev) | 0.00033 | ±0.0002 | ±0-100 | 2.5 or less | | | |
| 2776S | 2776SB | 0.0005 | 1 (0.05) | ±0.0005/±0.0005/±0.0015/±0.002 (First 20 Rev) | 0.0002 | ±0.0001 | ±0-50 | 2.5 or less | | | |
| 2904S | 2904SB | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | 0.0002 | ±0.0002 | 100-0 | 1.8 or less | | | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

DIMENSIONS



| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|----|------|----|------|------|----|-----|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 2050S | 38.8 | 75.2 | 57 | 17.7 | 20 | 16.9 | 29.8 | 52 | 7.6 | 149 | 140 |
| 2050S-60 | 59.8 | 87.2 | 57 | 17.7 | 20 | 12.3 | 46.4 | 52 | 7.6 | 155 | 146 |
| 2050S-19 | 38.8 | 75.2 | 57 | 17.7 | 20 | 16.9 | 29.8 | 52 | 7.6 | 149 | 140 |
| 2320S-10 | 38.8 | 75.2 | 57 | 17.7 | 20 | 16.9 | 29.8 | 52 | 7.6 | 150 | 141 |
| 2052S | 38.8 | 88.7 | 57 | 17.7 | 20 | 16.9 | 43.3 | 52 | 7.6 | 152 | 143 |
| 2052S-19 | 38.8 | 88.7 | 57 | 17.7 | 20 | 16.9 | 43.3 | 52 | 7.6 | 152 | 143 |
| 2330S-10 | 38.8 | 88.7 | 57 | 17.7 | 20 | 16.9 | 43.3 | 52 | 7.6 | 153 | 144 |
| 2952S | 38.8 | 88.7 | 57 | 17.7 | 20 | 16.9 | 43.3 | 52 | 7.6 | 152 | 143 |

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|------|------|-----|------|------|------|------|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 2416S | 1.53 | 3.02 | 2.24 | 0.70 | 3/4 | 0.54 | 1.37 | 2.05 | 0.30 | 164 | 139 |
| 2416S-06 | 1.53 | 3.02 | 2.24 | 0.70 | 3/4 | 0.54 | 1.37 | 2.05 | 0.30 | 164 | 139 |
| 2416S-10 | 1.53 | 3.02 | 2.24 | 0.70 | 3/4 | 0.54 | 1.37 | 2.05 | 0.30 | 164 | 139 |
| 2417S | 1.53 | 3.02 | 2.24 | 0.70 | 3/4 | 0.54 | 1.37 | 2.05 | 0.30 | 164 | 139 |
| 2424S-19 | 4.65 | 5.61 | 2.24 | 0.70 | 5/6 | 2.14 | 2.35 | 2.05 | 0.37 | 248 | 239 |
| 2776S | 1.53 | 3.02 | 2.24 | 0.70 | 3/4 | 0.54 | 1.37 | 2.05 | 0.30 | 164 | 139 |
| 2904S | 1.53 | 3.02 | 2.24 | 0.70 | 3/4 | 0.54 | 1.37 | 2.05 | 0.30 | 164 | 139 |

Note 1: Refer to pages F-57 to F-60 for details of contact points.

Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.

Note 1: Refer to pages F-57 to F-60 for details of contact points.

Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Dial Indicators


Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 1 — Compact Type, Extra Small Diameter

- Compact dial indicators with bezel diameters of 31 or 36 mm for restricted-space applications in gaging jigs.



1911T-10

 **Balanced scale**



Graduation: 0.01 mm, Measuring range: 2.5 mm  **Jeweled bearing**

 **Balanced scale**



Graduation: 0.02 mm, Measuring range: 0.5 mm  **Jeweled bearing**



1003T

 **Balanced scale**



Graduation: 0.01 mm, Measuring range: 4 mm **1003T**

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

DIMENSIONS

ISO/JIS Type

ANSI/AGD Type

1911T-10/1913T-10

1003T

1921T-10/1923T-10/1925T-10

Unit: mm Unit: in

| Metric | | | | | | | | | | Unit: mm | |
|-----------------|------|------|----|------|------|-----|------|----|-----|----------|-----------|
| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
| | | | | | | | | | | w/lug | Flat-back |
| 1911T-10 | 15.5 | 42 | 31 | 12.9 | 19.2 | 15 | 11.5 | 30 | 5.9 | 56 | 52 |
| 1913T-10 | 15.5 | 39.5 | 31 | 12.9 | 19.2 | 15 | 9 | 30 | 5.9 | 56 | 52 |
| 1003T | 18 | 40.3 | 36 | 13 | 15 | 9.5 | 12.8 | 32 | 6 | 61 | 58 |

| Inch | | | | | | | | | | Unit: in | |
|-----------------|------|------|------|------|-----|------|------|------|------|----------|-----------|
| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
| | | | | | | | | | | w/lug | Flat-back |
| 1921T-10 | 0.61 | 1.57 | 1.22 | 0.51 | 3/4 | 0.59 | 0.37 | 1.18 | 0.27 | 56 | 52 |
| 1923T-10 | 0.61 | 1.51 | 1.22 | 0.51 | 3/4 | 0.59 | 0.31 | 1.18 | 0.27 | 56 | 52 |
| 1925T-10 | 0.61 | 1.48 | 1.22 | 0.51 | 3/4 | 0.59 | 0.28 | 1.18 | 0.27 | 56 | 52 |

Note 1: Limit hands, bezel clamps and lifting levers cannot be installed.

Note 2: The shoulder on a contact point (standard accessory) acts as a stop to prevent spindle overrun that may otherwise damage the indicator. For this reason, if you need to install an optional contact point with an outside diameter smaller than 7 mm, use a washer (with outside diameter of at least 7 mm, inside diameter of 3 mm, and thickness of approx. 0.5 mm) placed between the contact point and the spindle.

Note 3: Being fixed by only two retaining screws, the back cannot be rotated by 90° to change the orientation of the lug.

SPECIFICATIONS

ISO/JIS type

| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | Dial reading | Measuring force (N) | |
|-----------------|------------------|-----------------|------------------------|--------------------------------------|---------|-------|------------|----------------|-----------------|---------------------|-------------|
| | | | | Indication error | | | Hysteresis | Repeat-ability | | | |
| w/lug | Flat-back | | | 1/10 Rev | 1/2 Rev | 1 Rev | | | Measuring range | | |
| 1911T-10 | 1911TB-10 | 0.01 | 2.5 (1) | 8 | 9 | 10 | 12 | 4 | 3 | 0-50-0 | 1.8 or less |
| 1913T-10 | 1913TB-10 | 0.002 | 0.5 (0.2) | 2.5 | 4 | 5 | 6 | 2.5 | 1 | 0-100-0 | 1.8 or less |
| 1003T | 1003TB | 0.01 | 4 (1) | 8 | 10 | 11 | 13 | 4 | 3 | 0-50-0 | 1.4 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

ANSI/AGD type

| Order No. | | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) |
|-----------------|------------------|-----------------|------------------------|----------------------------|---------|----------|---------------------|--------------|---------------------|
| | | | | First 1 Rev/2.5 Rev/10 Rev | Retrace | | | | |
| w/lug | Flat-back | | | | | | | | |
| 1921T-10 | 1921TB-10 | 0.001 | 0.1 (0.04) | ±0.001/±0.001/— | 0.0002 | ±0.0002 | 0-20-0 | 1.8 or less | |
| 1923T-10 | 1923TB-10 | 0.0005 | 0.05 (0.02) | ±0.0005/±0.005/— | 0.00016 | ±0.0001 | 0-10-0 | 1.8 or less | |
| 1925T-10 | 1925TB-10 | 0.0001 | 0.025 (0.01) | ±0.0002/±0.0002/— | 0.0001 | ±0.00003 | 0-5-0 | 1.8 or less | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 1 — Compact Type, Small Diameter

- Compact dial indicators ideal for restricted-space applications in gaging jigs.
- All models come with limit markers and a bezel clamp.
- Watertight assembly of bezel and crystal as well as the use of an O-ring prevents water or oil penetration.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.



10445

Continuous scale



Graduation: 0.01 mm, Measuring range: 3.5 mm **10405**
 Double scale spacing

Balanced scale



Graduation: 0.01 mm, Measuring range: 3.5 mm **10415**
 Double scale spacing

Continuous scale



Graduation: 0.01 mm, Measuring range: 5 mm **10445**
10445-15
 Jeweled bearing

Balanced scale

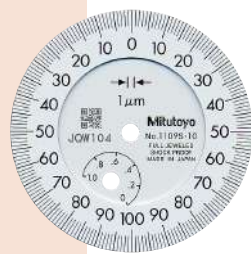


Graduation: 0.01 mm, Measuring range: 5 mm **10455**



11095-10

Balanced scale



Graduation: 0.001 mm, Measuring range: 1 mm **11095-10**
 Shockproof
 Jeweled bearing

Balanced scale



Graduation: 0.002 mm, Measuring range: 1 mm **10135-10**
 Shockproof
 Jeweled bearing

Continuous scale



Graduation: 0.005 mm, Measuring range: 3.5 mm **11245**

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.



An inspection certificate is supplied as standard. Refer to page U-11 for details.



10445-60

Continuous scale



Graduation: 0.01 mm, 10445-60
Measuring range: 5 mm Waterproof

SPECIFICATIONS

| Metric | | ISO/JIS type | | | | | | | | | |
|-----------|-----------|-----------------|------------------------|--------------------------------------|-----------------|-----|------------|----------------|---|--------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (µm) | | | | | | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | Hysteresis | Repeat-ability | | | |
| | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | | | |
| 1013S-10 | 1013SB-10 | 0.002 | 1 (0.2) | 2.5 | 4 | 5 | 6 | 2.5 | 1 | 0-100-0 | 1.5 or less |
| 1040S | 1040SB | 0.01 | 3.5 (0.5) | 8 | 10 | 11 | 13 | 4 | 3 | ±0-50 | 1.4 or less |
| 1041S | 1041SB | 0.01 | 3.5 (0.5) | 8 | 10 | 11 | 13 | 4 | 3 | 0-25-0 | 1.4 or less |
| 1044S | 1044SB | 0.01 | 5 (1) | 8 | 10 | 11 | 13 | 4 | 3 | ±0-100 | 1.4 or less |
| 1044S-15 | 1044SB-15 | 0.01 | 5 (1) | 8 | 10 | 11 | 13 | 4 | 3 | ±0-100 | 0.4 or less* |
| 1044S-60 | 1044SB-60 | 0.01 | 5 (1) | 8 | 10 | 11 | 13 | 4 | 3 | ±0-100 | 2.0 or less* |
| 1045S | 1045SB | 0.01 | 5 (1) | 8 | 10 | 11 | 13 | 4 | 3 | 0-50-0 | 1.4 or less |
| 1109S-10 | 1109SB-10 | 0.001 | 1 (0.2) | 2.5 | 3.5 | 4.5 | 5 | 2 | 1 | 0-100-0 | 1.5 or less |
| 1124S | 1124SB | 0.005 | 3.5 (0.5) | 6 | 9 | 10 | 12 | 3.5 | 3 | ±0-50 | 1.4 or less |

* For low measuring force type, use in the vertical orientation.

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

FEATURES

| Metric | | Features | | | | | |
|-----------|-----------|----------|---|---|---|---|---|
| Order No. | | | | | | | |
| w/lug | Flat-back | | | | | | |
| 1013S-10 | 1013SB-10 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 1040S | 1040SB | ✓ | | | | | |
| 1041S | 1041SB | | ✓ | ✓ | | | |
| 1044S | 1044SB | ✓ | | | | | |
| 1044S-15 | 1044SB-15 | ✓ | | | | | ✓ |
| 1044S-60 | 1044SB-60 | ✓ | | | | | ✓ |
| 1045S | 1045SB | | ✓ | | | | |
| 1109S-10 | 1109SB-10 | | ✓ | | | ✓ | ✓ |
| 1124S | 1124SB | ✓ | | | | | |

| Inch | | ANSI/AGD type | | | | | | | | | |
|-----------|-----------|-----------------|------------------------|----------------------------|---------|--|---------------------|--------------|---------------------|-------------|--|
| Order No. | | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) | | |
| w/lug | Flat-back | | | First 1 Rev/2.5 Rev/10 Rev | Retrace | | | | | | |
| 1410S | 1410SB | 0.001 | 0.25 (0.1) | ±0.001/±0.001/— | | | 0.0002 | ±0.0002 | 0-100 | 1.4 or less | |
| 1411S | 1411SB | 0.001 | 0.25 (0.1) | ±0.001/±0.001/— | | | 0.0002 | ±0.0002 | 0-50-0 | 1.4 or less | |
| 1410S-10 | 1410SB-10 | 0.001 | 0.25 (0.1) | ±0.001/±0.001/— | | | 0.0002 | ±0.0002 | 0-100 | 1.4 or less | |
| 1780S | 1780SB | 0.001 | 0.125 (0.05) | ±0.001/±0.001/— | | | 0.0002 | ±0.0002 | 0-50 | 1.4 or less | |
| 1781S | 1781SB | 0.001 | 0.125 (0.05) | ±0.001/±0.001/— | | | 0.0002 | ±0.0002 | 0-25-0 | 1.4 or less | |
| 1506S | 1506SB | 0.0005 | 0.125 (0.05) | ±0.0005/±0.0005/— | | | 0.00016 | ±0.0001 | 0-50 | 1.4 or less | |
| 1507S | 1507SB | 0.0005 | 0.125 (0.05) | ±0.0005/±0.0005/— | | | 0.00016 | ±0.0001 | 0-25-0 | 1.4 or less | |
| 1670S | 1670SB | 0.0005 | 0.1 (0.04) | ±0.0005/±0.0005/— | | | 0.00016 | ±0.0001 | 0-40 | 1.4 or less | |
| 1671S | 1671SB | 0.0005 | 0.1 (0.04) | ±0.0005/±0.0005/— | | | 0.00016 | ±0.0001 | 0-20-0 | 1.4 or less | |
| 1802S-10 | 1802SB-10 | 0.0001 | 0.025 (0.01) | ±0.0001/±0.0001/— | | | 0.0001 | ±0.00003 | 0-10 | 1.5 or less | |
| 1803S-10 | 1803SB-10 | 0.0001 | 0.025 (0.01) | ±0.0001/±0.0001/— | | | 0.0001 | ±0.00003 | 0-5-0 | 1.5 or less | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Inch | | Features | | | |
|-----------|-----------|----------|---|---|---|
| Order No. | | | | | |
| w/lug | Flat-back | | | | |
| 1410S | 1410SB | ✓ | | | |
| 1411S | 1411SB | | ✓ | | |
| 1410S-10 | 1410SB-10 | ✓ | | ✓ | |
| 1780S | 1780SB | ✓ | | | |
| 1781S | 1781SB | | ✓ | | |
| 1506S | 1506SB | ✓ | | | |
| 1507S | 1507SB | | ✓ | | |
| 1670S | 1670SB | ✓ | | | |
| 1671S | 1671SB | | ✓ | | |
| 1802S-10 | 1802SB-10 | ✓ | | ✓ | ✓ |
| 1803S-10 | 1803SB-10 | ✓ | | ✓ | ✓ |

DIMENSIONS

ANSI/AGD Type

Unit: in

| Order No. | A | B | C | D | E | F | G | H | I |
|-----------|------|------|------|------|-----|------|------|------|------|
| 1410S | 1.28 | 1.87 | 1.57 | 0.57 | 3/4 | 0.50 | 0.58 | 1.50 | 0.26 |
| 1411S | 1.28 | 1.87 | 1.57 | 0.57 | 3/4 | 0.50 | 0.58 | 1.50 | 0.26 |
| 1410S-10 | 1.28 | 1.87 | 1.57 | 0.57 | 3/4 | 0.50 | 0.58 | 1.50 | 0.26 |
| 1780S | 1.28 | 1.74 | 1.57 | 0.57 | 3/4 | 0.50 | 0.44 | 1.50 | 0.26 |
| 1781S | 1.28 | 1.74 | 1.57 | 0.57 | 3/4 | 0.50 | 0.44 | 1.50 | 0.26 |
| 1506S | 1.28 | 1.74 | 1.57 | 0.57 | 3/4 | 0.50 | 0.44 | 1.50 | 0.26 |
| 1507S | 1.28 | 1.74 | 1.57 | 0.57 | 3/4 | 0.50 | 0.44 | 1.50 | 0.26 |
| 1670S | 1.28 | 1.71 | 1.57 | 0.57 | 3/4 | 0.50 | 0.42 | 1.50 | 0.26 |
| 1671S | 1.28 | 1.71 | 1.57 | 0.57 | 3/4 | 0.50 | 0.42 | 1.50 | 0.26 |
| 1802S-10 | 1.28 | 1.63 | 1.57 | 0.57 | 3/4 | 0.50 | 0.33 | 1.50 | 0.26 |
| 1803S-10 | 1.28 | 1.63 | 1.57 | 0.57 | 3/4 | 0.49 | 0.33 | 1.50 | 0.26 |

Note 1: Refer to pages F-57 to F-60 for details of contact points.
Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.

ISO/JIS Type

Unit: mm

| Order No. | A | B | C | D | E | F | G | H | I |
|------------|------|------|----|------|----|------|------|----|-----|
| 1013S-10 | 32.5 | 49 | 40 | 14.5 | 20 | 13.8 | 15.2 | 38 | 6.6 |
| 1040S | 32.5 | 46 | 40 | 14.5 | 20 | 13.8 | 12.2 | 38 | 6.6 |
| 1041S | 32.5 | 46 | 40 | 14.5 | 20 | 13.8 | 12.2 | 38 | 6.6 |
| 1044S | 32.5 | 47.5 | 40 | 14.5 | 20 | 13.8 | 13.7 | 38 | 6.6 |
| 1044S-15*3 | 32.5 | 47.5 | 40 | 14.5 | 20 | 13.8 | 13.7 | 38 | 6.6 |
| 1044S-60 | 32.5 | 57 | 40 | 14.5 | 20 | 12.2 | 24.8 | 38 | 6.6 |
| 1045S | 32.5 | 47.5 | 40 | 14.5 | 20 | 13.8 | 13.7 | 38 | 6.6 |
| 1109S-10 | 32.5 | 49 | 40 | 14.5 | 20 | 13.8 | 15.2 | 38 | 6.6 |
| 1124S | 32.5 | 46 | 40 | 14.5 | 20 | 13.8 | 12.2 | 38 | 6.6 |

* 3 Use in the vertical orientation (contact point downward) for the low measuring force model.
Note 1: Refer to pages F-57 to F-60 for details of contact points.
Note 2: If the contact point of the waterproof model is replaced, the water resistance cannot be guaranteed.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

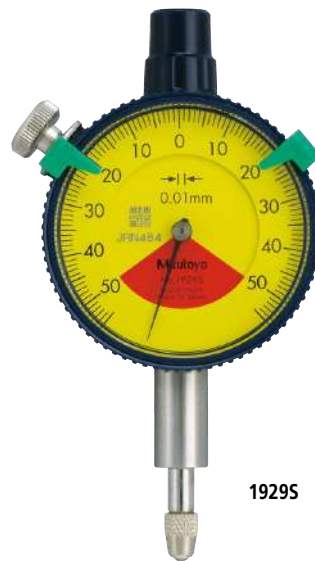
SERIES 1 — Compact One Revolution Type for Error-free Reading

- Compact dial indicators ideal for restricted-space applications in gaging jigs.
- Mitutoyo's unique shock-proof mechanism is incorporated, providing improved resistance to shock due to sudden spindle retraction caused by impact.
- This series has been developed to eliminate the possibility of reading errors due to miscounting multiple revolutions.
- The dead zone in red indicates "accuracy not guaranteed".
- One revolution type Back Plunger dial gages are also available. (Refer to pages F-55 to F-56 for details)
- All types come with limit markers and a bezel clamp.

One revolution type Back plunger dial gages are also available. (Refer to pages F-55 to F-56 for details.)



2990T-10



1929S

Balanced scale



Graduation: 0.01 mm,
Measuring range: 1 mm

1929S

One revolution

Shockproof

1929S-62

One revolution

Shockproof

Dustproof



1900S-10

Balanced scale



Graduation: 0.001 mm,
Measuring range: 0.1 mm

1900S-10

One revolution

Shockproof

Jeweled bearing

1900S-72

One revolution

Shockproof

Dustproof

Jeweled bearing

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

FEATURES

| Metric | | | | | | |
|-----------|-----------|---|---|---|---|---|
| Order No. | | | | | | |
| w/lug | Flat-back | | | | | |
| 1929S | 1929SB | ✓ | ✓ | | | ✓ |
| 1929S-62 | 1929SB-62 | ✓ | ✓ | | ✓ | ✓ |
| 1900S-10 | 1900SB-10 | ✓ | ✓ | ✓ | | ✓ |
| 1900S-72 | 1900SB-72 | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inch | | | | | | |
|-----------|-----------|---|---|---|---|---|
| Order No. | | | | | | |
| w/lug | Flat-back | | | | | |
| 1909S-62 | 1909SB-62 | ✓ | ✓ | | ✓ | ✓ |
| 1910S-72 | 1910SB-72 | ✓ | ✓ | ✓ | ✓ | ✓ |

SPECIFICATIONS

| Metric | | ISO/JIS type | | | | | | | | | |
|-----------|-----------|-----------------|------------------------|--------------------------------------|---------|-------|-----------------|------------|----------------|--------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | Hysteresis | Repeat-ability | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | Measuring range | | | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | | | | | |
| 1929S | 1929SB | 0.01 | 1 (1.4) | 7 | — | — | 11 | 4 | 3 | 50-0-50 | 1.4 or less |
| 1929S-62 | 1929SB-62 | 0.01 | 1 (1.4) | 7 | — | — | 11 | 4 | 3 | 50-0-50 | 1.4 or less |
| 1900S-10 | 1900SB-10 | 0.001 | 0.1 (0.14) | 2.5 | — | — | 5 | 2 | 1 | 50-0-50 | 1.5 or less |
| 1900S-72 | 1900SB-72 | 0.001 | 0.1 (0.14) | 2.5 | — | — | 5 | 2 | 1 | 50-0-50 | 1.5 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

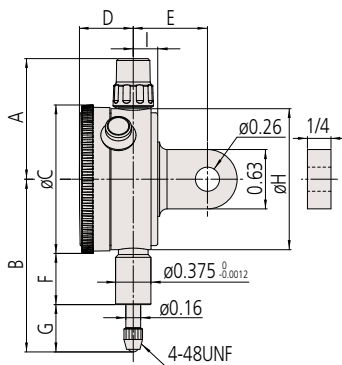
| Inch | | ANSI/AGD type | | | | | | | | | |
|-----------|-----------|-----------------|------------------------|----------------------------|---------|----------|---------------------|--------------|---------------------|--|--|
| Order No. | | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) | | |
| w/lug | Flat-back | | | First 1 Rev/2.5 Rev/10 Rev | Retrace | | | | | | |
| 1909S-62 | 1909SB-62 | 0.0005 | 0.04 (0.056) | ±0.0005/—/— | 0.00016 | ±0.0001 | 20-0-20 | 1.4 or less | | | |
| 1910S-72 | 1910SB-72 | 0.0001 | 0.006 (0.008) | ±0.0001/—/— | 0.0001 | ±0.00003 | 3-0-3 | 1.5 or less | | | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

DIMENSIONS

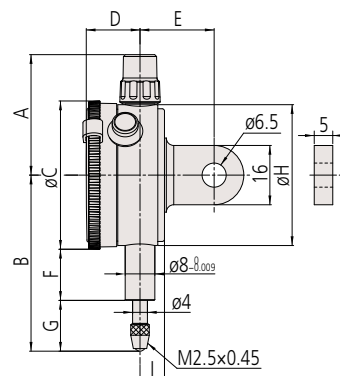
ANSI/AGD Type

Unit: in



ISO/JIS Type

Unit: mm



| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|------|------|------|------|------|------|------|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 1909S-62 | 1.28 | 1.64 | 1.57 | 0.57 | 0.75 | 0.50 | 0.35 | 1.50 | 0.26 | 90 | 70 |
| 1910S-72 | 1.28 | 1.61 | 1.57 | 0.57 | 0.75 | 0.50 | 0.31 | 1.50 | 0.26 | 90 | 70 |

Note: Refer to pages F-57 to F-60 for details of contact points.

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------|------|------|----|------|----|------|------|----|-----|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 1929S | 32.5 | 47.5 | 40 | 14.5 | 20 | 13.8 | 13.7 | 38 | 6.6 | 90 | 70 |
| 1929S-62 | 32.5 | 47.5 | 40 | 14.5 | 20 | 13.8 | 13.7 | 38 | 6.6 | 90 | 70 |
| 1900S-10 | 32.5 | 53.5 | 40 | 14.5 | 20 | 16.8 | 16.7 | 38 | 6.6 | 95 | 75 |
| 1900S-72 | 32.5 | 53.5 | 40 | 14.5 | 20 | 16.8 | 16.7 | 38 | 6.6 | 95 | 75 |

Note: Refer to pages F-57 to F-60 for details of contact points.





An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 3, 4 — Long Stroke Type, Large Diameter


-  Continuous scale
-  Balanced scale

- Dial indicators with a large-diameter dial face for easy reading.
- Models with longer measuring ranges are also available.
- All types are supplied with limit markers and a bezel clamp as standard.
- The stem and spindle are made of high-strength quench-hardened stainless steel suitable for heavy-duty use.
- A carbide contact point is used.
- The bezel clamp and lifting lever* (optional) can be attached to either the right or left side. These parts can be easily installed and removed without tools.

* Can be attached only to **3046S, 3047S, 3050S, 3109S-10** and **4046S**.




4046S

-  Continuous scale




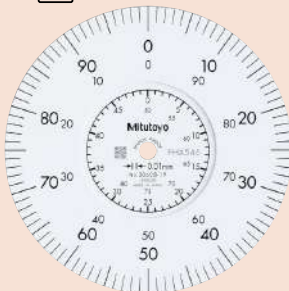
Graduation: 0.01 mm, Measuring range: 10 mm **3046S**

-  Continuous scale




Graduation: 0.01 mm, Measuring range: 20 mm **3050S**

-  Continuous scale

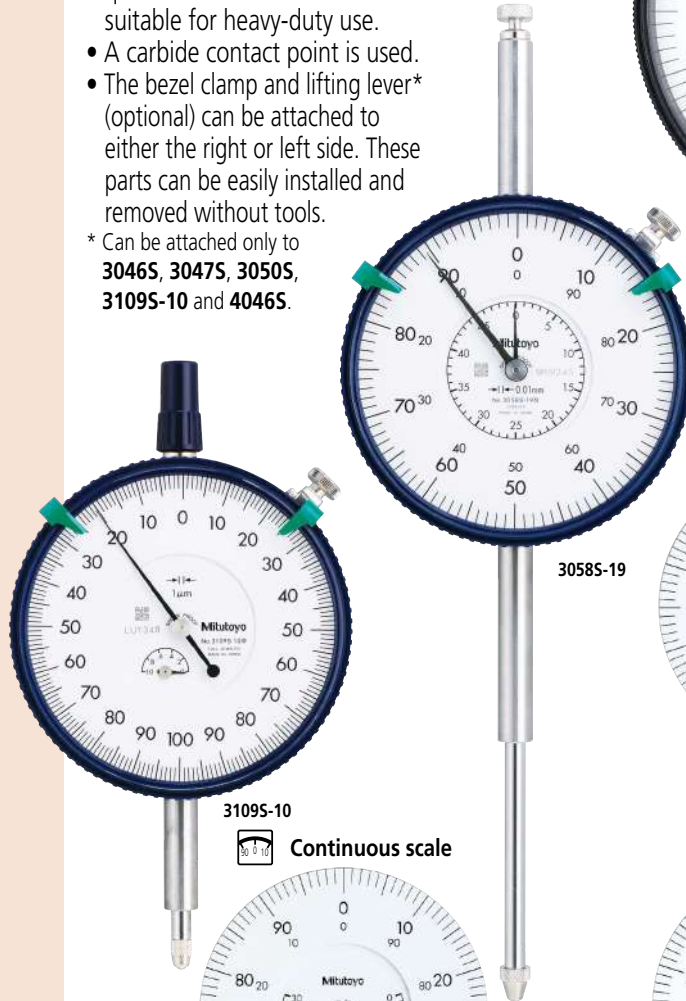


Graduation: 0.01 mm, Measuring range: 80 mm **3060S-19**

-  Continuous scale



Graduation: 0.01 mm, Measuring range: 10 mm **4046S**



3109S-10

-  Continuous scale



Graduation: 0.01 mm, Measuring range: 30 mm **3052S-19**

-  Continuous scale



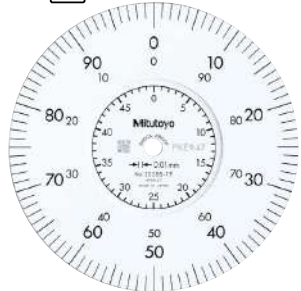
Graduation: 0.01 mm, Measuring range: 100 mm **3062S-19**

-  Balanced scale



Graduation: 0.01 mm, Measuring range: 10 mm **3047S**

-  Continuous scale



Graduation: 0.01 mm, Measuring range: 50 mm **3058S-19**

-  Balanced scale



Graduation: 0.001 mm, Measuring range: 1 mm **3109S-10**

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS

ISO / JIS Type

Unit: mm

| Order No. | A | B | C | D | E | F | G | H | I |
|-----------|-------|-------|----|------|----|------|-------|----|---|
| 3046S | 61.2 | 75.5 | 78 | 17.7 | 21 | 15.9 | 20.6 | 71 | 9 |
| 3047S | 61.2 | 75.5 | 78 | 17.7 | 21 | 15.9 | 20.6 | 71 | 9 |
| 3050S | 52.6 | 94 | 78 | 17.7 | 21 | 25.9 | 29.1 | 71 | 9 |
| 3052S-19* | 72.9 | 104.3 | 78 | 17.7 | 21 | 25.9 | 39.4 | 71 | 9 |
| 3058S-19* | 81.9 | 142.3 | 78 | 17.7 | 21 | 43.9 | 59.4 | 71 | 9 |
| 3060S-19* | 120.9 | 202.3 | 78 | 17.7 | 21 | 73.9 | 89.4 | 71 | 9 |
| 3062S-19* | 141.9 | 243.3 | 78 | 17.7 | 21 | 94.9 | 109.4 | 71 | 9 |
| 3109S-10 | 61.2 | 79 | 78 | 17.7 | 21 | 25.9 | 14.1 | 71 | 9 |
| 4046S | 61.2 | 84 | 92 | 21.5 | 21 | 18.9 | 19.1 | 71 | 9 |

* The shoulder on a contact point (standard accessory) acts as a stop to prevent spindle overrun that may otherwise damage the indicator. For this reason, if you need to install an optional contact point with an outside diameter smaller than 7 mm, use a washer (with outside diameter of at least 7 mm, inside diameter of 3 mm, and thickness of approx. 0.5 mm) placed between the contact point and the spindle. Note: Refer to pages F-57 to F-60 for details of contact points.

Unit: mm

ANSI / AGD Type

Unit: in

| Order No. | A | B | C | D | E | F | G | H | I |
|-----------|------|------|------|------|-----|------|------|------|------|
| 3414S | 2.07 | 2.89 | 3.07 | 0.70 | 3/4 | 0.50 | 0.86 | 2.80 | 0.35 |
| 3415S | 2.07 | 2.89 | 3.07 | 0.70 | 3/4 | 0.50 | 0.86 | 2.80 | 0.35 |
| 3416S | 2.07 | 3.39 | 3.07 | 0.70 | 3/4 | 0.50 | 1.36 | 2.80 | 0.35 |
| 3417S | 2.07 | 3.39 | 3.07 | 0.70 | 3/4 | 0.50 | 1.36 | 2.80 | 0.35 |
| 3424S-19* | 3.31 | 5.88 | 3.07 | 0.70 | 3/4 | 1.99 | 2.35 | 2.80 | 0.35 |
| 3426S-19* | 4.84 | 7.80 | 3.07 | 0.70 | 3/4 | 2.91 | 3.35 | 2.80 | 0.35 |
| 3428S-19* | 5.67 | 9.63 | 3.07 | 0.70 | 3/4 | 3.74 | 4.35 | 2.80 | 0.35 |
| 3802S-10 | 2.41 | 2.35 | 3.07 | 0.70 | 3/4 | 0.50 | 0.32 | 2.80 | 0.35 |
| 3803S-10 | 2.41 | 2.35 | 3.07 | 0.70 | 3/4 | 0.50 | 0.32 | 2.80 | 0.35 |
| 4887S-19* | 4.84 | 7.80 | 3.62 | 0.85 | 3/4 | 2.63 | 3.35 | 2.80 | 0.35 |

Unit: in

FEATURES

| Metric | | <input type="checkbox"/> ISO / JIS type | | | | | |
|-----------|-----------|---|-----|-----|---|---|---|
| Order No. | w/lug | Flat-back | 30° | 15° | 3 | 4 | 5 |
| 3046S | 3046SB | ✓ | ✓ | | | | |
| 3047S | 3047SB | | ✓ | | | | |
| 3050S | 3050SB | ✓ | | | ✓ | | |
| 3052S-19 | 3052SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3058S-19 | 3058SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3060S-19 | 3060SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3062S-19 | 3062SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3109S-10 | 3109SB-10 | | ✓ | ✓ | | | |
| 4046S | 4046SB | ✓ | | | | | |

| Inch | | <input type="checkbox"/> ANSI / AGD type | | | | | |
|-----------|-----------|--|-----|-----|---|---|---|
| Order No. | w/lug | Flat-back | 30° | 15° | 3 | 4 | 5 |
| 3414S | 3414SB | ✓ | ✓ | | | | |
| 3415S | 3415SB | | ✓ | | | | |
| 3416S | 3416SB | ✓ | | | ✓ | | |
| 3417S | 3417SB | | ✓ | | | | |
| 3424S-19 | 3424SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3426S-19 | 3426SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3428S-19 | 3428SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3802S-10 | 3802SB-10 | | ✓ | ✓ | | | |
| 3803S-10 | 3803SB-10 | | ✓ | ✓ | | | |
| 4887S-19 | 4887SB-19 | ✓ | ✓ | | ✓ | ✓ | ✓ |

SPECIFICATIONS

| Metric | | <input type="checkbox"/> ISO / JIS type | | | | | | | | | | |
|------------|-------------|---|-----------------|------------------------|--------------------------------------|-------|-----------------|------------|----------------|--------------|---------------------|-------------|
| Order No. | w/lug | Flat-back | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | Dial reading | Measuring force (N) | |
| | | | | | Indication error | | | Hysteresis | Repeat-ability | | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | | | | | |
| 3046S | 3046SB | | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | 3 | 3 | ±0-100 | 1.4 or less |
| 3047S | 3047SB | | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | 3 | 3 | 0-50-0 | 1.4 or less |
| 3050S | 3050SB | | 0.01 | 20 (1) | 8 | 10 | 15 | 20 | 5 | 4 | ±0-100 | 2.0 or less |
| 3052S-19 | 3052SB-19 | | 0.01 | 30 (1) | 10 | 12 | 15 | 25 | 7 | 5 | ±0-100 | 2.5 or less |
| 3058S-19 | 3058SB-19 | | 0.01 | 50 (1) | 10 | 12 | 15 | 30 | 8 | 5 | ±0-100 | 3.0 or less |
| 3060S-19*1 | 3060SB-19*1 | | 0.01 | 80 (1) | 12 | 17 | 20 | 45 | 9 | 5 | ±0-100 | 3.0 or less |
| 3062S-19*1 | 3062SB-19*1 | | 0.01 | 100 (1) | 12 | 17 | 20 | 50 | 9 | 5 | ±0-100 | 3.2 or less |
| 3109S-10 | 3109SB-10 | | 0.001 | 1 (0.2) | 2 | 3.5 | 4 | 5 | 2 | 0.5 | 0-100-0 | 1.5 or less |
| 4046S | 4046SB | | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | 3 | 3 | ±0-100 | 1.4 or less |

*1 Use in a vertical orientation (contact point downward) for the long stroke model.

*2 Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Inch | | <input type="checkbox"/> ANSI / AGD type | | | | | | | | | |
|------------|-------------|--|-----------------|------------------------|---|--|---------|----------|---------------------|--------------|---------------------|
| Order No. | w/lug | Flat-back | Graduation (in) | Range (range/rev) (in) | Accuracy*2 (in) | | | Retrace | Repeat-ability (in) | Dial reading | Measuring force (N) |
| | | | | | First 1 Rev/2.5 Rev/10 Rev | | | | | | |
| 3414S | 3414SB | | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less | |
| 3415S | 3415SB | | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | | 0.0002 | ±0.0002 | 0-50-0 | 1.8 or less | |
| 3416S | 3416SB | | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less | |
| 3417S | 3417SB | | 0.001 | 1 (0.1) | ±0.001/±0.001/±0.002 | | 0.0002 | ±0.0002 | 0-50-0 | 1.8 or less | |
| 3424S-19 | 3424SB-19 | | 0.001 | 2 (0.1) | ±0.001/±0.001/±0.002 /±0.003 (20 Rev) | | 0.00033 | ±0.0002 | ±0-100 | 3.0 or less | |
| 3426S-19*1 | 3426SB-19*1 | | 0.001 | 3 (0.1) | ±0.001/±0.001/±0.002/±0.003 (20 Rev)/±0.005 (Over 20 Rev) | | 0.00033 | ±0.0002 | ±0-100 | 3.0 or less | |
| 3428S-19*1 | 3428SB-19*1 | | 0.001 | 4 (0.1) | ±0.001/±0.001/±0.002/±0.003 (20 Rev)/±0.005 (Over 20 Rev) | | 0.00033 | ±0.0002 | ±0-100 | 3.2 or less | |
| 3802S-10 | 3802SB-10 | | 0.0001 | 0.025 (0.01) | ±0.0001/±0.0001/— | | 0.0001 | ±0.00003 | 0-10 | 2.0 or less | |
| 3803S-10 | 3803SB-10 | | 0.0001 | 0.025 (0.01) | ±0.0001/±0.0001/— | | 0.0001 | ±0.00003 | 0-5-0 | 2.0 or less | |
| 4887S-19*1 | 4887SB-19*1 | | 0.001 | 3 (0.1) | ±0.001/±0.001/±0.002/±0.003 (20 Rev)/±0.005 (Over 20 Rev) | | 0.00033 | ±0.0002 | ±0-100 | 3.0 or less | |

*1 Use in a vertical orientation (contact point downward) for the long stroke model.

*2 Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

ANSI/AGD Type Metric Dial Indicators with $\varnothing 3/8$ inch Stem and #4-48UNF-Thread Contact Point Compatible Type

SPECIFICATIONS

| Metric | | SERIES 1 | | ANSI/AGD type | | | | | | |
|-----------|-----------|-----------------|------------------------|----------------------------|----------------|---------|----------------------------------|--------------|---------------------|-------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Accuracy (μm) | | | Repeat-ability (μm) | Dial reading | Measuring force (N) | |
| w/lug | Flat-back | | | First 1 Rev | 2.5 Rev/10 Rev | Retrace | | | | |
| 1230S-01 | 1230SB-01 | 0.01 | 2.5 (1) | $\pm 10/\pm 10/-$ | | | 3 | ± 2 | 0-100 | 1.4 or less |
| 1231S-01 | 1231SB-01 | 0.01 | 2.5 (1) | $\pm 10/\pm 10/-$ | | | 3 | ± 2 | 0-50-0 | 1.4 or less |
| 1044S-01 | 1044SB-01 | 0.01 | 5 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | $\pm 0-100$ | 1.4 or less |
| 1045S-01 | 1045SB-01 | 0.01 | 5 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | 0-50-0 | 1.4 or less |
| 1010S-11 | 1010SB-11 | 0.002 | 0.5 (0.2) | $\pm 2/\pm 2/-$ | | | 2 | ± 1 | 0-20 | 1.5 or less |
| 1011S-11 | 1011SB-11 | 0.002 | 0.5 (0.2) | $\pm 2/\pm 2/-$ | | | 2 | ± 1 | 0-10-0 | 1.5 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Metric | | SERIES 2 | | ANSI/AGD type | | | | | | |
|-----------|-----------|-----------------|------------------------|---|----------------|---------|----------------------------------|--------------|---------------------|-------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Accuracy (μm) | | | Repeat-ability (μm) | Dial reading | Measuring force (N) | |
| w/lug | Flat-back | | | First 1 Rev | 2.5 Rev/10 Rev | Retrace | | | | |
| 2231S-01 | 2231SB-01 | 0.01 | 2.5 (1) | $\pm 10/\pm 10/-$ | | | 3 | ± 3 | 0-50-0 | 1.4 or less |
| 2046S-01 | 2046SB-01 | 0.01 | 10 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | $\pm 0-100$ | 1.4 or less |
| 2046S-11 | 2046SB-11 | 0.01 | 10 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | $\pm 0-100$ | 1.4 or less |
| 2047S-01 | 2047SB-01 | 0.01 | 10 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | 0-50-0 | 1.4 or less |
| 2047S-11 | 2047SB-11 | 0.01 | 10 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | 0-50-0 | 1.4 or less |
| 2902S-01 | 2902SB-01 | 0.01 | 10 (1) | $\pm 10/\pm 10/\pm 13$ | | | 3 | ± 3 | 100-0 | 1.4 or less |
| 2050S-01 | 2050SB-01 | 0.01 | 20 (1) | $\pm 10/\pm 10/\pm 15/\pm 20$ (20 Rev) | | | 4 | ± 3 | $\pm 0-100$ | 2.0 or less |
| 2056S-01 | 2056SB-01 | 0.01 | 25 (1) | $\pm 10/\pm 10/\pm 15/\pm 20$ (20 Rev)/ ± 25 (Over 20 Rev) | | | 4 | ± 3 | $\pm 0-100$ | 2.5 or less |
| 2109S-11 | 2109SB-11 | 0.001 | 1 (0.2) | $\pm 3/\pm 3/\pm 4$ | | | 2 | ± 0.3 | 0-10-0 | 1.5 or less |
| 2119S-11 | 2119SB-11 | 0.001 | 5 (0.2) | $\pm 7/\pm 7/\pm 8/\pm 10$ (20 Rev)/ ± 10 (Over 20 Rev) | | | 2.5 | ± 0.3 | 0-10-0 | 1.5 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

Optional Accessories

- Backs (See page F-61)
- Contact points (See pages F-57 to F-60)

FEATURES

| Metric | | | | | | | | | | |
|-----------|-----------|-------|-----------|--|--|--|--|-------------------------------------|--|-------------------------------------|
| Order No. | | w/lug | Flat-back | | | | | | | |
| 1230S-01 | 1230SB-01 | | | | | | | | | |
| 1231S-01 | 1231SB-01 | | | | | | | | | |
| 1044S-01 | 1044SB-01 | | | | | | | | | |
| 1045S-01 | 1045SB-01 | | | | | | | | | |
| 1010S-11 | 1010SB-11 | | | | | | | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |
| 1011S-11 | 1011SB-11 | | | | | | | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |

| Metric | | | | | | | | | | | | | |
|-----------|-----------|-------|-----------|--|--|--|--|-------------------------------------|--|--|--|-------------------------------------|-------------------------------------|
| Order No. | | w/lug | Flat-back | | | | | | | | | | |
| 2231S-01 | 2231SB-01 | | | | | | | | | | | | |
| 2046S-01 | 2046SB-01 | | | | | | | | | | | | |
| 2046S-11 | 2046SB-11 | | | | | | | <input checked="" type="checkbox"/> | | | | | |
| 2047S-01 | 2047SB-01 | | | | | | | | | | | | |
| 2047S-11 | 2047SB-11 | | | | | | | <input checked="" type="checkbox"/> | | | | | |
| 2902S-01 | 2902SB-01 | | | | | | | | | | | | <input checked="" type="checkbox"/> |
| 2050S-01 | 2050SB-01 | | | | | | | | | | | | |
| 2056S-01 | 2056SB-01 | | | | | | | | | | | | |
| 2109S-11 | 2109SB-11 | | | | | | | <input checked="" type="checkbox"/> | | | | <input checked="" type="checkbox"/> | |
| 2119S-11 | 2119SB-11 | | | | | | | <input checked="" type="checkbox"/> | | | | | |

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

SERIES 2 — Special Dial Indicators

Adjustable hand dial indicator

- The hand position can be adjusted independently of the position of the spindle by rotating the top knob.



2048S-10

Continuous scale



Graduation: 0.01 mm,
Measuring range: 10 mm

2048S-10

- With coaxial revolution counter
- Adjustable hand
- Jeweled bearing

DIMENSIONS

ISO/JIS Type

Unit: mm

21AZA319
(threaded: M2.5x0.45)

| Order No. | A | B | C | D | E | F | G | H | I | Mass (g) | |
|-----------------|------|------|----|------|----|------|------|----|-----|----------|-----------|
| | | | | | | | | | | w/lug | Flat-back |
| 2048S-10 | 47.4 | 64.9 | 57 | 17.7 | 20 | 16.9 | 19.5 | 52 | 7.6 | 144 | 135 |

Note 1: Contact points, other than dedicated types, cannot be installed.
 Note 2: The shoulder on a contact point (standard accessory) acts as a stop to prevent spindle overrun that may otherwise damage the indicator. For this reason, if you need to install an optional contact point with an outside diameter smaller than 7 mm, use a washer (with outside diameter of at least 7 mm, inside diameter of 3 mm, and thickness of approx. 0.5 mm) placed between the contact point and the spindle.

SPECIFICATIONS

| Metric | | <input type="checkbox"/> ISO/JIS type | | | | | | | | | |
|-----------------|------------------|---------------------------------------|--------------------------------------|---------|-------|------------|----------------|--------------|-----------------|---------------------|---------------------|
| Order No. | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) | |
| | | | Indication error | | | Hysteresis | Repeat-ability | Dial reading | | | Measuring force (N) |
| w/lug | Flat-back | | 1/10 Rev | 1/2 Rev | 1 Rev | | | | Measuring range | | |
| 2048S-10 | 2048SB-10 | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | 3 | 3 | ±0-100 | 1.4 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Inch | | <input type="checkbox"/> ANSI/AGD type | | | | | | | | | |
|-----------------|------------------|--|---------------|----------------------|--------|---------------------|--------------|---------------------|---------|--|--|
| Order No. | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeat-ability (in) | Dial reading | Measuring force (N) | | | |
| | | | First 1 Rev | 2.5 Rev | 10 Rev | | | | Retrace | | |
| w/lug | Flat-back | | | | | | | | | | |
| 2915S-10 | 2915SB-10 | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | 0.0002 | ±0.0002 | ±0-100 | 1.8 or less | | | |
| 2918S-10 | 2918SB-10 | 0.001 | 0.5 (0.1) | ±0.001/±0.001/±0.001 | 0.0002 | ±0.0002 | 0-50-0 | 1.8 or less | | | |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

FEATURES

| Metric | | | | | | | |
|-----------------|------------------|-----------|----------|-----------|---|---|---|
| Order No. | w/lug | Flat-back | | | | | |
| | | | 2048S-10 | 2048SB-10 | ✓ | ✓ | |
| 2048S-10 | 2048SB-10 | | ✓ | ✓ | | ✓ | ✓ |

| Inch | | | | | | | |
|-----------------|------------------|-----------|----------|-----------|---|---|---|
| Order No. | w/lug | Flat-back | | | | | |
| | | | 2915S-10 | 2915SB-10 | ✓ | ✓ | |
| 2915S-10 | 2915SB-10 | | ✓ | ✓ | | ✓ | ✓ |
| 2918S-10 | 2918SB-10 | | ✓ | ✓ | | ✓ | ✓ |



An inspection certificate is supplied as standard. Refer to page U-11 for details.

SERIES 2 — Special Dial Indicators

- A mechanism holds the pointer and the spindle at the position of maximum depression and hence displays the maximum value.

Note: Clearance of peak hold: Push the mechanism release in the direction of the arrow indicated in the dimensional drawing below.



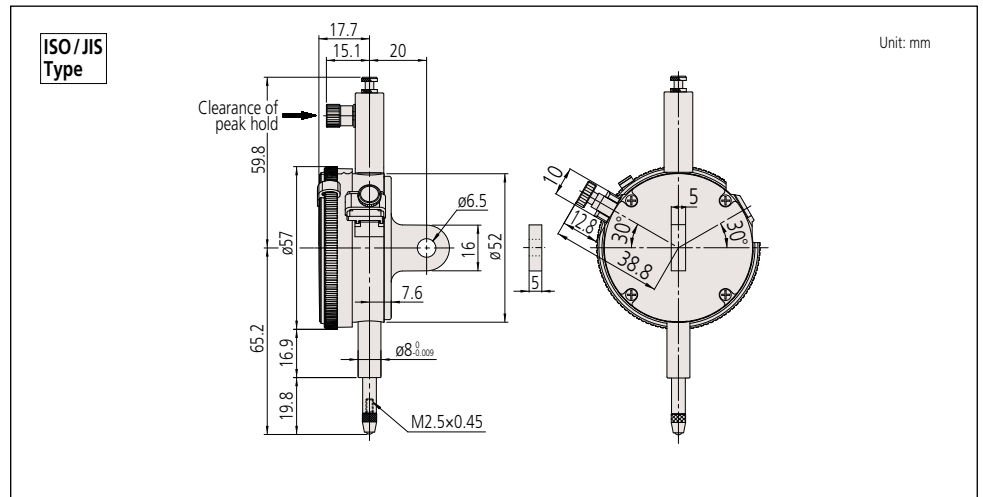
2046S-80

Continuous scale



Graduation: 0.01 mm, Measuring range: 10 mm **2046S-80** Peak retaining

DIMENSIONS



FEATURES

| Metric | | | | | |
|-----------|-----------|---|--|---|--|
| Order No. | | | | | |
| w/lug | Flat-back | | | | |
| 2046S-80 | 2046SB-80 | ✓ | | ✓ | |

SPECIFICATIONS

| Metric | | ISO/JIS type | | | | | | | | | |
|-----------|-----------|-----------------|------------------------|--------------------------------------|---------|-------|-----------------|------------|----------------|--------------|---------------------|
| Order No. | | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) |
| w/lug | Flat-back | | | Indication error | | | Repeatability | | | | |
| | | | | 1/10 Rev | 1/2 Rev | 1 Rev | Measuring range | Hysteresis | Repeat-ability | | |
| 2046S-80 | 2046SB-80 | 0.01 | 10 (1) | 5 | 9 | 10 | 15 | — | — | ±0-100 | 5.0 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

Dial Indicators

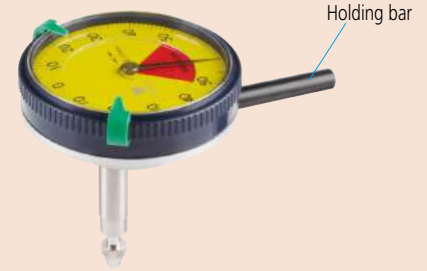
Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Back Plunger Type Dial Indicators SERIES 2

- Back Plunger type dial indicators are suitable for mounting onto leveling machine tool tables or inspection jigs, and for use in small spaces where the graduations of standard dial indicators are difficult to see.
- Mitutoyo's proprietary shock-proofing mechanism provides excellent durability and shock resistance.
- Model **2990T-10** provides 0.001 mm graduation.



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Holding bar (optional)

| Order No. | øD (mm) | L (mm) |
|-----------|---------|--------|
| 21AAA166 | ø6 | 42 |
| 136567 | ø6 | 81 |
| 124625 | ø6.35 | 81 |
| 21AAA167 | ø6.35 | 42 |
| 21AAA168 | ø8 | 42 |
| 136568 | ø8 | 81 |

Note: øD and L: detail shown in drawing below.



2960T

Balanced scale



Graduation: 0.01 mm,
Measuring range: 1 mm

2960T

- One revolution
- Shockproof
- Back Plunger



2990T-10

Balanced scale

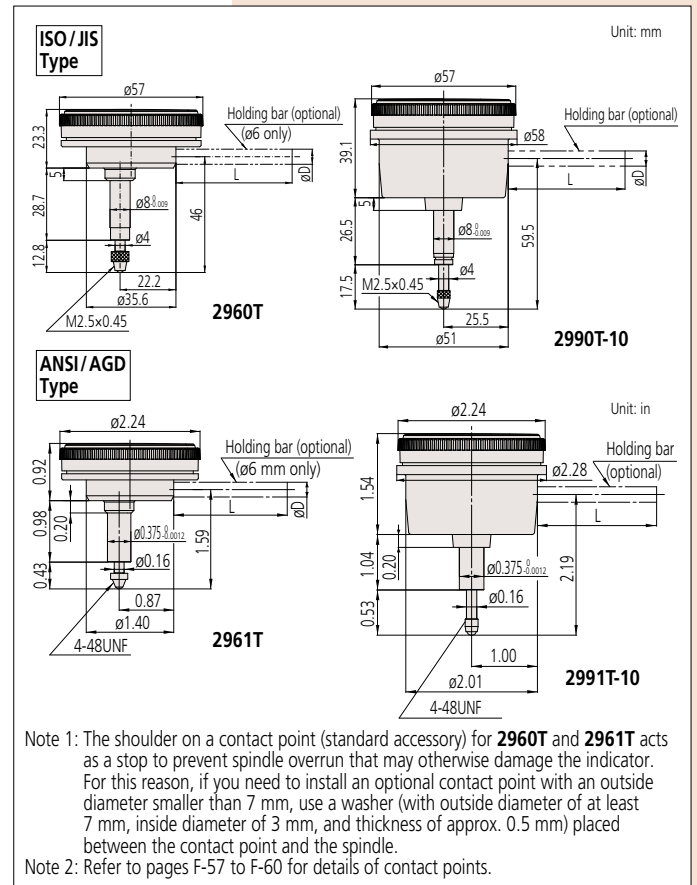


Graduation: 0.01 mm,
Measuring range: 1 mm

2990T-10

- One revolution
- Shockproof
- Back Plunger
- Jeweled bearing

DIMENSIONS



| Order No. | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | | Dial reading | Measuring force (N) |
|-----------|-----------------|------------------------|--------------------------------------|---------|-------|-----------------|------------|----------------|--------------|---------------------|
| | | | Indication error | | | Measuring range | Hysteresis | Repeat-ability | | |
| | | | 1/10 Rev | 1/2 Rev | 1 Rev | | | | | |
| 2960T | 0.01 | 1 (1.27) | 8 | — | — | 14 | 4 | 3 | 50-0-50 | 1.4 or less |
| 2990T-10 | 0.001 | 0.1 (0.14) | 2.5 | — | — | 5 | 2 | 1 | 50-0-50 | 1.5 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Order No. | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | | Repeat-ability (in) | Dial reading | Measuring force (N) |
|-----------|-----------------|------------------------|----------------------------|---------|---------|----------|---------------------|--------------|---------------------|
| | | | First 1 Rev/2.5 Rev/10 Rev | | Retrace | | | | |
| | | | First 1 Rev | 2.5 Rev | | | | | |
| 2961T | 0.0005 | 0.04/0.05 | ±0.0005 | —/— | 0.00016 | ±0.0001 | 20-0-20 | 1.4 or less | |
| 2991T-10 | 0.0001 | 0.008/0.01 | ±0.0002 | —/— | 0.0001 | ±0.00005 | 4-0-4 | 1.5 or less | |

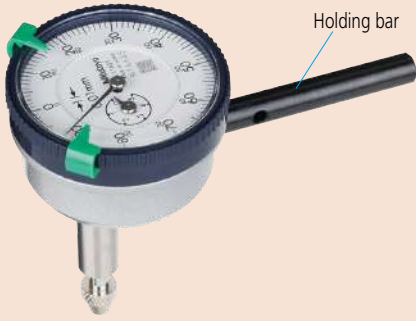
Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Order No. | ISO/JIS Type | One revolution | Shockproof | Jeweled bearing | Back Plunger |
|-----------|--------------|----------------|------------|-----------------|--------------|
| 2960T | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2990T-10 | ✓ | ✓ | ✓ | ✓ | ✓ |

| Order No. | ANSI/AGD Type | One revolution | Shockproof | Jeweled bearing | Back Plunger |
|-----------|---------------|----------------|------------|-----------------|--------------|
| 2961T | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2991T-10 | ✓ | ✓ | ✓ | ✓ | ✓ |



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Holding bar

Holding bar (optional)

| Order No. | øD (mm) | L (mm) |
|-----------|---------|--------|
| 21AAA166 | ø6 | 42 |
| 136567 | ø6 | 81 |
| 124625 | ø6.35 | 81 |
| 21AAA167 | ø6.35 | 42 |
| 21AAA168 | ø8 | 42 |
| 136568 | ø8 | 81 |

Note: øD and L: detail shown in drawing below.

DIMENSIONS

ANSI/AGD Type

Unit: in

ISO/JIS Type

Unit: mm

| Order No. | A | B | C | E | F | G | H | Mass (g) (Bar excluded) |
|-----------|------|------|------|-----|------|------|------|----------------------------|
| 1166T | 1.57 | 0.87 | 1.40 | 7/8 | 0.98 | 0.43 | 1.65 | 80 |
| 1167T | 1.57 | 0.87 | 1.40 | 7/8 | 0.98 | 0.43 | 1.65 | 80 |
| 1168T | 1.57 | 0.87 | 1.40 | 7/8 | 0.98 | 0.43 | 1.65 | 80 |
| 1961T | 1.57 | 0.87 | 1.40 | 7/8 | 0.98 | 0.43 | 1.57 | 80 |

Back Plunger Type Dial Indicators SERIES 1

- Back Plunger type dial indicators are suitable for mounting onto leveling machine tool tables or inspection jigs, and for use in situations where standard dial indicators are difficult to read.
- Model **1960T** and **1961T**, which uses Mitutoyo's proprietary shock-proofing mechanism, has excellent durability and shock resistance.



1160T



Continuous scale



Graduation: 0.01 mm,
Measuring range: 5 mm

1160T

Back Plunger



Reverse reading



Graduation: 0.01 mm,
Measuring range: 5 mm

1162T

Back Plunger



Balanced scale



Graduation: 0.01 mm,
Measuring range: 1 mm

1960T

One revolution

Shockproof

Back Plunger

FEATURES

| Order No. | ISO/JIS type | ANSI/AGD type | Reverse reading | Balanced scale | Shockproof | Back Plunger |
|-----------|--------------|---------------|-----------------|----------------|------------|--------------|
| 1960T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1160T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1162T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Inch

| Order No. | ISO/JIS type | ANSI/AGD type | Reverse reading | Balanced scale | Shockproof | Back Plunger |
|-----------|--------------|---------------|-----------------|----------------|------------|--------------|
| 1961T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1166T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1167T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1168T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

SPECIFICATIONS

| Order No. | Graduation (mm) | Range (range/rev) (mm) | Maximum permissible error (MPE) (μm) | | | | | Dial reading | Measuring force (N) | |
|-----------|-----------------|------------------------|--------------------------------------|---------|-------|------------|---------------|--------------|---------------------|-------------|
| | | | Indication error | | | Hysteresis | Repeatability | | | |
| | | | 1/10 Rev | 1/2 Rev | 1 Rev | | | | | |
| 1960T | 0.01 | 1 (1.27) | 8 | — | — | 14 | 4 | 3 | 50-0-50 | 1.4 or less |
| 1160T | 0.01 | 5 (1) | 8 | 12 | 14 | 16 | 4 | 3 | ±0-100 | 1.4 or less |
| 1162T | 0.01 | 5 (1) | 8 | 12 | 14 | 16 | 4 | 3 | 100-0 | 1.4 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

| Order No. | Graduation (in) | Range (range/rev) (in) | Accuracy (in) | | | Repeatability (in) | Dial reading | Measuring force (N) |
|-----------|-----------------|------------------------|----------------------------|----------------------|---------|--------------------|--------------|---------------------|
| | | | First 1 Rev/2.5 Rev/10 Rev | | Retrace | | | |
| | | | ±0.001/—/— | ±0.001/±0.001/±0.001 | | | | |
| 1961T | 0.001 | 0.04 (0.05) | ±0.001/—/— | | 0.0002 | ±0.0002 | 20-0-20 | 1.4 or less |
| 1166T | 0.001 | 0.2 (0.05) | ±0.001/±0.001/±0.001 | | 0.00033 | ±0.0002 | ±0-50 | 1.4 or less |
| 1167T | 0.001 | 0.2 (0.05) | ±0.001/±0.001/±0.001 | | 0.00033 | ±0.0002 | 0-25-0 | 1.4 or less |
| 1168T | 0.001 | 0.2 (0.05) | ±0.001/±0.001/±0.001 | | 0.00033 | ±0.0002 | 50-0 | 1.4 or less |

Note: Completed products inspection is performed in the vertical orientation (contact point downward) and the stated accuracy is guaranteed.

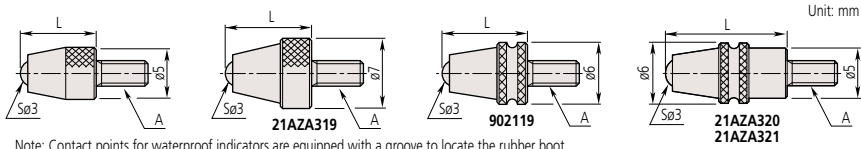
Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Optional Accessories for Digimatic and Dial Indicators and Linear Gages

Contact points, extension rod

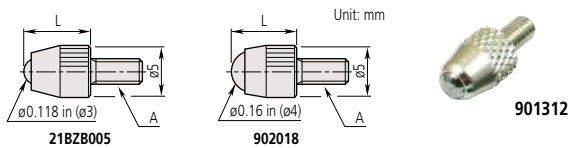
Standard contact point



Note: Contact points for waterproof indicators are equipped with a groove to locate the rubber boot.

A: M2.5x0.45

| L (mm) | Material | Carbide | | Ruby | Plastic |
|--------|----------|-----------------|-------------------------------|-----------------|----------------|
| | | Without groove | With groove (waterproof type) | Without groove | Without groove |
| 7.3 | | 901312 | — | 120047 | 901994 |
| 8.3 | | 21AZA319 | 902119 | — | — |
| 12.1 | | — | 21AZA320 | — | — |
| 14 | | 21JAA225 | — | — | — |
| 15 | | 120049 | — | 120051 | — |
| 17 | | 21JAA224 | — | — | — |
| 19.3 | | — | 21AZA321 | — | — |
| 20 | | 137391 | — | 137392 | — |
| 22 | | 21JAA226 | — | — | — |
| 25 | | 120053 | — | 120055 | — |
| 30 | | 21AAA252 | — | 21AAA253 | — |

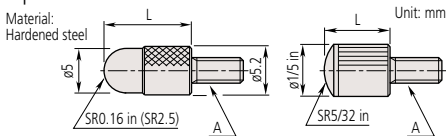


A: 4-48UNF

| L (inch) | Material | Carbide | Plastic |
|----------|----------|-----------------|---------------|
| 1/4 | | 21BZB005 | 902018 |

Shell Type Point

Contact point with a large radius.
Optimal for use on flat surfaces.



A: M2.5x0.45

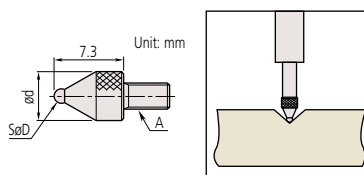
| Order No. | L (mm) |
|-----------------|--------|
| 101386 | 5 |
| 101118 | 10 |
| 137393 | 15 |
| 101387 | 20 |
| 101388 | 25 |
| 21AAA254 | 30 |

A: 4-48UNF

| Order No. | L (in) |
|-----------------|--------|
| 193697 | 3/32 |
| 101184 | 5/32 |
| 21AAA031 | 1/4 |
| 21AAA032 | 3/8 |
| 101185 | 1/2 |
| 21AAA033 | 5/8 |
| 101186 | 3/4 |
| 21AAA034 | 7/8 |
| 101187 | 1 |
| 21AAA035 | 1 1/4 |
| 21AAA036 | 1 1/2 |
| 21AAA037 | 1 3/4 |
| 21AAA038 | 2 |
| 21AAA039 | 2 1/4 |
| 21AAA040 | 2 1/2 |
| 21AAA041 | 2 3/4 |
| 21AAA042 | 3 |

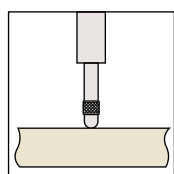
Ball point

Optimal for workpieces with deep indentations.

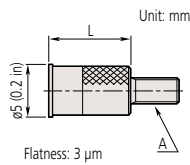


A: M2.5x0.45

| Order No. | SøD (mm) | ød (mm) |
|-----------------|--------------|---------|
| 21AAA349 | 1, carbide | 5 |
| 21AAA350 | 1.5, carbide | 5 |
| 101122 | 1.8, steel | 5 |
| 21AAA351 | 2.5, carbide | 5 |
| 21AAA352 | 4, carbide | 5 |



Flat Point

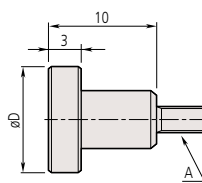


A: M2.5x0.45

| Order No. | L |
|-----------|----|
| 131365 | 8 |
| 21AAA340 | 10 |



131365



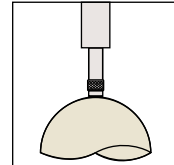
A: M2.5x0.45

| Order No. | øD |
|-----------|----|
| 101117 | 10 |
| 21AAA341 | 15 |
| 21AAA342 | 20 |
| 21AAA343 | 25 |
| 21AAA344 | 30 |



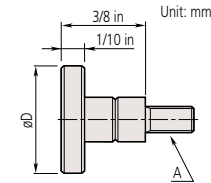
101117

Flatness: 5 µm



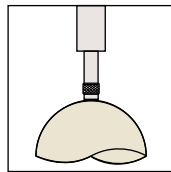
A: 4-48UNF

| Order No. | L (in) |
|-----------|--------|
| 133017 | 5/16 |
| 21AAA043 | 1/2 |
| 21AAA044 | 3/4 |
| 21AAA045 | 1 |

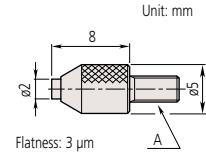


A: 4-48UNF

| Order No. | øD (in) |
|-----------|---------|
| 101188 | 1/2 |
| 101189 | 3/8 |



Flat Point (Carbide)

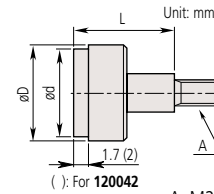


A: M2.5x0.45

| Order No. |
|-----------|
| 120056 |



120056



(): For 120042

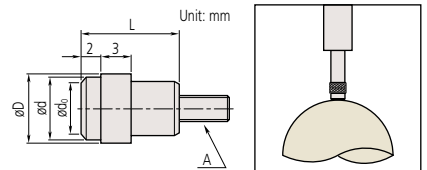


120043

A: M2.5x0.45

| Order No. | øD | ød | L |
|-----------|------|-------|----|
| 120041 | 5.2 | 4.3*1 | 5 |
| 120042 | 7 | 6.5*1 | 10 |
| 120043 | 10.5 | 9.5*1 | 10 |
| 21AAA345 | 17 | 15*2 | 10 |
| 21AAA346 | 22 | 20*2 | 10 |
| 21AAA347 | 27 | 25*2 | 10 |
| 21AAA348 | 32 | 30*2 | 10 |

Flatness: *1: 3 µm, *2: 5 µm



137255

A: M2.5x0.45

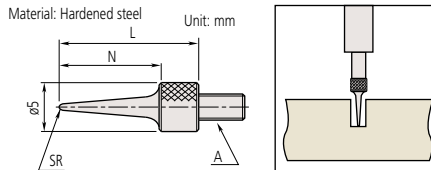
| Order No. | ød0 | ød | øD | L |
|-----------|-----|-----|----|----|
| 137255 | 3 | 6.4 | 7 | 10 |
| 137399 | 4.5 | 8 | 9 | 10 |

Flatness: 3 µm

Needle Point

Suitable for probing the bottom of a groove or hole.

Material: Hardened steel



101121

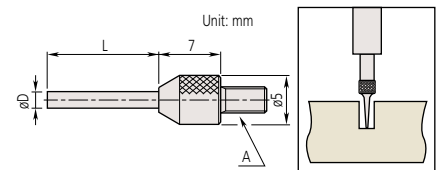
A: M2.5x0.45

| Order No. | N | L | SR |
|-----------|----|----|-----|
| 101121 | 11 | 15 | 0.4 |
| 137413 | 13 | 17 | 0.2 |
| 21AAA255 | 21 | 25 | 0.4 |
| 21AAA256 | 31 | 35 | 0.4 |

A: 4-48UNF

| Order No. | L (in) | SR (in) |
|-----------|--------|---------|
| 21AAA030 | 0.6 | 0.016 |
| 21AAA046 | 1 | 0.016 |
| 21AAA047 | 1 1/2 | 0.016 |
| 21AAA048 | 2 | 0.016 |

Needle Point (Carbide)



137257

A: M2.5x0.45

| Order No. | øD | L |
|-----------|------|----|
| 120066 | 0.45 | 3 |
| 21AAA329 | 0.45 | 5 |
| 120065 | 1 | 3 |
| 21AAA330 | 1 | 5 |
| 21AAA331 | 1 | 8 |
| 21AAA332 | 1 | 10 |
| 21AAA333 | 1 | 20 |
| 21AAA334 | 1 | 40 |
| 21AAA335 | 1.5 | 5 |
| 21AAA336 | 1.5 | 10 |
| 120064 | 1.5 | 13 |
| 21AAA337 | 1.5 | 20 |
| 21AAA338 | 1.5 | 40 |
| 137257 | 2 | 8 |
| 21AAA257 | 2 | 18 |
| 21AAA258 | 2 | 28 |
| 21AAA339 | 2 | 40 |

Dial Indicators

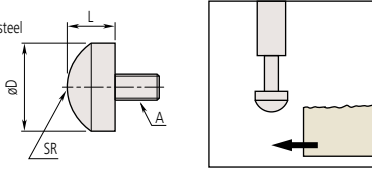
Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Optional Accessories for Digimatic and Dial Indicators and Linear Gages

Spherical Point

A large radius makes this contact point optimal for use where the workpiece needs to slide from the side.

Material:
Hardened steel



A: M2.5x0.45

| Order No. | D (mm) | L (mm) | SR (mm) |
|-----------|--------|--------|---------|
| 111460 | 5.5 | 3 | 5 |
| 125258 | 7.9 | 5 | 5 |
| 101119 | 10 | 5 | 7 |

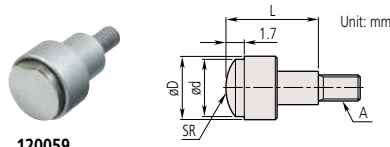


101119

A: 4-48UNF

| Order No. | D (in) | L (in) | SR (in) |
|-----------|--------|--------|---------|
| 101205 | 1/2 | 1/8 | 0.35 |
| 101204 | 3/8 | 3/32 | 0.28 |

Spherical Point (Carbide)



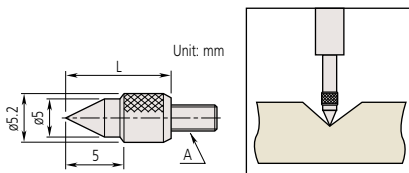
120059

A: M2.5x0.45

| Order No. | øD | ød | L | SR |
|-----------|------|-----|----|----|
| 120058 | 5.2 | 4.3 | 5 | 5 |
| 120059 | 7.5 | 6.5 | 10 | 7 |
| 120060 | 10.5 | 9.5 | 10 | 10 |

Conical Point

Used for positioning the measurement point. Since it can damage a workpiece easily, it is not suitable for use on soft materials.



A: M2.5x0.45

| Order No. | Tip angle | L |
|-----------|-----------|----|
| 101120 | 60° | 10 |



101120

A: 4-48UNF

| Order No. | Tip angle | L (in) |
|-----------|-----------|--------|
| 101190 | 60° | 1/2 |



101385

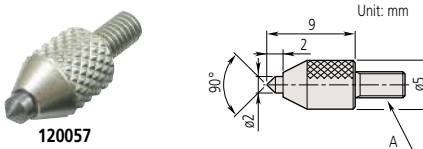
A: M2.5x0.45

| Order No. | Tip angle | L |
|-----------|-----------|---|
| 101385 | 90° | 5 |

A: 4-48UNF

| Order No. | Tip angle | L (in) |
|-----------|-----------|--------|
| 101191 | 90° | 1/4 |

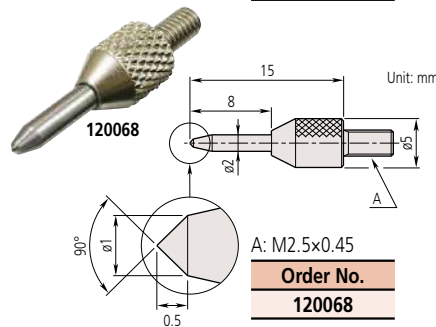
Conical Point (Carbide)



120057

A: M2.5x0.45

| Order No. |
|-----------|
| 120057 |



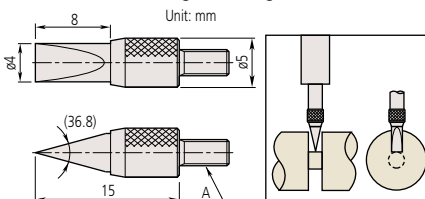
120068

A: M2.5x0.45

| Order No. |
|-----------|
| 120068 |

Knife Edge Point (Carbide)

Suitable for measuring narrow groove diameter, etc.



A: M2.5x0.45

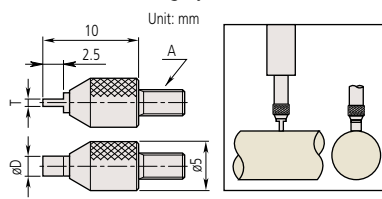
| Order No. |
|-----------|
| 120067 |



120067

Blade Point (Carbide)

Suitable for measuring cylinders.



A: M2.5x0.45

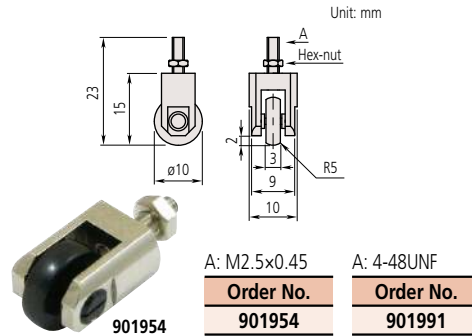
| Order No. | T | øD |
|-----------|-----|----|
| 120061 | 0.4 | 2 |
| 120062 | 0.6 | 2 |
| 120063 | 1 | 4 |



120062

Roller Point

Suitable for use on a moving workpiece surface, or where the workpiece needs to slide from the side.



Roller material: Hardened steel
Roller runout: 10 μm or better

Note 1: For a different roller diameter, contact your local Mitutoyo sales office.

Note 2: High-accuracy roller with 5 μm runout is also available. (Special order item)

Interchangeable Contact Point Set

This set consists of six types of popular contact point for extending the use of an indicator to many applications.



A: M2.5x0.45

| Order No. | Contact points included |
|-------------|--|
| 7822 | Flat Point (131365 , ø5 mm) |
| | Flat Point (101117 , ø10 mm) |
| | Needle Point (101121) |
| | Spherical Point (101119) |
| | Shell Type Point (101118) (R2.5x10) |
| | Shell Type Point (101387) (R2.5x10) |

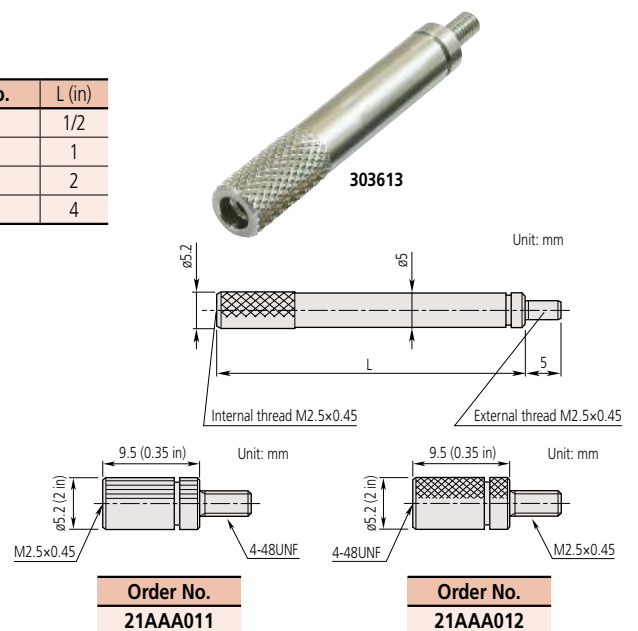
Extension Rod

A: M2.5x0.45

| Order No. | L |
|------------------|-----|
| 303611 | 10 |
| 21AAA259A | 15 |
| 303612 | 20 |
| 21AAA259B | 25 |
| 303613 | 30 |
| 21AAA259C | 35 |
| 21AAA259D | 40 |
| 21AAA259E | 45 |
| 21AAA259F | 50 |
| 21AAA259G | 55 |
| 304146 | 60 |
| 21AAA259H | 65 |
| 21AAA259J | 70 |
| 21AAA259L | 75 |
| 21AAA259M | 80 |
| 304147 | 90 |
| 303614 | 100 |

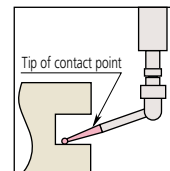
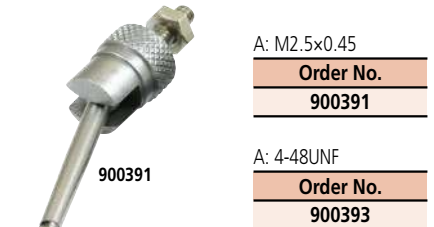
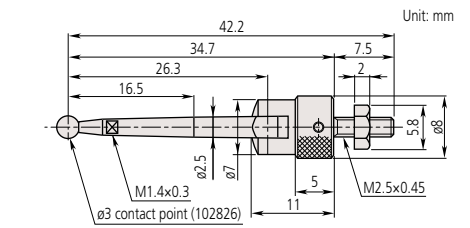
A: 4-48UNF

| Order No. | L (in) |
|---------------|--------|
| 139167 | 1/2 |
| 301655 | 1 |
| 301657 | 2 |
| 301659 | 4 |



Lever Point

Suitable for use* on perpendicular faces, such as those within mold cavities. Lever can be adjusted to the required angle.



The tip of contact point is interchangeable.

Interchangeable contact points (optional)

ø1 mm contact point: **102824**

ø2 mm contact point: **102825**

ø3 mm contact point: **102826** (provided as standard)


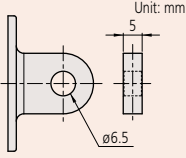



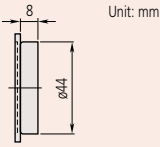

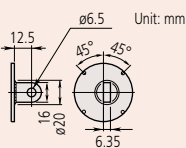

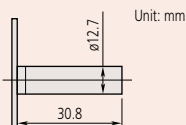

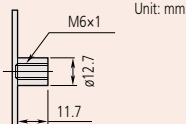

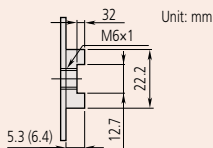

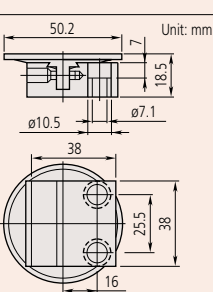
* Perform measurement in the same posture and conditions as for the reference setting so that variation due to lever deflection are reduced. Gently bring the contact point into touch with the workpiece. Use a dial indicator with as small a measuring force as possible.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

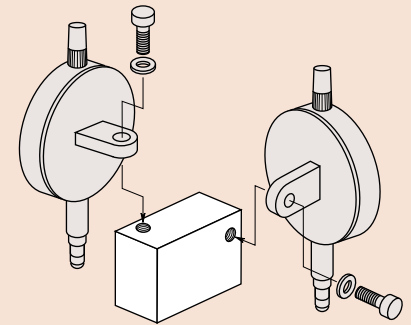
Interchangeable Backs Optional Accessory for Digimatic and Dial Indicators

SPECIFICATIONS

| Description | Order No. | | |
|--|--|--|--|
| | SERIES 1 (ø31, ø36, ø40 mm) | SERIES 2 (ø57 mm) | SERIES 3, 4 (ø78, 92 mm) |
| Lug-on-Center Back  |  Unit: mm 101210: metric type 101307: inch type 190561: for 1911T-10, 1913-10 190139: 1921T-10, 1923T-10, 1925T-10 137905: for 1003T | 101040: metric type 101306: inch type 21AZB230: for water-proof of S type (mm) 21BZB104: for water-proof of S type (inch) | 100691: metric type 100797: inch type |
| Flat Back  |  Unit: mm 101211: a=2.2 136872: for water-proof type 191559: for 1911TB-10, 1913TB-10, 1921TB-10, 1923TB-10, 1925TB-10 137906: for 1003TB | 101039: a=2.5 21AZB231: for water-proof of S type 192910: (F type waterproof model) | 100836: a=3.0 |
| Magnetic Back  |  Unit: mm 8 ø44 | Special order 900928 | 900929 |
| Back with Offset Lug  |  Unit: mm 12.5 ø6.5 16 ø20 6.35 45° 45° | Special order 101167 | 100837 |
| Back with Post  |  Unit: mm ø12.7 30.8 | 193172 Custom made | 101169 100839 |
| Back with Screw Mount  |  Unit: mm M6x1 ø12.7 11.7 | 193173: M6x1, Custom made 193174: #1/4-28UNF, Custom made | 136023: M6x1 101170: #1/4-28UNF 136024: M6x1 100840: #1/4-28UNF |
| Adjustable Back  |  Unit: mm 32 M6x1 22.2 5.3 (6.4) 12.7 | 136025: M6x1 129721: #1/4-20UNC | 136026: M6x1 101168: #1/4-20UNC 136027: M6x1 100838: #1/4-20UNC |
| Back with Adjustable Bracket  |  Unit: mm 50.2 7 18.5 ø10.5 ø7.1 38 25.5 38 16 | — | 901963 — |

- A dial or Digimatic indicator may be held in position by clamping on either the stem or the lug on the back of the indicator. The back of the indicator may need to be interchanged with another type for special applications. A wide variety of backs is available for Mitutoyo Digimatic and dial indicators.
- Most lugged backs can be rotated by 90° because they have four retaining screws. However, **190561** and **137905** (for compact dial indicators) are only equipped with two retaining screws, therefore the lug orientation cannot be changed.

Typical application



Note 1: If back lids are replaced when using a waterproof or dustproof model, the water resistance will not be guaranteed.
 Note 2: When installing to **297XTB** Series, separately prepare 4 fixing screws (**546666** Self-tapping screw only for plastic).
 Do not apply a tightening torque of more than 20 N-cm in order to avoid stripping the screw threads.

Spindle Lifting Lever and Cable Optional Accessories for Digimatic and Dial Indicators

Spindle Lifting Lever (F type)

21BZA205*1*3

Use for F type SERIES 1 dial indicators.



902011*3

Use for F type SERIES 2 dial indicators
(up to 10 mm/0.4 in range).



903424*1*3

Use for F type SERIES 2 dial indicators (up to
20 mm/0.8 in range) and SERIES 3 and 4 dial
indicators (up to 10 mm/0.4 in range).



Spindle Lifting Lever (S type)

902100*1

Use for S type SERIES 1 and F type SERIES 2 (up
to 10 mm/0.4 in range) dial indicators.



21AZB149*2

Use for S type SERIES 2, 3, and 4 dial indicators
(up to 10 mm/0.4 in).



21AZB150*2

Use for S type SERIES 2 and 3 dial indicators (from
10 mm/0.4 in up to 20 mm/0.8 in).



Spindle Lifting Lever (for ID-SS, ID-SX, ID-CX)

21EZA198*1*3



*1 Before use, replace the stop screw with the standard accessory.

*2 Use the stop screw already fixed to the dial indicator body.

*3 Stop screw is for mm model.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Spindle Lifting Cable

- The spindle can be moved up and down using the lifting lever or the release.

Lifting cable

Stroke: 10 mm



21JZA301: with auto-stop function (300 mm)

21JZA295: without auto-stop function (500 mm)

Note: This accessory is not applicable to dial indicators with a range of 20 mm or more. Applicable models are: **2048S(B)-10**, **2046S(B)-80**, **1911T(B)-10**, **1913T(B)-10**, **1921T(B)-10**, **1923T(B)-10**, **1925T(B)-10**, **2971TB**, **2972TB**, **2973TB**, **2976TB**, **2977TB**, **2978TB** and waterproof type.

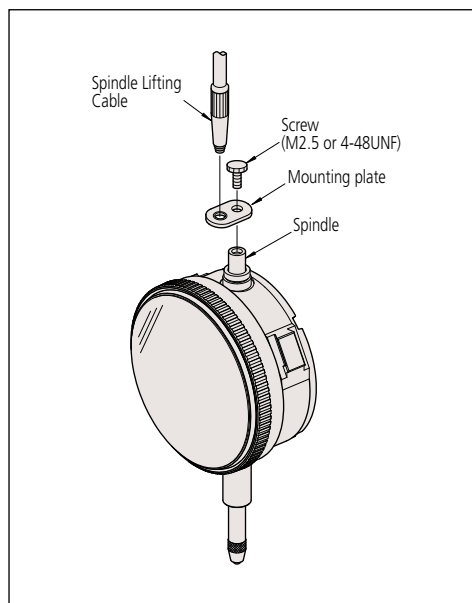
Spindle Lifting Lever

137693

Suitable for 4.8 mm spindle diameter.



Typical application



Limit Stickers

- Stuck onto the dial indicator's dial face or crystal, these stickers indicate the tolerance limits. They are available in three colors: red, green, and yellow.
- They are available only for Series 2 dial indicators (55.6 mm or 57 mm bezel/outside diameter).



Red



136420
(10 sheets/set)

Green



136421
(10 sheets/set)

Yellow



136422
(10 sheets/set)

Color-coded Spindle Caps

- 9 color-coded spindle caps are available for dial indicators with a range of 10 mm or less.



Note: When attaching to small dial indicators, the measuring range height will be 8 mm taller.

| Color | Order No. | |
|--------|-----------|------------|
| | Standard | Waterproof |
| Black | 193051 | 193595 |
| White | 193051W | 193595W |
| Red | 193051R | 193595R |
| Green | 193051G | 193595G |
| Blue | 193051B | 193595B |
| Yellow | 193051Y | 193595Y |
| Orange | 193051D | 193595D |
| Pink | 193051P | 193595P |
| Navy | 193051S | 193595S |

Note: This accessory is not applicable to 1003T(B), 1911T(B)-10, 1913T(B)-10, 1921T(B)-10, 1923T(B)-10, 1925T(B)-10, 2971TB, 2972TB, 2973TB, 2976TB, 2977TB, 2978TB.

Dial Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Dial Indicator Repair Tool Kit

Set order No. 7823EU

Set Configuration



- (1) Spindle rest (**129730**)
- (2) Pin remover (**129732**)
- (3) Punch (**129733**)
- (4) Bearing adjuster (**129734**)
- (5) Pinion rest (**129735**)
- (6) Reamer (ø1: 1/50 taper) (**129736**)
- (7) Reamer (ø0.6: 1/50 taper) (**193702**)
- (8) Reamer for pointer (ø0.5: 1/20 taper) (**21JAA273**)
- (9) Pointer removing tool (**126628**)
- (10) Soft touch pliers (**21JAA371**)
- (11) Nippers (**901179**)
- (12) Pin rest (**129731**)
- (13) Hammer (**901178**)
- (14) Stick (**21JAA314**)
- (15) Brush (**901177**)
- (16) Bamboo brush (**901176**)
- (17) Pin-vise (**901175**)
- (18) Screwdriver (Phillips/flat blade) (**901174**)
- (19) Tweezers (**129729**)
- (20) Screwdriver (Phillips) (**901173**)
- (21) Pointer removing tip (ø0.8) (**126630**)
- (22) Pointer removing tip (ø0.5) (**126630B**)
- (23) Pointer removing tip (ø1.6) (**126630C**)
- (24) Adjustable nut (**100699**)

Typical applications

Remove the long hand

Position the pointer removing tool (No. 9) on the hole diameter of the minute hand. Push the pivot with the pointer removing tool to remove the long hand.

Remove the little hand

Remove the little hand with the nippers (No. 11).

Adjust a bearing

Press the steel or jeweled bearing into its housing using the bearing adjuster (No. 4).

Remove or replace a pin

Place the spindle on the groove of the spindle rest (No. 1). Remove the pin with the pin remover (No. 2) and the hammer (No. 13). Tap the pin directly with the hammer (No. 13) to replace the pin.

Replace the long or little hand

Screw the pinion rest (No. 5) into the pin rest (No. 12). Support the pinion with the fixed pinion rest, and replace the hand with the punch (No. 3) and hammer (No. 13). Reaming is necessary when replacing with a new hand. Use reamers as follows:

- The hands of TI-X Series*1 dial test indicators do not require reaming.
- Use the reamer for pointer (No. 8) (ø0.5: 1/20 taper) for S type and T type dial indicators*2.
- Depending on the shaft diameter, use reamer (No. 6) (ø1: 1/50 taper) or reamer (No. 7) (ø0.6: 1/50 taper) for F type dial indicators and other than TI-X Series dial test indicators.

*1 Dial test indicator whose model No. ends in "X".

*2 Dial indicator whose order No. includes an "S" or "T".

Dial Indicator Crystal Setter



Order No. 7000

- Used for fitting a crystal on dial indicators (1003, 1911, 1913-10, 1003T, 1911T-10, 1913T-10, and 4046S) and dial test indicators (pocket type) with a non-integrated molded crystal.
 - 8 sizes of crystal setting pads are supplied as standard.
 - Typical applications
 - Nos. 2 and 3: Bezel outside diameter of approx. ø28
 - Nos. 3 and 4: Bezel outside diameter of approx. ø35
 - Size of crystal setting pads (mm)
 - (1) ø19.5 (2) ø22.5 (3) ø25.5 (4) ø28.5
 - (5) ø32.5 (6) ø35 (7) ø38 (8) ø50
 - Crystal setting pads set (including No. 1 to No. 8): **21JAA032**
- Note: Crystal setting pads for large dial indicators (SERIES 3 and 4) are available by special order.

Replacing bezels and graduation plates

A bezel and graduation plate must be swaged together so that the graduation plate always rotates with the bezel. Assemblies comprised of a swaged bezel and graduation plate are available for some models.

| Order No. of dial indicators | Order No. of swaged assemblies |
|------------------------------|--------------------------------|
| 2046S | 21AZB132 |
| 2109S-10 | 21AZB138 |
| 2046F | 903457 |
| 2109F | 903464 |



F

Dial Test Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 513 — Dial Test Indicator Features

- Designed to probe surfaces that cannot be reached with a normal dial gage. Useful both for alignment and for measurement purposes.
- Mitutoyo's proprietary new design permits smooth pointer operation.
- Strong frame provides excellent rigidity and durability.
- The pointer and carbide contact point are only slightly magnetizable*, and so they are hardly affected by a magnetic environment. In addition, models with a ruby contact point are available. The ruby contact point also has several times the abrasion resistance of carbide contact point and is safely usable with an electric discharge machine thanks to its being a non-conductor.
- Clear and concise wide dial face allows excellent visibility.
- The surface of the crystal is hard-coated for excellent scratch resistance.
- Flat crystal makes graduations easy to read. Moreover, the O-ring sealing method used for the bezel prevents water or oil penetration. (Note that this type is NOT waterproof.)
- The main unit is equipped with three dovetails to which the stem with dovetail groove $\varnothing 6$ (standard accessory) can be attached. This greatly improves convenience as the attachment location can be adjusted as needed.
- Five types are available: horizontal, horizontal (20° tilted face), vertical, parallel, and universal, allowing users to select according to their needs.
- Completed products are inspected according to JIS B 7533:2015. Horizontal, horizontal (20° tilted face), and vertical types are inspected with the dial face in the upward orientation, while the parallel type is inspected with the dial face in the vertical orientation to guarantee their accuracy.

* Magnetic material is used for some internal parts.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Feature icons

| Icon | Feature description |
|------|--|
| | High accuracy |
| | With revolution counter |
| | Long contact point |
| | Standard |
| | Double scale spacing |
| | Compact |
| | Carbide contact point (Slightly magnetic) |
| | Ruby contact point (Non-conductive and abrasion resistant) |



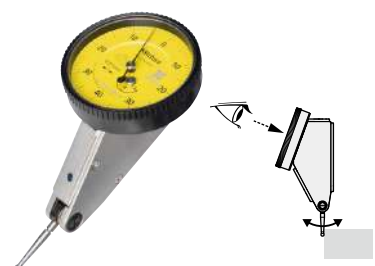
Horizontal



Vertical



Horizontal (20° Tilted face)



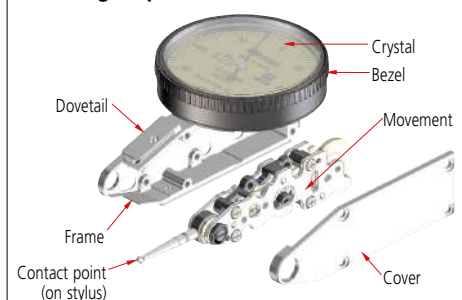
Parallel



Universal



Naming of parts



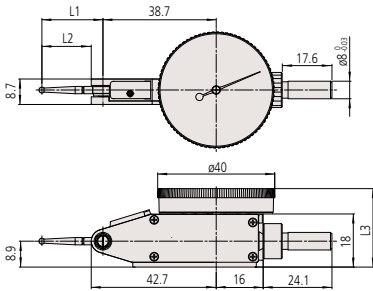


An inspection certificate is supplied as standard. Refer to page U-11 for details.

DIMENSIONS

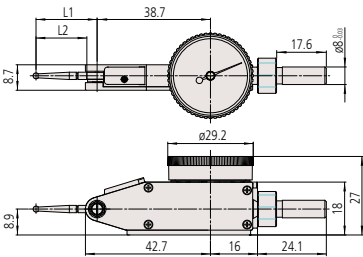
Horizontal

unit: mm



| Order No. | L1 | L2 | L3 |
|-----------------|------|------|----|
| 513-401-10E | 14.7 | 11.2 | 27 |
| 513-471-10E | | | |
| 513-405-10E/A/T | | | |
| 513-475-10E | 18.7 | 15.2 | 28 |
| 513-425-10E/A | | | |
| 513-404-10E/A/T | 20.9 | 17.4 | 27 |
| 513-474-10E | | | |
| 513-424-10E/A/T | 22.2 | 18.7 | 28 |
| 513-426-10E/A | | | |
| 513-478-10E | 37.4 | 33.9 | 27 |
| 513-414-10E/A/T | | | |
| 513-415-10E/A/T | | | |
| 513-477-10E | 44.5 | 41.0 | |

Compact



| Type | Order No. | L1 | L2 |
|---------|-------------|------|------|
| Compact | 513-465-10E | 18.7 | 15.2 |
| | 513-464-10E | 20.9 | 17.4 |
| | 513-466-10E | 22.2 | 18.7 |

Note: A slight difference may occur depending on the center of the contact point, graduation plate, and stem fixing position, etc.

Special Set: 513-908-10E (Metric)

513-404-10E: Dial test indicator
7014-10: Mini magnetic stand

513-907-10E (inch)

513-402-10E: Dial test indicator
7014E-10: Mini magnetic stand



Dial Test Indicator SERIES 513 — Horizontal Type



Graduation: 0.01 mm
Range: 0.8 mm

513-404-10E/10A/10T

- Standard
- Carbide contact point (Slightly magnetic)



Graduation: 0.01 mm
Range: 0.5 mm

513-424-10E/10A/10T

- Standard
- Double scale spacing
- Carbide contact point (Slightly magnetic)



Graduation: 0.01 mm
Range: 0.5 mm

513-414-10E/10A/10T

- Long stylus
- Carbide contact point (Slightly magnetic)
- Double scale spacing



Graduation: 0.01 mm
Range: 1.0 mm

513-415-10E/10A/10T

- Long stylus
- Carbide contact point (Slightly magnetic)



Graduation: 0.002 mm
Range: 0.2 mm

513-405-10E/10A/10T

- Standard
- Carbide contact point (Slightly magnetic)



Graduation: 0.002 mm
Range: 0.6 mm

513-425-10E/10A

- With revolution counter
- Carbide contact point (Slightly magnetic)



Graduation: 0.002 mm
Range: 0.2 mm

513-465-10E

- Compact
- Carbide contact point (Slightly magnetic)



Graduation: 0.001 mm
Range: 0.14 mm

513-401-10E

- High accuracy
- Carbide contact point (Slightly magnetic)



Graduation: 0.0005 in
Range: 0.03 in

513-402-10E/10T

- Standard
- Carbide contact point (Slightly magnetic)



Graduation: 0.0001 in
Range: 0.008 in

513-403-10E/10T

- Standard
- Carbide contact point (Slightly magnetic)

Note: 513-4XX-10 is indicated on the dial face. But the Order No. for the Special Set provided with the stem etc. has a suffix (E or T) at the end.

Dial Test Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SPECIFICATIONS

Metric

| Order No. | | | Graduation (mm) | Range (mm) | Dial reading | Maximum permissible error (MPE)* (µm) | | | | Mass (g) | Measuring force (N) | High accuracy | With revolution counter | Long contact point | Standard | Double scale spacing | Compact | Carbide contact point (Slightly magnetic) | Ruby contact point | | | | | | | | | | | | | | | | |
|-------------|-------------|-------------|-----------------|------------|--------------|---------------------------------------|----------|--------------------|------------|-------------|---------------------|---------------|-------------------------|--------------------|----------|----------------------|---------|---|--------------------|---------------|----|----|---|----|-------------|-------------|-------------|--|--|--|--|--|--|--|--|
| Basic set | Plus set | Full set | | | | Measuring range | One rev. | 10 scale divisions | Hysteresis | | | | | | | | | | | Repeatability | | | | | | | | | | | | | | | |
| 513-424-10E | 513-424-10A | 513-424-10T | 0.01 | 0.5 | 0-25-0 | 6 | - | 4 | 3 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | | |
| 513-478-10E | - | - | | | | | | | | | | | | | | | | | | 10 | 10 | 5 | 4 | 45 | 0.2 or less | | | | | | | | | | |
| 513-466-10E | - | - | | | | | | | | | | | | | | | | | | 16 | 10 | 5 | 4 | 45 | 0.4 or less | | | | | | | | | | |
| 513-414-10E | 513-414-10A | 513-414-10T | | 0.8 | 0-40-0 | 9 | - | 4 | 3 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | | |
| 513-426-10E | 513-426-10A | - | | | | | | | | | | | | | | | | | | | 10 | 10 | 5 | 4 | 45 | 0.2 or less | | | | | | | | | |
| 513-404-10E | 513-404-10A | 513-404-10T | | 0.002 | 0.2 | 0-100-0 | 4 | - | 3 | 1 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | |
| 513-474-10E | - | - | | | | | | | | | | | | | | | | | | | 7 | 5 | 2 | 4 | 45 | 0.4 or less | | | | | | | | | |
| 513-464-10E | - | - | | | 10 | 5 | 2 | 4 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | | | |
| 513-415-10E | 513-415-10A | 513-415-10T | | | 1.0 | 0-50-0 | 10 | - | 5 | 3 | 1 | 45 | 0.2 or less | | | | | | | | | | | | | | | | | | | | | | |
| 513-477-10E | - | - | | | | | | | | | | | | | | | | | | | | 7 | 5 | 2 | 4 | 45 | 0.4 or less | | | | | | | | |
| 513-405-10E | 513-405-10A | 513-405-10T | 0.001 | | 0.14 | 0-70-0 | 4 | - | 3 | 1 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | |
| 513-475-10E | - | - | | | | | | | | | | | | | | | | | | | 7 | 5 | 2 | 4 | 45 | 0.4 or less | | | | | | | | | |
| 513-455-10E | 513-455-10A | 513-455-10T | 0.001 | | 0.14 | 0-70-0 | 4 | - | 3 | 1 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | |
| 513-425-10E | 513-425-10A | - | | | | | | | | | | | | | | | | | | | 7 | 5 | 2 | 4 | 45 | 0.4 or less | | | | | | | | | |
| 513-401-10E | - | - | 0.001 | | 0.14 | 0-70-0 | 4 | - | 3 | 1 | 45 | 0.3 or less | | | | | | | | | | | | | | | | | | | | | | | |
| 513-471-10E | - | - | | 7 | | | | | | | | | | | | | | | | | 5 | 2 | 4 | 45 | 0.4 or less | | | | | | | | | | |

Inch

| Order No. | | | Graduation (in) | Range (in) | Dial reading | Maximum permissible error (MPE)* (in) | | | Mass (g) | Measuring force (N) | High accuracy | With revolution counter | Long contact point | Standard | Double scale spacing | Compact | Carbide contact point (Slightly magnetic) | Ruby contact point | | | | | | |
|-------------|----------|-------------|-----------------|------------|--------------|---------------------------------------|------------|---------------|----------|---------------------|---------------|-------------------------|--------------------|----------|----------------------|---------|---|--------------------|-------------|--|--|--|--|--|
| Basic set | Plus set | Full set | | | | One rev. | Hysteresis | Repeatability | | | | | | | | | | | | | | | | |
| 513-402-10E | - | 513-402-10T | 0.0005 | 0.03 | 0-15-0 | ±0.0005 | 0.0002 | ±0.0002 | 45 | 0.3 or less | | | | | | | | | | | | | | |
| 513-472-10E | - | - | | | | | | | | | | | | | | | | | 0.2 or less | | | | | |
| 513-412-10E | - | 513-412-10T | | | | | | | | | | | | | | | | | 0.2 or less | | | | | |
| 513-479-10E | - | - | | | | | | | | | | | | | | | | | 0.2 or less | | | | | |
| 513-462-10E | - | - | 0.0005 | 0.008 | 0-4-0 | ±0.0001 | 0.0001 | ±0.00004 | 45 | 0.3 or less | | | | | | | | | | | | | | |
| 513-407-10E | - | 513-407-10T | | | | | | | | | | | | | | | | | 0.3 or less | | | | | |
| 513-403-10E | - | 513-403-10T | | | | | | | | | | | | | | | | | 0.3 or less | | | | | |
| 513-473-10E | - | - | | | | | | | | | | | | | | | | | 0.3 or less | | | | | |
| 513-463-10E | - | - | 0.0001 | 0.008 | 0-4-0 | ±0.0001 | 0.0001 | ±0.00004 | 45 | 0.3 or less | | | | | | | | | | | | | | |
| 513-473-10E | - | - | | | | | | | | | | | | | | | | | 0.3 or less | | | | | |

Metric / Inch

| Order No. | | | Graduation | Range | Dial reading | Maximum permissible error (MPE)* (µm) | | | | Mass (g) | Measuring force (N) | High accuracy | With revolution counter | Long contact point | Standard | Double scale spacing | Compact | Carbide contact point (Slightly magnetic) | Ruby contact point |
|-------------|----------|-------------|----------------------|--------------------|-----------------|---------------------------------------|--------------------|------------|---------------|----------|---------------------|---------------|-------------------------|--------------------|----------|----------------------|---------|---|--------------------|
| Basic set | Plus set | Full set | | | | Measuring range | 10 scale divisions | Hysteresis | Repeatability | | | | | | | | | | |
| 513-409-10E | - | 513-409-10T | 0.002 mm / 0.0001 in | 0.2 mm / 0.0076 in | 0-10-0 / 0-38-0 | 4 | 2 | 3 | 1 | 45 | 0.3 or less | | | | | | | | |

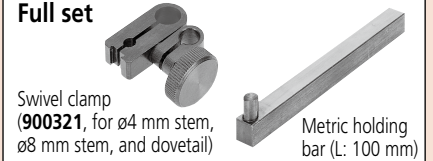
Inch / Metric

| Order No. | | | Graduation | Range | Dial reading | Maximum permissible error (MPE)* (in) | | | Mass (g) | Measuring force (N) | High accuracy | With revolution counter | Long contact point | Standard | Double scale spacing | Compact | Carbide contact point (Slightly magnetic) | Ruby contact point |
|-------------|----------|-------------|---------------------|------------------|-----------------|---------------------------------------|------------|---------------|----------|---------------------|---------------|-------------------------|--------------------|----------|----------------------|---------|---|--------------------|
| Basic set | Plus set | Full set | | | | One rev. | Hysteresis | Repeatability | | | | | | | | | | |
| 513-406-10E | - | 513-406-10T | 0.0005 in / 0.01 mm | 0.03 in / 0.7 mm | 0-15-0 / 0-35-0 | ±0.0005 | 0.0002 | ±0.0002 | 45 | 0.3 or less | | | | | | | | |

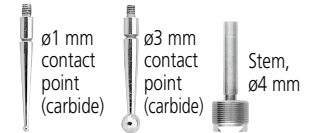
* We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.
Note: Stem with dovetail groove is not included in the mass.

Set Configuration: Metric and Metric / Inch

Full set



Plus set

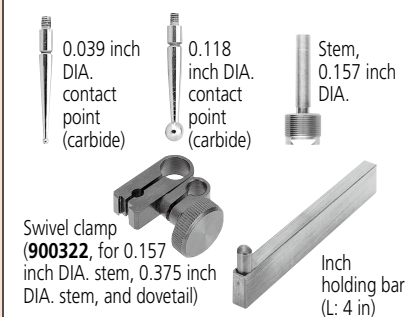


Basic set

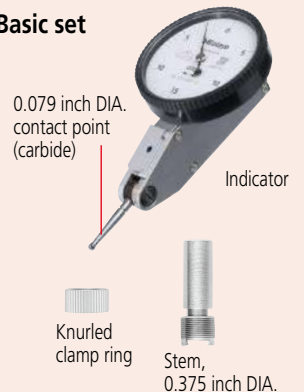


Set Configuration: Inch and Inch / Metric

Full set



Basic set

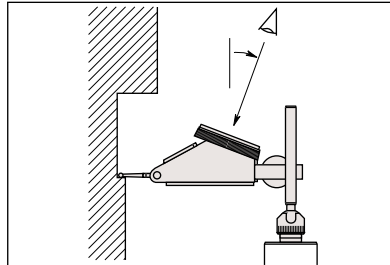




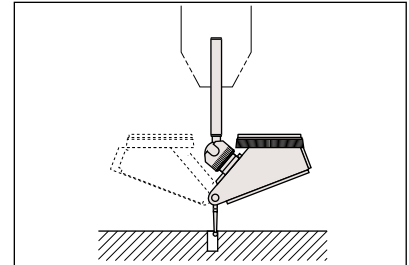
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Test Indicator SERIES 513 — Horizontal (20° Tilted Face), Vertical, and Parallel Types

- Specially designed for easy viewing of dial.



- The dial face obliquely faces upward, allowing users to read the graduations from the user's side. It is convenient when probing on the side of a large workpiece and the workbench is high.



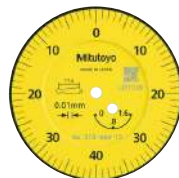
- Using the universal holder allows easy hole centering. The dial face always faces upward when the indicator is rotated, which makes reading easy.



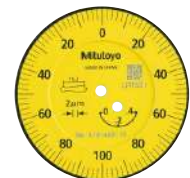
- Carbide contact point (Slightly magnetic)



- Carbide contact point (Slightly magnetic)



- With revolution counter
- Carbide contact point (Slightly magnetic)



- With revolution counter
- Carbide contact point (Slightly magnetic)



- Carbide contact point (Slightly magnetic)



- Carbide contact point (Slightly magnetic)

Note: 513-4XX-10 is indicated on the dial face. But the Order No. for the set provided with the stem etc. has a suffix (E or T) at the end.

Dial Test Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.



With revolution counter



Long stylus



Carbide contact point
(Slightly magnetic)

SPECIFICATIONS

| Metric | | | Horizontal (20° tilted face) type | | | | | | | | | | | | |
|-------------|-------------|-------------|-----------------------------------|------------|--------------|---------------------------------------|----------|--------------------|------------|----------|---------------------|-------------------------|-------------|---|---------|
| Basic set | Order No. | | Graduation (mm) | Range (mm) | Dial reading | Maximum permissible error (MPE)* (µm) | | | | Mass (g) | Measuring force (N) | With revolution counter | Long stylus | Carbide contact point (Slightly magnetic) | Remarks |
| | Plus set | Full set | | | | Measuring range | One rev. | 10 scale divisions | Hysteresis | | | | | | |
| 513-444-10E | 513-444-10A | 513-444-10T | 0.01 | 1.6 | 0-40-0 | 16 | 10 | 5 | 5 | 3 | 48 | 0.3 or less | ✓ | ✓ | ✓ |
| 513-445-10E | 513-445-10A | 513-445-10T | 0.002 | 0.4 | 0-100-0 | 6 | 5 | 2 | 4 | 1 | | | | | |

| Inch | | | Horizontal (20° tilted face) type | | | | | | | | | | | | |
|-----------|-------------|-------------|-----------------------------------|------------|--------------|---------------------------------------|----------------|------------|---------------|----------|---------------------|-------------------------|-------------|---|------------|
| Basic set | Order No. | | Graduation (in) | Range (in) | Dial reading | Maximum permissible error (MPE)* (in) | | | | Mass (g) | Measuring force (N) | With revolution counter | Long stylus | Carbide contact point (Slightly magnetic) | Remarks |
| | Plus set | Full set | | | | One rev. | First 2.5 rev. | Hysteresis | Repeatability | | | | | | |
| — | 513-442-10A | 513-442-10T | 0.0005 | 0.06 | 0-15-0 | ±0.0005 | ±0.0005 | 0.0002 | ±0.0002 | 48 | 0.3 or less | ✓ | ✓ | ✓ | Black dial |
| — | 513-442-16A | 513-442-16T | | | | | | | | | | | | | |
| — | 513-446-10A | 513-446-10T | | | | | | | | | | | | | |
| — | 513-446-16A | 513-446-16T | 0.0001 | 0.016 | 0-4-0 | ±0.0002 | ±0.0002 | 0.0001 | ±0.00004 | 48 | 0.3 or less | ✓ | ✓ | ✓ | Black dial |
| — | 513-443-10A | 513-443-10T | | | | | | | | | | | | | |
| — | 513-443-16A | 513-443-16T | | | | | | | | | | | | | |

| Metric | | | Vertical type | | | | | | | | | | | | |
|-------------|-------------|-------------|-----------------|------------|--------------|---------------------------------------|----------|--------------------|------------|----------|---------------------|-------------------------|-------------|---|---------|
| Basic set | Order No. | | Graduation (mm) | Range (mm) | Dial reading | Maximum permissible error (MPE)* (µm) | | | | Mass (g) | Measuring force (N) | With revolution counter | Long stylus | Carbide contact point (Slightly magnetic) | Remarks |
| | Plus set | Full set | | | | Measuring range | One rev. | 10 scale divisions | Hysteresis | | | | | | |
| 513-456-10E | — | — | 0.01 | 0.5 | 0-25-0 | 6 | — | 5 | 4 | 3 | 46 | 0.3 or less | ✓ | ✓ | ✓ |
| 513-454-10E | 513-454-10A | 513-454-10T | | 0.8 | 0-40-0 | 9 | — | — | — | — | | | | | |
| 513-455-10E | 513-455-10A | 513-455-10T | 0.002 | 0.2 | 0-100-0 | 4 | — | 2 | 3 | 1 | 46 | 0.3 or less | ✓ | ✓ | ✓ |

| Inch | | | Vertical type | | | | | | | | | | | | |
|-------------|-----------|-------------|-----------------|------------|--------------|---------------------------------------|----------------|------------|---------------|----------|---------------------|-------------------------|-------------|---|---------|
| Basic set | Order No. | | Graduation (in) | Range (in) | Dial reading | Maximum permissible error (MPE)* (in) | | | | Mass (g) | Measuring force (N) | With revolution counter | Long stylus | Carbide contact point (Slightly magnetic) | Remarks |
| | Plus set | Full set | | | | One rev. | First 2.5 rev. | Hysteresis | Repeatability | | | | | | |
| 513-452-10E | — | 513-452-10T | 0.0005 | 0.03 | 0-15-0 | ±0.0005 | — | 0.0002 | ±0.0002 | 46 | 0.3 or less | ✓ | ✓ | ✓ | ✓ |
| 513-453-10E | — | 513-453-10T | 0.0001 | 0.008 | 0-4-0 | ±0.0001 | — | 0.0001 | ±0.00004 | 46 | 0.3 or less | ✓ | ✓ | ✓ | ✓ |

| Metric | | | Parallel Type | | | | | | | | | | | | |
|-------------|-------------|-------------|-----------------|------------|--------------|---------------------------------------|----------|--------------------|------------|----------|---------------------|-------------------------|-------------|---|---------|
| Basic set | Order No. | | Graduation (mm) | Range (mm) | Dial reading | Maximum permissible error (MPE)* (µm) | | | | Mass (g) | Measuring force (N) | With revolution counter | Long stylus | Carbide contact point (Slightly magnetic) | Remarks |
| | Plus set | Full set | | | | Measuring range | One rev. | 10 scale divisions | Hysteresis | | | | | | |
| 513-486-10E | — | — | 0.01 | 0.5 | 0-25-0 | 6 | — | 5 | 4 | 3 | 53 | 0.3 or less | ✓ | ✓ | ✓ |
| 513-484-10E | 513-484-10A | 513-484-10T | | 0.8 | 0-40-0 | 9 | — | — | — | — | | | | | |
| 513-485-10E | — | — | 0.002 | 0.2 | 0-100-0 | 4 | — | 2 | 3 | 1 | 53 | 0.3 or less | ✓ | ✓ | ✓ |

| Inch | | | Parallel Type | | | | | | | | | | | | |
|-----------|-------------|-------------|-----------------|------------|--------------|---------------------------------------|----------------|------------|---------------|----------|---------------------|-------------------------|-------------|---|---------|
| Basic set | Order No. | | Graduation (in) | Range (in) | Dial reading | Maximum permissible error (MPE)* (in) | | | | Mass (g) | Measuring force (N) | With revolution counter | Long stylus | Carbide contact point (Slightly magnetic) | Remarks |
| | Plus set | Full set | | | | One rev. | First 2.5 rev. | Hysteresis | Repeatability | | | | | | |
| — | 513-482-10A | 513-482-10T | 0.0005 | 0.03 | 0-15-0 | ±0.0005 | — | 0.0002 | ±0.0002 | 53 | 0.3 or less | ✓ | ✓ | ✓ | ✓ |

* Horizontal (20° Tilted Face) Type, Vertical type:

We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.

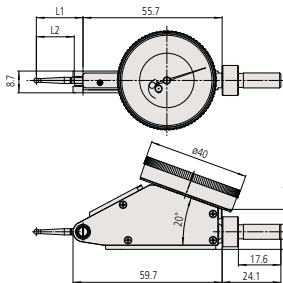
Parallel Type: We guarantee the accuracy of completed products by inspecting them with the dial face vertical.

Note: 513-4XX-10 is indicated on the dial face. But the Order No. for the set provided with the stem etc. has a suffix (E or T) at the end.

DIMENSIONS

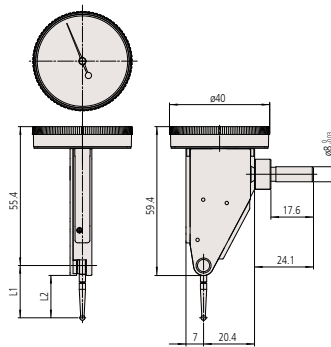
Horizontal (20° Tilted Face) Type

unit: mm



| Order No. | L1 | L2 |
|-------------|------|------|
| 513-445-10E | 18.7 | 15.2 |
| 513-444-10E | 20.9 | 17.4 |

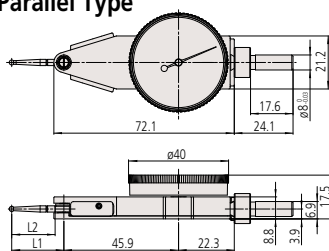
Vertical Type



| Order No. | L1 | L2 |
|-------------|------|------|
| 513-484-10E | 20.9 | 17.4 |
| 513-485-10E | 18.7 | 15.2 |
| 513-486-10E | 22.2 | 18.7 |

| Order No. | L1 | L2 |
|-------------|------|------|
| 513-454-10E | 20.9 | 17.4 |
| 513-455-10E | 18.7 | 15.2 |
| 513-456-10E | 22.2 | 18.7 |

Parallel Type



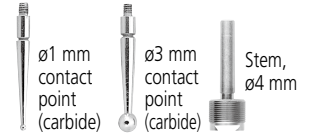
Note: A slight difference may occur depending on the center of the contact point, graduation plate, and stem fixing position, etc.

Set Configuration: Metric

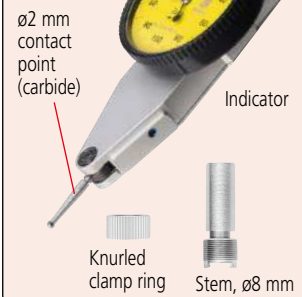
Full set

Swivel clamp (900321, for ø4 mm stem, ø8 mm stem, and dovetail) Metric holding bar (L: 100 mm)

Plus set



Basic set

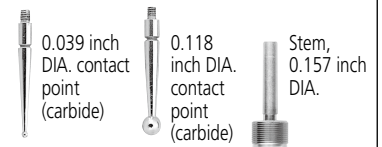


Set Configuration: Inch

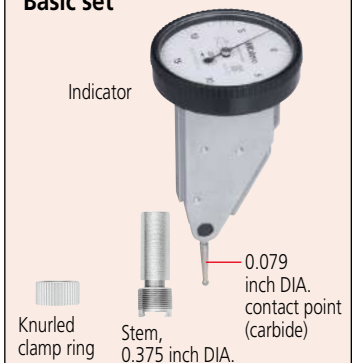
Full set

Swivel clamp (900322, for 0.157 inch DIA. stem, 0.375 inch DIA. stem, and dovetail) Inch holding bar (L: 4 in)

Plus set



Basic set





An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dial Test Indicator SERIES 513 — Universal Type

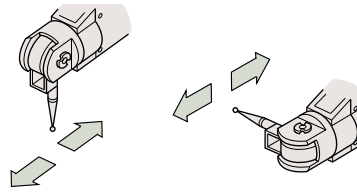
Set Configuration: Metric

Full set

- Swivel clamp (900321 for $\varnothing 4$ mm stem, $\varnothing 8$ mm stem, dovetail)
- $\varnothing 1$ mm contact point (carbide)
- $\varnothing 3$ mm contact point (carbide)
- Stem, $\varnothing 4$ mm
- Metric holding bar (L: 100 mm)
- Spare $\varnothing 2$ mm contact point (carbide)

Basic set

- $\varnothing 2$ mm contact point (carbide) (102825)
- Indicator
- Knurled clamp ring
- Spanner (102037)
- $\varnothing 8$ mm stem



- The direction of the probe movement can be freely changed by rotating the contact point section of the indicator.



513-304-10E

Set Configuration: Inch

Full set

- (900322 for 0.157 inch DIA stem, 0.375 inch DIA. stem, dovetail)
- 0.039 inch DIA. contact point (carbide)
- 0.118 inch DIA. contact point (carbide)
- Stem, 0.157 inch DIA.
- Inch holding bar (L: 4 in)
- Spare 0.079 inch DIA. contact point (carbide)

Basic set

- 0.079 inch DIA. contact point (carbide) (102825)
- Indicator
- Knurled clamp ring
- Spanner (102037)
- 0.375 inch DIA. stem

SPECIFICATIONS

| Order No. | | Graduation (mm) | Range (mm) | Dial reading | Maximum permissible error (MPE)* (μm) | | | | Mass (g) | Measuring force (N) | High accuracy | With revolution counter | Long contact point | Standard | Double scale spacing | Compact | Dustproof | Carbide contact point (Slightly magnetic) | Ruby contact point |
|-------------|-------------|-----------------|------------|--------------|--|----------|--------------------|------------|----------|---------------------|---------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|---|-------------------------------------|
| Basic set | Full set | | | | Measuring range | One rev. | 10 scale divisions | Hysteresis | | | | | | | | | | | |
| 513-304-10E | 513-304-10T | 0.01 | 0.8 | 0-40-0 | 9 | — | 5 | 4 | 3 | 71 | 0.3 or less | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

| Order No. | | Graduation (in) | Range (in) | Dial reading | Maximum permissible error (MPE)* (in) | | | Mass (g) | Measuring force (N) | High accuracy | With revolution counter | Long contact point | Standard | Double scale spacing | Compact | Dustproof | Carbide contact point (Slightly magnetic) | Ruby contact point |
|-------------|-------------|-----------------|------------|--------------|---------------------------------------|------------|---------------|----------|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|---|-------------------------------------|
| Basic set | Full set | | | | One rev. | Hysteresis | Repeatability | | | | | | | | | | | |
| 513-302-10E | 513-302-10T | 0.0005 | 0.03 | 0-15-0 | ± 0.0005 | 0.0003 | ± 0.0003 | 71 | 0.3 or less | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

* We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.
Note: 513-3XX-10 is indicated on the dial face. But the Order No. for the set provided with the stem etc. has a suffix (E or T) at the end.

DIMENSIONS

Unit: mm

513-304-10E

Optional Accessories

- Swivel clamps (See page F-75)
- Holding bars (See page F-75)
- Stems (See page F-75)
- 102824: $\varnothing 1$ mm contact point (carbide)
- 102825: $\varnothing 2$ mm contact point (carbide)
- 102826: $\varnothing 3$ mm contact point (carbide)

Dial Test Indicators

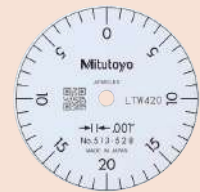
Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Pocket Type Dial Test Indicator SERIES 513

- Slim design is suited for measurement in deep holes.
- Jeweled bearings assure higher sensitivity and accuracy. Indicator can be mounted by clamping the stem or the body (except for **513-517WE** and **513-517WT**).
- Bezel is sealed with an O-ring to keep out water and oil. (Note that this type is NOT waterproof.)
- Clutch type (with a clutch lever)
- With $\varnothing 2$ mm Carbide contact point
- Jeweled bearing
- Completed products are inspected according to JIS B 7533:1990.



513-518



513-528



513-512



513-504



513-517E
513-517WE



513-515T



513-514E



513-503E



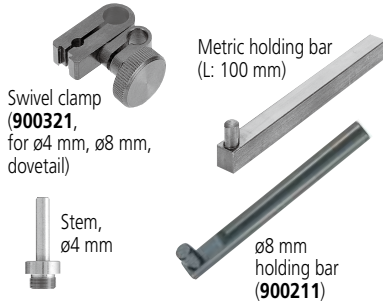
513-501E

Optional Accessories

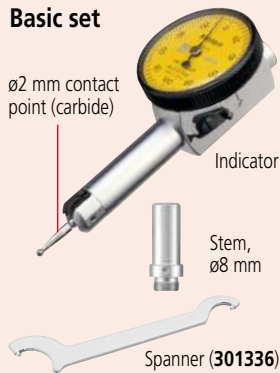
- Swivel clamps (See page F-75)
- Holding bars (See page F-75)
- Stems (See page F-75)
- Contact point (See page F-75)

Set Configuration: Metric

Full set

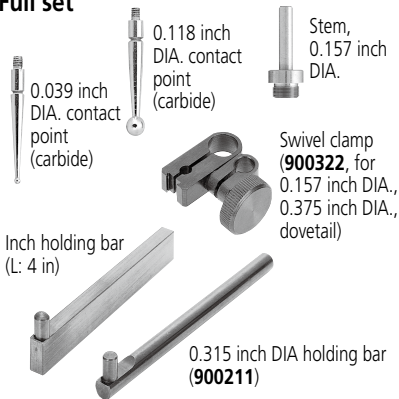


Basic set

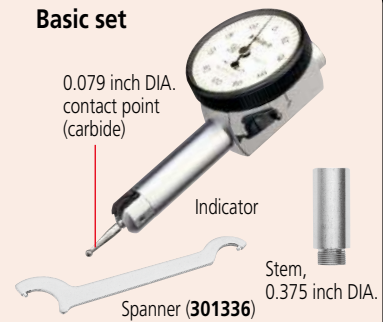


Set Configuration: Inch

Full set



Basic set



Long contact point



Jeweled bearing



Dustproof



Compact

SPECIFICATIONS

Metric

| Order No. | | Graduation (mm) | Range (mm) | Accuracy (µm) | Dial reading | Measuring force (N) | Long contact point | Jeweled bearing | Compact | Dustproof | — | — |
|-----------|-----------|-----------------|------------|---------------|--------------|---------------------|--------------------|-----------------|---------|-----------|---|---|
| Basic set | Full set | | | | | | | | | | | |
| 513-514E | 513-514T | 0.01 | 0.5 | 10 | 0-25-0 | 0.3 or less | ✓ | ✓ | | | | |
| 513-517E | 513-517T | 0.01 | 0.8 | 8 | 0-40-0 | 0.3 or less | | ✓ | | | | |
| 513-517WE | 513-517WT | 0.01 | 0.8 | 8 | 0-40-0 | 0.3 or less | | ✓ | | ✓ | | |
| 513-527E | 513-527T | 0.01 | 0.8 | 8 | 0-40-0 | 0.3 or less | | ✓ | ✓ | | | |
| — | 513-515T | 0.01 | 1 | 10 | 0-50-0 | 0.3 or less | ✓ | ✓ | | | | |
| 513-503E | 513-503T | 0.002 | 0.2 | 3 | 0-100-0 | 0.3 or less | | ✓ | | | | |
| 513-501E | 513-501T | 0.001 | 0.14 | 3 | 0-70-0 | 0.4 or less | | ✓ | | | | |

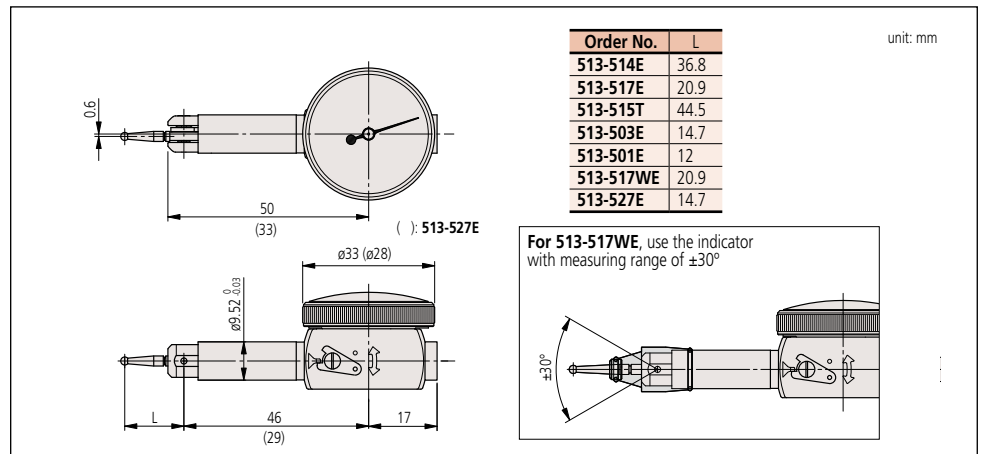
Note: We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.

Inch

| Order No. | | Graduation (in) | Range (in) | Accuracy (in) | Dial reading | Measuring force (N) | Long contact point | Jeweled bearing | Compact | — | — | — |
|-----------|----------|-----------------|------------|---------------|--------------|---------------------|--------------------|-----------------|---------|---|---|---|
| Basic set | Full set | | | | | | | | | | | |
| 513-518 | 513-518T | 0.001 | 0.04 | ±0.001 | 0-20-0 | 0.3 or less | | ✓ | | | | |
| 513-528 | 513-528T | 0.001 | 0.04 | ±0.001 | 0-20-0 | 0.3 or less | | ✓ | ✓ | | | |
| 513-512 | 513-512T | 0.0005 | 0.02 | ±0.0005 | 0-10-0 | 0.3 or less | ✓ | ✓ | | | | |
| 513-504 | 513-504T | 0.0001 | 0.01 | ±0.0002 | 0-5-0 | 0.3 or less | ✓ | ✓ | | | | |

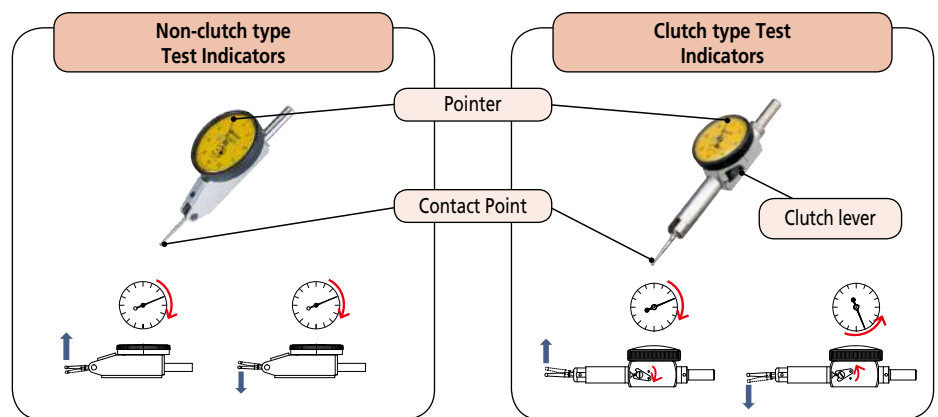
Note: We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.

DIMENSIONS



There are two types of Mitutoyo Dial Test Indicator:

The non-clutch type (without a clutch lever) and the clutch type (with a clutch lever)



In the non-clutch type, although the contact point may move either in the upward or downward direction, the pointer always rotates clockwise.

In the clutch type, if the clutch lever is set in one position the contact point moves in the upward direction and the pointer rotates clockwise. Conversely, if the lever is set in the other position the contact point moves in the downward direction and the pointer rotates counterclockwise.

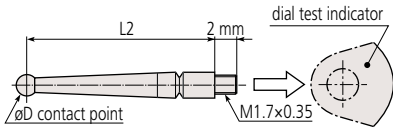
Dial Test Indicators

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Contact points, Stems and Holders Optional Accessories for Dial Test Indicators

Contact point (for Metric Models Only*)

* Except for universal type dial test indicator (513-304-10).



ø0.5 mm contact point **ø0.7 mm contact point**



190547 (L2=11.2 mm) **190548** (L2=11.2 mm)
21CAB109 (L2=15.2 mm) **21CAB110** (L2=15.2 mm)
190549 (L2=17.4 mm) **190550** (L2=17.4 mm)
190654 (L2=18.7 mm) **190653** (L2=18.7 mm)
21CAB111 (L2=33.9 mm) **21CAB112** (L2=33.9 mm)
190656 (L2=41.0 mm) **190655** (L2=41.0 mm)

ø1 mm contact point (Carbide) **ø2 mm contact point (Carbide)**



103017 (L2=11.2 mm) **103010** (L2=11.2 mm)
131314 (L2=15.2 mm) **103011** (L2=15.2 mm)
103013 (L2=17.4 mm) **103006** (L2=17.4 mm)
137558 (L2=18.7 mm) **137557** (L2=18.7 mm)
131316 (L2=33.9 mm) **131324** (L2=33.9 mm)
136235 (L2=41.0 mm) **136013** (L2=41.0 mm)

ø2 mm contact point (Ruby) **ø3 mm contact point (Carbide)**



21CZA209 (L2=11.2 mm) **103018** (L2=11.2 mm)
21CZB068 (L2=15.2 mm) **131315** (L2=15.2 mm)
21CZA201 (L2=17.4 mm) **103014** (L2=17.4 mm)
21CZA210 (L2=18.7 mm) **137559** (L2=18.7 mm)
21CZA211 (L2=41.0 mm) **131317** (L2=33.9 mm)
136236 (L2=41.0 mm)

Swivel Clamps

For ø6 mm stem,
ø8 mm stem, and
dovetail



902053

For ø4 mm stem,
ø8 mm stem, and
dovetail

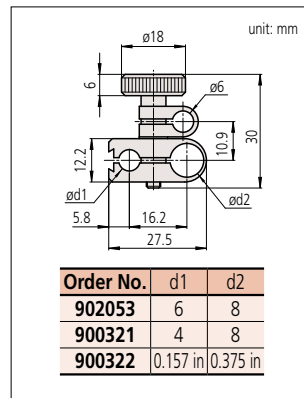


900321

For 0.157 inch DIA. stem,
0.375 inch DIA. stem,
and dovetail



900322



Spanner



102037

Holding Bars



9x9 mm **953638** (Length: 50 mm)
900209 (Length: 100 mm)



ø8 mm (0.315 inch DIA) **900211** (Length: 115 mm/4.528 in)



0.25 in x 0.5 in **953639** (Length: 2 in)
900306 (Length: 4 in)

Stems with Knurled Clamp Ring

ø4 mm
(0.157 inch DIA.)



21CZB131

ø8 mm **0.375 inch DIA.**



21CZB129

21CZB130

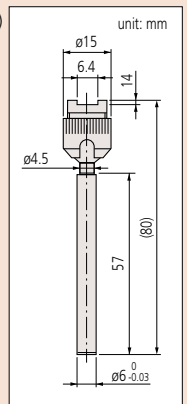
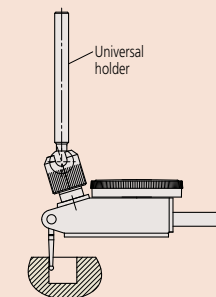
| Stem DIA. ød | Stem with dovetail (Individual item) | Nut (Individual item) | Full set (Stem with dovetail+Nut) |
|--------------|--------------------------------------|-----------------------|-----------------------------------|
| | Order No. | | |
| ø4 | 21CAB106 | 190322 | 21CZB131 |
| ø6 | 21CAB103 | 190322 | 21CZB128 |
| ø8 | 21CAB104 | 190322 | 21CZB129 |
| ø0.375 in | 21CAB105 | 190322 | 21CZB130 |

Universal Holder (dovetail clamp)

- A universal holder is an attachment used to mount a dial test indicator in a machine tool spindle so that it can be used to align the spindle axis with a workpiece feature such as a hole center, or a machine axis with an edge. (See diagram below.) It also gives some protection against accidental impacts on the indicator.

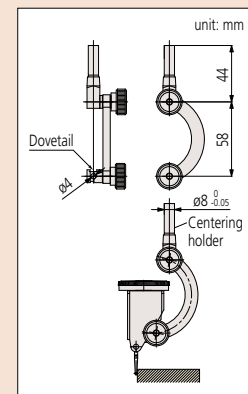


21CZA233 (ø8 mm stem)
21CZA231 (0.25 inch DIA. stem)
21CZA229 (ø6 mm stem)



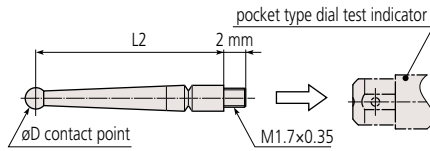
Centering Holder

- Allows large diameter cylinders or holes to be centered on a machine tool.

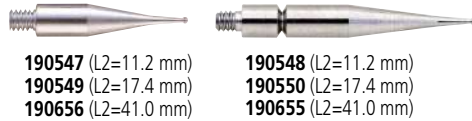


901959 (ø8 mm stem)
901997 (0.25 inch DIA. stem)

Contact point (for Metric Models Only)



$\phi 0.5$ mm contact point $\phi 0.7$ mm contact point



190547 (L2=11.2 mm)
190549 (L2=17.4 mm)
190656 (L2=41.0 mm)

190548 (L2=11.2 mm)
190550 (L2=17.4 mm)
190655 (L2=41.0 mm)

$\phi 1$ mm contact point (Carbide) $\phi 2$ mm contact point (Carbide)



136756 (L2=8.6 mm)
103017 (L2=11.2 mm)
103013 (L2=17.4 mm)
137746 (L2=33.3 mm)
136235 (L2=41.0 mm)

136104 (L2=8.6 mm)
103010 (L2=11.2 mm)
103006 (L2=17.4 mm)
129949 (L2=33.3 mm)
136013 (L2=41.0 mm)

$\phi 2$ mm contact point (Ruby) $\phi 3$ mm contact point (Carbide)



21CZA209 (L2=11.2 mm)
21CZA201 (L2=17.4 mm)
21CZA211 (L2=41.0 mm)

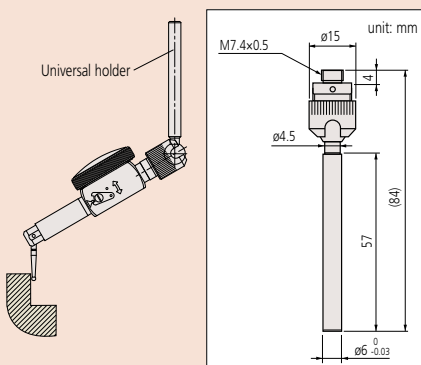
136758 (L2=8.6 mm)
103018 (L2=11.2 mm)
103014 (L2=17.4 mm)
137747 (L2=33.3 mm)
136236 (L2=41.0 mm)

Universal Holder (screw clamp)

- A universal holder is an attachment used to mount a dial test indicator in a machine tool spindle so that it can be used to align the spindle axis with a workpiece feature such as a hole center, or a machine axis with an edge. (See diagram below.) It also gives some protection against accidental impacts on the indicator.



21CZA234 ($\phi 8$ mm stem)
21CZA232 (0.25 inch DIA. stem)
21CZA230 ($\phi 6$ mm stem)



Swivel Clamps

For $\phi 6$ mm stem,
 $\phi 8$ mm stem,
and dovetail



902053

For $\phi 4$ mm stem
and $\phi 8$ mm stem,
and dovetail

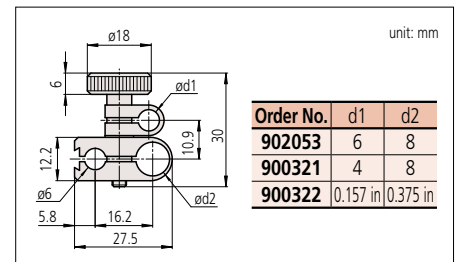


900321

For 0.157 inch DIA. stem
and 0.375 inch DIA. stem,
and dovetail



900322



Stems

$\phi 4$ mm $\phi 8$ mm
(0.157 inch DIA.) (0.315 inch DIA.) 0.375 inch DIA.



102036

102822

102081

Holding Bars



9x9 mm

90209 (Length: 100 mm)

8 mm (0.315 inch DIA)

900211 (Length: 115 mm)

0.25x0.5 in

953639 (Length: 2 in)

900306 (Length: 4 in)

Note: Suitable for height gages with a scriber section of 12.7x6.35 mm.

Spanner



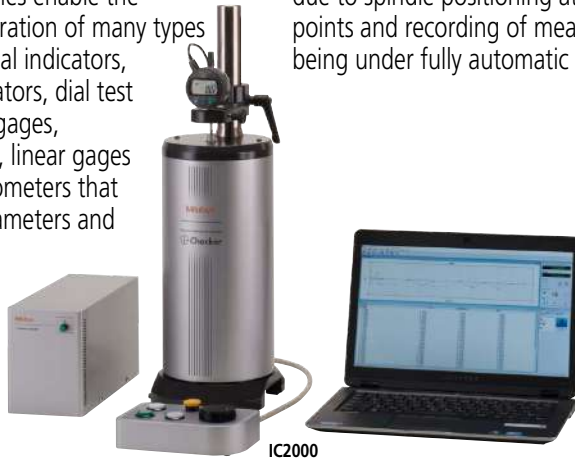
301336

Indicator Calibration

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

i-Checker IC2000 SERIES 170

- Indication accuracy of $(0.1 + 0.4L/100) \mu\text{m}$, the highest level in the world, is achieved. (When inspected in the vertical orientation.)
- Can directly inspect indicators with a stroke of up to 100 mm. Moreover, a wide variety of optional accessories enable the inspection and calibration of many types of gage including dial indicators, lever-type dial indicators, dial test indicators, cylinder gages, Digimatic indicators, linear gages and electronic micrometers that use various stem diameters and support systems.
- The pointer of the analog indicator is positioned just before the measuring point automatically in the semi-automatic mode.
- Digital indicators equipped with a data output function are checked very efficiently due to spindle positioning at the inspection points and recording of measurement results being under fully automatic control.



SPECIFICATIONS

| Order No. | 170-402 | 170-403 |
|-----------------------------|---|------------------|
| Remarks | with 8 mm bush | with 3/8 in bush |
| Measuring Range | 100 mm | |
| Resolution | 0.01 μm | |
| Accuracy (20 °C) | $(0.1 + 0.4L/100) \mu\text{m}$ L=Arbitrary length (mm) $(0.15 + 0.6L/100) \mu\text{m}$ L=Arbitrary length (mm) | |
| Feed speed | Maximum 10 mm/s | |
| Drive method | Motor drive (semi-automatic/fully-automatic) | |
| Measuring Unit | Separate type Linear Encoder | |
| Measurement method | Semi-automatic measurement Fully automatic measurement (only when using an indicator equipped with data output function)*1*2 | |
| Mass | 20 kg | |
| Operating temperature range | 20 °C±0.5 °C | |

*1 Automatic measurement requires the indicator's connecting cable. Additionally some form of indicator, along with the normally connected accessory (the optional accessory for the indicator such as a Digimatic power-supply unit in an EF counter) will be required.

*2 The indicator measured via RS-232C has the capability to receive data from the main unit and output the counter value.



An inspection certificate is supplied as standard. Refer to page U-11 for details.



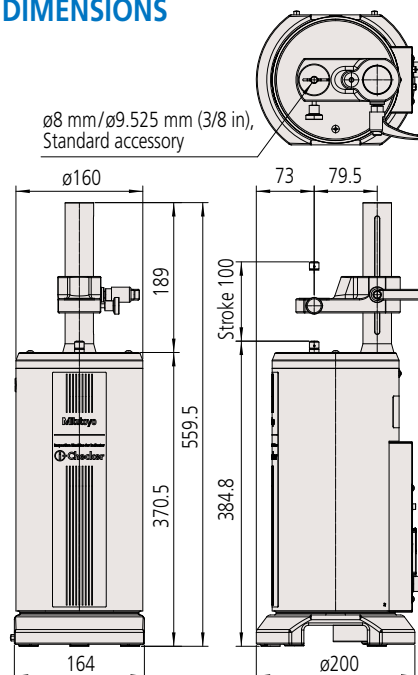
Typical application for Dial Test Indicator Accessory Set



Typical application using dial test indicator attachment set (**02ASK000**)



DIMENSIONS



Refer to the i-Checker Brochure (**E12015**) for more details.

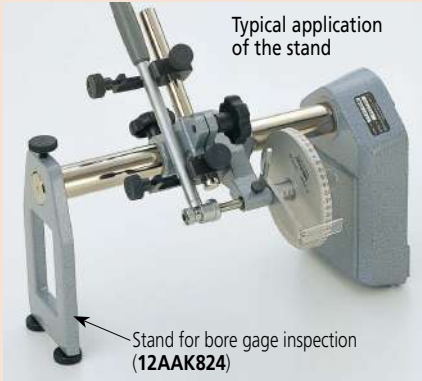


An inspection certificate is supplied as standard. Refer to page U-11 for details.

Optional accessory

Stand for bore gage inspection (12AAK824)

Note: Can be used for the inspection of bore gages 511 SERIES standard type and with micrometer head up to 400 mm. (Refer to pages C-33 and C-39 for details.)



SERIES 170 — UDT-2 Dial Indicator Tester

- UDT-2 is the accuracy tester for 0.01 mm resolution/graduation dial indicators, dial test indicators and bore gages.
- Stem mounting hole: $\varnothing 6$, $\varnothing 8$ mm (Metric) $\varnothing 1/4$ in, $\varnothing 3/8$ in (Inch)



170-102-12

SPECIFICATIONS

| Metric | | | | |
|------------|-----------------|------------|------------------------------|------------|
| Order No. | Micrometer head | | Accuracy (μm) | |
| | Graduation (mm) | Range (mm) | Feed accuracy (25 mm stroke) | Hysteresis |
| 170-102-12 | 0.001 | 0 - 25 | ± 2 | 0.5 |

| Inch | | | | |
|------------|-----------------|------------|------------------------------|------------|
| Order No. | Micrometer head | | Accuracy (in) | |
| | Graduation (in) | Range (in) | Feed accuracy (25 mm stroke) | Hysteresis |
| 170-101-10 | 0.0001 | 0 - 1 | ± 0.0001 | 0.00002 |

SERIES 521 — Calibration Tester

- Can also be used to inspect dial indicators and dial test indicators with 0.001 mm graduations, or to adjust the sensitivity of electronic micrometers.
- The mounting bracket, which can move in any direction, accepts a wide range of indicator stem sizes ($\varnothing 4$ mm to $\varnothing 10$ mm).



521-103

SPECIFICATIONS

| Metric | | | | |
|-----------|-----------------|------------|----------------------------|------------|
| Order No. | Micrometer head | | Accuracy (μm) | |
| | Graduation (mm) | Range (mm) | Indication accuracy | Hysteresis |
| 521-103 | 0.0002 | 0 - 1 | ± 0.2 | 0.2 |
| 521-105 | 0.0002 | 0 - 5 | ± 0.8 | 0.8 |

| Inch | | | | |
|-----------|-----------------|------------|---------------------|------------|
| Order No. | Micrometer head | | Accuracy (in) | |
| | Graduation (in) | Range (in) | Indication accuracy | Hysteresis |
| 521-104 | 0.00001 | 0 - 0.05 | ± 0.00001 | 0.00001 |
| 521-106 | 0.00001 | 0 - 0.2 | ± 0.00003 | 0.00003 |

Dial Indicator Applications

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Thickness Gages SERIES 547, 7

MeasurLink ENABLED

Data Management Software by Mitutoyo

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Standard Type (Resolution: 0.01 mm)



547-301



547-321

High Accuracy Type (Resolution: 0.001 mm)



547-401

Standard Type (Graduation: 0.01 mm)



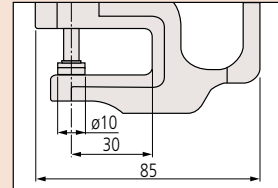
7301



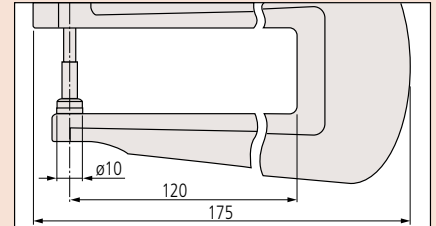
7321

DIMENSIONS

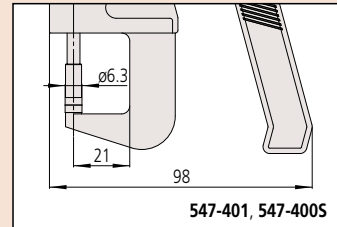
Unit: mm



7301, 7305, 7327, 547-301, 547-5265,
547-300S, 547-500S, 547-320S, 547-520S



7321, 7323, 7322S, 547-321, 547-320S, 547-520S



547-401, 547-400S

Technical Data

- Display: 6-digit LCD, sign
- Battery: SR44 (1 pc.), **938882** for initial operational checks (standard accessory)
- Battery life: Approx. 7,000 hours of continuous use
Approx. 1.2 years under normal use
- Maximum response speed: Not restricted (except for scanning measurement)

Functions

- Zero-setting (INC system)
- Presetting (ABS system)
- Direction switching
- Tolerance judgment
- Resolution switching (For 0.001 mm or 0.00005 inch resolution models)
- Calculation: $f(x) = Ax$
- Function Lock
- Data output
- Display value holding (when no external device is connected)
- 330° rotary display
- Low battery voltage alarm display
- Error alarm display

Optional Accessories

- SPC Cable:
 - 905338** (1 m)
 - 905409** (2 m)
 (Refer to pages A-27 to A-29 for details.)
- USB Input Tool Direct (2 m): **06AFM380F**
(Refer to page A-13 for details.)
- Connecting Cables for **U-WAVE-T** (160 mm):
02AZD790F
For foot switch: **02AZE140F**
(Refer to pages A-19 to A-21 for details.)
- Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505**

Lens thickness measurement

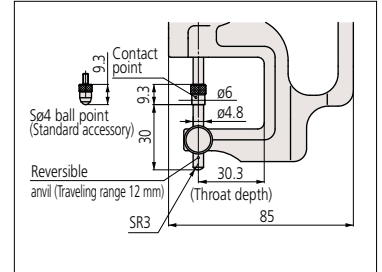
- Thickness of concave-convex lenses and surfaces can be measured. (Contact point, Anvil: hardened steel)
- Anvils and contact points are interchangeable to enable concave surfaces to be measured.



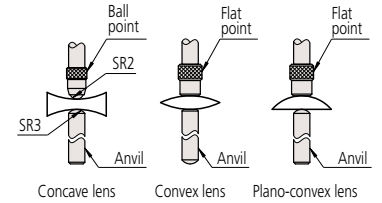
- Provided with a ball point as standard.

DIMENSIONS

Unit: mm



Typical applications



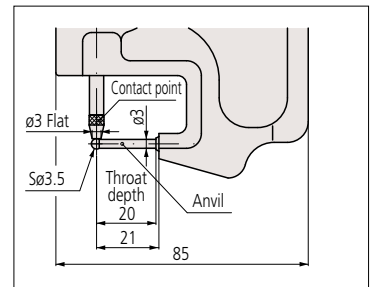
Tube thickness measurement

- Pipe wall thickness, thickness of curved boards can be measured. (Contact point, Anvil: hardened steel)



DIMENSIONS

Unit: mm

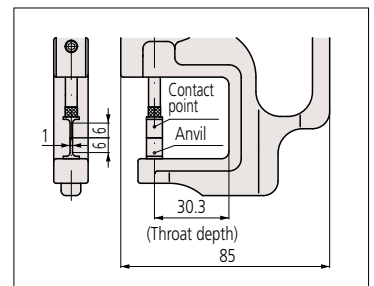


Groove thickness measurement



DIMENSIONS

Unit: mm



Dial Indicator Applications

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Thickness Gages SERIES 547, 7

SPECIFICATIONS

| Metric | | | | | | | | | |
|-----------|-------------------------|------------|----------------------|--|--|---------------|---------------------|----------|------------------------------------|
| Order No. | Resolution (mm) | Range (mm) | Measuring depth (mm) | Contact point, Anvil (mm) | Parallelism of Contact point, Anvil (μm) | Accuracy (μm) | Measuring force (N) | Mass (g) | Remarks |
| 547-401 | 0.001/0.01 (selectable) | 0 - 12 | 21 | ø6.3 Flat (Carbide) | 3 | ±3 | 3.5 or less | 280 | High accuracy, carbide point anvil |
| 547-301 | 0.01 | 0 - 10 | 30 | ø10 Flat | 10 | ±20 | 1.5 or less | 255 | Standard, ceramic point/anvil |
| 547-321 | 0.01 | 0 - 10 | 120 | ø10 Flat | 10 | ±20 | 1.5 or less | 425 | Deep throat, ceramic point/anvil |
| 547-313 | 0.01 | 0 - 10 | 30 | ø6 Flat (Contact point) ø4.8 Flat (Anvil) | 10 | ±20 | 1.5 or less | 275 | Lens thickness |
| 547-315 | 0.01 | 0 - 10 | 30 | t=1 Blade | 10 | ±20 | 1.5 or less | 270 | Groove thickness |
| 547-360 | 0.01 | 0 - 10 | 20 | ø3 Flat (Contact point) ø3.5 Ball (Anvil) | — | ±20 | 1.5 or less | 250 | Tube thickness |

| Inch/Metric | | | | | | | | | |
|-------------|---------------------|------------|------------------|--|-------------------------------------|------------------|---------------------|----------|------------------------------------|
| Order No. | Resolution | Range (in) | Measuring depth | Contact point, Anvil | Parallelism of Contact point, Anvil | Accuracy | Measuring force (N) | Mass (g) | Remarks |
| 547-400S | 0.00005 in/0.001 mm | 0 - 0.47 | 21 mm (0.83 in) | ø6.3 mm (ø0.25 in) Flat | 0.0001 in/0.003 mm | ±0.0001 in/±3 μm | 3.5 or less | 290 | High accuracy, carbide point anvil |
| 547-526S* | 0.0001 in/0.001 mm | 0 - 0.47* | 30 mm (1.18 in) | ø10 mm (ø0.39 in) Flat | 0.0002 in/0.005 mm | ±0.0002 in/±5 μm | 1.5 or less | 225 | Standard, ceramic point/anvil |
| 547-300S | 0.0005 in/0.01 mm | 0 - 0.4 | 30 mm (1.18 in) | ø10 mm (ø0.39 in) Flat | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 255 | Standard, ceramic point/anvil |
| 547-500S* | 0.0005 in/0.01 mm | 0 - 0.47* | 30 mm (1.18 in) | ø10 mm (ø0.39 in) Flat | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 225 | Standard, ceramic point/anvil |
| 547-320S | 0.0005 in/0.01 mm | 0 - 0.4 | 120 mm (4.72 in) | ø10 mm (ø0.39 in) Flat | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 400 | Deep throat, ceramic point/anvil |
| 547-520S* | 0.0005 in/0.01 mm | 0 - 0.47* | 120 mm (4.72 in) | ø10 mm (ø0.39 in) Flat | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 380 | Deep throat, ceramic point/anvil |
| 547-312S | 0.0005 in/0.01 mm | 0 - 0.4 | 30 mm (1.18 in) | ø6 mm (ø0.24 in) Flat (Contact point) ø4.8 mm (ø0.19 in) Flat (Anvil) | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 275 | Lens thickness |
| 547-512S* | 0.0005 in/0.01 mm | 0 - 0.47* | 30 mm (1.18 in) | ø6 mm (ø0.24 in) Flat (Contact point) ø4.8 mm (ø0.19 in) Flat (Anvil) | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 240 | Lens thickness |
| 547-316S | 0.0005 in/0.01 mm | 0 - 0.4 | 30 mm (1.18 in) | t=1 mm (0.04 in) Blade | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 270 | Groove thickness |
| 547-516S* | 0.0005 in/0.01 mm | 0 - 0.47* | 30 mm (1.18 in) | t=1 mm (0.04 in) Blade | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 260 | Groove thickness |
| 547-361S | 0.0005 in/0.01 mm | 0 - 0.4 | 20 mm (0.79 in) | ø3 mm (ø0.12 in) Flat (Contact point) ø3.5 mm (ø0.14 in) Ball (Anvil) | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 240 | Tube thickness |
| 547-561S* | 0.0005 in/0.01 mm | 0 - 0.47* | 20 mm (0.79 in) | ø3 mm (ø0.12 in) Flat (Contact point) ø3.5 mm (ø0.14 in) Ball (Anvil) | 0.005 in/0.01 mm | ±0.001 in/±20 μm | 1.5 or less | 215 | Tube thickness |

* Using ID-SX Digimatic indicator.

| Metric | | | | | | | | | |
|-----------|-----------------|------------|----------------------|--|--|---------------|---------------------|----------|--|
| Order No. | Graduation (mm) | Range (mm) | Measuring depth (mm) | Contact point, Anvil (mm) | Parallelism of Contact point, Anvil (μm) | Accuracy (μm) | Measuring force (N) | Mass (g) | Remarks |
| 7327 | 0.001 | 0 - 1 | 30 | ø10 Flat | 5 | ±5 | 1.5 or less | 230 | Fine dial reading, ceramic point/anvil |
| 7301 | 0.01 | 0 - 10 | 30 | ø10 Flat | 5 | ±15 | 1.4 or less | 218 | Standard, ceramic point/anvil |
| 7305 | 0.01 | 0 - 20 | 30 | ø10 Flat | 5 | ±20 | 2.0 or less | 236 | Standard, ceramic point/anvil |
| 7321 | 0.01 | 0 - 10 | 120 | ø10 Flat | 5 | ±15 | 1.4 or less | 377 | Deep throat, ceramic point/anvil |
| 7323 | 0.01 | 0 - 20 | 120 | ø10 Flat | 5 | ±22 | 2.0 or less | 371 | Deep throat, ceramic point/anvil |
| 7313 | 0.01 | 0 - 10 | 30 | ø6 Flat (Contact point) ø4.8 Flat (Anvil) | 5 | ±15 | 1.4 or less | 220 | Lens thickness |
| 7315 | 0.01 | 0 - 10 | 30 | t=1 Blade | 5 | ±15 | 1.4 or less | 220 | Groove thickness |
| 7360 | 0.01 | 0 - 10 | 20 | ø3 Flat (Contact point) ø3.5 Ball (Anvil) | — | ±15 | 1.4 or less | 220 | Tube thickness |

| Inch | | | | | | | | | |
|-----------|-----------------|------------|----------------------|--|--|---------------|---------------------|----------|--|
| Order No. | Graduation (in) | Range (in) | Measuring depth (in) | Contact point, Anvil (in) | Parallelism of Contact point, Anvil (in) | Accuracy (in) | Measuring force (N) | Mass (g) | Remarks |
| 7326S | 0.0001 | 0 - 0.05 | 1.18 | ø0.39 Flat | 0.0002 | ±0.0002 | 2.0 or less | 205 | Fine dial reading, ceramic point/anvil |
| 7300S | 0.001 | 0 - 0.5 | 1.18 | ø0.39 Flat | 0.0005 | ±0.001 | 1.8 or less | 205 | Standard, ceramic point/anvil |
| 7304S | 0.001 | 0 - 1 | 1.18 | ø0.39 Flat | 0.0005 | ±0.002 | 2.0 or less | 220 | Standard, ceramic point/anvil |
| 7322S | 0.001 | 0 - 1 | 1.18 | ø0.39 Flat | 0.0005 | ±0.002 | 2.0 or less | 370 | Deep throat, ceramic point/anvil |
| 7312S | 0.001 | 0 - 0.5 | 1.18 | ø0.24 Flat (Contact point) ø0.19 Flat (Anvil) | 0.0005 | ±0.001 | 1.8 or less | 215 | Lens thickness |
| 7316S | 0.001 | 0 - 0.5 | 1.18 | t=0.04 Blade | 0.0005 | ±0.001 | 1.8 or less | 220 | Groove thickness |
| 7361S | 0.001 | 0 - 0.5 | 0.8 | ø0.12 Flat (Contact point) ø0.14 Ball (Anvil) | — | ±0.001 | 1.8 or less | 200 | Tube thickness |

Note 1: The dial indicator needs to be reset when a contact point is replaced.

Note 2: The stated accuracy of Digimatic indicators does not include an allowance for quantizing error (±1 count).

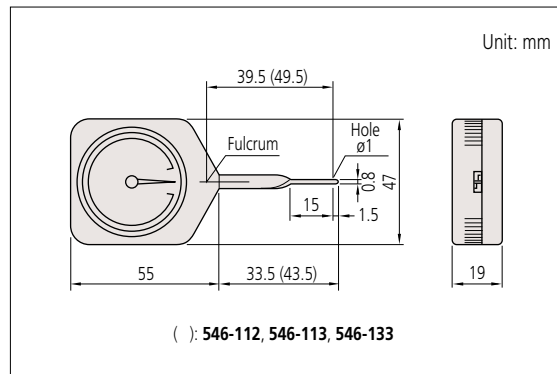
Measuring contact force on a relay



Contact Force Gage SERIES 546

- Contact Force Gages are widely used to determine the measuring force applied by an instrument to a workpiece, as well as contact forces of electrical relays, micro-switches, valves and precision springs.
- Thanks to the miniature anti-friction bearing in the fulcrum, stable measurement is guaranteed.
- 2 types are available: Standard and peak hold.

DIMENSIONS



Standard type
546-112



Standard type
546-119



Peak hold type
546-137

SPECIFICATIONS

mN-scale models

Standard

| Order No. | Graduation (mN) | Range (mN) | Accuracy (division) |
|-----------|-----------------|------------|---------------------|
| 546-112 | 2 | 6 - 50 | ±0.5 |
| 546-113 | 5 | 10 - 100 | |
| 546-114 | 10 | 30 - 300 | |

Peak hold

| Order No. | Graduation (mN) | Range (mN) | Accuracy (division) |
|-----------|-----------------|------------|---------------------|
| 546-133 | 5 | 10 - 100 | ±0.5 |
| 546-134 | 10 | 30 - 300 | |

Note: Please note that these products are only available in their standard forms; they cannot be customized for special sizes or specifications.

N-scale models

Standard

| Order No. | Graduation (N) | Range (N) | Accuracy (division) |
|-----------|----------------|------------|---------------------|
| 546-115 | 0.02 | 0.06 - 0.5 | ±0.5 |
| 546-116 | 0.05 | 0.1 - 1 | |
| 546-117 | 0.05 | 0.15 - 1.5 | |
| 546-118 | 0.1 | 0.3 - 3 | |
| 546-119 | 0.2 | 0.6 - 5 | |

Peak hold

| Order No. | Graduation (N) | Range (N) | Accuracy (division) |
|-----------|----------------|------------|---------------------|
| 546-135 | 0.02 | 0.06 - 0.5 | ±0.5 |
| 546-136 | 0.05 | 0.1 - 1 | |
| 546-137 | 0.05 | 0.15 - 1.5 | |
| 546-138 | 0.1 | 0.3 - 3 | |
| 546-139 | 0.2 | 0.6 - 5 | |

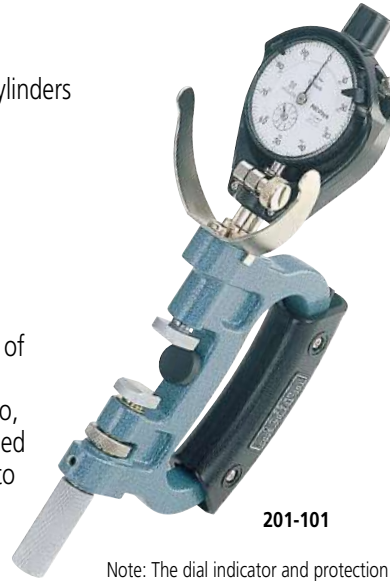
Note: Please note that these products are only available in their standard forms; they cannot be customized for special sizes or specifications.

Dial Indicator Applications

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

Dial Snap Gage SERIES 201

- Designed for quick GO/NG judgment of diameters of cylinders and shafts in machining processes.
- Wide (13.5×12 mm/1.53×47 in), flat carbide anvils.
- Anvil retracting stroke: 2 mm/0.08 in
Anvil positioning range: 25 mm/1 in
- Adjustment nut: adjusts the measuring range.
- Clamp: adjustment nut
- Flatness of measuring face: 1 μm
- Repeatability of indication: 2 μm or better (repeatability of indicators is not included)
- The dial indicator and protection cover are optional. Also, some dial indicators and protection covers cannot be used with the dial snap gage. Consult Mitutoyo if intending to use dial indicators which are not recommended.



201-101

Note: The dial indicator and protection cover are optional.

Optional accessories

Dial protection cover: **21DZA000**

Recommended dial indicators (optional)

- Metric models:
2046SB: Dial indicator (Graduation: 0.01 mm)
2109SB-10: Dial indicator (Graduation: 0.001 mm)
- Inch models: **2803SB-10** (Graduation: 0.0001 in)

SPECIFICATIONS

Metric

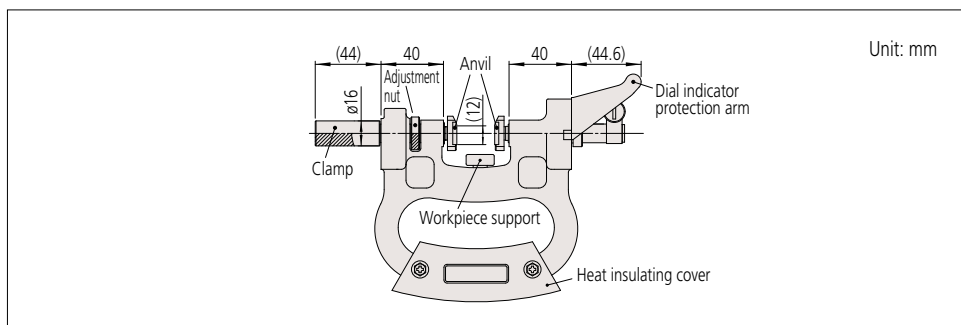
| Order No. | Range (mm) | Parallelism (μm) | Measuring force* (N) |
|-----------|------------|------------------|----------------------|
| 201-101 | 0 - 25 | 5 | 15±3 |
| 201-102 | 25 - 50 | | |
| 201-103 | 50 - 75 | | |
| 201-104 | 75 - 100 | | |
| 201-105 | 100 - 125 | | |
| 201-106 | 125 - 150 | | |
| 201-107 | 150 - 175 | | |
| 201-108 | 175 - 200 | | |
| 201-109 | 200 - 225 | | |
| 201-110 | 225 - 250 | | |
| 201-111 | 250 - 275 | | |
| 201-112 | 275 - 300 | | |

Inch

| Order No. | Range (in) | Parallelism (in) | Measuring force* (N) |
|-----------|------------|------------------|----------------------|
| 201-151 | 0 - 1 | 0.00025 | 15±3 |
| 201-152 | 1 - 2 | | |
| 201-153 | 2 - 3 | | |
| 201-154 | 3 - 4 | | |
| 201-155 | 4 - 5 | | |
| 201-156 | 5 - 6 | | |
| 201-157 | 6 - 7 | | |
| 201-158 | 7 - 8 | | |
| 201-159 | 8 - 9 | | |
| 201-160 | 9 - 10 | | |
| 201-161 | 10 - 11 | | |
| 201-162 | 11 - 12 | | |

* Measuring force is that force present before an indicator is installed and is determined at the point where the spindle is retracted 1 mm from the rest position.

DIMENSIONS



Unit: mm

Stands

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 7 — Magnetic Stands

- Mitutoyo's Magnetic Stands clamp to iron or steel surfaces with a strong magnetic force that is switchable ON or OFF to allow easy mounting and dismounting.
 - Vertical/horizontal mounting holes and bushes are available for attaching dial test indicators and dial indicators*.
 - In addition, models **7014-10**, **7014E-10**, **7031-10**, **7032-10** and **7033-10** have a dovetail groove in the swivel holder for attaching dial test indicators that are equipped with a dovetail.
- * Recommended dial indicators: compact and lightweight indicators*.



7010-10



7011-10



7012-10



7014-10
(magnetic clamping is non-switchable)



7033-10



7031-10

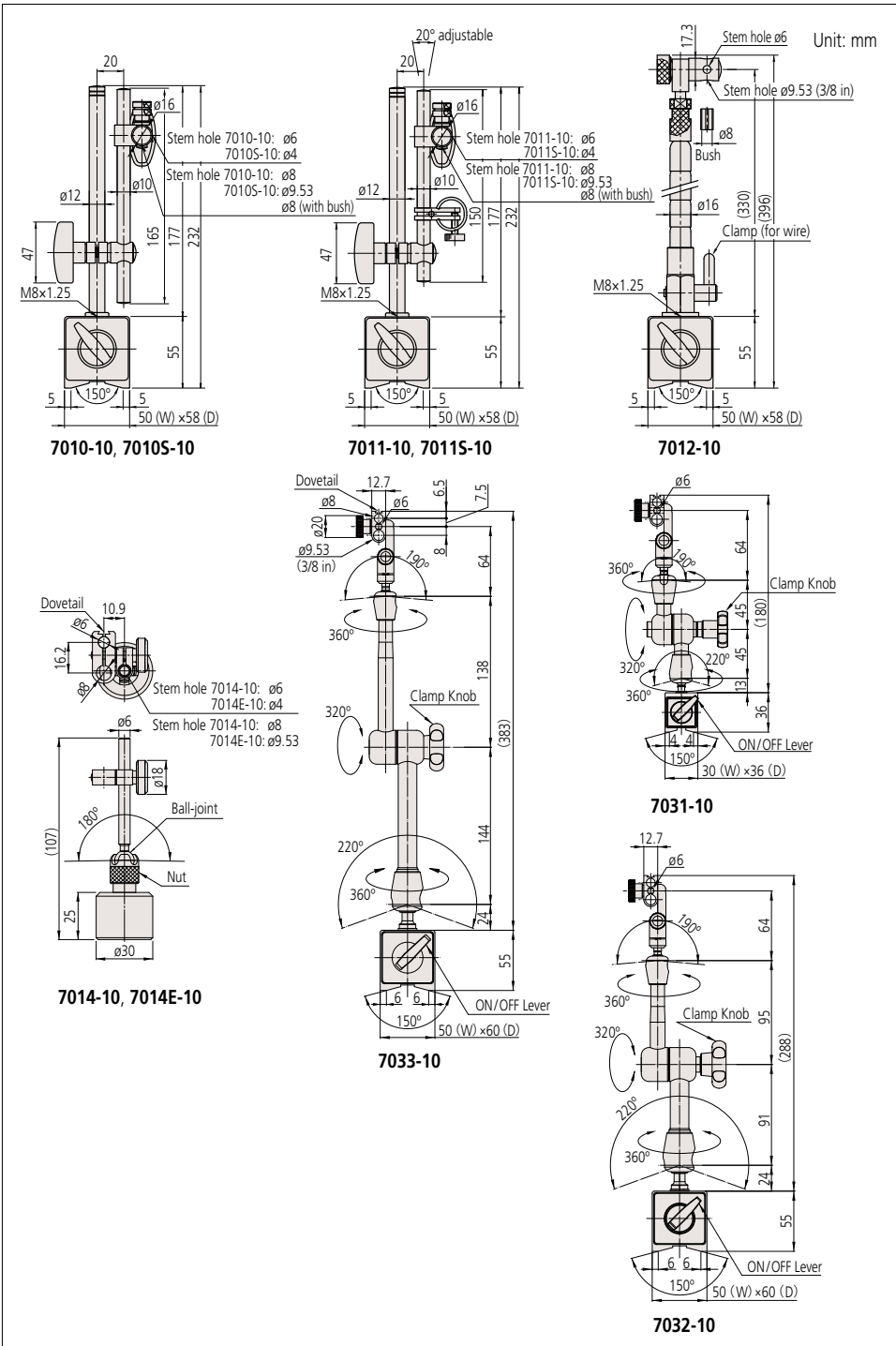


7032-10

Stands

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



SPECIFICATIONS

| Order No. | Description | Applicable holding stem sizes | Magnetic force*1 | Remarks |
|--------------|--------------------------|---|------------------|--------------------------------|
| 7010-10*2*3 | Magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm | Approx. 600 N | — |
| 7010S-10*2*3 | Magnetic stand | $\varnothing 4$ mm, $\varnothing 8$ mm, $\varnothing 9.53$ mm (3/8 in) | Approx. 600 N | — |
| 7011-10*2*3 | Magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm | Approx. 600 N | With fine adjustment |
| 7011S-10*2*3 | Magnetic stand | $\varnothing 4$ mm, $\varnothing 8$ mm, $\varnothing 9.53$ mm (3/8 in) | Approx. 600 N | With fine adjustment |
| 7012-10*4 | Magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm, $\varnothing 9.53$ mm (3/8 in) | Approx. 600 N | — |
| 7014-10*4 | Mini magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm, with dovetail | Approx. 150 N | Without magnet ON/OFF |
| 7014E-10*2*3 | Mini magnetic stand | $\varnothing 4$ mm, $\varnothing 9.53$ mm (3/8 in) | Approx. 150 N | Without magnet ON/OFF |
| 7031-10 | Universal magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm, $\varnothing 9.53$ mm (3/8 in), with dovetail | Approx. 300 N | With mechanical locking system |
| 7032-10 | Universal magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm, $\varnothing 9.53$ mm (3/8 in), with dovetail | Approx. 600 N | With mechanical locking system |
| 7033-10 | Universal magnetic stand | $\varnothing 6$ mm, $\varnothing 8$ mm, $\varnothing 9.53$ mm (3/8 in), with dovetail | Approx. 600 N | With mechanical locking system |

*1 The magnetic holding force applies to that needed for vertical separation from a thick and flat steel object.

*2 Back plunger type (1160T, etc.) cannot be attached.

*3 When attaching a compact dial indicator (outer frame diameter 31, 36 or 40 mm), select a back cover type with a lug.

*4 Use with a dial test indicator or SERIES 1 dial indicator (compact or lightweight type) is recommended.

Dial Gage Stands SERIES 7

- A convenient supporting stand for enabling a dial indicator to be used for comparative height or thickness measurements.
- Anvil: $\varnothing 58$ mm for **7001-10**, **7002-10**
90x90 mm for **7007-10**.
- Vertical fine adjustment is available with one-touch control thanks to the parallel spring suspension.



7001-10
(with $\varnothing 58$ mm serrated anvil)



7002-10
(with $\varnothing 58$ mm non-serrated anvil)

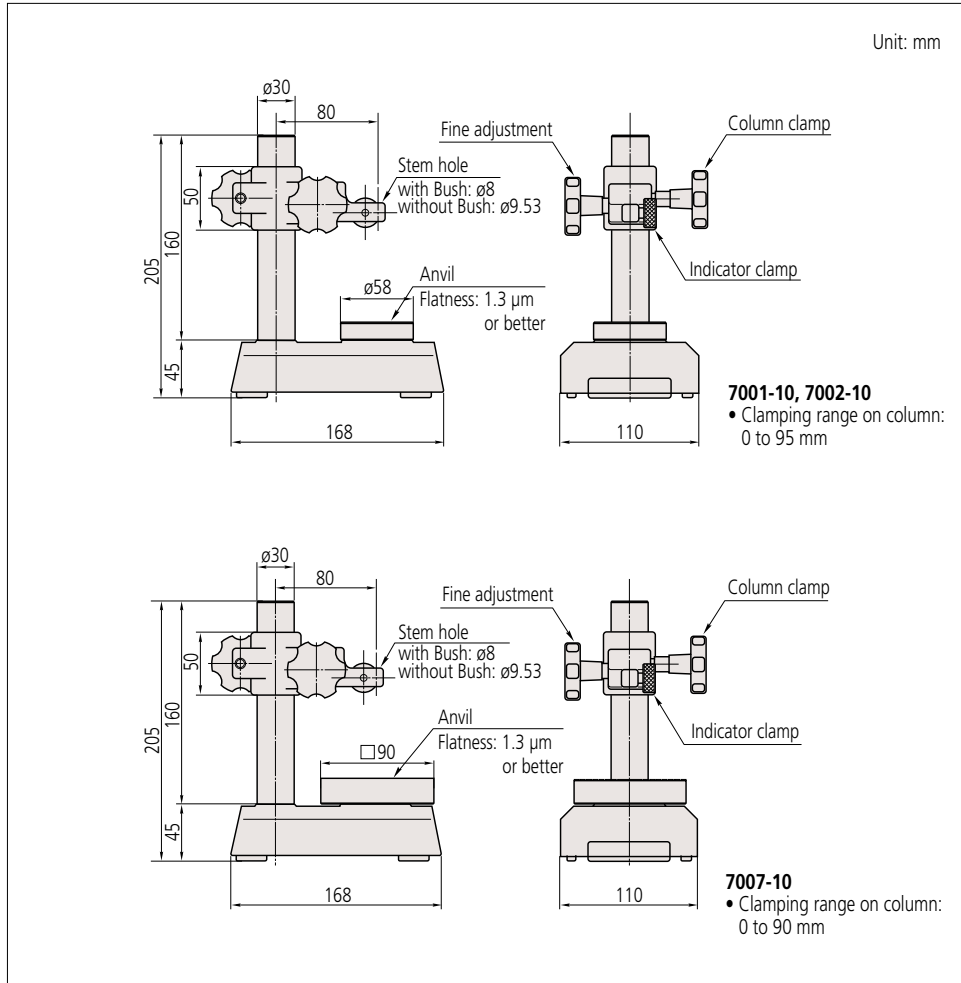


7007-10
(with 90 mm square semi-serrated anvil)

Stands

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



SPECIFICATIONS

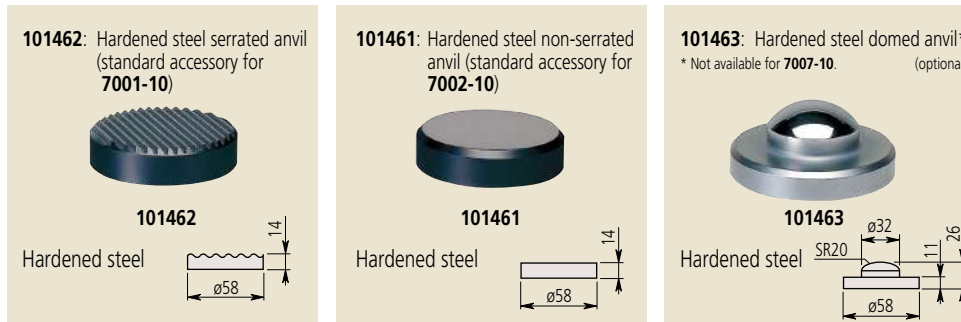
| Metric | | |
|-----------|----------------|---------------------|
| Order No. | Stem hole (mm) | Remarks |
| 7001-10 | ø8, ø9.53 | With serrated anvil |
| 7002-10 | ø8, ø9.53 | With flat anvil |
| 7007-10 | ø8, ø9.53 | With square anvil |

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.4 mm/100 mm

Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 μm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.

Accessories (for 7001-10, 7002-10)



Accessories for 215-156-10

- **21JAA329:** ø8 mm bush (standard accessory)
- **21JAA330:** ø9.53 mm (3/8 in) bush (standard accessory)
- **21JAA331:** ø15 mm bush (optional accessory)

SERIES 215 — Granite Base Comparator Stands

- The base is made of black granite that stays free of burrs and build-ups due to its fine-grain composition.
- Easy maintenance due to the non-rusting base.
- The stability of the granite base assures long-lasting flatness accuracy.



215-150-10



215-151-10



215-153-10



215-156-10

SPECIFICATIONS

| Order No. | Granite base size (WxDxH) (mm) | Clamping range (mm) | Stem hole (mm) | Remarks |
|-------------------|--------------------------------|---------------------|----------------|---|
| 215-150-10 | 120x180x50 | 110 | ø8, ø9.53 | With fine adjustment of 1 mm range |
| 215-151-10 | 150x200x50 | 250 | ø8, ø9.53 | With fine adjustment of 1 mm range |
| 215-153-10 | 200x250x80 | 260 | ø8, ø9.53 | With fine adjustment of 1 mm range |
| 215-156-10 | 300x250x80 | 275 | ø8, ø9.53, ø20 | With fine adjustment over entire travel |

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.2 mm/100 mm.

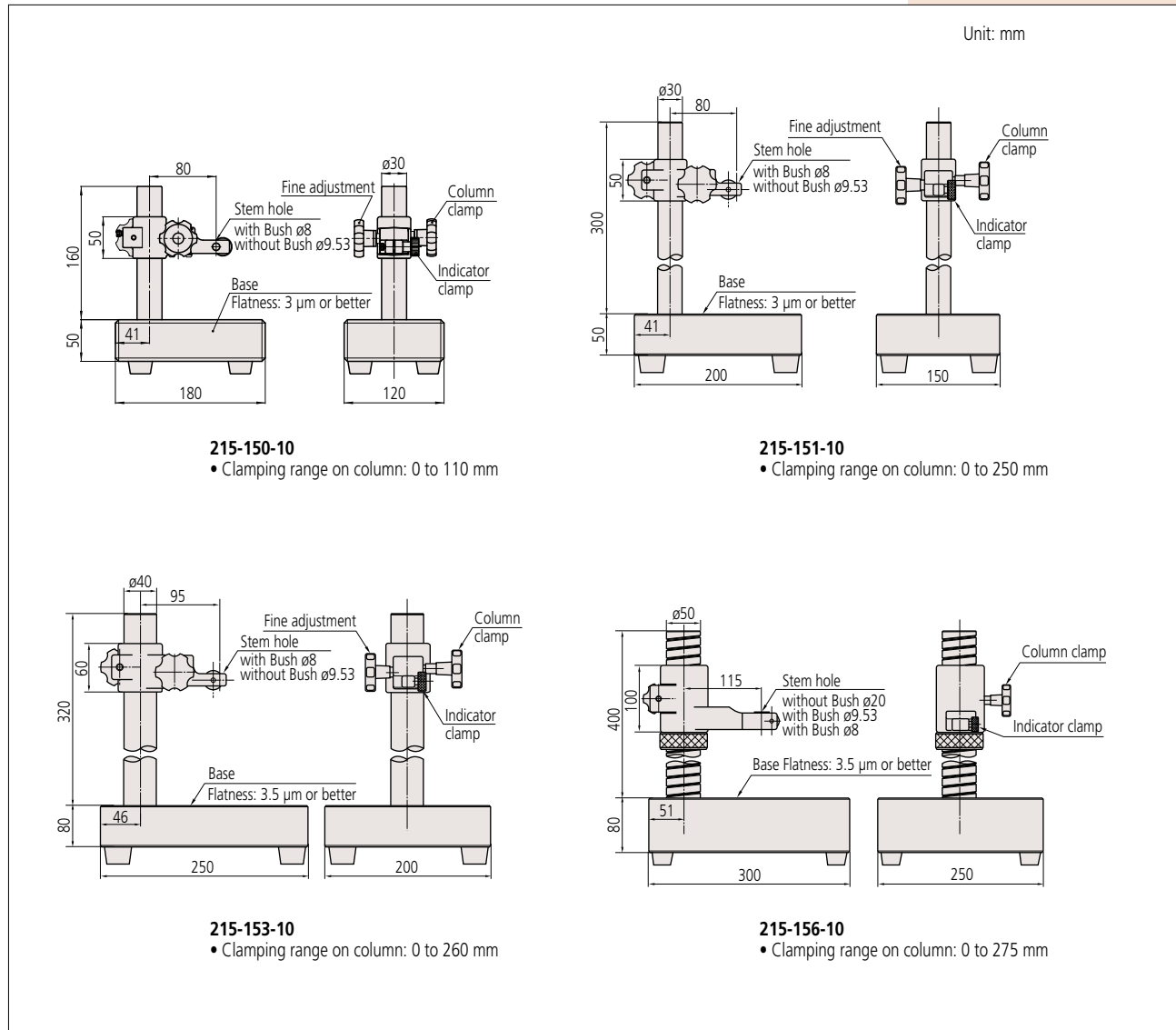
Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 µm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.

Stands

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

DIMENSIONS



SERIES 215 — Cast Iron Base Comparator Stands



Typical application using Digimatic Indicator ID-H.

- These stands have a very stable cast-iron base that enables precise measurement.
- The semi-serrated anvil prevents very flat workpieces from wringing to it and the 2.3 μm flatness (or better) promotes accurate measurement.
- With an integrated indicator mounting section and arm, the bracket for **BSC-30HX** provides further improved rigidity, making it easy to adjust parallelism.
- **BSB-20X** uses a square 110 mm×110 mm serrated anvil while **BSC-30HX** uses a square 150 mm×150 mm serrated anvil.



215-405-10

SPECIFICATIONS

| Order No. | Anvil | Micromotion mechanism (Adjustment range) | Stem hole (mm) |
|------------|---|--|--|
| 215-405-10 | Square semi-serrated anvil (110×110 mm) | Vertical fine adjustment (1 mm) | $\varnothing 9.53$, $\varnothing 8$ with Bush |
| 215-505-10 | Square semi-serrated anvil (150×150 mm) | Micromotion screw | $\varnothing 20$, $\varnothing 9.53$ with Bush, $\varnothing 8$ with Bush |

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.4 mm/100 mm.

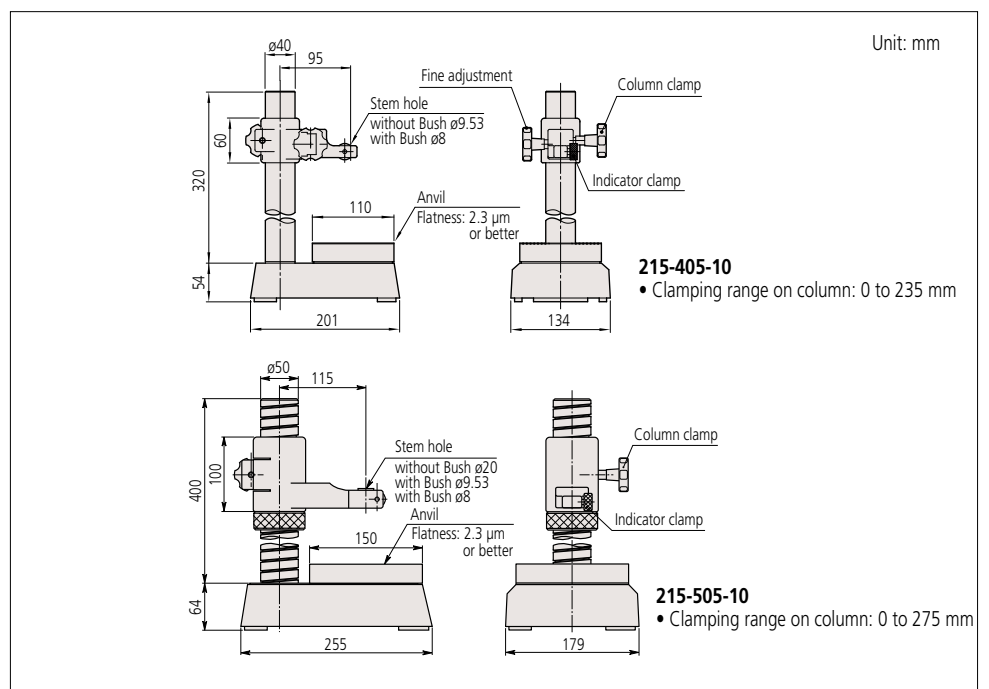
Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 μm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

Note 3: Compact dial indicators (bezel $\varnothing 31$, $\varnothing 36$) are not suitable for use with these stands.

Accessories for 215-505-10

- **21JAA329**: $\varnothing 8$ mm bush (standard accessory)
- **21JAA330**: $\varnothing 9.53$ mm (3/8 in) bush (standard accessory)
- **21JAA331**: $\varnothing 15$ mm bush (optional accessory)

DIMENSIONS



Stands

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

SERIES 519 — Transfer Stands

- Transfer Stands are designed for comparison measurements of size using a dial indicator or Digimatic Indicator.



519-109-10
(with a serrated anvil)

SPECIFICATIONS

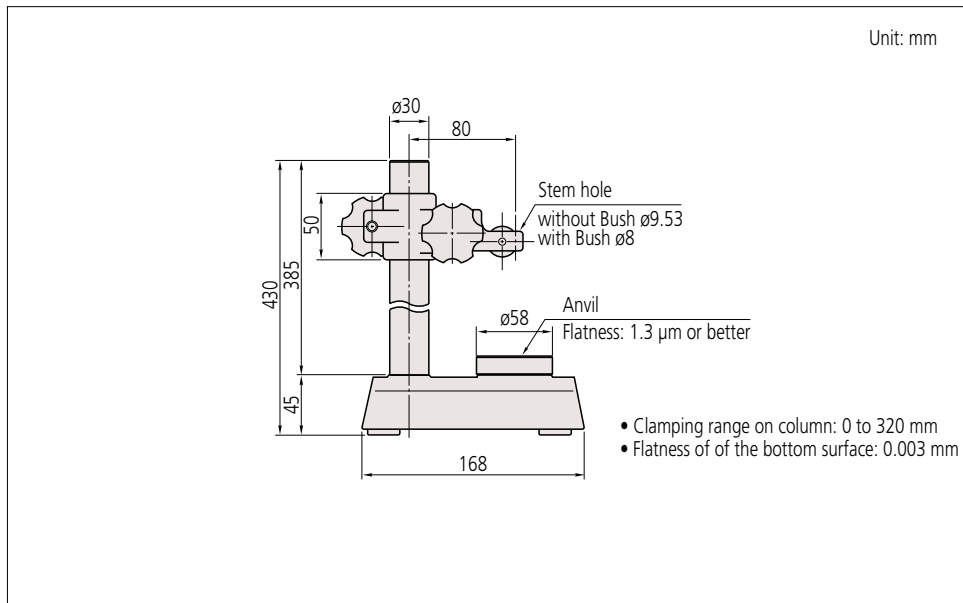
| Metric | | | |
|------------|-------------------------------|-----------------------------------|---------------------|
| Order No. | Clamping range on column (mm) | Micromotion adjustment range (mm) | Stem hole (mm) |
| 519-109-10 | 0 to 320 | 1 | ø9.53, ø8 with Bush |

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.4 mm/100 mm.

Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 µm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.

DIMENSIONS

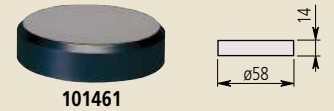


Accessories

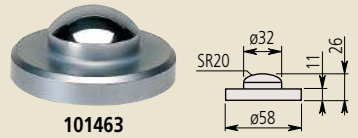
101462: Hardened steel serrated anvil (standard accessory)



101461: Hardened steel non-serrated anvil (optional)



101463: Hardened steel domed anvil (optional)



Accuracy

| | Mitutoyo | Reference JIS B 7540 Grade 1, 100 mm or shorter |
|--|------------------|--|
| Bottom-surface flatness | 2 μm or better | 10 μm or better |
| V-surface flatness | 2 μm or better | 10 μm or better |
| Parallelism between the bottom-surface and a cylinder on the V-surface | 7.5 μm or better | 10 μm or better |
| Inclination of the V-anvil against the bottom-surface | 10 μm or better | 10 μm or better |
| Parallelism between the side surface and a cylinder on the V-surface | 7.5 μm or better | 20 μm or better |
| Difference in the height of a pair of V-Blocks | 9 μm or better | 10 μm or better |

Optional Accessory

101462 Serrated anvil (standard accessory)

V-Block Set SERIES 181

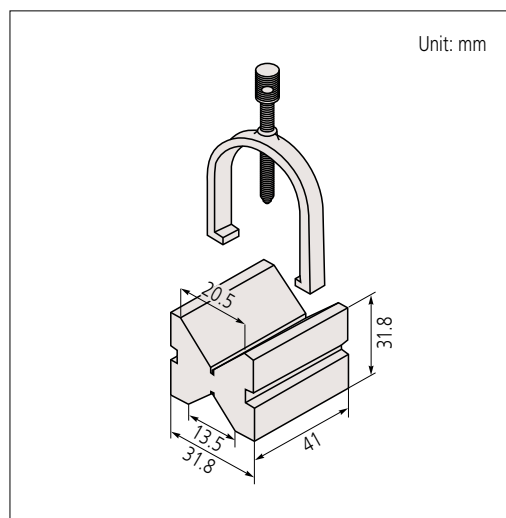


181-902-10

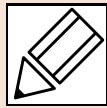
SPECIFICATIONS

| Metric | | |
|------------|--------------------------|--------------------------------|
| Order No. | Max. workpiece dia. (mm) | Remarks |
| 181-902-10 | 25 | A set of two blocks and clamps |

DIMENSIONS

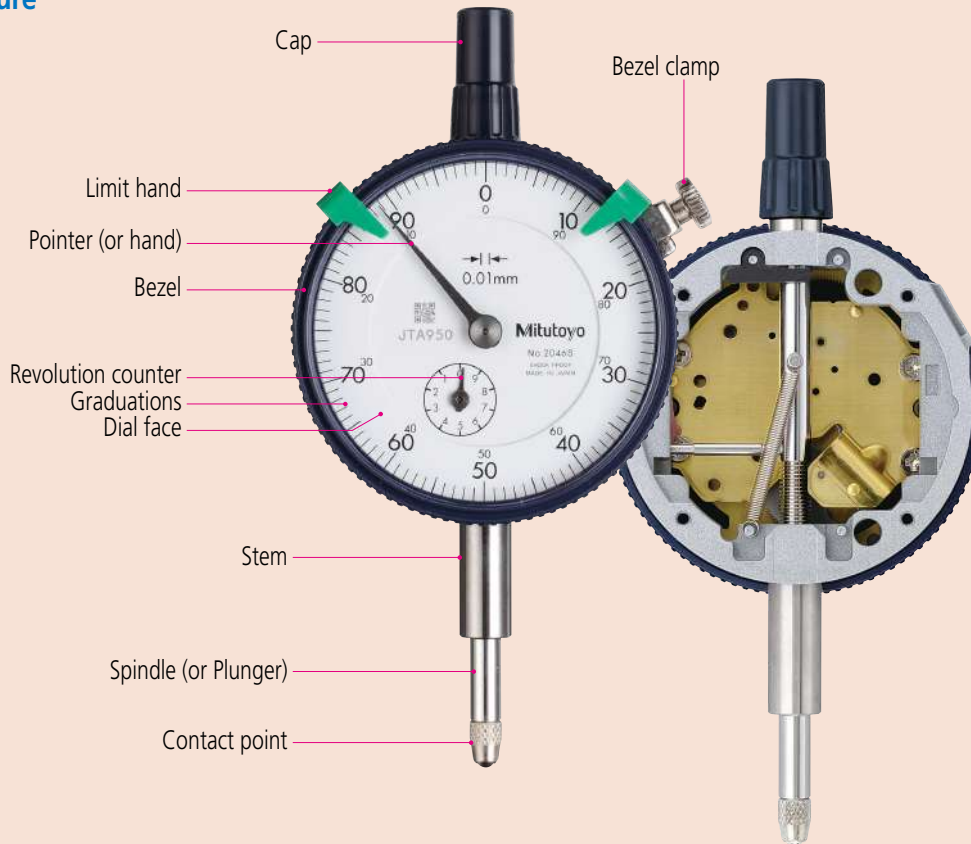


Quick Guide to Precision Measuring Instruments



Dial Gages and Digital Indicators

Nomenclature

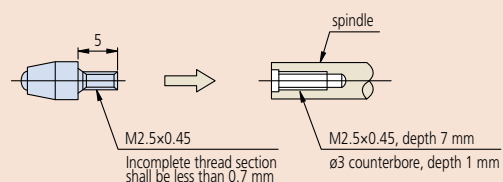


Mounting a Dial gage

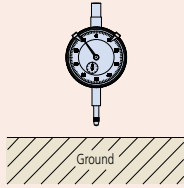
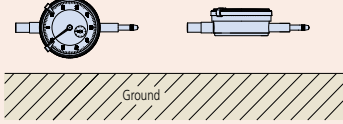
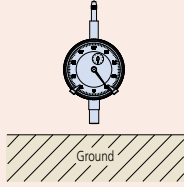
| | | | |
|---------------|--------|---|---|
| Stem mounting | Method | <p>Clamping the stem directly with a screw</p> | <p>Clamping the stem by split-clamp fastening</p> |
| | Note | <ul style="list-style-type: none"> • Mounting hole tolerance: $\varnothing 8$ G7 (+0.005 to 0.02) • Clamping screw: M4 to M6 • Clamping position: 8 mm or more from the lower edge of the stem • Maximum clamping torque: 150 N·cm when clamping with a single M5 screw • Note that excessive clamping torque may adversely affect spindle movement. | <ul style="list-style-type: none"> • Mounting hole tolerance: $\varnothing 8$ G7 (+0.005 to 0.02) |
| Lug mounting | Method | | |
| | Note | <ul style="list-style-type: none"> • Lugs can be changed 90° in orientation according to the application. (The lug is set horizontally when shipped.) • Lugs of some SERIES 1 models (1911T-10, 1913T-10 and 1003T), however, cannot be altered to horizontal. • To avoid cosine-effect error, ensure that any type of gage or indicator is mounted with its spindle in line with the intended measurement direction. | |

Contact point

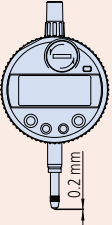
- Screw thread is standardized on M2.5x0.45 (Length: 5 mm).
- Incomplete thread section at the root of the screw shall be less than 0.7 mm when fabricating a contact point.



Measuring orientation

| Orientation | Remarks |
|---|---|
| Vertical (contact point downward)  | If measurement is performed in the lateral orientation, or upside-down orientation, the measuring force is less than in the vertical orientation. In this case be sure to check the operation and repeatability of the indicator. For guaranteed-operation specifications according to the operating orientation refer to the specific product descriptions in the catalog. |
| Lateral (spindle horizontal)  | |
| Upside-down (contact point upward)  | |

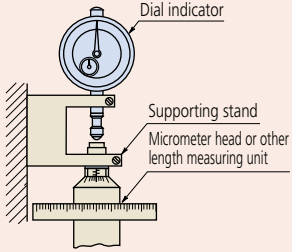
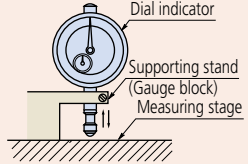
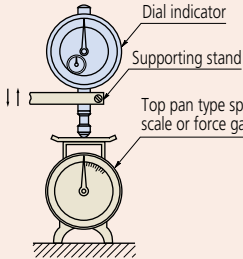
Setting the origin of a Digimatic indicator

| | |
|--|---|
|  | <p>The accuracy specification in the range of 0.2 mm from the end of the stroke is not guaranteed for Digimatic indicators. When setting the zero point or presetting a specific value, be sure to lift the spindle at least 0.2 mm from the end of the stroke.</p> |
|--|---|

Notes on using a dial indicator or Digimatic indicator

- Do not lubricate the spindle. Doing so might cause dust to accumulate, resulting in a malfunction.
- If the spindle movement is poor, wipe the upper and lower spindle surfaces with a dry or alcohol-soaked cloth. If the movement is not improved by cleaning, contact Mitutoyo for repair.
- Before making a measurement or calibration, confirm if the spindle moves upward and downward smoothly, and stability of the zero point.

Dial Indicator Standard B7503: 2017 (Extract from JIS / Japanese Industrial Standards)

| Item | Model | Measuring method (zero-point fixed) | Evaluation method (performance evaluation by moving the zero point) | Measurement examples | |
|------------------|---|--|---|---|---|
| Indication error | Indication error over the entire measuring range | One-revolution dial indicator and multi-revolution dial indicator | Set the dial indicator on the supporting stand, and read the indication error* ¹ of the next point while gradually retracting the spindle. - Every 1/10 revolution for the first two revolutions* ² - Every half revolution from two to five revolutions - Every revolution from five to ten revolutions - Every five revolutions from 10 to 50 revolutions - Every ten revolutions after 50 revolutions | Obtain the difference between the maximum and the minimum values of indication error of all measurement points in both retract and extend directions. During the first two revolutions in both retract and extend directions, obtain the maximum difference of the indication error among the adjacent measurement points per 1/10 revolutions* ³ . |  |
| | 1/10 revolution indication error | | During the first five revolutions in both retract and extend directions, obtain the maximum difference of the maximum and the minimum indication errors over the measuring range per 1/2 revolutions. | | |
| | 1/2 revolution indication error | Multi-revolution dial indicator | Next, after retracting the spindle for more than three graduations of the long hand, extend the spindle gradually and read the indication error at the same measurement point in the retract direction. | During the first ten revolutions in both retract and extend directions, obtain the maximum difference of the maximum and the minimum indication errors over the measuring range per one revolution. | |
| | 1 revolution indication error | | | | |
| Retrace error | One-revolution dial indicator and multi-revolution dial indicator | | Obtain the maximum difference of all the measuring points in reference to the indication error at the same measuring point in both forward and backward directions. | | |
| Repeatability | | Set the dial indicator on the supporting stand, retract the spindle at a desired position within the measuring range. Then, extend the spindle quickly and slowly three times and read each value. | Obtain the maximum difference among five indication values. |  | |
| Measuring force | One-revolution dial indicator and multi-revolution dial indicator | Set the dial indicator on the supporting stand, retract and extend the spindle continuously and gradually, and read the measuring force at the zero and end points. | Obtain the maximum measuring force, the minimum measuring force, and the difference of the measuring force in both retract and extend directions at the same measurement point. |  | |

*1 For how to read the indication error, either read the input quantity of the measuring instrument aligning the long hand to the graduation, or read the indication value of the dial indicator according to the moving amount of the measuring instrument.

*2 With the one-revolution dial indicator, read the indication error per 10 graduations.

*3 With the one-revolution dial indicator, obtain the maximum difference of the indication error in the interval of adjacent 10 graduations.

Maximum permissible error

(unit: μm)

| | | Maximum permissible error (MPE) by measurement characteristics -- dial indicators with bezel dia. 50 mm or larger | | | | | | | | | | | Maximum permissible error (MPE) by measurement characteristics - dial indicators with bezel dia. 50 mm or smaller and Back Plunger type dial indicators | | | | | | | |
|----------------------|---------------------------|--|--------------------|--------------------|---------------------|----------------------|----------------------|----------------------|-----------------------|-----------|-----------|--------------------|--|-----------|--------------------|--------------------|---------------------|-----------|-----------|-----------|
| Graduation (mm) | | 0.01 | | | | | | | 0.005 | 0.001 | | | 0.01 | | | | 0.005 | 0.002 | 0.001 | |
| Measuring range (mm) | | 1 or less | Over 1 and up to 3 | Over 3 and up to 5 | Over 5 and up to 10 | Over 10 and up to 20 | Over 20 and up to 30 | Over 30 and up to 50 | Over 50 and up to 100 | 5 or less | 1 or less | Over 1 and up to 2 | Over 2 and up to 5 | 1 or less | Over 1 and up to 3 | Over 3 and up to 5 | Over 5 and up to 10 | 5 or less | 1 or less | 1 or less |
| Retrace error | | 3 | 3 | 3 | 3 | 5 | 7 | 8 | 9 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 3.5 | 2.5 | 2 |
| Repeatability | | 3 | 3 | 3 | 3 | 4 | 5 | 5 | 5 | 3 | 0.5 | 0.5 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 |
| Indication error | Arbitrary 1/10 revolution | 5 | 5 | 5 | 5 | 8 | 10 | 10 | 12 | 5 | 2 | 2 | 3.5 | 8 | 8 | 8 | 9 | 6 | 2.5 | 2.5 |
| | Arbitrary 1/2 revolution | 8 | 8 | 9 | 9 | 10 | 12 | 12 | 17 | 9 | 3.5 | 4 | 5 | 11 | 11 | 12 | 12 | 9 | 4.5 | 4 |
| | Arbitrary One revolution | 8 | 9 | 10 | 10 | 15 | 15 | 15 | 20 | 10 | 4 | 5 | 6 | 12 | 12 | 14 | 14 | 10 | 5 | 4.5 |
| | Entire measuring range | 8 | 10 | 12 | 15 | 25 | 30 | 40 | 50 | 12 | 5 | 7 | 10 | 15 | 16 | 18 | 20 | 12 | 6 | 5 |

Note 1: The maximum permissible error (MPE) for one-revolution dial indicators does not specify the indication error of an arbitrary 1/2 and 1 revolution.

Note 2: The MPE represents the value at 20 °C, which JIS B 0680 defines as the standard temperature.

Note 3: The measurement characteristics of a dial indicator have to meet both maximum permissible error (MPE) and measurement force permissible limits (MPL) at any position within the measuring range in any posture when the measurement characteristics are not specified by the manufacturer.

Mitutoyo's Response to Dial Indicator Standard B 7503: 2017

- We guarantee the accuracy of completed products by inspecting them in the vertical posture. Standard-attached inspection certificate includes inspection data.
- We issue paid-for inspection certificates for horizontal or opposite posture if required.
- It is said that, for evaluation of the compatibility to the specifications, JIS B 0641-1 or the criteria where the internationally-recognized specification range and the OK range are equal shall be applied. Also, it is said that the uncertainty is preferred to be evaluated based on ISO 14253-2 and ISO/IEC Guide 98-3. Therefore, we perform shipping inspection of dial indicators inclusive of the uncertainty of calibration as in the past.

Dial test indicator (lever type) Standard B7533: 2015 (Extract from JIS / Japanese Industrial Standards)

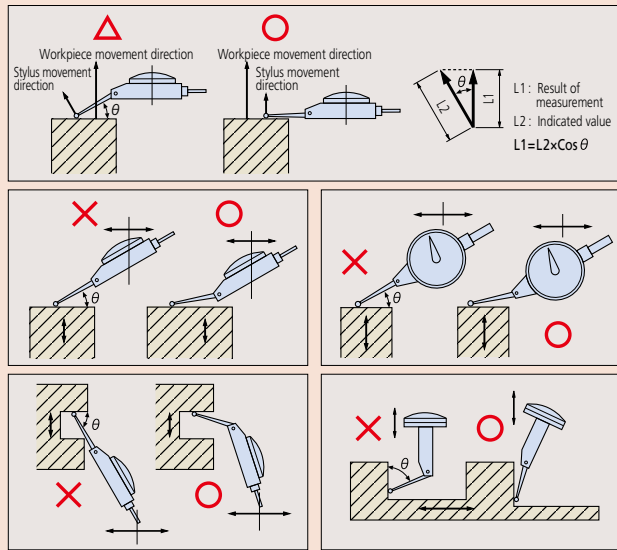
| No. | Item. | Measuring method | Measuring point | Evaluation method | Diagram |
|-----|--|---|---|---|---------|
| 1 | Error of indication over a range of Measuring range | Holding the dial test indicator (lever type), define the reference point at near the contact point resting point where the indication and error of indication is set zero. | Per 10 graduations in the forward and backward direction from the reference point to the end point. | Obtain the difference between the maximum and the minimum values of indication error of all measurement points in the forward direction. | |
| 2 | Error of indication over a range of 10 scale divisions | Then, move the contact point in the forward direction and read the error of indication at each measuring point. | | In the forward direction from the reference point to the end point, obtain the maximum difference of the indication error among the adjacent measurement points per 10 graduations. | |
| 3 | Error of indication over a range of One revolution | Next, after moving the contact point for more than three graduations from the end of the measuring range, move the contact point in the backward direction and read the error of indication at the same measurement point in the forward direction. (The forward direction is the direction against the measuring force to the contact point of the lever-operated dial indicator; the backward direction is the measuring force applied direction.) | | In the forward direction from the reference point to the end point, obtain the maximum difference of the maximum and the minimum indication errors to be read by the zero-point fixed method over the measuring range per 1 revolution. | |
| 4 | Hysteresis | (The forward direction is the direction against the measuring force to the contact point of the lever-operated dial indicator; the backward direction is the measuring force applied direction.) | | Obtain the maximum difference in reference to the indication error at the same measuring point in both forward and backward directions among all the measurement points. | |
| 5 | Repeatability | Holding the dial test indicator (lever type) with its contact point parallel with the top face of the measuring stage, move the contact point quickly and slowly five times at a desired position within the measuring range and read the indication at each point. | At arbitrary points within the measuring range | Obtain the maximum difference of the five measured values. | |
| 6 | Measuring force | Holding the dial test indicator (lever type), move the contact point in the forward and backward directions continuously and gradually, and read the measuring force in the measuring range. | Reference point and end point within the measuring range | Obtain the maximum and the minimum values in reference to the measuring force. | |

• Maximum permissible error and permissible limits

| Graduation (mm) | | 0.001/0.002 | | | 0.01 | | |
|-------------------------------------|-------------------------|--------------|---------------------|---------------------|--------------|---------------------|---------|
| | | 1 revolution | Multi-revolution | | 1 revolution | Multi-revolution | |
| Revolutions | | 0.3 or less | Over 0.3, up to 0.5 | Over 0.5, up to 0.6 | 0.5 or less | Over 0.5, up to 0.6 | |
| Measuring range (mm) | | 0.3 or less | Over 0.3, up to 0.5 | Over 0.5, up to 0.6 | 0.5 or less | L1 ≥ 35 | 35 < L1 |
| Error of indication over a range of | Measuring range (μm) | 4 | 6 | 7 | 6 | 9 | 10 |
| | One revolution (μm) | — | 5 | 5 | — | — | 10 |
| | 10 scale divisions (μm) | 2 | 2 | 2 | 5 | 5 | 5 |
| Hysteresis (μm) | | 3 | 4 | 4 | 4 | 4 | 5 |
| Repeatability (μm) | | 1 | 1 | 1 | 3 | 3 | 3 |
| Measuring force (N) | Max. | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| | Min. | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

Dial Test Indicators and the Cosine Effect

Always minimize the angle between movement directions during use.



The reading of any indicator will not represent an accurate measurement if its measuring direction is misaligned with the intended direction of measurement (cosine effect). Because the measuring direction of a dial test indicator is at right angles to a line drawn through the contact point and the stylus pivot, this effect can be minimized by setting the stylus to minimize angle θ (as shown in the figures). If necessary, the dial reading can be compensated for the actual θ value by using the table below to give the result of measurement.

Result of measurement = indicated value x compensation value

Compensating for a non-zero angle

| Angle | Compensation value |
|-------|--------------------|
| 10° | 0.98 |
| 20° | 0.94 |
| 30° | 0.87 |
| 40° | 0.77 |
| 50° | 0.64 |
| 60° | 0.50 |

Examples

If a 0.002 mm measurement is indicated on the dial at various values of θ , the result of measurements are:
 For $\theta=10^\circ$, $0.002 \text{ mm} \times 0.98 = 0.00196 \text{ mm}$
 For $\theta=20^\circ$, $0.002 \text{ mm} \times 0.94 = 0.00188 \text{ mm}$
 For $\theta=30^\circ$, $0.002 \text{ mm} \times 0.87 = 0.00174 \text{ mm}$

Mitutoyo's Response to Lever-operated Dial Indicator B 7533: 2015

- In the finished product inspection, the accuracy is guaranteed using the horizontal, tilted, vertical type dial indicator with its dial face facing upward; the parallel type with its dial face set in the vertical orientation. Standard-attached inspection certificate includes inspection data.
- The inspection certificate for other than the above postures is available for a fee.
- It is said that, for evaluation of the compatibility to the specifications, the criteria based on JIS B 0641-1 or ISO/TR14253-6 shall be applied. Also, it is said that the uncertainty is preferred to be evaluated based on ISO 14253-2 and ISO/IEC Guide 98-3. Therefore, we perform shipping inspection of dial indicators inclusive of the uncertainty of calibration as in the past.
- For pocket types, we perform the finished product inspection based on JIS B 7533-1990.

New Products



Linear Gages / Gage Heads

LGH (0.01 / 0.005 μm resolution)

Refer to page G-11 for details.



Laser Scan Micrometers

LSM-6902H

Refer to pages G-32 for details.

Linear Gages



Mu-checker



Laser Scan Micrometers



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Linear Gages

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| LGB2 (Slim) | G-6 |
| LGF (Economical Design Robust) | G-7 |
| LGF (0.1 μm resolution) | G-8 |
| LGF-Z (with origin point mark) | G-9 |
| LGS-1012P (ABSOLUTE) | G-10 |

High-accuracy/resolution Type

| | |
|---|------|
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|---|------|

Linear Gage Counter

| | |
|--|------|
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| EG (Panel mount, Single function Type) | G-13 |
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Display unit for the EV counter

| | |
|---------------------|------|
| D-EV (Display Unit) | G-17 |
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Data Loading software

| | |
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| SENSORPAK | G-18 |
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High-accuracy Digital Length Measuring Unit

| | |
|--|------|
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Mu-Checker (Electronic micrometer)






















| | |
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Laser Scan Micrometers


| | |
|---|------|
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Gage Heads / Display Units

| Measuring range Resolution | Gage Heads | | | | |
|-------------------------------|---------------------------|--|---------------------|--|--|
| | | 5 mm | 10 mm | 25 mm | |
| Incremental | 0.000005 mm (0.005 μm) | LGH Series Page G-11 | | 542-720 542-721 (Low measuring force)  Pages G-11 and G-12 | |
| | 0.00001 mm (0.01 μm) | LGH Series Page G-11 | | 542-715 542-716 (Low measuring force)  Pages G-11 and G-12 | |
| | 0.0001 mm (0.1 μm) | LGB2 Series (nut clamp) Page G-6 L GK Series Page G-5 LGF Series Page G-8 | 542-246 Page G-6 | 542-158 542-181  Pages G-5 and G-8 | 542-182  Page G-8 |
| | 0.0005 mm (0.5 μm) | L GK Series Page G-5 LGF Series Page G-7 | | 542-171 542-157  Pages G-5 and G-7 | 542-172  Page G-7 |
| | 0.001 mm (1 μm) | L GK Series Page G-5 LGF Series Page G-7 | | 542-156 542-161  Pages G-5 and G-7 | 542-162  Page G-7 |
| | | LGB2 Series (nut clamp) Page G-6 | 542-244 Page G-6 | 542-262 542-262H (High accuracy) 542-264 (Low measuring force) 542-270 (Air drive) Page G-6 | |
| | 0.0005 mm (0.5 μm) | LGF Series Series with reference point mark Page G-9 | | 542-174  Page G-9 | 542-175  Page G-9 |
| | 0.001 mm (1 μm) | LGF Series Series with reference point mark Page G-9 | | 542-164  Page G-9 | 542-165  Page G-9 |
| Absolute | 0.01 mm (10 μm) | LGS Series ABSOLUTE™ Page G-10 | | 575-303  Page G-10 | |

| Gage Heads | | Display unit | | |
|------------|--|---|---|--|
| | 50 mm | Point measurement | Calculation measurement (addition and subtraction) | Multi-point measurement |
| | | Dedicated counter (sold in sets with Gage Head)  SENSORPAK | | |
| | | EG Counter 542-015  Page G-13 EB Counter 542-092-2  Page G-14 EH Counter 542-075  SENSORPAK Page G-15 | EH Counter 542-071  SENSORPAK Page G-15 SENSORPAK : Compatible with Measurement data loading software SENSORPAK. Refer to page G-18 for details.  | EV Counter 542-063  SENSORPAK Page G-16  |
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**Measurement data loading software for EH, EV, VL
SENSORPAK**



Linear Gages

Ideal for integration into harsh environments such as automation applications

LGK SERIES 542 — Slim type

- Compact model offers the vibration/shock resistance of the proven **LGF Series**. Cross-sectional area is approx. 1/5 compared to **542-181**.
- Resolution of each model can be selected from 0.1 μm , 0.5 μm , or 1 μm .
- Excellent sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Excellent shock resistance, 100 G/11 ms (IEC 60068-2-27)



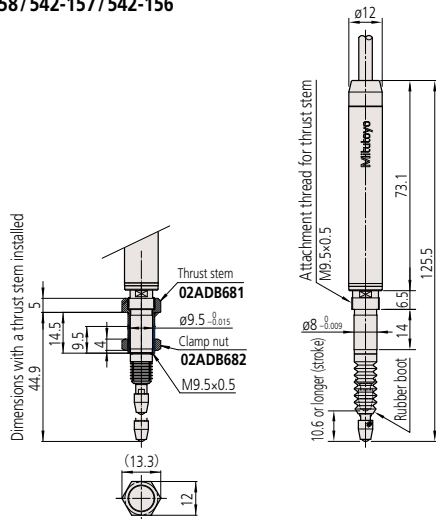
SPECIFICATIONS

| Order No. | 542-158 | 542-157 | 542-156 |
|---|---|--|-----------------|
| Measuring range | | 10 mm | |
| Resolution | 0.1 μm | 0.5 μm | 1 μm |
| Measuring accuracy (20 °C) | (0.8 + L/50) μm L=arbitrary measuring length (mm) | (1.5 + L/50) μm L=arbitrary measuring length (mm) | |
| Measuring force | Contact point downwards | 0.8 N or less | |
| | Contact point horizontal | 0.75 N or less | |
| | Contact point upwards | 0.7 N or less | |
| Position detection method | Photoelectric linear encode | | |
| Response speed | 400 mm/s | 1500 mm/s | |
| Output signal | 90° phase difference, differential square wave (RS-422A equivalent), minimum edge intervals: 200 ns for 0.1 μm model, 250 ns for 0.5 μm model, 500 ns for 1 μm model | | |
| Output signal pitch | 0.4 μm | 2 μm | 4 μm |
| Mass | Approx. 175 g | | |
| Contact point | \varnothing 3 mm carbide tipped (fixing screw: M2.5 (P=0.45) x5), standard contact point: 901312 | | |
| Stem | \varnothing 8 mm | | |
| Bearing | Linear ball type | | |
| Output cable length | 2 m (directly from casing) | | |
| Connector | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | | |

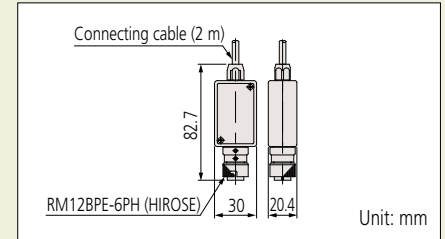
DIMENSIONS

Unit: mm

542-158 / 542-157 / 542-156



Connector



Optional Accessories

- Air lifter: **02ADE230**
- Note 1: Required air pressure: 0.2 to 0.4 MPa (With a 0.1 μm resolution type: 0.2 MPa)
- Note 2: Spindle extends when air is supplied.



- Rubber boot: **238772** (spare)
- Thrust stem set*: **02ADB680**
- Thrust stem : **02ADB681**
- Clamp nut : **02ADB682**
- Special wrench : **02ADB683**
- * Thrust stem set is a combination of thrust stem and a clamp nut. A special wrench is required for tightening. If using multiple gages, a thrust stem set for each gage and one special wrench are required.



- Extension cable
- 5 m: **902434**
- 10 m: **902433**
- 20 m: **902432**
- Note 3: Connectable up to 3 pieces, 20 m at maximum.



Refer to the Linear Gage Brochure (**E13007**) for more details.

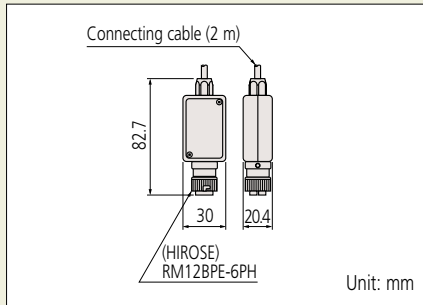
Optional Accessories

- Rubber boot (spare)
For 5 mm range models : **238773**
For 10 mm range models : **238772**
- Extension cable
5 m : **902434**
10 m : **902433**
20 m : **902432**

Note: Connectable up to 3 pieces, 20 m at maximum.

- Wrench for tightening nut: **200168**

Connector



LGB2 SERIES 542 — Slim Type

- Slim design, nut clamp type
(Stem is $\varnothing 9.5$ mm)

- The spindle used in this series is supported by a linear ball bearing to enhance durability.



SPECIFICATIONS

| Type | L-shaped | | Straight | | Low measuring force | Air-driven contact point*1 |
|---|--|----------------|----------------|-----------------|---------------------|----------------------------|
| Order No. | 542-246 | 542-244 | 542-262 | 542-262H | 542-264 | 542-270*2 |
| Measuring range | 5 mm | | 10 mm | | | |
| Resolution | 0.1 μ m | | 1 μ m | | | |
| Measuring accuracy (20 °C) | 0.8 μ m | | 2 μ m | 1 μ m | 2 μ m | |
| Maximum response speed | 380 mm/s | | 900 mm/s | | | |
| Measuring force | Contact point downwards | 0.65 N or less | 0.8 N or less | 0.6 N or less | 0.8 N or less | |
| | Contact point horizontal | 0.6 N or less | 0.75 N or less | 0.55 N or less | 0.75 N or less | |
| | Contact point upwards | 0.55 N or less | 0.7 N or less | 0.5 N or less | 0.7 N or less | |
| Mass | Approx. 160 g | | Approx. 155 g | | Approx. 170 g | |
| Contact point | $\varnothing 3$ mm carbide tipped (fixing screw: M2.5 (P=0.45) $\times 5$), standard contact point: 901312 | | | | | |
| Stem | $\varnothing 9.5$ mm | | | | | |
| Bearing | Linear ball type | | | | | |
| Output cable length | 2 m (directly from casing) | | | | | |
| Connector | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | | | | | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | | | | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | | | | | |
| Standard Accessories | Wrench for contact point: 538610 | | | | | |

*1 Required air pressure: 0.3 to 0.4 MPa

*2 Spindle extends when air is supplied.

Example of slim gage head low measuring force (made to order)

- Low measuring force, suitable for measurement of soft-material workpieces (consult us for other measuring forces).

| Model | L-shaped model | Air-driven contact point model |
|------------------|--------------------------|--------------------------------|
| Measuring range | 5 μ m | 10 μ m |
| Resolution | 1 μ m | 1 μ m |
| Measuring force* | Contact point downwards | 0.5 N or less |
| | Contact point horizontal | 0.45 N or less |
| | Contact point upwards | 0.4 N or less |

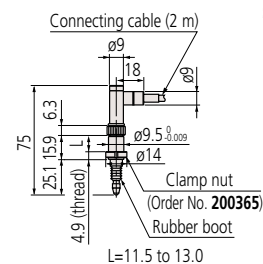
* Measuring force at the maximum retraction depth within the measuring range

Depending on the operating method, the spindle forward speed of the low measuring force model may be slow compared to the standard model. Please check if this restriction is compatible with the application. Please contact Mitutoyo to verify the application.

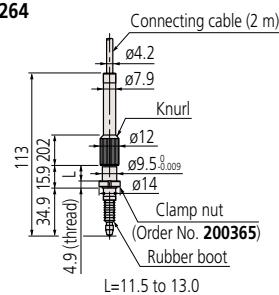
DIMENSIONS

Unit: mm

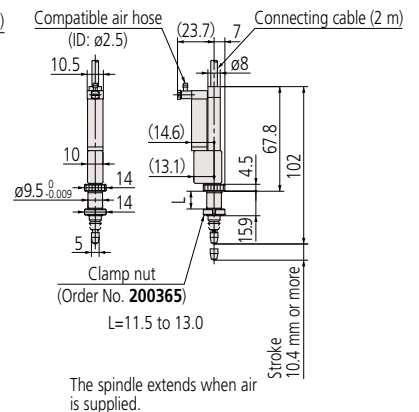
542-246/ 542-244



542-262/ 542-262H 542-264



542-270



Linear Gages

Ideal for integration into harsh environments such as automation applications

LGF SERIES 542 — Economical Design

- Excellent vibration/shock resistance due to the design of the spindle guide.
- Sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Shock resistance, 100 G/11 ms (IEC 60068-2-27)
- The **LGF-Z** Series, which is equipped with a reference point mark on the linear encoder (refer to page G-9), and includes a 0.1 μm resolution type (refer to page G-8) is also available.

542-171/542-161

IP66



542-172/542-162

IP66



542-173/542-163

IP66

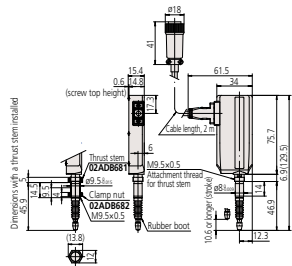


SPECIFICATIONS

| Order No. | 542-171 | 542-161 | 542-172 | 542-162 | 542-173 | 542-163 |
|---|---|---------------|---------------|---------------|---------------|---------------|
| Measuring range | 10 mm | | 25 mm | | 50 mm | |
| Resolution | 0.5 μm | 1 μm | 0.5 μm | 1 μm | 0.5 μm | 1 μm |
| Measuring accuracy (20 °C) | (1.5 + L/50) μm L=arbitrary measuring length (mm) | | | | | |
| Measuring force | Contact point downwards | 1.2 N or less | | 4.6 N or less | | 5.7 N or less |
| | Contact point horizontal | 1.1 N or less | | 4.3 N or less | | 5.3 N or less |
| | Contact point upwards | 1.0 N or less | | 4.0 N or less | | 4.9 N or less |
| Position detection method | Photoelectric linear encoder | | | | | |
| Response speed | 1500 mm/s | | | | | |
| Output | 90° phase difference, differential square wave (RS-422A equivalent), minimum edge intervals: 1000 ns for 5 μm model, 500 ns for 1 μm model, 250 ns for 0.5 μm model | | | | | |
| Output square wave pitch | 2 μm | 4 μm | 2 μm | 4 μm | 2 μm | 4 μm |
| Mass | Approx. 260 g | | Approx. 300 g | | Approx. 400 g | |
| Contact point | ø3 mm carbide tipped (fixing screw: M2.5 (P=0.45) x5), standard contact point: 901312 | | | | | |
| Stem | ø8 mm | | ø15 mm | | | |
| Bearing | Linear ball type | | | | | |
| Output cable length | 2 m (directly from casing) | | | | | |
| Connector | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | | | | | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | | | | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | | | | | |

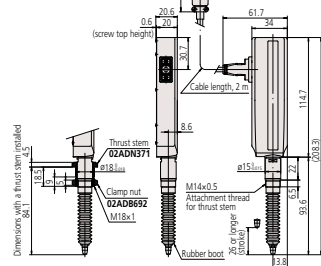
DIMENSIONS

542-171/542-161



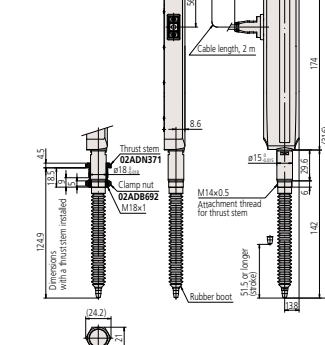
With thrust stem set (optional accessory)

542-172/542-162



With thrust stem set (optional accessory)

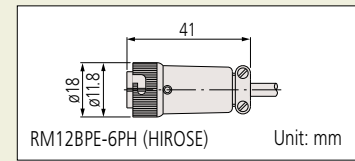
542-173/542-163



With thrust stem set (optional accessory)

Unit: mm

Connector



Optional Accessories

- Air drive unit
 - For 10 mm range models: **02ADE230**
 - For 25 mm range models: **02ADE250**
 - For 50 mm range models: **02ADE270**
- Note 1: Required air pressure: 0.2 to 0.4 MPa
Note 2: Spindle extends when air is supplied.



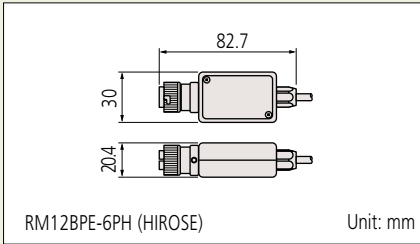
- Rubber boot (spare)
 - For 10 mm range models: **238772**
 - For 25 mm range models: **962504**
 - For 50 mm range models: **962505**
 - Thrust stem set *
 - For 10 mm range models: **02ADB680**
 - Thrust stem: **02ADB681**
 - Clamp nut: **02ADB682**
 - For 25/50 mm range models: **02ADN370**
 - Thrust stem: **02ADN371**
 - Clamp nut: **02ADB692**

Note 3: External dimensions are described in the dimensional drawing of the product.
 - Special wrench
 - For 10 mm range models: **02ADB683**
 - For 25/50 mm range models: **02ADB693**
- * Thrust stem set is a combination of thrust stem and a clamp nut. A special wrench is required for tightening. If using multiple gages, a thrust stem set for each gage and one special wrench are required.
- Extension cable
 - 5 m : **902434**
 - 10 m : **902433**
 - 20 m : **902432**
- Note 4: Connectable up to 3 pieces, 20 m at maximum.



Refer to the Linear Gage Brochure (**E13007**) for more details.

Connector



Optional Accessories

- Air drive unit
 - For 10 mm range models: **02ADE230**
 - For 25 mm range models: **02ADE250**
- Note 1: Required air pressure: 0.2 to 0.4 MPa
(With a 0.1 μm resolution type: 0.2 MPa)
- Note 2: Spindle extends when air is supplied.

- Rubber boot (spare)
 - For 10 mm range models: **238772**
 - For 25 mm range models: **962504**
- Thrust stem set*
 - For 10 mm range models: **02ADB680**
 - Thrust stem: **02ADB681**
 - Clamp nut: **02ADB682**
 - For 25 mm range models: **02ADN370**
 - Thrust stem: **02ADN371**
 - Clamp nut: **02ADB692**

Note 3: External dimensions are described in the dimensional drawing of the product.

- Special wrench
 - For 10 mm range models: **02ADB683**
 - For 25 mm range models: **02ADB693**
- * Thrust stem set is a combination of thrust stem and a clamp nut. A special wrench is required for tightening. If using multiple gages, a thrust stem set for each gage and one special wrench are required.



- Extension cable
 - 5 m : **902434**
 - 10 m: **902433**
 - 20 m: **902432**

Note 4: Connectable up to 3 pieces, 20 m at maximum.



Refer to the Linear Gage Brochure (**E13007**) for more details.

LGF (0.1 μm resolution) SERIES 542 — Economical Design

- 0.1 μm resolution type from the reliable LGF Series.

542-181
IP66



542-182
IP66

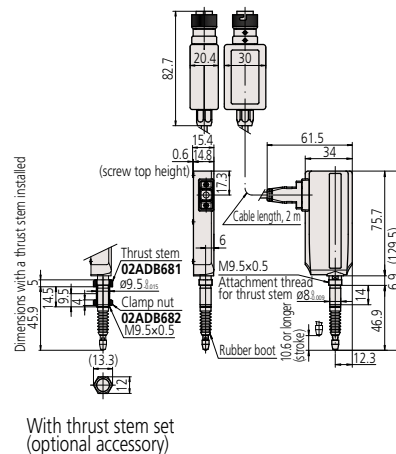


SPECIFICATIONS

| Order No. | 542-181 | 542-182 |
|---|---|---------------|
| Measuring range | 10 mm | 25 mm |
| Resolution | 0.1 μm | |
| Measuring accuracy (20 °C) | (0.8 + L/50) μm L=arbitrary measuring length (mm) | |
| Measuring force | Contact point downwards | 1.2 N or less |
| | Contact point horizontal | 1.1 N or less |
| | Contact point upwards | 1.0 N or less |
| Position detection method | Photoelectric linear encoder | |
| Response speed | 400 mm/s | |
| Output signal | 90° phase difference, differential squarewave (RS-422A equivalent) Minimum edge-to-edge interval, 200 ns | |
| Output signal pitch | 0.4 μm | |
| Mass | Approx. 310 g | Approx. 350 g |
| Contact point | ø3 mm carbide tipped (fixing screw: M2.5 (P=0.45) x5), standard contact point: 901312 | |
| Stem | ø8 mm | ø15 mm |
| Bearing | Linear ball type | |
| Output cable length | 2 m (directly extended from the main unit) | |
| Connector | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | |

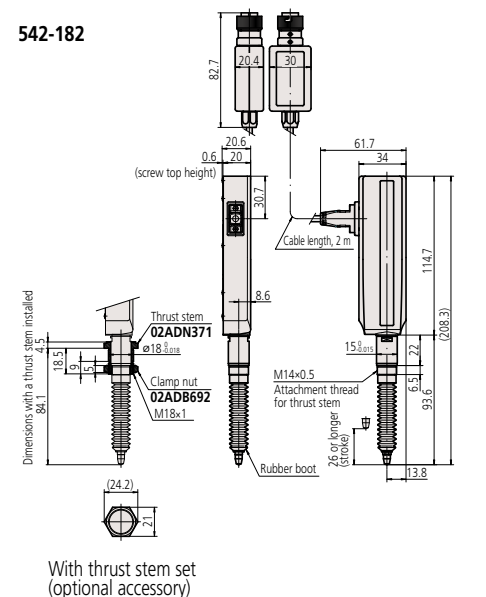
DIMENSIONS

542-181



With thrust stem set (optional accessory)

542-182



With thrust stem set (optional accessory)

Unit: mm

Linear Gages

Ideal for integration into harsh environments such as automation applications

LGF-Z SERIES 542 — with Origin Point Mark

- LGF Series with reference point signal output function.
- The master setting is incorporated in the unit and is easy to operate. The origin point can be easily detected even if a fault, such as an over-speed error, occurs.
- Sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Shock resistance, 100 G/11 ms (IEC 60068-2-27)
- Resolutions are available in 0.5 μm and 1 μm .

542-174 / 542-164

IP66



542-175 / 542-165

IP66



542-176 / 542-166

IP66

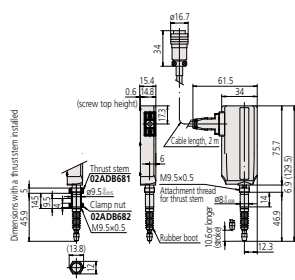


SPECIFICATIONS

| Order No. | 542-174 | 542-164 | 542-175 | 542-165 | 542-176 | 542-166 |
|--|---|-----------------|---|-----------------|-------------------|-----------------|
| Measuring range | 10 mm | | 25 mm | | 50 mm | |
| Resolution | 0.5 μm | 1 μm | 0.5 μm | 1 μm | 0.5 μm | 1 μm |
| Measuring accuracy (20 °C) | (1.5 + L/50) μm L=arbitrary measuring length (mm) | | | | | |
| Measuring force | Contact point downwards | 1.2 N or less | 4.6 N or less | | 5.7 N or less | |
| | Contact point horizontal | 1.1 N or less | 4.3 N or less | | 5.3 N or less | |
| | Contact point upwards | 1.0 N or less | 4.0 N or less | | 4.9 N or less | |
| Position detection method | Photoelectric linear encoder | | | | | |
| Reference mark position | Approx. 3 mm from contact point tip (lowest rest point) | | Approx. 5 mm from contact point tip (lowest rest point) | | | |
| Reference mark repeatability (20 °C): σ | $\sigma \leq 0.5 \mu\text{m}$ (at a constant reference point passing speed less than 300 mm/s in the same direction) | | | | | |
| Response speed | 1500 mm/s | | | | | |
| Output signal | 90° phase difference, differential square wave (RS-422A equivalent), minimum edge intervals: 250 ns for 0.5 μm model, 500 ns for 1 μm model | | | | | |
| Output square wave pitch | 2 μm | 4 μm | 2 μm | 4 μm | 2 μm | 4 μm |
| Mass | Approx. 260 g | | Approx. 300 g | | Approx. 400 g | |
| Contact point | $\phi 3$ mm carbide tipped (fixing screw: M2.5 (P=0.45) x5), standard contact point: 901312 | | | | | |
| Stem | $\phi 8$ mm | | $\phi 15$ mm | | | |
| Bearing | Linear ball type | | | | | |
| Output cable length | 2 m (directly extended from the main unit) | | | | | |
| Connector | Plug: EPRC05-P8M (TAJIMI), Compatible receptacle: EPRC05-R8F (TAJIMI) | | | | | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | | | | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | | | | | |

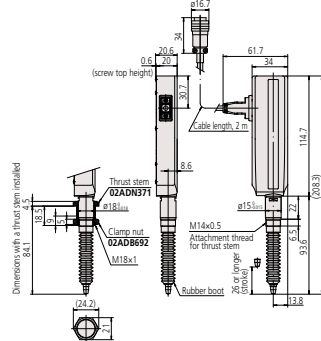
DIMENSIONS

542-174 / 542-164



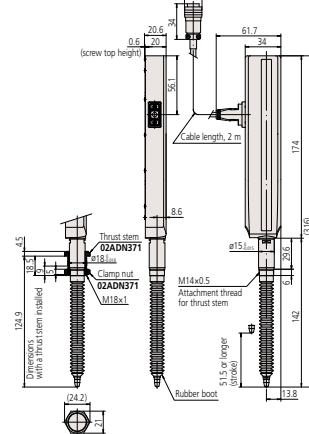
With thrust stem set (optional accessory)

542-175 / 542-165



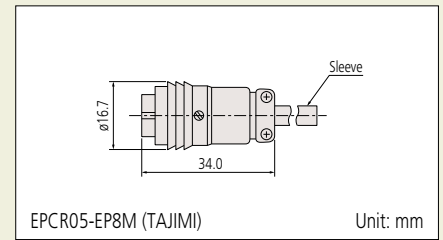
With thrust stem set (optional accessory)

542-176 / 542-166 Unit: mm



With thrust stem set (optional accessory)

Connector



EPRC05-EP8M (TAJIMI)

Unit: mm

Optional Accessories

- Air drive unit
 - For 10 mm range models: **02ADE230**
 - For 25 mm range models: **02ADE250**
 - For 50 mm range models: **02ADE270**
- Note 1: Required air pressure: 0.2 to 0.4 MPa
Note 2: Spindle extends when air is supplied.



Equipped with the **LGK**

- Rubber boot (spare)
 - For 10 mm range models: **238772**
 - For 25 mm range models: **962504**
 - For 50 mm range models: **962505**
 - Thrust stem set*
 - For 10 mm range models: **02ADB680**
 - Thrust stem: **02ADB681**
 - Clamp nut: **02ADB682**
 - For 25/50 mm range models: **02ADN370**
 - Thrust stem: **02ADN371**
 - Clamp nut: **02ADB692**
- Note 3: External dimensions are given in the drawing of the product.

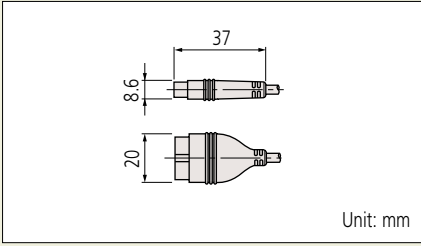
- Special wrench
 - For 10 mm range models: **02ADB683**
 - For 25/50 mm range models: **02ADB693**
- * Thrust stem set is a combination of thrust stem and a clamp nut. A special wrench is required for tightening. If using multiple gages, a thrust stem set for each gage and one special wrench are required.

Note 4: Connectable up to 3 pieces, 20 m at maximum.



Refer to the Linear Gage Brochure (**E13007**) for more details.

Connector



Optional Accessories

- Rubber boot: **238774** (spare)
- Air drive unit (metric): **903594**
- Air drive unit (inch): **903598**
- SPC cable extension adapter: **02ADF640**
- Extension cable for Digimatic gages (0.5 m): **02ADD950**
- Extension cable for Digimatic gages (1 m): **936937**
- Extension cable for Digimatic gages (2 m): **965014**

Note: When connecting an extension cable, an SPC cable extension adapter is required.

LGS-1012P
SERIES 575 — 0.01 mm Resolution Type

- ABSOLUTE electrostatic capacitance type encoder makes it possible to maintain the reference point even when the power is switched off.
- Excellent protection against dust and splashing water (IP66) on the factory floor.

575-303
IP66

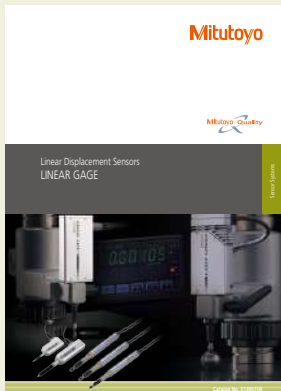
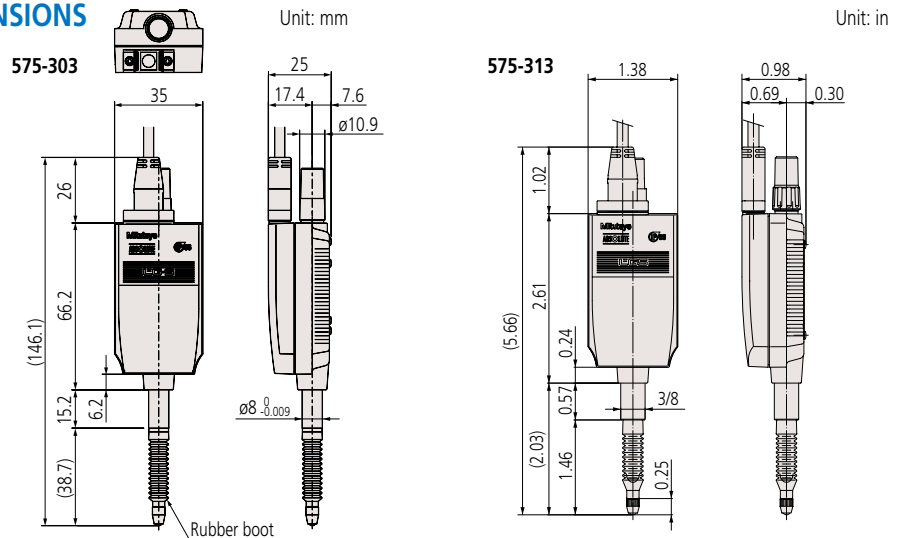


SPECIFICATIONS

| Metric | | |
|---|--|---------------|
| Order No. | 575-303 | |
| Measuring range | 12.7 mm | |
| Resolution | 10 μm | |
| Measuring accuracy (20 °C) | 15 μm | |
| Measuring force | Contact point downwards | 2 N or less |
| | Contact point horizontal | 1.8 N or less |
| | Contact point upwards | 1.6 N or less |
| Position detection method | ABSOLUTE electrostatic capacitance type linear encoder | |
| Response speed | Unlimited (not applicable to scanning measurement) | |
| Output | Digimatic code | |
| Mass | Approx. 190 g | |
| Contact point | ø3 mm carbide tipped (fixing screw: M2.5 (P=0.45) x5), standard contact point: 901312 | |
| Stem | ø8 mm | |
| Bearing | Plain type | |
| Output cable length | 2 m (directly extended from the main unit) | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | |

| Inch | | |
|---|--|---------------|
| Order No. | 575-313 | |
| Measuring range | 0.5 in | |
| Resolution | 0.0005 in | |
| Measuring accuracy (20 °C) | 0.0008 in | |
| Measuring force | Contact point downwards | 2 N or less |
| | Contact point horizontal | 1.8 N or less |
| | Contact point upwards | 1.6 N or less |
| Position detection method | ABSOLUTE electrostatic capacitance type linear encoder | |
| Response speed | Unlimited (not applicable to scanning measurement) | |
| Output | Digimatic code | |
| Mass | Approx. 190 g | |
| Contact point | ø3 mm carbide tipped (fixing screw: 4-48 UNF), standard contact point: 21BZB005 | |
| Stem | ø9.52=3/8 in DIA | |
| Bearing | Plain type | |
| Output cable length | 2 m (directly extended from the main unit) | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | |
| Storage temperature (humidity) ranges | -10 to 60 °C (RH 20 to 80 %, non-condensing) | |

DIMENSIONS



Refer to the Linear Gage Brochure (E13007) for more details.

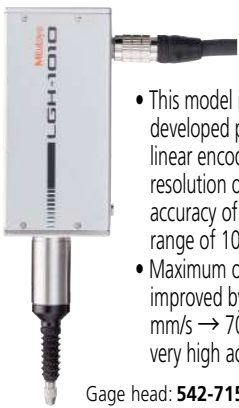
Linear Gages

Ideal for integration into harsh environments such as automation applications

LGH (0.01/0.005 μm resolution) SERIES 542 — High-accuracy/resolution Type

- This series has achieved very high accuracy combined with a resolution of 0.01/0.005 μm (according to model), practically equivalent to that of a laser interferometer, and a wide measuring range of 10 mm.
- A compact body design makes a significant contribution to a downsizing of this gage itself, which is best suited for calibration/evaluation of master gages as well as

- measurement of high-precision parts and as a length measuring sensor incorporated into high-precision positioning/control units.
- A low measuring force model is available for those applications where measurement of easily deformed or damaged workpieces is required.
- Every **LGH** Series gage is bundled with a dedicated counter.



Gage head: **542-715**

- This model is equipped with a newly developed photoelectric reflection-type linear encoder, achieving an excellent resolution of 0.01 μm , a measuring accuracy of 0.2 μm and a measuring range of 10 mm at a low price.
- Maximum operating speed has been improved by a factor of 2.8 times (250 mm/s \rightarrow 700 mm/s) while maintaining very high accuracy.



Gage head: **542-720**

- This model is equipped with a newly developed ultra-high precision transmission type linear encoder, achieving the outstanding resolution of 0.005 μm (5 nm).
- Exceptional measuring accuracy of 0.1 μm has been attained over the wide measuring range of 10 mm. This series is most suited for calibration/evaluation of master gages where its wide measuring range is a great advantage.



Dedicated counter

TYPICAL APPLICATIONS

Master gage calibration/evaluation



Inspection of high-precision parts

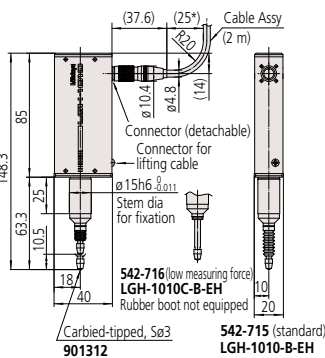


Needle contact-point mounting example

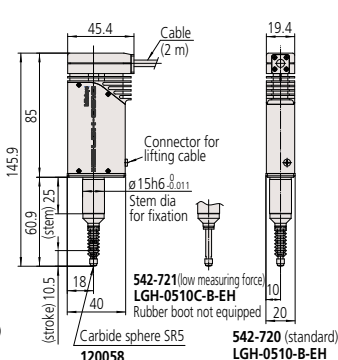
DIMENSIONS

Unit: mm

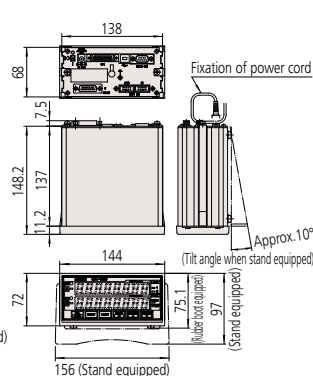
542-716



542-721



Dedicated counter (set)



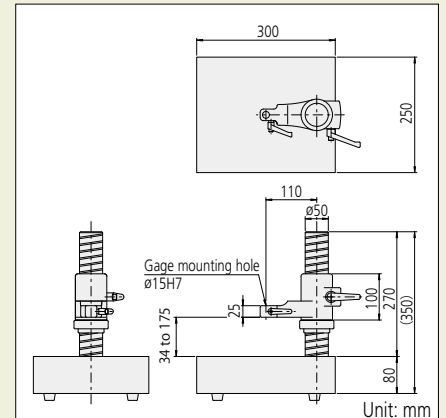
* Minimum bending radius or minimum dressed dimension



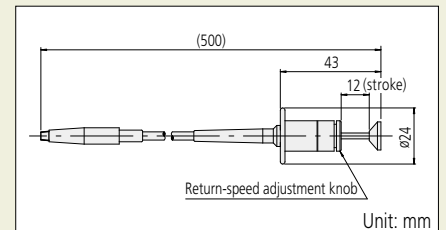
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Optional Accessories

- Measuring stand: **971750**



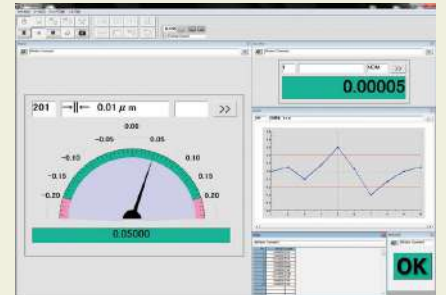
- Spindle lifting cable: **971753**



- I/O connector: **02ADB440**



- SENSORPAK**



Note: Refer to page G-18 for more details.

- Rubber boot: **238772**
(Spare for 542-715 and 542-720)



Refer to the Linear Gage brochure (E13007) for more details.

SPECIFICATIONS

| Order No. | | Resolution 0.01 µm / Accuracy 0.2 µm model | |
|---|--------------------------|---|-------------------------------|
| | | 542-715 (Standard) | 542-716 (Low measuring force) |
| Measuring range | | 10 mm | |
| Resolution | | 0.01 µm (0.05 µm, 0.1 µm, 0.5 µm, 1 µm can be selected from the counter) | |
| Measuring accuracy (20 °C)*1 | | 0.2 µm | |
| Repeatability (20 °C)*1 | | 0.1 µm (2 σ) | |
| Retrace error (20 °C)*1 | | 0.1 µm | |
| Measuring force | Contact point downwards | 0.65 N or less | Approx. 0.12 N |
| | Contact point horizontal | 0.55 N or less | Not applicable |
| | Contact point upwards | 0.45 N or less | Not applicable |
| Position detection method | | Photoelectric reflection type linear encoder | |
| Detectable operation speed | | In normal measurement: 700 mm/sec; for peak detection: 120 mm/sec | |
| Mass of gage head | | Approx. 370 g | |
| Contact point | | Carbide tipped, Sφ3 mm (M2.5 (P=0.45) x5 mm), standard contact point: 901312 | |
| Stem | | φ15 mm | |
| Bearing | | Linear ball type | |
| Output cable length | | Approx. 2 m | |
| Operating temperature (humidity) ranges | | 0 to 40 °C (Reference temperature 20 °C)/20 to 80 % RH (non-condensing) | |
| Storage temperature (humidity) ranges | | -10 to 60 °C/20 to 80 % RH (non-condensing) | |
| Counter Specifications | | | |
| Display range | | ±999.99999 mm | |
| Functions | | Zero-setting, presetting, direction changeover, tolerance judgment (3 steps/5 steps), RS-RINK | |
| Peak hold function | | Yes | |
| Interface | | RS-232C, USB (only for SENSORPAK), Digimatic (Printer: DP-1VA LOGGER)*3, I/O Connector | |
| External output | | <ul style="list-style-type: none"> • RS-232C: counting data • Digimatic output: counting data*3 • I/O connector: counting data (simplified BCD), tolerance judgment result, simplified analog output | |
| External control | | Zero-setting, presetting, data hold, peak measurement mode selection, peak clear | |
| Power supply | | Supplied AC Adapter, or 12 to 24 V DC, max. 700 mA | |
| Power consumption | | 8.4 W (max. 700 mA), ensure at least 1 A power supply per unit. | |
| Mass of counter | | Approx. 900 g (AC Adapter excluded) | |
| Standard accessories | | Wrench for contact point, rubber boot, stand, washer (for counter), AC Adapter, AC cord, DC plug, user's manual, inspection certificate | |

| Order No. | | Resolution 0.005 µm / Accuracy 0.1 µm model | |
|---|--------------------------|---|-------------------------------|
| | | 542-720 (Standard) | 542-721 (Low measuring force) |
| Measuring range | | 10 mm | |
| Resolution | | 0.005 µm (0.01 µm, 0.05 µm, 0.1 µm can be selected from the counter) | |
| Measuring accuracy (20 °C)*1 | | 0.1 µm | |
| Repeatability (20 °C)*1 | | 0.02 µm (2 σ) | |
| Retrace error (20 °C)*1 | | 0.05 µm | |
| Measuring force | Contact point downwards | 0.65 N or less | Approx. 0.1 N |
| | Contact point horizontal | 0.55 N or less | Not applicable |
| | Contact point upwards | 0.45 N or less | Not applicable |
| Position detection method | | Ultra-high accuracy transmission type linear encoder | |
| Detectable operation speed | | In normal measurement: 250 mm/sec | |
| Mass of gage head | | Approx. 370 g | |
| Contact point | | Carbide sphere SR5 (M2.5 (P=0.45) x5 mm), standard contact point: 120058 | |
| Stem | | φ15 mm | |
| Bearing | | Linear ball type | |
| Output cable length | | Approx. 2 m | |
| Operating temperature (humidity) ranges | | 15 to 25 °C (Reference temperature 20 °C)/30 to 60 % RH (non-condensing) | |
| Storage temperature (humidity) ranges | | -10 to 60 °C/20 to 80 % (non-condensing)*2 | |
| Counter Specifications | | | |
| Display range | | ±99.999995 mm | |
| Functions | | Zero-setting, presetting, direction changeover, tolerance judgment (3 steps/5 steps), RS-RINK | |
| Peak hold function | | No | |
| Interface | | RS-232C, USB (only for SENSORPAK), Digimatic (Printer: DP-1VA LOGGER)*3, I/O Connector | |
| External output | | <ul style="list-style-type: none"> • RS-232C: counting data • Digimatic output: counting data*3 • I/O connector: counting data (simplified BCD), tolerance judgment result, simplified analog output | |
| External control | | Zero-setting, presetting, data hold | |
| Power supply | | Supplied AC Adapter, or +12 to 24 V DC, max. 700 mA | |
| Power consumption | | 8.4 W (max. 700 mA), ensure at least 1 A power supply per unit. | |
| Mass of counter | | Approx. 900 g (AC Adapter excluded) | |
| Standard accessories | | Wrench for contact point, rubber boot, stand, washer (for counter), AC Adapter, AC cord, DC plug, user's manual, inspection certificate | |

*1 Applies when used with counter.

*2 The storage temperature/humidity ranges after unpacking are the same as the operating temperature/humidity ranges.

*3 Digimatic output shall be up to 6 digits of data. For data of 7 digits or more, all digits will not be output to the display.



Refer to the Linear Gage Brochure (E13007) for more details.

Linear Gages

Ideal for integration into harsh environments such as automation applications

EC Counter SERIES 542 — Only for Digimatic output

- This Digimatic display can be connected to Linear gages with Digimatic output (**LGS**).
- Employs DIN size (96×48 mm) and mount-on-panel configuration to facilitate system integration.
- It has a data output and tolerance evaluation function.



542-007

SPECIFICATIONS

| | | |
|---|---|--|
| Order No. | 542-007* | |
| Quantizing error | ±1 count | |
| Resolution () indicates maximum display range | 0.01 mm (±9999.99)/0.0005 in (±99.9995 in)/0.001 in (±999.999 in) 0.001 mm (±999.999)/0.00005 in (±9.99995 in)/0.0001 in (±99.999 in) [Automatic setting by gage] | |
| Display | Sign plus 6 digits (Green LED) | |
| Tolerance judgment display | LED display (3 steps: Amber, Green, Red) | |
| External output (switching type) | Tolerance judgment output | -NG, OK, +NG (open-collector) |
| | Data output | Digimatic output |
| Control input | External PRESET, external HOLD | |
| Power supply | Voltage | Supplied AC adapter, or 9 to 12 V DC |
| | Consumption | 4.8 W (max. 400 mA) Ensure at least 1 A is available per unit. |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | |
| External dimensions | 96 (W) ×48 (H) ×84.6 (D) mm | |
| Standard Accessories | AC adapter: (Japan/North America) 06AGC5851A / (EU) 06AGC585D / (UK) 06AGC585E / (Korea) 06AGC585K / (China) 06AEG302DC | |
| Applicable gage head | LGS, ID | |
| Mass | 220 g | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

EG Counter SERIES 542 — Panel mount, Single function Type

- Produces 3-step/5-step, 3 kinds of tolerance output and BCD output.
- A smoothing function reduces display digit fluctuations (**542-015** and **542-017**)
- Employs DIN size (96×48 mm) and mount-on-panel configuration to facilitate system integration.



542-015



542-017



542-016

SPECIFICATIONS

| Order No. | 542-015 | 542-017 | 542-016 |
|---|--|--|--|
| Quantizing error | ±1 count | | |
| Maximum input frequency | 1.25 MHz, response speed depends on gage specification. | | — |
| Resolution () indicates maximum display range | 0.01 mm (±9999.99 mm)/0.0005 in (±99.9995 in)/0.001 in (±999.999 in) 0.005 mm (±999.995 mm)/0.00005 in (±9.99995 in)/0.0001 in (±99.999 in) 0.001 mm (±999.999 mm)/0.00005 in (±9.99995 in)/0.0001 in (±99.999 in) 0.0005 mm (±99.9995 mm)/0.000005 in (±0.999995 in)/0.00001 in (±9.99999 in) 0.0001 mm (±9.99999 mm)/0.000005 in (±0.999995 in)/0.00001 in (±9.99999 in) | | 0.01 mm (±9999.99 mm)/0.0005 in (±99.9995 in)/0.001 in (±999.999 in) 0.005 mm (±999.995 mm)/0.0001 in (±99.999 in) 0.001 mm (±999.999 mm)/0.00005 in (±9.99995 in)/0.0001 in (±99.999 in) 0.0005 mm (±99.9995 mm)/0.00005 in (±9.99995 in)/0.0001 in (±99.999 in) |
| Tolerance judgment display | LED display (3 steps: Amber, Green, Red/5 steps: Amber, Amber flashing, Green, Red flashing, Red) | | |
| Tolerance judgment output | L1 to L5 (Open-collector/Switchover between L1 to L5 and BCD output with parameter) | | |
| Control output | Open-collector | | |
| BCD output | Open-collector/Switchover between 6-digit (positive/negative-true logic) and tolerance judgment output with parameter | | |
| Control input | Presetting, display hold, peak value clear, tolerance judgment BANK switch | | |
| Power supply | Voltage | 12 to 24 V DC, terminal block (M3 screw) | |
| | Consumption | 6 W or less (500 mA max.) Ensure at least 1 A is available per unit. | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | |
| Storage temperature (humidity) ranges | -10 to 50 °C (RH 20 to 80 %, non-condensing) | | |
| External dimensions | 96 (W) ×48 (H) ×156 (D) mm | | |
| Applicable gage head | LGF, LGK, LGB, LGB2* Model with reference point mark is excluded. | LGF with reference point mark | LGS, ID |
| Mass | Approx. 400 g | | |

* When a gage of 0.1 μm resolution is connected, the maximum display range will be ±99.9999.

Function

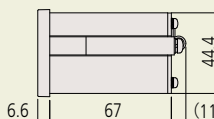
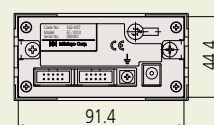
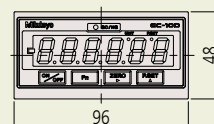
- Preset
- Tolerance judgment (3 steps)
- Digimatic output

Optional Accessories

- Connecting cable for digimatic mini-processor: **936937** (1 m), **965014** (2 m)
- DC plug: **214938**
- I/O cable (2 m): **21HZA222**

DIMENSIONS

Unit: mm



Function

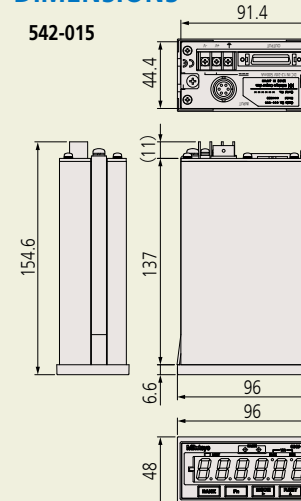
- Preset
- Direction switch
- Tolerance judgment (3/5-step, 3 kinds)
- Peak (max., min., runout) measurement
- Constant number
- Smoothing
- Error display/output
- Key protection

Optional Accessories

- I/O output connector (with cover): **02ADB440**
 - AC adapter: **357651**
 - AC cable (Japan): **02ZAA000***
 - AC cable (USA): **02ZAA010***
 - AC cable (EU): **02ZAA020***
 - AC cable (UK): **02ZAA030***
 - AC cable (China): **02ZAA040***
 - AC cable (Korea): **02ZAA050***
 - Terminal connecting cable: **02ADD930***
- * Required when using AC adapter.

DIMENSIONS

Unit: mm



Function

- Preset
- Tolerance judgment output (3/5-step, 7 kinds)
- Limit value output (2 kinds independently for each of the 7 channels)
- Peak (max., min., runout) measurement
- Diverse data output (Serial BCD, Simplified analog, Digimatic)

Optional Accessories

- I/O output connector (with cover): **02ADB440**
 - AC adapter: **357651**
 - AC cable (Japan): **02ZAA000***
 - AC cable (USA): **02ZAA010***
 - AC cable (EU): **02ZAA020***
 - AC cable (UK): **02ZAA030***
 - AC cable (China): **02ZAA040***
 - AC cable (Korea): **02ZAA050***
 - Terminal connecting cable: **02ADD930***
 - External switch box
- The tolerance values or preset values can be easily input. **02ADF180** (with 2 m cable)



* Required when using AC adapter.

EB Counter SERIES 542 — Panel mount, Multi-function Type

- Produces 3-step/5-step, 7 kinds of tolerance output and limit value output independently for each of 7 channels.
- Comes with serial BCD output capability, for connection to a programmable controller or personal computer, etc.
- Dynamic measurement possible with simplified analog output.
- Employs DIN size (96×48 mm) and mount-on-panel configuration to facilitate system integration.



542-092-2



542-094-2



542-093-2

SPECIFICATIONS

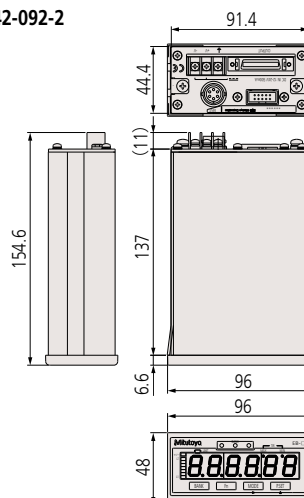
| Order No. | 542-092-2 | 542-094-2 | 542-093-2 |
|---|--|--|---|
| Quantizing error | ±1 count | | |
| Maximum input frequency | 1.25 MHz (2-phase square wave), response speed depends on gage specification. | | Response speed depends on gage specification. |
| Resolution () indicates maximum display range | 0.01 mm (±9999.99 mm)/0.0005 in (±99.9995 in) 0.005 mm (±999.995 mm)/0.00005 in (±9.99995 in) 0.001 mm (±99.999 mm)/0.00005 in (±9.99995 in) 0.0005 mm (±9.9995 mm)/0.000005 in (±0.99995 in) 0.0001 mm (±99.9999 mm)/0.000005 in (±0.99995 in) [Parameter set] | | 0.01 mm (±9999.99 mm)/0.0005 in (±99.9995 in) 0.001 mm (±999.999 mm)/0.00005 in (±9.99995 in) [Automatic setting by gage] |
| Tolerance judgment display | LED display (3 steps: Amber, Green, Red/5 steps: Amber, Amber flashing, Green, Red flashing, Red) | | |
| Input/output | Tolerance judgment output | L1 to L5, open-collector | |
| | Control output | Open-collector | |
| | Control input | Presetting, display hold, peak value clear, tolerance judgment BANK switch, open-collector or no-voltage contact signal (with/without contact point) | |
| Interface | Serial BCD | Bit serial format, open-collector | |
| | Analog output | 2.5 V + Counting value × Voltage resolution (25 mV/2.5 mV): Full-scale 0 to 5 V | |
| | Digimatic input/output | <ul style="list-style-type: none"> • Connecting to the external switch box (02ADF180) makes it easy to enter tolerance limits and preset values. Note: This function is not available when the gage is connected to Digimatic Mini-Processor DP-1VA LOGGER (264-505). • It can be connected to DP-1VA LOGGER (264-505) and to IT-016U. | |
| Power supply | Voltage | 12 to 24 V DC, terminal block (M3 screw) | |
| | Consumption | 6 W or less (500 mA max.) Ensure at least 1 A is available per unit. | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | |
| Storage temperature (humidity) ranges | -10 to 50 °C (RH 20 to 80 %, non-condensing) | | |
| Applicable gage head | LGF, LGK, LGB, LGB2* Models with reference point mark is excluded. | LGF with reference point mark | LGS, ID |
| Mass | Approx. 400 g | Approx. 400 g | Approx. 400 g |

* When a gage of 0.1 μm resolution is connected, the maximum display range will be ±99.9999.

DIMENSIONS

542-092-2

Unit: mm



Refer to the Linear Gage Brochure (**E13007**) for more details.

Linear Gages

Ideal for integration into harsh environments such as automation applications

EH Counter SERIES 542 — Panel mount, Multi-function Type with RS-232C Communication Functions

- Two types are available for this model: a 1-axis display and a 2-axis display, both of which enable addition or subtraction calculations between two gages.
- Multifunctional counter equipped with zero-setting, presetting, tolerance judgment.
- RS-232C and USB are equipped as standard. Data transfer to a PC is possible. (USB is supported only by Mitutoyo **SENSORPAK**.)
- A multi-point measuring system (max. 20 points and max. 10 units) can easily be configured with the built-in RS Link networking function. Refer to "Quick Guide to Precision Measuring Instruments" on page G-21 for details of the RS link.
- Employs DIN size (144×72 mm) and mount-on-panel configuration to facilitate system integration.

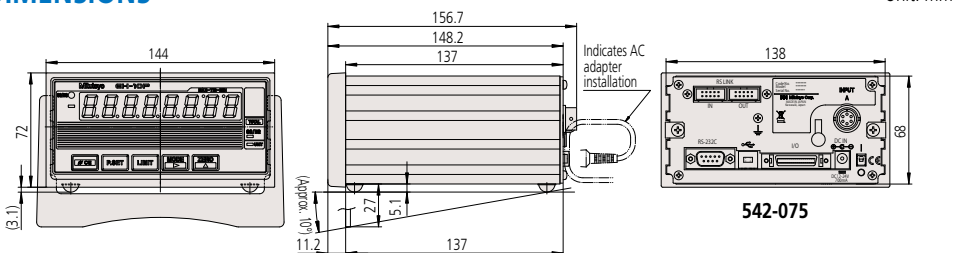


SPECIFICATIONS

| Order No. | 542-075* | 542-071* | 542-073* | 542-072* |
|---|--|--|--------------------------------------|---------------------------|
| Number of axes to be displayed | 1 axis | | 2 axes | |
| Quantizing error | ±1 count | | | |
| Maximum input frequency | 2.5 MHz (2-phase square wave) | | | — |
| Resolution () indicates maximum display range | 0.01 mm (±9999.99 mm)/0.0005 in (±99.9995 in) 0.005 mm (±999.995 mm)/0.00005 in (±9.99995 in) 0.001 mm (±999.999 mm)/0.00005 in (±9.99995 in) 0.0005 mm (±99.9995 mm)/0.000005 in (±0.999995 in) 0.0001 mm (±99.9999 mm)/0.000005 in (±0.999995 in) [Parameter set] | | | Automatic setting by gage |
| Tolerance judgment display | LED display (3 steps: Amber, Green, Red/5 steps: Amber, Amber flashing, Green, Red flashing, Red) | | | |
| Interface | RS-232C/USB/parameter selection via digimatic (only DP-1VA LOGGER , digimatic mini-processor can be connected) (USB used only with SENSORPAK .) Selection by parameter from 3-step, 5-step, or simple BCD Total tolerance judgment output (when tolerance function is enabled) Analog output (1 V to 4 V) | | | |
| Input/output | Control output | Open-collector | | |
| | Control input | Display BANK switching, peak mode, presetting, display hold, hold per axis: open-collector or no-voltage contact signal (with/without contact point) | | |
| Power supply | Voltage | Supplied AC adapter, or 12 to 24 V DC | | |
| | Consumption | 8.4 W (max. 700 mA) Ensure at least 1 A is available per unit. | | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | | |
| Storage temperature (humidity) ranges | -10 to 50 °C (RH 20 to 80 %, non-condensing) | | | |
| AC adapter/AC cable | AC adapter: 357651 / AC cable: 02ZAA000 , AC cable (Japan): 02ZAA000* , AC cable (USA): 02ZAA010* , AC cable (EU): 02ZAA020* , AC cable (UK): 02ZAA030* , AC cable (China): 02ZAA040* , AC cable (Korea): 02ZAA050* | | | |
| Applicable gage head | LGF, LGK, LGB, LGB2 Model with reference point mark is excluded. | | LGF with reference point mark | LGS, ID |
| Mass | Approx. 760 g | Approx. 800 g | Approx. 800 g | Approx. 800 g |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.
For those models of the Order No. with Suffix "1", an AC adapter is not supplied as a standard accessory.

DIMENSIONS



Optional Accessories

- I/O output connector (with cover): **02ADB440**
 - SPC cable (0.5 m): **02ADD950**
 - SPC cable (1 m): **936937**
 - SPC cable (2 m): **965014**
 - Measurement data loading software: **SENSORPAK**
- Note: The Digimatic connecting cable doubles as a RS Link cable.



Refer to the Linear Gage brochure (**E13007**) for more details.

Function

- External Control (Zero-set, Preset etc.)
- Direction switch
- Error display
- Tolerance judgment output
- Diverse data output (RS-232C, BCD, Segment)
- Peak measurement
Maximum value, minimum value, runout, and differential measurement between two gages
Addition, averaging, maximum value, minimum value, and maximum width

Optional Accessories

- Output connector: **02ADB440**
- D-EV External display unit*1: **02ADD400**
- SPC cable (0.5 m): **02ADD950**
- SPC cable (1 m): **936937**
- SPC cable (2 m): **965014**
- AC adapter: **357651**
- AC cable (Japan): **02ZAA000***2
- AC cable (USA): **02ZAA010***2
- AC cable (EU): **02ZAA020***2
- AC cable (UK): **02ZAA030***2
- AC cable (China): **02ZAA040***2
- AC cable (Korea): **02ZAA050***2
- Terminal connecting cable: **02ADD930***2

*1 Refer to page G-17 for details of **D-EV**.

*2 Required when using AC adapter.

SENSORPAK



Note: Refer to page G-18 for more details.



Refer to the Linear Gage Brochure (**E13007**) for more details.

EV-16P/Z/D Counter SERIES 542 — 6-channel, No-display Type

- Up to six gages can be connected to one unit, extendable up to 10 units (60 gages at maximum) using the RS Link function* to facilitate the configuration of a multi-point measurement system.
- A range of output modes to choose from: I/O output for tolerance judgment and segment output, BCD data output and RS-232C output are available.
- Other than normal measurement, peak measurement or differential measurement between gages can be performed.

* Refer to "Quick Guide to Precision Measuring Instruments" on page G-21 for details of the RS link.



542-063



542-067



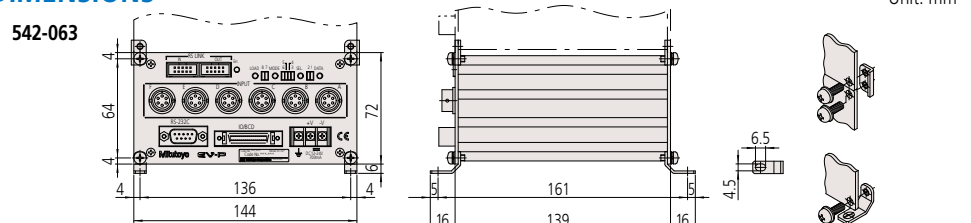
542-064

SPECIFICATIONS

| Order No. | 542-063 | 542-067 | 542-064 |
|---|---|---|---|
| Number of input channels | 6 | | |
| Maximum input frequency | 1.25 MHz (2-phase square wave), response speed depends on gage specification. Max. counting speed: 5 MHz | | Response speed depends on gage specification. |
| Quantizing error | ±1 count | | |
| Resolution () indicates maximum display range | 10 μm (±999999.99 mm) / 0.0005 in (±9999.9995 in) 5 μm (±99999.995 mm) / 0.00005 in (±999.99995 in) 1 μm (±9999.999 mm) / 0.00005 in (±99.99995 in) 0.5 μm (±999.9995 mm) / 0.00005 in (±9.999995 in) 0.1 μm (±99.99995 mm) / 0.00005 in (±9.999995 in)* [Parameter set] | | Depends on gage specification. |
| LED display | 8 digits for parameter display (displays settings), 1 for error display | | |
| Error message | Overspeed, gage error etc. | | |
| External display | Dedicated external display unit D-EV (optional) can be connected. | | |
| Number of input switches | 4 | | |
| Function of input switches | Measurement mode switching, parameter setting | | |
| Input/output | Tolerance judgment output | 1 to 6 channels (L1, L2, L3), open-collector | |
| | BCD output | Parallel BCD output (positive/negative-true logic), open-collector | |
| | Segment output | A function to enable only output from the terminal corresponding to the counting values, open-collector | |
| | Control output | Open-collector | |
| Control input | Output channel designation (segment, in the BCD mode), presetting, peak value clear, range changeover (at segment output), holding counting value open-collector or no-voltage contact signal (with/without contact point) | | |
| | Measurement data output and control input EIA RS-232C-compatible Use cross cables for home position, DTE (terminal definition). | | |
| Interface | RS-232C | EIA RS-232C-compatible Use cross cables for home position, DTE (terminal definition). | |
| | RS link | Max. connecting unit: 10 Connecting cable length: Max. 10 m (sum of link cable length) Data transfer time: 1 sec./60 ch (when transmission rate is 19200 bps) | |
| Power supply | Voltage | 12 to 24 V DC (terminal block: M3) | |
| | Consumption | 8.4 W or less (700 mA max.) Ensure at least 1 A is available per unit. | |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) | | |
| Storage temperature (humidity) ranges | -10 to 50 °C (RH 20 to 80 %, non-condensing) | | |
| Mass | Approx. 910 g | Approx. 910 g | Approx. 830 g |
| Standard Accessories | Fixing foot (4), connecting bracket (4), fixing screw M4×12 (8) | | |
| Applicable gage head | LGF, LGK, LGB, LGB2 Model with reference point mark is excluded. | LGF with reference point mark | LGS |

* Available when using **D-EV**.

DIMENSIONS



Unit: mm

Linear Gages

Ideal for integration into harsh environments such as automation applications

D-EV Display unit for the EV counter

- Display unit for the **EV** counter.
- Connecting this display unit helps configuration of the **EV** counter.
- Able to display each gage measurement value and GO/NG judgment result, total GO/NG judgment result for all gages, setting details, and errors.



02ADD400

Optional Accessories

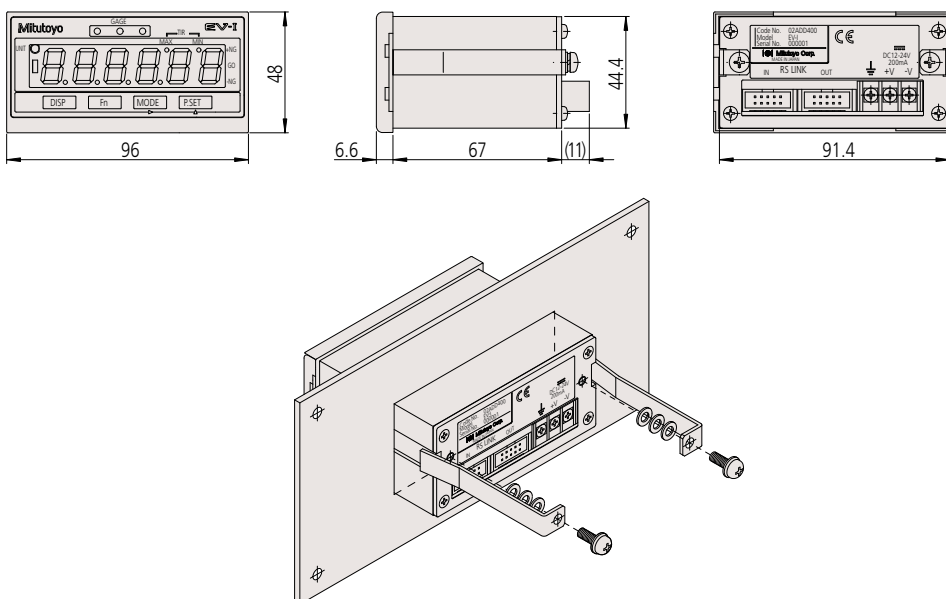
- SPC cable (0.5 m): **02ADD950***1
 - SPC cable (1 m): **936937***1
 - SPC cable (2 m): **965014***1
 - AC adapter: **357651**
 - AC cable (Japan): **02ZAA000***2
 - AC cable (USA): **02ZAA010***2
 - AC cable (EU): **02ZAA020***2
 - AC cable (UK): **02ZAA030***2
 - AC cable (China): **02ZAA040***2
 - AC cable (Korea): **02ZAA050***2
 - Terminal connecting cable: **02ADD930***2
- *1 Required when connecting with **EV-16P/D/Z**.
*2 Required when using AC adapter.

SPECIFICATIONS

| Order No. | 02ADD400 |
|---|---|
| Number of connections | 1 EV counter per unit |
| Number of digits | Sign plus 6 digits (8 digits internal to EV counter) |
| LED display | Channel display (also for judgment result display): 3 (3-color LED) Measurement mode display (current data, maximum value, minimum value, runout): 2 Status display: 1 (2 colors) |
| Operation switches | 4 |
| Function of operation switch | Channel switching, measurement mode switching (current data, maximum value, minimum value, runout), parameter setting, presetting, tolerance setting |
| Input/output | RS Link connectors: 1 each for IN, OUT |
| Error message | Overspeed, gage error etc. |
| Power supply | 12 to 24 V DC, 200 mA (Terminal block: M3) |
| Operating temperature (humidity) ranges | 0 to 40 °C (RH 20 to 80 %, non-condensing) |
| Storage temperature (humidity) ranges | -10 to 50 °C (RH 20 to 80 %, non-condensing) |
| External dimensions | 96 (W) x 48 (H) x 84.6 (D) mm |
| Mass | 150 g |

DIMENSIONS

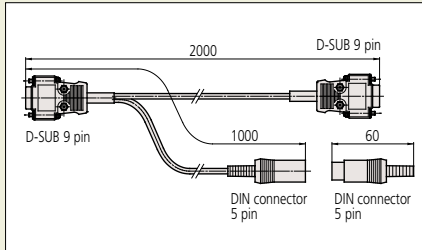
Unit: mm



Refer to the Linear Gage Structure (**E13007**) for more details.

Optional Accessories

- I/O cable: **21HZA137**



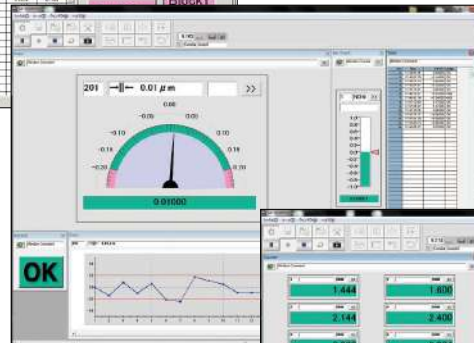
Communication cable (1 pc.)
Connection between PC and counter: 2 m
Input/output cable: 1 m
Input/output connector (1 pc.)

SENSORPAK
Measurement data loading software

- This software facilitates loading measurement data onto a personal computer from a linear gage counter with RS-232C output (**EH, EV**), with USB output (**EH**), or from a Litematic display (**VL**).
- 60 channels (max.) of measurement data can be processed.
- Arithmetical calculations and maximum width calculations can be performed using the measurement data.
- Exporting measurement data into MS-Excel format is supported.
- Real time graphical display by means of bar-graph or meter is provided.



Measurement screen



Meter screen



Chart screen

SPECIFICATIONS

| | | |
|--|---|---|
| Order No. | 02NGB072 | |
| Product Configuration | Program disk (CD), license key, operation manual | |
| Compatible devices (Connection method) | Mitutoyo RS_LINK compatible devices <ul style="list-style-type: none"> • LGH Series (USB, RS-232C) • EH counter (USB, RS-232C) • EV counter (RS-232C) • Litematic VL (RS-232C) | |
| Connecting cable | A cable should be prepared to the following specifications: Accessory <ul style="list-style-type: none"> • RS-232C connection: I/O cable (21HZA137)*1 Commercial product <ul style="list-style-type: none"> • USB connection: USB cable (type A to type B) • RS-232C connection: RS-232C cross cable*1 | |
| Number of connectable gages | Max. 60 units (when 10 units of EV counter for linear gage are connected via RS-Link) | |
| Functions | Display*2 | Display format: counting, bar graph, indicator, chart, and table Display cycle: 1s (when 60 gage units are connected, 1-window display, and no Excel output) |
| | Calculation | Calculation (up to 30 items) between designated gages is available. Calculation items: Sum, difference, total, average, maximum, minimum, range (maximum-minimum), calculation with a constant |
| | Tolerance judgment | Per item: Displays the result in colors (3-step tolerance: red/green/red; 5-step tolerance: red/yellow/green/yellow/red) Total judgment: Displays in colors (red/green) by monitoring the multiple gages and calculation result |
| | Recording*2 | Items: channel values, calculation result, tolerance judgment, total tolerance judgment, timestamp Max. number of records: 60000 for software recording (with 6 gages connected); up to 9000 (with 60 gages connected) Output function: Direct output to Excel, CSV file output (compatible with MeasurLink) Recording trigger: key, timer, external TRG |
| | Input/output*3 | Input: TRG for recording (HOLD) Output: Total tolerance judgment result |
| System Environment | DOS/V compatible PC environment CPU: Pentium4 2 GHz or more, Memory: 2 GB or more, Hard disk: 2 GB or more free space OS: Windows 7 (32 bit/64 bit), Windows 8.1 (32 bit/64 bit), Windows 10 (64 bit) | |

*1 If the PC is not equipped with an RS-232C port, please contact the nearest Mitutoyo sales office.
 *2 Display cycle and the maximum number of records differ depending on the environment (specification of PC, number of connected gages, display format and communication setting).
 *3 With use of the I/O cable (accessory). When an I/O cable is not used, the I/O connector of the counter alternatively functions. (Refer to the user's manual of the counter in use.)



Refer to the Linear Gage Brochure (E13007) for more details.

Linear Gages

Ideal for integration into harsh environments such as automation applications

VL-50-B/50S-B Litematic SERIES 318 — High-accuracy/resolution Measuring Machine

- With a measuring force of only 0.01 N, the Litematic is ideal for measuring easily deformed workpieces or high-accuracy components.
- For workpieces for which 0.01 N is insufficient, either the 0.15 N or 1 N model is recommended.
- The motor-driven spindle moves up/down and stops when the contact point touches the workpiece. Then the maximum, minimum and runout values are measured under a constant force.
- High resolution of 0.01 μm , and wide measuring range of 50 mm.
- Measuring system **VL-50-B**, integrated display type, and **VL-50S-B**, a separate display type, are available.
- The measuring table supplied with **VL-50-B** is ceramic, which is corrosion free, for easier maintenance and storage.
- The spindle is made of low thermal expansion material.
- Motor life is approximately 100,000 operations, after which replacement is advisable.



318-221



318-226

SPECIFICATIONS

| Order No. | 318-221*4 | 318-222*4 | 318-223*4 | 318-226*4 | 318-227*4 | 318-228*4 |
|-----------------------------------|---|------------|-------------|-----------|-------------|--------------|
| Model | VL-50-B | VL-50-15-B | VL-50-100-B | VL-50S-B | VL-50S-15-B | VL-50S-100-B |
| Measuring range | 0 to 50 mm (0 to 2 in) | | | | | |
| Resolution | 0.01/0.1/1.0 μm (0.000005 in/0.000005 in/0.00005 in) | | | | | |
| Display unit | 8 digits/14 mm (0.6 in) character height (without signs) | | | | | |
| Scale type | Reflection type linear encoder | | | | | |
| Stroke | 51.5 mm (2 in) (when using a standard contact point) | | | | | |
| Measuring accuracy (20 °C)*1 | (0.5 + L/100) μm L=arbitrary measuring length (mm) | | | | | |
| Accuracy guaranteed temperature*2 | 20 \pm 1 °C | | | | | |
| Repeatability*1 | $\sigma=0.05 \mu\text{m}$ | | | | | |
| Measuring force*1 | 0.01 N | 0.15 N*3 | 1 N*3 | 0.01 N | 0.15 N*3 | 1 N*3 |
| Feed speed | Measurement: Approx. 2 mm/s (0.08 in/s) or 4 mm/s (0.16 in/s) (changeable by parameter) | | | | | |
| Fast feed | Approx. 8 mm/s (0.3 in/s) | | | | | |
| Contact point | \varnothing 3 mm carbide tipped (fixing screw: M2.5 (P=0.45) x5), standard contact point: 901312 | | | | | |
| Measuring table | \varnothing 100 (ceramic, grooved, removable) | | | | | |
| Input | Foot switch input (when optional foot switch is used) External Control | | | | | |
| Output | Digimatic output/RS-232C output (changeable by parameter) | | | | | |
| Rating | Power supply: 85 to 264 V AC (depends on AC adapter) | | | | | |
| Power consumption | Max. 12 W (12 V, 1 A) | | | | | |
| Standard Accessories | AC adapter: 357651 , Power cable: 02ZAA000 , Grounding wire: 934626 , AC cable (Japan): 02ZAA000 , AC cable (USA): 02ZAA010 , AC cable (EU): 02ZAA020 , AC cable (UK): 02ZAA030 , AC cable (China): 02ZAA040 , AC cable (Korea): 02ZAA050 , Hex wrench (2 pcs. for fixing contact point and for removing fixing bracket) | | | | | |

*1 Normal measurement using standard contact point.

*2 Under less temperature change, and hot or cold direct air flow should be avoided.

*3 0.15 N, 1 N types are factory-installed option.

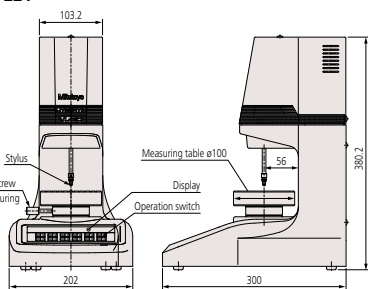
*4 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.

Note: Motor life is approximately 100,000 operations, after which replacement is advisable.

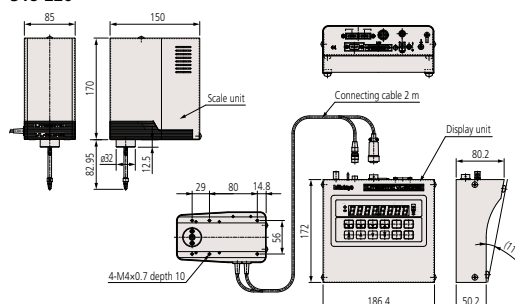
This maintenance factor is particularly important to bear in mind when the machine is used frequently, such as on a production line.

DIMENSIONS

318-221

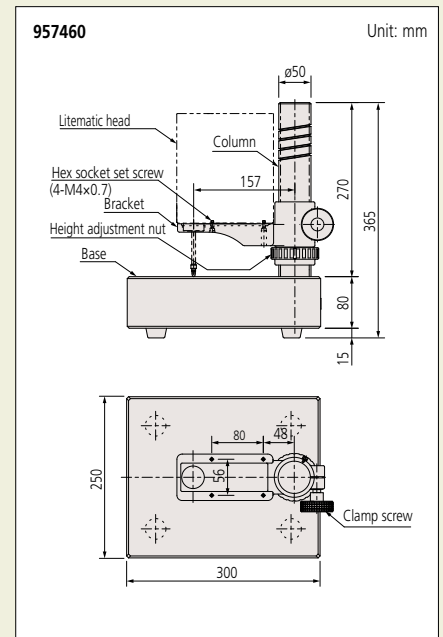


318-226



Unit: mm

Optional Stand for VL-50S-B



Optional Accessories

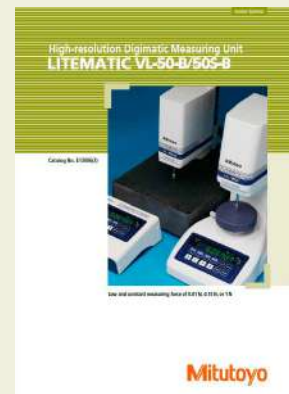
- Foot switch: **937179T**
- Dedicated stand: **957460***5
- SPC cable (1 m): **936937***6
- SPC cable (2 m): **965014***6
- VL weight part: **02AZE375***7
- Recommended spare contact points:
Shell type: **101118** (Approx. 0.02 N)*8
Carbide tipped spherical contact point, \varnothing 7.5:
120059 (Approx. 0.03 N)*8
Carbide tipped spherical contact point, \varnothing 10.5:
120060 (Approx. 0.06 N)*8
Carbide tipped needle contact point, \varnothing 0.45:
120066 (Approx. 0.01 N)*8

*5 Only VL-50S is available.

*6 Refer to page G-21 for details of the RS link.

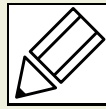
*7 Not applicable to **318-223** and **318-228**

*8 Values in parentheses indicate the measuring force of a 0.01 N model fitted with the respective optional points



Refer to the Litematic Brochure (E13006) for more details.

Quick Guide to Precision Measuring Instruments

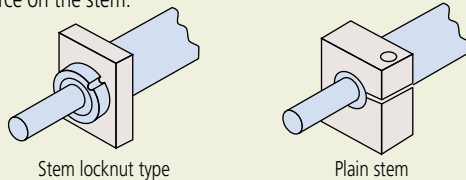


Linear Gages

Head

Plain Stem and Stem with Clamp Nut

The stem used to mount a linear gage head is classified as a "plain type" or "clamp nut type" as illustrated below. The clamp nut stem allows fast and secure clamping of the linear gage head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does require a split-fixture clamping arrangement or adhesive fixing. However, take care so as not to exert excessive force on the stem.



Stem locknut type

Plain stem

Measuring Force

This is the force exerted on a workpiece during measurement by the contact point of a linear gage head, at its stroke end, expressed in newtons.

Comparative Measurement

A measurement method where a workpiece dimension is found by measuring the difference in size between the workpiece and a master gage representing the nominal workpiece dimension.

Ingress Protection Code

IP54 protection code

| Type | Level | Description |
|--|----------------------|--|
| Protects the human body and protects against foreign objects | 5: Dust protected | Protection against harmful dust |
| Protects against exposure to water | 4: Splash-proof type | Water splashing against the enclosure from any direction shall have no harmful effect. |

IP66 protection code

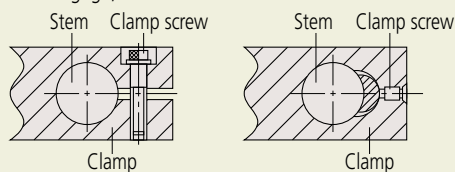
| Type | Level | Description |
|--|-------------------------|---|
| Protection against contact with the human body and foreign objects | 6: Dust tight | Protection from dust ingress Complete protection against contact |
| Protects against exposure to water | 6: Water-resistant type | Water jets directed against the enclosure from any direction shall have no harmful effects. |

Precautions in Mounting a Gage Head

- Insert the stem of the gage into the mounting clamp of a measuring unit or a stand and tighten the clamp screw.
- Notice that excessively tightening the stem can cause problems with spindle operation.
- Never use a mounting method in which the stem is clamped by direct contact with a screw.
- Never mount a linear gage by any part other than the stem.
- Mount the gage head so that it is in line with the intended direction of measurement. Mounting the head at an angle to this direction will cause an error in measurement.
- Exercise care so as not to exert a force on the gage through the cable.

Precautions in Mounting LGH Series

To fix the Laser Hologage, insert the stem into the dedicated stand or fixture.



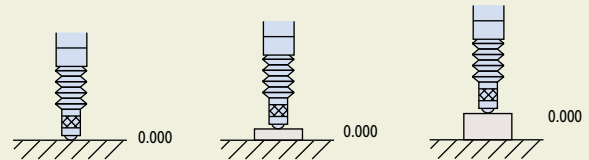
Recommended hole diameter on the fixing side: 15 mm +0.034/+0.014

- Machine the clamping hole so that its axis is parallel with the measuring direction. Mounting the gage at an angle will cause a measuring error.
- When fixing the Laser Hologage, do not clamp the stem too tightly. Over-tightening the stem may impair the sliding ability of the spindle.
- If measurement is performed while moving the Laser Hologage, mount it so that the cable will not be strained and no undue force will be exerted on the gage head.

Display Unit

Zero-setting

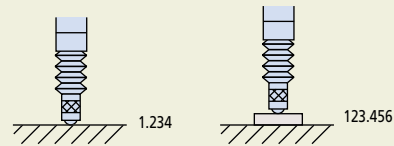
The display value can be set to 0 (zero) at any position of the spindle.



Note: Perform the zero-setting beyond 0.2 mm stroke from the rest position. This puts the spindle in the guaranteed accuracy region.

Presetting

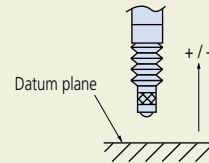
Any numeric value can be set on the display unit for starting the count from this value.



Note: Perform the zero-setting beyond 0.2 mm stroke from the rest position. This puts the spindle in the guaranteed accuracy region.

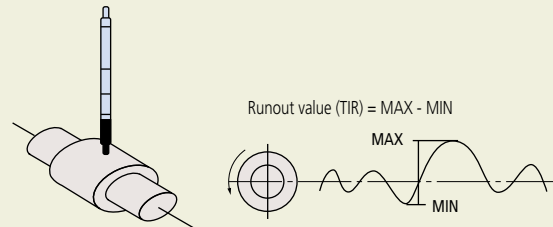
Direction Changeover

The measuring direction of the gage spindle can be set to either plus (+) or minus (-) of count.



MAX, MIN, TIR Settings

The display unit can hold the maximum (MAX) and minimum (MIN) values, and the run out value (TIR) during measurement.



Tolerance Setting

Tolerance limits can be set in various display units for automatically indicating if a measurement falls within those limits.

Open-collector Output

An external load, such as a relay or a logic circuit, can be driven from the collector output of an internal transistor which is itself controlled by a Tolerance Judgment result, etc.

Digimatic Code

A communication protocol for connecting the output of measuring tools with various Mitutoyo data processing units. This allows output connection to a Digimatic Mini Processor **DP-1VA LOGGER** for performing various statistical calculations and creating histograms, etc.

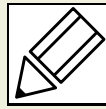
BCD Output

A system for outputting data in binary-coded decimal notation.

RS-232C Output

A serial communication interface in which data can be transmitted bi-directionally under the EIA Standards. For the transmission procedure, refer to the specifications of each measuring instrument.

Quick Guide to Precision Measuring Instruments



Linear Gages

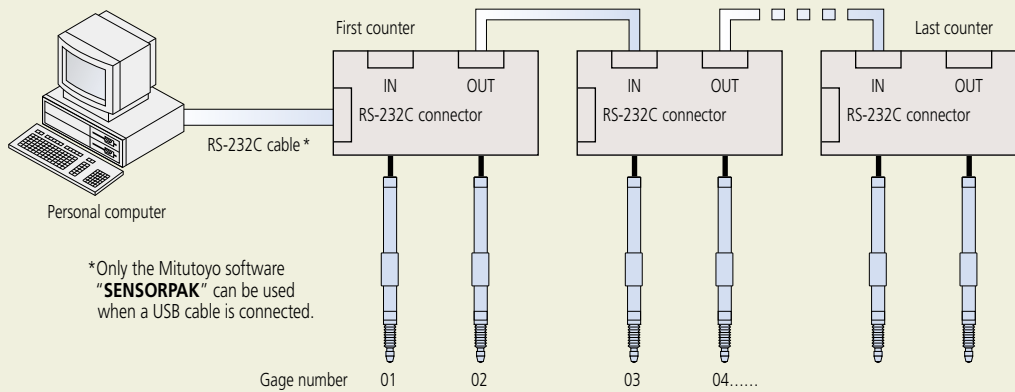
RS Link Function Multi-point measurement can be performed by connecting multiple **EH** or **EV** counters with RS Link cables.

RS Link for EH Counter

It is possible to connect a maximum of 10 counter units and handle up to 20 channels of multi-point measurement at a time.

For this connection use a dedicated RS Link cable **02ADD950** (0.5 m), **936937** (1 m) or **965014** (2 m).

(The total length of RS Link cables permitted for the entire system is up to 10 m.)

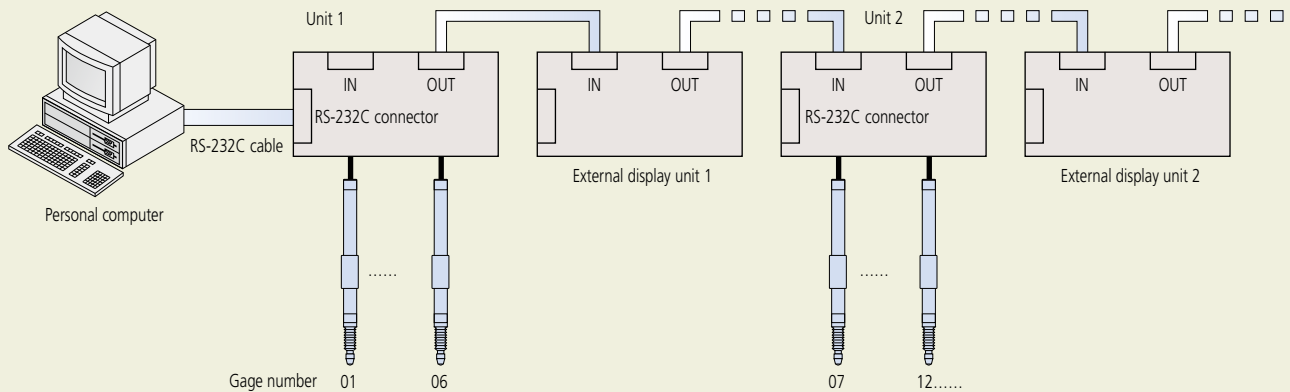


RS Link for EV Counter

It is possible to connect a maximum of 10* counter units and handle up to 60 channels of multi-point measurement at a time.

For this connection use a dedicated RS Link cable **02ADD950** (0.5 m), **936937** (1 m) or **965014** (2 m).

(The total length of RS Link cables permitted for the entire system is up to 10 m.)

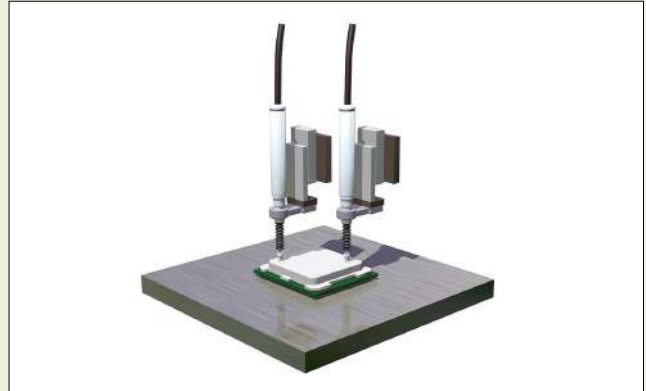


Measurement Examples

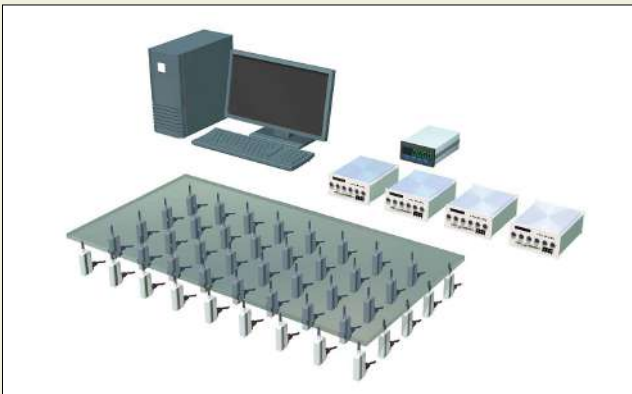
Roll gap measurement



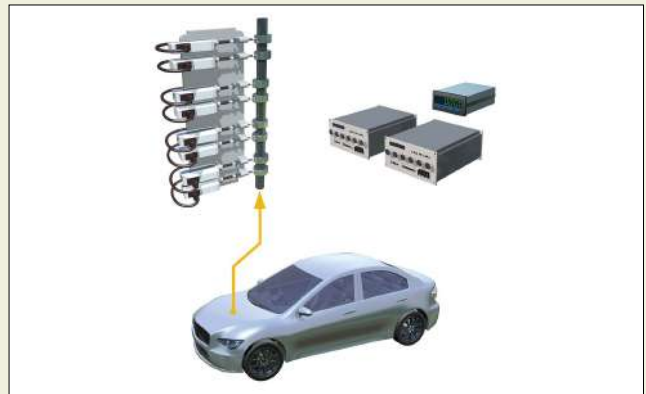
Chip parallelism measurement



FPD board multipoint measurement



Cam-lift measurement



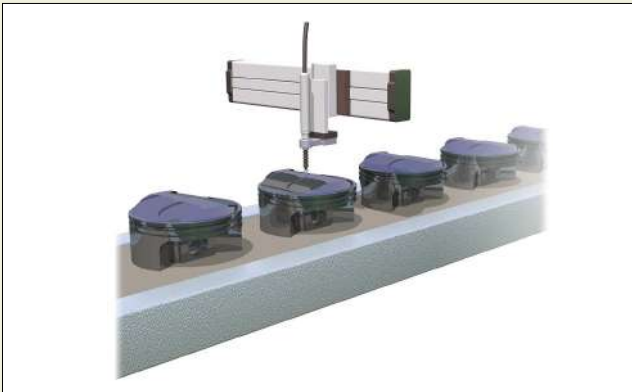
Brake disk multipoint measurement



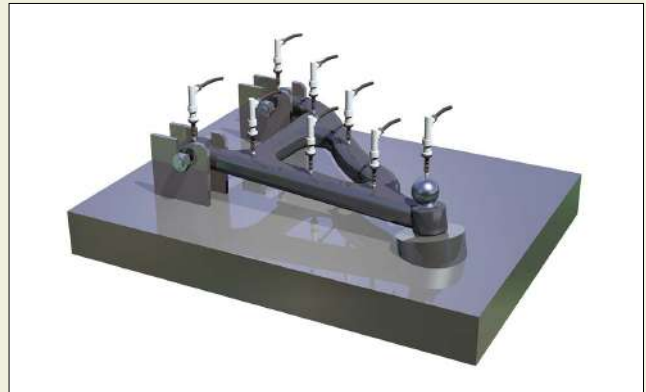
Machine device tool length measurement



Workpiece discrimination



Inspection fixture



Mu-checker

To support building a system with automatic measuring unit or dedicated gages

Lever/Cartridge Probe Heads SERIES 519 — Electronic micrometer

SPECIFICATIONS

Lever heads

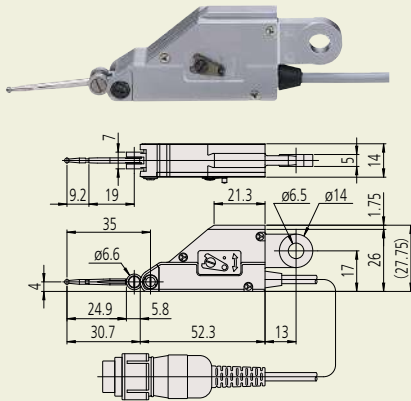
| Order No. | 519-521 | 519-522 | 519-326 | 519-327 |
|----------------------|---------------|---------------|----------------------|---------------|
| Measuring range (mm) | ±0.5 | | | |
| Stroke (mm) | ±0.6 | | ±0.65 | |
| Measuring force (N) | Approx. 0.2 | Approx. 0.02 | Approx. 0.15 | |
| Linearity (%) | ±0.3 | | ±0.5 | |
| Stylus support | Pivot bearing | Pivot bearing | Parallel-leaf spring | Pivot bearing |

Note: A $\varnothing 2$ mm ball-ended stylus is supplied as standard with all probes.

Common specifications

- Connection: Half-bridge
- Cable length: 2 m
- Connector type: MAS-5100 (DIN5P) or equivalent

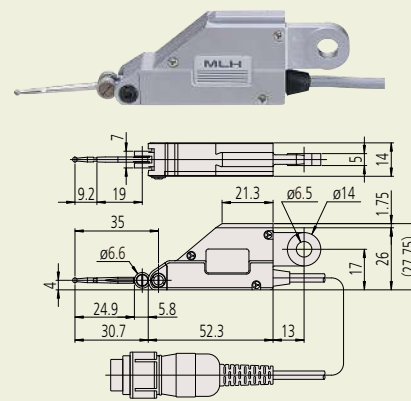
519-521



- Interchangeable styli:
 - ø1: **520940** (Standard accessory)
 - ø2: **520939** (Standard equipment)
 - ø3: **520938** (Standard accessory)

Unit: mm

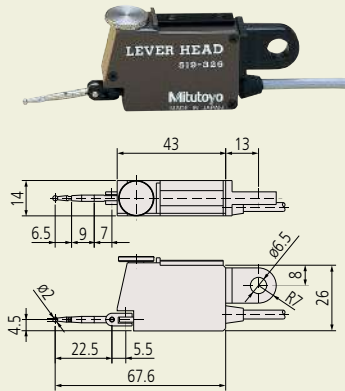
519-522



- Interchangeable styli:
 - ø1: **520940** (Standard accessory)
 - ø2: **520939** (Standard equipment)
 - ø3: **520938** (Standard accessory)

Unit: mm

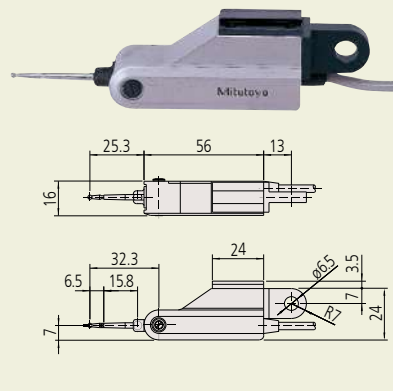
519-326



- Interchangeable styli:
 - ø1: **102824** (Optional)
 - ø2: **102825** (Standard equipment)
 - ø3: **102826** (Optional)

Unit: mm

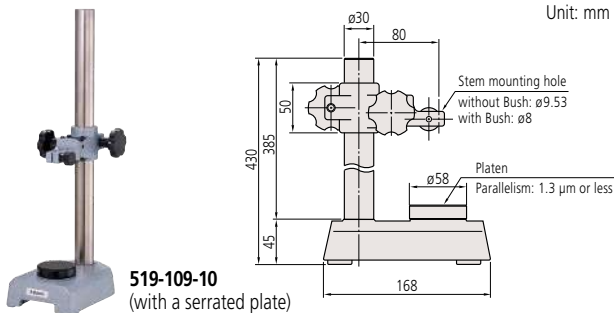
519-327



- Interchangeable styli:
 - ø1: **102824** (Optional)
 - ø2: **102825** (Standard equipment)
 - ø3: **102826** (Optional)

Unit: mm

Transfer Stand



519-109-10
(with a serrated plate)

Unit: mm

Main Specifications

| Order No. | Effective transfer range (mm) | Fine adjustment range (mm) | Mounting hole (mm) |
|-------------------|-------------------------------|----------------------------|--|
| 519-109-10 | 0 - 320 | 1 | Without Bush: $\varnothing 9.53$ With Bush: $\varnothing 8$ |

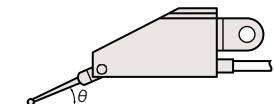
Note on stylus angle

If the stylus of a pivot bearing type probe makes an angle with a workpiece surface, as in the figure, calibration should be performed for accurate measurement. Alternatively, the displayed value may be corrected by multiplying it by the appropriate correction factor as given in the table.

Model **519-326** does not need correction.

| Angle (θ) | Correction factor |
|--------------------|-------------------|
| 0° | 1.00 |
| 10° | 0.98 |
| 20° | 0.94 |
| 30° | 0.87 |
| 40° | 0.77 |
| 50° | 0.64 |
| 60° | 0.50 |

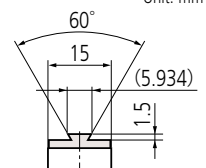
Display value \times Correction factor = Corrected value



Dimensions of dovetail plate on probe body

Enables mounting on a lever head mounting bracket or stem.

Unit: mm



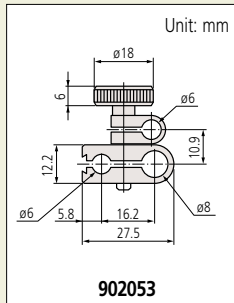
Lever-head mounting brackets (optional)

Optional accessories for Mitutoyo test indicators can be used.

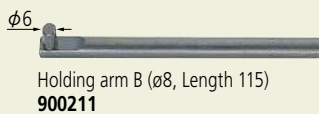
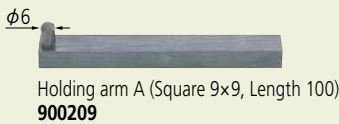
Stems



Clamp



Holder



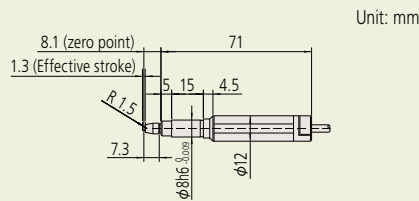
SPECIFICATIONS

Cartridge heads (special order only)

| Order No. | 519-331 | 519-332 | 519-346 | 519-347 | 519-385 | 519-341 | 519-348 |
|----------------------|---------------|--------------|---------------------|----------------|----------------|--------------|----------------|
| Measuring range (mm) | ±0.5 | ±0.5 | ±0.25 | ±0.5 | ±1.5 | ±2.5 | ±1.0 |
| Stroke (mm) | ±0.65 | ±0.65 | +0.34 -0.26 | +0.85 -0.65 | +2.35 -1.65 | +3.2 -2.8 | +1.35 -1.15 |
| Measuring force (N) | Approx. 0.25 | Approx. 0.25 | Approx. 0.7 | Approx. 0.7 | Approx. 0.7 | Approx. 0.9 | Approx. 0.7 |
| Stem Dia. (mm) | ø8 | ø9.52 | ø8 | ø8 | ø8 | ø8 | ø8 |
| Linearity (%) | ±0.5 | ±0.5 | ±0.3 | ±0.3 | ±0.3 | ±0.5 | ±0.3 |
| Plunger support | Plain bearing | | Linear ball-bearing | | | | |

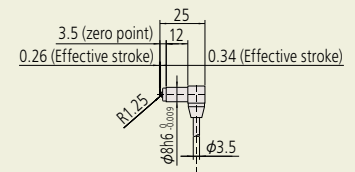
519-331

- M2.5x5 interchangeable contact points for dial indicators can be used.



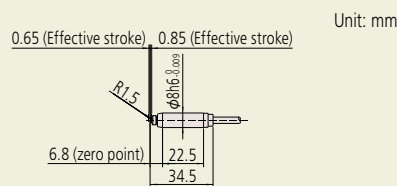
519-346

- Dedicated contact point only that cannot be replaced.



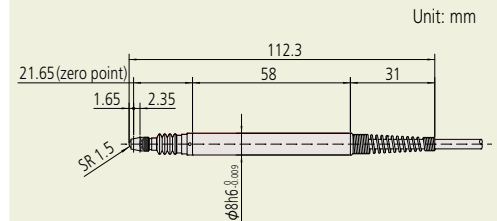
519-347

- Dedicated contact point only that cannot be replaced.



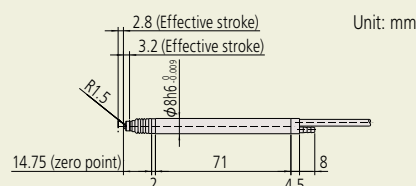
519-385

- M2.5x5 interchangeable contact points for dial indicators can be used.



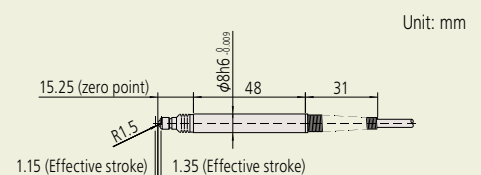
519-341

- M2.5x5 interchangeable contact points for dial indicators can be used.
- Recommended air pressure 0.05 MPa



519-348

- M2.5x5 interchangeable contact points for dial indicators can be used.



Mu-checker

To support building a system with automatic measuring unit or dedicated gages

Display unit for Mu-checker (analog/digital) SERIES 519 — Electronic micrometer

- Single touch zero-set function is standard.
- Switchable measurement ranges make the Mu-checker suitable for a range of applications, especially those that involve moderately fast-changing measurement values which suit the use of analog readout.
- Two types of analog display are available and one digital type.

Analog Mu-checker



Standard type
519-551



Differential type
519-553

SPECIFICATIONS

| | Metric | | Inch | |
|-------------------------------|--|--|--|--|
| Order No. | 519-551* | 519-553* | 519-552* | 519-554* |
| Type | Standard type (one probe required) | Differential type (one/two probes required) | Standard type (one probe required) | Differential type (one/two probes required) |
| Display range | $\pm 5 \mu\text{m}/\pm 15 \mu\text{m}/\pm 50 \mu\text{m}/\pm 150 \mu\text{m}/\pm 500 \mu\text{m}/\pm 1500 \mu\text{m}$ | | $\pm 5 \mu\text{m}/\pm 15 \mu\text{m}/\pm 50 \mu\text{m}/\pm 150 \mu\text{m}/\pm 500 \mu\text{m}/\pm 1500 \mu\text{m}$ $\pm 0.00015 \text{ in}/\pm 0.0005 \text{ in}/\pm 0.0015 \text{ in}/\pm 0.005 \text{ in}/\pm 0.015 \text{ in}/\pm 0.05 \text{ in}$ | |
| Graduation | 0.1 $\mu\text{m}/0.5 \mu\text{m}/1 \mu\text{m}/5 \mu\text{m}/10 \mu\text{m}/50 \mu\text{m}$ | | 0.1 $\mu\text{m}/0.5 \mu\text{m}/1 \mu\text{m}/5 \mu\text{m}/10 \mu\text{m}/50 \mu\text{m}$ 0.000005 in/0.00001 in/0.00005 in/0.0001 in/0.0005 in/0.001 in | |
| Differential mode | $\pm A$ | $\pm A, \pm B, \pm A \pm B$ | $\pm A$ | $\pm A, \pm B, \pm A \pm B$ |
| Display accuracy (linearity) | $\pm 1\%$ of full-scale reading | | | |
| Analog output | $\pm 1.0 \text{ V}$ at full-scale reading | | | |
| Analog output accuracy | Within $\pm 0.1\%$ of full-scale reading (excluding probe) | | | |
| Zero-setting adjustment range | $\pm 15\%$ /FS (error: $\pm 0.2\%$ /FS) | | | |
| External dimensions | 134 (W) \times 183 (D) \times 208 (H) mm | | | |
| Mass | 2.4 kg | | | |
| Power input | AC adapter 100, 120, 220, 240 V AC 50/60 Hz | | | |
| Probe | Various probes (refer to pages G-23 and G-24) | | | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

Digital Mu-checker



Digital Mu-checker
519-561

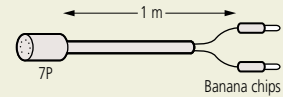
SPECIFICATIONS

| | Metric | Inch |
|---------------------|---|---|
| Order No. | 519-561* | 519-562* |
| Type | Differential type digital Mu-Checker (2 connecting heads) | |
| Display range | $\pm 2.000 \text{ mm}/\pm 0.2000 \text{ mm}$ | $\pm 2.000 \text{ mm}/\pm 0.2000 \text{ mm}/\pm 0.08 \text{ in}/\pm 0.008 \text{ in}$ |
| Resolution | 0.001 mm/0.0001 mm | 0.001 mm/0.0001 mm/0.00005 in/0.000005 in |
| Differential mode | $\pm A, \pm B, \pm A \pm B$ | |
| Measurement mode | ABS/CMP | |
| Analog output | $\pm 1 \text{ V}$ at full-scale reading | |
| Digital output | Digimatic code out | |
| External dimensions | 134 (W) \times 183 (D) \times 208 (H) mm | |
| Mass | Approx. 2.6 kg | |
| Power input | AC adapter 100, 120, 220, 240 V AC 50/60 Hz | |
| Probe | Various probes (refer to pages G-23 and G-24) | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

Optional Accessories

- Vertical stand (271214)
Attached to the bottom surface of the Mu-checker, it can be vertically mounted on the base.
- SPC Cable for connecting digital Mu-checker (936937)
Used for connecting to the Digimatic mini-processor.
- Output cable A (934795)
Used for connecting to external devices, such as data recorders, etc.



- Analog, limit out (7P) connector (529035)
Used for output to external data recorders, sequencers, etc.



Refer to the Mu-checker Brochure (E13003) for more details.

Main features

- External control (Zero-set, Preset etc.)
- Direction switching
- Error messaging
- Tolerance judgment output
- Each data output (RS-232C, BCD, segment)
- Peak measurement (maximum value, minimum value, runout) and arithmetic operation (addition, average, maximum value, minimum value, maximum width) between axes

Optional Accessories

- Output connector: **02ADB440**
- D-EV External display unit*1: **02ADD400**
- SPC cable (0.5 m): **02ADD950**
- SPC cable (1 m): **936937**
- SPC cable (2 m): **965014**
- AC adapter: **357651**
- AC cable (Japan): **02ZAA000***2
- AC cable (USA): **02ZAA010***2
- AC cable (EU): **02ZAA020***2
- AC cable (UK): **02ZAA030***2
- AC cable (China): **02ZAA040***2
- AC cable (Korea): **02ZAA050***2
- Terminal connecting cable: **02ADD930***2

*1 Refer to page G-17 for details of **D-EV**.

*2 Required when using AC adapter.

• SENSORPAK



Note: Refer to page G-18 for more details.



Refer to the Mu-checker Brochure (**E13003**) for more details.

EV-16A Counter SERIES 519 — 6-channel, No-display Type

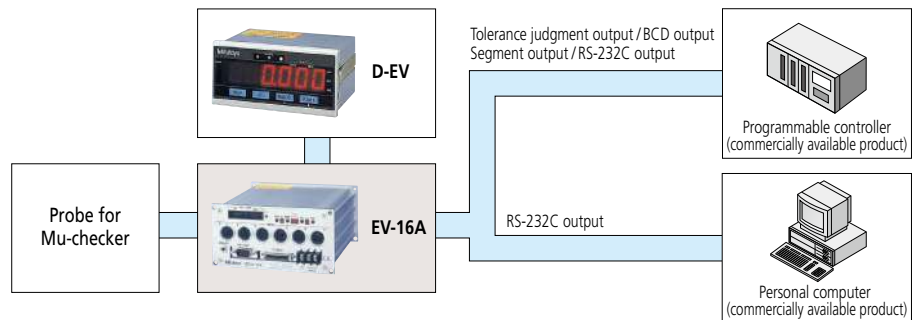


519-355
EV-16A

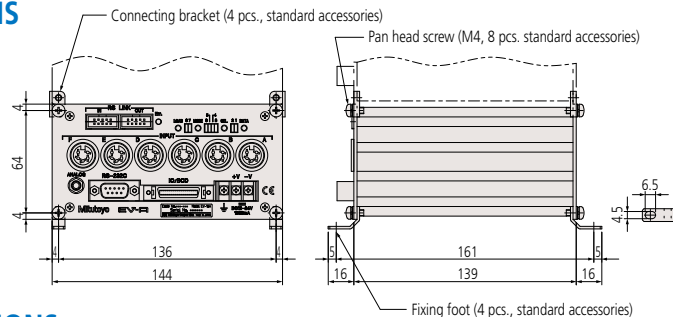
- Up to six probes can be connected to one unit. Up to ten counters can be connected to one personal computer using the RS Link function to enable the configuration of a multi-point measurement system comprising a maximum of 60 gages.
- I/O outputs for RS-232C, BCD, tolerance judgment and segment output are available.
- Maximum, minimum and runout measurement between channels (in the same unit) is possible in addition to normal measurement on individual channels.

SYSTEM CONFIGURATION

Mitutoyo probes, **EV-16A** counters and **D-EV** display units combined with commercial controllers and personal computers enable construction of a powerful, multi-channel system that can be built to meet the needs of almost any measurement application.



DIMENSIONS

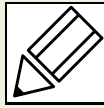


Unit: mm

SPECIFICATIONS

| Order No. | | 519-355 |
|---|---------------------------|---|
| Number of gage inputs | | 6 |
| Quantizing error | | ±1 count |
| Display range (mm) | | ±2.000, ±0.200 |
| Resolution (mm) | | 0.001, 0.0001 |
| Display processing | | 8 digits for parameters (display setting), 1 for error display |
| Error messaging | | Power supply voltage error, Gage error, etc. |
| External display | | Dedicated external display unit D-EV (optional) can be connected |
| Number of input switches | | 4 |
| Input switch function | | Measurement mode switching, Parameter settings |
| I/O | Tolerance judgment output | 1 to 6 gages (L1, L2, L3), open-collector |
| | BCD output | Parallel BCD output (positive/negative-true logic), open-collector |
| | Segment output | A function to enable only output from the terminal corresponding to the counting values, open-collector |
| | Control output | Normal operation signal (NOM), open-collector |
| | Control input | Output channel designation (segment, in BCD mode), presetting, peak value clear, range changeover (at segment output), holding counting value, open-collector or no-voltage contact signal (with/without contact point) |
| Interface | RS-232C | Measurement data output and control input, EIA RS-232C-compatible Use cross cables for home position DTE (terminal definition) |
| | RS link | Max. connected units: 10 Connecting cable length: Max. 10 m (sum of link cable length) Data transfer time: 1.1 sec./60 ch (when transmission rate is 19200 bps) |
| Power supply | Voltage | 12 to 24 V DC (Terminal block: M3) |
| | Consumption | 1 A |
| Operating temperature (humidity) ranges | | 0 to 40 °C (RH 20 to 80 %, non-condensing) |
| Storage temperature (humidity) ranges | | -10 to 50 °C (RH 20 to 80 %, non-condensing) |
| External dimensions | | 144 (W) x 72 (H) x 139 (D) mm |
| Mass | | Approx. 1000 g |
| Standard accessories | | Fixing foot (4), connecting bracket (4), fixing screw M4x8 (8) |
| Applicable probes | | For probes, refer to pages G-23 and G-24. |

Quick Guide to Precision Measuring Instruments



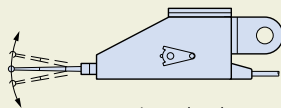
Electronic Micrometer

Probe

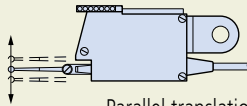
A sensor that converts movement of a contact point, on a stylus or plunger, into an electrical signal.

Lever probes

Lever probes are available in two types. The most common type uses a pivoted stylus so the contact point moves in a circular arc; this type is subject to cosine effect and, therefore, measurements may require linearity correction if the direction of measurement is much different to the direction of movement of the contact point. The less common type uses a parallel translation leaf-spring mechanism so contact point movement is linear; this type requires no correction.



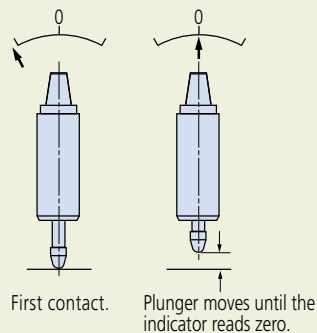
Pivoted stylus type
519-521 (measuring direction can be switched with the up/down lever)
519-522 (measuring direction is not switchable)



Parallel translation type
519-326 (measuring direction can be switched with the upper dial)

Pre-travel

The distance from first contact with a workpiece until the measurement indicator reads zero.



Measuring force

The force applied to the workpiece by the probe when the indicator registers zero. It is indicated in newtons (N).

Digimatic code

A communication protocol for connecting the output of measuring tools with various Mitutoyo data processing units. This allows output connection to a Digimatic Mini Processor **DP-1VA LOGGER** for performing various statistical calculations and creating histograms, etc.

Open-collector output

A direct connection to the collector of a driving transistor.

Comparative measurement

A measurement method where a workpiece dimension is found by measuring the difference in size between the workpiece and a master gage that represents the nominal dimension.

This method is usually applied when the measurement to be made is greater than the measuring range of the instrument.

Linearity

The ratio of proportionality between measuring system output and measured distance.

If this is not constant within acceptable limits then correction is required.

0 (zero) point

A reference point on the master gage in a comparative measurement.

Sensitivity

The ratio of the electric micrometer output signal to the input signal to the amplifier. The sensitivity is normal if a value as expected from the given displacement is displayed.

Tolerance setting

Tolerance limits can be set on the electronic micrometer to provide an automatic judgment as to whether a measured value falls within the tolerance.

Laser Scan Micrometer

Non-contact, high-speed, high-precision measurement

LSM-500S Measuring Unit SERIES 544 — 5 μm to 2 mm Measuring Unit

- Capable of measuring down to 5 μm outside diameter.
- Provides ultra-high accuracy of ±0.3 μm over the entire measuring range (5 μm to 2 mm).



With signal cable (5 m)
02AGN770A

SPECIFICATIONS

| Order No. | 544-531 | 544-532 |
|----------------------------|---|-----------------|
| Applicable laser standards | JIS | IEC, FDA |
| User's Manual | Japanese version | English version |
| Measuring range | 0.005 to 2 mm*1 | |
| Resolution | 0.01 to 10 μm (selectable) | |
| Repeatability*2 | ±0.03 μm | |
| Linearity*3 (20 °C) | ±0.3 μm | |
| Positional error*4 | ±0.4 μm | |
| Measuring region*5 | 1×2 mm (0.005 to 2 mm) | |
| Scanning rate | 3200 scans/s | |
| Laser wavelength | 650 nm (Visible) | |
| Laser scanning speed | 76 m/s | |
| Operating environment | Temperature: 0 to 40 °C Humidity: RH 35 to 85 % (non-condensing) | |
| Protection Level | IP64*6 | |

- *1 The measuring range for a transparent object is 0.05 mm to 2 mm. Please consult your local Mitutoyo office for objects smaller than 0.05 mm.
The measuring range is 0.1 mm to 2 mm in the 1 to 255 edge measurement mode or when activating automatic workpiece detection. If using the optional dual connection unit for **LSM-6200**, the measuring range will be 0.05 mm to 2 mm.
- *2 Determined at the level of ±2σ (σ: standard deviation) when measuring ø2 mm at the interval of 0.32 sec. (average 1024 times).
- *3 Applies at the center of the measuring range when measuring outside diameters.
- *4 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
- *5 The area defined by [optical axis depth]×[scanning width].
- *6 The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.
- Note: When using the extra-fine line measurement function (FINE), guide messages for setting the following will not be displayed: dual-measurement, segment designation, automatic workpiece detection, and group judgment.

LSM-501S Measuring Unit SERIES 544 — 50 μm to 10 mm Measuring Unit

- Provides ultra-high accuracy of ±0.5 μm over the entire measuring range (0.05 to 10 mm).
- The industry's first narrow-range accuracy performance in this measuring range of ±(0.3+0.1ΔD) μm is available for high-accuracy measurement.



With signal cable (5 m)
02AGN770A

SPECIFICATIONS

| Order No. | 544-533 | 544-534 |
|----------------------------|---|-----------------|
| Applicable laser standards | JIS | IEC, FDA |
| User's Manual | Japanese version | English version |
| Measuring range | 0.05 to 10 mm | |
| Resolution | 0.01 to 10 μm (selectable) | |
| Repeatability*1 | ±0.04 μm | |
| Linearity*2 | Whole range: ±0.5 μm Narrow range: ±(0.3+0.1ΔD) μm*3 | |
| Positional error*4 | ±0.5 μm | |
| Measuring region*5 | 2×10 mm (0.05 to 0.1 mm) 4×10 mm (0.1 to 10 mm) | |
| Scanning rate | 3200 scans/s | |
| Laser wavelength | 650 nm (Visible) | |
| Laser scanning speed | 113 m/s | |
| Operating environment | Temperature: 0 to 40 °C Humidity: RH 35 to 85 % (non-condensing) | |
| Protection Level | IP64*6 | |

- *1 Determined at the level of ±2σ (σ: standard deviation) when measuring ø10 mm at the interval of 0.32 sec. (average 1024 times).
- *2 Applies at the center of the measuring range when measuring outside diameters.
- *3 ΔD=Difference in diameter between the master gage and workpiece. (Unit: mm)
- *4 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
- *5 The area defined by [optical axis depth]×[scanning width].
- *6 The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Optional Accessories

- Multifunctional display unit, **LSM-6200**:

| Order No. | Display type | Remarks |
|-----------|---------------|------------------------|
| 544-071 | Japanese mm/E | Japanese user's manual |
| 544-071* | English mm/E | English user's manual |
| 544-072* | English mm/in | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.*

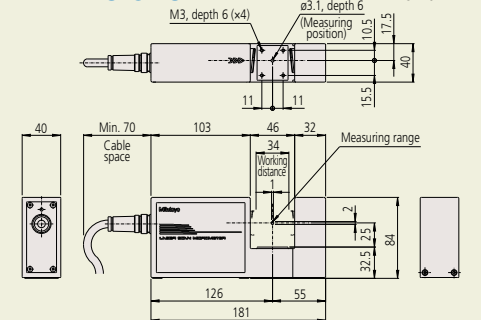
- Panel-mount type display unit, **LSM-5200**:

| Order No. | Remarks |
|-----------|------------------------|
| 544-046 | Japanese user's manual |
| 544-047 | English user's manual |

- Standard calibration gage set (ø0.1, ø2.0): **02AGD110**
- Guide pulley: **02AGD200**
- Air blower: **02AGD220**
- Extension signal cable (max. 15 m)

| Order No. | Cable length |
|-----------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |

DIMENSIONS



Optional Accessories

- Multifunctional display unit, **LSM-6200**:

| Order No. | Display type | Remarks |
|-----------|---------------|------------------------|
| 544-071 | Japanese mm/E | Japanese user's manual |
| 544-071* | English mm/E | English user's manual |
| 544-072* | English mm/in | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.*

- Panel-mount type display unit, **LSM-5200**:

| Order No. | Remarks |
|-----------|------------------------|
| 544-046 | Japanese user's manual |
| 544-047 | English user's manual |

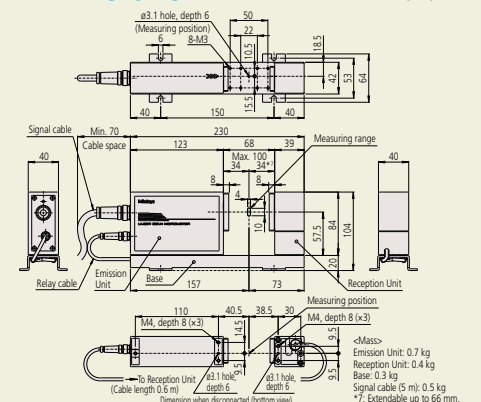
- Standard calibration gage set (ø0.1, ø10.0): **02AGD120**
- Wire guiding pulley: **02AGD210**
- Adjustable workstage: **02AGD400**
- Air blower: **02AGD230**
- Workstage: **02AGD270**
- Extension signal cable (max. 15 m)

| Order No. | Cable length |
|-----------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |

- Extension relay cable

| Order No. | Cable length |
|-----------|--------------|
| 02AGC150A | 1 m |

DIMENSIONS



Optional Accessories

- Multifunctional display unit, **LSM-6200**:

| Order No. | Display type | Remarks |
|-----------------|---------------|------------------------|
| 544-071 | Japanese mm/E | Japanese user's manual |
| 544-071* | English mm/E | English user's manual |
| 544-072* | English mm/in | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.*

- Panel-mount type display unit, **LSM-5200**:

| Order No. | Remarks |
|----------------|------------------------|
| 544-046 | Japanese user's manual |
| 544-047 | English user's manual |

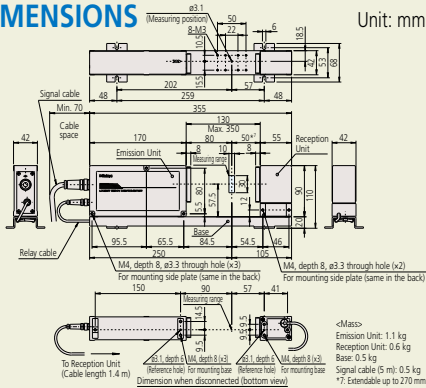
- Standard calibration gage set (ø1.0, ø30.0): **02AGD130**
- Adjustable workstage: **02AGD490**
- Air blower: **02AGD240**
- Workstage: **02AGD270**
- Extension signal cable (max. 25 m)

| Order No. | Cable length |
|------------------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |
| 02AGN780D | 20 m |

- Extension relay cable (max. 5 m)

| | |
|------------------|-----|
| 02AGC150A | 1 m |
| 02AGC150B | 3 m |
| 02AGC150C | 5 m |

DIMENSIONS



Unit: mm

Optional Accessories

- Multifunctional display unit, **LSM-6200**:

| Order No. | Display type | Remarks |
|-----------------|---------------|------------------------|
| 544-071 | Japanese mm/E | Japanese user's manual |
| 544-071* | English mm/E | English user's manual |
| 544-072* | English mm/in | |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.*

- Panel-mount type display unit, **LSM-5200**:

| Order No. | Remarks |
|----------------|------------------------|
| 544-046 | Japanese user's manual |
| 544-047 | English user's manual |

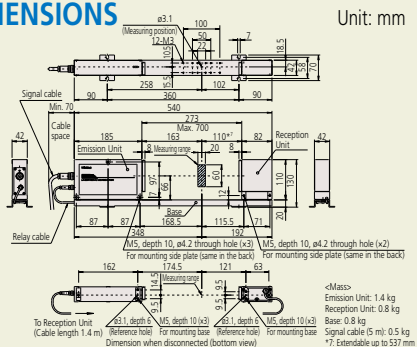
- Standard calibration gage set (ø0.1, ø60.0): **02AGD140**
- Adjustable workstage: **02AGD520**
- Air blower: **02AGD250**
- Extension signal cable (max. 25 m)

| Order No. | Cable length |
|------------------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |
| 02AGN780D | 20 m |

- Extension relay cable (max. 5 m)

| | |
|------------------|-----|
| 02AGC150A | 1 m |
| 02AGC150B | 3 m |
| 02AGC150C | 5 m |

DIMENSIONS



Unit: mm

LSM-503S Measuring Unit SERIES 544 — 0.3 mm to 30 mm Measuring Unit

- Ensures $\pm 1.0 \mu\text{m}$ accuracy over the entire measuring range (0.3 to 30 mm).
- The industry's first narrow-range accuracy performance in this measuring range of $\pm(0.6+0.1\Delta D) \mu\text{m}$ is available for high-accuracy measurement.



With signal cable (5 m)
02AGN770A

SPECIFICATIONS

| Order No. | 544-535 | 544-536 |
|----------------------------|--|---------------------------------------|
| Applicable laser standards | JIS | IEC, FDA |
| User's Manual | Japanese version | English version |
| Measuring range | 0.3 to 30 mm | |
| Resolution | 0.02 to 100 μm (selectable) | |
| Repeatability*1 | $\pm 0.11 \mu\text{m}$ | |
| Linearity*2 (20 °C) | Whole range | $\pm 1.0 \mu\text{m}$ |
| | Narrow range | $\pm(0.6+0.1\Delta D) \mu\text{m}^*3$ |
| Positional error*4 | $\pm 1.5 \mu\text{m}$ | |
| Measuring region*5 | 10x30 mm (0.3 to 30 mm) | |
| Scanning rate | 3200 scans/s | |
| Laser wavelength | 650 nm (Visible) | |
| Laser scanning speed | 226 m/s | |
| Operating environment | Temperature | 0 to 40 °C |
| | Humidity | RH 35 to 85 % (non-condensing) |
| Protection Level | IP64*6 | |

- *1 Determined at the level of $\pm 2\sigma$ (σ : standard deviation) when measuring ø30 mm at the interval of 0.32 sec. (average 1024 times).
- *2 Applies at the center of the measuring range when measuring outside diameters.
- *3 ΔD =Difference in diameter between the master gage and workpiece (Unit: mm)
- *4 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
- *5 The area defined by [optical axis depth]x[scanning width].
- *6 The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

LSM-506S Measuring Unit SERIES 544 — 1 mm to 60 mm Measuring Unit

- Ensures $\pm 3 \mu\text{m}$ accuracy over the entire measuring range (1 to 60 mm).
- The industry's first narrow-range accuracy performance in this measuring range of $\pm(1.5+0.5\Delta D) \mu\text{m}$ is available for high-accuracy measurement.



With signal cable (5 m)
02AGN770A

SPECIFICATIONS

| Order No. | 544-537 | 544-538 |
|----------------------------|--|---------------------------------------|
| Applicable laser standards | JIS | IEC, FDA |
| User's Manual | Japanese version | English version |
| Measuring range | 1 to 60 mm | |
| Resolution | 0.05 to 100 μm (selectable) | |
| Repeatability*1 | $\pm 0.36 \mu\text{m}$ | |
| Linearity*2 (20 °C) | Whole range | $\pm 3 \mu\text{m}$ |
| | Narrow range | $\pm(1.5+0.5\Delta D) \mu\text{m}^*3$ |
| Positional error*4 | $\pm 4 \mu\text{m}$ | |
| Measuring region*5 | 20x60 mm (1 to 60 mm) | |
| Scanning rate | 3200 scans/s | |
| Laser wavelength | 650 nm (Visible) | |
| Laser scanning speed | 452 m/s | |
| Operating environment | Temperature | 0 to 40 °C |
| | Humidity | RH 35 to 85 % (non-condensing) |
| Protection Level | IP64*6 | |

- *1 Determined at the level of $\pm 2\sigma$ (σ : standard deviation) when measuring ø60 mm at the interval of 0.32 sec. (average 1024 times).
- *2 Applies at the center of the measuring range when measuring outside diameters.
- *3 ΔD =Difference in diameter between the master gage and workpiece (Unit: mm)
- *4 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
- *5 The area defined by [optical axis depth]x[scanning width].
- *6 The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Laser Scan Micrometer

Non-contact, high-speed, high-precision measurement

LSM-512S Measuring Unit SERIES 544 — 1 mm to 120 mm Measuring Unit

- Ensures $\pm 6 \mu\text{m}$ accuracy over the entire measuring range (1 to 120 mm).
- The industry's first narrow-range accuracy performance in this measuring range of $\pm(4.0+0.5\Delta D) \mu\text{m}$ is available for high-accuracy measurement.



With signal cable (5 m)
02AGN770A

SPECIFICATIONS

| Order No. | 544-539 | 544-540 |
|----------------------------|---------------------------------------|---|
| Applicable laser standards | JIS | IEC, FDA |
| User's Manual | Japanese version | English version |
| Measuring range | 1 to 120 mm | |
| Resolution | 0.1 to 100 μm (selectable) | |
| Repeatability*1 | $\pm 0.85 \mu\text{m}$ | |
| Linearity*2 (20 °C) | Whole range | $\pm 6 \mu\text{m}$ |
| | Narrow range | $\pm(4.0+0.5\Delta D) \mu\text{m}^{*3}$ |
| Positional error*4 | $\pm 8 \mu\text{m}$ | |
| Measuring region*5 | 30x120 mm (1 to 120 mm) | |
| Scanning rate | 3200 scans/s | |
| Laser wavelength | 650 nm (Visible) | |
| Laser scanning speed | 904 m/s | |
| Operating environment | Temperature | 0 to 40 °C |
| | Humidity | RH 35 to 85 % (non-condensing) |
| Protection Level | IP64*6 | |

- *1 Determined at the level of $\pm 2\sigma$ (σ : standard deviation) when measuring $\phi 120 \text{ mm}$ at the interval of 0.32 sec. (average 1024 times).
 *2 Applies at the center of the measuring range when measuring outside diameters.
 *3 ΔD =Difference in diameter between the master gage and workpiece (Unit: mm)
 *4 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
 *5 The area defined by (optical axis depth)x(scanning width).
 *6 The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

LSM-516S Measuring Unit SERIES 544 — 1 mm to 160 mm Measuring Unit

- Ensures $\pm 7 \mu\text{m}$ accuracy over the entire measuring range (1 to 160 mm).
- The industry's first narrow-range accuracy performance in this measuring range of $\pm(4.0+2.0\Delta D) \mu\text{m}$ is available for high-accuracy measurement.



With signal cable (5 m)
02AGN770A

SPECIFICATIONS

| Order No. | 544-541 | 544-542 |
|----------------------------|---------------------------------------|---|
| Applicable laser standards | JIS | IEC, FDA |
| User's Manual | Japanese version | English version |
| Measuring range | 1 to 160 mm | |
| Resolution | 0.1 to 100 μm (selectable) | |
| Repeatability*1 | $\pm 1.4 \mu\text{m}$ | |
| Linearity*2 (20 °C) | Whole range | $\pm 7 \mu\text{m}$ |
| | Narrow range | $\pm(4.0+2.0\Delta D) \mu\text{m}^{*3}$ |
| Positional error*4 | $\pm 8 \mu\text{m}$ | |
| Measuring region*5 | 40x160 mm (1 to 160 mm) | |
| Scanning rate | 3200 scans/s | |
| Laser wavelength | 650 nm (Visible) | |
| Laser scanning speed | 1206 m/s | |
| Operating environment | Temperature | 0 to 40 °C |
| | Humidity | RH 35 to 85 % (non-condensing) |
| Protection Level | IP64*6 | |

- *1 Determined at the level of $\pm 2\sigma$ (σ : standard deviation) when measuring $\phi 160 \text{ mm}$ at the interval of 0.32 sec. (average 1024 times).
 *2 Applies at the center of the measuring range when measuring outside diameters.
 *3 ΔD =Difference in diameter between the master gage and workpiece (Unit: mm)
 *4 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
 *5 The area defined by (optical axis depth)x(scanning width).
 *6 The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Optional Accessories

- Multifunctional display unit, **LSM-6200**:

| Order No. | Display type | Remarks |
|-----------------|---------------|------------------------|
| 544-071 | Japanese mm/E | Japanese user's manual |
| 544-071* | English mm/E | English user's manual |
| 544-072* | English mm/in | English user's manual |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.*

- Panel-mount type display unit, **LSM-5200**:

| Order No. | Remarks |
|----------------|------------------------|
| 544-046 | Japanese user's manual |
| 544-047 | English user's manual |

- Standard calibration gage set ($\phi 20.0, \phi 120.0$): **02AGD150**
- Air blower : **02AGD260**
- Extension signal cable (max. 25 m)

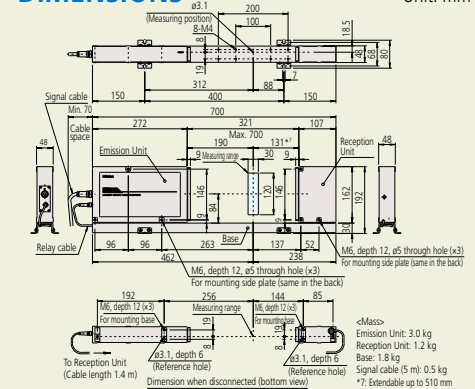
| Order No. | Cable length |
|------------------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |
| 02AGN780D | 20 m |

- Extension relay cable (max. 5 m)

| | |
|------------------|-----|
| 02AGC150A | 1 m |
| 02AGC150B | 3 m |
| 02AGC150C | 5 m |

DIMENSIONS

Unit: mm



Optional Accessories

- Multifunctional display unit, **LSM-6200**:

| Order No. | Display type | Remarks |
|-----------------|---------------|------------------------|
| 544-071 | Japanese mm/E | Japanese user's manual |
| 544-071* | English mm/E | English user's manual |
| 544-072* | English mm/in | English user's manual |

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.*

- Panel-mount type display unit, **LSM-5200**:

| Order No. | Remarks |
|----------------|------------------------|
| 544-046 | Japanese user's manual |
| 544-047 | English user's manual |

- Standard calibration gage set ($\phi 20.0, \phi 160.0$): **02AGM300**
- Extension signal cable (max. 25 m)

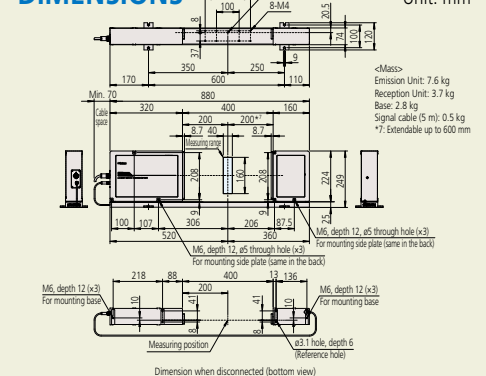
| Order No. | Cable length |
|------------------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |
| 02AGN780D | 20 m |

- Extension relay cable (max. 5 m)

| | |
|------------------|-----|
| 02AGC150A | 1 m |
| 02AGC150B | 3 m |
| 02AGC150C | 5 m |

DIMENSIONS

Unit: mm



LSM-6902H Measuring Unit and 6900 Display SERIES 544 — 0.1 mm to 25 mm High Accuracy

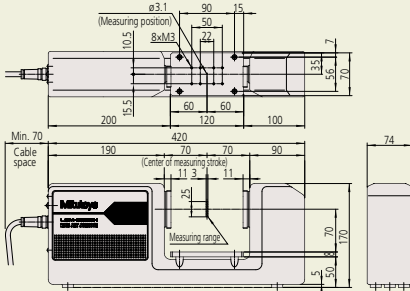
Optional Accessories

- Standard calibration gage set ($\phi 1.0$, $\phi 25.0$) : **02AGD180**
- Workstage : **02AGD270**
- Adjustable workstage : **02AGD280**

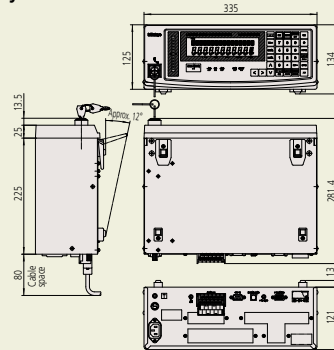
External Dimensions

Unit: mm

Measuring Unit



Display unit



- Demonstrates the best repeatability available in the 25 mm class.
- The ultra-precise scanning motor enables the highest measurement accuracy to be realized.
- Thanks to excellent linearity, an accuracy of $\pm 0.5 \mu\text{m}$ over the entire measuring range and a higher accuracy of $\pm(0.3+0.1\Delta D) \mu\text{m}$ over a narrow range are guaranteed.

- The optimal solution for measuring the outside diameter of pin gages or plug gages.



LSM-6902H

SPECIFICATIONS

| Set Order No. | 544-497-1 | 544-498-1*6 | 544-499-1*6 |
|-----------------------|---|---|-------------|
| Measuring unit | | | |
| Type | mm | mm | inch/mm |
| Applicable standards | JIS | IEC, FDA | |
| Measuring range | 0.1 to 25 mm (0.004 to 1.0 in) | | |
| Resolution | 0.01 to 10 μm (selectable) (0.000001 to 0.0005 in) | | |
| Repeatability*1 | Whole range | $\pm 0.045 \mu\text{m}$ (± 0.0000018 in) ($\phi 25$ mm) | |
| | Narrow range | $\pm 0.03 \mu\text{m}$ (± 0.0000012 in) ($\phi 10$ mm) | |
| Linearity*2 (20 °C) | Whole range | $\pm 0.5 \mu\text{m}$ (± 0.000020 in) | |
| | Narrow range | $\pm(0.3+0.1\Delta D) \mu\text{m}$ $\pm(0.000012+0.01\Delta D)$ inch*5 | |
| Positional error*3 | $\pm 0.5 \mu\text{m}$ (± 0.000020 in) | | |
| Measuring region*4 | ± 1.5 mm \times 25 mm (± 0.006 \times 1.0 in) | | |
| Scanning rate | 3200 scans/s | | |
| Laser wavelength | 650 nm (Visible) | | |
| Laser scanning speed | 226 m/s | | |
| Operating environment | Temperature | 0 to 40 °C | |
| | Humidity | RH 35 to 85 % (non-condensing) | |

- *1 $\pm 2\sigma$ values (σ being the standard deviation) for when $\phi 25$ mm and $\phi 10$ mm samples are measured for 1.28 seconds (2048 scans on average, 2 samples).
- *2 The value at the center of the measuring range.
- *3 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
- *4 The region defined by [optical axis depth] \times [scanning width].
- *5 ΔD = Difference in diameter between the master gage and workpiece (Unit: mm).
- *6 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.

Display unit

| | |
|-----------------------|---|
| Display | 16-digit plus 11-digit fluorescent display, and guide message LED |
| Segment | 1 to 7 (1 to 3, transparent) or 1 to 255 edges |
| Averaging times | Arithmetic average: 2 to 2048 scans. Moving average: 32 to 2048 scans. |
| Judgment | Selection from "target value + tolerance", "lower tolerance + upper tolerance", or "7 classes multilimit tolerance zone". |
| Measurement mode | Standby, Single measurement, Continuous measurement |
| External dimensions | 335 (W) \times 134 (H) \times 250 (D) mm |
| Power supply | 100 to 240 VAC ± 10 % 30 W 50/60 Hz |
| Standard I/F | RS-232C, Analog I/O |
| Optional I/F | Digimatic code output unit (2-ch), 2nd I/O analog I/F, BCD I/F |
| Operating environment | 0 to 40 °C, RH 35 to 85 % (non-condensing) |
| Others | Nominal setting, sample setting, suppression of unnecessary digits, transparent object measurement, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position), zero-set/offset Note: In the case of dual measuring-unit connection, extra-fine line measurement and some of the communication commands are not available |

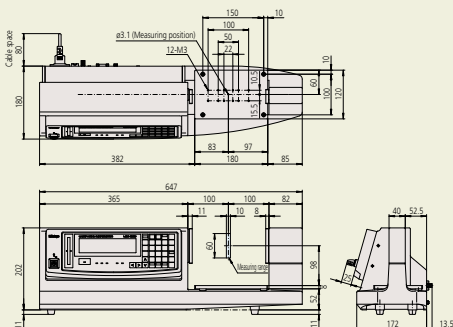
LSM-9506 Integrated Display/Measuring Unit SERIES 544 — 0.5 mm to 60 mm High Accuracy

Optional Accessories

- Standard calibration gage set ($\phi 1.0$, $\phi 60.0$): **02AGD170**
- Adjustable workstage
Horizontal stroke 200 mm : **02AGD370**
Horizontal stroke 300 mm : **02AGD680**

DIMENSIONS

Unit: mm



- High accuracy of $\pm 2.5 \mu\text{m}$, integrated display unit with many functions equivalent to the multi-function display unit. (Some functions may be unavailable.)



SPECIFICATIONS

| Order No. | 544-115*5 | 544-116*6 |
|-----------------------|---|--|
| Type | mm | inch/mm |
| Measuring range | 0.5 to 60 mm | 0.02 to 2.36 in/0.5 to 60 mm |
| Resolution | 0.05 to 100 μm (selectable) | 0.000002 to 0.005 in/0.00005 to 0.1 mm |
| Repeatability*1 | $\pm 0.6 \mu\text{m}$ (± 0.00003 in) | |
| Linearity*2 (20 °C) | $\pm 2.5 \mu\text{m}$ (± 0.0001 in) | |
| Positional error*3 | Optical axis direction | $\pm 2.5 \mu\text{m}$ (± 0.0001 in) |
| | Scanning direction | $\pm (2.0+L/10) \mu\text{m}$ L: Displacement between workpiece center and optical axis center |
| Measuring region*3 | ± 5 \times 60 mm (± 0.2 \times 2.36 in) | |
| Scanning rate | 1600 scans/s | |
| Laser wavelength | 650 nm (Visible)*4 | |
| Laser scanning speed | 226 m/s (8900 in/s) | |
| Display unit | 16-digit dot matrix (upper column) + 7 segment 11-digit (lower column), guidance LEDs | |
| Standard interface | RS-232C, Digimatic code output unit (1-ch) | |
| Optional interface | No | |
| Power supply | AC 100 V to 240 V ± 10 %, 25 W, 50/60 Hz | |
| Operating environment | 0 to 40 °C, RH 35 to 85 % (non-condensing) | |

- *1 Determined at the level of $\pm 2\sigma$ (σ : standard deviation) when measuring $\phi 60$ mm in the interval of 0.32 sec. (average 512 times).
- *2 Applies at the center of the measuring range when measuring outside diameters.
- *3 An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.
- *4 FDA Class II (544-116-1A)/IEC Class 2 (All models except 544-116-1A) semiconductor laser for scanning (Maximum power: 1.0 mW)
- *5 To denote your AC power cable add the following suffixes to the order No.: D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.
- *6 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC and No suffix are required for PSE.

Laser Scan Micrometer

Non-contact, high-speed, high-precision measurement

LSM-5200 Display Unit SERIES 544 — Panel-mount Type

- A compact controller which could be used for multi-unit system configurations.
- A panel-mount type display unit designed for the **LSM-S** Series.
- Analog I/O and RS-232C is standard.



SPECIFICATIONS

| Order No. | 544-047 |
|---|--|
| Display | 9-digit (upper) and 8-digit (lower) 7-segment |
| Segment | 1 to 7 (1 to 3, transparent) or 1 to 255 edges*1 |
| Averaging method | Arithmetic average: from 4 to 2048; Moving average: from 32 to 2048 (Arithmetic average is from 16 to 2048 when using LSM-500S .) |
| Judgment | Selecting from "target value±tolerance value" or "lower limit/upper limit". |
| Measurement mode | Standby, Single measurement, Continuous measurement |
| Statistical analysis | Calculation result is output via USB or RS-232C. |
| External dimensions | 144 (W) x 72 (H) x 197.1 (D) mm |
| Power supply | 24 V DC±10 %, 1.3 A or more |
| Standard I/F | USB2.0, RS-232C, I/O analog |
| Operating temperature (humidity) ranges | 0 to 40 °C, RH 35 to 85 % (non-condensing) |
| Storage temperature (humidity) ranges | -20 to 70 °C, RH 35 to 85 % (non-condensing) |
| Other functions | Measurement of odd fluted parts, simultaneous measurement, nominal setting, sample setting, selection of unnecessary digits, transparent object measurement*2 Automatic workpiece detection (dimension/position detected)*1, abnormal data elimination, mastering, statistical processing (when using USB, RS-232C), output timer, automatic measurement in edge mode, presetting Note that every function is limited in its combination possibilities. See the user manual for details. |
| Mass | 1.4 kg |

*1 The measuring range will be 0.1 mm to 2 mm in the 1 to 255 edge measurement mode or when activating the automatic workpiece detection with **544-531, 544-532**. Each function has its combination limit.

*2 The measuring range is 50 μm to 2 mm when using **544-531, 544-532**. For smaller ranges, contact your local Mitutoyo sales office.
Note 1: Cannot be connected to **544-495, 544-496**.

Note 2: Previous models such as **544-451** cannot be connected.

Note 3: For USB communication with a PC, a dedicated device driver is required. For details, contact your local Mitutoyo sales office.

LSM-6200 Display Unit SERIES 544 — Multi-function Type

- 2-axis display unit enables 2 items be displayed simultaneously.
- Statistical operation is supported.
- Capable of statistical analysis such as: average, maximum value, minimum value, range (max. to min.).
- Segment measurement (7 points) or edge measurement (1 to 255 edges) can be selected.
- A function to eliminate abnormal values is standard.
- 100 tolerance values, preset values, or settings can be stored.



SPECIFICATIONS

| Order No. | 544-071 | 544-072 |
|-----------------------|--|---------|
| Type | mm | inch/mm |
| Display | 16-digit dot matrix (upper) and 11-digit 7-segment (lower) | |
| Segment | 1 to 7 (1 to 3, transparent) or 1 to 255 edges*1 | |
| Averaging times | Arithmetic average: per 2 to 2048/Moving average: per 32 to 2048 (Arithmetic average is per 16 to 2048 when using 544-531, 544-532) | |
| Judgment | Selection from "target value+tolerance", "lower tolerance + upper tolerance", or "7 classes multi-limit tolerance zone". | |
| Measurement mode | Standby, Single measurement, Continuous measurement | |
| Statistical analysis | Maximum, Minimum, Average, Dispersion, σ (S.D) | |
| Size | 335 (W) x 134 (H) x 250 (D) mm | |
| Power supply | 100 to 240 V AC ±10 %, 45 W, 50/60 Hz | |
| Standard I/F | RS-232C, Analog I/O | |
| Optional I/F | Digimatic code output unit (2-ch), 2nd I/O analog I/F, BCD I/F | |
| Operating environment | 0 to +40 °C, RH 35 to 85 % (non-condensing) | |
| Other functions | Nominal setting, sample setting, selection of unnecessary digits, transparent object measurement*2, measurement of odd fluted parts, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position)*1, zero-set/offset, dual measurement (optional) | |

*1 The measuring range will be 0.1 mm to 2 mm in the 1 to 255 edge measurement mode or when activating automatic workpiece detection with **544-531, 544-532**. Each function has its combination limit.

*2 The measuring range is 50 μm to 2 mm when using **544-531, 544-532**. For smaller ranges, contact your local Mitutoyo sales office.

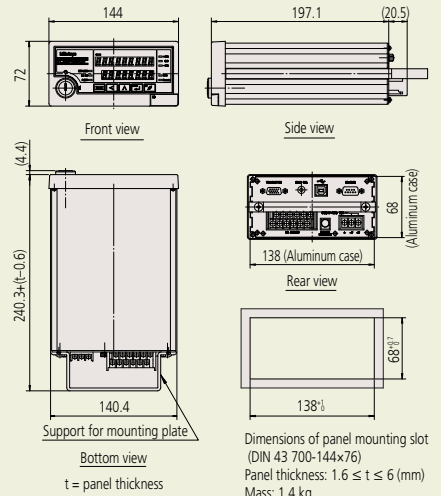
Note 1: To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.

Note 2: Cannot be connected to **544-495, 544-496**.

Note 3: Previous models such as **544-451** cannot be connected.

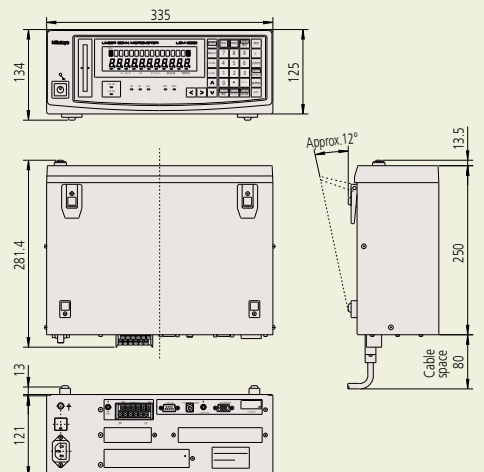
DIMENSIONS

Unit: mm



DIMENSIONS

Unit: mm



Optional Accessories SERIES 544 — Laser Scan Micrometer (Measuring Unit)

Standard calibration gage set

- Standard gage set suitable for calibration of Laser Scan Micrometers.
- Nominal gage diameters (1 to 160 mm) are as given in Specifications.



SPECIFICATIONS

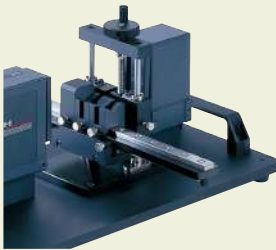
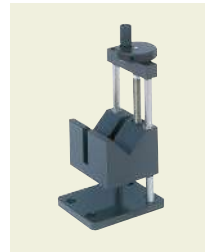
| For calibrating models | | LSM-6902H | LSM-500S | LSM-501S | LSM-503S | LSM-506S | LSM-512S | LSM-516S | LSM-9506 |
|------------------------------|---------------|-------------------------------|----------------------------|-----------------------------|-------------------------------|-------------------------------|-----------------------------|-------------------------------|-------------------------------|
| Set No. | | 02AGD180 | 02AGD110 | 02AGD120 | 02AGD130 | 02AGD140 | 02AGD150 | 02AGM300 | 02AGD170 |
| Configuration (Order No.) | Stand | 02AGD181 | 02AGD111 | 02AGD121 | 02AGD131 | 02AGD141 | 02AGD151 | 02AGM320 | 02AGD171 |
| | Gages | ø1: 02AGD920 ø25: 02AGD963 | ø0.1: 958200 ø2: 958202 | ø0.1: 958200 ø10: 229317 | ø1: 02AGD920 ø30: 02AGD961 | ø1: 02AGD920 ø60: 02AGD962 | ø20: 229730 ø120: 234072 | ø20: 229730 ø160: 02AGM303 | ø1: 02AGD920 ø60: 02AGD962 |
| | Carrying case | 02AGD190 | 958203 | 958203 | 02AGD980 | 02AGD980 | 02AGD990 | 02AGM310 | 02AGD970 |

Workstage

- Easy set-up and height adjustment enables high-precision measurement.

SPECIFICATIONS

| | |
|-----------|-----------------------------------|
| Model | LSM-501S LSM-503S LSM-6902H |
| Order No. | 02AGD270 |

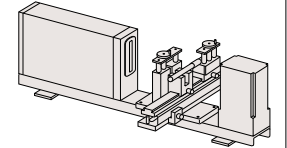
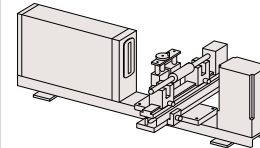


Adjustable workstage

- Vertical/horizontal slide mechanism enables easy measurement of various workpiece diameters.
- Suitable for quality control of high-precision shafts, rollers, pin gages and similar.

Measurement Examples

- Roller of copying machine
- Pin gage or plug gage



Basic configuration

| Basic set | Order No. | Model | Standard Accessories | Measuring range (mm) | Horizontal stroke (mm) | Vertical stroke (mm) |
|---------------------------------------|-----------|-----------|--|----------------------|------------------------|----------------------|
| 1) Main unit 2) V-block 3) Stop | 02AGD280 | LSM-6902H | V-block (02AGD420), 2 pcs. Stopper (02AGD430), 1 pc. | 0.1 - 25 | 130 | 47 |
| | 02AGD400 | LSM-501S | | 0.05 - 10 | 130 | 32 |
| | 02AGD490 | LSM-503S | | 0.3 - 30 | 200 | 35 |
| | 02AGD520 | LSM-506S* | V-block A (02AGD550), 2 pcs. V-block B (02AGD560), 1 pc. V-block C (02AGD570), 1 pc. | 1 - 60 | 300 | 45 |
| | 02AGD370 | LSM-9506* | | 0.5 - 60 | 200 | 45 |
| | 02AGD680 | | | 0.5 - 60 | 300 | 45 |

* The stop is not included in the basic set for these models.

Note: Optional part for the adjustable workstage, such as center support, adjustable V-block (up/down) etc., are available.

Guide pulley

- Used for supporting measurement of outside diameter of fine wirelike materials such as magnetic wire or fiber.

SPECIFICATIONS

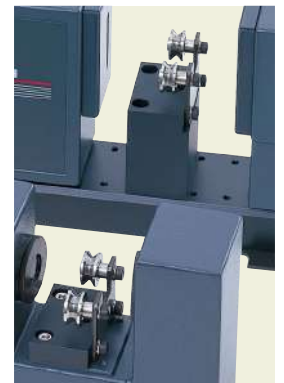
| | | |
|-----------|----------|----------|
| Model | LSM-500S | LSM-501S |
| Order No. | 02AGD200 | 02AGD210 |

Note 1: Each measurement range is as follows:

LSM-500S: ø5 µm to ø1.6 mm

LSM-501S: ø50 µm to ø2 mm

Note 2: For calibration, the calibration gage set for LSM-500S (02AGD110) is required.



Laser Scan Micrometer

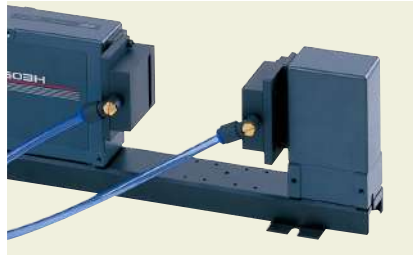
Non-contact, high-speed, high-precision measurement

Optional Accessories

SERIES 544 — Laser Scan Micrometer (Measuring Unit)

Air shield

- Air blows from the air outlet installed on the laser section to clear dust adhering to the laser window.



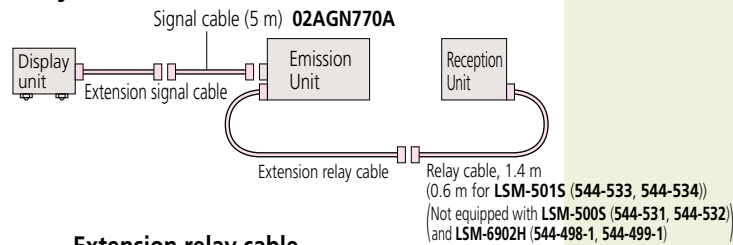
SPECIFICATIONS

| Air supply unit | Air shield | Applicable models |
|-----------------|------------|-----------------------------|
| 957608 | 02AGD220 | LSM-500S (544-531, 544-532) |
| | 02AGD230 | LSM-501S (544-533, 544-534) |
| | 02AGD240 | LSM-503S (544-535, 544-536) |
| | 02AGD250 | LSM-506S (544-537, 544-538) |
| | 02AGD260 | LSM-512S (544-539, 544-540) |

Note: Air shield is supplied with 5 m air tube (Outside Diameter: 6 mm).

Extension signal cable / Extension relay cable

- Extension signal cables are necessary when the measuring unit and display unit are separated in operation; Extension relay cables are necessary when the optical section is separated in operation.



SPECIFICATIONS

Extension signal cable

| Order No. | Cable length |
|-----------|--------------|
| 02AGN780A | 5 m |
| 02AGN780B | 10 m |
| 02AGN780C | 15 m |
| 02AGN780D | 20 m |

Extension relay cable

| Order No. | Cable length |
|-----------|--------------|
| 02AGC150A | 1 m |
| 02AGC150B | 3 m |
| 02AGC150C | 5 m |

Note 1: For 544-531, 544-532, 544-533, 544-534, the total length of the signal cable and the extension signal cable is 20 m at a maximum.

Note 2: For 544-535, 544-536, 544-537, 544-538, 544-539, 544-540, 544-541, 544-542 the total length of the signal cable and the extension signal cable is 30 m at a maximum.

Note 3: The length of the relay extension cable is 5 m at a maximum.

Note 4: The maximum extension length of the signal cable and relay cable is 32 m in total.

Note 5: Cannot be used with 544-498-1 and 544-499-1.

Optional Accessories

SERIES 544 — Laser Scan Micrometer (Display Unit)

Foot switch

- For LSM-6200 (544-071, 544-072), LSM-6902H (544-498-1, 544-499-1) and LSM-9506 (544-115, 544-116).



Optional Accessories

Interface for LSM6200, 6902H

BCD Interface

- Outputs measurement data in BCD output (7-digit) or HEX output.
- Data logic can be switched.
- Isolated I/O circuitry
- Available for LSM-6200 (544-071, 544-072) and LSM-6902H (544-498-1, 544-499-1).



SPECIFICATIONS

| Order No. | 02AGC910 |
|----------------------|-----------------------------------|
| Standard Accessories | Connector (DDK) 57-30360 (214188) |

Optional Accessories SERIES 544 — Laser Scan Micrometer (Display Unit)

Digimatic code output unit

- 2-channel Digimatic code output
- In simultaneous measurement, measurement data are output as follows:
Program No. 0 to No. 4 in OUTPUT-1
Program No. 5 to No. 9 in OUTPUT-2
(10 programs operated)
- 10 pin MIL type connector.
- Output cable is not supplied.
Connecting cable (optional) 1 m (936937)
- Available for **LSM-6200 (544-071, 544-072)** and **LSM-6902H (544-498-1, 544-499-1)**.

Note 1: Output is 6 digits of measurement data.

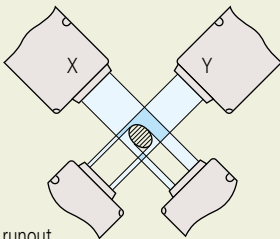
Note 2: Displaying 6th and 7th digit after the decimal point is not supported.



SPECIFICATIONS

| | |
|-----------|----------|
| Order No. | 02AGC840 |
|-----------|----------|

XY Measurement

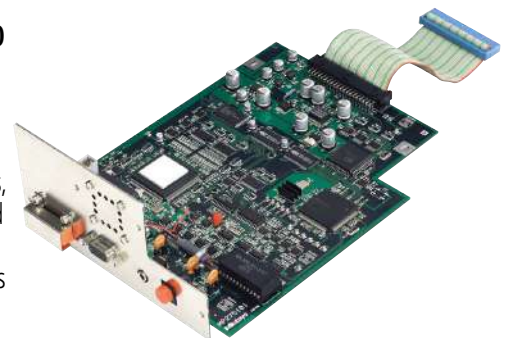


(X-Y): runout
(X+Y)/2: average
Note: XY requires 10 mm-interval.

Dual connection unit

- Enables second unit connection to **LSM-6200 (544-071, 544-072)**. (both units must be the same model)
- Note: Cannot be used for **LSM-6902H (544-498-1, 544-499-1)**.

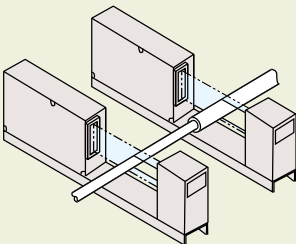
- Depending on the layout of the two measuring units, large-diameter measurement, XY measurement, and parallel measurement are possible.
- Both of the measuring units and display units can be simultaneously operated.



SPECIFICATIONS

| | |
|-----------|----------|
| Order No. | 02AGP150 |
|-----------|----------|

Parallel Measurement

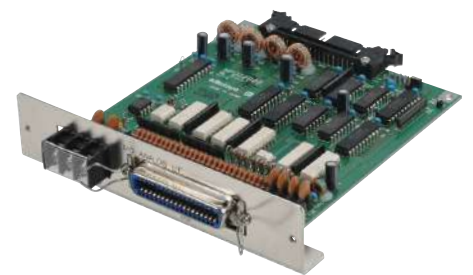


2nd I/O analog I/F

- I/O, analog output.
- Simultaneous measurement is supported by two pairs of GO/NG judgment outputs.
- Available for **LSM-6200 (544-071, 544-072)** and **LSM-6902H (544-498-1, 544-499-1)**.

SPECIFICATIONS

| | |
|----------------------|-----------------------------------|
| Order No. | 02AGC880 |
| Standard Accessories | Connector (DDK) 57-30360 (214188) |



Cable for BCD and 2nd I/O simultaneous mount

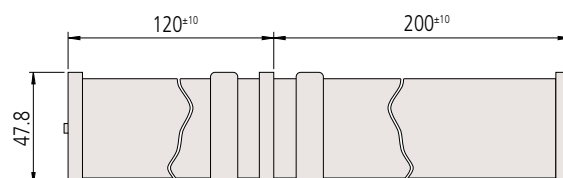
- Both BCD (02AGC910) and 2nd I/O analog I/F (02AGC880) can be mounted on **LSM-6200 (544-071, 544-072)** and **LSM-6902H (544-498-1, 544-499-1)** using this cable.

Note: If using this cable, the dual connection unit (02AGP150) cannot be used.

SPECIFICATIONS

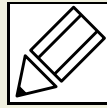
| | |
|-----------|----------|
| Order No. | 02AGE060 |
|-----------|----------|

DIMENSIONS



Unit: mm

Quick Guide to Precision Measuring Instruments



Laser Scan Micrometers

Compatibility

Your Laser Scan Micrometer has been adjusted together with the ID Unit, which is supplied with the measuring unit. The ID Unit, which has the same code number and the same serial number as the measuring unit, must be installed in the display unit. This means that if the ID Unit is replaced the measuring unit can be connected to another corresponding display unit.

The workpiece and measuring conditions

Depending on whether the laser is visible or invisible, the workpiece shape, and the surface roughness, measurement errors may result. If this is the case, perform calibration with a master workpiece which has dimensions, shape, and surface roughness similar to the actual workpiece to be measured. If measurement values show a large degree of dispersion due to the measuring conditions, increase the number of scans for averaging to improve the measurement accuracy.

Electrical interference

To avoid operational errors, do not route the signal cable and relay cable of the Laser Scan Micrometer alongside a high voltage line or other cables capable of inducing noise current in nearby conductors. Ground all appropriate units and cable shields.

Connection to a computer

If the Laser Scan Micrometer is to be connected to an external personal computer via the RS-232C interface, ensure that the cable connections conform to the specification.

Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 device.

Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.

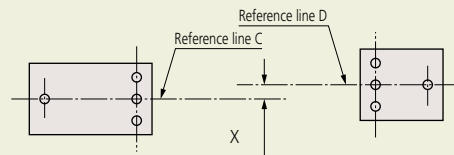


Re-assembly after removal from the base

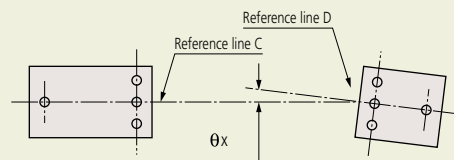
Observe the following limits when re-assembling the emission unit and reception unit to minimize measurement errors due to misalignment of the laser's optical axis with the reception unit.

• Alignment within the horizontal plane

- a. Parallel deviation between reference lines C and D:
X (in the transverse direction)

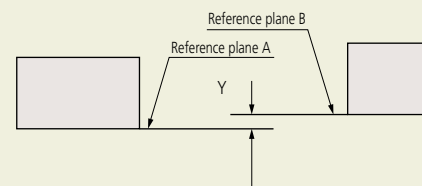


- b. Angle between reference lines C and D: θ_x (angle)

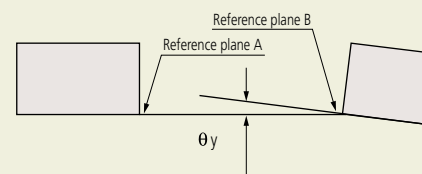


• Alignment within the vertical plane

- c. Parallel deviation between reference planes A and B: Y (in height)



- d. Angle between reference planes A and B: θ_y (angle)

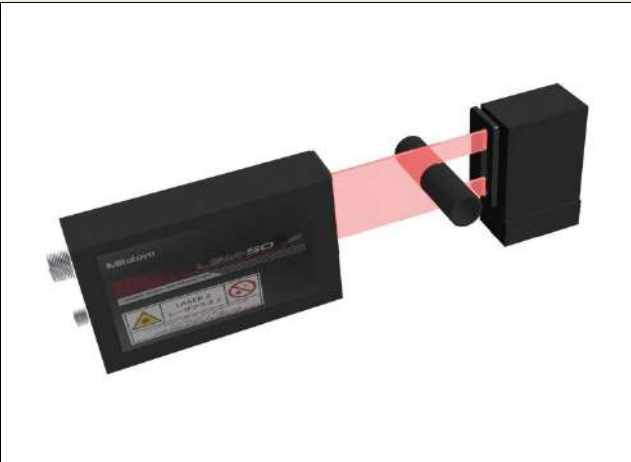


• Allowable limits of optical axis misalignment

| Model | Distance between Emission Unit and Reception Unit | X and Y | θ_x and θ_y |
|----------|---|-------------------------|---------------------------|
| LSM-501S | 68 mm (2.68 in) or less | within 0.5 mm (0.02 in) | within 0.4° (7 mrad) |
| | 100 mm (3.94 in) or less | within 0.5 mm (0.02 in) | within 0.3° (5.2 mrad) |
| LSM-503S | 130 mm (5.12 in) or less | within 1 mm (0.04 in) | within 0.4° (7 mrad) |
| | 350 mm (13.78 in) or less | within 1 mm (0.04 in) | within 0.16° (2.8 mrad) |
| LSM-506S | 273 mm (10.75 in) or less | within 1 mm (0.04 in) | within 0.2° (3.5 mrad) |
| | 700 mm (27.56 in) or less | within 1 mm (0.04 in) | within 0.08° (1.4 mrad) |
| LSM-512S | 321 mm (12.64 in) or less | within 1 mm (0.04 in) | within 0.18° (3.1 mrad) |
| | 700 mm (27.56 in) or less | within 1 mm (0.04 in) | within 0.08° (1.4 mrad) |
| LSM-516S | 800 mm (31.50 in) or less | within 1 mm (0.04 in) | within 0.09° (1.6 mrad) |

Measurement Examples

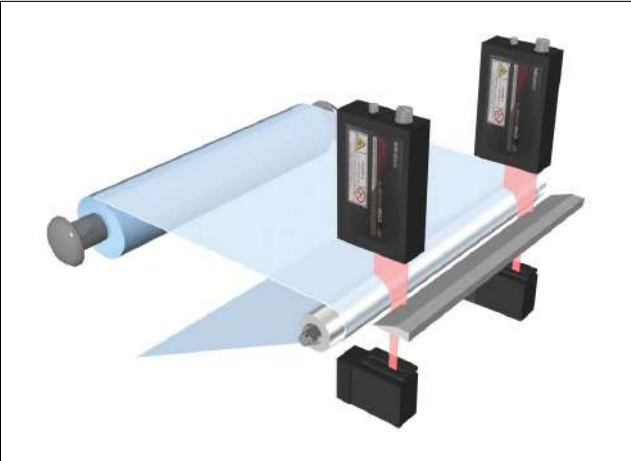
Measurement of outside diameter of rubber roll



Simultaneous measurement of roller outside diameter and deflection



Measurement of uneven thickness of film or sheet (simultaneous measurement)



Measurement of gap between rollers



Measurement of film sheet thickness



Dual system for measuring a large outside diameter



New Products



Assembly Type Scale Unit for Absolute Systems ABS AT1300 Series

Refer to page H-11 for details.



Assembly Type Scale Unit for Absolute Systems ABS AT1100 Series

Refer to page H-12 for details.



Digimatic Scale Units/Linear Scales

ABSOLUTE Digimatic Scale Units



Linear Scales



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ABSOLUTE Digimatic Scale Units

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Linear Scales

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| AT113 Slim Spar Type | H-9 |
| AT211-A, AT211-B Slim Spar, High Speed | H-10 |
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| ABS AT715 Slim Spar Type | H-13 |
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ABSOLUTE Digimatic Scale Units

Designed to accurately capture positional coordinates along an axis

SD ABSOLUTE Digimatic Scale Units SERIES 572



IP66 Horizontal single-function type (Water-proof type)
572-602 SD-20G



Horizontal single-function type
572-202-30 SD-20AX
572-203-10 SD-30D



Horizontal multi-function type
572-461 SD-15E

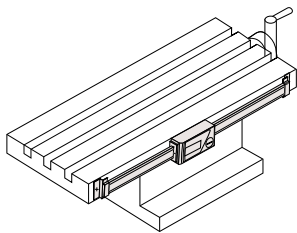


Vertical single-function type
572-303-10 SDV-30D

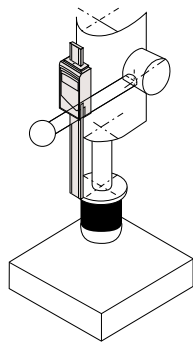
Vertical multi-function type
572-561 SDV-15E

Typical applications

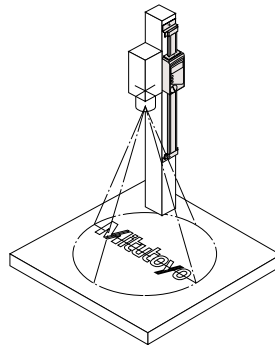
Machine table position



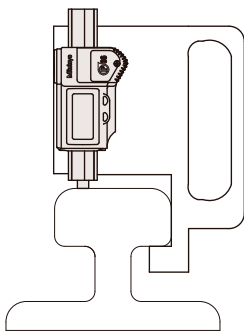
Drilling machine stroke position



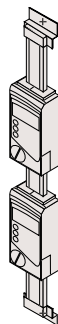
Focus setting on optical instruments



Special applications



As a measurement jig for outdoor use (SD-G)



Detector head mechanism

Please contact Mitutoyo for special applications.

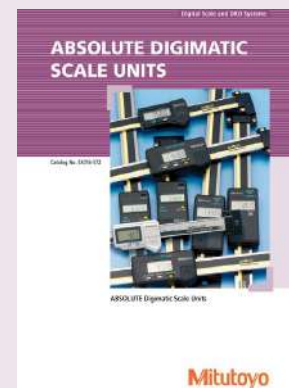
ABSOLUTE™

- SD Series facilitates mounting on jigs, tools, and small machine tools to enable accurate positioning.
- Built-in absolute scale including the ABS point does not require a zero-set every time the power is turned on. In addition, reliability has improved thanks to elimination of overspeed errors.
- Horizontal or vertical display according to the scale mounting direction.
- The dust resistance and the environmental resistance of the display has improved. The **SD-G** Series offers dust/water protection level IP66.
- Long battery life for easier maintenance.
- **EC** counters are available as external display units.
- Equipped with an output port to transfer measurement data, allowing implementation in control systems and gaging systems.

Functions

- ABS (Absolute) measurement function
 - INC (Incremental) measurement function
 - Zero-setting function
 - Presetting function (2 preset values can be set. Not available for **SD-G**, **SD-AX**, **SD-D**, **SDV-D**)
 - Double reading function (Available only for **SD-F** or **SDV-F**)
 - Direction switch function (Available only for **SD-E**, **SDV-E**)
 - Hold function*
 - Measurement value composition error alarm
 - Low battery alarm
 - Output function
- * To activate the hold function when using **SD-AX**, **SD-D** or **SDV-D** models, an optional hold unit is required. Simultaneous activation with the output function is not available.

SD-G models are also available to special order.
Note: These units use 1.5 V silver oxide cells for the power supply. Therefore, when the units are directly fixed to the frame of a machine tool that requires a high voltage, malfunctions such as display digit fluctuations and errors may occur. Countermeasure examples are described in the user manuals provided.



Refer to the ABSOLUTE DIGIMATIC SCALE UNITS Brochure (**E4316**) for more details.

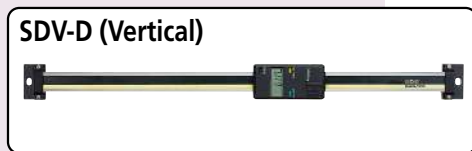
System Diagram

[Scale units]

Single-function type with high dust / water resistance



Single-function type



Multi-function type



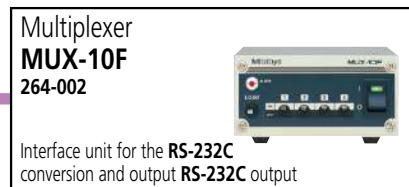
Multi-function type



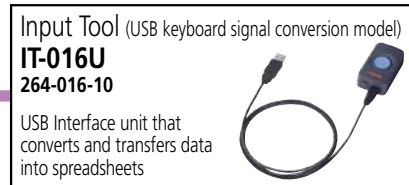
[Display units]



Tolerance judgment output^{*1}

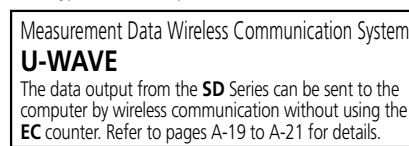


RS-232C output



USB keyboard signal conversion

Note: May also be connected to an RS-232C conversion type (IT-007R) input tool.

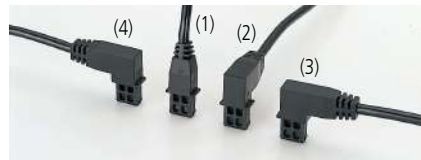


USB keyboard signal conversion

Connecting cable with the water-proof type output switch^{*2} 1 m: 05CZA624
2 m: 05CZA625

Connecting cable with the output switch 1 m: 959149
2 m: 959150

Connecting cable with the output switch



(1) 1 m: 905338 (3) 1 m: 905691
2 m: 905409 2 m: 905692
(2) 1 m: 905689 (4) 1 m: 905693
2 m: 905690 2 m: 905694

Connecting cable 1 m: 936937
2 m: 965014

*1 Select the tolerance judgment output or Digimatic output when setting the parameters.

*2 Connecting cable with the water-proof type output switch can be used only for SD-G or Water-proof Digital Caliper equipped with the external output function.

*3 Connecting of SD Series and DP-1VA LOGGER/MUX-10F/IT-016U is also available without passing through the EC counter. In this case, connect these units and SD Series with the cables used for connection with the EC counter.

ABSOLUTE Digimatic Scale Units

Designed to accurately capture positional coordinates along an axis

ABSOLUTE Digimatic Scale Units SERIES 572 SPECIFICATIONS

| Type | Unit spec. | Order No. | Model | Range | Resolution | Accuracy | Repeatability | Response speed*2 | Battery life | | | | | | |
|---|-------------------------------|--------------------------------|---------------|--------------|-------------------|-------------------|-------------------|--|----------------------|-----------|---------------------|--|------------------|---------------------|----------------------|
| Horizontal single-function type (Water-proof type) | Metric | 572-600 | SD-10G | 100 mm | 0.01 mm | 0.03 mm | 0.01 mm | Unlimited | Approx. 13,000 hours | | | | | | |
| | | 572-601 | SD-15G | 150 mm | | | | | | | | | | | |
| | | 572-602 | SD-20G | 200 mm | | | | | | | | | | | |
| | Metric/Inch | 572-613 | SD-4" /10G | 100 mm/4 in | | | | | | | | | | | |
| | | 572-614 | SD-6" /15G | 150 mm/6 in | | | | | | | | | | | |
| Horizontal single-function type | Metric | 572-615 | SD-8" /20G | 200 mm/8 in | 0.0005 in/0.01 mm | 0.03 mm/0.001 in | | | | 0.01 mm | Unlimited | Approx. 18,000 hours | | | |
| | | 572-200-30 | SD-10AX | 100 mm | | | | | | | | | | | |
| | | 572-201-30 | SD-15AX | 150 mm | | | | | | | | | | | |
| | | 572-202-30 | SD-20AX | 200 mm | | | | | | | | | | | |
| | | 572-203-10 | SD-30D | 300 mm | | | | | | | | | | | |
| | Metric/Inch | 572-210-30 | SD-4" AX | 100 mm/4 in | | | | | | | | | | | |
| | | 572-211-30 | SD-6" AX | 150 mm/6 in | | | | | | | | | | | |
| | | 572-212-30 | SD-8" AX | 200 mm/8 in | | | | | | | | | | | |
| | | 572-213-10 | SD-12" D | 300 mm/12 in | | | | | | | | | | | |
| | | Horizontal multi-function type | Metric | 572-460 | | | SD-10E | 100 mm | 0.0005 in/0.01 mm | | | | 0.03 mm/0.001 in | 0.01 mm | Unlimited |
| 572-461 | SD-15E | | | 150 mm | | | | | | | | | | | |
| 572-462 | SD-20E | | | 200 mm | | | | | | | | | | | |
| 572-463 | SD-30E | | | 300 mm | | | | | | | | | | | |
| 572-464 | SD-45E | | | 450 mm | | | | | | | | | | | |
| 572-465 | SD-60E | | | 600 mm | | | | | | | | | | | |
| 572-466 | SD-80E | | | 800 mm | | | | | | | | | | | |
| 572-467 | SD-100E | | | 1000 mm | | | | | | | | | | | |
| Metric/Inch | 572-470 | | | SD-4" E | 100 mm/4 in | | | | | | | | | | |
| | 572-471 | | | SD-6" E | 150 mm/6 in | | | | | | | | | | |
| | 572-472 | | SD-8" E | 200 mm/8 in | | | | | | | | | | | |
| | 572-473 | | SD-12" E | 300 mm/12 in | | | | | | | | | | | |
| | 572-474 | | SD-18" E | 450 mm/18 in | | | | | | | | | | | |
| | 572-475 | | SD-24" E | 600 mm/24 in | | | | | | | | | | | |
| | 572-476 | | SD-32" E | 800 mm/32 in | | | | | | | | | | | |
| Horizontal multi-function type (equipped with double reading function) | Metric | | 572-477 | SD-40" E | 1000 mm/40 in | 0.0005 in/0.01 mm | 0.03 mm/0.001 in | 0.01 mm (Radius indication, not diameter) | | Unlimited | Approx. 5,000 hours | | | | |
| | | | 572-480-10*1 | SD-10F | 100 mm | | | | | | | | | | |
| | | 572-481-10*1 | SD-15F | 150 mm | | | | | | | | | | | |
| | | 572-482-10*1 | SD-20F | 200 mm | | | | | | | | | | | |
| | | 572-483-10*1 | SD-30F | 300 mm | | | | | | | | | | | |
| | | 572-484-10*1 | SD-45F | 450 mm | | | | | | | | | | | |
| | | 572-485-10*1 | SD-60F | 600 mm | | | | | | | | | | | |
| | | 572-486-10*1 | SD-80F | 800 mm | | | | | | | | | | | |
| | | 572-487-10*1 | SD-100F | 1000 mm | | | | | | | | | | | |
| | | Metric/Inch | 572-490-10*1 | SD-4" F | 100 mm/4 in | | | | | | | | | | |
| | 572-491-10*1 | | SD-6" F | 150 mm/6 in | | | | | | | | | | | |
| | 572-492-10*1 | | SD-8" F | 200 mm/8 in | | | | | | | | | | | |
| | 572-493-10*1 | | SD-12" F | 300 mm/12 in | | | | | | | | | | | |
| | 572-494-10*1 | | SD-18" F | 450 mm/18 in | | | | | | | | | | | |
| | 572-495-10*1 | | SD-24" F | 600 mm/24 in | | | | | | | | | | | |
| | 572-496-10*1 | | SD-32" F | 800 mm/32 in | | | | | | | | | | | |
| | Vertical single-function type | Metric | 572-497-10*1 | SD-40" F | 1000 mm/40 in | | | | 0.01 mm | | | 0.03 mm | 0.01 mm | Unlimited | Approx. 20,000 hours |
| 572-300-10 | | | SDV-10D | 100 mm | | | | | | | | | | | |
| 572-301-10 | | | SDV-15D | 150 mm | | | | | | | | | | | |
| 572-302-10 | | | SDV-20D | 200 mm | | | | | | | | | | | |
| 572-303-10 | | | SDV-30D | 300 mm | | | | | | | | | | | |
| Metric/Inch | | 572-310-10 | SD-4" D | 100 mm/4 in | | | | | | | | | | | |
| | | 572-311-10 | SD-6" D | 150 mm/6 in | | | | | | | | | | | |
| | | 572-312-10 | SD-8" D | 200 mm/8 in | | | | | | | | | | | |
| | | 572-313-10 | SD-12" D | 300 mm/12 in | | | | | | | | | | | |
| | | Vertical multi-function type | Metric | 572-560 | SDV-10E | 100 mm | 0.0005 in/0.01 mm | 0.03 mm/0.001 in | | 0.01 mm | Unlimited | | | | |
| 572-561 | SDV-15E | | | 150 mm | | | | | | | | | | | |
| 572-562 | SDV-20E | | | 200 mm | | | | | | | | | | | |
| 572-563 | SDV-30E | | | 300 mm | | | | | | | | | | | |
| 572-564 | SDV-45E | | | 450 mm | | | | | | | | | | | |
| 572-565 | SDV-60E | | | 600 mm | | | | | | | | | | | |
| 572-566 | SDV-80E | | | 800 mm | | | | | | | | | | | |
| 572-567 | SDV-100E | | | 1000 mm | | | | | | | | | | | |
| Metric/Inch | 572-570 | | | SDV-4" E | 100 mm/4 in | | | | | | | | | | |
| | 572-571 | | | SDV-6" E | 150 mm/6 in | | | | | | | | | | |
| | 572-572 | | SDV-8" E | 200 mm/8 in | | | | | | | | | | | |
| | 572-573 | | SDV-12" E | 300 mm/12 in | | | | | | | | | | | |
| | 572-574 | | SDV-18" E | 450 mm/18 in | | | | | | | | | | | |
| | 572-575 | | SDV-24" E | 600 mm/24 in | | | | | | | | | | | |
| | 572-576 | | SDV-32" E | 800 mm/32 in | | | | | | | | | | | |
| Vertical multi-function type (equipped with double reading function) | Metric | | 572-577 | SDV-40" E | 1000 mm/40 in | 0.01 mm | | | 0.03 mm | | | 0.01 mm (Radius indication, not diameter) | Unlimited | Approx. 5,000 hours | |
| | | | 572-580-10*1 | SDV-10F | 100 mm | | | | | | | | | | |
| | | 572-581-10*1 | SDV-15F | 150 mm | | | | | | | | | | | |
| | | 572-582-10*1 | SDV-20F | 200 mm | | | | | | | | | | | |
| | | 572-583-10*1 | SDV-30F | 300 mm | | | | | | | | | | | |
| | | 572-584-10*1 | SDV-45F | 450 mm | | | | | | | | | | | |
| | | 572-585-10*1 | SDV-60F | 600 mm | | | | | | | | | | | |
| | | 572-586-10*1 | SDV-80F | 800 mm | | | | | | | | | | | |
| | | 572-587-10*1 | SDV-100F | 1000 mm | | | | | | | | | | | |
| | | Metric/Inch | 572-590-10*1 | SDV-4" F | 100 mm/4 in | | | | | | | | | | |
| | 572-591-10*1 | | SDV-6" F | 150 mm/6 in | | | | | | | | | | | |
| | 572-592-10*1 | | SDV-8" F | 200 mm/8 in | | | | | | | | | | | |
| | 572-593-10*1 | | SDV-12" F | 300 mm/12 in | | | | | | | | | | | |
| | 572-594-10*1 | | SDV-18" F | 450 mm/18 in | | | | | | | | | | | |
| | 572-595-10*1 | | SDV-24" F | 600 mm/24 in | | | | | | | | | | | |
| | 572-596-10*1 | | SDV-32" F | 800 mm/32 in | | | | | | | | | | | |
| | 572-597-10*1 | SDV-40" F | 1000 mm/40 in | | | | | | | | | | | | |

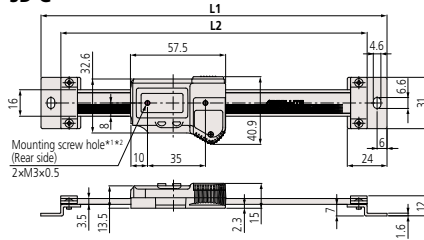
*1 Available to special order

*2 High slider speed does not cause data errors. Position feedback and output data may not be used while the slider is moving.

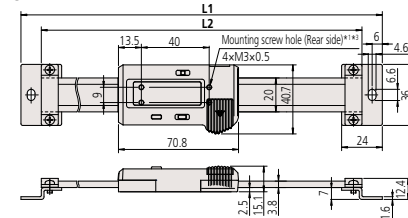
DIMENSIONS

Unit: mm

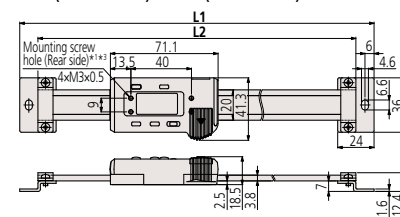
SD-G



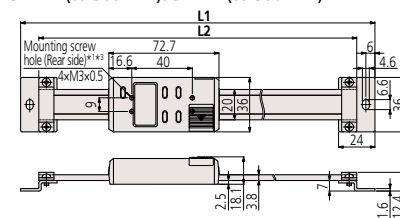
SD-D



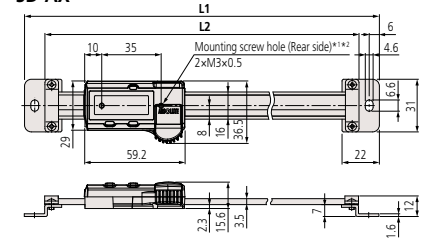
SD-E (to 300 mm)/SD-F (to 300 mm)



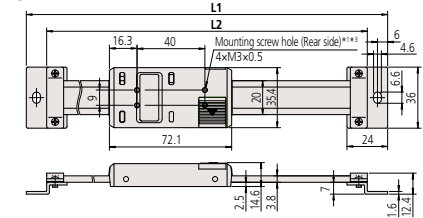
SDV-E (to 300 mm)/SDV-F (to 300 mm)



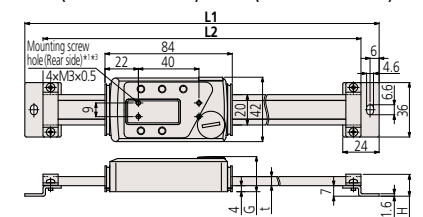
SD-AX



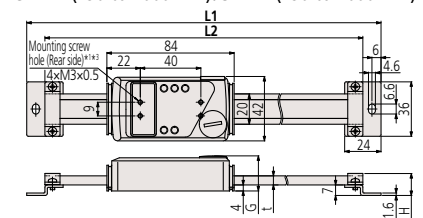
SDV-D



SD-E (450 to 1000 mm)/SD-F (450 to 1000 mm)



SDV-E (450 to 1000 mm)/SDV-F (450 to 1000 mm)



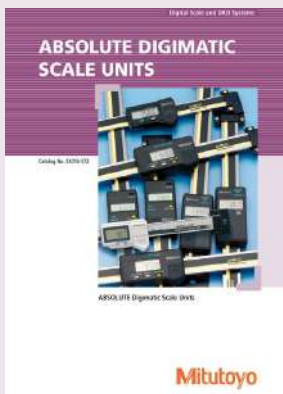
*1 Refer to the dimension table for details of the depth including the screw on the rear of the display.

*2 Mounting screw hole: 2xNo.5-40 UNC (Inch type, Inch/Metric switching type)/2xM3x0.5 (Metric type) Screwed depth on the rear side of display unit: under 2 mm

*3 Mounting screw hole: 4xNo.5-40 UNC (Inch type, Inch/Metric switching type)/4xM3x0.5 (Metric type) Screwed depth on the rear side of display unit: under 2 mm

SPECIFICATIONS

| Model | Range (mm) | Dimensions (mm) | | | | | Depth including the screw on the rear of the display | Mass (g) |
|----------------|------------|-----------------|------|----|------|------|--|----------|
| | | L1 | L2 | t | G | H | | |
| SD-G | 100 | 209 | 185 | — | — | — | Less than 2 mm | 390 |
| | 150 | 259 | 235 | — | — | — | | 410 |
| | 200 | 311 | 287 | — | — | — | | 430 |
| SD-AX | 100 | 209 | 185 | — | — | — | Less than 2 mm | 235 |
| | 150 | 259 | 235 | — | — | — | | 255 |
| | 200 | 311 | 287 | — | — | — | | 275 |
| SD-30D | 300 | 444 | 420 | — | — | — | Less than 2 mm | 370 |
| | 100 | 244 | 220 | — | — | — | | 250 |
| | 150 | 294 | 270 | — | — | — | | 280 |
| SD-E SD-F | 200 | 344 | 320 | — | — | — | Less than 3 mm | 310 |
| | 300 | 444 | 420 | — | — | — | | 370 |
| | 450 | 594 | 570 | 6 | 23.2 | 14.6 | | 760 |
| | 600 | 774 | 750 | 6 | 23.2 | 14.6 | | 900 |
| | 800 | 974 | 950 | 10 | 27.2 | 18.6 | | 1710 |
| | 1000 | 1174 | 1150 | 10 | 27.2 | 18.6 | | 2040 |
| SDV-D | 100 | 244 | 220 | — | — | — | Less than 2 mm | 250 |
| | 150 | 294 | 270 | — | — | — | | 280 |
| | 200 | 344 | 320 | — | — | — | | 310 |
| | 300 | 444 | 420 | — | — | — | | 370 |
| | 100 | 244 | 220 | — | — | — | | 250 |
| | 150 | 294 | 270 | — | — | — | | 280 |
| SDV-E SDV-F | 200 | 344 | 320 | — | — | — | Less than 2 mm | 310 |
| | 300 | 444 | 420 | — | — | — | | 370 |
| | 450 | 594 | 570 | 6 | 23.2 | 14.6 | | 760 |
| | 600 | 774 | 750 | 6 | 23.2 | 14.6 | | 900 |
| | 800 | 974 | 950 | 10 | 27.2 | 18.6 | | 1710 |
| | 1000 | 1174 | 1150 | 10 | 27.2 | 18.6 | | 2040 |

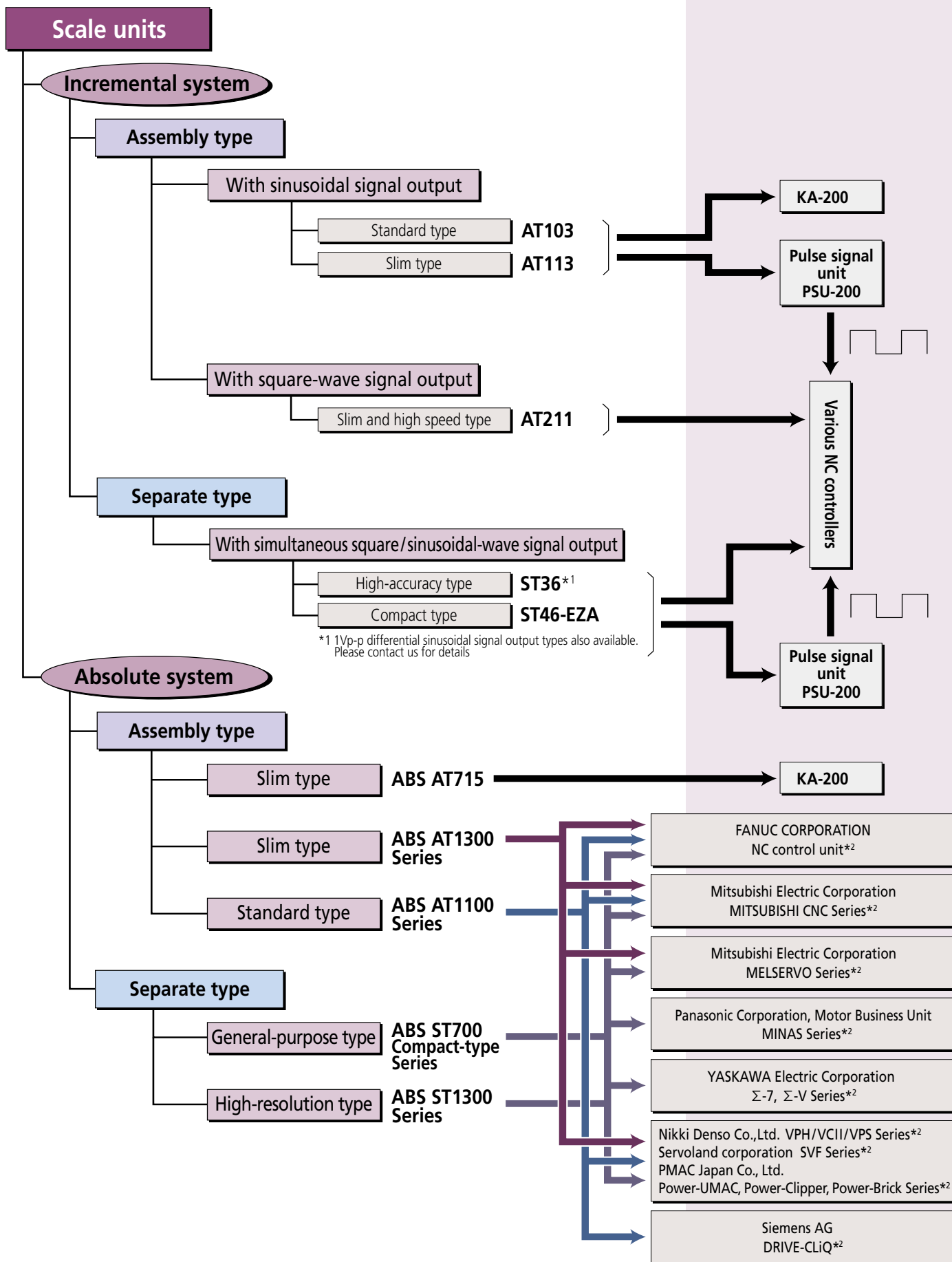


Refer to the ABSOLUTE DIGIMATIC SCALE UNITS Brochure (E4316) for more details.

Linear Scales

Designed to accurately capture positional coordinates along an axis

Linear Scale System Diagram





An inspection certificate is supplied as standard. Refer to page U-11 for details.

- A wide choice of measuring range is available in this standard type scale unit.
- Connectable to the **KA-200** counter or **PSU-200**.

Linear Scales AT103 SERIES 539 — Standard Type



SPECIFICATIONS

| Model | AT103 |
|------------------------|---|
| Effective range | 100 to 6000 mm |
| Accuracy (20 °C) | Effective range 100 to 3000 mm: (5 + 5L _o /1000) μm Effective range 3250 to 6000 mm: (5 + 8L _o /1000) μm |
| Output signal | Two 90° phase-shifted sinusoidal signals |
| Maximum response speed | 120 m/min (50 m/min when the effective measuring length is 3250 to 6000 mm) |
| Signal output pitch | 20 μm |
| Scale reference point | Output in 50 mm pitch |
| Operating temperature | 0 to 45 °C |

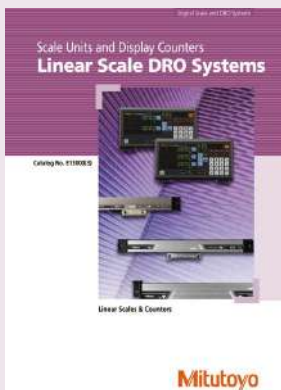
Note 1: High precision model **AT103F** (JIS Class 0, (3 + 3L_o/1000) μm) is also available to special order for the effective range of 100 to 2000 mm.

Note 2: Ultra-high precision model **AT103S** (2 + 2L_o/1000) μm is also available to special order for the effective range of 100 to 500 mm.

Note 3: The indication accuracy does not include quantizing error. L_o=Effective range (mm)

| AT103 | | Effective range* L _o (mm) | Signal cable length (m) |
|------------|------------|---|----------------------------|
| Order No. | Model | | |
| 539-111-30 | AT103-100 | 100 (4 in) | 3 |
| 539-112-30 | AT103-150 | 150 (6 in) | |
| 539-113-30 | AT103-200 | 200 (8 in) | |
| 539-114-30 | AT103-250 | 250 (10 in) | |
| 539-115-30 | AT103-300 | 300 (12 in) | |
| 539-116-30 | AT103-350 | 350 (14 in) | |
| 539-117-30 | AT103-400 | 400 (16 in) | |
| 539-118-30 | AT103-450 | 450 (18 in) | |
| 539-119-30 | AT103-500 | 500 (20 in) | |
| 539-121-30 | AT103-600 | 600 (24 in) | |
| 539-123-30 | AT103-700 | 700 (28 in) | 5 |
| 539-124-30 | AT103-750 | 750 (30 in) | |
| 539-125-30 | AT103-800 | 800 (32 in) | |
| 539-126-30 | AT103-900 | 900 (36 in) | |
| 539-127-30 | AT103-1000 | 1000 (40 in) | |
| 539-128-30 | AT103-1100 | 1100 (44 in) | |
| 539-129-30 | AT103-1200 | 1200 (48 in) | |
| 539-130-30 | AT103-1300 | 1300 (52 in) | |
| 539-131-30 | AT103-1400 | 1400 (56 in) | |
| 539-132-30 | AT103-1500 | 1500 (60 in) | |
| 539-133-30 | AT103-1600 | 1600 (64 in) | 7 |
| 539-134-30 | AT103-1700 | 1700 (68 in) | |
| 539-135-30 | AT103-1800 | 1800 (72 in) | |
| 539-136-30 | AT103-2000 | 2000 (80 in) | |
| 539-137-30 | AT103-2200 | 2200 (88 in) | |
| 539-138-30 | AT103-2400 | 2400 (96 in) | |
| 539-139-30 | AT103-2500 | 2500 (100 in) | |
| 539-140-30 | AT103-2600 | 2600 (104 in) | |
| 539-141-30 | AT103-2800 | 2800 (112 in) | |
| 539-142-30 | AT103-3000 | 3000 (120 in) | |
| 539-143-30 | AT103-3250 | 3250 (130 in) | 10 |
| 539-144-30 | AT103-3500 | 3500 (140 in) | |
| 539-145-30 | AT103-3750 | 3750 (150 in) | |
| 539-146-30 | AT103-4000 | 4000 (160 in) | |
| 539-147-30 | AT103-4250 | 4250 (170 in) | |
| 539-148-30 | AT103-4500 | 4500 (180 in) | |
| 539-149-30 | AT103-4750 | 4750 (190 in) | |
| 539-150-30 | AT103-5000 | 5000 (200 in) | |
| 539-151-30 | AT103-5250 | 5250 (210 in) | |
| 539-152-30 | AT103-5500 | 5500 (220 in) | |
| 539-153-30 | AT103-5750 | 5750 (230 in) | 15 |
| 539-154-30 | AT103-6000 | 6000 (240 in) | |

* Models for the effective range 3250 mm or more are made-to-order.



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.

Linear Scales

Designed to accurately capture positional coordinates along an axis

Linear Scales AT113 SERIES 539 — Slim Type



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Slim type with unit sectional dimensions of 22×35 mm.
- Connectable to the **KA-200** counter or **PSU-200**.

SPECIFICATIONS

| Model | AT113 |
|------------------------|--|
| Effective range | 100 to 1500 mm |
| Accuracy (20 °C) | (5 + 5L ₀ /1000) μm |
| Output signal | Two 90° phase-shifted sinusoidal signals |
| Maximum response speed | 120 m/min |
| Signal output pitch | 20 μm |
| Scale reference point | Output in 50 mm pitch |
| Operating temperature | 0 to 45 °C |

Note 1: High precision model **AT113F** (JIS Class 0, 3 + 3L₀/1000) μm is also available to special order.

Note 2: Ultra-high precision model **AT113S** (2 + 2L₀/1000) μm is also available to special order for the effective range 100 to 500 mm.

Note 3: The indication accuracy does not include quantizing error. L₀=Effective range (mm)

| AT113 | | Effective range L ₀ (mm) | Signal cable length (m) |
|------------|------------|--|----------------------------|
| Order No. | Model | | |
| 539-201-30 | AT113-100 | 100 (4 in) | 3 |
| 539-202-30 | AT113-150 | 150 (6 in) | |
| 539-203-30 | AT113-200 | 200 (8 in) | |
| 539-204-30 | AT113-250 | 250 (10 in) | |
| 539-205-30 | AT113-300 | 300 (12 in) | |
| 539-206-30 | AT113-350 | 350 (14 in) | |
| 539-207-30 | AT113-400 | 400 (16 in) | |
| 539-208-30 | AT113-450 | 450 (18 in) | |
| 539-209-30 | AT113-500 | 500 (20 in) | |
| 539-211-30 | AT113-600 | 600 (24 in) | |
| 539-213-30 | AT113-700 | 700 (28 in) | |
| 539-214-30 | AT113-750 | 750 (30 in) | |
| 539-215-30 | AT113-800 | 800 (32 in) | |
| 539-216-30 | AT113-900 | 900 (36 in) | |
| 539-217-30 | AT113-1000 | 1000 (40 in) | 5 |
| 539-218-30 | AT113-1100 | 1100 (44 in) | |
| 539-219-30 | AT113-1200 | 1200 (48 in) | |
| 539-220-30 | AT113-1300 | 1300 (52 in) | |
| 539-221-30 | AT113-1400 | 1400 (56 in) | |
| 539-222-30 | AT113-1500 | 1500 (60 in) | |



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

- This is a slim, sealed, 2-phase, square-wave scale that can be directly connected to a control unit.
- Scale alarm LED enables easy maintenance.
- A wide range of specifications to best suit your application.
- Suitable for the control of semiconductor manufacturing systems and NC machine tools.

Linear Scales AT211-A (Multipoint mounting) AT211-B (Double-end mounting) SERIES 539 — Slim and high speed Type

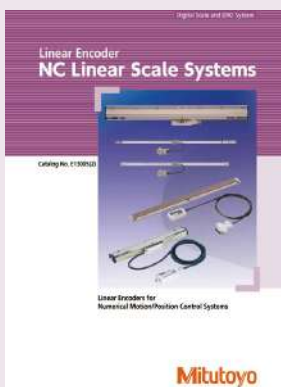
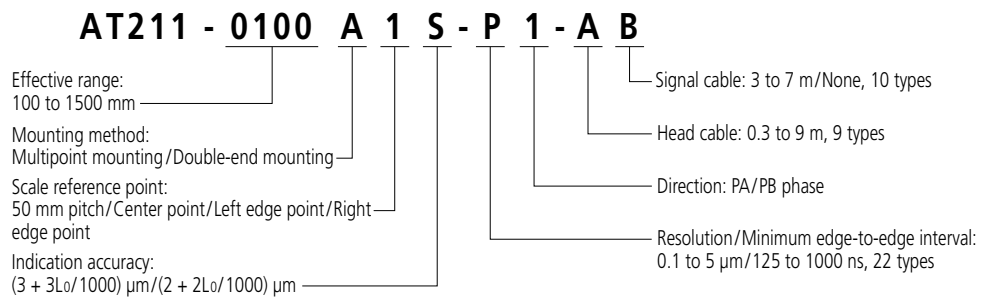


Common specification

| Model | AT211 |
|-------------------------|--|
| Effective range* | 100 to 1500 mm |
| Accuracy (20 °C)* | (3 + 3L ₀ /1000) μm L ₀ =effective range (mm) (2 + 2L ₀ /1000) μm (L ₀ ≤500 mm) |
| Output signal | Two 90° phase-shifted square-wave signals |
| Maximum response speed* | 5.4 to 120 m/min (varies depending on the resolution or minimum edge interval) |
| Resolution* | 0.1/0.2/0.5/1.0/2.5/5.0 μm |
| Scale reference point* | 50 mm pitch/Center point/Left-edge point/Right-edge point |
| Operating temperature | 0 to 45 °C |

* Desired specification is selectable.

Meaning of Model No.



Refer to the NC Linear Scale Systems Brochure (**E13005**) for more details.

Linear Scales

Designed to accurately capture positional coordinates along an axis

Linear Scales ABS AT1300 — Slim Type Assembly Type Scale Unit for Absolute Systems



ABS AT1300-S



ABS AT1300-H

SPECIFICATIONS

| | High rigidity type | High accuracy type |
|--|--|--------------------------------|
| Model | ABS AT13□□(A)-S | ABS AT13□□(A)-H |
| Detection method | Photoelectric type linear encoder | |
| Resolution | 0.001/0.01/0.05 μm | |
| Maximum response speed | 3 m/s | |
| Maximum effective measuring length | 2.2 m | 1 m |
| Accuracy (20 °C)*1 | (3 + 3L _o /1000) μm | (2 + 2L _o /1000) μm |
| Reference point*2 | Center of the effective measuring length | |
| Operating temperature (humidity) range | 0 to 50 °C (RH 20 to 80 %, non-condensing) | |
| Storage temperature (humidity) range | -20 to 70 °C (RH 20 to 80 %, non-condensing) | |

*1 The indication accuracy does not include quantizing error. L_o=Effective range (mm)

*2 Scale is mechanically fixed at this point, therefore expansion caused by temperature fluctuations are relative to this point.

Meaning of Model No.

ABS AT13□□□ - □□□□ - □

Interface specifications

Effective range

Type of the scale unit

S : High rigidity type
H : High accuracy type

| Model | Applicable system |
|-------------|---|
| ABS AT135□ | FANUC CORPORATION Serial αi Interface |
| ABS AT134□ | Mitsubishi Electric Corporation MDS-D/MDS-DH Series |
| ABS AT134□A | Mitsubishi Electric Corporation MELSERVO servo amplifier MR-J4 Series |
| ABS AT130□A | Mitutoyo ENSIS |

Note 1: Be sure to contact each manufacturer for details of the applicable systems.

Note 2: ABS AT13□□□

Resolution — Transmission method
7: 0.001 μm Nothing: Full duplex communication
4: 0.01 μm A: Half-duplex communication
3: 0.05 μm

Signal cable specifications (optional)

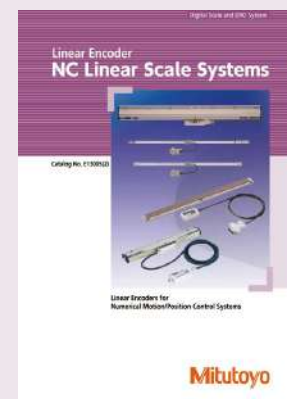
| Items | Specifications |
|----------------------|---|
| Cable length | 1 m, 2 m, 3 m, 4 m, 5 m, 6 m, 7 m, 8 m, 9 m, 12 m |
| Cable material | PVC sheath (ø6.5 mm), High-flex connecting cable (No metal conduit) |
| I/O output connector | Flying lead specifications FANUC specifications Mitsubishi specifications D-sub specifications (Alarm display LED mounted) |

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Outstanding resistance to contamination compared to conventional optical types by using a new detection principle (in-house testing result).
- Features a new coolant-proof design incorporating a high-performance rubber seal to provide higher reliability in the harsh factory environment.
- Delivers high accuracy and the outstanding resolution of 0.001 μm, the best-in-class in absolute scales.
- Allows space-saving design thanks to a slim form. (AT500-S and AT500-H are compatible with each other in installation.)
- Supports the interfaces of various manufacturers allowing a variety of system configurations.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Features a new coolant-proof design incorporating a high-performance rubber seal to provide higher reliability in the harsh factory environment.
- The 0.4 mm air gap between the sensors is approximately four times wider than the conventional optical or magnetic sensors. Therefore, the chance of foreign objects lodging in this gap is lower. This air gap is the world's largest in this class of scale used on machine tools.
- The de facto standard multi-point fixing method for the frame is adopted, resulting in high vibration/shock-resistance.
- Due to an improvement in the signal processing technique for the electromagnetic induction ABSOLUTE linear encoder, the repeatability is six times better than our conventional model.
- Being compatible with the high-speed serial interface of each company, a direct connection to the NC controller is possible.

Linear Scales ABS AT1100 Assembly Type Scale Unit for Absolute Systems



ABS AT1100

SPECIFICATIONS

| Model | ABS AT11□3(A) |
|---|---|
| Detection method | Electromagnetic induction |
| Mounting method | Frame multipoint |
| Effective range | 140 to 3040 mm |
| Resolution | 0.05 μm |
| Maximum response speed | 3 m/s |
| Accuracy (20 °C) | Effective length L ₀ =140 to 2040 mm: 3 + 5L ₀ /1000 (μm) Effective length L ₀ =2240 to 3040 mm: 5 + 5L ₀ /1000 (μm) |
| Expansion coefficient | ≈8×10 ⁻⁶ /K |
| Vibration resistance | ≤196 m/s ² (20 G) (55 to 2000 Hz) |
| Shock resistance | Effective length L ₀ =140 to 2040 mm: ≤343 m/s ² (35 G) Effective length L ₀ =2240 to 3040 mm: ≤294 m/s ² (30 G) (1/2 sin 11 ms) |
| Power supply voltage | ABS AT1153/1143/1103A: 5 VDC ± 10% ABS AT1123: DC24 V (Conforming to DRIVE-CLiQ) |
| Maximum current consumption | AT1153: 300 mA (Max.) AT1143: 290 mA (Max.) AT1123: 140 mA (Max.) AT1103A: 300 mA (Max.) |
| Operational temperature (humidity) ranges | 0 to 50 °C (RH 20 to 80 %, non-condensing) |
| Storage temperature (humidity) ranges | -20 to 70 °C (RH 20 to 80 %, non-condensing) |

Meaning of Model No.

ABS AT11□3 - □□□□
Effective range

Interface specifications

| Model | Applicable system |
|--------------------|--|
| ABS AT1153 | FANUC CORPORATION Serial ai Interface |
| ABS AT1143 | Mitsubishi Electric Corporation MDS-D/MDS-DH Series |
| ABS AT1123 | Siemens AG DRIVE-CLiQ |
| ABS AT1103A | Mitutoyo ENSIS |

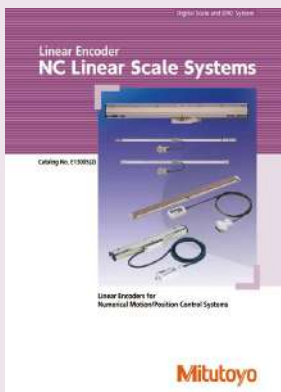
Note 1: Please contact each manufacturer for details of the applicable systems.

Note 2: **ABS AT11□3□**

- Transmission method
- Nothing: Full duplex communication
- A:** Half-duplex communication

Signal cable specifications (optional)

| Items | Specifications |
|----------------------|---|
| Cable length | 1 m, 3 m, 6 m, 9 m, 12 m |
| Cable material | PVC sheath ø6.5 Without conduit, High-flex specification with conduit PUR sheath ø6.5 Without conduit |
| I/O output connector | Flying lead specifications FANUC specifications Mitsubishi specifications Mitutoyo standard specifications Siemens specifications M12 connector specifications |



Refer to the NC Linear Scale Systems Brochure (**E13005**) for more details.

Linear Scales

Designed to accurately capture positional coordinates along an axis

Linear Scales ABS AT715 SERIES 539 — Slim Type

IP67



ABSOLUTE™



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

- The electromagnetic induction principle adopted means Absolute system-type linear scales are highly resistant to environmental contamination.
- Absolute scales have eliminated the need for origin restoration, also drastically reducing power consumption.

SPECIFICATIONS

| Model | ABS AT715 | |
|----------------------------|--|------------------|
| Detection method | Electromagnetic induction | |
| Minimum resolution | 0.001 mm to 0.01 mm (Changeable by parameter on the KA-200 counter) | |
| Effective range | 100 to 3000 mm | |
| Accuracy (20 °C) | ±5 μm (Lo: 100 to 500 mm), ±7 μm (Lo: 600 to 1800 mm), ±10 μm (Lo: 2000 to 3000 mm) Lo=Effective range (mm) | |
| Maximum response speed | 50 m/min | |
| Protection level | IP67 | |
| Sliding force | 5 N or less | |
| Signal cable | Standard Accessories Refer to the dimension table shown below for the length. | |
| Extension cable (optional) | Length | Order No. |
| | 2 m | 09AAB674A |
| | 5 m | 09AAB674B |
| | 7 m | 09AAB674C |
| Connectable counter | KA-200 Counter | |

| AT715 | | Effective range Lo (mm) | Signal cable length (m) | |
|-----------|----------------|----------------------------|----------------------------|---|
| Order No. | Model | | | |
| 539-801 | ABS AT715-100 | 100 (4 in) | 3.5 | |
| 539-802 | ABS AT715-150 | 150 (6 in) | | |
| 539-803 | ABS AT715-200 | 200 (8 in) | | |
| 539-804 | ABS AT715-250 | 250 (10 in) | | |
| 539-805 | ABS AT715-300 | 300 (12 in) | | |
| 539-806 | ABS AT715-350 | 350 (14 in) | | |
| 539-807 | ABS AT715-400 | 400 (16 in) | | |
| 539-808 | ABS AT715-450 | 450 (18 in) | | |
| 539-809 | ABS AT715-500 | 500 (20 in) | | |
| 539-811 | ABS AT715-600 | 600 (24 in) | | |
| 539-813 | ABS AT715-700 | 700 (28 in) | | |
| 539-814 | ABS AT715-750 | 750 (30 in) | | |
| 539-815 | ABS AT715-800 | 800 (32 in) | | |
| 539-816 | ABS AT715-900 | 900 (36 in) | | |
| 539-817 | ABS AT715-1000 | 1000 (40 in) | | 5 |
| 539-818 | ABS AT715-1100 | 1100 (44 in) | | |
| 539-819 | ABS AT715-1200 | 1200 (48 in) | | |
| 539-820 | ABS AT715-1300 | 1300 (52 in) | | |
| 539-821 | ABS AT715-1400 | 1400 (56 in) | | |
| 539-822 | ABS AT715-1500 | 1500 (60 in) | | |
| 539-823 | ABS AT715-1600 | 1600 (64 in) | | |
| 539-824 | ABS AT715-1700 | 1700 (68 in) | | |
| 539-825 | ABS AT715-1800 | 1800 (72 in) | | |
| 539-860 | ABS AT715-2000 | 2000 (80 in) | 7* | |
| 539-861 | ABS AT715-2200 | 2200 (88 in) | | |
| 539-862 | ABS AT715-2400 | 2400 (96 in) | | |
| 539-863 | ABS AT715-2500 | 2500 (100 in) | | |
| 539-864 | ABS AT715-2600 | 2600 (104 in) | | |
| 539-865 | ABS AT715-2800 | 2800 (112 in) | | |
| 539-866 | ABS AT715-3000 | 3000 (120 in) | | |

* Combination of a 5 m signal cable and a 2 m extension cable



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.

KA-200 Counter SERIES 174 — Standard Type

- **KA-200** counter is high-performance unit that can be used as "standard counter" or "lathe counter".
- Downsizing and weight saving have been realized.
- The RS-232C interface enables connection to a PC or printer.

Optional Accessory

- Code out unit: **06AET993**

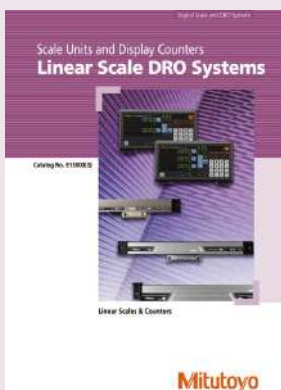


174-183
KA-212

SPECIFICATIONS

| Order No. | 174-183 □ | 174-185 □ |
|--------------------------------|--|-----------|
| Model | KA-212 | KA-213 |
| Number of axes to be displayed | 2 | 3 |
| Resolution | (Changeable according to the parameter) When AT100 is connected: 0.05 to 0.0001 mm When AT715 is connected: 0.01 to 0.001 mm | |
| Display/digit | Main display: 9 digits including sign Sub display: 8 digits | |
| Power supply voltage | AC 100 to 240 V, 50/60 Hz | |
| Dimensions | 300 (W) x 70 (D) x 167 (H) mm | |
| Output (optional) | RS-232C | |
| Mass | 1.25 kg | 1.3 kg |

□: To denote your AC power cable add the following suffixes to the order No. :
A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.




























Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.

Linear Scales

Designed to accurately capture positional coordinates along an axis

Linear scale counter

FUNCTIONS

| Function | Type | High performance  KA-200 Counter |
|---|---|---|
| Zero-setting |  | ● |
| Preset |  | ● |
| Resolution setting |  | ● |
| Measurement direction setting |  | ● |
| mm/inch conversion |  | ● |
| Diameter display |  | ● |
| Scale reference point setting*1 |  | ● |
| 1/2 calculation |  | ● |
| Coordinate system switching |  | ● |
| Bolt-hole circle machining |  | ●*2 |
| Pitch machining |  | ● |
| Zero approach machining (INC mode) |  | ● |
| Addition of 2-axis data |  | ●*3 |
| Linearity error compensation |  | ● |
| Pitch error compensation |  | ●*1 |
| Smoothing |  | ● |
| Memory backup |  | ● |
| Expansion/contraction coefficient setting |  | — |
| Lower digit blanking out |  | ● |
| External zero-setting |  | ▲*4 |
| RS-232C output |  | ▲*4 |
| USB output |  | ▲*5 |
| Limit signal output |  | — |
| Error message |  | ● |

●: Standard function, ▲: Optional function, —: Not available

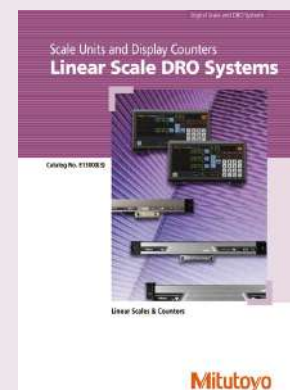
*1 Only available when connecting with **AT100** Series.

*2 Not available in single-axis use

*3 Only available for 3-axis model (**KA-213**)

*4 Code out unit (**06AET993**) is required.

*5 Text can be output by code out unit and foot switch



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Outputs 2-phase sinusoidal wave signals at 4 μm pitch.
- The maximum effective measuring length is 3000 mm when the resolution is 0.01/0.02/0.05/0.1 μm (2-phase square-wave is output).
- Compact detector head enables space saving design.
- Along with the output specifications of 2-phase sinusoidal wave and 2-phase square-wave, the output specification of 1Vp-p wave is also available.
- Equipped with the function to display signal errors on the LED.

Linear Scales ST36 SERIES 579 — High Accuracy Type

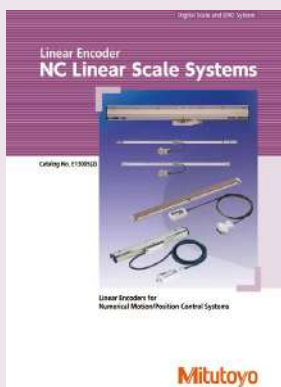


SPECIFICATIONS

| Model | ST36 |
|--|--|
| Detection method | Reflective photoelectric linear encoder |
| Output signal | ST36A : 2Vp-p sinusoidal signals ST36B : 2-phase square-wave signals, Alarm reset input ST36C : 2-phase square-wave signals, 2-phase sinusoidal signals ST36D : 1Vp-p differential sinusoidal signals |
| Main scale grating pitch | 8 μm |
| Signal output pitch | 4 μm |
| Effective range | 10 to 3000 mm |
| Accuracy (20 °C)* ¹ | $\pm 0.5 \mu\text{m}$, $\pm 1 \mu\text{m}$, $\pm 2 \mu\text{m/m}$ |
| Maximum response speed* ² | 1200 mm/s |
| Scale reference point | 10 to 80 mm: 1 center point; 100 to 300 mm: 50 mm pitch |
| Power supply voltage | 5 VDC $\pm 5\%$ |
| Operating temperature (humidity) range | 0 to 40 °C (20 to 80 % RH, non-condensing) |
| Storage temperature (humidity) range | -20 to 60 °C (20 to 80 % RH, non-condensing) |
| Head cable length | 1 m (high-flex connecting cable) |

| *1 | Effective range | Accuracy |
|----|-----------------|-----------------------|
| | 300 mm or less | $\pm 0.5 \mu\text{m}$ |
| | 500 mm or less | $\pm 1 \mu\text{m}$ |
| | 1000 mm or less | $\pm 2 \mu\text{m}$ |
| | 3000 mm or less | $\pm 2 \mu\text{m/m}$ |

*2 Maximum response speed when sinusoidal signals are output



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Linear Scales

Designed to accurately capture positional coordinates along an axis

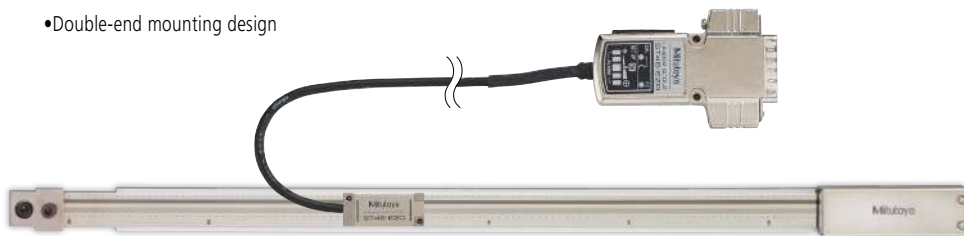
Linear Scales ST46-EZA SERIES 579 — Compact Type

Glass Scale Type

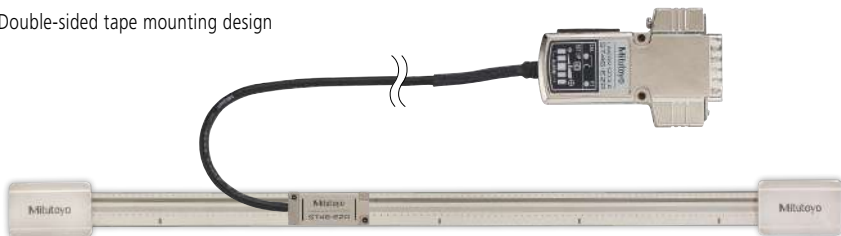


Metal Tape Scale Type

- Double-end mounting design



- Double-sided tape mounting design



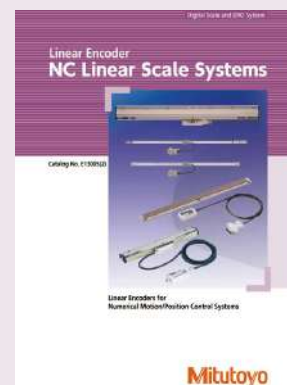
SPECIFICATIONS

| Model | ST46-EZA | |
|--|--|---|
| Detection method | Reflective photoelectric linear encoder | |
| Scale type | Glass | Metal tape |
| Main scale grating pitch | 20 μm | |
| Output signal | Type B: 2-phase square-wave signals, reference point pulse, external reset input. Type C: 2-phase square-wave signals, reference point pulse, 2-phase sinusoidal signals. | |
| Effective range | 10 to 3000 mm | |
| Accuracy (20 °C) | Effective range 10 to 300 mm: $\pm 1 \mu\text{m}$ Effective range 350 to 500 mm: $\pm 2 \mu\text{m}$ Effective range 600 to 1000 mm: $\pm 3 \mu\text{m}$ Effective range 1100 to 3000 mm: $\pm 3 \mu\text{m/m}$ | Effective range 10 to 1000 mm: $\pm 5 \mu\text{m}$ Effective range 1100 to 3000 mm: $\pm 5 \mu\text{m/m}$ (The above accuracy applies to individual scales. For double-end mounting designs, perform point-to-point correction after ensuring the metal tape is tensioned correctly.) |
| Maximum response speed | 2.6 m/s (at the point where the sinusoidal signal amplitude has decreased by 3 dB) | |
| Scale reference point | 10 to 80 mm: 1 center point; 100 to 300 mm: 50 mm pitch | |
| Power supply voltage | 5 VDC $\pm 5\%$ | |
| Operating temperature (humidity) range | 0 to 40 °C (RH 20 to 80 %, non-condensing) | |
| Storage temperature (humidity) range | -20 to 60 °C (RH 20 to 80 %, non-condensing) | |
| Head cable length | 1 m (high-flex connecting cable) | |



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Glass and metal tape versions are available.
- Includes an automatic adjusting function for the signal (EZA function) at the push of a button.
- Detector head mounting and signal adjustment possible without oscilloscope or PC.
- A setup indicator for checking signal strength is included.
- Self-diagnosis function with USB connectivity facilitates signal strength checking and parameter setup.
- I/F circuit integrated in connector shell reduces volume to 60 % compared to conventional interface.
- The thickness of the detector head is only 7.5 mm. The metal tape scale type has a mounting surface area of 12.5 by 9.325 mm, allowing use in applications where a space-saving design is important.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Absolute measurement with separate type scales
- Non-contact detection is optimal for high speed and high acceleration devices such as linear motors
- Electromagnetic induction principle means scales are unaffected by water and oil contamination
- The detector head is approximately 1/3 the previous model size: 50 mm (W) x 28 mm (D) x 11 mm (H)
- Cable outlets can be in four directions, with mounting holes on the top and sides
- Compatible with servo amplifiers from a range of companies (high-speed serial interfaces)

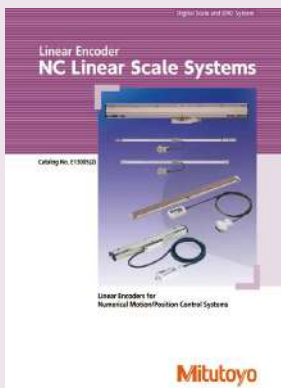
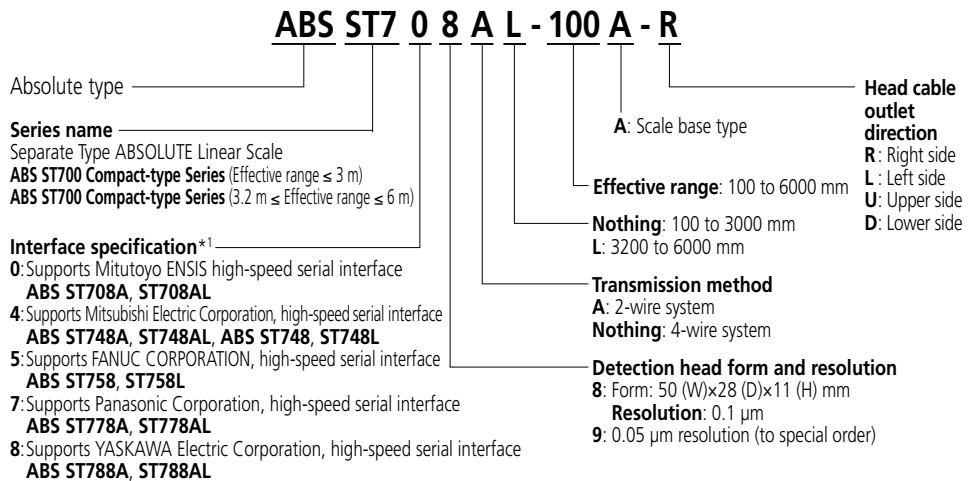
Linear Scales ABS ST700 SERIES 579 — General-purpose Type



SPECIFICATIONS

| | | |
|--|--|--|
| Model | ABS ST700 | |
| Scale type | Scale base | |
| Resolution | 0.1 μm | |
| Detection method | Electromagnetic induction ABS linear encoder | |
| Max. effective range | 100 to 3000 mm | 3200 to 6000 mm |
| Accuracy (20 °C) | 5 + (5L/1000) μm L=Effective range (mm) | 3 + (5L/1000) μm L=Effective range (mm) |
| Maximum response speed | 5 m/s | |
| Power supply voltage | 5 VDC ± 10% (at the detection head) (Ripple+spike noise component should be less than 100 mV) | |
| Maximum current consumption | 270 mA | |
| Head cable length | 1 m (high-flex connecting cable) | |
| Maximum cable length | 29 m (including the head cable length) | |
| Operating temperature (humidity) range | 0 to 50 °C (RH 20 to 80 %, non-condensing) | 0 to 50 °C (RH 20 to 70 %, non-condensing) |
| Storage temperature (humidity) range | -20 to 70 °C (RH 20 to 80 %, non-condensing) | -20 to 60 °C (RH 20 to 70 %, non-condensing) |

Meaning of Model No.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Available Interfaces*1

| |
|--|
| FANUC CORPORATION, FANUC αi Series CNC |
| Mitsubishi Electric Corporation, MITSUBISHI CNC Drive Unit MDS Series |
| Mitsubishi Electric Corporation, MELSERVO Servo Amplifier MR-J4 Series, MR-J3 Series |
| YASKAWA Electric Corporation, SERVOPACK Σ-7 Series, Σ-V Series |
| Panasonic Corporation, MINAS A5 Series, MINAS A6 Series |
| Mitutoyo ENSIS*2 |
| Nikki Denso Co., Ltd. VPH/VC II/VPS Series |
| Servoland Corporation SVF Series |
| PMAC Japan Co., Ltd. Power-UMAC, Power-Clipper, Power-Brick Series |

*1 Be sure to contact each manufacturer for details of the applicable systems (availability of connection).

*2 ENSIS is a registered trademark of Mitutoyo Corporation.

Linear Scales

Designed to accurately capture positional coordinates along an axis

Linear Scales ABS ST1300 SERIES 579

Double-end mounting type



Double-sided tape mounting type



SPECIFICATIONS

| Model | ABS ST1300 | | |
|--------------------------------------|--|---|---|
| Detection method | Optical reflection type linear encoder | | |
| Scale type | Double-end mounting | Center mounting | Double-sided tape mounting |
| Maximum effective length | 12000 mm | 6000 mm | 3000 mm |
| Fixing part material | — | — | Equivalent to iron Other than equivalent to iron |
| Accuracy (20 °C) | ±5 μm (1 m or less), ±5 μm/m (1.1 m or more)*4 | With system parameters: ±5 μm (1 m or less), ±5 μm/m (1.1 m or more) Without system parameters: ±10 μm (1 m or less), ±10 μm/m (1.1 m or more) | ±5 μm (1 m or less), ±5 μm/m (1.1 m or more) |
| Maximum response speed | 8 m/s or less | | |
| Expansion coefficient | ≈10×10 ⁻⁶ /K*5 | ≈10×10 ⁻⁶ /K | ≈10×10 ⁻⁶ /K*2 |
| Power supply | 5 VDC ± 10% | | |
| Maximum current consumption | 270 mA or 250 mA (depends on interface) | | |
| Cable length | 1 m (high-flex connecting cable) | | |
| Maximum cable length | 29 m (including head cable) | | |
| Usable temperature (humidity) range | 0 to 50 °C (RH 20 to 70 %, non-condensing) | | 0 to 50 °C*1 (RH 20 to 70 %*3, non-condensing) When mounting: ±10 °C |
| Storage temperature (humidity) range | -20 to 70 °C (RH 20 to 70 %, non-condensing) | | |

*1 Double-sided tape fixing type, careful for the condition of operating temperature range, in case that the sealing surface material is except for Fe equivalent.

*2 Thermal expansion coefficient occasionally change, as the difference between scale material's and sealing surface material's is excessive.

*3 Double-sided tape fixing type, the accuracy compensation occasionally change, in case that the sealing surface material is except for Fe equivalent and stored in environment over operating temperature range. Imaging these conditions, double-end fixing type is adopted.

*4 Tension fix is adopted to be stable the temperature property. Because scale tension is longer 250 μm/m, the accuracy compensation is needed over the system.

*5 Thermal expansion coefficient after mounted conform to expansion/contraction of mounted surface by changing outer temperature (Double-end fixing type).

Note: For details on specification, mounting procedure, and adjustments, refer to the corresponding brochure and operation manual.

Meaning of Model No.

ABS ST13 4 1 A - 1200 D

Absolute type

Series name

Separate Type ABSOLUTE Linear Scale

Interface specification*1

0: Supports Mitutoyo ENSIS high-speed serial interface

ABS ST130□A

4: Supports Mitsubishi Electric Corporation, high-speed serial interface

ABS ST134□A

5: Supports FANUC CORPORATION, high-speed serial interface

ABS ST135□

7: Supports Panasonic Corporation, high-speed serial interface

ABS ST137□A

8: Supports YASKAWA Electric Corporation, high-speed serial interface

ABS ST138□A

Scale mount

D: Double-end mounting

E: Double-sided tape mounting

F: Center mounting (With system parameters)

G: Center mounting (Without system parameters)

Effective range: 10 to 12000 mm

Transmission method

A: When 0, 4, 7, or 8 is selected in the interface specification listed on the left

Nothing: When 5 is selected in the interface specification listed on the left

Resolution

1: Resolution 0.01 μm

2: Resolution 0.001 μm

Available Interfaces*1

FANUC CORPORATION, FANUC αi Series CNC

Mitsubishi Electric Corporation, MELSERVO Servo Amplifier MR-J4 Series

YASKAWA Electric Corporation, SERVOPACK Σ-7 Series, Σ-V Series

Panasonic Corporation, MINAS A5 Series, MINAS A6 Series

Mitutoyo ENSIS*2

*1 Be sure to contact each manufacturer for details of the applicable systems (availability of connection).

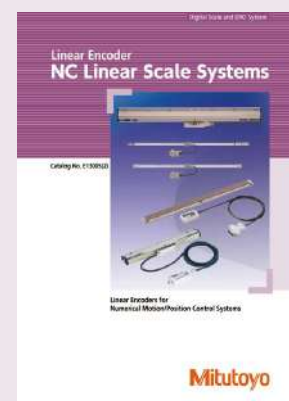
*2 ENSIS is a registered trademark of Mitutoyo Corporation.

ABSOLUTE™



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Effective length: 12 m, Maximum response speed: 8 m/s, Resolution: 1 nm
- Various interfaces are supported.
- A new detection method has improved robustness in regards to contamination resistance and gap tolerance (in-house testing result).
- Can be mounted using double-sided tape or screws (on both sides or at the center of the unit).
- Signal check program enables integrity check and maintenance.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

- The **PSU-200** splits the sinusoidal signal output by Mitutoyo linear scales into a minimum of four and a maximum of 200 divisions, and converts the signal to a square-wave signal so that NC feedback systems, measurement control devices, etc., can be used with linear scales in order to achieve highly accurate positioning.

Pulse signal interface unit PSU-200 SERIES 539



SPECIFICATIONS

| | |
|-----------------------------|---|
| Order No. | 539-005 |
| Model | PSU-200 |
| Number of axes | 1 |
| Input | Input connector DA-15S-N (JAE) or equivalent Input signal: 2-phase sinusoidal and the reference voltage, Reference point, Scale alarm |
| Output | Output connector: MR-20RMA (HONDA TSUSHIN KOGYO CO., LTD.) Output signal: 2-phase square-wave signals (PA, PB), reference point (PZ), Alarm, Alarm reset, Photo-coupler |
| Number of divisions | 4, 8, 10, 20, 40, 80, 100, 200 (Selectable by switch) |
| Function | Setting the number of divisions, setting the minimum edge interval, and maximum response speed. Detection of broken wires or short circuits and abnormalities (alarm), detection of signal errors (alarm). Power supply voltage low alarm (warning light only), switching between high-impedance mode and alarm signal output mode. Reference position detection light, hysteresis width settings (directly linked to No. of divisions), external alarm reset input (Photo-coupler) |
| Power supply voltage | 5 VDC \pm 5% |
| Current consumption | 200 mA |
| Operating temperature range | 0 to 50 °C |
| Storage temperature range | -20 to 70 °C |
| Dimensions | 160 (W) \times 100 (D) \times 28 (H) mm |
| Mass | Approx. 620 g |

- **PSU-251** Series is a serial signal interface unit for incremental linear scales.

The interface outputs serial data equivalent to 400 divisions from the sinusoidal signal (according to EIA Standard **RS-422-A**)

- The **PSU-251** can be connected to Mitsubishi Electric Corporation's MR-J4/MR-J3 Series servo amplifier.
- Since this unit is connected to incremental linear scales, the reference point should be passed through to determine the absolute position.

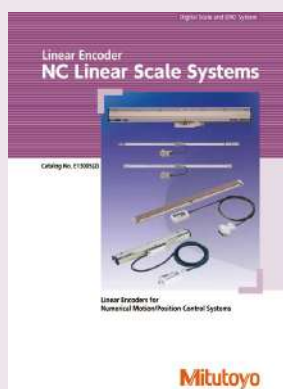
Serial signal interface unit PSU-251/252 SERIES 539



SPECIFICATIONS

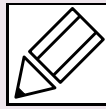
| | | |
|-----------------------------|--|---|
| Order No. | 539-006 | 539-007 |
| Model | PSU-251 | PSU-252 |
| Number of axes | 1 | |
| Input | 2-phase sinusoidal signals and standard voltage, reference signal, scale alarm signal. Maximum input frequency: 500 kHz | |
| Output | Mitsubishi Electric Corporation MR-J4/MR-J3 Series High-speed serial data* | Panasonic Corporation Motor Business Unit MINAS-A5, A5L, A5N, A5NL Series* MINAS-A4, A4P, A4N, A4NL Series* |
| Number of divisions | 400 | |
| Function | Alarm detection: Broken wires, short circuits in the scale and abnormalities. Alarm output: Status data is output through serial communication and the PWR light blinks. Also, the PWR light turns on. | |
| Power supply voltage | Power supply from the servo amplifier: 5 VDC \pm 5% External power supply: 5 VDC \pm 5% Power supply is selected with the shorting link for the terminal block used to supply external power. To choose a servo amplifier or external power supply, please refer to the servo amplifier power specifications (in particular, the maximum supplied current) and the power supply specifications of the scale that is used. | |
| Current consumption | 150 mA (not including the scale) | |
| Operating temperature range | 0 °C to 40 °C | |
| Storage temperature range | -20 °C to 70 °C | |

* Please contact each manufacturer for details of the applicable systems.



Refer to the NC Linear Scale Systems Brochure (**E13005**) for more details.

Quick Guide to Precision Measuring Instruments



Linear Scales

Glossary

Absolute system

A measurement mode in which every point measurement is made relative to a fixed origin point.

Incremental system

A measurement mode in which every point measurement is made relative to a certain stored reference point.

Origin offset

A function that enables the origin point of a coordinate system to be translated to another point offset from the fixed origin point. For this function to work, a system needs a permanently stored origin point.

Restoring the origin point

A function that stops each axis of a machine accurately in position specific to the machine while slowing it with the aid of integrated limit switches.

Sequence control

A type of control that sequentially performs control steps according to a prescribed order.

Numerical control

A way of controlling the movements of a machine by encoded commands created and implemented with the aid of a computer (CNC). A sequence of commands typically forms a 'part program' that instructs a machine to perform a complete operation on a workpiece.

Binary output

Refers to output of data in binary form (ones and zeros) that represent numbers as integer powers of 2.

RS-232C

An interface standard that uses an asynchronous method of serial transmission of data over an unbalanced transmission line for data exchange between transmitters located relatively close to each other. It is a means of communication mainly used for connecting a personal computer with peripherals.

Line driver output

This output features fast operating speeds of several tens to several hundreds of nanoseconds and a relatively long transmission distance of several hundreds of meters. A differential-voltmeter line driver (RS-422A compatible) is used as an I/F to the NC controller in the linear scale system.

BCD

A notation of expressing the numerals 0 through 9 for each digit of a decimal number by means of four-bit binary sequence. Data transmission is one-way output by means of TTL or open collector.

RS-422

An interface standard that uses serial transmission of bits in differential form over a balanced transmission line. RS-422 is superior in its data transmission characteristics and in its capability of operating with only a single power supply of 5 VDC.

Accuracy

The accuracy specification of a scale is given in terms of the maximum error to be expected between the indicated and true positions at any point, within the range of that scale, at a temperature of 20 °C. Since there is no international standard defined for scale units, each manufacturer has a specific way of specifying accuracy. The accuracy specifications given in our catalog have been determined using laser interferometry.

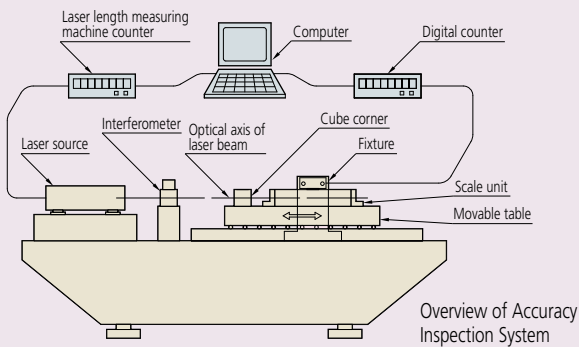
Narrow range accuracy

Scale gratings on a scale unit normally adopt 20 µm pitch though it varies according to the kind of scale. The narrow range accuracy refers to the accuracy determined by measuring one pitch of each grating at the limit of resolution (1 µm for example).

Specifying Linear Scale Accuracy

Positional Indication accuracy

The accuracy of a linear scale is determined by comparing the positional value indicated by the linear scale with the corresponding value from a laser length measuring machine at regular intervals using the accuracy inspection system as shown in the figure below. As the temperature of the inspection environment is 20 °C, the accuracy of the scale applies only in an environment at this temperature. Other inspection temperatures may be used to comply with internal standards.



The accuracy of the scale at each point is defined in terms of an error value that is calculated using the following formula:

$$\text{Error} = \text{Value indicated by Laser length measuring machine} - \text{Corresponding value indicated by the linear scale}$$

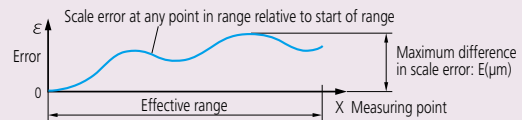
A graph in which the error at each point in the effective positioning range is plotted is called an accuracy diagram.

There are two methods used to specify the accuracy of a scale, unbalanced or balanced, described below.

(1) Unbalanced accuracy specification - maximum minus minimum error

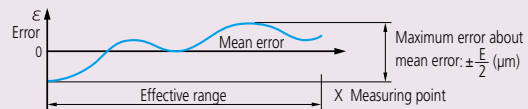
This method simply specifies the maximum error minus the minimum error from the accuracy graph, as shown below. It is of the form: $E = (\alpha + \beta L) \mu\text{m}$. L is the effective range (mm), and α and β are factors specified for each model.

For example, if a particular type of scale has an accuracy specification of $(3 + \frac{3L}{1000}) \mu\text{m}$ and an effective range of 1000 mm, E is 6 μm .



(2) Balanced accuracy specification - plus and minus about the mean error

This method specifies the maximum error relative to the mean error from the accuracy graph. It is of the form: $e = \pm \frac{E}{2} (\mu\text{m})$. This is mainly used in separate-type (retrofit) scale unit specifications.



A linear scale detects displacement based on graduations of constant pitch. Two-phase sinusoidal signals with the same pitch as the graduations are obtained by detecting the graduations. Interpolating these signals in the electrical circuit makes it possible to read a value smaller than the graduations by generating pulse signals that correspond to the desired resolution. For example, if the graduation pitch is 20 μm , interpolated values can generate a resolution of 1 μm . The accuracy of this processing is not error-free and is called interpolation accuracy. The linear scale's overall positional accuracy specification depends both on the pitch error of the graduations and interpolation accuracy.

New Products



Profile projectors PJ-PLUS Series

Refer to page J-3 for details.



Motor-Driven Z-axis Measuring Microscopes MF-J/MF-UJ/MF-UK Series

Refer to pages J-6, J-8 for details.



Varifocal Lens TAGLENS

Refer to page J-15 for details.





Profile Projectors

Horizontal / Vertical Profile Projectors



Microscopes

Measuring Microscopes



Video Microscope Units



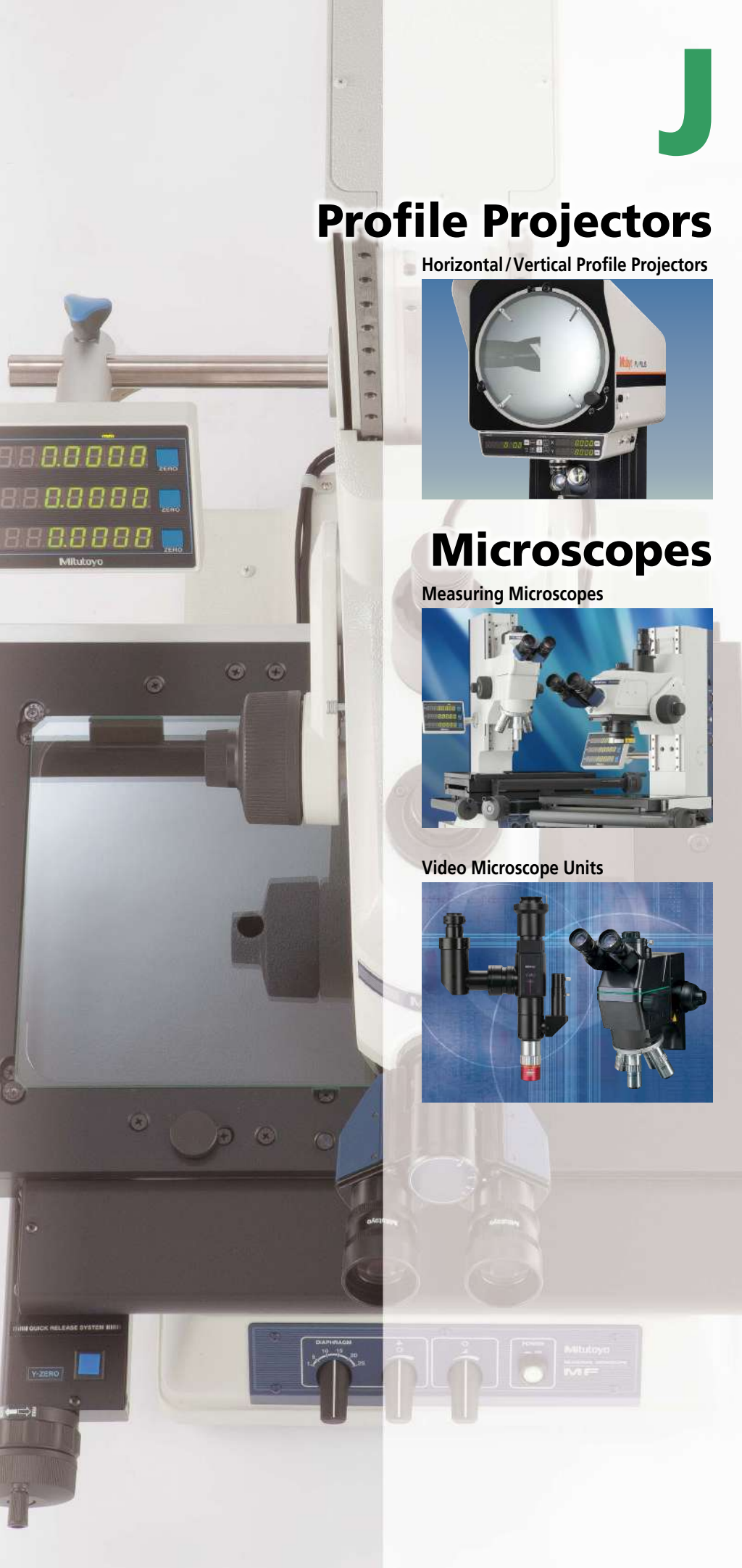
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Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

PJ-PLUS Series

SERIES 302 — Premium Benchtop Series

- The profile projector that "can be operated intuitively" even by inexperienced operators and also has excellent durability and energy saving performance thanks to adoption of an "LED illumination source" and "fan-less cooling system".
- Provides stable dimension and angle measurements in harsher environments, such as manufacturing and processing lines, than can be handled by conventional models.
- Stepless illumination has been adopted so as to allow precise adjustment of lighting to suit the surface texture and color of the workpiece.

MeasurLink ENABLED

Data Management Software by Mitutoyo



PJ-P2010A

SPECIFICATIONS

| Model No. | PJ-P1010A | | PJ-P2010A | |
|----------------------------------|--------------------------------|---|------------|------------|
| Order No. | 302-801-10 | 302-801-20 | 302-802-10 | 302-802-20 |
| Unit system for the counter unit | mm/in | mm | mm/in | mm |
| Projected image | Inverted-reversed | | | |
| Protractor screen | Effective diameter | ø315 mm (12.4 in) | | |
| | Screen rotation | ±360° (±370° for display) | | |
| | Angle display | Digital counter (ABS/INC mode switching, Zero Set) | | |
| | Resolution | 1' or 0.01° (switchable) | | |
| | Cross-hairs | 90° (solid lines) | | |
| Projection lens | Magnification | 10X (standard accessory), 20X, 50X, 100X 10X, 20X (equipped with an external half-mirror for coaxial surface illumination) | | |
| | Lens mount | Bayonet mount | | |
| Illumination | Contour illumination | White LED light source, Telecentric, Variable brightness adjustment | | |
| | Surface illumination | White LED light source, With an adjustable condenser lens, Variable brightness adjustment | | |
| Resolution for X/Y counter | 0.001 mm or 0.0001 in/0.001 mm | | | |
| Measuring unit | Digital scale | | | |
| Measuring range (XxY) | 100x100 mm | | 200x100 mm | |

MeasurLink ENABLED

Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Refer to the Profile Projector Brochure (E14005) for more details.

PJ-H30

SERIES 303 — Premium Benchtop Series

- Conforms to JIS B 7184: 1999 "Profile projectors".
- High-end model that achieves accuracy of $(3.0 + 0.02L) \mu\text{m}$
- ø306 mm screen makes erect-unreversed images more visible.
- The largest measuring range in the class, up to 300x170 mm.
- Quick-release handle and 3-lens parfocal turret enables efficient measurement.
- Elevating shaft mechanism for the screen head reduces operator fatigue.
- Unique model equipped with a highly accurate edge detector (OPTOEYE) and motorized up/down drive is available.

MeasurLink ENABLED

Data Management Software by Mitutoyo



PJ-H30D3017B

SPECIFICATIONS

| Protractor screen | Model No. | PJ-H30A1010B | PJ-H30A2010B | PJ-H30A2017B | PJ-H30A3017B |
|---|--|---|--------------|--------------|--------------|
| | Order No. | 303-712-1*1 | 303-713-1*1 | 303-714-1*1 | 303-715-1*1 |
| Protractor screen, OPTOEYE (built-in), Electromotive focusing | Model No. | PJ-H30D1010B | PJ-H30D2010B | PJ-H30D2017B | PJ-H30D3017B |
| | Order No. | 303-732-1*1 | 303-733-1*1 | 303-734-1*1 | 303-735-1*1 |
| Projected image | Erect | | | | |
| Protractor screen | Effective diameter | ø306 mm (12 in) | | | |
| | Screen rotation | ±360° (±370° for display) | | | |
| | Angle display | Digital counter (ABS/INC mode switching, Zero Set) | | | |
| | Resolution | 1' or 0.01° (switchable) | | | |
| | Mechanism | Fine feed and clamp | | | |
| Projection lens | Cross-hairs | 90° (solid lines) | | | |
| | Magnification | 10X (standard accessory), 5X, 20X, 50X, 100X, All lens have the same focus. Half-mirror for the coaxial surface illumination are built-in and movable. | | | |
| Illumination | Lens mount | Bayonet mount, 3-lens mount turret type | | | |
| | Contour illumination | Halogen bulb (24 V, 150 W, 50 hours) (515530), Variable illumination angle (Coaxial surface/Oblique reflected, Beam concentration and adjustment), Built-in heat-absorbing filter, Built-in cooling fan, Stepless brightness adjustment, Soft lighting (inrush current reduction) | | | |
| | Surface illumination | Zoom Telecentric system, Heat absorbing filter, Built-in cooling fan, Stepless brightness adjustment, Soft lighting (inrush current reduction), Bulb sliding mechanism | | | |
| Resolution for X/Y counter *2 | 0.001 mm/0.0001 in | | | | |
| Measuring unit | High-accuracy digital scale | | | | |
| Measuring range (XxY) | 100x100 mm | 200x100 mm | 200x170 mm | 300x170 mm | |
| Measuring accuracy *3 | $(3 + 0.02L) \mu\text{m}$ L=Measured length (mm) | | | | |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.

*2 0.5 μm or 0.1 μm resolution is also available. Please contact Mitutoyo Techno Service Business Division.

*3 Measuring method complies with JIS B 7184.

MeasurLink ENABLED

Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

- Floor-standing projector with a vertical axis and a unique forward-sloping screen.
- The large 500 mm diameter screen enables the whole of a 100 mm diameter workpiece to be inspected using a 5X projection lens without needing to move the workpiece.

PV-5110
SERIES 304 — Profile Projectors



PV-5110

SPECIFICATIONS

| | | |
|------------------------------|---------------------------------|--|
| Model No. | PV-5110 | |
| Order No. | 304-919*1 | |
| Projected image | Inverted-reversed | |
| Effective diameter | ø508 mm (20 in) | |
| Screen rotation | ±360° (±370° for display) | |
| Protractor screen | Angle display | Digital counter (ABS/INC mode switching, Zero Set) |
| Resolution | 1' or 0.01° (switchable) | |
| Mechanism | Fine feed and clamp | |
| Cross-hairs | 90° (solid lines) | |
| Zero-base index | Built-in, With a LED back light | |
| Projection lens | Magnification | 10X (standard accessory), 5X, 20X, 50X, 100X |
| Illumination | Contour illumination | Halogen bulb (24 V, 150 W, 500 hours) (512305), 2-step (High/Low) brightness switch, Combination use with a color filter available |
| | Surface illumination | Double-lighting oblique surface illumination unit (optional), Halogen bulb (24 V, 150 W, 500 hours) (512305), 2-step (High/Low) brightness switch |
| Resolution for X/Y counter*2 | — | |
| Measuring unit | Digital scale | |
| Measuring range (XxY) | 200x100 mm (164x68 mm*3) | |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.

*2 X and Y counters are not built into the **PV-5110** main unit. If a counter display is required, it is recommended that a **QM-Data200** or **KA-212** is purchased separately.

*3 The range where no shading is observed using a 5X projection lens with contour illumination.

- Standard models as used in the machine tool industry. Best for observation and measurement of cutting tools (end mills, lathe tools).
- The stage has a higher loading capacity (45 kg) than any other type of projector.

PH-3515F, PH-A14
SERIES 172 — Profile Projector



PH-3515F



PH-A14

- Unique projector employing horizontal optical system. The optical axis and the stage are parallel, and the workpiece can be easily removed.

SPECIFICATIONS

| | | |
|------------------------------|--------------------------------|--|
| Model No. | PH-3515F | PH-A14 |
| Order No. | 172-868*1 | 172-810*2 |
| Projected image | Erect-reversed | Inverted-reversed |
| Effective diameter | ø353 mm (13.9 in) | ø356 mm (14 in) |
| Screen rotation | ±360° (±370° for display) | |
| Protractor screen | Angle display | Digital counter (ABS/INC mode switching), Zero Set |
| Resolution | 1' or 0.01° (switchable) | |
| Mechanism | Fine feed and clamp | |
| Cross-hairs | 90° (solid lines) | |
| Projection lens | Magnification | 10X (standard accessory), 5X (PH-3515F only), 20X, 50X, 100X |
| Illumination*3 | Contour illumination | Halogen bulb (24 V, 150 W, 500 hours) (515530), 2-step (High/Low) brightness switch, Combination use with a color filter available |
| | Surface illumination (oblique) | Parabolic halogen bulb (24 V, 200 W, 50 hours) (12BAA637) Beam concentration and adjustment available, Heat-absorbing filter, Built-in cooling fan |
| Resolution for X/Y counter*4 | — | |
| Measuring unit | Digital scale | |
| Measuring range (XxY) | 254x152 mm | 200x100 mm |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.

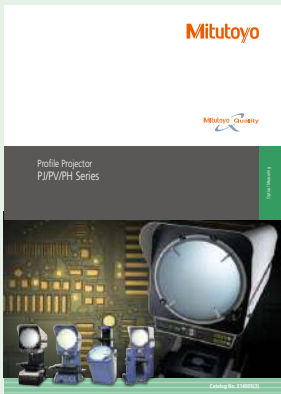
*2 To denote your AC power cable add the following suffixes to the order No.: -10A for UL/CSA, -20D for CEE, -20DC for CCC, -20E for BS, -20K for KC.

*3 For the **PH-A14**, a light source (24 V, 150 W), which is common to the Contour illumination and Surface illumination, is used. It is not possible to regulate brightness.

*4 XY counter is not built in the main unit of the **PH-3515F** or **PH-A14**.

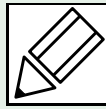
If a counter display is required, it is recommended to purchase the **QM-Data200** or a counter (**KA-212**) separately.

Note: Depending on the angle of illumination, measurement results may be smaller than actual values.



Refer to the Profile Projector Brochure (**E14005**) for more details.

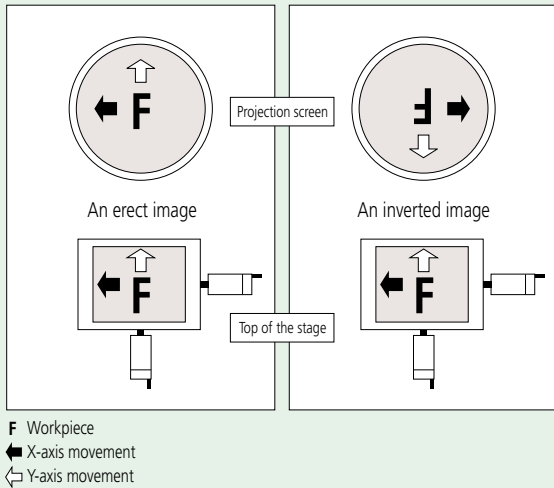
Quick Guide to Precision Measuring Instruments



Profile Projectors

Erect Image and Inverted Image

An image of an object projected onto a screen is erect if it is orientated the same way as the object on the stage. If the image is reversed top to bottom, left to right and by movement with respect to the object on the stage (as shown in the figure below) it is referred to as an inverted image (also known as a reversed image).



Magnification Accuracy

The magnification accuracy of a projector when using a certain lens is established by projecting an image of a reference object and comparing the size of the image of this object, as measured on the screen, with the expected size (calculated from the lens magnification, as marked) to produce a percentage magnification accuracy figure, as illustrated below. The reference object is often in the form of a small, graduated glass scale called a 'stage micrometer' or 'standard scale', and the projected image of this is measured with a larger glass scale known as a 'reading scale'.

(Note: That magnification accuracy is not the same as measuring accuracy.)

$$\Delta M (\%) = \frac{L - \ell M}{\ell M} \times 100$$

ΔM (%): Magnification accuracy expressed as a percentage of the nominal lens magnification
 L : Length of the projected image of the reference object measured on the screen
 ℓ : Length of the reference object
 M : Magnification of the projection lens

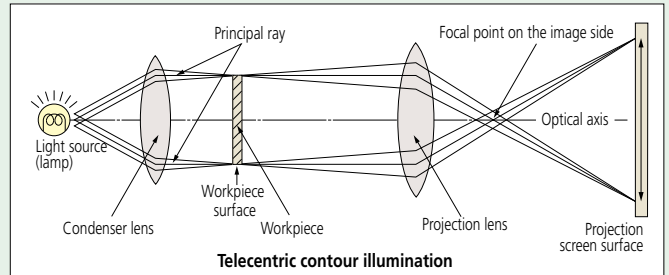
Type of Illumination

- **Contour illumination:** An illumination method to observe a workpiece by transmitted light and is used mainly for measuring the magnified contour image of a workpiece.
- **Coaxial surface illumination:** An illumination method whereby a workpiece is illuminated by light transmitted coaxially to the lens for the observation/measurement of a surface. (A half-mirror or a projection lens with a built-in half-mirror is needed.)
- **Oblique surface illumination:** A method of illumination by obliquely illuminating the workpiece surface. This method provides an image of enhanced contrast, allowing it to be observed three-dimensionally and clearly. However, note that an error is apt to occur in dimensional measurement with this method of illumination. (An oblique mirror is needed. **PJ-H30** models are supplied with an oblique mirror.)

Telecentric Optical System

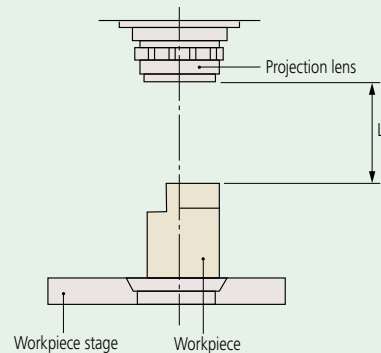
An optical system based on the principle that the primary rays are aligned parallel to the optical axis by placing a lens stop on the focal point on the image side. Its functional feature is that the image will not vary in size even though the image blurs as the object is shifted along the optical axis.

For measuring projectors and measuring microscopes, an identical effect is obtained by placing a lamp filament at the focal point of a condenser lens instead of a lens stop so that the object is illuminated with parallel beams. (See the figure below.)



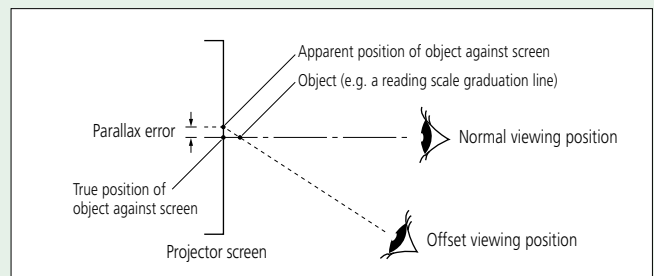
Working distance

Refers to the distance from the face of the projection lens to the surface of a workpiece in focus. It is represented by L in the diagram below.



Parallax error

This is the displacement of an object against a fixed background caused by a change in the observer's position and a finite separation of the object and background planes. Can cause a reading error on a projector screen.



Field of view diameter

The maximum diameter of the workpiece that can be projected using a particular lens.

$$\text{Field of view diameter (mm)} = \frac{\text{Screen diameter of profile projector (mm)}}{\text{Magnification of projection lens used}}$$

Example: If a 5X magnification lens is used for a projector with a screen of $\phi 500$ mm:

$$\text{Field of view diameter is given by } \frac{500 \text{ mm}}{5} = 100 \text{ mm}$$

Microscopes

Microscope lineups that systemize observation, measurement and processing

MF SERIES 176 — Measuring Microscopes

- An easy-to-operate standard measuring microscope using specially designed long working distance **ML** objective lenses.
- Measuring accuracy is the highest in its class (and conforms to JIS B 7153).
- Illumination can be selected from an LED unit, which has a longer life, or a powerful halogen unit for high-magnification applications.
- Excellent usability, a high-NA and long working distance objectives enable effective observation.



MF-B2017D
• The binocular tube (eyepiece) and illumination unit are optional accessories.

Manual type

- Stages range in size from 100x100 mm to 400x200 mm.
- The XY stage is equipped with a quick-release mechanism that enables switching between coarse and fine feed to provide swift and precise stage movement, even over a large distance.

SPECIFICATIONS

| | | MF-A1010D | MF-A2010D | MF-A2017D | MF-A3017D | MF-A4020D |
|---|---------------------------|---|------------|------------|------------|------------|
| Without Z-axis scale | Model No. | MF-A1010D | MF-A2010D | MF-A2017D | MF-A3017D | MF-A4020D |
| | Order No. | 176-861*1 | 176-862*1 | 176-863*1 | 176-864*1 | 176-865*1 |
| With Z-axis scale | Model No. | MF-B1010D | MF-B2010D | MF-B2017D | MF-B3017D | MF-B4020D |
| | Order No. | 176-866*1 | 176-867*1 | 176-868*1 | 176-869*1 | 176-870*1 |
| Observation image | | BF (Bright-field)/Erect image | | | | |
| Eyepiece with diopter adjustment | | 10X (eyepiece field number: 24), 15X, 20X Note: Monocular - one 10X eyepiece provided as standard; Binocular - two 10X eyepieces provided as standard | | | | |
| Objective | | ML objective 3X (provided as standard), 1X, 5X, 10X, 20X, 50X, 100X | | | | |
| Illumination unit (One of the two options must be selected.) | LED illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, White LED light source, stepless light intensity control with cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, White LED light source, stepless light intensity control Control unit: Power ON/OFF switch (main switch), AC100 to 240 V power input connector | | | | |
| | Halogen illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, Halogen bulb (12 V, 50 W), stepless light intensity control, With cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, Halogen bulb (12 V, 50 W), stepless light intensity control, With cooling fan Control unit: Power ON/OFF switch (main switch), AC100 to 240 V power input connector | | | | |
| Stage | Measuring range | 100x100 mm | 200x100 mm | 200x170 mm | 300x170 mm | 400x200 mm |
| | Quick-release mechanism | Provided as standard for the X and Y axes | | | | |
| Z axis | Zero-set button | Provided as standard for the X and Y axes (and for the Z axis only for the MF-B type) | | | | |
| | Max. workpiece height | 150 mm | 220 mm | | | |
| Measuring accuracy*2 (X and Y axes, when not loaded) | Feed mechanism | Coaxial coarse and fine feed, handles on both sides (coarse: 30 mm/rotation, fine: 0.2 mm/rotation) | | | | |
| | Resolution | (2.2 + 0.02L) μm L=measuring length (mm) | | | | |
| Digital display | Display axes | 1/0.5/0.1 μm 0.0001/0.00005/0.00001 in (switchable) | | | | |
| | Functions | X and Y (or X, Y, and Z only for the MF-B type) | | | | |
| | | Zero-setting, direction switching, RS-232C output, USB output (specific to QSPAK) | | | | |

*1 The following suffixes are added to the order No. to specify the User Manual's language:
-10 for English; -11 for Simplified Chinese; No suffix for Japanese.

*2 Measuring method complies with JIS B 7153.

| | |
|---|---|
| Bulb replacement for transmitted/reflected illumination | Standard: Halogen bulb (12 V, 50 W) (513667) Bulb life: 50 hours |
|---|---|

Motor-Driven Z-axis

- Freedom from burdensome focus adjustment even on a workpiece with many asperities allows the operator to perform stress-free measurement.
- Using the Vision Unit (optional) enables the image AF function.



MF-J2017D
• The binocular tube (eyepiece) and illumination unit are optional accessories.

SPECIFICATIONS for Motor-Driven Z-axis MF models

| | | MF-J2017D | MF-J3017D | MF-J4020D |
|-------------|-------------------------|---|-----------|-----------|
| Model No. | | MF-J2017D | MF-J3017D | MF-J4020D |
| Order No. | | 176-891*1 | 176-892*1 | 176-893*1 |
| Vision AF*2 | | Available | | |
| Stage | Quick release mechanism | Fitted to X and Y axes | | |
| | Zero set switch | Fitted to X and Y axes | | |
| Z axis | Max. workpiece height | 220 mm | | |
| | Feed mechanism | Motordrive (Maximum measuring speed: 20 mm/s) | | |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.

*2 Vision Unit and an image AF cable are separately required.

Note: The specification other than the above is subject to the **MF** Series.



Refer to the **MF/MF-U Series Brochure (E14003)** for more details.

Microscopes

Microscope lineups that systemize observation, measurement and processing

MF-U SERIES 176 — Universal Measuring Microscopes

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Integration of metallurgical and measurement microscope functions provides high-resolution observation and a high-accuracy measurement solution.



MF-UB2017D

- The turret, objectives and illumination unit are optional accessories.

- Measuring accuracy is the highest in its class (and conforms to JIS B 7153).
- Illumination can be selected from an LED unit, which has a longer life, or a powerful halogen unit for high-magnification applications.
- Excellent usability, a high-NA and long working distance objectives enable effective observation.

Manual type

- Stages range in size from 100×100 mm to 400×200 mm.
- The XY stage is equipped with a quick-release mechanism that enables switching between coarse and fine feed to provide swift and precise stage movement, even over a large distance.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Refer to the **MF/MF-U Series Brochure (E14003)** for more details.

SPECIFICATIONS

| | Without Z-axis scale | Model No. | MF-UA1010D | MF-UA2010D | MF-UA2017D | MF-UA3017D | MF-UA4020D |
|--|--|---|------------|------------|------------|------------|------------|
| BF (Bright-field) | Without Z-axis scale | Order No. | 176-871*1 | 176-872*1 | 176-873*1 | 176-874*1 | 176-875*1 |
| | With Z-axis scale | Model No. | MF-UB1010D | MF-UB2010D | MF-UB2017D | MF-UB3017D | MF-UB4020D |
| BD (Bright-field/Dark-field) | Without Z-axis scale | Order No. | 176-876*1 | 176-877*1 | 176-878*1 | 176-879*1 | 176-880*1 |
| | With Z-axis scale | Model No. | MF-UC1010D | MF-UC2010D | MF-UC2017D | MF-UC3017D | MF-UC4020D |
| | Without Z-axis scale | Order No. | 176-881*1 | 176-882*1 | 176-883*1 | 176-884*1 | 176-885*1 |
| | With Z-axis scale | Model No. | MF-UD1010D | MF-UD2010D | MF-UD2017D | MF-UD3017D | MF-UD4020D |
| | | Order No. | 176-886*1 | 176-887*1 | 176-888*1 | 176-889*1 | 176-890*1 |
| Observation image | BF (Bright-field), DF (Dark-field) (MF-UC and MF-UD models only), Polarization, Differential Interference Contrast (DIC)/Erect image | | | | | | |
| Eyepiece (optional) with diopter adjustment | 10X (eyepiece field number: 24, two eyepieces provided as standard), 15X, 20X | | | | | | |
| Turret (required) | Bright-field (BF) | Manual/Motor (select either one) | | | | | |
| | Bright-field/dark-field (BD) | | | | | | |
| Objective (optional) | Bright-field (BF) | M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo Series | | | | | |
| | Bright-field/dark-field (BD) | BD Plan Apo Series | | | | | |
| Illumination unit (One of the two options must be selected.) | LED illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, White LED light source, stepless light intensity control, With cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, White LED light source, stepless light intensity control Control unit: Power ON/OFF switch (main switch), AC100 to 240 V power input connector | | | | | |
| | Halogen illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, Halogen bulb (12 V, 50 W), stepless light intensity control, With cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, 12 V, 100 W or 12 V, 150 W halogen bulb (selectable), external fiber-optic illumination, stepless light intensity control Control unit: Power ON/OFF switch (main switch), AC100 to 240 V power input connector | | | | | |
| Stage | Measuring range | 100×100 mm | 200×100 mm | 200×170 mm | 300×170 mm | 400×200 mm | |
| | Quick-release mechanism | Provided as standard for the X and Y axes | | | | | |
| | Zero-set button | Provided as standard for the X and Y axes (and for the Z axis only for the MF-UB and -UD types) | | | | | |
| Z axis | Max. workpiece height | 150 mm | | | 220 mm | | |
| | Feed mechanism | Coaxial coarse and fine feed, handles on both sides (coarse: 10 mm/rotation, fine: 0.1 mm/rotation) | | | | | |
| Measuring accuracy*2 (X and Y axes, when not loaded) | | (2.2 + 0.02L) μm L=measuring length (mm) | | | | | |
| | Resolution | 1/0.5/0.1 μm 0.0001/0.00005/0.00001 in (switchable) | | | | | |
| Digital display | Display axes | X and Y (or X, Y, and Z only for the MF-UB and -UD types) | | | | | |
| | Functions | Zero-setting, direction switching, RS-232C output, USB output (specific to QSPAK) | | | | | |

*1 The following suffixes are added to the order No. to specify the User Manual's language: -10 for English; -11 for Simplified Chinese; No suffix for Japanese.

*2 Measuring method complies with JIS B 7153.

| | |
|---|---|
| Bulb replacement for transmitted/reflected illumination | Standard: Halogen bulb (12 V, 50 W) (513667) |
| | Bulb life: 50 hours |
| For replacement for reflected illumination (from separate light source)*3 | Standard: Halogen bulb (12 V, 100 W) (517181) |
| | High-intensity bulb (12 V, 100 W) (12BAD602) |

*3 At the time of purchase, a standard bulb and a high-intensity bulb are provided. (Only for the Reflected illumination models.)

Motor-Driven Z-axis

- Freedom from burdensome focus adjustment even on a workpiece with many asperities allows the operator to perform stress-free measurement.
- Using Vision Unit (optional) enables the image AF function.



MF-UJ2017D

- The turret, objectives and illumination unit are optional accessories.

SPECIFICATIONS for Motor-Driven Z-axis MF-U models

| BF (Bright-field) | Model No. | MF-UJ2017D | MF-UJ3017D | MF-UJ4020D |
|--|-----------|---|-----------------------------|-----------------------------|
| | Order No. | 176-894^{*1} | 176-895^{*1} | 176-896^{*1} |
| BD (Bright-field/Dark-field) | Model No. | MF-UK2017D | MF-UK3017D | MF-UK4020D |
| | Order No. | 176-897^{*1} | 176-898^{*1} | 176-899^{*1} |
| Eyepiece (optional) with diopter adjustment | | 10X (eyepiece field number: 24, two eyepieces provided as standard), 15X, 20X | | |
| Objective (optional) | | M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo Series | | |
| Bright-field (BF) | | BD Plan Apo Series | | |
| Bright-field/dark-field (BD) | | BD Plan Apo Series | | |
| Vision AF ^{*2} | | Available | | |
| Measuring range | | 200x170 mm | 300x170 mm | 400x200 mm |
| Stage | | Fitted to X and Y axes | | |
| Quick release mechanism | | Fitted to X and Y axes | | |
| Zero set switch | | Fitted to X and Y axes | | |
| Z axis | | 220 mm | | |
| Max. workpiece height | | Motor drive (measuring speed: max. 20 mm/s) | | |
| Feed mechanism | | (2.2 + 0.02L) μm L=measuring length (mm) | | |
| Measuring accuracy ^{*3} (X and Y axes, when not loaded) | | 1/0.5/0.1 μm 0.0001/0.00005/0.00001 in (switchable) | | |
| Resolution | | X, Y and Z | | |
| Digital display | | Zero-setting, direction switching | | |
| Display axes | | | | |
| Functions | | | | |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.

*2 Vision Unit and an image AF cable are separately required.

*3 Measuring method complies with JIS B 7153.

Note: For all specifications not included above see page J-7.

Microscopes

Microscope lineups that systemize observation, measurement and processing

Hyper MF/MF-U SERIES 176 — High-Accuracy Measuring Microscopes

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- This is the ultimate measuring microscope achieving the world's highest accuracy (1.5 + 10L/1000 μm), with 0.01 μm resolution.
- Three-axis motorized front operation joystick control, which makes a refreshing change from conventional microscope operation, allows fine positioning even during fast movement.



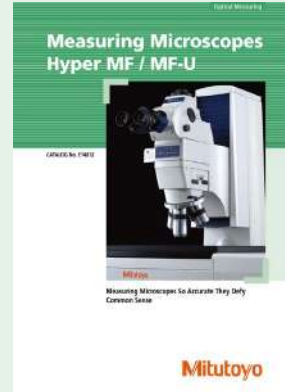
Hyper MF-U

- The optical tube, turret, and objective lens are optional.

- Large workstage with stroke of 250×150 mm provides enough margin for the measurement of larger workpieces.
- The best-selling data processing unit, **QM-Data200**, and the Vision Unit can be integrated to provide an effective and stable measurement environment.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Refer to the Hyper MF/MF-U Brochure (E14012) for more details.

SPECIFICATIONS

| Model No. | HyperMF-B2515B | HyperMF-UB2515B | HyperMF-UD2515B | HyperMF-UE2515B | HyperMF-UF2515B |
|---|--|---|--|--|---|
| Order No. | 176-430*1 | 176-431*1 | 176-432*1 | 176-433*1 | 176-434*1 |
| Optical tube | Finite correction optical system BF (Bright-field) | Infinity-correction optical system BF (Bright-field) | Infinity-correction optical system BD (Bright/Dark-field) | Infinity-correction optical system BF (Bright-field) with the LAF function | Infinity-correction optical system BD (Bright/Dark-field) with the LAF function |
| Standard reticle (Built-in) | 90° broken-cross line (line width 5 μm) | | | | |
| Pupil distance adjustment | Siedentopf type Adjustment range: 51 to 76 mm | | | | |
| Optical path switching ratio | Observation/TV-photomicrography=50/50 | | | | |
| Vertical tilt angle | 25° | | | | Tilting |
| TV port | Provided as standard | | | | |
| Observation image | Erect image | | | | |
| Eyepiece Magnification | 10X, 15X, 20X | | | | |
| Objective lens (optional) | Selectable from the monocular unit (equipped with one eyepiece) or binocular tube (equipped with two eyepieces) | | Equipped with two 10X eyepieces | | |
| ML Series objective lens | 1X, 3X, 5X, 10X, 20X, 50X, 100X | | — | | |
| BF (Bright-field) | — | | M Plan Apo, M plan Apo SL, G plan Apo | | |
| BD (Bright/Dark-field) | — | | BD Plan Apo, BD Plan Apo SL | | |
| Turret (optional) | — | | (Equipped with a four-hole manual turret/motorized five-hole turret*2) | | |
| BD (Bright/Dark-field) | — | | (Equipped with a four-hole manual turret/motorized four-hole turret*3) | | |
| Focusing section | Maximum height of workpiece | 150 mm | | | |
| Measuring accuracy | (1.5 + 10L/1000) μm L=Measuring length (mm) | | | | |
| Drive method | Motorized control using a joystick | | | | |
| Illumination unit | Transmitted illumination device | Telecentric system, Built-in aperture diaphragm, Halogen bulb (12 V, 50 W), 100-step light intensity control, Fiber-optic cable cold light illumination | | | |
| Reflected illumination unit | Koehler illumination, Variable aperture diaphragm mechanism, Halogen bulb (12 V, 100 W), 100-step light intensity control, Fiber-optic cable cold light illumination | | | | |
| Workstage | Measuring range (X×Y) | 250×150 mm | | | |
| Measuring accuracy*4 (When no load is put on the X or Y axis) | (0.9 + 3L/1000) μm L=Measuring length (mm) | | | | |
| Dimensions of the top plane | 460×350 mm | | | | |
| Usable dimensions of the stage glass | 300×200 mm | | | | |
| Swiveling angle | ±3° | | | | |
| Maximum loading mass | 30 kg | | | | |
| Drive method | Motorized control using a joystick | | | | |
| Detector | High precision digital scale (Patented) | | | | |
| Digital display | Resolution | 0.01 μm | | | |
| Axes to be displayed | X, Y, Z | | | | |
| Data processing unit | QM-Data200 or Vision Unit (required) | | | | |
| Operation section | LAF (just focus) | — | — | — | Available |
| LAF (tracking focus) | — | — | — | — | Available |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.

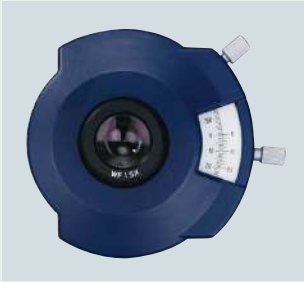
*2 and *3 are factory-installed options.

*4 Measurement accuracy complies with JIS B 7153.

| | |
|---|--|
| Bulb replacement for transmitted illumination | Standard: Halogen bulb (12 V, 50 W) (02APA527) |
|---|--|

| | |
|---|---|
| For replacement for reflected illumination (from separate light source) | Standard: Halogen bulb (12 V, 100 W) (517181) High-intensity bulb (12 V, 100 W) (12BAD602) |
|---|---|

Angle Index (Standard Accessory)



TM SERIES 176 — Toolmakers' Microscopes

- Compact universal toolmakers' microscope that can be installed on any site.
- Newly designed LED illuminators provide enhanced observation for higher accuracy and resolution.
- Optional LED circular illuminator available for applications requiring all-round lighting.
- Achieves a maximum measuring height of 115 mm despite the compact size.
- Installation of Digimatic micrometer heads (**MHD-50MB**, optional) makes measurement easy and precise.
- A vernier scale (Angle Index) built into the eyepiece mount enables accurate angular measurements.
- Lenses are available for a wide range of magnifications (20X to 200X in total).



TM-505B



TM-1005B

Note: Micrometer heads are optional.

SPECIFICATIONS

| Model No. | TM-505B | TM-1005B | |
|------------------------------|--|--|--|
| Order No. | 176-818 | 176-819 | |
| Optical tube | Monocular type (Vertical tilt angle: 30°) | | |
| Observation image | Erect | | |
| Eyepiece protractor | Resolution (graduation): 1°, Rotation angle: 360°, Resolution (angle): 6', Adjustable zero point | | |
| Eyepiece | Standard accessory: 15X (field number: 13), Options: 10X, 20X | | |
| Objective lens | Standard accessory: 2X, Optional: 5X, 10X | | |
| Microscope head | Maximum height of workpiece | 115 mm | |
| | Focusing method | Manual (Coarse feed) | |
| Illumination unit | Transmitted illumination | Stepless brightness adjustment, White LED light source with green filter | |
| | Reflected illumination | Oblique single-source type, Stepless brightness adjustment, White LED light source | |
| Cross-travel stage | Measuring range | 50x50 mm | 100x50 mm (An optional 50 mm gauge block is required to cover full range. A CERA block is recommended.) |
| | Table size | 152x152 mm | 240x152 mm |
| | Usable area of the stage glass | 96x96 mm | 154x96 mm |
| | Maximum stage glass loading | 5 kg | |
| Linear measurement method | Micrometer head* | | |
| Resolution | Depends on the micrometer head specifications* (for MHD-50MB (164-163) : 0.001 mm) | | |
| Micrometer head travel range | For MHD-50MB (164-163) : 50 mm | | |
| Power supply | AC 100 to 240 V 50/60 Hz Maximum power consumption: 4.2 W | | |
| Main unit mass | 14 kg | 15 kg | |

* Micrometer heads are optional for **TM-505B** and **TM-1005B**.

Note: The main unit with Digimatic micrometer head (MHD-2"MB) is provided in the **TM** Series.

TM-A505B (176-820A)

TM-A1005B (176-821A)

Other specifications are the same as the other **TM** Series.



Refer to the **TM** Series Brochure (**E14013**) for more details.

Microscopes

Microscope lineups that systemize observation, measurement and processing

Vision Unit SERIES 359 — Vision System Retrofit for Microscopes

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The measurement tools and various macro icons allow measurement in one easy step.
- The graphics and measurement navigation functions facilitate operation.
- The image saving function and the data output function to the spreadsheet software are standard.
- Combined use with the **MF/MF-U** Series (Motor-Driven Z-axis/Motor-Driven) achieves the image AF (auto focus) function.



MF-J2017D plus Vision Unit

SPECIFICATIONS

| Model | Vision Unit |
|--|---|
| Order No. | 359-763 |
| Magnification of the optical system | When installed on the microscope 0.5X (using the 0.5X TV adapter) |
| Image detection | High-sensitivity 1/2 in color CMOS camera 3 megapixel |
| Resolution | 0.1 μm |
| Accuracy (Measurement environment: 20 °C) | Depends on the accuracy specification of the Mitutoyo measuring microscope to which the unit is fitted. For reference: When using an ML Series 3X objective lens (In an inspection using a sample workpiece based on the Mitutoyo standards) Measurement accuracy in the screen: Within $\pm 2.5 \mu\text{m}$ Repetitive accuracy in the screen ($\pm 2 \sigma$): Within $\pm 1 \mu\text{m}$ |
| Software (optional) | QSPAK Vision Unit Edition |

Note: Software (**QSPAK VUE**) and calculation processor are required separately.

Applicable Models

Mitutoyo **MF** Series, **MF-U** Series (Connection to the **MF-H** Series is not available.)

Hyper MF Series, **Hyper MF-U** Series

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Foot switch
12AAJ088



Refer to the **QM-Data200** and Vision Unit Brochure (**E14008**) for more details.

QM-Data200 SERIES 264 — 2D Data Processing Unit

- 2D Data Processor designed to perform arithmetic processing of XY coordinate data acquired from projectors and measuring microscopes for local display or output to a printer.
- Informative color-graphic displays on the large LCD screen make for easy measurement operations.
- The AI measurement function (automatic identification of measuring item) eliminates switching between the measurement command keys.
- Equipped with a measurement procedure teaching function and measuring position navigation in Repeat mode.
- The user menu function allows users to register measurement commands or part programs to create their own menus.
- Measurement result output to CSV format in spreadsheet software.
- Measurement procedures and calculation results can be saved on a USB-compatible memory device.



QM-Data200
(stand type)



Foot switch
12AAJ088

SPECIFICATIONS

| Model No. | QM-Data200 | | |
|--|--|--|---|
| | Stand type | Flexible arm type | Stand type |
| Order No. | 264-155 *1 | 264-156 *1 | 264-159 *1 |
| Applicable models (Conventional models)*2 | PJ-PLUS Series PJ-H30 Series PV-5110 PH-3515F PH-A14 MF Series MF-U Series | PJ-PLUS Series PJ-H30 Series PV-5110 *3 PH-3515F *3 PH-A14 *3 | Hyper MF/MF-U |
| Unit of measurement | Length: mm Angle: Switchable between decimal degree and sexagesimal notation | | |
| Resolution | 0.1 μm | | 0.01 μm |
| Program function | Creating, performing, and editing of measurement procedures | | |
| Statistical processing | Number of data, maximum value, minimum value, mean value, standard deviation, range, histogram, Statistics classified by each measurement function (Statistics classified by each command) | | |
| Display unit | Color graphic LCD (equipped with LED backlight) | | |
| ABS point | — | | Available (Automatic movement) |
| LAF (Laser AF) | — | | Available |
| Edge sensor position correction | Available (Profile Projectors with OPTOEYE 200) | | — |
| Input/output | XYZ: Data input from linear scales (Maximum number of axes: 3) RS-232C 1 : Connection to an external PC RS-232C 2 : Connection to a measuring unit counter OPTOEYE: Connection to an OPTOEYE edge signal (OPTOEYE 200) FS: For the connection to the foot switch PRINTER: For the connection to an external printer USB-MEMORY: For the connection to a USB memory | | |
| Measurement result file output | RS-232C output (CSV format, MUX-10 format) | | |
| Display language | 16 languages (Japanese, English, German, French, Italian, Spanish, Portuguese, Czech, Chinese (simplified/traditional), Korean, Turkish, Swedish, Polish, Dutch, Hungarian) | | |
| Power supply | AC100 to 240 V | | |
| Maximum power consumption | 17 W (excluding optional accessories) | | |
| External dimensions (W×H×D) | 260×242×310 mm (including the stand section) | 318×153×275 mm (when the arm is horizontal) | 260×242×310 mm (including the stand section) |
| Mass | Approx. 2.9 kg | Approx. 2.8 kg | Approx. 2.9 kg |
| Standard Accessories | AC adapter, Power cable, Quick Operation Guide | | |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, E for BS, K for KC, C and No suffix is required for PSE, and 00 for power cord other than A, D, E, K, C, No suffix.

*2 Please contact Mitutoyo sales office with respect to the models that are applicable to the models other than mentioned above.

*3 The flexible arm type cannot be used concurrently with a counter stand.



Refer to the **QM-Data200** and Vision Unit Brochure (**E14008**) for more details.

Microscopes

Microscope lineups that systemize observation, measurement and processing

FS-70

SERIES 378 — Microscope Unit for Semiconductor Inspection

- Compact microscope unit equipped with an eyepiece observation section.
- Can be used with YAG (near-infrared, visible, near-ultraviolet, or ultraviolet) lasers.*1
- Usable in infrared optical systems*2. Applications: observation of silicon wafers; spectral characteristics analysis using infrared.

*1 The performance and safety of laser-equipped system products is not guaranteed.

*2 An infrared source and infrared camera are necessary.

- Models supporting BF (Bright-field), DF (Dark-field), Polarization, and Differential Interference Contrast (DIC) are available.
- The inward-facing turret and long working distance objective lenses maintain the high operability of the microscope.



FS70Z



FS70L4

Note: The parfocal manual turret, eyepieces and objective lenses are optional.



Refer to the Microscope Units and Objectives Brochure (E14020) for more details.

SPECIFICATIONS

| Standard head type | Model No. | FS70 | — | FS70Z | — | FS70ZD | FS70L | FS70L4 |
|---|--|---|---------------------------------|---|--------------------------------------|---|--------------------------------------|---|
| | Order No. | 378-184-1 | — | 378-185-1 | — | Made-to-order | 378-186-1 | 378-187-1 |
| Tilting head type | Model No. | — | FS70-TH | — | FS70Z-TH | FS70ZD-TH | FS70L-TH | FS70L4-TH |
| | Order No. | — | 378-184-3 | — | 378-185-3 | Made-to-order | 378-186-3 | 378-187-3 |
| Focus adjustment | 50 mm travel range with concentric coarse (3.8 mm/rev) and fine (0.1 mm/rev) focusing wheels (right/left) | | | | | | | |
| Observation image | Erect image | | | | | | | |
| | BF (Bright-field) | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| | BD (Bright-field/Dark-field) | | | | | ✓ | | |
| | Polarization | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Differential Interference Contrast (DIC) | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Optical tube type | Siedentopf, adjustable interpupillary distance range: 51 to 76 mm | | | | | | | |
| Field number | 24 mm | | | | | | | |
| Tilt angle | 0 to 20°, displacement of eye point: 114 mm (only for tilting head type) | | | | | | | |
| Optical pass ratio | Fixed type (Eyepiece/TV= 50/50) | Switchable type (Eyepiece/Tube= 100/0: 0/100) | Fixed type (Eyepiece/TV= 50/50) | Switchable type (Eyepiece/Tube= 100/0: 0/100) | Fixed type*3 (Eyepiece/TV= 50/50) | Switchable type (Eyepiece/Tube= 100/0: 0/100) | | |
| Protective filter | — | | | | | Built-in laser beam filter | | |
| Tube lens | 1X | | | 1X to 2X zoom | | 1X | | |
| Applicable laser | — | | | | | 1064/532/355 nm | | 532/266 nm |
| Camera mount | C-mount (using optional adapter B*1) | | | | | Use a laser with TV port. | | C-mount receptacle (with green filter switch) |
| Illumination system, optional | Reflective illumination for Bright-field (Koehler illumination, with aperture diaphragm) 12 V, 100 W fiber-optics, stepless adjustment, light guide length: 1.5 m | | | | | | | |
| Objective, optional (for observation) | M Plan Apo /HR/SL, G Plan Apo | | | | BD Plan Apo | M Plan Apo /HR/SL, G Plan Apo | | |
| Objective, optional (for laser-cutting) | — | | | | | | NIR Series NUV Series | UV Series |
| Loading*2 | 14.5 kg | 13.6 kg | 14.1 kg | 13.2 kg | 14.1 kg (tilting head type: 13.2 kg) | 14.2 kg (tilting head type: 13.5 kg) | 13.9 kg (tilting head type: 13.1 kg) | |
| Mass (main unit) | 6.1 kg | 7.1 kg | 6.6 kg | 7.5 kg | 6.6 kg (tilting head type: 7.5 kg) | 6.4 kg (tilting head type: 7.2 kg) | 6.7 kg (tilting head type: 7.5 kg) | |

*1 Installation is optional.

*2 Loading on optical tube excluding weight of objective lenses and eyepieces

*3 It is a switchable type when using FS70ZD-TH (Tilting head type).

Note: Observe the following precautions when using FS70L or FS70L4 with YAG laser source attached.

- Be aware of the laser power and energy density limitations of the optical system to avoid damage.
- Check the mass of the laser source. When mounting on a high-speed device or acceleration/deceleration device, please contact us.

| | |
|------------------|---|
| Bulb replacement | Standard: Halogen bulb (12 V, 100 W) (517181) |
| | For the fiber-optic cable illumination unit (12 V, 100 W) (378-700) |

- Compact and lightweight microscope designed to be built in for camera observation
- Can be used with YAG (near-infrared, visible, near-ultraviolet, or ultraviolet) lasers.*1
- *1 The performance and safety of laser-equipped system products is not guaranteed.
- For **VMU-LB** and **VMU-L4B**, the rigidity and general performance of the microscope main unit have been enhanced compared with previous models.
- Compatible with infrared optical systems*2
- *2 An infrared source and infrared camera are necessary.

VMU SERIES 378 — Video Microscope Unit

- Telecentric system equipped with an aperture diaphragm is standard on the reflected illumination optical system.
- Best suited to process images for which uniform illumination is required.
- Design and manufacture are flexible to meet your demands such as double camera mounting or double (low/high) magnification.



SPECIFICATIONS

| Model No. | VMU-V | VMU-H | VMU-LB | VMU-L4B |
|---------------------------------------|---|-----------------------------|--|--|
| Order No. | 378-505 | 378-506 | 378-513 | 378-514 |
| Camera mounting direction | Vertical | Horizontal | Vertical (Rotatable) | |
| Observation | Bright-field/Erect image | Bright-field/Inverted image | Bright-field/Erect image | |
| Optical tube | Equipped with a C-mount | | | Equipped with a C-mount (Equipped with a green filter switching mechanism) |
| Image forming (tube) lens | Built-in 1X (visible/near-infrared calibration) | | Built-in 1X (near-infrared/visible/near-ultraviolet calibration) | Built-in 1X (ultraviolet/visibility compensation) |
| Available for lasers | — | | YAG laser source (Fundamental, Second/Third harmonic) mountable | YAG laser source (Second/Third/Fourth harmonic) mountable |
| Objective lens (optional) | For laser processing | | M/LCD Plan Apo NIR Series M/LCD Plan Apo NUV Series Note: Selected depending on the wavelength of the laser source | M/LCD Plan Apo NIR Series M/LCD Plan Apo NUV Series M/LCD Plan UV Series Note: Selected depending on the wavelength of the laser source |
| Applicable camera (s) | 2/3 type or less cameras (C-mount type) | | | |
| Reflected illumination optical system | Telecentric system equipped with an aperture diaphragm | | | |
| Illumination unit (optional) | Fiber-optic cable illumination unit (12 V, 100 W) (378-700*)/(15 V, 150 W) (176-316*) | | | |
| Main unit mass | 650 g | 750 g | 1270 g | 1300 g |

* Order numbers differ depending on the power supply cord.

Note 1: Besides the models shown above, products equipped with a compact Koehler illumination system intended for general observation are also available.

Note 2: The **M Plan Apo 1X** objective lens is used with the polarization unit (**378-710** or **378-715**).



Refer to the Microscope Units and Objectives Brochure (**E14020**) for more details.

- Incorporates a wide-field image sensor (APS-C format or smaller size) providing seven times greater viewing area than the **VMU** Series for greatly enhanced inspection efficiency.
- In addition to normal bright-field observation, this series supports dark-field observation for scratch inspection, etc., and polarized light observation for increased contrast when viewing certain specimens.
- Bulk inspections covering a wide area can be performed with multiple units in a high-density configuration.

WIDE VMU SERIES 378 — Wide-field Video Microscope Unit



WIDE VMU-V

WIDE VMU-H

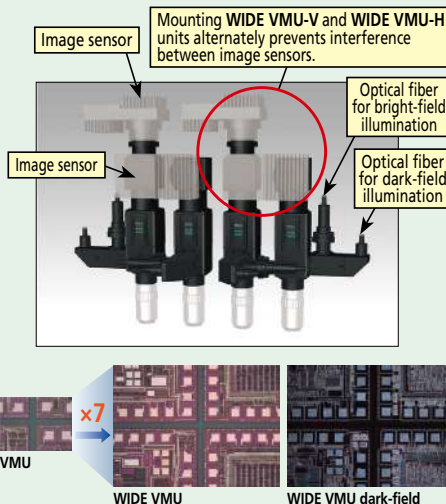
WIDE VMU-BDV

WIDE VMU-BDH

SPECIFICATIONS

| | For Bright-field Observation | | For Bright/Dark-field Observation | |
|---------------------------------------|---|-----------------------------|---|----------------------------------|
| Model No. | WIDE VMU-V | WIDE VMU-H | WIDE VMU-BDV | WIDE VMU-BDH |
| Order No. | 378-515 | 378-516 | 378-517 | 378-518 |
| Camera mounting orientation | Vertical | Horizontal | Vertical | Horizontal |
| Observation | Bright-field/Erect image | Bright-field/Inverted image | Bright/Dark-field/Erect image | Bright/Dark-field/Inverted image |
| Optical system | Magnification: 1X Visible light | | | |
| Camera Mount | F-Mount, C-Mount (with aligning and parfocal adjustment mechanism) | | | |
| Optical tube | Imaging forming (tube) lens Built-in 1X tube lens (Correcting wavelength range: 436 to 656 nm) | | | |
| Image field | ø30 | | | |
| Polarized unit* | Mountable | | | |
| Objective lens (required option) | M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo | | BD Plan Apo | |
| Applicable camera | APS-C format or smaller size | | | |
| Reflected illumination optical system | Telecentric illumination, Bright-field illumination optical tube (Single-port fiber-optic illumination) | | Telecentric illumination, Bright/Dark-field illumination optical tube (Dual-port fiber-optic illumination) Bright/Dark-field switching with light source on-off | |
| Illumination unit (optional) | Fiber-optic illumination unit (12 V, 100 W) (378-700)/(15 V, 150 W) (176-316) | | | |
| Main unit mass | 1800 g | 1950 g | 2000 g | 2150 g |

* Polarized observation by Bright-field illumination



Microscopes

Microscope lineups that systemize observation, measurement and processing

FS objective lenses

SERIES 378 — Ultra-long working distance objective lens

- **M/BD Plan Apo** (M Plan Apochromat Bright/Dark-field) Series objectives feature the image evenness over the entire view field needed to achieve high color reproducibility.
- The following objective lenses support a wide range of wavelength including near infrared, visible, and ultraviolet lasers. Specialty LCD laser objectives are available: **M/LCD Plan NIR (-HR)** Series (Near-infrared lenses for laser processing featuring ultra-long working distances), **M/LCD Plan NUV** Series (Near-ultraviolet lenses), **M/LCD Plan UV** Series (Ultraviolet lenses), and **G Plan Apo** Series (Cover Glass corrected lenses that allow focusing through a window for vacuum and high temperature applications).
- Uses environment-friendly glass (no lead or arsenic) for the lens material (of the specified models).

BF (Bright-field) for observation/measurement



BD (Bright/Dark-field) for observation/measurement



For near-infrared calibration (**NIR**)



For near-ultraviolet calibration (**NUV**)



For the ultraviolet calibration (**UV**)



Refer to the Microscope Units and Objectives Brochure (**E14020**) for more details.

Varifocal Lens TAGLENS

- Without changing the required magnification, ultra-high speed variable focal length enables obtaining perfectly focused images in real-time with stress-free operation.
- The time required for auto-focusing is drastically reduced, and the optical system focus range is extended without the expense of a mechanical drive.

TAGLENS-T1

Ultra-high speed, varifocal lens.
A dedicated controller is equipped as standard.

SPECIFICATIONS

| | |
|---------------------|--|
| Operating principle | Variable refraction index |
| Resonance frequency | 70 kHz |
| Effective aperture | ø11 mm* |
| Transmittance | 90 % or more (λ 400 to 700 nm)* |

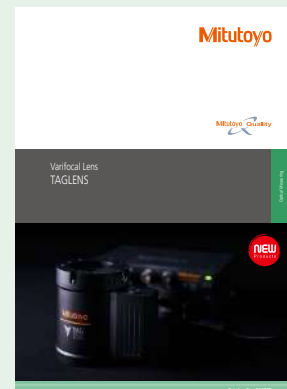
* The above values are theoretical based on optical design.

Video Microscope Unit VMU-T1

TAGLENS-T1 is installed in the microscope unit. Incorporating the objective lens and the camera enables configuring a varifocal optical system.

SPECIFICATIONS

| Compatible TAGLENS | TAGLENS-T1 |
|----------------------------|---|
| Imaging lens magnification | 1X |
| Imaging area | ø11 mm |
| Applicable objective lens | M Plan Apo Series |
| Optional | Manual turret, Power turret, Polarizer, Focusing unit A or B, XY stage, Simplified stand. |

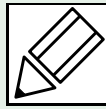


Refer to the Varifocal Lens **TAGLENS** Brochure (**E14025**) for more details.

M Plan Apo Series

| Objective lens | 1X | 2X | 5X | 7.5X | 10X | 20X | 50X |
|---------------------------|-----------------|---------|---------|-----------|-----------|-----------|-----------|
| Depth of focus×2 (mm) | 0.88 | 0.18 | 0.028 | 0.012 | 0.007 | 0.003 | 0.0018 |
| Total scanning width (mm) | 16 | 4.0 | 0.64 | 0.28 | 0.16 | 0.04 | 0.007 |
| Real FOV | | | | | | | |
| (mm) | 1/2 inch camera | 4.8×6.4 | 2.4×3.2 | 0.96×1.28 | 0.64×0.85 | 0.48×0.64 | 0.24×0.32 |
| | 2/3 inch camera | 6.6×8.8 | 3.3×4.4 | 1.32×1.76 | 0.88×1.17 | 0.66×0.88 | 0.33×0.44 |

Quick Guide to Precision Measuring Instruments



Microscopes

Numerical Aperture (NA)

The NA figure is important because it indicates the resolving power of an objective lens. The larger the NA value the finer the detail that can be seen. A lens with a larger NA also collects more light and will normally provide a brighter image with a narrower depth of focus than one with a smaller NA value.

$$NA = n \cdot \sin \theta$$

The formula above shows that NA depends on n , the refractive index of the medium that exists between the front of an objective and the specimen (for air, $n = 1.0$), and angle θ , which is the half-angle of the maximum cone of light that can enter the lens.

Resolving Power (R)

The minimum detectable distance between two image points, representing the limit of resolution. Resolving power (R) is determined by numerical aperture (NA) and wavelength (λ) of the illumination.

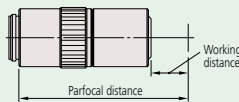
$$R = \frac{\lambda}{2 \cdot NA} \quad (\mu\text{m}) \quad \lambda = 0.55 \mu\text{m} \text{ is often used as the reference wavelength}$$

Working Distance (W.D.)

The distance between the front end of a microscope objective and the surface of the workpiece at which the sharpest focusing is obtained.

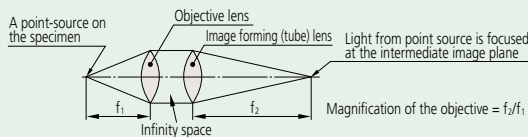
Parfocal Distance

Distance between the surface of the specimen and the objective's seating surface when in focus.



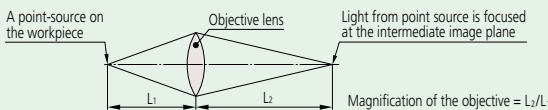
Infinity-corrected Optical System

An optical system in which the image is formed by an objective and a tube lens with an 'Infinity Space' between them, into which optical accessories can be inserted.



Finite-corrected Optical System

An optical system in which the image is formed only by an objective lens.



Focal Length (f)

unit: mm

The distance from the principal point to the focal point of a lens: if f_1 represents the focal length of an objective and f_2 represents the focal length of an image forming (tube) lens then magnification is determined by the ratio between the two. (In the case of the infinity-correction optical system.)

$$\text{Objective magnification} = \frac{\text{Focal length of the image-forming (tube) lens}}{\text{Focal length of the objective}}$$

$$\text{Example: } 1X = \frac{200}{200} \quad \text{Example: } 10X = \frac{200}{20}$$

Focal Point

Light rays traveling parallel to the optical axis of a converging lens system and passing through that system will converge (or focus) to a point on the axis known as the rear focal point, or image focal point.

Depth of Focus (DOF)

unit: mm

This is the distance (measured in the direction of the optical axis) between the two planes which define the limits of acceptable image sharpness when the microscope is focused on an object. As the numerical aperture (NA) increases, the depth of focus becomes shallower, as shown by the expression below:

$$DOF = \frac{\lambda}{2 \cdot (NA)^2} \quad \lambda = 0.55 \mu\text{m} \text{ is often used as the reference wavelength}$$

Example: For an **M Plan Apo 100X** lens ($NA = 0.7$)

The depth of focus of this objective is

$$\frac{0.55 \mu\text{m}}{2 \times 0.7^2} = 0.6 \mu\text{m}$$

Bright-field and Dark-field Illumination

In bright-field illumination a full cone of light is focused by the objective on the specimen surface. This is the normal mode of viewing with an optical microscope. With dark-field illumination, the inner area of the light cone is blocked so that the surface is only illuminated by light from an oblique angle. Dark-field illumination is good for detecting surface scratches and contamination.

Apochromat and Achromat Objectives

An apochromat objective is a lens corrected for chromatic aberration (color blur) in three colors (red, green, blue). An achromat objective is a lens corrected for chromatic aberration in two colors (red, blue).

Magnification

The ratio of the size of a magnified object image created by an optical system to that of the object. Magnification commonly refers to lateral magnification although it can mean lateral, vertical, or angular magnification.

Principal Ray

A ray considered to be emitted from an object point off the optical axis and passing through the center of an aperture diaphragm in a lens system.

Aperture Diaphragm

An adjustable circular aperture which controls the amount of light passing through a lens system. It is also referred to as an aperture stop and its size affects image brightness and depth of focus.

Field Stop

An aperture which controls the field of view in an optical instrument.

Telecentric System

An optical system where the light rays are parallel to the optical axis in object and/or image space. This means that magnification is nearly constant over a range of working distances, therefore almost eliminating perspective error.

Erect Image

An image in which the orientations of left, right, top, bottom and moving directions are the same as those of a workpiece on the workstage.

Field number (FN), real field of view, and monitor display magnification

unit: mm

The observation range of the sample surface is determined by the diameter of the eyepiece's field stop. The value of this diameter in millimeters is called the field number (FN). In contrast, the real field of view is the range on the workpiece surface when actually magnified and observed with the objective lens. The real field of view can be calculated with the following formula:

(1) The range of the workpiece that can be observed with the microscope (diameter)

$$\text{Real field of view} = \frac{\text{FN of eyepiece}}{\text{Objective lens magnification}}$$

$$\text{Example: The real field of view of a 10X lens is } 2.4 = \frac{24}{10}$$

(2) Monitor observation range

$$\text{Monitor observation range} = \frac{\text{The size of the camera image sensor (Length} \times \text{Height)}}{\text{Objective lens magnification}}$$

Size of image sensor

| Format | Diagonal length | Length | Height |
|--------|-----------------|--------|--------|
| 1/3 in | 6.0 | 4.8 | 3.6 |
| 1/2 in | 8.0 | 6.4 | 4.8 |
| 2/3 in | 11.0 | 8.8 | 6.6 |

(3) Monitor display magnification

$$\text{Monitor display magnification} = \frac{\text{Display diagonal length on the monitor}}{\text{Objective lens magnification} \times \text{Diagonal length of camera image sensor}}$$

New Products

Mitutoyo



MISCAN
Vision System



CNC Vision Measuring System

QV Active

Refer to page K-3 for details.



Vision Measuring Machine with Micro-Form Scanning Probe

MiSCAN Vision System

Refer to page K-10 for details.



Vision Measuring System

QUICK SCOPE QS-L

Refer to page K-13 for details.



Vision Measuring Systems

Quick Vision



MiSCAN Vision System



QUICK SCOPE



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HYPER MiSCAN Vision System



K

Vision Measuring Systems

Vision measuring systems for multipurpose use

QV Active CNC Vision Measuring System

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Cost effective, multifunction, CNC Vision Measuring System.
- Usability has been improved by adopting a color camera and 8-step zoom optics.
- A touch-probe model can seamlessly perform non-contact and contact measurement.

- The zoom ratio of 7X (14X at maximum by changing the fixed-magnification objective lens) enables a wide range of inspection from wide view measurement at low magnification to micro-measurement at high magnification.
- The 74 mm maximum working distance (1X optional objective) promotes safe working by reducing the risk of collision, and allows greater freedom in fixture design.



QV Active 202

From wide view measurement to micro-measurement

| Optical magnification | 0.5X | 0.65X | 0.75X | 0.85X | 0.98X | 1X | 1.28X | 1.3X | 1.5X | 1.7X | 2X | 2.25X | 2.5X | 3X | 3.5X | 3.75X | 4X | 5X | 5.25X | 7X | |
|--------------------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| View field (mm) | Horizontal (H) | 13.60 | 10.46 | 9.07 | 8.00 | 6.94 | 6.80 | 5.31 | 5.23 | 4.53 | 4.00 | 3.40 | 3.02 | 2.72 | 2.27 | 1.94 | 1.81 | 1.70 | 1.36 | 1.30 | 0.97 |
| | Vertical (V) | 10.80 | 8.31 | 7.20 | 6.35 | 5.51 | 5.40 | 4.22 | 4.15 | 3.60 | 3.18 | 2.70 | 2.40 | 2.16 | 1.80 | 1.54 | 1.44 | 1.35 | 1.08 | 1.03 | 0.77 |
| Total magnification (on the monitor) | | 13.20 | 17.10 | 19.80 | 22.40 | 25.80 | 26.40 | 33.70 | 34.30 | 39.50 | 44.80 | 52.70 | 59.30 | 65.90 | 79.10 | 92.30 | 98.90 | 105.50 | 131.80 | 138.40 | 184.50 |
| Objective lens | 1X objective (optional) Working distance | 74 mm | | | | | | | | | | | | | | | | | | | |
| | 1.5X objective (standard accessory) Working distance | 42 mm | | | | | | | | | | | | | | | | | | | |
| | 2X objective (optional) Working distance | 42 mm | | | | | | | | | | | | | | | | | | | |

Note: The total magnification indicates the magnification on the monitor when the size of the QVPAK video window is 178.8x143.0 mm (default).

SPECIFICATIONS

| Model | QV Active 202 | QV Active 404 |
|---|---|---|
| Type | Standard model | Standard model |
| Measuring range (XxYxZ) | 250x200x150 mm (250x200x118 mm: when 1X objective is used) | 400x400x200 mm (400x400x168 mm: when 1X objective is used) |
| Observation unit | Zoom unit (8 positions) | |
| Imaging device | Color CMOS camera | |
| Measuring accuracy* | E _x , E _y | (2 + 3L/1000) μm |
| | E _z | (3 + 5L/1000) μm |
| | E _z | (2.5 + 4L/1000) μm |
| | Accuracy guaranteed with optics specified | Objective: 1.5X, Optical magnification: 5.25X |
| Touch-trigger probe measuring accuracy* | E _x , E _y , E _z | — |
| Accuracy guaranteed temperature | 20±1 °C | 20±1 °C |

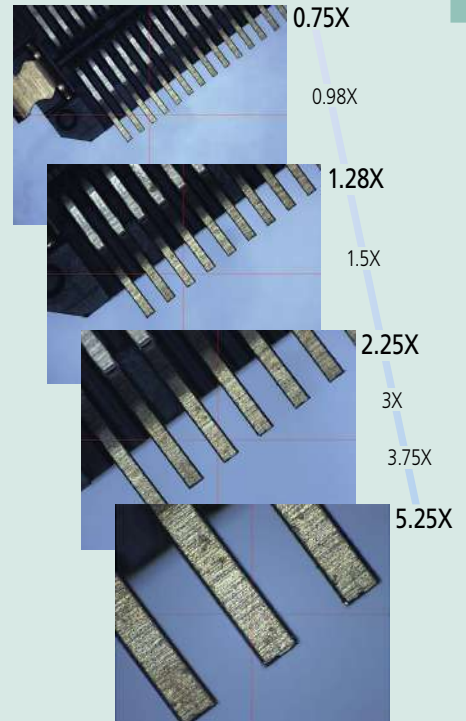
* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

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Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **QUICK VISION Active Series Brochure (E14022)** for more details.

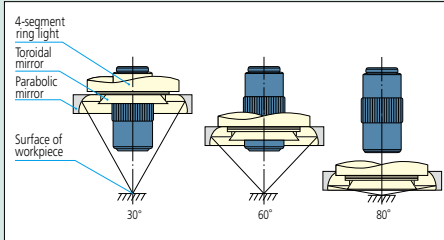


An inspection certificate is supplied as standard. Refer to page U-11 for details.

- QV Series standard models range in size from compact to large.
- There are a general-purpose model with white LED light and an enhanced edge detection model with RGB color LEDs.
- A custom model with higher optical performance 3CCD camera is also available to order.

Programmable ring light

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. Illumination can be controlled independently in every direction, back and forth, right and left.



QV Apex/Hyper QV CNC Vision Measuring System



QV Apex 302



Hyper QV 404

Measurement example of IC package terminal bottom width

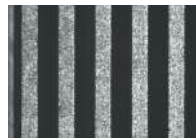


Image viewed with Co-axial light

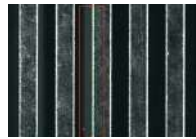
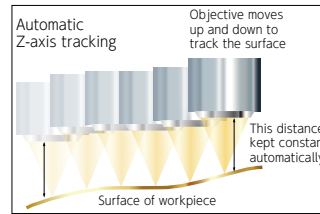


Image with programmable ring light

Tracking Auto Focus (TAF)

Laser radiation from the objective lens enables automatic focusing. The system automatically keeps the object in focus according to its shape, eliminating the task of focus adjustment and increasing measurement throughput.

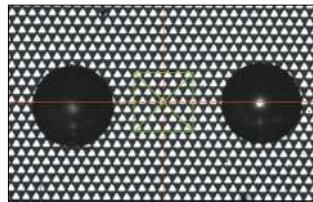


| | |
|-------------------|--|
| Laser source | Semiconductor laser (peak wavelength: 690 nm) |
| Laser safety | Class 2 (JIS C6802: 2014, EN/IEC 60825-1: 2014) |
| Auto focus system | Objective coaxial autofocusing (knife-edge method) |

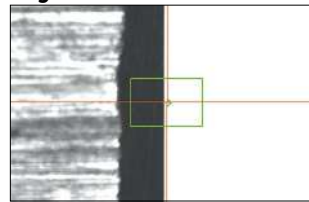
High-Performance Multi-Auto Focus

The QV Series is equipped with a high-performance image auto focus function as standard. Image auto focus is used to guarantee accuracy. Thanks to the availability of various auto focus tools, the optimal focus for each surface texture and measured feature can be selected, which makes it possible to perform highly reliable height measurements.

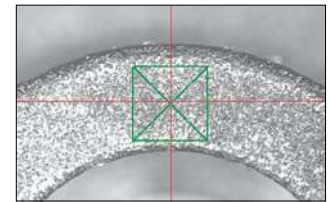
Pattern Focus



Edge Focus



Surface Focus



SPECIFICATIONS

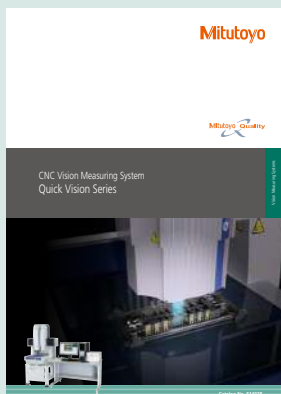
QV Apex

| Model | QV Apex 302 | QV Apex 404 | QV Apex 606 |
|-------------------------|-----------------------------------|--------------------|----------------|
| Measuring range (XxYxZ) | 300x200x200 mm | 400x400x250 mm | 600x650x250 mm |
| Observation Unit | | PT 1X-2X-6X | |
| Imaging Device | | B&W CCD (1/2 in) | |
| Measuring accuracy* | E _{1X} , E _{1Y} | (1.5 + 3L/1000) μm | |
| | E _{1Z} | (1.5 + 4L/1000) μm | |
| | E _{2XY} | (2 + 4L/1000) μm | |

Hyper QV (Specifications other than as quoted in the table are the same as the QV Apex specifications.)

| Model | Hyper QV 302 | Hyper QV 404 | Hyper QV 606 |
|---------------------|-----------------------------------|--------------------|--------------|
| Imaging Device | | B&W CCD (1/2 in) | |
| Measuring accuracy* | E _{1X} , E _{1Y} | (0.8 + 2L/1000) μm | |
| | E _{1Z} | (1.5 + 2L/1000) μm | |
| | E _{2XY} | (1.4 + 3L/1000) μm | |

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)



Refer to the **QUICK VISION Series Brochure (E14028)** for more details.

Vision Measuring Systems

Vision measuring systems for multipurpose use

QV STREAM PLUS Non-stop CNC Vision Measuring System

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The main unit operation and the strobe light are synchronized to enable vision measurement without stopping the stage. As it is unnecessary to increase or decrease the stage speed, measurement becomes 5X faster than conventional models depending on the object type. (Compared with our conventional models.)
- The model with tracking auto focus performs continuous measurement by adapting to height differences, thus reducing the measurement time significantly.



QV STREAM PLUS 606

SPECIFICATIONS

| Model No. | QV STREAM PLUS 302 | QV STREAM PLUS 404 | QV STREAM PLUS 606 |
|----------------------------|--------------------|-------------------------------|--------------------|
| Measuring range (XxYxZ) | 300x200x200 mm | 400x400x250 mm | 600x650x250 mm |
| Observation unit | PT 1X-2X-6X | | |
| Imaging device | B&W CCD (1/2 in) | | |
| Measuring accuracy* | E_{1x}, E_{1y} | (1.5 + 3L/1000) μm | |
| | E_{1z} | (1.5 + 4L/1000) μm | |
| | E_{2xy} | (2.0 + 4L/1000) μm | |
| Tracking auto focus device | Optional | | |

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)
Note: Only one of the illumination functions (reflected, transmitted, and PRL illumination) can be set in STREAM mode.
The 4-way PRL illumination can be set to 4-direction lighting or single-direction lighting.

QV ACCEL Large CNC Vision Measuring System

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- This is a vision measuring machine with moving-bridge type main unit structure suitable for measuring large objects.
- **QV ACCEL 1212** (range: 1250x1250x100mm) and **QV ACCEL 1517** (range: 1500x1750x100 mm) are available to special order.
- As the stage is immobile on the moving-bridge structure, you can use

a simple method to fix a workpiece, which is suitable for measuring small, thin objects.



QV ACCEL 808

SPECIFICATIONS

| Model No. | QV ACCEL 808 | | QV ACCEL 1010 |
|----------------------------|------------------|-------------------------------|---------------------------|
| Measuring range (XxYxZ) | 800x800x150 mm | | 1000x1000x150 mm |
| Observation unit | PT 1X-2X-6X | | |
| Imaging device | B&W CCD (1/2 in) | | |
| Measuring accuracy* | E_{1x}, E_{1y} | (1.5 + 3L/1000) μm | |
| | E_{1z} | (1.5 + 4L/1000) μm | |
| | E_{2xy} | (2.5 + 4L/1000) μm | |
| Repeatability* | Short dimensions | X axis, Y axis | $3\sigma=0.2 \mu\text{m}$ |
| | Long dimensions | | $3\sigma=0.7 \mu\text{m}$ |
| Tracking auto focus device | Optional | | |

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

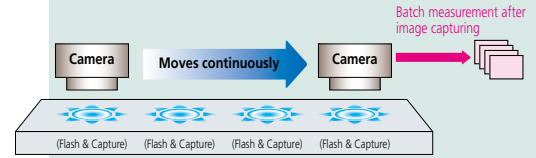
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Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Flow of non-stop measurement

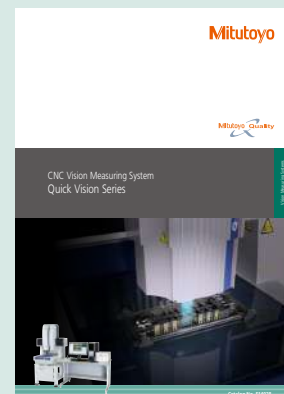


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Refer to the **QUICK VISION Series Brochure (E14028)** for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

ULTRA QV 404 Ultra-High Accuracy CNC Vision Measuring System



ULTRA QV 404

- Ultra-high accuracy CNC vision measuring machine with measuring accuracy of E_{1XY} ($0.25 + L/1000$) μm .
- Our proprietary high-resolution (Resolution: $0.01 \mu\text{m}$) and high-accuracy low-expansion glass scales are used on the X, Y and Z axes.
- The high-rigidity Y-axis table moving mechanism with fixed bridge has been adopted. The base is made of high stability granite.
- This model is standard-equipped with an automatic temperature compensation function that uses a temperature sensor on the main unit of the measuring machine and a temperature sensor for the workpiece.

SPECIFICATIONS

| Model No. | ULTRA QV 404 | |
|---------------------------------|---------------------------|---|
| Measuring range (X×Y×Z) | 400×400×200 mm | |
| Observation unit | PT 1X-2X-6X | |
| Imaging device | B&W CCD (1/2 in) | |
| Measuring accuracy (E_1) *1 | E_{1X}, E_{1Y} | ($0.25 + L/1000$) μm |
| | E_{1Z} (Full stroke) | ($1.5 + 2L/1000$) μm (Range 200 mm) |
| | E_{1Z} (50 mm stroke)*2 | ($1.0 + 2L/1000$) μm (Range 10 to 60 mm) |
| Measuring accuracy (E_2)*1 | E_{2XY} | ($0.5 + 2L/1000$) μm |
| Tracking auto focus device | Optional | |

*1 Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

*2 Verified at shipment from factory.

Hyper QVWLI Non-contact 3D Measuring System



Hyper QVWLI 606

- **Hyper QVWLI** is a high-accuracy complex 3D measurement system consisting of **QV** and a white light interferometer.
- Allows you to analyze 3D surface texture from 3D data captured by the WLI optical head. It is also suitable for measuring dimensions at a specific height and any cross-section from 3D data.

SPECIFICATIONS

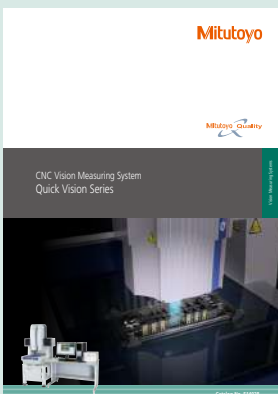
| Model No. | Hyper QVWLI 302 | Hyper QVWLI 404 | Hyper QVWLI 606 |
|---|--|-------------------------------|-----------------|
| Measuring range Vision measuring area (X×Y×Z) | 300×200×190 mm | 400×400×240 mm | 600×650×220 mm |
| | WLI measuring area*1 | 215×200×190 mm | 315×400×240 mm |
| WLI optical head unit | | | |
| View field (H×V) | 5X lens: approx. 0.64×0.48 mm / 10X lens: approx. 0.32×0.24 mm / 25X lens: approx. 0.13×0.10 mm / 50X lens: approx. 0.064×0.048 mm | | |
| Z repeatability | $2\sigma \leq 0.08 \mu\text{m}$ | | |
| Vision optical head unit | | | |
| Observation unit | PT 1X-2X-6X | | |
| Imaging device | B&W CCD (1/2 in) | | |
| Measuring accuracy*2 | E_{1X}, E_{1Y} | (0.8 + 2L/1000) μm | |
| | E_{1Z} | (1.5 + 2L/1000) μm | |
| | E_{2XY} | (1.4 + 3L/1000) μm | |

*1 Movable range of **WLI** optical head.

*2 Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **QUICK VISION** Series Brochure (**E14028**) for more details.

Vision Measuring Systems

Vision measuring systems for multipurpose use

QV TP CNC Vision Measuring System equipped with a Touch Trigger Probe

MeasurLink® ENABLED
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Non-contact and contact measurement on one machine

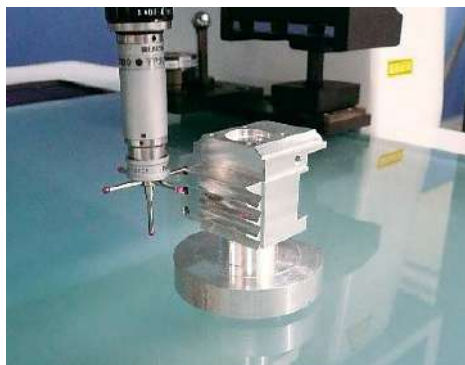
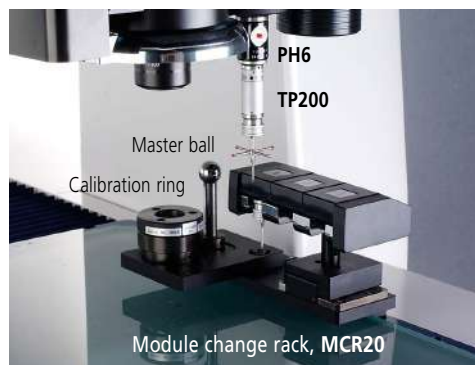
- QV touch-trigger probe unit enables both vision measurement and touch-trigger probe measurement.

3D workpiece measurement

- Enables 3D measurement of workpieces, such as press-molded products, plastic-molded products, and machined products, that until now could not be measured with image processing alone.

Module change rack available

- Using the module change rack enables switching between vision measurement and touch probe measurement during an automatic measuring sequence.



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Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

SPECIFICATIONS WITH TOUCH-TRIGGER PROBE OPTIONS MOUNTED

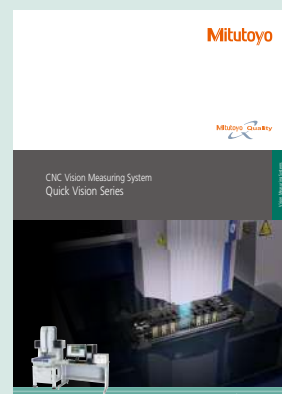
| Model No. | | QV TP Active 202 | QV TP Active 404 |
|--|---|--------------------|--------------------|
| Measuring range*1 (X×Y×Z) | Vision | 250×200×150 mm | 400×400×200 mm |
| | Common to Touch-trigger Probe | 184×200×150 mm | 334×400×200 mm |
| Measuring accuracy*2 (Touch-trigger probe) | E _{ix} , E _{iy} , E _{iz} | (2.4 + 3L/1000) μm | (2.4 + 3L/1000) μm |

| Model No. | | QV TP Apex 302 | QV TP Apex 404 | QV TP Apex 606 | Hyper QV TP 302 | Hyper QV TP 404 | Hyper QV TP 606 |
|--|---|--------------------|----------------|----------------|--------------------|-----------------|-----------------|
| Measuring range*1 (X×Y×Z) | Vision | 300×200×200 mm | 400×400×250 mm | 600×650×250 mm | 300×200×200 mm | 400×400×250 mm | 600×650×250 mm |
| | Common to Touch-trigger Probe | 234×200×200 mm | 334×400×250 mm | 534×650×250 mm | 234×200×200 mm | 334×400×250 mm | 534×650×250 mm |
| Measuring accuracy*2 (Touch-trigger probe) | E _{ix} , E _{iy} , E _{iz} | (1.8 + 3L/1000) μm | | | (1.7 + 3L/1000) μm | | |

*1 When a module change rack, a master ball, and a calibration ring are mounted, the measurement ranges are smaller than those in the table. Other specifications are the same as those for QV Active, QV Apex, and Hyper QV.

Please contact our sales office for more details.

*2 Inspected by Mitutoyo standard. L=length between two arbitrary points (mm)



Refer to the **QUICK VISION Series Brochure (E14028)** for more details.



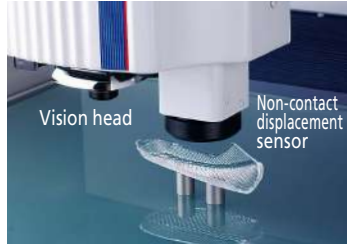
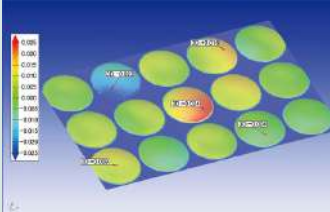
An inspection certificate is supplied as standard. Refer to page U-11 for details.

QVH Apex/Hyper QVH/ QVH STREAM PLUS CNC Vision Measuring System equipped with Non-contact displacement sensor

- A multi-sensor measuring machine equipped with an imaging optical head and non-contact displacement sensor. Both vision measurement and non-contact form measurement are possible.

- The laser probe equipped **HYBRID TYPE1** and CPS probe equipped **HYBRID TYPE4** are available.

Example of 3D form comparison



QVH 606

Features: HYBRID TYPE1

- The focusing point method minimizes the difference in the measuring face reflectance and achieves high measurement reproducibility.
- Capable of measuring detailed shapes in high resolution.

Features: HYBRID TYPE4

- Enables detection of high inclination angles for both mirror and diffused Surfaces.
- The automatic lighting adjustment function allows for high accuracy measurements.
- Surface roughness or thickness measurement of thin and transparent objects such as film.

COMMON SPECIFICATIONS for TYPE1/TYPE4

Apex / Hyper (Specifications other than as described below are the same as for models QV Apex, Hyper QV.)

| Items | | Model No. | QVH Apex 302 | QVH Apex 404 | QVH Apex 606 | Hyper QVH 302 | Hyper QVH 404 | Hyper QVH 606 |
|---|-----------------------------------|--------------|--------------------|----------------|----------------|--------------------|----------------|----------------|
| Measuring range (X×Y×Z) | Vision | | 300×200×200 mm | 400×400×250 mm | 600×650×250 mm | 300×200×200 mm | 400×400×250 mm | 600×650×250 mm |
| | Non-contact displacement sensor | TYPE1 | 180×200×200 mm | 280×400×250 mm | 480×650×250 mm | 180×200×200 mm | 280×400×250 mm | 480×650×250 mm |
| | | TYPE4 | 176×200×200 mm | 276×400×250 mm | 476×650×250 mm | 176×200×200 mm | 276×400×250 mm | 476×650×250 mm |
| Measuring accuracy* (Vision) | E _{1x} , E _{1y} | | (1.5 + 3L/1000) μm | | | (0.8 + 2L/1000) μm | | |
| | E _{1z} | | (1.5 + 4L/1000) μm | | | (1.5 + 2L/1000) μm | | |
| | E _{2xy} | | (2.0 + 4L/1000) μm | | | (1.4 + 3L/1000) μm | | |
| Measuring accuracy (non-contact displacement sensor)* | E _{1z} | | (1.5 + 4L/1000) μm | | | (1.5 + 2L/1000) μm | | |

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

SPECIFICATIONS for TYPE4

STREAM PLUS (Specifications other than as described below are the same as for model QV STREAM PLUS.)

| Items | | Model No. | QVH STREAM PLUS 302 | QVH STREAM PLUS 404 | QVH STREAM PLUS 606 |
|---|-----------------------------------|-----------|---------------------|---------------------|---------------------|
| Measuring range (X×Y×Z) | Vision | | 300×200×200 mm | 400×400×250 mm | 600×650×250 mm |
| | Non-contact displacement sensor | | 176×200×200 mm | 276×400×250 mm | 476×650×250 mm |
| Measuring accuracy* (Vision) | E _{1x} , E _{1y} | | (1.5 + 3L/1000) μm | | |
| | E _{1z} | | (1.5 + 4L/1000) μm | | |
| | E _{2xy} | | (2.0 + 4L/1000) μm | | |
| Measuring accuracy (non-contact displacement sensor)* | E _{1z} | | (1.5 + 4L/1000) μm | | |

* Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

CLASS 1 LASER PRODUCT

Safety precautions regarding QV HYBRID TYPE1

This product uses a low-power invisible laser (780 nm) for measurement. The laser is a CLASS 1 EN/IEC 60825-1 device. A warning and explanation label, as shown above, is attached to the product as appropriate.

Vision Measuring Systems

Vision measuring systems for multipurpose use

UMAP Vision System TYPE2 Micro Form Measuring System

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink ENABLED
Data Management Software by Mitutoyo

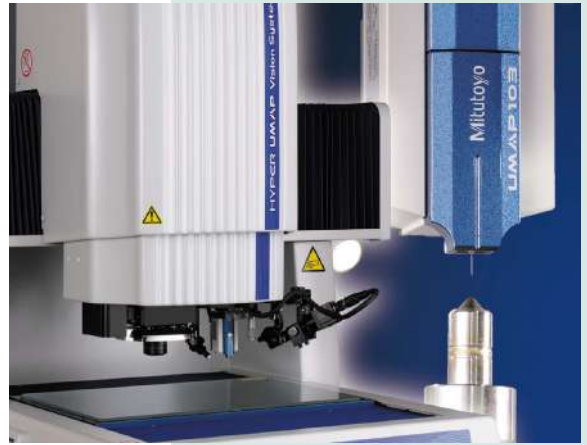
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



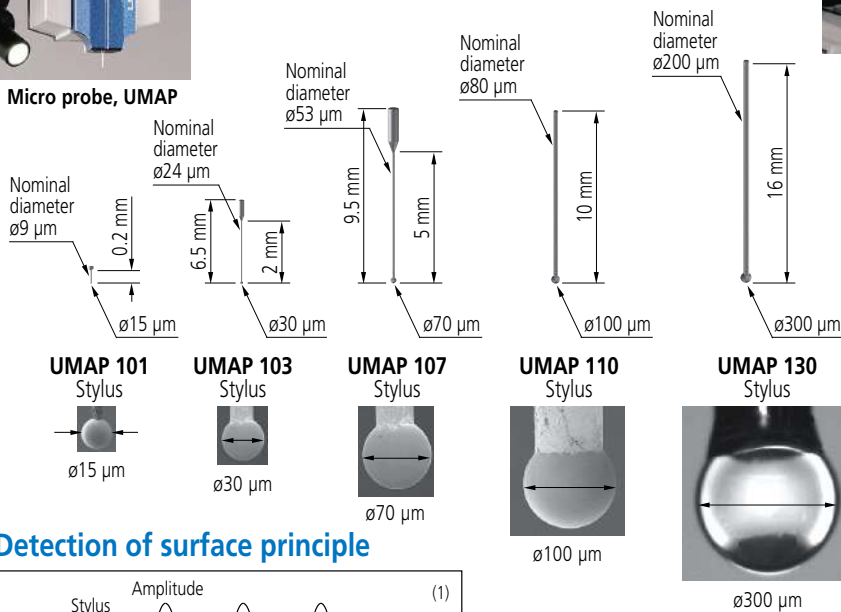
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Ultrasonic Micro Probe UMAP

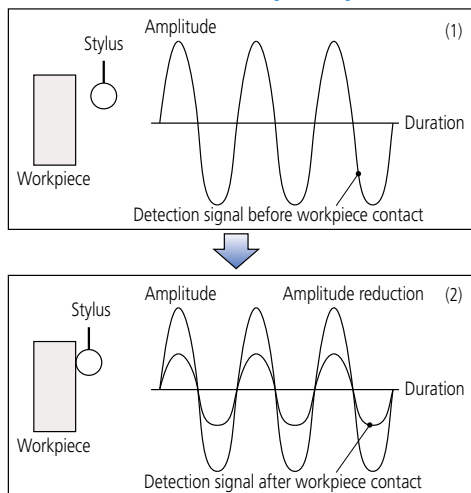
Contact measurement of a small hole's diameter and its section or contour is possible, which is difficult with a conventional Vision Measuring System or CMM. Capable of high accuracy, sophisticated, non-contact and contact measurement on one machine. With a minimum measuring force of 1 μN, it allows you to measure easy-to-deform and lightweight workpieces.



Micro probe, UMAP

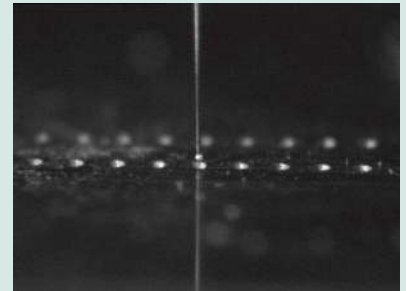


Detection of surface principle

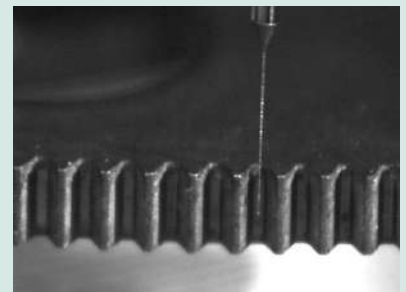


- (1) In this drawing, the stylus is vibrating with micro amplitude. If it does not come into contact with the workpiece the vibration state is maintained.
- (2) As the stylus comes into contact with the workpiece surface the vibration amplitude decreases as the contact increases. When the decreasing amplitude falls below a certain level, a touch-trigger signal is generated.

Typical application



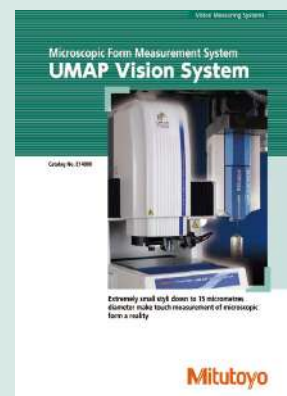
Contour measurement of a ø0.125 mm hole



Measuring form of micro gear teeth

SPECIFICATIONS

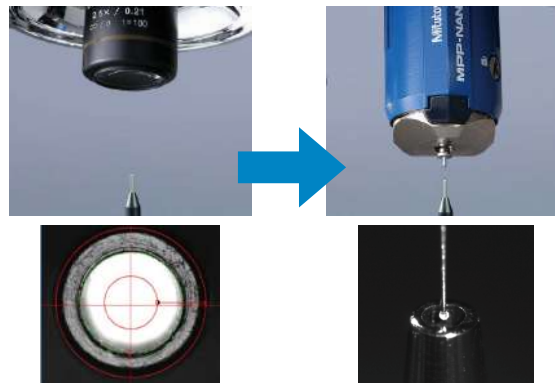
| Model No. | TYPE2 | | |
|--|------------------|-------------------------------|-------------------------------|
| | Hyper UMAP 302 | ULTRA UMAP 404 | |
| Measuring range (common to vision and UMAP) | X axis×Y axis | 185×200 mm | 285×400 mm |
| | Z axis | UMAP 101/103 | 175 mm |
| | | UMAP 107/110 UMAP 130 | 180 mm 185 mm |
| Measuring accuracy (Vision) | E_{1x}, E_{1y} | $(0.8 + 2L/1000) \mu\text{m}$ | $(0.25 + L/1000) \mu\text{m}$ |
| | E_{1z} | $(1.5 + 2L/1000) \mu\text{m}$ | |
| Repeatability | UMAP 101/103/107 | $\sigma = 0.1 \mu\text{m}$ | $\sigma = 0.08 \mu\text{m}$ |
| | UMAP 110/130 | $\sigma = 0.15 \mu\text{m}$ | $\sigma = 0.12 \mu\text{m}$ |



Refer to **UMAP Vision System Brochure (E14000)** for more details.

Vision Measuring Machine with Micro-Form Scanning Probe MiSCAN Vision System

- Hybrid measuring machine with vision head and scanning probe (**MPP-NANO**, **SP25M**).
- Newly developed **MPP-NANO** probe on which styli as small as 125 μm diameter can be mounted achieves autonomous 3D scanning of fine detail. The highly proven **SP25M** scanning probe is also supported.
- Using the observation camera, the approach to the workpiece for **MPP-NANO** stylus where visual confirmation is difficult can be easily performed while also checking for dirt and scratches on the workpiece.
- Using the same vision head as the **Quick Vision Series**, the best-selling vision measuring system, high level performance can be provided in vision measurement.



Precise positioning by monitoring the image

Measurement using **MPP-NANO** stylus

SPECIFICATIONS

| Model No. | | Hyper MVS 302 | Hyper MVS 404 | MVS Apex 404 |
|---------------------------------|-------------------------|--|--------------------|--------------------|
| Measuring range (X×Y×Z) | Vision measuring area | 300×200×200 mm | 400×400×250 mm | |
| | MPP-NANO / SP25M | 175×200×200 mm | 275×400×250 mm | |
| Imaging device | | B&W CCD camera | | |
| Observation unit | | PT 1X-2X-6X | | |
| Illumination unit | | Co-axial light, Transmitted light, PRL (programmable ring light) | | |
| Contact type probe | | MPP-NANO/SP25M | SP25M only | |
| Measuring accuracy | Vision* | E1x, E1y | (0.8 + 2L/1000) μm | (1.5 + 3L/1000) μm |
| | | E1z | (1.5 + 2L/1000) μm | (1.5 + 4L/1000) μm |
| | | E2xy | (1.4 + 3L/1000) μm | (2.0 + 4L/1000) μm |
| | MPP-NANO | E0, MPE | (1.9 + 4L/1000) μm | — |
| | SP25M | E0, MPE | (1.9 + 4L/1000) μm | (2.5 + 6L/1000) μm |
| Scanning accuracy | MPP-NANO | 0.6 μm | — | |
| | SP25M | MPE _{THP} | 2.5 μm | 2.7 μm |
| Probing accuracy | MPP-NANO | 0.6 μm | — | |
| | SP25M | P _{FTU} , MPE | 1.9 μm | 2.2 μm |
| Repeatability (σ) | MPP-NANO | 0.05 μm | — | |
| Accuracy guaranteed temperature | Ambient temperature | 18 to 23 °C | | |
| | Temperature variation | 0.5 °C / 1 H and 1 °C / 24 H | | |

* Image accuracy using a **QV-HR 2.5X** objective and 2X tube lens.



Refer to the **MiSCAN Vision System Brochure (E14024)** for more details.

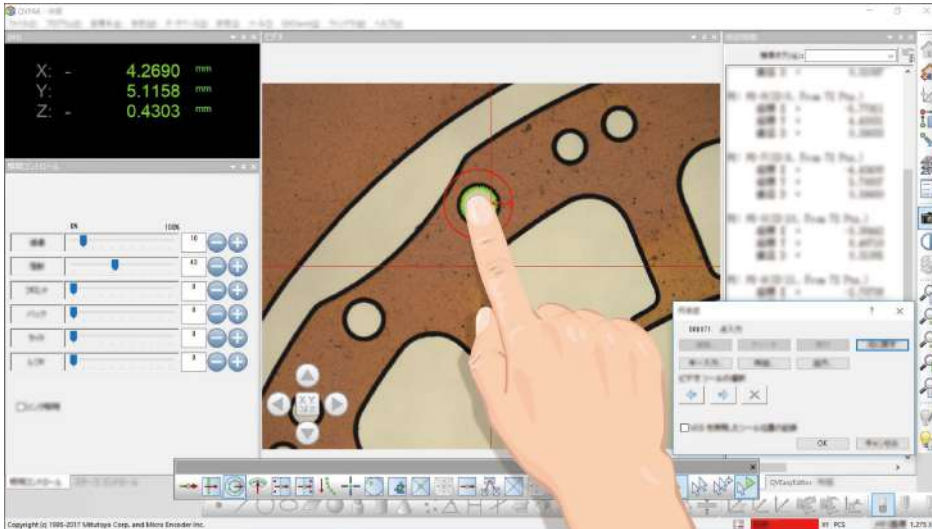
Vision Measuring Systems

Vision measuring systems for multipurpose use

QVPAK Data Processing Software for QUICK VISION

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The X, Y, and Z position data is detected from the measurement data gathered by the Quick Vision system and the arithmetic processing of coordinates and dimensions is performed immediately.



Gesture operation, like operating a smartphone, enables easy tool layout or stage shifting on systems with touch screens.

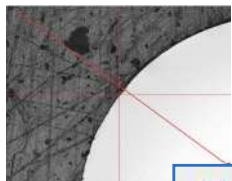
MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

MiCAT
Mitutoyo Intelligent Computer Aided Technology

the standard in world
metrology software
VISION

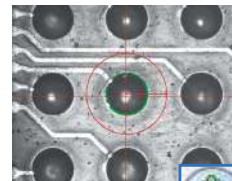
Edge Detection Tools



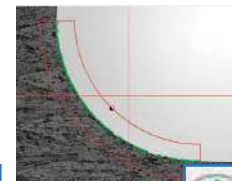
Point Tool
This is a basic tool for detecting one point.



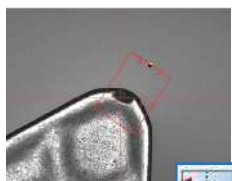
Box Tool
This tool detects linear edges with a minimum of one pixel interval. Compared to the point tool, the Box tool can perform averaging and remove abnormal points, which enables stable measurements.



Circle Tool
This tool detects circular edges with a minimum of one pixel space. Edges can be specified easily with a single click.



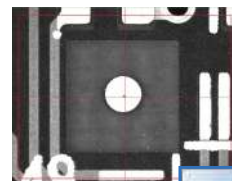
Arc Tool
This tool is suited to detection of arcs and corner radii.



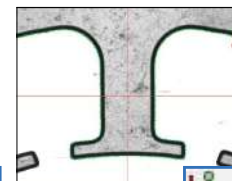
Maximum/Minimum Tool
This tool detects the maximum or minimum point within the range.



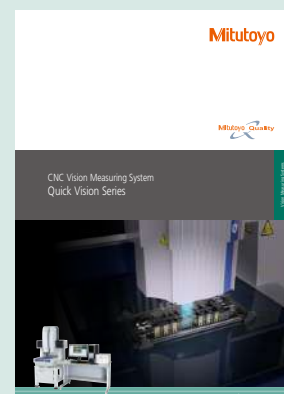
Area Centroid Tool
This tool detects the position of a form's centroid, and is suited to the positioning of different forms.



Pattern Search Tool
This tool performs pattern matching to detect a position, and is optimal for positioning alignment marks and similar tasks.



Auto Trace Tool
This is a shape-measuring tool that automatically tracks a contour with input consisting only of a start point and end point.



Refer to the **QUICK VISION Series Brochure (E14028)** for more details.

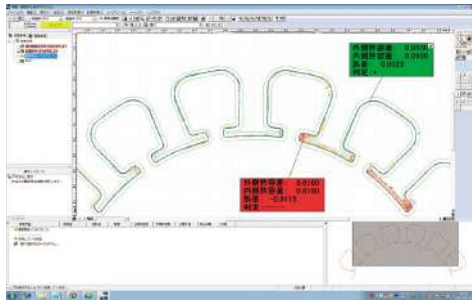
Application software (Optional)

QV PartManager

The **QV PartManager** is execution program management software for multiple workpieces arranged on the measuring stage.

Form assessment/analysis software FORMTRACEPAK-AP

Verification of designed value and form analysis are performed on the basis of the contour data obtained via the **QV** auto trace tool, non-contact displacement sensor, PFF, and WLI.

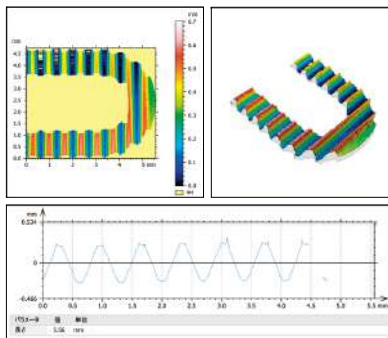


FORMTRACEPAK-PRO

This software performs 3D form analysis from the data obtained via the non-contact displacement sensor of the **QVHYBRID** Series.

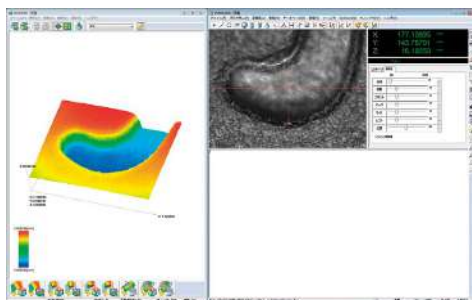
MCubeMap

Allows you to analyze parameters compliant with JIS B681-2: 2018 (ISO25178-6: 2010), such as Sa, Sq and other height parameters from the 3D data captured by **QVWLI**.



QV3DPAK

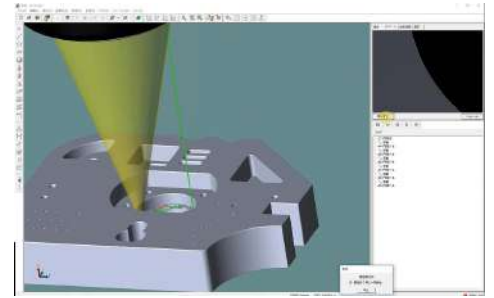
This software generates 3D forms from the PFF (Points From Focus) or WLI (White Light Interferometer) data.



Measurement support software

QV3DCAD

QV3DCAD uses 3D CAD models to easily create **QVPAK** part program both online and offline.



Offline teaching software

EASYPAG-PRO

This software creates **QVPAK** measurement procedure programs using 2D CAD data.

Statistical processing software

MeasurLink

This software enables statistical arithmetic processing of measurement results.

External control software

QVEio

Allows you to externally control or output the operating status of a **QV** connected to a PLC or PC.

K

Vision Measuring Systems

Vision measuring systems for multipurpose use

QS-LZ/AFC Manual Vision Measuring System

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Manual vision measuring system with a high speed, high-definition auto focus 3-megapixel camera.
- A 4-quadrant high-intensity LED ring light provides excellent observation performance.
- The newly designed zoom unit and interchangeable objectives achieve a maximum magnification ratio of 14X. Viewing possibilities extend from low magnification wide view measurement to high magnification micro-measurement.



QS-L3017Z/AFC

From wide view measurement to micro-measurement

| Optical magnification | 0.5X | 0.65X | 0.75X | 0.85X | 0.98X | 1X | 1.28X | 1.3X | 1.5X | 1.7X | 2X | 2.25X | 2.5X | 3X | 3.5X | 3.75X | 4X | 5X | 5.25X | 7X |
|--------------------------------------|--|-------|-------|-------|-------|-----|-------|------|------|------|------|-------|------|-----|-------|-------|-------|-------|-------|-------|
| View field Horizontal (H) (mm) | 13.2 | 10.2 | 8.8 | 7.8 | 6.8 | 6.6 | 5.2 | 5.1 | 4.4 | 3.9 | 3.3 | 2.9 | 2.6 | 2.2 | 1.8 | 1.7 | 1.7 | 1.3 | 1.2 | 0.9 |
| View field Vertical (V) (mm) | 9.9 | 7.7 | 6.6 | 5.9 | 5.1 | 5.0 | 3.9 | 3.8 | 3.3 | 2.9 | 2.4 | 2.2 | 2.0 | 1.6 | 1.4 | 1.3 | 1.2 | 1.0 | 1.0 | 0.7 |
| Total magnification (on the monitor) | 20 | 26 | 30 | 34 | 39 | 40 | 51 | 52 | 60 | 68 | 79.3 | 89 | 99.3 | 119 | 138.7 | 149 | 158.7 | 198.7 | 208 | 277.3 |
| Objective lens | 1X objective (optional) Working distance 74 mm | | | | | | | | | | | | | | | | | | | |
| | 1.5X objective (standard accessory) Working distance 42 mm | | | | | | | | | | | | | | | | | | | |
| | 2X objective (optional) Working distance 42 mm | | | | | | | | | | | | | | | | | | | |

Note: The total magnification indicates the magnification on the monitor when the size of the QSPAK video window is 252.7x214.9 mm (default).

SPECIFICATIONS

| Model No. | QS-L2010Z/AFC | QS-L3017Z/AFC | QS-L4020Z/AFC |
|---------------------------------|--|----------------------|----------------|
| Drive method | Auto focus equipped, X, Y axis: manual; Z axis: motor-operated | | |
| Measuring range (XxYxZ) | 200x100x150 mm | 300x170x150 mm | 400x200x150 mm |
| Resolution/Scale unit | 0.1 μm/Linear encoder | | |
| Measuring accuracy*1+2 | X axis, Y axis (2.2 + 0.02L/1000) μm Z axis (4.5 + 0.006L/1000) μm | | |
| Accuracy guaranteed temperature | 20±1 °C | | |
| Observation unit*3 | 7X zoom (8 steps) interchangeable objective lenses (1X objective 0.5X - 3.5X; 1.5X objective 0.75X - 5.25X; 2X objective 1X - 7X) | | |
| Image detection method | 3 megapixel, CMOS color camera (1/2 in) | | |
| Illumination | Transmitted light | White LED | |
| | Co-axial light | White LED | |
| | Ring light | 4-quadrant white LED | |

*1 Inspected to a Mitutoyo standard. L=length between two arbitrary points (mm)

*2 3X lens magnification or greater

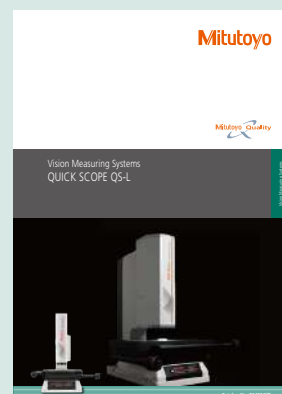
*3 1X and 2X objective lenses are optional

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **QUICK SCOPE QS-L Brochure (E14004)** for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Quick Image Non-contact 2D Vision Measuring System

- This series of manual 2D vision measuring machines offers high-efficiency measurement by employing a telecentric optical system that has a deep focal depth and a wide view monitor.
- The stitching function enables the entire display of a large workpiece so that highly accurate and speedy measurement can be performed.
- A model equipped with a motorized stage has been added to the series to offer easy and comfortable stage operation.
- A single click enables multiple measurements in one display. A batch measurement can be applied to multiple workpieces in the display after executing a pattern search based on the workpiece position.
- This series is equipped with a 3-megapixel color camera. Even with low magnification, high repeatability can be obtained.
- The choice of five stage sizes makes it easy to choose a machine to suit the user's application.
- The video window automatically displays the measurement data, which enables quick verification.



Refer to the **QUICK IMAGE** Series Brochure (E14009) for more details.



QI-C2017D



A motorized stage

SPECIFICATIONS

| Model | 0.2X 0.5X | Manual stage model | | | | | Motorized stage model | | |
|----------------------------|--------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|----------------|----------------|
| | | QI-A1010D QI-B1010D | QI-A2010D QI-B2010D | QI-A2017D QI-B2017D | QI-A3017D QI-B3017D | QI-A4020D QI-B4020D | QI-C2010D | QI-C2017D | QI-C3017D |
| Measuring range (XxY) | | 100x100 mm | 200x100 mm | 200x170 mm | 300x170 mm | 400x200 mm | 200x100 mm | 200x170 mm | 300x170 mm |
| Effective stage glass size | | 170x170 mm | 242x140 mm | 260x230 mm | 360x230 mm | 440x232 mm | 242x140 mm | 260x230 mm | 360x230 mm |
| Maximum stage loading* | | Approx. 10 kg | | Approx. 20 kg | | Approx. 15 kg | Approx. 10 kg | Approx. 20 kg | |
| Main unit mass | | Approx. 65 kg | Approx. 69 kg | Approx. 150 kg | Approx. 158 kg | Approx. 164 kg | Approx. 72 kg | Approx. 153 kg | Approx. 161 kg |

* Does not include extremely offset or concentrated loads

| Model | QI-A/QI-C | | QI-B |
|---------------------------------|--|-------------------------------------|---|
| View field | 32x24 mm | | 12.8x9.6 mm |
| Measurement mode | High resolution mode/Normal mode*4 | | |
| Travel range (Z axis) | 100 mm | | |
| Measuring accuracy | Measurement accuracy within the screen*1 | High resolution mode Normal mode | ±2 μm ±4 μm |
| | Repeatability within the screen (±σ)*2 | High resolution mode Normal mode | ±1 μm ±2 μm |
| | | Measurement accuracy (E1xy)*1 | ±(3.5 + 0.02L) μm L=arbitrary measuring length (mm) |
| Monitor magnification*3 | 7.6X | | 18.9X |
| Optical system | Magnification (Telecentric Optical System) | 0.2X | |
| | Depth of focus | High resolution mode Normal mode | ±0.6 mm ±11 mm |
| | | Working distance | 90 mm |
| Camera | 3 megapixel, CMOS color camera (1/2 in) | | |
| Illumination | Transmitted light | Green LED telecentric illumination | |
| | Co-axial light | White LED | |
| | Ring light | 4-quadrant white LED | |
| Power supply | AC100 to 240 V 50/60 Hz | | |
| Accuracy guaranteed temperature | 20±1 °C | | |

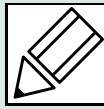
*1 Inspected to Mitutoyo standards by focus point position.

*2 The measuring accuracy is guaranteed to be accurate within the depth of focus.

*3 For 1X digital zoom (when using a 22-inch-wide monitor)

*4 Patent registered (Japan)

Quick Guide to Precision Measuring Instruments



Vision Measuring Machines

Vision Measurement

Vision measuring machines mainly provide the following processing capabilities.

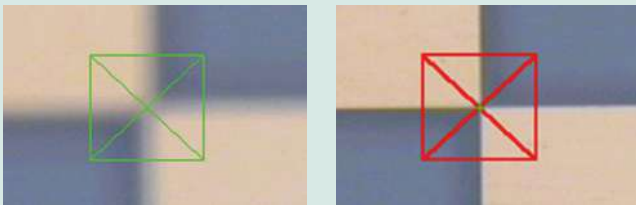
- **Edge detection**

Detecting/measuring edges in the XY plane



- **Auto focusing**

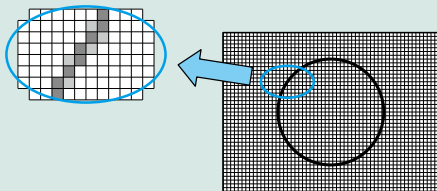
Focusing and Z-axis measurement



- **Pattern recognition**

Alignment, positioning, and inspecting a feature

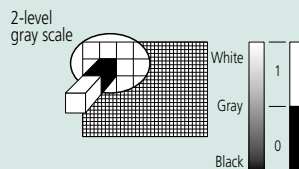
Image Storage



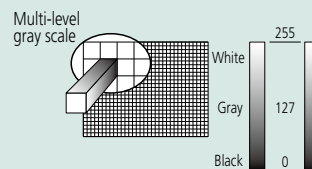
An image is comprised of a regular array of pixels. This is just like a picture on fine plotting paper with each square solid-filled differently.

Gray Scale

A PC stores an image after internally converting it to numeric values. A numeric value is assigned to each pixel of an image. Image quality varies depending on how many levels of gray scale are defined by the numeric values. The PC provides two types of gray scale: two-level and multi-level. The pixels in an image are usually displayed as 256-level gray scale.



Pixels in an image brighter than a given level are displayed as white and all other pixels are displayed as black.

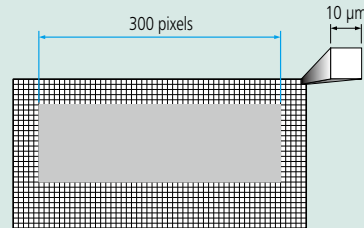


Each pixel is displayed as one of 256 levels between black and white. This allows high-fidelity images to be displayed.

Dimensional Measurement

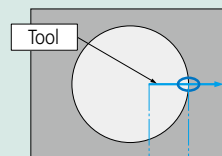
An image consists of pixels. If the number of pixels in a section to be measured is counted and is multiplied by the size of a pixel, then the section can be converted to a numeric value in length. For example, assume that the total number of pixels in the lateral size of a square workpiece is 300 pixels as shown in the figure below.

If a pixel size is 10 μm under imaging magnification, the total length of the workpiece is given by 10 μm × 300 pixels = 3000 μm = 3 mm.



Edge Detection

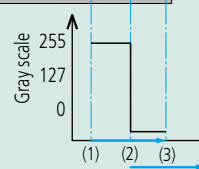
How to actually detect a workpiece edge in an image is described using the following monochrome picture as an example. Edge detection is performed within a given domain. A symbol which visually defines this domain is referred to as a tool. Multiple tools are provided to suit various workpiece geometries or measurement data.



The edge detection system scans within the tool area as shown in the figure at left and detects the boundary between light and shade.

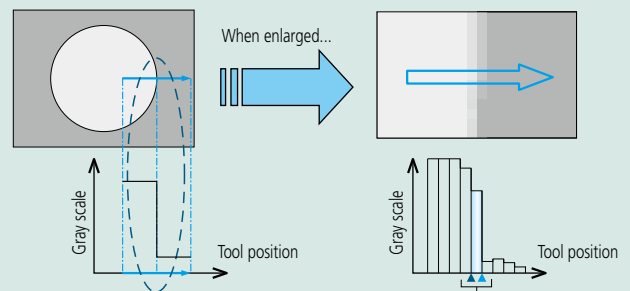
| | | | | | | | | | |
|-----|-----|-----|-----|----|----|----|----|----|----|
| 244 | 241 | 220 | 193 | 97 | 76 | 67 | 52 | 53 | 53 |
| 243 | 242 | 220 | 195 | 94 | 73 | 66 | 54 | 53 | 55 |
| 244 | 246 | 220 | 195 | 94 | 75 | 64 | 56 | 51 | 50 |

Example of numeric values assigned to pixels on the tool



(1) Scan start position
(2) Edge detection position
(3) Scan end position

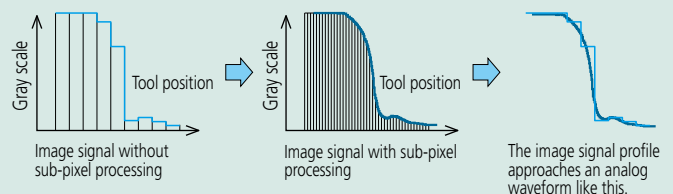
High-resolution Measurement



A position the system recognizes as an edge may be in error by up to one pixel width using normal image processing. This will prevent the execution of high-resolution measurement.

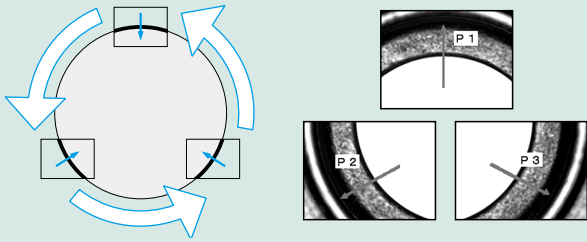
To increase the accuracy in edge detection, sub-pixel image processing is used. An edge is detected by determining an interpolation curve from adjacent pixel data as shown below.

As a result, it allows measurement with a resolution better than 1 pixel.

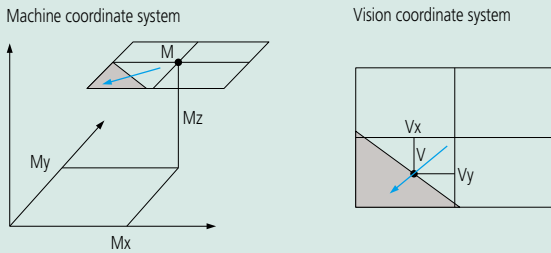


Measurement along Multiple Portions of an Image

Large features that cannot be contained on one screen have to be measured by precisely controlling the position of the sensor and stage so as to locate each reference point within individual images. By this means the system can measure even a large circle, as shown below, by detecting the edge while moving the stage across various parts of the periphery.



Composite Coordinates of a Point



Measuring machine stage position
 $M = (Mx, My, Mz)$

Detected edge position (from the center of vision)
 $V = (Vx, Vy)$

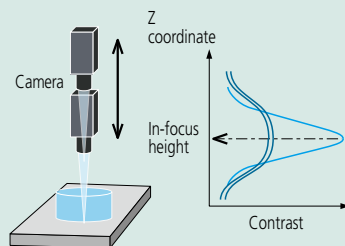
Actual coordinates are given by $X=(Mx+Vx)$, $Y=(My+Vy)$, and $Z=Mz$, respectively.

Since measurement is performed while individual measured positions are stored, the system can measure dimensions that cannot be included in one screen, without problems.

Principle of Auto Focusing

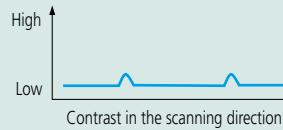
The system can perform XY-plane measurement, but cannot perform height measurement using only the camera image. The system is commonly provided with the Auto Focus (AF) mechanism for height measurement. The following explains the AF mechanism that uses a common image, although some systems may use a laser AF.

The AF system analyzes an image while moving the camera up and down in the Z axis. In the analysis of image contrast, an image in sharp focus will show a peak contrast and one out of focus will show a low contrast. Therefore, the height at which the image contrast peaks is the just-in-focus height.

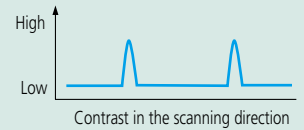
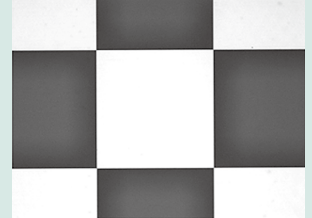


Variation in Contrast Depending on the Focus Condition

Edge contrast is low due to out-of-focus edges.



Edge contrast is high due to sharp, in-focus edges.



Overview of ISO 10360-7

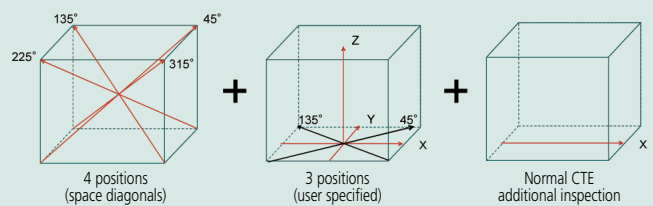
ISO 10360-7 (Geometrical product specifications (GPS) -- Acceptance and reverification tests for coordinate measuring machines (CMM) -- Part 7: CMMs equipped with imaging probing systems) was published on June 1, 2011.

Some inspection items are listed in ISO 10360-7. The following summarizes the test method for determining length measurement error (E) and probing error (P_{F2D}).

Length measurement error, E

Five test lengths in seven different directions within the measuring volume, each length measured three times, for a total of 105 measurements. Four directions are the space diagonal. Remaining three directions are user specified; default locations are parallel to the VMM axes.

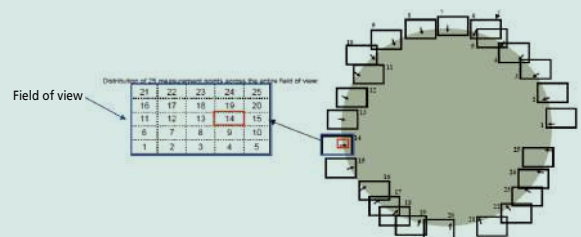
When CTE (coefficient of thermal expansion) of the test-length artifact is $< 2 \times 10^{-6}/K$, additional measurement using an artifact with a normal CTE (8 to $13 \times 10^{-6}/K$) is performed.



Probing error, P_{F2D}

Measure 25 points distributed evenly around the test circle (14.4° pitch). Each of the 25 points shall be measured using the specified 25 areas of the field of view.

Calculate probing error as the range of the 25 radial distances ($R_{max} - R_{min}$) from the center of the least-square circle.



New Products



FORMTRACER Avant (Surface Texture Measuring Instruments)

C3000/4000 Series

Refer to page L-10 for details.



FORMTRACER (Surface Texture Measuring Instruments)

CS-3300 Series

Refer to page L-12 for details.



Roundtest Extreme (CNC Roundness/Cylindricity Measuring System)

RA-6000CNC

Refer to page L-24 for details.



Surftest



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| SJ-500/SV-2100 | L-6 |
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Surftest Extreme (CNC Surface Roughness Testers)

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Contracer (Contour Measuring Instruments)

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Formtracer (Surface Texture Measuring Instruments)

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Formtracer Extreme (CNC Surface Texture Measuring Systems)

| | |
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| SV-C4500CNC | L-13 |
| SV-C4500CNC HYBRID TYPE1 | L-13 |
| CS-5000CNC/CS-H5000CNC | L-14 |
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Quick Guide to Precision Measuring Instruments (Surface Roughness Testers)

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Roundtest (Roundness / Cylindricity Measuring Instruments)

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| RA-10 | L-21 |
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Roundtest Extreme (CNC Roundness / Cylindricity Measuring Systems)

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| RA-H5200CNC | L-24 |
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Quick Guide to Precision Measuring Instruments

| | |
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Contracer



Formtracer



Roundtest



Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest SJ-210 SERIES 178 — On-site Surface Roughness Tester

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo



SPECIFICATIONS

| Model No. | Standard drive unit | | Retractable drive unit | | Transverse tracing drive unit | | |
|----------------------------------|---|---|--------------------------|-----------------------|-------------------------------|-----------------------|--|
| | SJ-210 (0.75 mN type) | SJ-210 (4 mN type) | SJ-210 (0.75 mN type) | SJ-210 (4 mN type) | SJ-210 (0.75 mN type) | SJ-210 (4 mN type) | |
| Order No. | mm 178-560-11 | mm 178-560-12 | mm 178-562-11 | mm 178-562-12 | mm 178-564-11 | mm 178-564-12 | |
| | inch/mm 178-561-11 | inch/mm 178-561-12 | inch/mm 178-563-11 | inch/mm 178-563-12 | inch/mm 178-565-11 | inch/mm 178-565-12 | |
| Measuring range | X axis | 16.0 mm | | | | 5.6 mm | |
| Detector | Range | 360 μm (-200 μm to +160 μm) | | | | | |
| | Range/Resolution | 360 μm/0.02 μm, 100 μm/0.006 μm, 25 μm/0.002 μm | | | | | |
| Measuring force/Stylus tip shape | Depends on the Order No.: 0.75 mN/2 μmR 60° (when the Order No. ends with "-11") 4 mN/5 μmR 90° (when the Order No. ends with "-12") | | | | | | |
| Applicable standards | JIS 1982/JIS 1994/JIS 2001/ISO 1997/ANSI/VDA | | | | | | |
| Assessed profile | Primary profile, Roughness profile, DF profile, Roughness motif profile | | | | | | |

Surftest SJ-310 SERIES 178 — On-site Surface Roughness Tester

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo



SPECIFICATIONS

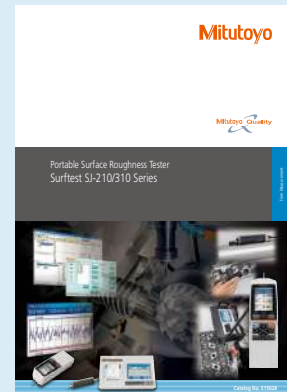
| Model No. | Standard drive unit | | Retractable drive unit | | Transverse tracing drive unit | | |
|----------------------------------|---|---|--------------------------|-----------------------|-------------------------------|-----------------------|--|
| | SJ-310 (0.75 mN type) | SJ-310 (4 mN type) | SJ-310 (0.75 mN type) | SJ-310 (4 mN type) | SJ-310 (0.75 mN type) | SJ-310 (4 mN type) | |
| Order No. | mm 178-570-11 | mm 178-570-12 | mm 178-572-11 | mm 178-572-12 | mm 178-574-11 | mm 178-574-12 | |
| | inch/mm 178-571-11 | inch/mm 178-571-12 | inch/mm 178-573-11 | inch/mm 178-573-12 | inch/mm 178-575-11 | inch/mm 178-575-12 | |
| Measuring range | X axis | 16.0 mm | | | | 5.6 mm | |
| Detector | Range | 360 μm (-200 μm to +160 μm) | | | | | |
| | Range/Resolution | 360 μm/0.02 μm, 100 μm/0.006 μm, 25 μm/0.002 μm | | | | | |
| Measuring force/Stylus tip shape | Depends on the Order No.: 0.75 mN/2 μmR 60° (when the Order No. ends with "-11") 4 mN/5 μmR 90° (when the Order No. ends with "-12") | | | | | | |
| Applicable standards | JIS 1982/JIS 1994/JIS 2001/ISO 1997/ANSI/VDA | | | | | | |
| Assessed profile | Primary profile, Roughness profile, DF profile, Roughness motif profile, Waviness motif profile | | | | | | |

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Compact type all-in-one surface roughness tester has evolved by meeting customer demands

- The color LCD can display not only calculation results and measurement conditions, but also surface roughness waveforms. In addition, bigger character size contributes to visibility.
- Built-in rechargeable battery allows measurement without a mains power supply connection.



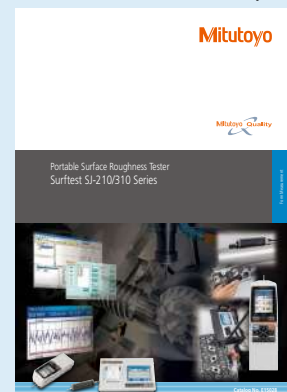
Refer to the Surftest SJ-210/310 Series Brochure (E15028) for more details.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Advanced handheld tester that is easy to operate and meets a variety of needs

- Equipped with a large, touch-screen color graphic LCD for intuitive operation and excellent ease of use.
- Equipped with a high-speed thermal printer (approx. 1.5 times faster than conventional models) as standard, allows for printing of BAC and ADC curves in addition to calculation results (including pass/fail judgments) and assessment profiles. The printer can also print horizontally to match the content displayed on the LCD, and has an easy-to-understand layout.



Refer to the Surftest SJ-210/310 Series Brochure (E15028) for more details.

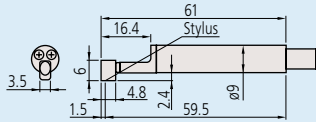
Optional Accessories for Surftest SJ-210/310

Unit: mm

• Standard detectors

| Order No. | Measuring force | Stylus profiles* | Remarks |
|-----------|-----------------|----------------------------|--|
| 178-296 | 0.75 mN | 2 $\mu\text{mR}/60^\circ$ | Dedicated to the standard/retractable drive unit |
| 178-390 | 4 mN | 5 $\mu\text{mR}/90^\circ$ | Dedicated to the standard/retractable drive unit |
| 178-387 | 0.75 mN | 2 $\mu\text{mR}/60^\circ$ | Dedicated to the transverse tracing drive unit |
| 178-386 | 4 mN | 5 $\mu\text{mR}/90^\circ$ | Dedicated to the transverse tracing drive unit |
| 178-391 | 4 mN | 10 $\mu\text{mR}/90^\circ$ | Dedicated to the standard/retractable drive unit |

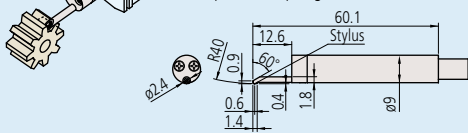
*Tip radius/Tip angles



• Gear-tooth surface detectors

| Order No. | Measuring force | Stylus profiles* |
|-----------|-----------------|---------------------------|
| 178-388 | 0.75 mN | 2 $\mu\text{mR}/60^\circ$ |
| 178-398 | 4 mN | 5 $\mu\text{mR}/60^\circ$ |

*Tip radius/Tip angles

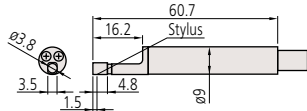


Detector

• Small hole detectors

| Order No. | Measuring force | Stylus profiles* | Remarks |
|-----------|-----------------|---------------------------|---|
| 178-383 | 0.75 mN | 2 $\mu\text{mR}/60^\circ$ | Minimum measurable hole diameter: $\phi 4.5$ mm |
| 178-392 | 4 mN | 5 $\mu\text{mR}/90^\circ$ | |

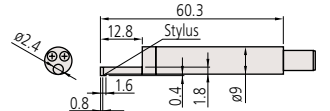
*Tip radius/Tip angles



• Extra small hole detectors

| Order No. | Measuring force | Stylus profiles* | Remarks |
|-----------|-----------------|---------------------------|---|
| 178-384 | 0.75 mN | 2 $\mu\text{mR}/60^\circ$ | Minimum measurable hole diameter: $\phi 2.8$ mm |
| 178-393 | 4 mN | 5 $\mu\text{mR}/90^\circ$ | |

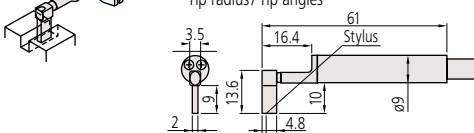
*Tip radius/Tip angles



• Deep groove detectors

| Order No. | Measuring force | Stylus profiles* | Remarks |
|-----------|-----------------|---------------------------|---|
| 178-385 | 0.75 mN | 2 $\mu\text{mR}/60^\circ$ | Not available for the transverse tracing drive unit |
| 178-394 | 4 mN | 5 $\mu\text{mR}/90^\circ$ | |

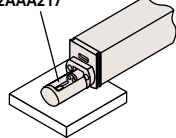
*Tip radius/Tip angles



Optional Accessories for Drive Units

• Nosepiece for flat surfaces

Nosepiece for flat surfaces
12AAA217

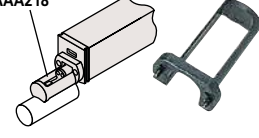


12AAA217

- Standard accessory for the standard/retractable drive unit of the SJ-310 Series
- Not available for the transverse tracing drive unit

• Nosepiece for cylindrical surfaces

Nosepiece for cylindrical surfaces
12AAA218



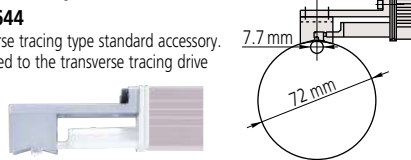
12AAA218

- Standard accessory for the standard/retractable drive unit of the SJ-310 Series
- Not available for the transverse tracing drive unit

• V-type adapter

12AAE644

- Transverse tracing type standard accessory.
- Dedicated to the transverse tracing drive unit.



• Point-contact adapter

12AAE643

- Transverse tracing type standard accessory.
- Dedicated to the transverse tracing drive unit.

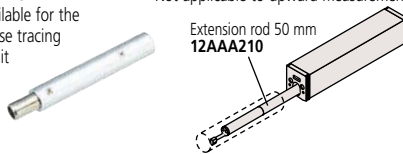


• Extension rod (50 mm) (Note: Only one rod can be used.)

12AAA210

- Not available for the transverse tracing drive unit

• Not applicable to upward measurement.



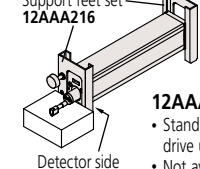
• Extension cable (1 m) (Note: Only one rod can be used.)

12BAA303

- For the connection between the calculation display unit and drive unit

• Support feet set

Support feet set
12AAA216



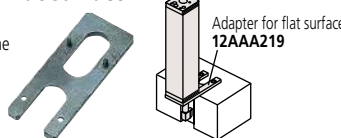
12AAA216

- Standard accessory for the standard/retractable drive unit of the SJ-310 Series
- Not available for the transverse tracing drive unit
- Adjustment range is 28 mm from bottom face.

• Adapter for flat surface

12AAA219

- Not available for the transverse tracing drive unit



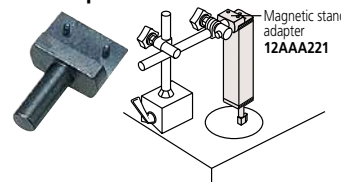
• Magnetic stand adapter

12AAA221

Mounting spigot diameter is 8 mm.

12AAA220

Mounting spigot diameter is 9.5 mm.



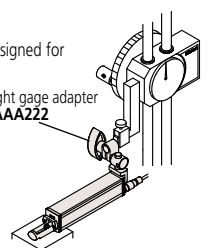
• Height gage adapter

Note: Suitable for a height gage holder designed for 9x9 mm section scribers.

12AAA222



Height gage adapter
12AAA222



Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest SJ-410 SERIES 178 — Compact Surface Roughness Tester

MeasurLink ENABLED
Data Management Software by Mitutoyo



SPECIFICATIONS

| Model No. | SJ-411 | | SJ-412 | | |
|-----------------------------|--|--|--|--|--|
| Order No. | mm inch/mm | 178-580-11 178-581-11 | 178-580-12 178-581-12 | 178-582-11 178-583-11 | 178-582-12 178-583-12 |
| Measuring range | X axis Z axis (detector) | 25 mm 800 μm, 80 μm, 8 μm | | 50 mm Up to 2,400 μm when using an optional stylus. | |
| Detector | Detection method | Differential inductance | | | |
| | Resolution | 0.01 μm (800 μm range), 0.001 μm (80 μm range), 0.0001 μm (8 μm range) | | | |
| | Stylus tip shape (Angle/Radius) | 60°/2 μm | 90°/5 μm | 60°/2 μm | 90°/5 μm |
| | Measuring force | 0.75 mN | 4 mN | 0.75 mN | 4 mN |
| | Radius of skid curvature | 40 mm | | | |
| Drive unit (X axis) | Measuring speed | 0.05, 0.1, 0.2, 0.5, 1.0 mm/s | | | |
| | Drive speed | 0.5, 1, 2, 5 mm/s | | | |
| | Straightness | 0.3 μm/25 mm | | 0.5 μm/50 mm | |
| Up/down inclination unit | Vertical travel Inclination adjustment angle | 10 mm ±1.5° | | | |
| Applicable standards | JIS 1982/JIS 1994/JIS 2001/ISO 1997/ANSI/VDA | | | | |
| Parameter | Ra, Rq, Rz, Ry, Rp, Rv, Rt, Rz, Rsk, Rku, Rc, Rpc, RSm, Rmax*1, Rz1max*2, S, HSC, RzJIS*3, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rσc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, λa, λq, Lo, Rpm, tp*4, Htp*4, R, Rx, AR, W, AW, Wx, Wte Customizable | | | | |
| Filtered profile | Primary profile, Roughness profile, DF profile, Waviness profile, Roughness motif profile, Waviness motif profile | | | | |
| Analysis graph | Material ratio curve, Profile height amplitude distribution curve | | | | |
| Data compensation functions | Parabola, Hyperbola, Ellipse, Circle, Tilt, No compensation | | | | |
| Filter | 2CR, PC75, Gaussian | | | | |
| Cutoff value | λc λs*5 | 0.08, 0.25, 0.8, 2.5, 8 mm 2.5, 8, 25 μm | | | |
| Sampling length | 0.08, 0.25, 0.8, 2.5, 8, 25 mm | | | | |
| Number of intervals | x1, x2, x3, x4, x5, x6, x7, x8, x9, x10, x11, x12, x13, x14, x15, x16, x17, x18, x19, x20 | | | | |
| Arbitrary length | 0.1 to 25 mm | | 0.1 to 50 mm | | |
| Calculation display unit | Customization | Selection of display/evaluation roughness parameter | | | |
| | Simplified contour analysis function | Step, Step quantity, Area, Coordinate difference | | | |
| | D.A.T. (Digimatic Adjustment Table) function | Helps to level workpiece prior to skidless measurement | | | |
| | Real sampling function | Inputs the displacement of the detector while stopping the drive unit | | | |
| | Statistical processing | Calculates the maximum value, minimum value, average value, standard deviation, pass rate and histogram for each parameter. | | | |
| | Judgment*6 | Maximum value rule, 16 % rule, mean value rule, standard deviation (1σ, 2σ, 3σ) | | | |
| | Storing measurement condition | Max. 10 (calculation display unit) | | | |
| | Print function (Built-in thermal printer) | Measurement condition/Calculation result/Judgment result/Calculation result per segment/Tolerance value/Evaluation curve/Graphic curve/Material ratio curve/Profile height amplitude distribution curve/Environmental setting items/Statistical result (Histogram) | | | |
| | Display language | 16 languages (Japanese, English, German, French, Italian, Spanish, Portuguese, Korean, Chinese (simplified/traditional), Czech, Polish, Hungarian, Turkish, Swedish, Dutch) | | | |
| | Storage function | Built-in memory: Measurement condition (Up to 10) Memory card (optional): 500 measurement conditions, 10000 measured profiles, 500 display images, 10000 text files, 500 statistical data, 1 backup file of device setting data, 10 data of Trace 10 | | | |
| Power supply | External I/O functions | USB I/F, Digimatic output, RS-232C I/F, Foot switch I/F | | | |
| | Battery | Built-in battery (rechargeable Ni-MH battery)/AC adapter | | | |
| | Charging time/Endurance | Charging time of the built-in battery: about 4 hours (may vary due to ambient temperature) Endurance: about 1000 measurements (differs slightly due to use conditions/environment) | | | |
| External dimensions (WxDxH) | Max. power consumption | 50 W | | | |
| | Calculation display unit | 275x198x109 mm | | | |
| | Up/down inclination unit | 130.9x63x99 mm | | | |
| Mass | Drive unit | 128x35.8x46.6 mm | 154.5x35.8x46.6 mm | | |
| | Calculation display unit | 1.7 kg | | | |
| | Up/down inclination unit | 0.4 kg | | | |
| Standard Accessories | Drive unit | 0.6 kg | 0.64 kg | | |
| | Detector*7/Standard stylus*8 | 178-601 Roughness specimen (Ra3 μm) 270732 Receipt paper (Standard type: 5-roll set) 12BAL402 Protective sheet for the LCD (x1 sheet) 12BAS07 Touch pen 12AAN041 Carrying case | | | |
| | | AC adapter, Power cable, Flat-blade screwdriver, Phillips screwdriver, Hex wrench, Strap for the touch pen, Operation manual, One-sheet manual, Warranty card | | | |
| | | | | | |
| | | | | | |

*1 Calculation is available only when selecting the VDA, ANSI, or JIS 1982 standards.
*2 Calculation is available only when selecting the ISO 1997 standard. *3 Calculation is available only when selecting the JIS 2001 standard.
*4 Calculation is available only when selecting the ANSI standard. *5 Not available when selecting the JIS 1982 standard.
*6 Only the mean value rule is available for the ANSI standard. 16 % rule is not available when selecting the VDA standard.
*7 Depending on the Order No. of the SJ-410 Series main unit, 178-396 or 178-397 is provided as standard.
*8 Standard stylus (12AAC731 or 12AAB403) supporting the provided detector is provided as standard.

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Data Management Software by Mitutoyo

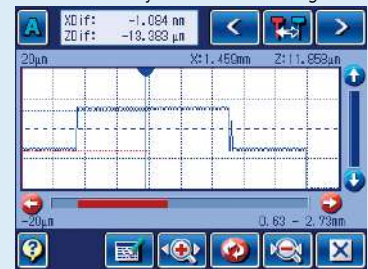
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Dramatic improvement on compact type surface roughness testers

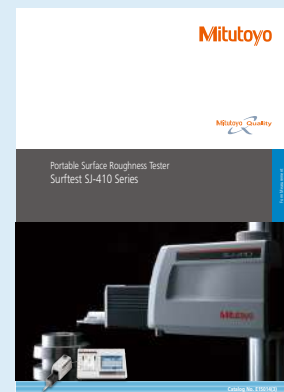
- Equipped with a large, touch-screen color graphic LCD to achieve both intuitive operation and high operability.
- Skidded and skidless measurement are switchable to perform optimum evaluation according to the measurement setup.
- A wide-range, high-resolution detector and a very accurate drive unit provide superior high-accuracy measurement in its class.
- **Detector**
Measuring range: 800 μm
Resolution: 0.0001 μm (when the measuring range is 8 μm)
- **Drive unit**
Straightness/Drive length: 0.3 μm/25 mm (SJ-411)
Straightness/Drive length: 0.5 μm/50 mm (SJ-412)
- Simplified contour analysis (Step, Step quantity, Area, Coordinate difference) is available using the point cloud data collected to evaluate the surface roughness.
Allows the evaluation of detailed shapes that cannot be achieved by contour measuring instruments.



- Allows the evaluation of surface roughness in a circumferential direction using the skidless measurement and R-surface compensation functions.
- Conforms to the latest ISO standard and ANSI/VDA standard in addition to the JIS standard (2001/1994/1982).
- Achieves the performance of a desktop type surface roughness tester in combination with the simplified stand and associated optional accessories.

Optional Accessories for SJ-410 Consumables

- Receipt paper Standard type (5-roll set) **270732**
- Receipt paper High-durability paper (5-roll set) **12AA876**
- Protective sheet for the touch panel (x10 sheets) **12AAN040**
- Memory card (2 GB) **12AAW452**



Refer to the Surftest SJ-410 Series Brochure (E15014) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

High precision and high performance type surface roughness tester with a dedicated control unit, offering a user-friendly display and simple operation.

- Equipped with a 7.5-inch, color TFT LCD, color icons and touch panel controls, the display unit is easy to read and simple to operate.
- A built-in joystick on the control unit allows quick and easy positioning. The manual adjustment knob allows fine positioning of a small stylus for measuring small holes.
- In addition to the roughness parameters compliant with ISO/JIS/ANSI/VDA surface roughness standards, contour analysis is also available.

SPECIFICATIONS

| Model No. | SJ-500 | SV-2100M4*1 | SV-2100S4*1 | SV-2100H4*1 | SV-2100W4*1 |
|------------------|---|--------------|--|-----------------|-------------|
| Stand type | (Optional)*2 | Manual stand | | Motorized stand | |
| Measuring range | Z1 axis (detector) | | 800 μm, 80 μm, 8 μm | | |
| | X axis | 50 mm | 100 mm | | |
| Resolution | X axis | | 0.05 μm | | |
| | Z1 axis (detector) | | 0.01 μm (800 μm), 0.001 μm (80 μm), 0.0001 μm (8 μm) | | |
| | Z2 axis (column) | — | | 1 μm | |
| Assessed profile | Primary profile, Roughness profile, Waviness profile, DF profile, Roughness motif profile, Waviness motif profile | | | | |

*1 While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.
*2 Stand for SJ-500 is optional.

Surftest SJ-500/SV-2100 SERIES 178 — Dedicated Control Unit Type Surface Roughness Tester



An inspection certificate is supplied as standard. Refer to page U-11 for details.

A superior data processing tester with PC data analysis for higher efficiency.

Surftest SJ-500P/SV-2100M4 Data Processing Unit (PC) Surface Roughness Testers



FORMTRACEPAK: Best-selling Surface Roughness Analysis Program

Best-selling dedicated software for surface roughness measurement and analysis. Features a flexible printer format and creation of an original inspection certificate.

SPECIFICATIONS

| Type of data processing unit | PC type | |
|------------------------------------|--|--|
| Model No. | SJ-500P | SV-2100M4*2 |
| Elevating shaft mechanism of stand | —*1 | Manual operation only |
| Measuring range | X axis | 100 mm |
| | Z1 axis (detector) | 800 μm, 80 μm, 8 μm |
| Z2-axis (column) travel range | — | 350 mm |
| Resolution | X axis | 0.05 μm |
| | Z1 axis (detector) | 0.01 μm (800 μm), 0.001 μm (80 μm), 0.0001 μm (8 μm) |
| | Z2 axis (column) | — |
| Applicable standards | JIS 1982/JIS 1994/JIS 2001/ISO 1997/ANSI/VDA | |
| Assessed profile | Primary profile, Roughness profile, Waviness profile, Filtered waviness profile, Rolling circle waviness profile, Rolling circle center line waviness profile, Envelope residual profile, DIN4776 profile, Roughness motif profile, Waviness motif profile | |

*1 The simplified stand or manual column stand is available as an optional accessory.
*2 While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.



Refer to the Surftest SJ-500/SV-2100 Brochure (E15006) for more details.

Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest Extreme SV-3000CNC/SV-M3000CNC SERIES 178 — CNC Surface Roughness Testers

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



SV-3000CNC
(Inclinable drive unit + Y-axis table)



SV-M3000CNC
(Surface Roughness Tester with built-in Y axis.)
(The photo represents a special specification model.)

SV-3000CNC SPECIFICATIONS

| Model No. | | SV-3000CNC | | |
|----------------------------------|-------------------------|--|----------------------------------|--------|
| X1 axis (drive unit) | Measuring range | 200 mm | | |
| | Resolution | 0.05 μm | | |
| | Scale type | Reflective-type linear encoder | | |
| | Drive speed | CNC mode | Max. 200 mm/s | |
| | | Joystick mode | 0 to 50 mm/s | |
| | Measuring speed | 0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0 mm/s | | |
| Y axis (table) | Measuring range | 200 mm | | |
| | Resolution | 0.05 μm | | |
| | Drive speed | CNC mode | Max. 200 mm/s | |
| | | Joystick mode | 0 to 50 mm/s | |
| | Maximum table loading | 20 kg | | |
| | Z2 axis (column) | Travel range | Z2 axis (column, type S) | 300 mm |
| Z2 axis (column, type H) | | | 500 mm | |
| Resolution | | 0.05 μm | | |
| Scale type | | Reflective-type linear encoder | | |
| Drive speed | | CNC mode | Max. 200 mm/s | |
| | | Joystick mode | 0 to 50 mm/s | |
| Base unit | Base size (width×depth) | 750×600 mm | | |
| | Base material | Granite | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

SV-M3000CNC SPECIFICATIONS

| Model No. | | SV-M3000CNC | | |
|----------------------|---------------------------------------|--|---------------|--|
| X1 axis (drive unit) | Measuring range | 200 mm | | |
| | Resolution | 0.05 μm | | |
| | Scale type | Reflective-type linear encoder | | |
| | Drive speed | CNC mode | Max. 200 mm/s | |
| | | Joystick mode | 0 to 50 mm/s | |
| | Measuring speed | 0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0 mm/s | | |
| Z2 axis (column) | Straightness | When using a standard detector | 0.5 μm/200 mm | |
| | Measuring range | 500 mm | | |
| | Resolution | 0.05 μm | | |
| | Scale type | Reflective-type linear encoder | | |
| | Drive speed | CNC mode | Max. 200 mm/s | |
| | | Joystick mode | 0 to 50 mm/s | |
| Y axis | Measuring range | 800 mm | | |
| | Resolution | 0.05 μm | | |
| | Scale type | Reflective-type linear encoder | | |
| | Drive speed | CNC mode | Max. 200 mm/s | |
| | | Joystick mode | 0 to 50 mm/s | |
| | Measuring speed | 0.02 to 2 mm/s | | |
| Straightness | When using a standard detector holder | Narrow range | 0.5 μm/50 mm | |
| | | Wide range | 2 μm/800 mm | |
| Base unit | Base size (width×depth) | 600×1500 mm | | |
| | Base material | Steel | | |
| | Maximum table loading | 300 kg | | |

- The X1, Y and Z2 axes have a maximum drive speed of 200 mm/s. This permits high-speed positioning that can potentially result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- Capable of inclined plane measurement through 2 axis simultaneous control in X and Y.
- Models equipped with the α axis allow continuous measurement on horizontal and inclined surfaces by power-tilting the X1 axis.
- It is possible to expand the measuring range for multiple workpieces through positioning in Y.
- All connecting cables are contained within the measuring instrument to eliminate any inconvenience during measurement.
- Since the Z1-axis detector incorporates an anti-collision safety device, the detector unit will automatically stop if it touches a workpiece or fixture.
- Surftest Extreme **SV-M3000CNC** (CNC Surface Roughness Tester with a movable Y-axis table) that handles measurement of large/heavy workpieces, such as engine blocks or crankshafts, is also available.
- Optional external control function (Ext I/O) through bidirectional communication (RS-232C) with the PLC (programmable logic controller) is available.



Refer to the CNC Form Measuring Instrument Series Brochure (**E15021**) for more details.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Contour Measuring System enabling measurement that is fast, accurate, and easy.

- The operation flow is significantly shortened by arranging the controls for stylus position change, measurement start/stop and return on the front of the drive unit.



Centralized front control panel

- Fine and coarse X-axis positioning can be performed easily by using the jog shuttle that covers the whole measuring range.



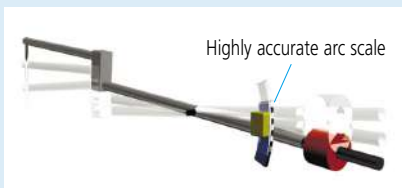
Motor-driven jog shuttle

- The quick-vertical-motion stand allows operators to swiftly and easily move the drive unit to and from the measurement height without having to push or pull (only for CV-2100M4).



Quick-vertical-motion stand

- The detector unit (Z1 axis) is equipped with a highly accurate arc scale. This scale directly tracks the arc locus of the stylus tip so that the most accurate compensation can be applied to the scale output, which leads to higher accuracy and resolution. Operators are free from bothersome operations such as measurement magnification switching and calibrating each magnification as required for analog instruments.



Highly accurate arc scale



Refer to the Contracer CV-2100 Series Brochure (E15020) for more details.

Contracer

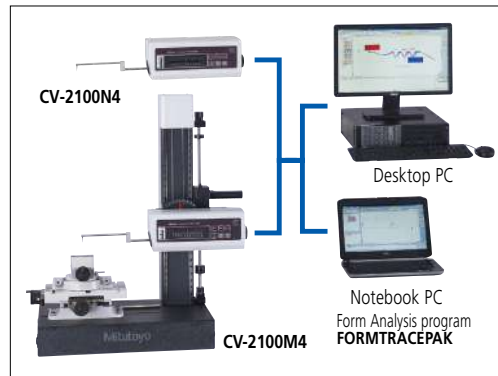
High precision + High-function + High operability = Contracer

Contracer CV-2100 SERIES 218 — Contour Measuring Instruments

MeasurLink ENABLED
Data Management Software by Mitutoyo



CV-2100M4



Optional Column Stand for CV-2100N4

- Allows the use of the CV-2100N4 in a fixed configuration.

218-042

Base material: Granite
Inclination range: $\pm 45^\circ$
Vertical travel: 320 mm
Mass: 110 kg

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.



SPECIFICATIONS

| Model No. | CV-2100M4 | CV-2100N4 |
|--|---|--|
| Measuring range | X axis | 100 mm |
| | Z1 axis (detector unit) | 50 mm |
| Z2-axis (column) travel range | 350 mm | — |
| X-axis inclination angle | $\pm 45^\circ$ | — |
| Resolution | X axis | 0.1 μm |
| | Z1 axis | 0.1 μm |
| Drive method | X axis | Motor (0 to 20 mm/s) |
| | Vertical travel (Z-axis column) | Manual (Quick-vertical-motion, fine) |
| Measuring speed | 0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0 mm/s | |
| Straightness (when the X axis is horizontal) | 2.5 $\mu\text{m}/100\text{ mm}$ | |
| Accuracy (20 °C) | X axis | $\pm(2.5+0.02L)\ \mu\text{m}$ L = Measurement Length (mm) |
| | Z1 axis | $\pm(2.5+[0.1H])\ \mu\text{m}$ H = Measurement height from horizontal position within $\pm 25\text{ mm}$ |
| Measuring direction | Both pulling and pushing directions | |
| Measuring face direction | Downward direction | |
| Measuring force | 30 \pm 10 mN (3 gf) | |
| Traceable angle (using the standard stylus) | Ascent 77°, Descent 87° (according to surface property) | |
| External dimensions (WxDxH) | 745x450x885 mm | 651x143x138.5 mm |
| Mass | 145.8 kg | 5.8 kg |

Note 1: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

Note 2: For the CV-2100N4, a manual column stand (optionally available) or custom fixture is required.

Formtracer

Hybrid machine with dual-role capability

FORMTRACER Avant S3000 Series SERIES 178 — Surface Texture Measuring Instruments

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



FTA-S4S3000

- **FORMTRACER Avant S3000 Series** are highly functional and user-friendly surface roughness measuring systems with innovative design features.
- **The FORMTRACER Avant S3000 Series** includes models with inclined drive unit. Inclining the drive unit makes it easier to approach target surfaces and measure large workpieces.
- Equipped with an operability focused, new style remote box. The new part program key strongly supports manual part-programming.
- High throughput is achieved thanks to high drive speed (X axis: Max. 80 mm/s, Z2 axis: Max. 30 mm/s) and acceleration (X axis: 30 mm/s²).
- All connecting cables are contained within the measuring instrument to eliminate any inconvenience during measurement.
- The Z1-axis detector is equipped with a built-in anti-collision safety device.
- A variety of detector holders (optional) are available.
- A detector for measuring contours can be retrofitted.



Inclined drive unit



Large sized base models and high-column models are added to the line-up.



Remote box with user-friendly operability



Detector holder (optional)



Refer to the **FORMTRACER Avant Series Brochure (E15030)** for more details.

SPECIFICATIONS

| Model No. | FTA-S4S3000 | FTA-H4S3000 | FTA-W4S3000 | FTA-L4S3000 | FTA-S8S3000 | FTA-H8S3000 | FTA-W8S3000 | FTA-L8S3000 |
|--|---|-------------|-------------|-------------|---|-------------|-------------|-------------|
| Measuring range | X axis | | | | 200 mm | | | |
| | Z1 axis | | | | 800 μm, 80 μm, 8 μm | | | |
| Straightness (when the X axis is horizontal) | (0.05+0.001L) μm L = Measurement Length (mm) | | | | (0.1+0.002L) μm L = Measurement Length (mm) | | | |
| X-axis inclination angle | ±45° (Only for models with X-axis inclining drive unit) | | | | | | | |
| Z2-axis (column) travel range | 300 mm | 500 mm | 700 mm | 300 mm | 500 mm | 700 mm | 500 mm | 700 mm |
| Base size (WxD) | 60x450 mm | | 1000x450 mm | | 600x450 mm | | 1000x450 mm | |
| Base material | Granite | | | | | | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

FORMTRACER Avant C3000/4000 Series SERIES 218 — Surface Texture Measuring Instruments

- **FORMTRACER Avant C3000/4000** Series are highly functional and user-friendly contour measuring systems with innovative design features.
- **FORMTRACER Avant C3000/4000** Series comes with the inclined drive unit as standard, making approach to the target surface and measurement of large workpieces much easier.
- Equipped with an operability focused, new style remote box. The new part program key strongly supports manual part-programming.
- High throughput is achieved thanks to high drive speed (X axis: Max. 80 mm/s, Z2 axis: Max. 30 mm/s) and acceleration (X axis: 30 mm/s²).
- All connecting cables are contained within the measuring instrument to eliminate any inconvenience during measurement.
- The Z1-axis detector is equipped with a built-in anti-collision safety device.
- A detector for measuring contours can be retrofitted.
- The arm of the detector is a user-friendly, magnetic, one-touch, detachable mechanism.
- **C4000** type is a highly functional contour measuring system that has a wide-range digital detector (measuring range: 60 mm), top/bottom plane continuous measurement function, automatic variable measuring force function, and stylus drop detection function.



Inclined drive unit



FTA-S4C3000



FTA-S4C4000



Large sized base models and high-column models are added to the line-up.



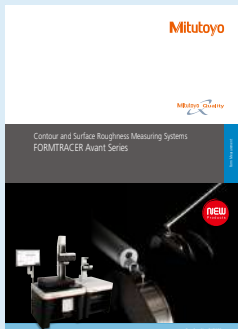
Remote box with user-friendly operability



For C4000

For C3000

Detector



Refer to the **FORMTRACER Avant** Series Brochure (E15030) for more details.

SPECIFICATIONS

| Model No. | FTA-S4C3000 | FTA-H4C3000 | FTA-W4C3000 | FTA-L4C3000 | FTA-S8C3000 | FTA-H8C3000 | FTA-W8C3000 | FTA-L8C3000 | |
|--|---------------|--|---|-------------|-------------|---|-------------|-------------|--|
| | FTA-S4C4000 | FTA-H4C4000 | FTA-W4C4000 | FTA-L4C4000 | FTA-S8C4000 | FTA-H8C4000 | FTA-W8C4000 | FTA-L8C4000 | |
| Measuring range | X axis | 100 mm | | | 200 mm | | | | |
| | Z1 axis | 60 mm (±30 mm in horizontal situation) | | | | | | | |
| Straightness (when the X axis is horizontal) | 0.8 μm/100 mm | | | | 2 μm/200 mm | | | | |
| Accuracy (20 °C) | C3000 | X axis | (0.8+0.01L) μm L = Measurement Length (mm) | | | (0.8+0.015L) μm L = Measurement Length (mm) | | | |
| | | Z1 axis (detector unit) | ±(1.2+ 2H /100) μm H = Measurement height from the horizontal position (mm) | | | | | | |
| | C4000 | X axis | (0.8+0.01L) μm L = Measurement Length (mm) | | | (0.8+0.015L) μm L = Measurement Length (mm) | | | |
| | | Z1 axis (detector unit) | ±(0.8+ 2H /100) μm H = Measurement height from the horizontal position (mm) | | | | | | |
| X-axis inclination angle | ±45° | | | | | | | | |
| Z2-axis (column) travel range | 300 mm | 500 mm | 700 mm | 300 mm | 500 mm | 700 mm | 300 mm | 500 mm | |
| Base size (WxD) | 600x450 mm | | 1000x450 mm | | 600x450 mm | | 1000x450 mm | | |
| Base material | Granite | | | | | | | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

Formtracer

Hybrid machine with dual-role capability

FORMTRACER Avant D3000/4000 Series SERIES 525 — Surface Texture Measuring Instruments

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



FTA-S4D3000
(Detector for surface roughness measurement equipped, with monitor arm)

FTA-S4D3000
(Detector for form/contour measurement equipped, with monitor arm)

- **FORMTRACER Avant D3000/4000 Series** are highly functional and user-friendly surface roughness and contour measuring systems with innovative design features. Both surface roughness measurement and contour measurement are available on a single system just by replacing the detector.
- The contour/roughness detector can be replaced without turning off the controller power and without using any tool. Furthermore, the detector is recognized automatically.
- **FORMTRACER Avant D Series** comes with the inclined drive unit as standard, making approach to the target surface and measurement of large workpieces much easier.
- Equipped with an operability focused, new style remote box. The new part program key strongly supports manual part-programming.
- High throughput is achieved thanks to high drive speed (X axis: Max. 80 mm/s, Z2 axis: Max. 30 mm/s) and acceleration (X axis: 30 mm/s²).
- All connecting cables are contained within the measuring instrument to eliminate any inconvenience during measurement.
- The Z1-axis detector is equipped with a built-in anti-collision safety device.
- A detector for measuring contours can be retrofitted.
- The arm of the detector for contour measurement is a magnetic, one-touch, detachable mechanism.
- **D4000 type** is a highly functional contour measuring system with a digital detector (measuring range: 60 mm) that enables wide range measurement, top/bottom plane continuous measurement function, automatic variable measuring force function, and stylus drop detection function.



Large sized base models and high-column models are added to the line-up.



Inclined drive unit



Remote box with user-friendly operability



Detector holder (optional)



Detector



Connecting cables are contained within the measuring instrument.



Refer to the **FORMTRACER Avant Series Brochure (E15030)** for more details.

SPECIFICATIONS

| Model No. | FTA-S4D3000 | FTA-H4D3000 | FTA-W4D3000 | FTA-L4D3000 | FTA-S8D3000 | FTA-H8D3000 | FTA-W8D3000 | FTA-L8D3000 | |
|--|--------------|--|---|-------------|---|---|-------------|-------------|--|
| | FTA-S4D4000 | FTA-H4D4000 | FTA-W4D4000 | FTA-L4D4000 | FTA-S8D4000 | FTA-H8D4000 | FTA-W8D4000 | FTA-L8D4000 | |
| Surface roughness measurement | | | | | | | | | |
| Measuring range | X axis | 100 mm | | | 200 mm | | | | |
| | Z1 axis | 800 μm, 80 μm, 8 μm | | | | | | | |
| Straightness (when the X axis is horizontal) | | (0.05+0.001L) μm L = Measurement Length (mm) | | | (0.1+0.002L) μm L = Measurement Length (mm) | | | | |
| Contour measurement | | | | | | | | | |
| Measuring range | X axis | 100 mm | | | 200 mm | | | | |
| | Z1 axis | 60 mm (±30 mm in horizontal situation) | | | | | | | |
| Straightness (when the X axis is horizontal) | | 0.8 μm/100 mm | | | 2 μm/200 mm | | | | |
| Accuracy (20 °C) | D3000 | X axis | (0.8+0.01L) μm L = Measurement Length (mm) | | | (0.8+0.015L) μm L = Measurement Length (mm) | | | |
| | | Z1 axis (detector unit) | ±(1.2+ 2H /100) μm H = Measurement height from the horizontal position (mm) | | | | | | |
| | D4000 | X axis | (0.8+0.01L) μm L = Measurement Length (mm) | | | (0.8+0.015L) μm L = Measurement Length (mm) | | | |
| | | Z1 axis (detector unit) | ±(0.8+ 2H /100) μm H = Measurement height from the horizontal position (mm) | | | | | | |
| Common specifications | | | | | | | | | |
| X-axis inclination angle | | ±45° | | | | | | | |
| Z2-axis (column) travel range | | 300 mm | 500 mm | 700 mm | 300 mm | 500 mm | 700 mm | | |
| Base size (WxD) | | 600x450 mm | | 1000x450 mm | | 600x450 mm | | 1000x450 mm | |
| Base material | | Granite | | | | | | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

CS-3300 Series SERIES 525 — Surface Texture Measuring Instruments

- **CS-3300** Series are highly functional and user-friendly surface roughness and contour measuring systems with innovative design features.
- Large sized base models and high-column models are newly added to the line-up.
- Equipped with a wide range and high resolution Z1-axis detector.
- **CS-3300** Series comes with the inclined drive unit as standard, making approach to the target surface and measurement of large workpieces much easier.
- Equipped with an operability focused, new style remote box. The new part program key strongly supports manual part-programming.
- High throughput is achieved thanks to high drive speed (X axis: Max. 80 mm/s, Z2 axis: Max. 30 mm/s).
- All connecting cables are contained within the measuring instrument to eliminate any inconvenience during measurement.
- The Z1-axis detector is equipped with a built-in anti-collision safety device.



CS-3300H8



CS-3300H8
(With monitor arm)



Refer to the **FORMTRACER Avant CS-3300** Series Brochure (E15029) for more details.



Inclinable drive unit



Detector sliding mechanism



Connecting cables are contained within the measuring instrument.

SPECIFICATIONS

| Model No. | CS-3300S4 | CS-3300H4 | CS-3300W4 | CS-3300L4 | CS-3300S8 | CS-3300H8 | CS-3300W8 | CS-3300L8 |
|--|-------------------------|---|---|---------------|---|-----------|-------------|-----------|
| Measuring range | X axis | 100 mm | | | 200 mm | | | |
| | Z1 axis | 5 mm (±2.5 mm in horizontal situation) | | | | | | |
| Straightness (when the X axis is horizontal) | 0.2 μm/100 mm | | | 0.8 μm/200 mm | | | | |
| Accuracy (20 °C) | X axis | ±(0.8+0.01L) μm L = Measurement Length (mm) | | | (0.8+0.015L) μm L = Measurement Length (mm) | | | |
| | Z1 axis (detector unit) | ±(1.5+ 2H /100) μm H = Measurement height from the horizontal position (mm) | | | | | | |
| Detector (Z1 axis) | Detection method | | Differential inductance | | | | | |
| | Measuring force | | 0.75 mN | | | | | |
| | Stylus tip | Standard | Tip radius 2 μm, Tip angle 60°, Diamond (surface roughness/contour) | | | | | |
| | | Cone | Tip radius 25 μm, Tip angle 30°, Sapphire (contour) | | | | | |
| Stylus up/down | | Available (stoppable at mid-stroke if required) | | | | | | |
| X-axis inclination angle | ±45° | | | | | | | |
| Z2-axis (column) travel range | 300 mm | 500 mm | 700 mm | 300 mm | 500 mm | 700 mm | | |
| Base size (WxD) | 600x450 mm | | 1000x450 mm | | 600x450 mm | | 1000x450 mm | |
| Base material | Granite | | | | | | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

Formtracer

Hybrid machine with dual-role capability

Formtracer Extreme SV-C4500CNC/SV-C4500CNC HYBRID TYPE1 SERIES 525 — CNC Surface Roughness and Contour Measuring Systems

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



SV-C4500CNC (Contour detector shown mounted together with the inclinable drive unit and Y-axis table)



SV-C4500CNC HYBRID TYPE1 (Mounting example of non-contact detector)

SV-C4500CNC SPECIFICATIONS

| Model No. | | SV-C4500CNC | |
|-------------------------|-------------------|--|---|
| X1 axis (Drive unit) | Contour | Measuring range | 200 mm |
| | | Resolution | 0.05 μm |
| | | Scale type | Reflective-type linear encoder |
| | Surface roughness | Straightness | 2 μm/200 mm |
| | | Accuracy (20 °C) | ±(0.8+4L/200) μm L: Measuring length (mm) |
| Z1 axis (Detector) | Contour | Measuring range | 60 mm (±30 mm from the horizontal) |
| | | Resolution | 0.02 μm |
| | | Scale type | Arc |
| | Surface roughness | Accuracy (20 °C) | ±(0.8+ 2H /100) μm H: Measuring height from horizontal position (mm) |
| | | Measuring range | 800 μm, 80 μm, 8 μm |
| Z2 axis (Column) | Resolution | 0.01 μm, 0.001 μm, 0.0001 μm | |
| | Drive range | Specification is selectable from 300 mm or 500 mm. | |
| | Resolution | 0.05 μm | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

SV-C4500CNC HYBRID TYPE1 SPECIFICATIONS

| Model No. | | SV-C4500CNC HYBRID TYPE1 | |
|---|-----------------------|---|---|
| X1 axis (Drive unit) | Contour | Measuring range | 200 mm |
| | | Resolution | 0.05 μm |
| | | Scale type | Reflective-type linear encoder |
| | Surface roughness | Straightness (20 °C) | 2 μm/200 mm |
| | | Accuracy | ±(0.8+4L/200) μm L: Measuring length (mm) |
| Non-contact type | Straightness | 0.5 μm/200 mm | |
| | Accuracy | ±(0.8+4L/200) μm L: Measuring length (mm) | |
| Y axis | Measuring range | 200 mm | |
| | Resolution | 0.05 μm | |
| | Maximum table loading | 20 kg | |
| Z1 axis | Contour | Measuring range | 60 mm (±30 mm from the horizontal) |
| | | Resolution | 0.02 μm |
| | | Scale type | Arc |
| | Surface roughness | Accuracy (20 °C) | ±(0.8+ 2H /100) μm H: Measuring height from horizontal position (mm) |
| | | Measuring range | 800 μm, 80 μm, 8 μm |
| Non-contact type detector CPS2525 *1 | Resolution | 0.01 μm, 0.001 μm, 0.0001 μm | |
| | Measuring range | 1.2 mm | |
| Non-contact type detector CPS0517 *1 | Resolution | 25 nm | |
| | Measuring range | 0.1 mm | |
| Z2 axis | Resolution | 5 nm | |
| | Drive range | 500 mm | |
| | Resolution | 0.05 μm | |

*1 Select either **CPS2525** or **CPS0517**.

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

SV-C4500CNC

- High-accuracy stylus type CNC Surface Roughness/Contour Measuring System that allows measurement of surface roughness and form/contour with one unit through detector replacement.
- For models with the α axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the X1 axis. In addition, automatic measuring force adjustment function of Z1-axis detector for contour measurement enables automatic measurement with constant measuring force even with the X1-axis tilted.
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces through positioning in the Y-axis direction.
- Since the Z1-axis detector incorporates an anti-collision safety device, the machine will automatically stop if the detector touches a workpiece or jig.
- Optional external control function (Ext I/O) through bidirectional communication (RS-232C) with the PLC (programmable logic controller) is available.

SV-C4500CNC HYBRID TYPE1

- CNC Surface Roughness/Contour Measuring System equipped with a non-contact type detector as well as a contact type surface roughness contour measuring detector.
- Equipped with the Y-axis table, it is possible to expand the measuring range for multiple workpieces through positioning in the Y-axis direction.
- Since the Z1-axis detector incorporates an anti-collision safety device, the machine will automatically stop if the detector touches a workpiece or jig.
- Optional external control function (Ext I/O) through bidirectional communication (RS-232C) with the PLC (programmable logic controller) is available.



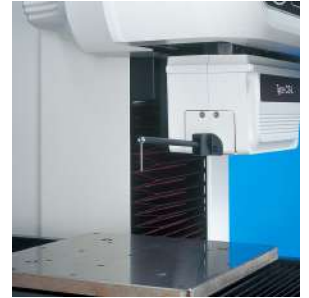
An inspection certificate is supplied as standard. Refer to page U-11 for details.

Formtracer Extreme CS-5000CNC/CS-H5000CNC SERIES 525 — CNC Surface Roughness and Contour Measuring Systems

- High-accuracy stylus type CNC Surface Measuring System that allows batch measurement of surface roughness and form/contour.
- The X1 and Z2 axes have maximum drive speeds of 40 mm/s and 200 mm/s, respectively. This permits high-speed positioning that can potentially result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- The high resolution linear encoder is incorporated in the X1 and Z1 axes so that high resolution is achieved and batch measurement of form/contour and surface roughness can be made.
- The active control method is employed for the Z1-axis detector to implement a wide-range measurement capability wherein the variation in dynamic measuring force is restricted.
- Since the Z1-axis detector incorporates an anti-collision safety device, the detector unit will automatically stop if it touches a workpiece or fixture.
- For models with the α axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the X1 axis. (**CS-5000CNC** only)
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces through positioning in the Y-axis direction.
- Optional external control function (Ext I/O) through bidirectional communication (RS-232C) with the PLC (programmable logic controller) is available.



CS-H5000CNC
(with Y-axis table)



Wide-range detector employing active control technology

SPECIFICATIONS

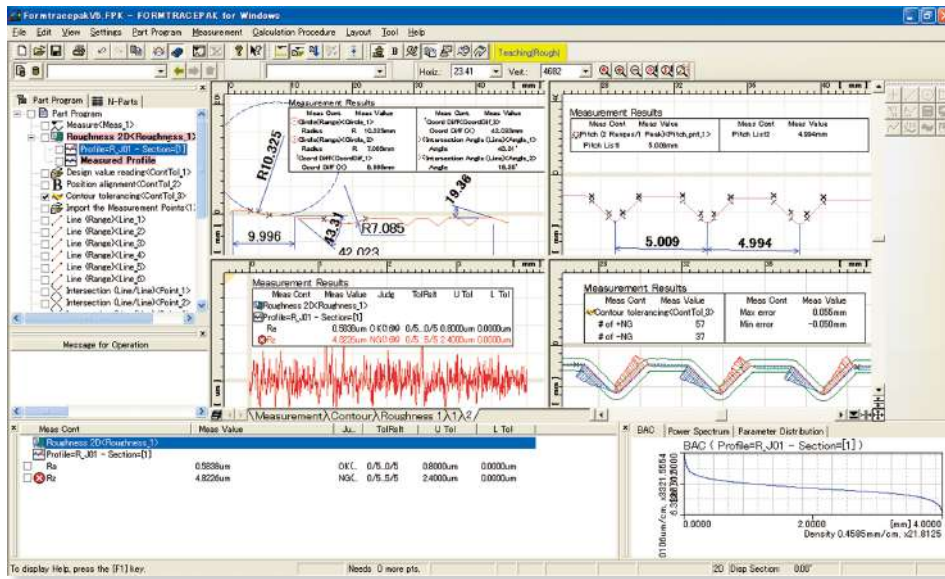
| Model No. | | CS-5000CNC | CS-H5000CNC | |
|-----------------------|---|--|--|--|
| X1 axis | Measuring range | 200 mm | | |
| | Resolution | 0.005 μ m | | |
| | Scale type | Transmission-type linear encoder | | |
| | Drive speed | CNC mode | Max. 40 mm/s | |
| | | Joystick mode | 0 to 40 mm/s | |
| | Measuring speed | 0.02, 0.05, 0.1, 0.2 mm/s (surface roughness), 0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0 mm/s (form/contour) | | |
| | Measuring direction | Forward/backward | | |
| | Straightness | with standard stylus | (0.1+0.0015L) μ m L: traverse length (mm) | (0.05+0.0003L) μ m L: traverse length (mm) |
| with 2X-long stylus | | (0.2+0.0015L) μ m L: traverse length (mm) | (0.1+0.0015L) μ m L: traverse length (mm) | |
| Accuracy (20 °C) | $\pm(0.3+0.002L)$ μ m L: traverse length (mm) | | | |
| α axis | Inclination range | -45° (CCW), +10° (CW) | | |
| Z1 axis (Detector) | Measuring range | with standard stylus | 12 mm | |
| | | with 2X-long stylus | 24 mm | |
| | Resolution | with standard stylus | 0.0008 μ m | |
| | | with 2X-long stylus | 0.0016 μ m | |
| | Vertical movement of the stylus | Arc motion | | |
| | Scale type | Transmission-type linear encoder | | |
| | Accuracy (20 °C) | $\pm(0.3+0.02H)$ μ m H: probing height (mm) | $\pm(0.07+0.02H)$ μ m H: probing height (mm) | |
| | Measuring force | with standard stylus | 4 mN (Fixed) | |
| | | with 2X-long stylus | 0.75 mN (Fixed) | |
| | Traceable angle | Ascent: 60°, Descent: 60° (Depends on the surface texture.) | | |
| | Stylus tip shape | Standard stylus | Tip radius: 5 μ m, Tip angle: 40°, Diamond | |
| | | Standard ball stylus | Tip ball radius: 0.25 mm, Sapphire | |
| 2X-long stylus | | Tip radius: 5 μ m, Tip angle: 40°, Diamond | | |
| 2X-long stylus | | — | Tip radius: 2 μ m, Tip angle: 60°, Diamond tip | |
| 2X-long ball stylus | | Tip ball radius: 0.25 mm, Sapphire | | |
| Face of stylus | Downward | | | |
| Travel range | Z2 axis (column, type S) | 300 mm | | |
| | Z2 axis (column, type H) | 500 mm | | |
| Resolution | 0.05 μ m | | | |
| Scale type | Reflective-type linear encoder | | | |
| Drive speed | CNC mode | Max. 200 mm/s | | |
| | Joystick mode | 0 to 50 mm/s | | |
| Base | Base size (WxD) | 750x600 mm | | |
| | Base material | Granite | | |

Note: While the appearance of the natural stone base varies according to the source, the high stability for which this material is known can always be relied upon.

Formtracer

Hybrid machine with dual-role capability

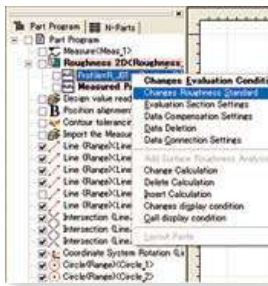
Surface Roughness/Contour Analysis Program FORMTRACEPAK



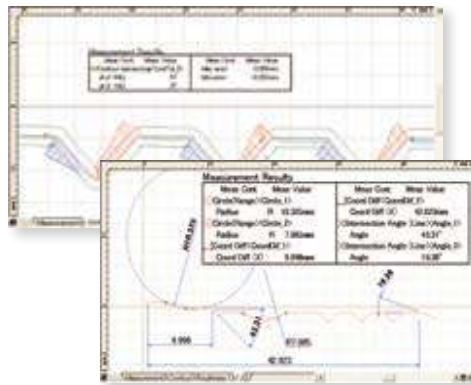
- FORMTRACEPAK functions offer total support for controlling the measurement system, surface roughness analysis, contour analysis, contour tolerancing, and inspection report creation.

• Editing measurement procedures

The items displayed in the measurement procedure window can be directly modified. You can, for example, perform new analyses by modifying the evaluation setup or roughness standard.



• Versatile graphics windowing for data and analysis



• Operation messaging

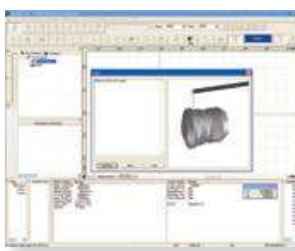
The operation message window for explaining the next step is incorporated.



• Measurement control

To make only a single measurement, you can create a part program in the single mode. To measure multiple workpieces of an identical shape, you can use the teaching mode. Since you can embed the entire flow, from making measurement to printing a report, into a part program, you can efficiently make measurements, analyze data, and output a report. A function is also provided that enables you to insert comments accompanied with photographs at desired timings, enabling you to embed the roles described in a measurement procedure document that specifies important points such as work settings.

To make immediate measurements, you can use the pull-down menu to easily select and call up the desired operating procedure.

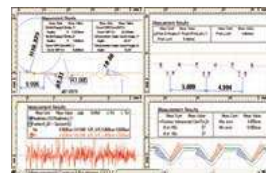


Tab-selection graphics window

Just select a tab to display the measurement data required, such as contour, roughness, or tolerancing results.

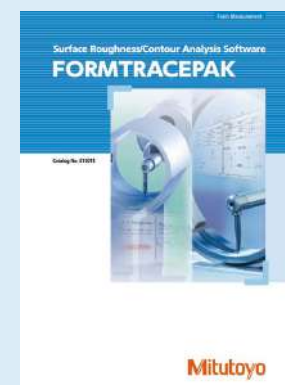
Dividing the screen into two or four windows

The screen can be divided into two, or four, windows for the convenient display of measurement data (for contour and roughness), analysis results, and contour tolerancing data, as required.



Displaying the results in the graphics window

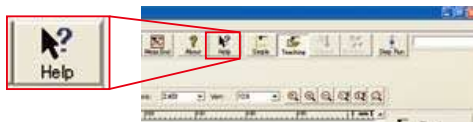
You can paste the graphics obtained from measurements, as well as measurement values (including pass/fail results) and an analysis graph, into the graphics window. This enables you to check the graphics and measurement results at a glance using the graphics window alone.



Refer to the FORMTRACEPAK Brochure (E15018) for more details.

• Online help functions

Online help that can be viewed any time is incorporated into the software. In addition to index and keyword searches, a status-saving help button, which displays menus and Windows help with a click of the mouse, is provided.



• Button-editing function

You can hide buttons that are not used frequently. For example, you can choose to display only those buttons that are used frequently and increase the size of the displayed graphics window, thereby customizing the window to suit your needs.



• Multiple language support (18 languages)

You can switch the language to be used in the measurement, analysis, and layout windows. After measurements have been made, you can switch to another language and create a report in that language. This function can be used worldwide.

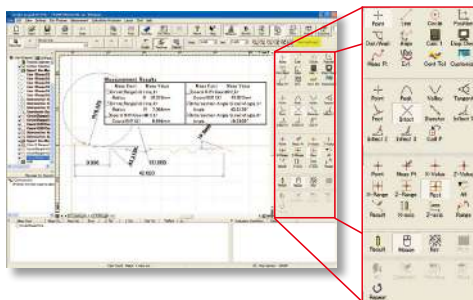
• Simple statistical commands

You can perform statistical calculations of roughness parameters and contour analysis results without using a separate program such as Excel.

Contour measurement

• Contour analysis

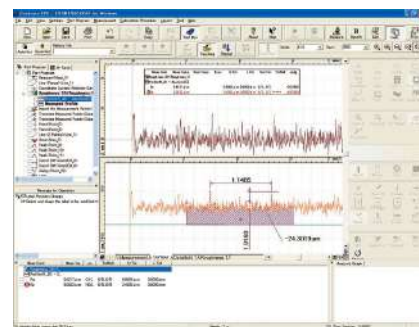
A wide variety of commands, which form the basic elements for analysis, are provided, including those for points (10 types), lines (6 types) and circles (6 types). A rich set of commands that combine these elements to calculate angles, pitches and distances as well as performing contour tolerancing and design value generation are also provided as standard features. These functions, combined with the function that enables you to customize the calculation command buttons by hiding less frequently used commands, help you to tailor the window according to the user's environment.



Surface roughness measurement

• Surface roughness analysis

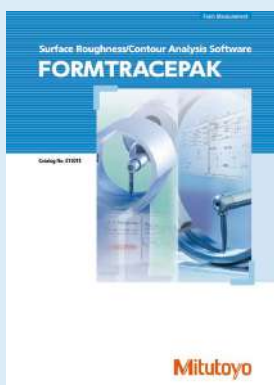
FORMTRACEPAK can perform surface roughness analyses that conform to various standards such as ISO, JIS, ANSI and VDA. For comparing measurement values with the tolerance limits, you can use the 16 % rule or the maximum value rule. Furthermore, since **FORMTRACEPAK** comes with parameter calculation functions as well as a rich set of graphic analysis functions, it can be widely utilized for everything from routine quality control to R&D applications. It also includes many other functions such as the function for eliminating (compensating) shapes, such as slopes and radiused surfaces (R-surfaces), and data deletion.



• Contour-tolerancing as a standard feature

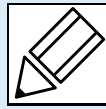
- Design value generation
- Data combination
- Simple pitch calculation

- Micro contour analysis
- Simple input using drawing symbols
- Multiple-point measurement
- Analysis using multiple-point measurements
- Reference length dialog box
- Analysis condition modification with preview
- R-surface automatic measurement



Refer to the **FORMTRACEPAK** Brochure (E15018) for more details.

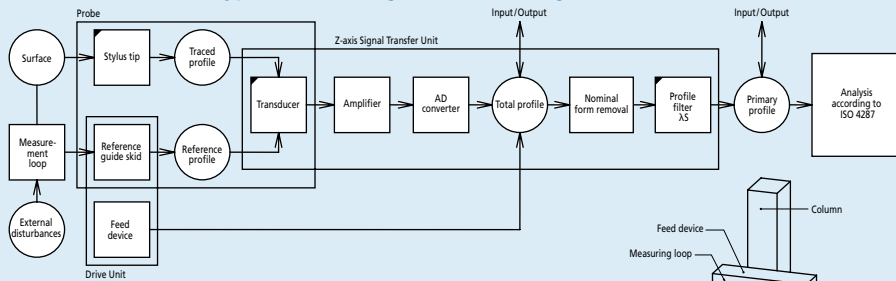
Quick Guide to Precision Measuring Instruments



Surftest (Surface Roughness Testers)

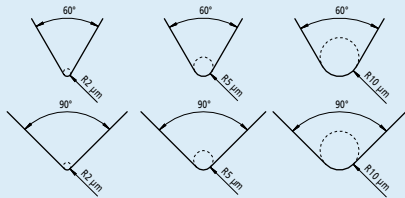
- ISO 4287: 1997 Geometrical Product Specifications (GPS) – Surface Texture: Profile method– Terms, definitions, and surface texture parameters
- ISO 4288: 1996 Geometrical Product Specifications (GPS) – Surface Texture: Profile method– Rules and procedures for the assessment of surface texture
- ISO 3274: 1996 Geometrical Product Specifications (GPS) – Surface Texture: Profile method– Nominal characteristics of contact (stylus) instruments
- ISO 11562: 1996 Geometrical Product Specifications (GPS) – Surface texture: Profile method– Metrological characteristics of phase correct filters

Elements of Contact Type Surface Roughness Measuring Instruments



Stylus Shape

A typical shape for a stylus end is conical with a spherical tip.
 Tip radius: $r_{tip} = 2 \mu\text{m}, 5 \mu\text{m}$ or $10 \mu\text{m}$
 Cone angle: $60^\circ, 90^\circ$
 In typical surface roughness testers, the conical angle of the stylus end is 60° unless otherwise specified.



Static Measuring Force

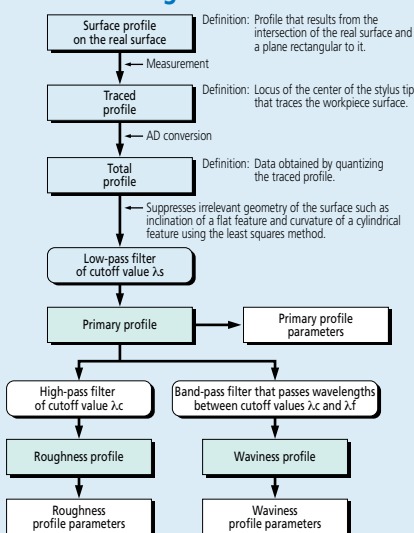
| Nominal radius of curvature of stylus tip: μm | Static measuring force at the mean position of stylus: mN | Tolerance on static measuring force variations: mN/ μm |
|--|---|---|
| 2 | 0.75 | 0.035 |
| 5 | 0.75 (4.0) ^{*1} | 0.2 |
| 10 | | |

*1 The maximum value of static measuring force at the average position of a stylus is to be 4.0 mN for a probe with a special structure including a replaceable stylus.

Metrological Characterization of Phase Correct Filters

A profile filter is a phase-correct filter without phase delay (cause of profile distortion dependent on wavelength). The weight function of a phase-correct filter shows a normal (Gaussian) distribution in which the amplitude transmission is 50 % at the cutoff wavelength.

Data Processing Flow



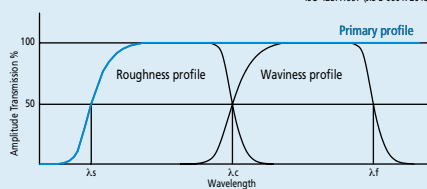
Relationship between Cutoff Value and Stylus Tip Radius

The following table lists the relationship between the roughness profile cutoff value λ_c , stylus tip radius r_{tip} , and cutoff ratio λ_c/λ_s .

| λ_c mm | λ_s μm | λ_c/λ_s | Maximum r_{tip} μm | Maximum sampling length μm |
|----------------|---------------------------|-----------------------|---------------------------------|---------------------------------------|
| 0.08 | 2.5 | 30 | 2 | 0.5 |
| 0.25 | 2.5 | 100 | 2 | 0.5 |
| 0.8 | 2.5 | 300 | 2 ^{*1} | 0.5 |
| 2.5 | 8 | 300 | 5 ^{*2} | 1.5 |
| 8 | 25 | 300 | 10 ^{*2} | 5 |

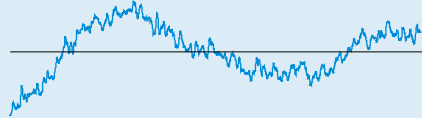
*1 For a surface with $Ra \geq 0.5 \mu\text{m}$ or $Rz > 3 \mu\text{m}$, a significant error will not usually occur in a measurement even if $r_{tip} = 5 \mu\text{m}$.
 *2 If a cutoff value λ_s is $2.5 \mu\text{m}$ or $8 \mu\text{m}$, attenuation of the signal due to the mechanical filtering effect of a stylus with the recommended tip radius appears outside the roughness profile pass band. Therefore, a small error in stylus tip radius or shape does not affect parameter values calculated from measurements. If a specific cutoff ratio is required, the ratio must be defined.

Surface Profiles



Primary Profile

Profile obtained from the measured profile by applying a low-pass filter with cutoff value λ_s .



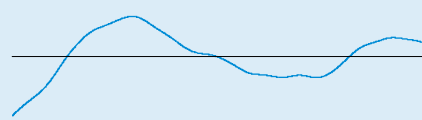
Roughness Profile

Profile obtained from the primary profile by suppressing the longer wavelength components using a high-pass filter of cutoff value λ_c .



Waviness Profile

Profile obtained by applying a band-pass filter to the primary profile to remove the longer wavelengths above λ_f and the shorter wavelengths below λ_c .



Roughness sampling length for non-periodic profiles

Table 1: Sampling lengths for aperiodic profile roughness parameters ($Ra, Rq, Rsk, Rku, RAr, RArq$), material ratio curve, probability density function, and related parameters

| Ra μm | Sampling length lr mm | Evaluation length ln mm |
|-------------------------|-------------------------|---------------------------|
| $(0.006 < Ra \leq 0.02$ | 0.08 | 0.4 |
| $0.02 < Ra \leq 0.1$ | 0.25 | 1.25 |
| $0.1 < Ra \leq 2$ | 0.8 | 4 |
| $2 < Ra \leq 10$ | 2.5 | 12.5 |
| $10 < Ra \leq 80$ | 8 | 40 |

Table 2: Sampling lengths for aperiodic profile roughness parameters (Rz, Rv, Rp, Rc, Rt)

| Rz $Rz1max$ μm | Sampling length lr mm | Evaluation length ln mm |
|--------------------------------|-------------------------|---------------------------|
| $(0.025 < Rz, Rz1max \leq 0.1$ | 0.08 | 0.4 |
| $0.1 < Rz, Rz1max \leq 0.5$ | 0.25 | 1.25 |
| $0.5 < Rz, Rz1max \leq 10$ | 0.8 | 4 |
| $10 < Rz, Rz1max \leq 50$ | 2.5 | 12.5 |
| $50 < Rz, Rz1max \leq 200$ | 8 | 40 |

1) Rz is used for measurement of Rz, Rv, Rp, Rc, Rt .
 2) $Rz1max$ only used for measurement of $Rz1max, Rv1max, Rp1max, Rc1max$.

Table 3: Sampling lengths for measurement of periodic roughness profile roughness parameters and periodic or aperiodic profile parameter Rsm

| Rsm mm | Sampling length lr mm | Evaluation length ln mm |
|-------------------------|-------------------------|---------------------------|
| $0.013 < Rsm \leq 0.04$ | 0.08 | 0.4 |
| $0.04 < Rsm \leq 0.13$ | 0.25 | 1.25 |
| $0.13 < Rsm \leq 0.4$ | 0.8 | 4 |
| $0.4 < Rsm \leq 1.3$ | 2.5 | 12.5 |
| $1.3 < Rsm \leq 4$ | 8 | 40 |

Procedure for determining a sampling length if it is not specified

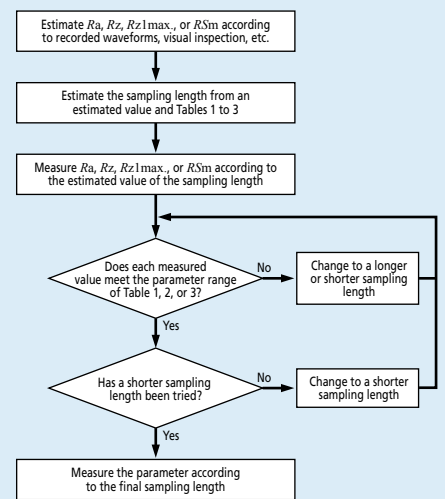


Fig.1 Procedure for determining the sampling length of an aperiodic profile if it is not specified.

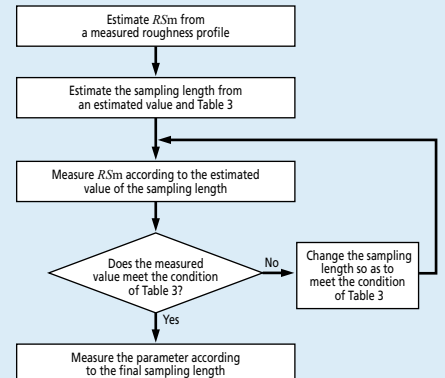


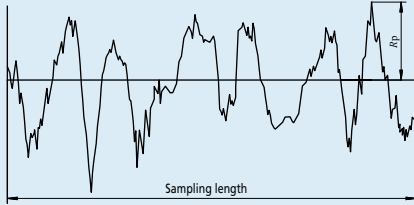
Fig.2 Procedure for determining the sampling length of a periodic profile if it is not specified.

Definition of Parameters

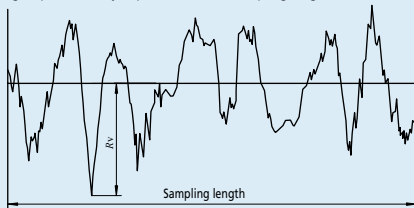
ISO 4287:1997, Amd. 1: 2009 (JIS B 0261: 2013)

Amplitude Parameters (peak and valley)

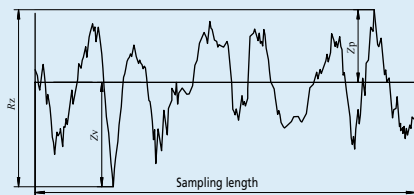
Maximum peak height of the primary profile P_p
 Maximum peak height of the roughness profile R_p
 Maximum peak height of the waviness profile W_p
 Largest profile peak height Z_p within a sampling length



Maximum valley depth of the primary profile P_v
 Maximum valley depth of the roughness profile R_v
 Maximum valley depth of the waviness profile W_v
 Largest profile valley depth Z_v within a sampling length



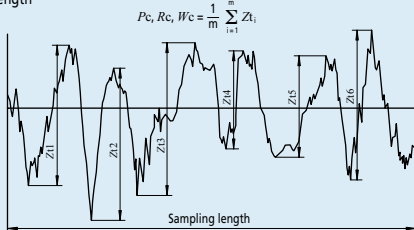
Maximum height of the primary profile P_z
 Maximum height of the roughness profile R_z
 Maximum height of the waviness profile W_z
 Sum of height of the largest profile peak height Z_p and the largest profile valley depth Z_v within a sampling length



Warning: In the old JIS and ISO 4287-1: 1984, R_z was used to indicate the "ten point height of irregularities". Care must be taken because differences between results obtained according to the existing and old standards are not always negligibly small. (Be sure to check whether the drawing instructions conform to existing or old standards.)

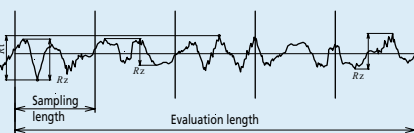
Mean height of the primary profile elements P_c
 Mean height of the roughness profile elements R_c
 Mean height of the waviness profile elements W_c

Mean value of the profile element heights Z_i within a sampling length



Total height of the primary profile P_t
 Total height of the roughness profile R_t
 Total height of the waviness profile W_t

Sum of the height of the largest profile peak height Z_p and the largest profile valley depth Z_v within the evaluation length



Amplitude Parameters (average of ordinates)

Arithmetical mean deviation of the primary profile P_a
 Arithmetical mean deviation of the roughness profile R_a
 Arithmetical mean deviation of the waviness profile W_a
 Arithmetic mean of the absolute ordinate values $Z(x)$ within a sampling length

$$P_a, R_a, W_a = \frac{1}{l} \int_0^l |Z(x)| dx$$

with l as l_p, l_r , or l_w according to the case.

Root mean square deviation of the primary profile P_q
 Root mean square deviation of the roughness profile R_q
 Root mean square deviation of the waviness profile W_q

Root mean square value of the ordinate values $Z(x)$ within a sampling length

$$P_q, R_q, W_q = \sqrt{\frac{1}{l} \int_0^l Z^2(x) dx}$$

with l as l_p, l_r , or l_w according to the case.

Skewness of the primary profile P_{sk}
 Skewness of the roughness profile R_{sk}
 Skewness of the waviness profile W_{sk}

Quotient of the mean cube value of the ordinate values $Z(x)$ and the cube of P_q, R_q , or W_q respectively, within a sampling length

$$R_{sk} = \frac{1}{R_q^3} \left[\frac{1}{l} \int_0^l Z^3(x) dx \right]$$

The above equation defines R_{sk} . P_{sk} and W_{sk} are defined in a similar manner. P_{sk} , R_{sk} , and W_{sk} are measures of the asymmetry of the probability density function of the ordinate values.

Kurtosis of the primary profile P_{ku}
 Kurtosis of the roughness profile R_{ku}
 Kurtosis of the waviness profile W_{ku}

Quotient of the mean quartic value of the ordinate values $Z(x)$ and the fourth power of P_q, R_q , or W_q respectively, within a sampling length

$$R_{ku} = \frac{1}{R_q^4} \left[\frac{1}{l} \int_0^l Z^4(x) dx \right]$$

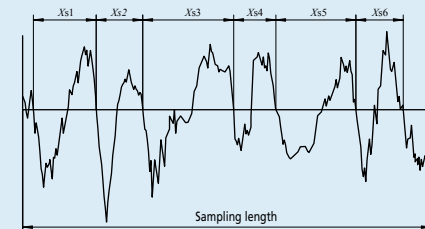
The above equation defines R_{ku} . P_{ku} and W_{ku} are defined in a similar manner. P_{ku} , R_{ku} , and W_{ku} are measures of the sharpness of the probability density function of the ordinate values.

Spacing Parameters

Mean width of the primary profile elements P_{Sm}
 Mean width of the roughness profile elements R_{Sm}
 Mean width of the waviness profile elements W_{Sm}

Mean value of the profile element widths X_i within a sampling length

$$P_{Sm}, R_{Sm}, W_{Sm} = \frac{1}{m} \sum_{i=1}^m X_i$$



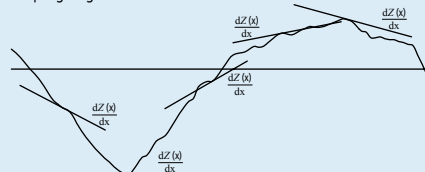
Peak count number based on the primary profile elements PP_c
 Peak count number based on the roughness profile elements RP_c
 Peak count number based on the waviness profile elements WP_c

$$RP_c = \frac{1}{R_{Sm}}$$

Hybrid Parameters

Root mean square slope of the primary profile PA_d
 Root mean square slope of the roughness profile RA_d
 Root mean square slope of the waviness profile WA_d

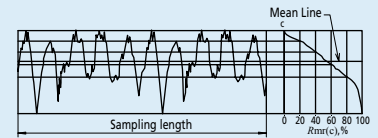
Root mean square value of the ordinate slope dZ/dX within a sampling length



Curves, Probability Density Function, and Related Parameters

Material ratio curve of the profile (Abbott-Firestone curve)

Curve representing the material ratio of the profile as a function of section level c



Material ratio of the primary profile $P_{mr}(c)$
 Material ratio of the roughness profile $R_{mr}(c)$
 Material ratio of the waviness profile $W_{mr}(c)$

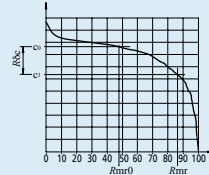
Ratio of the material length of the profile elements $MI(c)$ at a given level c to the evaluation length

$$P_{mr}(c), R_{mr}(c), W_{mr}(c) = \frac{MI(c)}{ln}$$

Section height difference of the primary profile $P_{\delta c}$
 Section height difference of the roughness profile $R_{\delta c}$
 Section height difference of the waviness profile $W_{\delta c}$

Vertical distance between two section levels of a given material ratio

$$R_{\delta c} = c(R_{mr1}) - c(R_{mr2}); R_{mr1} < R_{mr2}$$



Relative material ratio of the primary profile P_{mr}
 Relative material ratio of the roughness profile R_{mr}
 Relative material ratio of the waviness profile W_{mr}

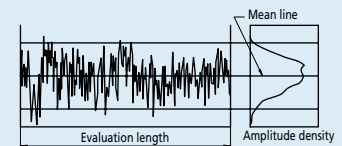
Material ratio determined at a profile section level $R_{\delta c}$ related to the reference section level c_0

$$P_{mr}, R_{mr}, W_{mr} = P_{mr}(c), R_{mr}(c), W_{mr}(c)$$

where $c_1 = c_0 - R_{\delta c}(P_{\delta c}, R_{\delta c})$
 $c_0 = c(P_{m0}, R_{m0}, W_{m0})$

Probability density function (profile height amplitude distribution curve)

Sample probability density function of the ordinate $Z(x)$ within the evaluation length

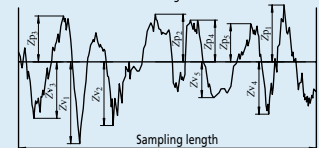


JIS Specific Parameters

Ten-point height of irregularities, RZ_{JIS}

Sum of the absolute mean height of the five highest profile peaks and the absolute mean depth of the five deepest profile valleys, measured from the mean line within the sampling length of a roughness profile. This profile is obtained from the primary profile using a phase-correct band-pass filter with cutoff values of l_c and l_s .

$$RZ_{JIS} = \frac{|Z_{p1} + Z_{p2} + Z_{p3} + Z_{p4} + Z_{p5}| + |Z_{v1} + Z_{v2} + Z_{v3} + Z_{v4} + Z_{v5}|}{5}$$



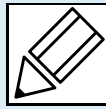
| Symbol | Used profile |
|-------------|---|
| RZ_{JIS2} | Surface profile as measured |
| RZ_{JIS4} | Roughness profile derived from the primary profile using a phase-correct high-pass filter |

Arithmetic mean deviation of the profile Ra_{75}

Arithmetic mean of the absolute values of the profile deviations from the mean line within the sampling length of the roughness profile (75 %). This profile is obtained from a measurement profile using an analog high-pass filter with an attenuation factor of 12db/octave and a cutoff value of λ_c .

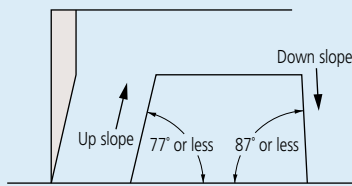
$$Ra_{75} = \frac{1}{ln} \int_0^{ln} |Z(x)| dx$$

Quick Guide to Precision Measuring Instruments



Contracer (Contour Measuring Instruments)

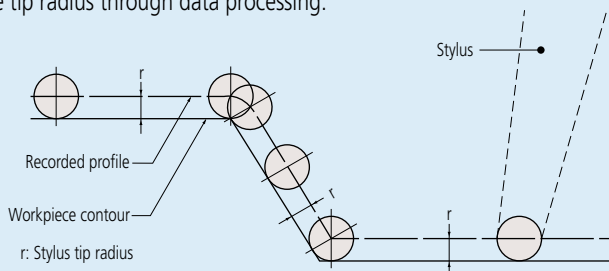
Traceable Angle



The maximum angle at which a stylus can trace upwards or downwards along the contour of a workpiece, in the stylus travel direction, is referred to as the traceable angle. A one-sided sharp stylus with a tip angle of 12° (as in the above figure) can trace a maximum 77° of up slope and a maximum 87° of down slope. For a conical stylus (30° cone), the traceable angle is smaller. An up slope with an angle of 77° or less overall may actually include an angle of more than 77° due to the effect of surface roughness. Surface roughness also affects the measuring force.

Compensating for Stylus Tip Radius

A recorded profile represents the locus of the center of the ball tip rolling on a workpiece surface. (A typical radius is 0.025 mm.) Obviously this is not the same as the true surface profile so, in order to obtain an accurate profile record, it is necessary to compensate for the effect of the tip radius through data processing.

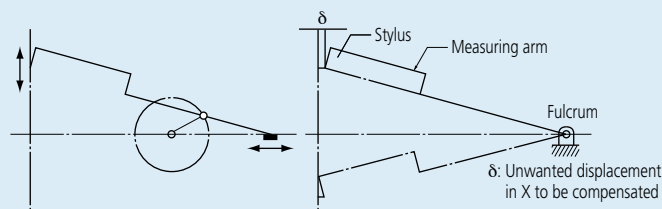


If a profile is read from the recorder through a template or scale, it is necessary to compensate for the stylus tip radius beforehand according to the applied measurement magnification.

Compensating for Arm Rotation

When the stylus traces through a circular-arc, error arises in the X-axis direction of the recorded profile. Possible methods for compensating for this effect are as follows:

- 1) Mechanical compensation
- 2) Electrical compensation



- 3) Software processing. To measure a workpiece contour that involves a large displacement in the vertical direction with high accuracy, one of these compensation methods needs to be implemented.

Accuracy

As the detector units of the X-and Z-axes incorporate scales, the magnification accuracy is displayed not as a percentage but as the linear displacement accuracy for each axis.

Overload Safety Cutout

If an excessive force (overload) is exerted on the stylus tip due, perhaps, to the tip encountering a too-steep slope on a workpiece feature, or a burr, for example, a safety device automatically stops operation and sounds an alarm buzzer. This type of instrument is commonly equipped with separate safety devices for the tracing direction (X axis) load and vertical direction (Z axis) load.

Circular-Arc/Linear Tracing

The locus traced by the stylus tip during vertical stylus movement can be a circular arc or a straight line. Ensuring a straight-line locus entails complex mechanics, while in the case of a circular-arc locus, if the amplitude of stylus displacement is large in the vertical direction, an error (δ) in the recorded profile in the horizontal direction arises. (See figure at lower left)

Z-axis Measurement Methods

Though the X-axis measurement method commonly adopted is by means of a digital scale, the Z-axis measurement divides into analog methods (using a differential transformer, for example) and digital scale methods.

Analog methods vary in Z-axis resolution depending on the measurement magnification and measuring range. Digital scale methods have fixed resolution.

Generally, a digital scale method provides higher accuracy than an analog method.

Contour analysis methods

You can analyze the contour with one of the following two methods after completing the measurement operation.

Data processing section and analysis program

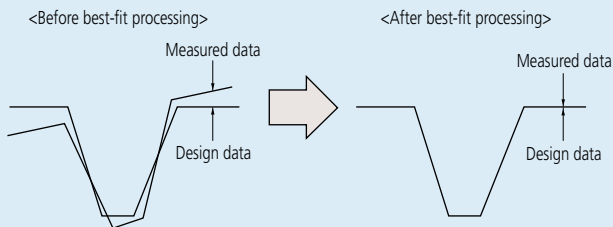
The measured contour is input into the data processing section in real time and a dedicated program performs the analysis using the mouse and/or keyboard. The angle, radius, step, pitch and other data are directly displayed as numerical values. Analysis combining coordinate systems can be easily performed. The graph that goes through stylus radius correction is output to the printer as the recorded profile.

Tolerancing with Design Data

Measured workpiece contour data can be compared with design data in terms of actual and designed shapes rather than just analysis of individual dimensions. In this technique each deviation of the measured contour from the intended contour is displayed and recorded. Also, data from one workpiece example can be processed so as to become the master design data to which other workpieces are compared. This function is particularly useful when the shape of a section greatly affects product performance, or when its shape has an influence on the relationship between mating or assembled parts.

Best-fitting

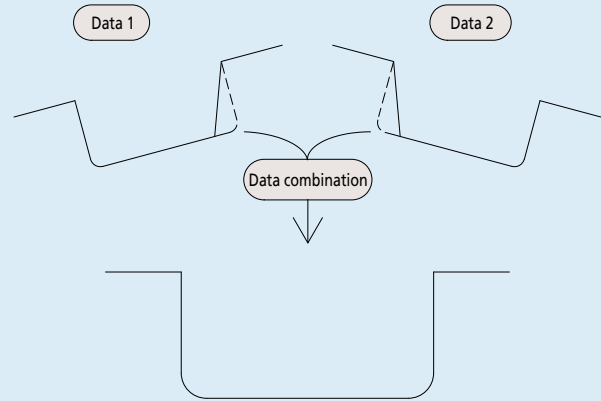
If there is a standard for surface profile data, tolerancing with design data is performed according to the standard. If there is no standard, or if tolerancing only with shape is desired, best-fitting between design data and measurement data can be performed.



The best-fit processing algorithm searches for deviations between both sets of data and derives a coordinate system in which the sum of squares of the deviations is a minimum when the measured data is overlaid on the design data.

Data Combination

Conventionally, if tracing a complete contour is prevented by stylus traceable-angle restrictions then it has to be divided into several sections that are then measured and evaluated separately. This function avoids this undesirable situation by combining the separate sections into one contour by overlaying common elements (lines, points) onto each other. With this function the complete contour can be displayed and various analyses performed in the usual way.



Measurement Examples



Aspheric lens contour



Inner/outer ring contour of a bearing



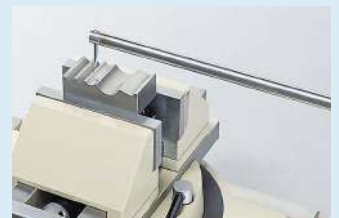
Internal gear teeth



Female thread form



Male thread form



Gage contour

Roundtest

To realize efficient centering and leveling combined with high-precision measurement

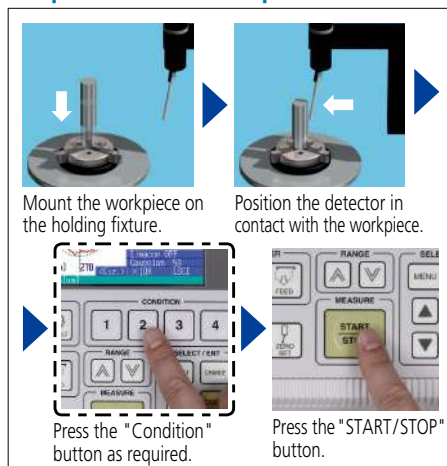
Roundtest RA-10 SERIES 211 — Roundness Measuring Instrument

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo



RA-10

Simple measurement procedure



SPECIFICATIONS

| Model No. | | RA-10 | |
|-------------------|---------------------------------------|------------------|---|
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction | (0.04+6H/10000) μm H: Probing height (mm) |
| | | Axial direction | (0.04+6X/10000) μm X: distance from the center of rotation (mm) |
| | Maximum probing diameter | | ø100 mm |
| | Maximum loading mass | | 10 kg |
| Vertical movement | Vertical travel | | 117 mm |
| X axis | Travel range | | 75 mm (-25 mm to 50 mm from the rotation center) |
| Detector* | Measuring range | | ±1000 μm |

* Only the standard length stylus is applicable to this detector. The long type cannot be used.

Roundtest RA-120/120P SERIES 211 — Roundness Measuring Instruments

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RA-120



RA-120P

The analysis capabilities for the various models (RA-120/120P/10) vary. For details, refer to page L-26.

SPECIFICATIONS

| Model No. | | RA-120 | | RA-120P | |
|-------------------|---------------------------------------|------------------|---|---------|--|
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction | (0.04+6H/10000) μm H: Probing height (mm) | | |
| | | Axial direction | (0.04+6X/10000) μm X: distance from the center of rotation (mm) | | |
| | Maximum probing diameter*1 | | ø280 mm (ø380 mm: for the vertical position when detector holder is installed reversely, the maximum probing height is up to 50 mm from the table top.) | | |
| | Maximum loading mass | | 25 kg | | |
| Vertical movement | Vertical travel | | 280 mm | | |
| X axis | Travel range | | 165 mm (-25 mm to 140 mm from the rotation center) | | |
| Detector*2 | Measuring range | | ±1000 μm | | |

*1 Auxiliary stage for a low-height workpiece (optional) is required for the measurement 20 mm or less in the radial direction from the center point of the table and 20 mm or less from the table top.

*2 Only the standard length stylus is applicable to this detector. The long type cannot be used.

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Data Management Software by Mitutoyo

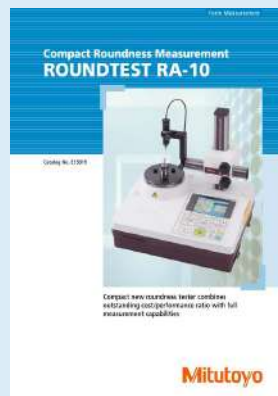
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

A cost-effective compact instrument that enables full-scale roundness evaluation.

- Offers easy operation for anyone. A large, simple key arrangement is used.
- User-friendly operation. Measurement results and recorded profiles are easy to view with the large LCD, and can then be printed by the built-in thermal line printer. Furthermore, optional functions to improve usability can be offered.

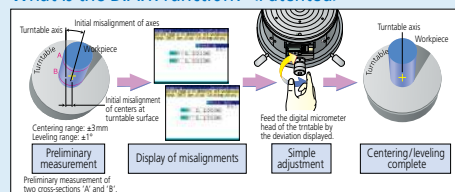


Refer to the Roundtest RA-10 Brochure (E15019) for more details.

Easy operation, compact and outstanding cost/performance ratio, designed for use on the shop-floor right beside the production line.

- D.A.T. (Digimatic Adjustment Table) function aids adjustments such as centering and leveling, and substantially reduces the time required for preliminary setup operations.

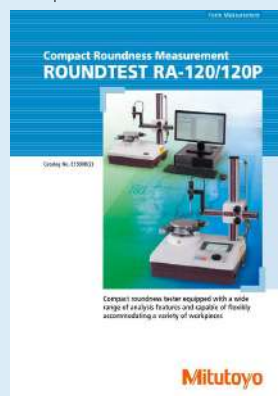
What is the D.A.T. function? <Patented>



Dedicated analysis unit type (RA-120)

Data analysis by PC (RA-120P)

- Compact, lightweight design from incorporating electronic components inside the main unit.
- **ROUNDPAK**, a data analysis program employs Windows OS and archived higher level of analysis.

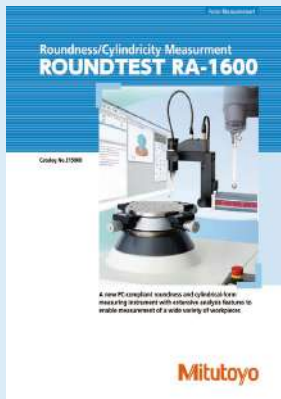


Refer to the Roundtest RA-120/120P Brochure (E15008) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Compact body and a wide measuring range assures precision that compares well with that of higher-grade models.
- D.A.T. (Digital Adjustment Table) function aids manual workpiece centering and leveling.
- Safety mechanism provided in the detection section as a standard feature.
- A sliding mechanism (optional sliding detector holder) can be installed in the detector holder. It enables one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the standard detector.



Refer to the Roundtest **RA-1600** Brochure (E15000) for more details.

Achieved the world's highest level of accuracy for this class of machine. A high-performance automatic system equipped with a high-speed automatic centering/leveling function.

- High-speed automatic centering/leveling function contributes to a significant reduction in the man-hours required for setups.
- A fully automatic system which performs processing automatically from part program calling, centering/leveling, measurement, calculation, all the way through to printing.
- Capable of continuous inside/outside diameter measurement without changing the detector orientation (up to 50 mm ID).
- The automatic positioning function of the turntable enables automatic measurement in combination with table rotation and slider/column movement.
- Advanced graphical analysis such as power spectrum chart is available.
- A sliding mechanism is incorporated in the detector holder part.



Refer to the Roundtest **RA-2200** Series Brochure (E15001) for more details.

Roundtest RA-1600 SERIES 211 — Roundness/Cylindricity Measuring System

MeasurLink ENABLED
Data Management Software by Mitutoyo



Detector safety mechanism



RA-1600

SPECIFICATIONS

| Model No. | | | RA-1600 |
|--|---------------------------------------|--------------------------|---|
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction | (0.02+6H/10000) μm H: Probing height (mm) |
| | | Axial direction | (0.02+6X/10000) μm X: Distance from the center of rotation (mm) |
| | | Maximum loading mass | 25 kg |
| | | Maximum probing diameter | ø280 mm |
| Vertical movement (Z-axis column unit) | Vertical travel | | 300 mm |
| | X axis | | Travel range |
| | | | 165 mm (-25 mm to +140 mm from the rotation center) |
| Detector | Measuring range | Standard | ±400 μm/±40 μm/±4 μm |
| | | Tracking | ±5 mm |

Roundtest RA-2200 SERIES 211 — Roundness/Cylindricity Measuring System

MeasurLink ENABLED
Data Management Software by Mitutoyo



RA-2200 AS

System vibration isolator (with side table)



RA-2200 AS

System vibration isolator (monitor arm type)*

* Printer table (provided by the customer) not shown.

SPECIFICATIONS

| Model No. | | | RA-2200AS | RA-2200DS | RA-2200AH | RA-2200DH |
|--|---------------------------------------|--------------------------|---|-----------|-----------|-----------|
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction | (0.02+3.5H/10000) μm H: Probing height (mm) | | | |
| | | Axial direction | (0.02+3.5X/10000) μm X: Distance from the center of rotation (mm) | | | |
| | | Maximum loading mass | 30 kg | | | |
| | | Maximum probing diameter | ø300 mm | | | |
| Vertical movement (Z-axis column unit) | Vertical travel | | 300 mm | 500 mm | | |
| | X axis | | Travel range | | | |
| | | | 175 mm (-25 mm to +150 mm from the rotation center) | | | |
| Detector | Measuring range | Standard | ±400 μm/±40 μm/±4 μm | | | |
| | | Tracking | ±5 mm | | | |

Roundtest

To realize efficient centering and leveling combined with high-precision measurement

Roundtest RA-H5200 SERIES 211 — Roundness/Cylindricity Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo



RA-H5200AH
with side table

SPECIFICATIONS

| Model No. | | RA-H5200AS | | RA-H5200AH | |
|--|---------------------------------------|----------------------------------|---|------------|--|
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction | (0.02+3.5H/10000) μm H: Probing height (mm) | | |
| | | Axial direction | (0.02+3.5X/10000) μm X: Distance from the center of rotation (mm) | | |
| | Maximum loading mass | 80 kg (On auto-centering: 65 kg) | | | |
| | Maximum probing diameter | ø400 mm | | | |
| Vertical movement (Z-axis column unit) | Vertical travel | 350 mm | | 550 mm | |
| | X axis | Travel range | 225 mm (-25 mm to +200 mm from the rotation center) | | |
| Detector | Measuring range | Standard | ±400 μm/±40 μm/±4 μm | | |
| | | Tracking | ±5 mm | | |

Roundtest Extreme RA-2200 CNC SERIES 211 — CNC Roundness/Cylindricity Measuring System

MeasurLink® ENABLED
Data Management Software by Mitutoyo



RA-2200 CNC
System vibration isolator (with side table)



SPECIFICATIONS

| Model No. | | RA-2200 CNC | | | |
|--|---------------------------------------|------------------|---|--------|--|
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction | (0.02+3.5H/10000) μm H: Probing height (mm) | | |
| | | Axial direction | (0.02+3.5X/10000) μm X: Distance from the center of rotation (mm) | | |
| | Maximum loading mass | 30 kg | | | |
| | Maximum probing diameter | ø256 mm | | | |
| Vertical movement (Z-axis column unit) | Vertical travel | 300 mm | | 500 mm | |
| | X axis | Travel range | 175 mm | | |
| Detector | Measuring range | Standard | ±400 μm/±40 μm/±4 μm | | |
| | | Tracking | ±5 mm | | |

MeasurLink® ENABLED
Data Management Software by Mitutoyo

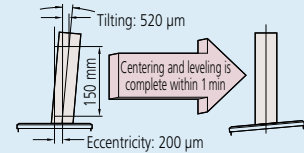
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

A high-performance automatic system equipped with a high-speed automatic centering/leveling function achieves the world's highest-level of accuracy.

- High-speed automatic centering/leveling function contributes to a significant reduction in the man-hours required for setups.



- A fully automatic system which performs processing automatically from part program calling, centering/leveling, measurement, calculation, all the way through to printing.
- Capable of continuous inside/outside diameter measurement without changing the detector orientation (up to 50 mm ID).
- The automatic positioning function of the turntable enables automatic measurement in combination with table rotation and slider/column movement.
- Advanced graphical analysis such as a power spectrum chart is available.
- A sliding mechanism is incorporated in the detector holder.

- **Highly accurate and easy-to-use turntable.** The turntable with automatic centering and leveling function is equipped as standard, which frees operators from manual centering and leveling operations.
- **A function to change the detector posture enables CNC automatic measurement.** Automatic control of holder arm posture (vertical/horizontal) and the rotation feature of the detector (rotates in 1° increments in the range of 0 to 270°) enables continuous measurement of various feature combinations, such as OD/ID and/or top/bottom plane measurements.
- **A positioning sensor to achieve CNC high-accuracy automatic measurement.** A Mitutoyo linear scale is used in the X-axis drive unit to directly detect the position of the drive unit. It guarantees the highly precise positioning vital for automatic measurement.
- **A roughness detector (optional) is supported.**



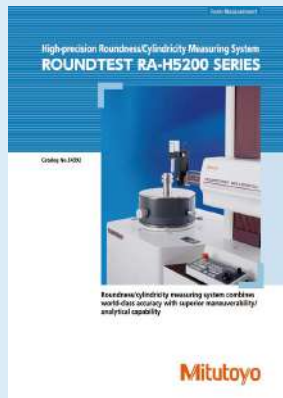
Refer to the Roundtest RA-2200 Series Brochure (E15001) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

Top productivity and performance from a CNC machine with highest-level accuracy.

- The turntable with automatic centering and leveling function is equipped as standard, which frees operators from manual centering and leveling operations.
- Automatic control of holder arm posture (vertical/horizontal) and the rotation feature of the detector (rotates in 1° increments in the range of 0 to 270°) enables continuous measurement of various feature combinations, such as OD/ID and/or top/bottom plane measurements.
- A Mitutoyo linear scale is used in the X-axis drive unit to directly detect the position of the drive unit. It guarantees the highly precise positioning vital for automatic measurement.
- A roughness detector (optional) is supported.



Refer to the Roundtest **RA-H5200** Series Brochure (**E4392**) for more details.

The best accuracy achieved in the class of large cylindricity measuring machine.

- Loading capacity is 350 kg, and the highest rotational accuracy in the class is achieved. Besides roundness and cylindricity, the flatness can be measured in high accuracy. The workpiece that requires high accuracy measurement such as large and heavy cylindrical parts can be measurement.
- For the ID measurement of a deep hole, such as a main shaft of machine tool, a deep hole measuring unit (specially made, without CNC functions) is available.
- A Mitutoyo linear scale is used in the X-axis drive unit to directly detect the position of the drive unit. It guarantees the highly precise positioning vital for automatic measurement.

Roundtest Extreme RA-H5200 CNC SERIES 211 — CNC Roundness/Cylindricity Measuring System



RA-H5200 CNC with side table

SPECIFICATIONS

| Model No. | | RA-H5200 CNC | |
|--|---------------------------------------|---|---|
| Z-axis column unit | | Standard column specification (Vertical travel: 350 mm) | High column specification (Vertical travel: 550 mm) |
| Turntable | Rotational accuracy (JIS B 7451-1997) | Radial direction (0.02+3.5H/10000) μm | H: Probing height (mm) |
| | | Axial direction (0.02+3.5X/10000) μm | X: Distance from the center of rotation (mm) |
| | Maximum loading mass | 80 kg (On auto-centering: 65 kg) | |
| | Maximum probing diameter | ø356 mm | |
| Vertical movement (Z-axis column unit) | Vertical travel | 350 mm | 550 mm |
| X axis | Travel range | 225 mm | |
| Detector | Measuring range | Standard | ±400 μm/±40 μm/±4 μm |
| | | Tracking | ±5 mm |

Roundtest Extreme RA-6000 CNC SERIES 211 — CNC Roundness/Cylindricity Measuring System



RA-6000 CNC

SPECIFICATIONS

| Model No. | | RA-6000 CNC | |
|--|---|-------------------------------------|--|
| Turntable | | Radial direction (0.05+6H/10000) μm | H: Probing height (mm) |
| | Rotational accuracy ^{*1+2} (JIS B 7451-1997) | Axial direction (0.05+6X/10000) μm | X: Distance from the center of rotation (mm) |
| | Maximum loading mass | 350 kg | |
| | Maximum probing diameter | ø880 mm | |
| Vertical movement (Z-axis column unit) | Vertical travel | 1050 mm | |
| X axis | Travel range | 465 mm | |
| Detector | Measuring range | Standard | ±400 μm/±40 μm/±4 μm |
| | | Tracking | ±5 mm |

*1 The temperature at which the accuracy can be guaranteed is 20 °C.

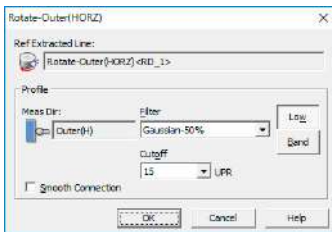
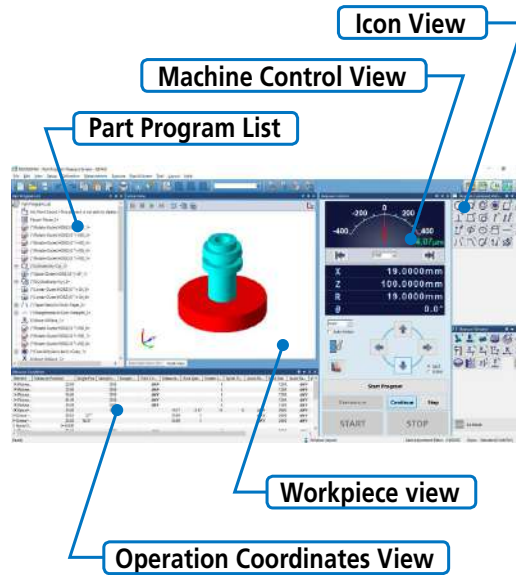
*2 The rotational accuracy has been obtained when load is applied to the rotation center.

Roundtest

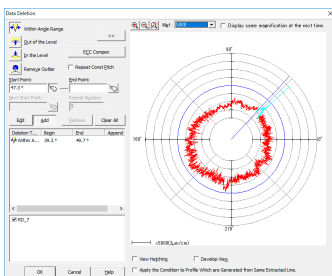
To realize efficient centering and leveling combined with high-precision measurement

ROUNDPAK Roundness/Cylindricity measurement/Analysis software

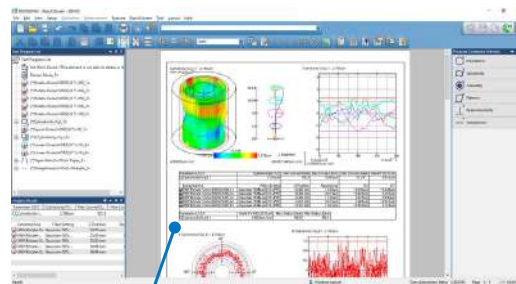
- A wide variety of parameters including those for roundness/cylindricity, as well as flatness and parallelism, are provided as standard features. You can visually select these parameters using icons.
- **ROUNDPAK** also comes with specialized functions, such as the design value best-fit analysis function, the harmonic analysis function, and a function for recording the peak or trough points on a circumference. Data that has already been collected can be easily used for re-calculation, or deleted.



Recalculation

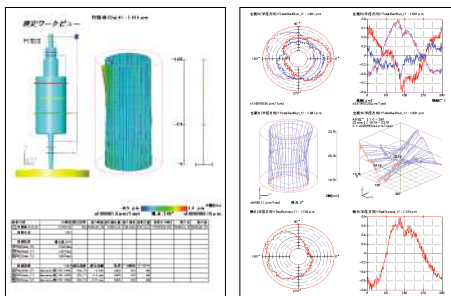


Data deletion

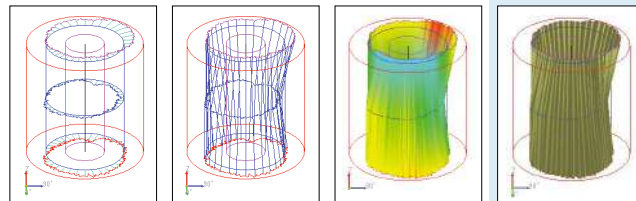


Result view

- The customer can create reports in custom formats by specifying how the analysis results will be displayed, as well as the sizes and positions of graphics. The analysis result window can be directly utilized as a layout window. Since the measurement procedure, including the layout information, is saved, the entire process, from measurement start, calculation, result saving, and finally to printing, can be automatically executed.

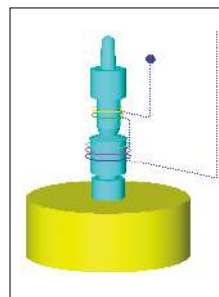


- Analysis results such as cylindricity and coaxiality can be visually expressed in 3D graphics.



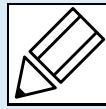
Normal display Wire-frame display Surface-map display Shading display

- An offline teaching function is provided to create a part program (measurement procedure) without an actual measurement target, enabling the user to virtually execute the measurement operation in a 3D simulation window.



| Analysis type | | Model | RA-2200 / H5200 | RA-1600 | RA-120P | RA-120 | RA-10 |
|---------------------------------|--------------|-------|------------------------------------|---------|---------|--------|-------|
| | | | RA-2200CNC / H5200CNC / 6000CNC | | | | |
| Roundness | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Cylindricity | | | ✓ | ✓ | | | |
| Concentricity | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Coaxiality | Axis element | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Axis | | ✓ | ✓ | ✓ | | |
| Flatness | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Parallelism | | | ✓ | ✓ | ✓ | ✓ | |
| Perpendicularity | | | ✓ | ✓ | ✓ | ✓ | |
| Radial deviation | | | ✓ | ✓ | | | |
| Thickness deviation | | | ✓ | ✓ | ✓ | ✓ | |
| Radial runout | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Total runout | | | ✓ | ✓ | | | |
| Diameter measurement | | | ✓ | ✓ | | | |
| Straightness | | | ✓ | ✓ | | | |
| Inclination | | | ✓ | ✓ | | | |
| Taper | | | ✓ | ✓ | | | |
| Diameter contour tolerancing | | | ✓ | ✓ | | | |
| Rectilinear contour tolerancing | | | ✓ | ✓ | | | |
| Width measurement (only CNC) | | | ✓ (only CNC) | | | | |
| Power spectrum | | | ✓ | ✓ | | | |
| Harmonic analysis | | | ✓ | ✓ | ✓ | | |
| Profile operation | | | ✓ | ✓ | ✓ | | |
| Tapered surface analysis | | | ✓ | ✓ | | | |

Quick Guide to Precision Measuring Instruments

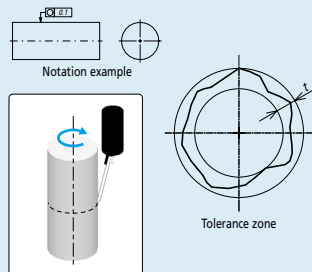


Roundtest (Roundform Measuring Instruments)

Geometrical tolerances ISO/DIS 1101: 1996*1, ISO 5459*2

○ Roundness

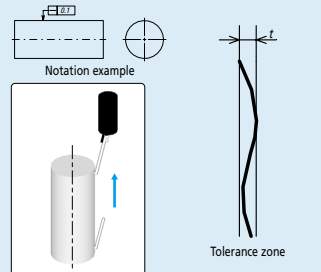
Any circumferential line must be contained within the tolerance zone formed between two coplanar circles with a difference in radii of t



Verification example using a roundness measuring instrument

— Straightness

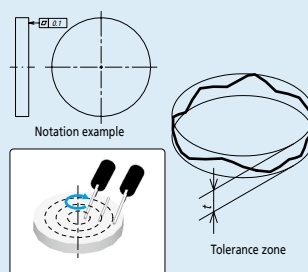
Any line on the surface must lie within the tolerance zone formed between two parallel straight lines a distance t apart and in the direction specified



Verification example using a roundness measuring instrument

□ Flatness

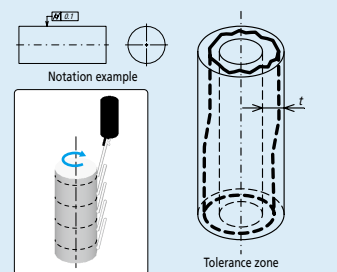
The surface must be contained within the tolerance zone formed between two parallel planes a distance t apart



Verification example using a roundness measuring instrument

○/○ Cylindricity

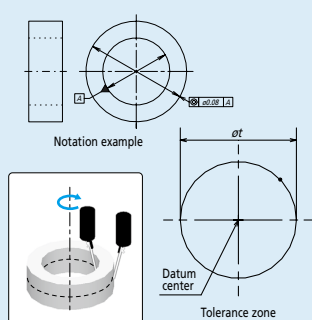
The surface must be contained within the tolerance zone formed between two coaxial cylinders with a difference in radii of t



Verification example using a roundness measuring instrument

◎ Concentricity

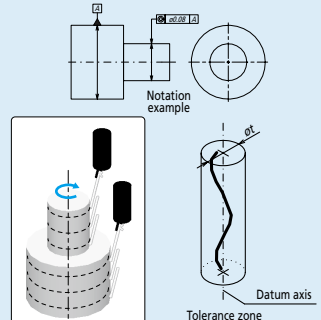
The center point must be contained within the tolerance zone formed by a cylinder of diameter t concentric with the datum



Verification example using a roundness measuring instrument

◎ Coaxiality

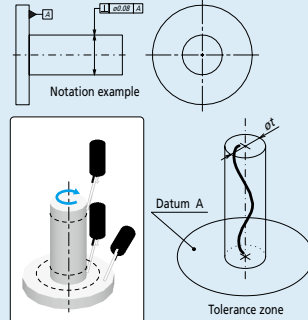
The axis must be contained within the tolerance zone formed by a cylinder of diameter t concentric with the datum



Verification example using a roundness measuring instrument

⊥ Perpendicularity

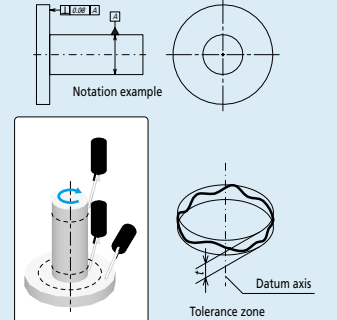
The line or surface must be contained within the tolerance zone formed between two planes a distance t apart and perpendicular to the datum



Verification example using a roundness measuring instrument

⊥ Perpendicularity

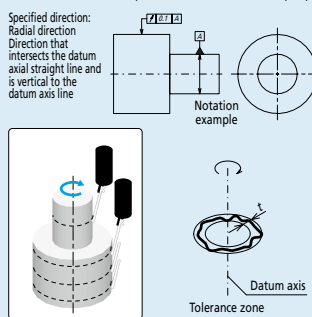
The line or surface must be contained within the tolerance zone formed between two planes a distance t apart and perpendicular to the datum



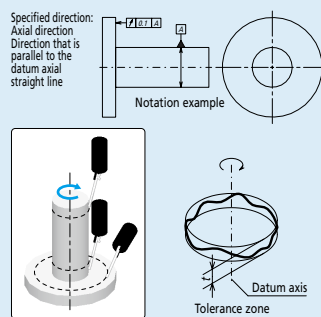
Verification example using a roundness measuring instrument

↗ Circular Runout (Radial and Axial)

The line must be contained within the tolerance zone formed between two coplanar and/or concentric circles a distance t apart concentric with or perpendicular to the datum



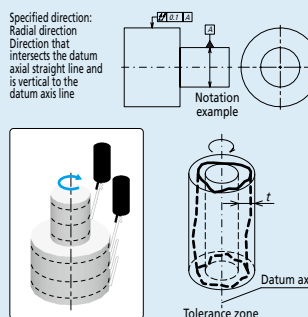
Verification example using a roundness measuring instrument



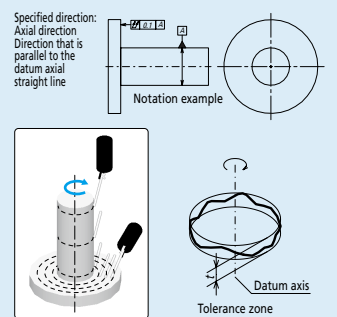
Verification example using a roundness measuring instrument

↗ Total Runout (Radial and Axial)

The surface must be contained within the tolerance zone formed between two coaxial cylinders with a difference in radii of t , or planes a distance t apart, concentric with or perpendicular to the datum



Verification example using a roundness measuring instrument

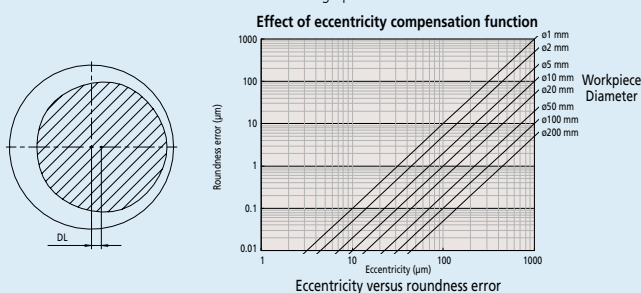


Verification example using a roundness measuring instrument

Adjustment prior to Measurement ISO 4291:1985*3

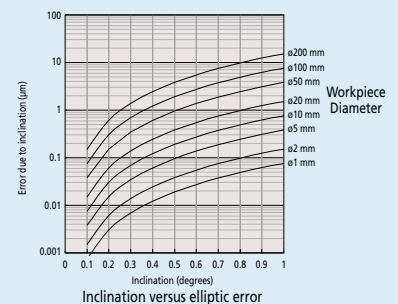
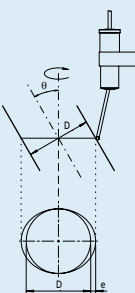
Centering

A displacement offset (eccentricity) between the Roundtest's turntable axis and that of the workpiece results in distortion of the measured form (limaçon error) and consequently produces an error in the calculated roundness value. The larger the eccentricity, the larger is the error in calculated roundness. Therefore the workpiece should be centered (axes made coincident) before measurement. Some roundness testers support accurate measurement with a limaçon error correction function. The effectiveness of this function can be seen in the graph below.



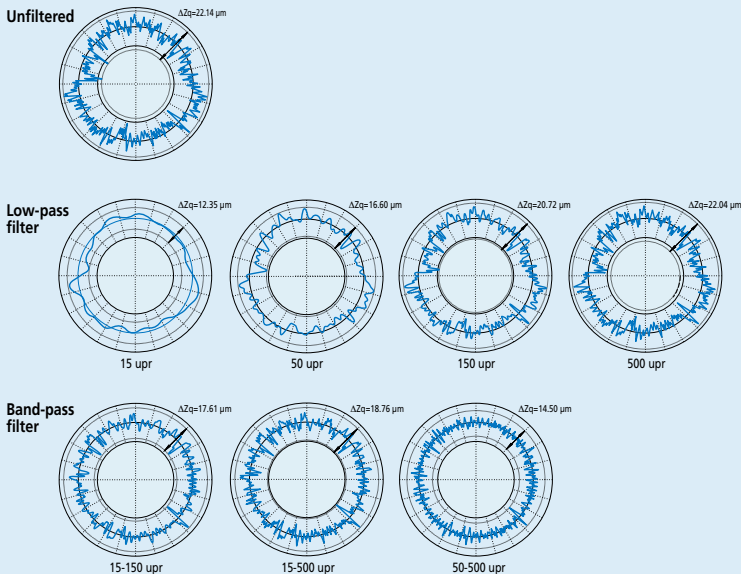
Leveling

Any inclination of the axis of a workpiece with respect to the rotational axis of the measuring instrument will cause an elliptic error. Leveling must be performed so that these axes are sufficiently parallel.



Effect of Filter Settings on the Measured Profile ISO 12181-2: 2011*4

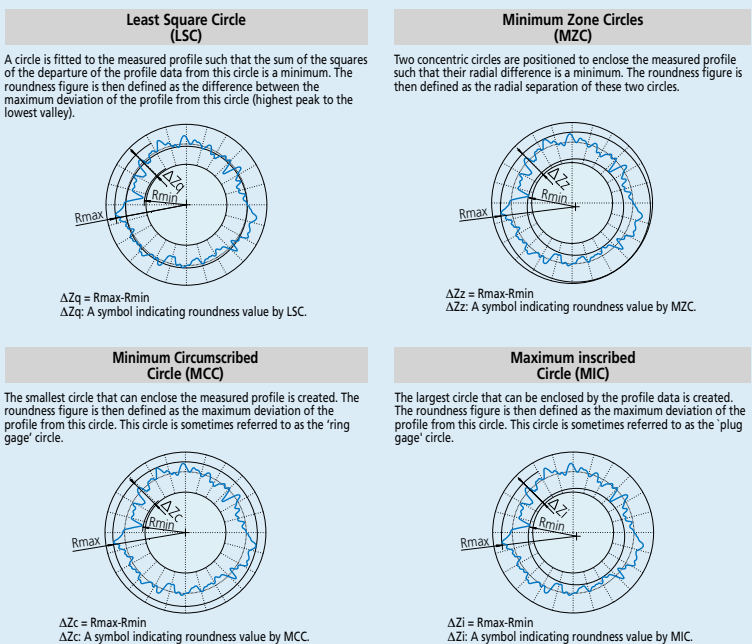
Profiles can be filtered in various ways to reduce or eliminate unwanted detail, with a cut-off value set in terms of undulations per revolution (upr). The effect of different upr settings is shown in the diagrams below, which illustrate how the measured roundness value decreases as lower upr settings progressively smooth out the line.



Evaluating the Measured Profile Roundness ISO 12181-1: 2011*5, ISO 4291: 1985*3

Roundness testers use the measurement data to generate reference circles whose dimensions define the roundness value. There are four methods of generating these circles, as shown below, and each method has individual characteristics so the method that best matches the function of the workpiece should be chosen.

Each method results in a different center position for the reference circles and therefore affects the axial location of the circular feature measured.



*1 ISO/DIS 1101: 1996 Geometrical Product Specifications (GPS) - Geometrical tolerancing - Tolerancing of form, orientation, location and run-out

*2 ISO 5459 Technical drawings - Geometrical tolerancing - Datums and datum-systems for geometrical tolerances

*3 ISO 4291: 1985 Methods for the assessment of departure from roundness - Measurement of variations in radius

*4 ISO 12181-2: 2011 Geometrical Product Specifications (GPS) - Roundness - Part 2: Specification operators

*5 ISO 12181-1: 2011 Geometrical Product Specifications (GPS) - Roundness - Part 1: Vocabulary and parameters of roundness

Filtering

| | 2CR filter | Gaussian filter |
|------------------|------------------|---------------------|
| Standard | ISO 4291: 1985*3 | ISO 12181-1: 2011*5 |
| Attenuation rate | 75 % | 50 % |

Terms and abbreviated terms ISO 12181-1: 2011*5

| Abbreviated terms | Terms |
|-------------------|--|
| LSCI | Least squares reference circle |
| LSCY | Least squares reference cylinder |
| LSLI | Least squares reference line |
| LSPL | Least squares reference plane |
| LCD | Local cylindricity deviation |
| LFD | Local flatness deviation |
| LRD | Local roundness deviation |
| LSD | Local straightness deviation |
| MICI | Maximum inscribed reference circle |
| MICY | Maximum inscribed reference cylinder |
| MCCI | Minimum circumscribed reference circle |
| MCCY | Minimum circumscribed reference cylinder |
| MZCI | Minimum zone reference circles |
| MZCY | Minimum zone reference cylinder |
| MZLI | Minimum zone reference lines |
| MZPL | Minimum zone reference planes |
| UPR | Undulations per revolution |

Parameters and abbreviated terms ISO 12181-1: 2011*5

| Abbreviated terms | Parameter | Reference element* | | | |
|-------------------|---|--------------------|--------------|-----------------------|-------------------|
| | | Minimum zone | Least square | Minimum circumscribed | Minimum inscribed |
| CYLtt | Cylinder taper | | ✓ | | |
| STRsg | Generatrix straightness deviation | | ✓ | | |
| STRlc | Local generatrix straightness deviation | | ✓ | | |
| CYLp | Peak-to-reference cylindricity deviation | | ✓ | | |
| FLTp | Peak-to-reference flatness deviation | | ✓ | | |
| RONp | Peak-to-reference roundness deviation | | ✓ | | |
| STRp | Peak-to-reference straightness deviation | | ✓ | | |
| CYLt | Peak-to-valley cylindricity deviation | ✓ | ✓ | ✓ | ✓ |
| FLTt | Peak-to-valley flatness deviation | ✓ | ✓ | | |
| RONt | Peak-to-valley roundness deviation | ✓ | ✓ | ✓ | ✓ |
| STRt | Peak-to-valley straightness deviation | ✓ | ✓ | | |
| CYLv | Reference-to-valley cylindricity deviation | | ✓ | | |
| FLTv | Reference-to-valley flatness deviation | | ✓ | | |
| RONv | Reference-to-valley roundness deviation | | ✓ | | |
| STRv | Reference-to-valley straightness deviation | | ✓ | | |
| CYLq | Root-mean-square cylindricity deviation | | ✓ | | |
| FLTq | Root-mean-square flatness deviation | | ✓ | | |
| RONq | Root-mean-square roundness deviation | | ✓ | | |
| STRq | Root-mean-square straightness deviation | | ✓ | | |
| STRsa | Straightness deviation of the extracted median line | ✓ | ✓ | ✓ | ✓ |

* The reference elements to which the parameter can be applied.

New Products



Micro Vickers Hardness Testing Machines

HM-100

Refer to page M-3 for details.



Rockwell Hardness Testing Machines

HR-600

Refer to page M-5 for details.



Rockwell Hardness Testing Machines

HR-530

Refer to page M-6 for details.



Micro Vickers Hardness Testing Machines



Vickers Hardness Testing Machines



Rockwell Hardness Testing Machines



Portable Hardness Testing Instruments



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| Vickers Hardness Testing Machines | |
| HV-100 | M-4 |
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| HR-100/200/300/400 | M-7 |
| Portable Hardness Testing Instruments | |
| Rebound Type Portable Hardness Testing Instrument, HH-411 | M-8 |
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| Quick Guide to Precision Measuring Instruments | M-9 |

Hardness Testing Machines

Start quality control from the material — Mitutoyo's hardness testing machines can handle it

HM-200 SERIES 810 — Micro Vickers Hardness Testing Machines

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo



System A
(HM-210A/220A)

- The latest electromagnetic force motor used in the loading mechanism enables the test force to be freely selected.
- In addition to Vickers hardness testing, Knoop (HK)* and Fracture toughness (Kc) tests can also be performed.

* For Knoop hardness testing, Knoop indenter (optional) is required.

SPECIFICATIONS

| Order No. | 810-401 | 810-402 | 810-404 | 810-406 | 810-407 | 810-409 |
|---|--|---------|---------|---|---------|---------|
| Model | HM-210 | | | HM-220 | | |
| Unit (display unit) | metric | inch/mm | metric | metric | inch/mm | metric |
| Operation | Manual | Manual | System | Manual | Manual | System |
| Applicable standards | JIS B 7725, ISO 6507-2 | | | | | |
| Test force mN (gf) | 98.07 to 9807 (10 to 1000) | | | 0.4903 to 19610 (0.05 to 2000) | | |
| Arbitrary test force | One setting can be saved, default is HV0.025 | | | | | |
| External dimensions (WxDxH) (excluding protrusions and stage); Main unit mass | System A: 315x671x595 mm, 38.5 kg System B/C/D: 315x586x741 mm, 37.4 kg | | | | | |
| Power supply (main unit) | AC100 V 50/60 Hz System A: 31 W System B/C/D: 30 W | | | AC100 V 50/60 Hz System A: 44 W System B/C/D: 43 W | | |

Note: 810-401, 810-406: System A, 810-404, 810-409: System B/C/D

System A (HM-210A/220A)

All-in-one model with simple color touch-panel operation

System B (HM-210B/220B)

A system equipped with automatic reading function with AVPAK software

System C (HM-210C/220C)

In addition to the functions of System B, System C is equipped with an electric stage

System D (HM-210D/220D)

In addition to the functions of System B and System C, System D is equipped with the auto focus function

CAUTION: The AVPAK-20 software package is not for use within, or export to, the United States of America
The AVPAK-10 software package is for the United States of America

HM-100 SERIES 810 — Micro Vickers Hardness Testing Machines

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- The HM-100 Series is an affordable line of microhardness testers able to work with very small test loads (from 98.07 mN, 10 gf, and upwards), which is perfect for evaluating the mechanical characteristics and controlling the quality of electric/electronic components.



810-959-20
HM-103

SPECIFICATIONS

| Order No. | 810-124-20* | 810-125-20 | 810-959-20 |
|---|----------------------------------|--|----------------|
| Model | HM-101 | HM-102 | HM-103 |
| Applicable standards | JIS B 7725, ISO 6507-2 | | |
| Test force mN (gf) | 98.07 to 9807 (10 to 1000) | | |
| External dimensions (WxDxH) (excluding protrusions and stage); Main unit mass | Main unit: 380x600x590 mm, 42 kg | | |
| | — | Control panel: 165x235x125 mm, 1.5 kg | |
| | — | TV monitor: 202x29.2x175.8 mm, 1.17 kg | |
| Power supply (main unit) | AC100 V 50/60 Hz | | |
| | Less than 60 W | | Less than 90 W |

* Models which can be connected to the MeasurLink measurement data network system are only HM-102 and HM-103.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the Hardness Testing Machines Brochure (E17001) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

HV-100 SERIES 810 — Vickers Hardness Testing Machines

- Vickers hardness testers have a wide application in testing metals, especially small heat-treated parts, and are also suitable for making special-purpose tests such as carburized case hardness, maximum hardness of spot welds, high-temperature hardness, and fracture toughness of ceramic materials.
- In addition to Vickers hardness testing, Knoop (HK)*¹/Brinell (HB)*²/Fracture toughness (Kc) tests can also be performed.



System A
(HV-110A / 120A)

*1 For Knoop hardness testing, Knoop indenter (optional) is required.

*2 For Brinell hardness testing a Brinell indenter (optional) and additional weight are required.

SPECIFICATIONS

| Order No. | 810-440 | 810-441 | 810-443 | 810-445 | 810-446 | 810-448 |
|---|--|---------|---------|----------------------------|---------|---------|
| Model | HV-110 | | | HV-120 | | |
| Unit (display unit) | metric | inch/mm | metric | metric | inch/mm | metric |
| Operation | Manual | Manual | System | Manual | Manual | System |
| Applicable standards | JIS B 7725, ISO 6507-2 | | | | | |
| Test force N (kgf) | 9.807 to 490.3 (1 to 50) | | | 2.942 to 294.2 (0.3 to 30) | | |
| External dimensions (WxDxH) (excluding protrusions and stage) | System A: 307x696x781 mm System B/C/D: 307x627x875 mm | | | | | |
| Main unit mass | HV-110: Approx. 60 kg | | | HV-120: Approx. 58 kg | | |
| Power supply (main unit) | AC100 V 50/60 Hz System A: 24 W System B/C/D: 22 W | | | | | |

Note: 810-440, 810-445: System A, 810-443, 810-448: System B/C/D

System A (HM-110A / 120A)

All-in-one model with simple color touch-panel operation

System B (HM-110B / 120B)

A system equipped with automatic reading function with AVPAK software

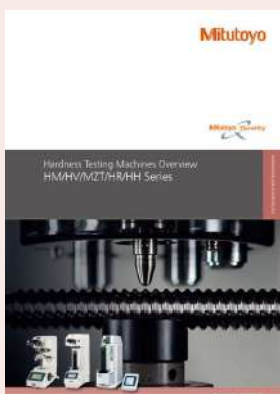
System C (HM-110C / 120C)

In addition to the functions of System B, System C is equipped with an electric stage

System D (HM-110D / 120D)

In addition to the functions of System B and System C, System D is equipped with the auto focus function

CAUTION: The AVPAK-20 software package is not for use within, or export to, the United States of America
The AVPAK-10 software package is for the United States of America



Refer to the Hardness Testing Machines Brochure (E17001) for more details.

Hardness Testing Machines

Start quality control from the material — Mitutoyo's hardness testing machines can handle it

HR-600 SERIES 810 — Rockwell Hardness Testing Machines

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- A workpiece that cannot be placed on a tester due to its large size can be placed on the table of this product and tested as is. (Maximum loading mass 100 kg)
- The motorized stage makes automatic multi-point testing at multiple places and of multiple workpieces possible.
- Plastic hardness testing is also available in addition to Rockwell/Brinell tests on metal. Brinell and Vickers indentation hardness tests which do not require vision measurement can also be performed.

- The **HR-610A / 620A** main unit is operable with the touch panel display and the **HR-620B** is operable with the touch panel display and **AVPAK** software.
- Automatic testing with movement in the X-, Y- and Z-axis directions for a workpiece having uneven surfaces or steps becomes possible by adding an X-axis stage and **AVPAK** software to **HR-620B**. Also, using **FORMEio** software makes possible easy communication with PLCs for automation purposes, such as control of handling devices and work cells.



**810-510-11
HR-610A**
(Motorized X-axis table is available)



**810-525-11
HR-620B**
(Equipped with motorized Y-axis table. Motorized X-axis table is also available.)

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.



Refer to the **HR-600 Series Brochure (E17011)** for more details.

SPECIFICATIONS

| Order No. | 810-510-11 | 810-510-13 | 810-511-11 | 810-511-13 | 810-512-11 | 810-512-13 | 810-520-11 | 810-520-13 | 810-521-11 | 810-521-13 | 810-522-11 | 810-522-13 | 810-525-11 | 810-526-11 | 810-527-11 |
|----------------------------------|------------------------------|------------|---|------------|------------|--------------|--|------------|---|------------|------------|------------|--------------------------------|------------|--|
| Model | HR-610A | | | | | | HR-620A | | | | | | HR-620B | | |
| Unit (display unit) | metric | inch/mm | metric | inch/mm | metric | inch/mm | metric | inch/mm | metric | inch/mm | metric | inch/mm | — | — | — |
| Indenter type*1 | Diamond 1/16" Steel ball | | Diamond 1/16" Tungsten carbide ball | | — | | Diamond 1/16" Steel ball | | Diamond 1/16" Tungsten carbide ball | | — | | Diamond 1/16" Steel ball | | Diamond 1/16" Tungsten carbide ball |
| Hardness testing methods | Rockwell | | | | | | JIS B 7726, ISO 6508-2, ASTM E18*2 | | | | | | | | |
| | Brinell*3 | | | | | | JIS B 7724, ISO 6506-2, ASTM E10 | | | | | | | | |
| | Plastic | | | | | | ISO 2039-1 | | | | | | | | |
| | Indentation Brinell hardness | | | | | | JIS K 7202-2, ISO 2039-2, ASTM D785 | | | | | | | | |
| Indentation Vickers hardness | | | | | | VDI/VDE 2616 | | | | | | | | | |
| Initial test force N (kgf) | Rockwell | | | | | | 29.42 (3) 98.07 (10) | | | | | | | | |
| | Plastic | | | | | | 9.807 (1) | | | | | | | | |
| | Indentation Brinell hardness | | | | | | 98.07 (10) | | | | | | | | |
| | Indentation Vickers hardness | | | | | | 98.07 (10) 490.3 (50) | | | | | | | | |
| Test force N (kgf) | Rockwell | | | | | | 147.1 (15) 294.2 (30) 441.3 (45) 588.4 (60) 980.7 (100) 1471 (150) | | | | | | | | |
| | Brinell | | | | | | 49.03 (5) to 1839 (187.5) | | | | | | 9.807 (1) to 2452 (250) | | |
| | Plastic | | | | | | 49.03 (5) 132.4 (13.5) 358.0 (36.5) 962.1 (98.1) | | | | | | | | |
| | Indentation Brinell hardness | | | | | | 588.4 (60) 980.7 (100) 1471 (150) | | | | | | | | |
| | Indentation Vickers hardness | | | | | | 612.9 (62.5) 1839 (187.5) 2452 (250) | | | | | | 294.2 (30) 490.3 (50) | | |
| Power supply | | | | | | | AC100 to 200 V 50/60 Hz | | | | | | | | |
| Mass | 176 kg | | | | | | 181 kg | | | | | | 205 kg | | |

*1 Supplied as standard.

*2 Please contact us for information on ASTM standards.

*3 For Brinell hardness testing, an indenter (optional) and a measurement microscope are required.

Note: Plastic testing may not be enabled depending on the material. For Brinell hardness, indentation Brinell hardness, and plastic hardness testing, other special accessories are required.

CAUTION: The **AVPAK-20** software package is not for use within, or export to, the United States of America
The **AVPAK-10** software package is for the United States of America



An inspection certificate is supplied as standard. Refer to page U-11 for details.

HR-530 SERIES 810 — Rockwell Hardness Testing Machines

- Unique electronic control makes the **HR-530** Series of hardness testers extremely versatile by enabling Brinell hardness testing* as well as load-sequence hardness testing of plastics, plus Rockwell and Rockwell Superficial hardness testing.

* For Brinell hardness testing, an indenter (optional) and a measurement microscope are required.

- This series can test the hardness of the inside wall of a ring, a test that is only possible using ordinary hardness testers by cutting the ring into pieces. (All models)
- The touch-panel display unit can be mounted on top of the tester, providing significant convenience if the machine installation space is restricted. (All models) Use the optional display mounting bracket to mount the unit.
- This series allows numeric display of statistical analysis results such as maximum and minimum values, mean value and graphic display of \bar{X} -R control charts and histograms required for hardness evaluation.



Refer to the **HR-530** Series Brochure (**E17009**) for more details.



810-331 / 332 / 336 / 337
HR-530L

SPECIFICATIONS

| Order No. | 810-231*1 | 810-232*1 | 810-236*2 | 810-237*2 | 810-233-11 | 810-233-13 | 810-331*1 | 810-332*1 | 810-336*2 | 810-337*2 | 810-333-11 | 810-333-13 |
|--------------------------|---|-----------|-----------------------------|-----------|--------------|------------|------------------|-----------|-----------------------------|-----------|--------------|------------|
| Model | HR-530 | | | | | | HR-530L | | | | | |
| Unit (display unit) | metric | inch/mm | metric | inch/mm | metric | inch/mm | metric | inch/mm | metric | inch/mm | metric | inch/mm |
| Indenter type | 1/16" Steel ball | | 1/16" Tungsten carbide ball | | | | 1/16" Steel ball | | 1/16" Tungsten carbide ball | | | |
| Applicable standards | JIS B 7726, ISO 6508-2 | | | | | | | | | | | |
| Hardness testing methods | Rockwell/Rockwell Superficial/Brinell/Plastics hardness | | | | | | | | | | | |
| Initial test force | N(kgf) | | 29.42 (3) | | 98.07 (10) | | | | | | | |
| Test force | Rockwell | | 588.4 (60) | | 980.7 (100) | | 1471 (150) | | | | | |
| Test force | Rockwell Superficial | | 147.1 (15) | | 294.2 (30) | | 441.3 (45) | | | | | |
| N(kgf) | Brinell | | 61.29 (6.25) | | 98.07 (10) | | 153.2 (15.625) | | 245.2 (25) | | 294.2 (30) | |
| | | | 306.5 (31.25) | | 612.9 (62.5) | | 980.7 (100) | | 1226 (125) | | 1839 (187.5) | |
| Power supply | AC100/120/220/240 V Auto-selection | | | | | | | | | | | |
| External dimensions | Main unit | | 250x667x621 mm | | | | | | 300x667x766 mm | | | |
| (WxDxH) | Touch-panel display unit | | 191x147x71 mm | | | | | | | | | |
| Mass | | | Main unit: Approx. 60 kg | | | | | | Main unit: Approx. 69 kg | | | |
| | | | Display: Approx. 1.1 kg | | | | | | Display: Approx. 1.1 kg | | | |

*1 1/16" steel ball indenter is equipped as a standard accessory.

*2 1/16" carbide ball indenter is equipped as a standard accessory.

Note: Plastic testing may not be enabled depending on the material.

For Brinell hardness, indentation Brinell hardness, and plastic hardness testing, other special accessories are required.

Hardness Testing Machines

Start quality control from the material — Mitutoyo's hardness testing machines can handle it

HR-100/200/300/400 SERIES 963 — Rockwell Hardness Testing Machines

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- A series of economical Rockwell hardness testing machines. The lineup consists of 5 models including a digital display type and an analog display type.



963-210
HR-110MR



963-241
HR-430MS

SPECIFICATIONS

| Order No. | 963-210* | 963-220* | 963-240 | 963-231 | 963-241 |
|---|------------------------|--|------------|-------------------------------|-----------------------|
| Model | HR-110MR | HR-210MR | HR-430MR | HR-320MS | HR-430MS |
| Applicable standards | JIS B 7726, ISO 6508-2 | | | | |
| Supported hardnesses | Rockwell hardness | | | | |
| | — | | | Rockwell Superficial hardness | |
| Preliminary test force N (kgf) | 98.07 (10) | | | 29.42 (3) | 98.07 (10) |
| Test force N (kgf) | Rockwell | | 588.4 (60) | 980.7 (100) | 1471 (150) |
| | Superficial | | — | 147.1 (15) | 294.2 (30) 441.3 (45) |
| External dimensions (WxDxH) (excluding protrusions and stage) | 296x512x780 mm | 214x512x780 mm | | | |
| Main unit mass | 49 kg | 46 kg | 49 kg | 47 kg | 50 kg |
| Power supply | No power required | AC100 to 240 V 1.2 A (DC adapter DC12 V 3.5 A) | | | |

* Models which can be connected to the MeasurLink measurement data network system are only **HR-320MS, HR-430MR** and **HR-430MS**.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



An inspection certificate is supplied as standard. Refer to page U-11 for details.

M



Refer to the Hardness Testing Machines Brochure (**E17001**) for more details.



An inspection certificate is supplied as standard. Refer to page U-11 for details.

HARDMATIC HH-411 SERIES 810 — Rebound Type Portable Hardness Tester

- Excellent operability that performs hardness tests with the touch of a key and a compact body allows users to measure hardness in the field. This instrument is best suited for on-site hardness tests such as large molds, railroad track, and welded spots in structures.



SPECIFICATIONS

| Order No. | 810-299-10 | 810-299-11 | 810-298-10 | 810-298-11 |
|---|---|---------------------|--|---------------------|
| Model | HH-411 | | | |
| Standard | JIS | | ASTM | |
| Detector | Impact hammer with integrated detector and carbide-ball tip (D type) | | | |
| Display unit | 7-segment LCD | | | |
| Hardness display range | Leeb hardness: 1 to 999 HL | | | |
| Display range (This display range varies depending on the conversion table used.) | Vickers hardness: 43 to 950 HV Brinell hardness: 20 to 896 HB Rockwell hardness (C scale): 19.3 to 68.2 HRC Rockwell hardness (B scale): 13.5 to 101.7 HRB | | Shore hardness: 30.1 to 99.5 HS Tensile strength: 499 to 1999 MPa | |
| Power supply | Alkaline AA battery 2 pcs. (battery life: 70 hours) or optional AC adapter | Optional AC adapter | Alkaline AA battery 2 pcs. (battery life: 70 hours) or optional AC adapter | Optional AC adapter |
| External dimensions/Mass | Detector: ø28×175 mm in length, 120 g Display (W×D×H): 70×110×35 mm, 200 g | | | |



Refer to the Hardness Testing Machines Brochure (E17001) for more details.

HARDMATIC HH-300 SERIES 811 — Durometers for Sponge, Rubber, and Plastics

- Hardness measurement by durometer is simply performed by holding the instrument against the surface of a specimen and reading the indicated value. This type of hardness tester is most widely used for hardness testing of sponge, rubber, plastics and other soft materials.



SPECIFICATIONS

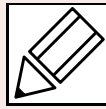
| Order No. | 811-329-10 | 811-330-10 | 811-331-10 | 811-332-10 | 811-333-10 | 811-334-10 | 811-335-10 | 811-336-10 | 811-337-10 | 811-338-10 |
|---------------------------------|--|----------------------------------|---|----------------------------------|------------------------------------|----------------------------------|---|----------------------------------|------------------------------------|----------------------------------|
| Model No. | HH-329* | HH-330 | HH-331* | HH-332 | HH-333* | HH-334 | HH-335* | HH-336 | HH-337* | HH-338 |
| Type | Compact | | Long | | | | Compact | | | |
| Display specification | Analog | Digital | Analog | Digital | Analog | Digital | Analog | Digital | Analog | Digital |
| Measurement target | Soft rubber, sponge, felt, hard film, winder | | General rubber, soft plastic | | hard rubber, hard plastic, ebonite | | General rubber, soft plastic | | hard rubber, hard plastic, ebonite | |
| Classification by specification | Type E | | Type A | | Type D | | Type A | | Type D | |
| Needle shape | Shaft diameter | | ø1.25 mm | | | | | | | |
| | Tip shape | | Circular truncated cone | | Cone | | Circular truncated cone | | Cone | |
| | Tip angle | | 35° | | 30° | | 35° | | 30° | |
| | Tip diameter | | ø0.79 mm | | — | | ø0.79 mm | | — | |
| Tip curvature | | — | | 0.1 mm | | — | | 0.1 mm | | |
| Power supply | — | Button silver oxide battery SR44 | — | Button silver oxide battery SR44 | — | Button silver oxide battery SR44 | — | Button silver oxide battery SR44 | — | Button silver oxide battery SR44 |
| External dimensions (W×D×H) | 68×34×146 mm | 59×40×147 mm | Analog, long type : 68×35×188 mm Digital, compact type: 59×41×190 mm | | | | Analog, long type : 68×34×146 mm Digital, compact type: 59×40×147 mm | | | |
| Mass | 300 g | 290 g | 320 g | 310 g | 320 g | 310 g | 300 g | 290 g | 300 g | 290 g |

* Models which can be connected to the MeasurLink measurement data network system are only Digital types.

Optional Accessories for Dual-purpose Stand CTS Series

| Order No. | 811-019 | 811-012 | 811-013 |
|-------------------|-----------|-----------------|-----------|
| Model | CTS-101 | CTS-102 | CTS-103 |
| Applicable models | HH-331/32 | HH-333/34/37/38 | HH-335/36 |

Quick Guide to Precision Measuring Instruments



Hardness Testing Machines

Methods of Hardness Measurement

(1) Vickers

Vickers hardness is a test method that has the widest application range, allowing hardness inspection with an arbitrary test force. This test has an extremely large number of application fields particularly for hardness tests conducted with a test force less than 9.807 N (1 kgf). As shown in the following formula, Vickers hardness is a value determined by dividing test force F (N) by contact area S (mm²) between a specimen and an indenter, which is calculated from diagonal length d (mm, mean of two directional lengths) of an indentation formed by the indenter (a square pyramidal diamond, opposing face angle $\theta=136^\circ$) in the specimen using a test force F (N). k is a constant ($1/g=1/9.80665$).

$$HV = k \frac{F}{S} = 0.102 \frac{F}{S} = 0.102 \frac{2F \sin \frac{\theta}{2}}{d^2} = 0.1891 \frac{F}{d^2} \quad \begin{matrix} F: \text{N} \\ d: \text{mm} \end{matrix}$$

The error in the calculated Vickers hardness is given by the following formula. Here, Δd_1 , Δd_2 , and 'a' represent the measurement error that is due to the microscope, an error in reading an indentation, and the length of an edge line generated by opposing faces of an indenter tip, respectively. The unit of $\Delta \theta$ is degrees.

$$\frac{\Delta HV}{HV} \approx \frac{\Delta F}{F} - 2 \frac{\Delta d_1}{d} - 2 \frac{\Delta d_2}{d} - \frac{a^2}{d^2} 3.5 \times 10^{-3} \Delta \theta$$

(2) Knoop

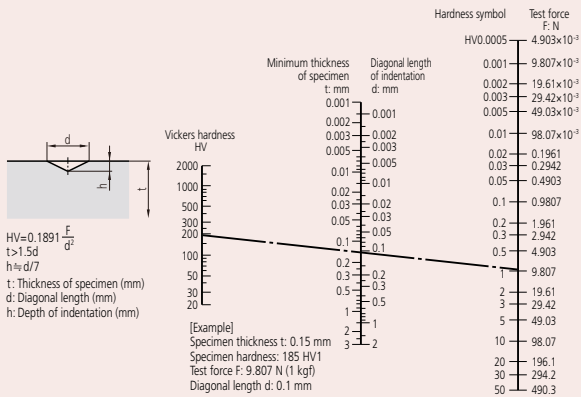
As shown in the following formula, Knoop hardness is a value obtained by dividing test force by the projected area A (mm²) of an indentation, which is calculated from the longer diagonal length d (mm) of the indentation formed by pressing a rhomboidal diamond indenter (opposing edge angles of $172^\circ 30'$ and 130°) into a specimen with test force F applied. Knoop hardness can also be measured by replacing the Vickers indenter of a microhardness testing machine with a Knoop indenter.

$$HK = k \frac{F}{A} = 0.102 \frac{F}{A} = 0.102 \frac{F}{cd^2} = 1.451 \frac{F}{d^2} \quad \begin{matrix} F: \text{N} \\ d: \text{mm} \\ c: \text{Constant} \end{matrix}$$

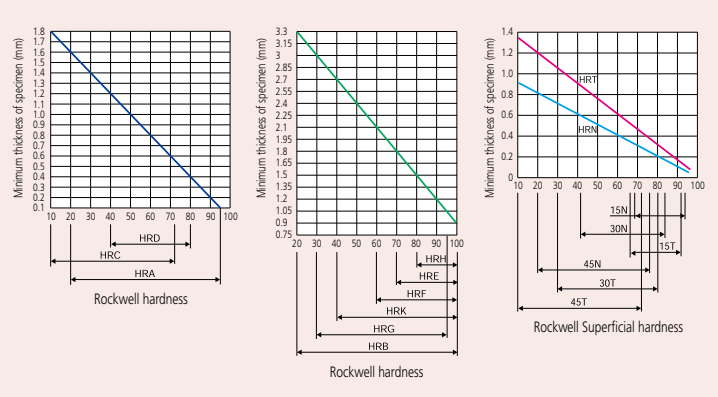
(3) Rockwell and Rockwell Superficial

To measure Rockwell or Rockwell Superficial hardness, first apply a preload force and then the test force to a specimen and return to the preload force using a diamond indenter (tip cone angle: 120° , tip radius: 0.2 mm) or a sphere indenter (steel ball or carbide ball). This hardness value is obtained from the hardness formula expressed by the difference in indentation depth h (μm) between the preload and test forces. Rockwell uses a preload force of 98.07 N, and Rockwell Superficial 29.42 N. A specific symbol provided in combination with a type of indenter, test force, and hardness formula is known as a scale. Japanese Industrial Standards (JIS) define various scales of related hardness.

Relationship between Vickers Hardness and the Minimum Allowable Thickness of a Specimen



Relationship between Rockwell / Rockwell Superficial Hardness and the Minimum Thickness of a Specimen



Rockwell Hardness Scales

| Scale | Indenter | Test force | Application |
|-------|------------------------------|------------|--|
| A | Diamond | 588.4 N | Carbide, sheet steel |
| D | | 980.7 N | Case-hardened steel |
| C | | 1471 N | Steel (100 HRB or more to 70 HRC or less) |
| F | Sphere of 1.5875 mm diameter | 588.4 N | Bearing metal, annealed copper |
| B | | 980.7 N | Brass |
| G | | 1471 N | Hard aluminum alloy, beryllium copper, phosphor bronze |
| H | Sphere of 3.175 mm diameter | 588.4 N | Bearing metal, grinding wheel |
| E | | 980.7 N | Bearing metal |
| K | | 1471 N | Bearing metal |
| L | Sphere of 6.35 mm diameter | 588.4 N | Plastic, lead |
| M | | 980.7 N | |
| P | | 1471 N | |
| R | Sphere of 12.7 mm diameter | 588.4 N | Plastic |
| S | | 980.7 N | |
| V | | 1471 N | |

Rockwell Superficial Hardness Scales

| Scale | Indenter | Test force | Application |
|-------|------------------------------|------------|---|
| 15-N | Diamond | 147.1 N | Thin surface-hardened layer on steel such as carburized or nitrided |
| 30-N | | 294.2 N | |
| 45-N | | 441.3 N | |
| 15-T | Sphere of 1.5875 mm diameter | 147.1 N | Sheet of mild steel, brass, bronze, etc. |
| 30-T | | 294.2 N | |
| 45-T | | 441.3 N | |
| 15-W | Sphere of 3.175 mm diameter | 147.1 N | Plastic, zinc, bearing alloy |
| 30-W | | 294.2 N | |
| 45-W | | 441.3 N | |
| 15-X | Sphere of 6.35 mm diameter | 147.1 N | Plastic, zinc, bearing alloy |
| 30-X | | 294.2 N | |
| 45-X | | 441.3 N | |
| 15-Y | Sphere of 12.7 mm diameter | 147.1 N | Plastic, zinc, bearing alloy |
| 30-Y | | 294.2 N | |
| 45-Y | | 441.3 N | |

New Products



Shop-floor Type CNC Coordinate Measuring Machine

MiSTAR 555

Refer to page N-6 for details.



CNC Coordinate Measuring Machine MICROCORD CRYSTA-Apex V Series

Refer to page N-3 for details.



Non-contact Line-Laser Probe SurfaceMeasure

Refer to page N-18 for details.



N

Coordinate Measuring Machines

MICROCORD



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MICROCORD

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Note: All Mitutoyo CNC CMMs manufactured since 2008 incorporate a main unit Startup system (relocation detection system), which disables operation when an unexpected vibration has occurred or the machine has been relocated. Be sure to contact your nearest Mitutoyo Sales Office prior to relocating your machine after initial installation.

Coordinate Measuring Machines

Precision measuring technology in three dimensions

Standard CNC CMM MICROCORD CRYSTA-Apex V500/700/900 Series



MeasurLink® ENABLED
Data Management Software by Mitutoyo



An online system to monitor the operational and mechanical statuses of measuring machines. This allows you to grasp the state of a process flow from the operational status of measuring machines within a production process.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

- The **CRYSTA-Apex V500/700/900** Series, CNC CMMs deliver high accuracy (1.7 μm), high speed, and high acceleration. This series offers flexibility with a wide range of models to suit practically any size workpiece.
- Has achieved a contamination resistance more than 2 times better than Mitutoyo's conventional machine by adopting a newly developed absolute scale* that is highly resistant to the challenging production-line environment.
- * Absolute scale that provides an absolute value for each measurement point. This eliminates the need for an initialization operation.
- Equipped with a temperature compensation system that guarantees the specified accuracy within the wide range of 16 to 26 °C under certain environmental conditions, although high-accuracy CMMs should ideally be installed in a temperature controlled room.



CRYSTA-Apex V 574



CRYSTA-Apex V 776



CRYSTA-Apex V 9106

SPECIFICATIONS

| Items | | Model | CRYSTA-Apex V 544 | CRYSTA-Apex V 574 | CRYSTA-Apex V 776 | CRYSTA-Apex V 7106 |
|-----------------|--------|-------|-------------------|-------------------|-------------------|--------------------|
| Measuring range | X axis | | 500 mm | | 700 mm | |
| | Y axis | | 400 mm | 700 mm | 700 mm | 1000 mm |
| | Z axis | | 400 mm | | 600 mm | |

| Items | | Model | CRYSTA-Apex V 9106 (Z600)/9108 (Z800) | CRYSTA-Apex V 9166 (Z600)/9168 (Z800) | CRYSTA-Apex V 9206 (Z600)/9208 (Z800) |
|-----------------|--------|-------|---------------------------------------|---------------------------------------|---------------------------------------|
| Measuring range | X axis | | 900 mm | | |
| | Y axis | | 1000 mm | 1600 mm | 2000 mm |
| | Z axis | | 600 mm/800 mm | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

CRYSTA-Apex V Series Accuracy

Unit: μm

| Series | Probe used | Length measurement error*1 ISO 10360-2: 2009 |
|---------------------------|--------------|---|
| 500/700/900 Series | SP25M | $E_0, MPE = 1.7 + 3L/1000^{*2}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)



Refer to the **CRYSTA-Apex V Series Brochure (E16026)** for more details.

Standard CNC CMM MICROCORD CRYSTA-Apex V1200/1600/2000 Series

- The **CRYSTA-Apex V1200/1600/2000** Series are large-sized CNC CMMs developed for supporting quality evaluation of large parts.

- Equipped with a temperature compensation system that guarantees the specified accuracy within the wide range of 16 to 26 °C for **CRYSTA-Apex V1200** and 16 to 24 °C for **V1600/2000** under certain environmental conditions, although high-accuracy CMMs should ideally be installed in a temperature controlled room.



CRYSTA-Apex V122010



CRYSTA-Apex V162012

SPECIFICATIONS

| Items | | Model | CRYSTA-Apex V 121210 | CRYSTA-Apex V 122010 | CRYSTA-Apex V 123010 |
|-----------------|--------|-------|----------------------|----------------------|----------------------|
| Measuring range | X axis | | | 1200 mm | |
| | Y axis | | 1200 mm | 2000 mm | 3000 mm |
| | Z axis | | | 1000 mm | |

| Items | | Model | CRYSTA-Apex V 162012 (Z1200)/162016 (Z1600) | CRYSTA-Apex V 163012 (Z1200)/163016 (Z1600) | CRYSTA-Apex V 164012 (Z1200)/164016 (Z1600) |
|-----------------|--------|-------|---|---|---|
| Measuring range | X axis | | | 1600 mm | |
| | Y axis | | 2000 mm | 3000 mm | 4000 mm |
| | Z axis | | | 1200 mm/1600 mm | |

| Items | | Model | CRYSTA-Apex V 203016 | CRYSTA-Apex V 204016 |
|-----------------|--------|-------|----------------------|----------------------|
| Measuring range | X axis | | | 2000 mm |
| | Y axis | | 3000 mm | 4000 mm |
| | Z axis | | | 1600 mm |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

CRYSTA-Apex V Series Accuracy

Unit: μm

| Series | Probe used | Length measurement error*1 ISO 10360-2: 2009 |
|-------------|------------|--|
| 1200 Series | SP25M | $E_0, MPE = 2.3 + 3L/1000^{*2}$ |
| 1600 Series | | $E_0, MPE = 3.3 + 4.5L/1000 (4.5 + 5.5L/1000)^{*2} *3$ |
| 2000 Series | | $E_0, MPE = 4.5 + 8L/1000^{*2}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)

*3 () indicates Z: 1600 mm specification

Coordinate Measuring Machines

Precision measuring technology in three dimensions

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

CNC Coordinate Measuring Machine MICROCORD CRYSTA-Apex EX 500T/700T/900T Series

- The **CRYSTA-Apex EX 500T/700T/900T** Series are CNC CMMs equipped with the PH20 5-axis control touch-trigger probe.
- 5-axis operation makes it possible to reduce machine movements by transferring some of these to the probe, thus increasing measuring speed and reducing programming time needed.
- In addition to 3-axis point measurement similar to conventional CMMs, the **PH20** probe head also supports 'head touch' operation for quick point measurement by using only the 2 axes of the probe head.



CRYSTA-Apex EX 544T

SPECIFICATIONS

| Items | Model | CRYSTA-Apex EX 544T | CRYSTA-Apex EX 574T | CRYSTA-Apex EX 776T | CRYSTA-Apex EX 7106T | CRYSTA-Apex EX 9106T | CRYSTA-Apex EX 9166T | CRYSTA-Apex EX 9206T |
|-----------------|--------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|
| Measuring range | X axis | 500 mm | | 700 mm | | 900 mm | | |
| | Y axis | 400 mm | 700 mm | 700 mm | 1000 mm | 1000 mm | 1600 mm | 2000 mm |
| | Z axis | 400 mm | | 600 mm | | 600 mm | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

CRYSTA-Apex EX 500T / 700T / 900T Series Accuracy Unit: μm

| Probe used | Length measurement error ISO 10360-2: 2009 |
|-------------|---|
| PH20 + TP20 | $E_0, MPE = 2.2 + 3L/1000^*$ |

* L = Measuring length (unit: mm)

Standard CNC CMM MICROCORD CRYSTA-Apex EX 1200R Series

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- **CRYSTA-Apex EX 1200R** Series products are advanced CNC CMMs equipped with the REVO-2 probe head and a choice of probes to create a range of standard 5-axis measuring machines.
- 5-axis operation reduces the time required for probe repositioning movements and allows more flexible positioning. This also facilitates access to complex workpieces and saves time both during programming and measurement.
- Allows ultra high-speed 5-axis scanning (max. 500 mm/s), far surpassing conventional 3-axis control. Support for high-speed sampling of up to 4,000 points per second allows acquisition of densely spaced measurement points, even during fast scanning.
- Internal implementation of laser sensing technology ensures high-accuracy measurement, even with long styli (up to 500 mm*).

* Distance from probe rotation center to stylus tip



CRYSTA-Apex EX 123010R

SPECIFICATIONS

| Items | Model | CRYSTA-Apex EX 121210R | CRYSTA-Apex EX 122010R | CRYSTA-Apex EX 123010R |
|-----------------|--------|------------------------|------------------------|------------------------|
| Measuring range | X axis | 1200 mm | | |
| | Y axis | 1200 mm | 2000 mm | 3000 mm |
| | Z axis | 960 mm | | |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

CRYSTA-Apex EX 1200R Series Accuracy Unit: μm

| Probe used | Length measurement error* ¹ ISO 10360-2: 2009 |
|------------------------|---|
| REVO + RSP2 + RSH250 | $E_0, MPE = 2.9 + 4L/1000^{*2}$ |
| REVO + RSP3-3 + RSH3-3 | $E_0, MPE = 2.5 + 3L/1000^{*2}$ |

*¹ Specifications vary by configuration, size, and thermal environment.

*² L = Measuring length (unit: mm)

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



Helical scan



Gasket scan



Sweep scan



Airfoil section scan



Shop-floor Type CNC Coordinate Measuring Machine MiSTAR 555



Equipped with the PH10MQ probe head

- An accuracy-guaranteed temperature range of 10 to 40 °C is possible thanks to a combination of technologies, such as the symmetric guide structure, uniform material and temperature compensation.
- A contamination resistance more than 2 times better than Mitutoyo's conventional machine is achieved by adopting a newly developed environment-resistant absolute scale*¹.
- The footprint is reduced to about 80% compared with that of the conventional moving bridge model by adopting the horizontal-arm structure and installing the CMM controller and PC under the measuring table.

* Absolute scale that provides an absolute XYZ-values relative to an internal reference point for each coordinate captured. This eliminates the need for an initialization operation.



MiSTAR 555

SPECIFICATIONS

| Model | | MiSTAR 555 |
|--|--------------|---|
| Measuring range | X axis | 570 mm |
| | Y axis | 500 mm |
| | Z axis | 500 mm |
| Maximum permissible length measurement error* ¹ * ² ISO 10360-2: 2009 (18 to 22 °C) | | 2.2 + 3L/1000 μm |
| Drive speed | | 5 to 350 mm/s (max. combined speed 606 mm/s) in CNC MODE |
| Drive acceleration | | 1556 mm/s ² (max. combined acceleration 2695 mm/s ²) |
| Workpiece | Max. height | 660 mm |
| | Max. loading | 120 kg |
| Accuracy guaranteed temperature range | | 10 to 40 °C |
| Mass (including the controller and installation platform) | | 655 kg |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)

Note1: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

Note2: For information about guaranteed accuracy outside of the 18 to 22 °C temperature range, contact your local Mitutoyo sales office.



Refer to the MiSTAR 555 Brochure (E16028) for more details.

Coordinate Measuring Machines

Precision measuring technology in three dimensions

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

High Accuracy CNC CMM MICROCORD STRATO-Apex Series

MeasurLink ENABLED
Data Management Software by Mitutoyo

- The **STRATO-Apex** Series of CNC CMMs offer improved structural rigidity and guide systems to guarantee very high accuracy measurement. High drive speed and high acceleration provide lower cycle times in critical measurement applications.
- The **STRATO-Apex** Series uses the same ultra-high accuracy length measuring unit (manufactured in-house) as used in the **LEGEX** Series for position detection, allowing for extremely advanced position detection and enabling control of these ultra-high-accuracy machines. It also applies various other technologies, such as a high-speed control program, that enable high speed and accuracy.



STRATO-Apex 574



STRATO-Apex 776



STRATO-Apex 9106



STRATO-Apex 162016

SPECIFICATIONS

| Items | | Model | STRATO-Apex 574 | STRATO-Apex 776 | STRATO-Apex 7106 |
|-----------------|--------|-------|-----------------|-----------------|------------------|
| Measuring range | X axis | | 500 mm | | 700 mm |
| | Y axis | | 700 mm | 700 mm | 1000 mm |
| | Z axis | | 400 mm | | 600 mm |

| Items | | Model | STRATO-Apex 9106 | STRATO-Apex 9166 | STRATO-Apex 162012 | STRATO-Apex 162016 | STRATO-Apex 163012 | STRATO-Apex 163016 |
|-----------------|--------|-------|------------------|------------------|--------------------|--------------------|--------------------|--------------------|
| Measuring range | X axis | | 900 mm | | | 1600 mm | | |
| | Y axis | | 1000 mm | 1600 mm | 2000 mm | | 3000 mm | |
| | Z axis | | 600 mm | | 1200 mm | 1600 mm | 1200 mm | 1600 mm |

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

STRATO-Apex Series Accuracy

Unit: μm

| Series | Probe used | Length measurement error*1 ISO 10360-2: 2009 |
|----------------|------------|---|
| 574 Series | SP25M | $E_0, \text{MPE} = 0.7 + 2.5L/1000^{*2}$ |
| 700/900 Series | | $E_0, \text{MPE} = 0.9 + 2.5L/1000^{*2}$ |
| 1600 Series | | $E_0, \text{MPE} = 2.5 + 4.0L/1000 (3.0 + 4.0L/1000)^{*2 *3}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)

*3 () indicates Z: 1600 mm specification

High-accuracy Separate Guide Type MICROCORD STRATO-Apex Series

- The **STRATO-Apex** Series are CNC CMMs that use Mitutoyo's standard structure for large machines which are designed to be used for measuring large and heavy workpieces with high accuracy. The picture below gives a good idea of how large the machine is. The measuring accuracy and drive speed are the world's highest in the X-axis measuring range of 2000 mm and 3000 mm.
- High-accuracy linear encoders (manufactured in-house) are built into the length measuring units used for position detection. Their excellent position detection capability is what makes the control of these high-accuracy devices possible. The series also applies a multitude of technologies regarding structure, control, component processing, assembly, and other aspects that enable large CMMs to deliver high-accuracy measurements.
- These series are equipped with a system to automatically restore accuracy deterioration (**MOVAC**) caused by foundation deformation as a standard feature.
- Equipped with a temperature compensation system that guarantees the specified accuracy within the wide range of 18 to 22 °C under certain environmental conditions, although high-accuracy CMMs should ideally be installed in a temperature controlled room.
- Safety devices such as a Z-axis beam sensor, tape switch, and area sensor are available as options.



STRATO-Apex 3000G Series

SPECIFICATIONS

| Items | | Model | STRATO-Apex 2000G Series | STRATO-Apex 3000G Series | STRATO-Apex 4000G Series |
|-----------------|--------|-------|---------------------------------|--------------------------|--------------------------|
| | | | | | |
| Measuring range | X axis | | 2000 mm | 3000 mm | 4000 mm |
| | Y axis | | 3000 mm/4000 mm/5000 mm/6000 mm | | |
| | Z axis | | 1200 mm/1600 mm/2000 mm | | |

Note: For information on accuracy specifications, contact your local Mitutoyo sales office.

Coordinate Measuring Machines

Precision measuring technology in three dimensions

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Ultra-high Accuracy CNC CMM MICROCORD LEGEX Series

MeasurLink ENABLED
Data Management Software by Mitutoyo

- The **LEGEX** Series is an ultra-high precision CNC CMM with the world's highest level of accuracy, made possible by rigorous analysis of all possible error-producing factors and the elimination or minimization of their effects.
- The fixed bridge structure and precision air bearings running on highly rigid guideways ensure superior motion stability and ultra-high geometrical accuracy. Thorough testing, using FEM structure analysis simulation, guarantees geometric motion accuracy with minimal errors due to fluctuations in inertial loading and other variables. In addition, other technologies have been utilized in the structure of the drive unit, minimizing vibration, etc., to provide ultra-high accuracy.
- The combination of a Mitutoyo ultra-high accuracy crystallized glass scale with a coefficient of thermal expansion of almost zero and a high resolution, high-performance reflection type linear encoder provides excellent position detection for premium performance.
- Many optional systems are available, including probes (contact and non-contact types), data processing units, and many other items to support the ultra-high accuracy measurement of a wide variety of workpieces.



LEGEX 574



LEGEX 776



LEGEX 9106

SPECIFICATIONS

| Model | | LEGEX 574 | LEGEX 774 | LEGEX 776 | LEGEX 9106 | LEGEX 12128* |
|-----------------|--------|-----------|-----------|-----------|------------|--------------|
| Measuring range | X axis | 500 mm | 700 mm | 700 mm | 900 mm | 1200 mm |
| | Y axis | 700 mm | 700 mm | 700 mm | 1000 mm | 1200 mm |
| | Z axis | 450 mm | 450 mm | 600 mm | 600 mm | 800 mm |

* Custom-made model. For information about **LEGEX 12128**, contact your local Mitutoyo sales office.

Note: Choose either a cast iron or a ceramic coated measuring table.

LEGEX Series Accuracy

Unit: μm

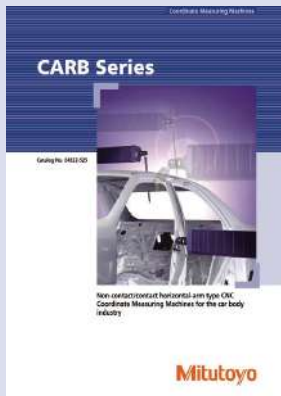
| Probe used | Length measurement error* ¹ ISO 10360-2: 2009 |
|-----------------|---|
| MPP-310Q | $E_0, \text{MPE} = 0.28 + L/1000^{*2}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)



Measurement example for dual-ram type
(Simultaneous use of touch-trigger probe and line laser probe)



Refer to the **CARB Series Brochure (E16014)** for more details.

Car Body Measuring System MICROCORD CARBstrato Series

- The world's largest class of CMM
The **CARBstrato** Series is a lineup of horizontal-ram type CNC CMMs, offering the world's largest measurement range that even makes it possible to measure car bodies.

- Single- & Dual-ram systems
Single- and dual-ram types are available to suit the intended use.
Single-ram type: Measures a workpiece using a single ram
Dual-ram type: Measures a workpiece placed between two simultaneously controlled rams

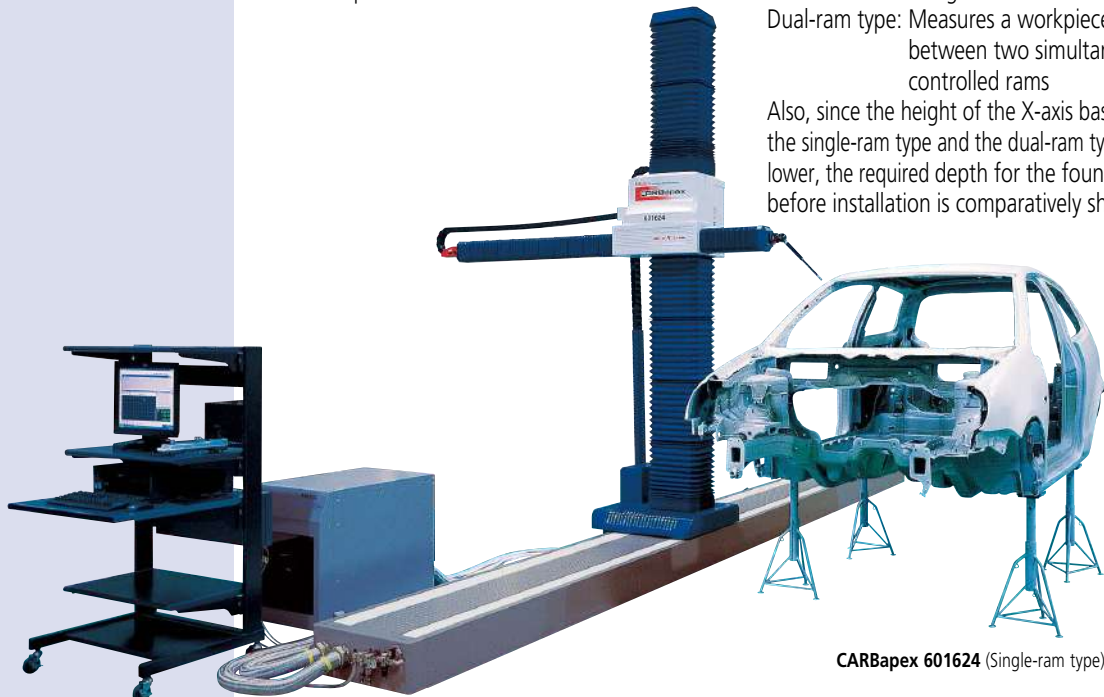


CARBstrato 601624D (Dual-ram type)

Car Body Measuring System MICROCORD CARBapex Series

- The world's largest class of CMM
The **CARBapex** Series is a lineup of cost-effective horizontal-ram type, large CNC CMMs, and offers the world's largest measurement range that even makes it possible to measure car bodies.

- Single- & Dual-ram systems
Single- and dual-ram types are available to suit the intended use.
Single-ram type: Measures a workpiece with a single-ram
Dual-ram type: Measures a workpiece placed between two simultaneously controlled rams
Also, since the height of the X-axis bases of both the single-ram type and the dual-ram type are set lower, the required depth for the foundation before installation is comparatively shallow.



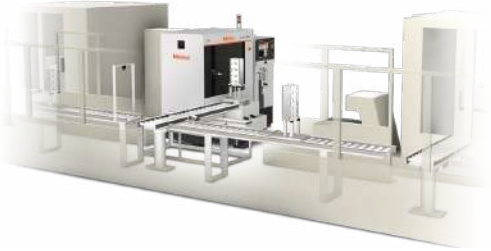
CARBapex 601624 (Single-ram type)

Coordinate Measuring Machines

Precision measuring technology in three dimensions

In-line Type CNC CMM MICROCORD MACH-3A Series

- In-line type CNC CMM (Horizontal-ram type) Incorporating the CMM controller and the host computer in the main unit results in a compact space-saving footprint for the shop floor. This series is designed for 24-hour operation with high stability and remarkable durability. In addition, its accuracy is guaranteed within the temperature range 5 to 40 °C.



MeasurLink ENABLED
Data Management Software by Mitutoyo



MACH-3A 653
The indexing table shown is optional

In-line Type CNC CMM MICROCORD MACH-V9106

- This makes it possible to build a flexible measuring system to replace gage measurements on power train production lines. It also allows for high throughput thanks to high acceleration and high drive speed. In addition, its accuracy is guaranteed within the temperature range 5 to 35 °C.



MeasurLink ENABLED
Data Management Software by Mitutoyo



MACH-V9106

CMM equipped with high-accuracy/ high-speed/flexible CNC measuring head MACH Ko-ga-me

- Can be used in standalone applications or integrated into work cells.
- If required, the system can measure workpiece features that exceed the **Ko-ga-me**'s X stroke by mounting the workpiece, or the **Ko-ga-me**, on an auxiliary X axis.
- Ideal for inspection of large or small workpieces and offers a wide choice of measuring probes including touch-trigger and scanning types. (Note: Probe choice may be restricted, depending on the application.)



Standalone system



Stand, measuring table, etc. are options.

MeasurLink ENABLED
Data Management Software by Mitutoyo

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

SPECIFICATIONS

| Items | Model | MACH-3A 653 |
|-----------------|-------------|---|
| Measuring range | X axis | 600 mm |
| | Y axis | 500 mm |
| | Z axis | 280 mm |
| Accuracy*1 | 19 to 21 °C | $E_0, MPE = 2.5 + 3.5L/1000 \mu m^{*2}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)

Note: For information about guaranteed accuracy within a temperature range other than 19 to 21 °C, contact your local Mitutoyo sales office.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

SPECIFICATIONS

| Items | Model | MACH-V9106 |
|-----------------|-------------|---|
| Measuring range | X axis | 900 mm |
| | Y axis | 1000 mm |
| | Z axis | 600 mm |
| Accuracy*1 | 19 to 21 °C | $E_0, MPE = 2.5 + 3.5L/1000 \mu m^{*2}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)

Note: For information about guaranteed accuracy within a temperature range other than 19 to 21 °C, contact your local Mitutoyo sales office.



An online system to monitor the operational and mechanical statuses of measuring machines. This allows you to grasp the state of a process flow from the operational status of measuring machines within a production process.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

SPECIFICATIONS

| Model | KGM12128-C |
|---------------------------|---|
| Measuring range (Xx Yx Z) | 120x120x80 mm |
| Accuracy*1 (19 to 21 °C) | $E_0, MPE = 2.4 + 5.7L/1000 \mu m^{*2}$ |

*1 Specifications vary by configuration, size, and thermal environment.

*2 L = Measuring length (unit: mm)

Note: For information about guaranteed accuracy within a temperature range other than 19 to 21 °C, contact your local Mitutoyo sales office.

Manual Type CMM MICROCORD Crysta-Plus M Series

- Manual floating type CMMs developed in the quest for high accuracy, low cost and easy operation.
- High-accuracy linear encoders (manufactured in-house) are built into the length measuring units used for position detection. Their excellent position detection capability is what makes the control of these high-accuracy devices possible. The series also applies a multitude of other technologies regarding structure, component processing, assembly, and other aspects that enable high-accuracy measurements.

- Clamping along the X, Y, or Z axes can be performed by pressing a button. Because the **Crysta-Plus M700** Series has a large main unit, the Mobile Clamp Box is provided as a standard accessory, putting clamp operations along any axis right at your fingertips. Also, all models of the **Crysta-Plus M** Series support continuous fine feeding of clamped workpieces along the X, Y, or Z axes, over the entire range of measurement.

- Equipped with a temperature compensation system that guarantees the specified accuracy within a wide range of temperature under certain environmental conditions, although CMMs should ideally be installed in a temperature controlled room.
- Available options include the auto-leveling air-spring vibration isolator and the illuminator unit for the probe.



Crysta-Plus M443



Crysta-Plus M574



Crysta-Plus M7106



Refer to the **Crysta-Plus M** Series Brochure (E16013) for more details.

SPECIFICATIONS

| Model | | Crysta-Plus M443 | Crysta-Plus M544 | Crysta-Plus M574 | Crysta-Plus M776 | Crysta-Plus M7106 |
|-----------------|----------------------|------------------|------------------|------------------|--------------------|-------------------|
| Measuring range | X axis | 400 mm | 500 mm | | 700 mm | |
| | Y axis | 400 mm | 400 mm | 700 mm | 700 mm | 1000 mm |
| | Z axis | 300 mm | 400 mm | | 600 mm | |
| Accuracy* | E ₀ , MPE | 3.0 + 4L/1000 μm | 3.5 + 4L/1000 μm | | 4.5 + 4.5L/1000 μm | |
| | PFTU, MPE | 4.0 μm | 4.0 μm | | 5.0 μm | |

* L = Measuring length (unit: mm)

Note: While the appearance of the natural stone measuring table varies according to the source, the high stability for which this material is known can always be relied upon.

Coordinate Measuring Machines

Precision measuring technology in three dimensions

Portable Articulated Arm Coordinate Measuring System **MeasurLink[®] ENABLED**
 SpinArm-Apex Data Management Software by Mitutoyo

MeasurLink[®] ENABLED
 Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).



SpinArm-Apex 186H

SpinArm-Apex 367H

SPECIFICATIONS

SpinArm-Apex H Series (6-axis model)

| Model No. | SpinArm-Apex 186H | SpinArm-Apex 246H | SpinArm-Apex 306H | SpinArm-Apex 366H |
|--|-------------------|-------------------|-------------------|-------------------|
| Measuring envelope (Probe reaching diameter)*1 | 1800 mm | 2400 mm | 3000 mm | 3600 mm |
| Repeatability*2*3 | ±0.021 mm | ±0.026 mm | ±0.044 mm | ±0.060 mm |
| Accuracy (Arm type)*2*3 | ±0.028 mm | ±0.035 mm | ±0.058 mm | ±0.072 mm |

SpinArm-Apex H Series (7-axis model)

| Model No. | SpinArm-Apex 247H | SpinArm-Apex 307H | SpinArm-Apex 367H |
|--|-------------------|-------------------|-------------------|
| Measuring envelope (Probe reaching diameter)*1 | 2400 mm | 3000 mm | 3600 mm |
| Repeatability*2*3 | ±0.031 mm | ±0.051 mm | ±0.071 mm |
| Accuracy (Arm type)*2*3 | ±0.042 mm | ±0.072 mm | ±0.103 mm |

*1 Measurement range is expressed as a diameter value at the maximum reach using software with the Sφ10 mm standard probe mounted.

*2 According to Mitutoyo's acceptance procedure.

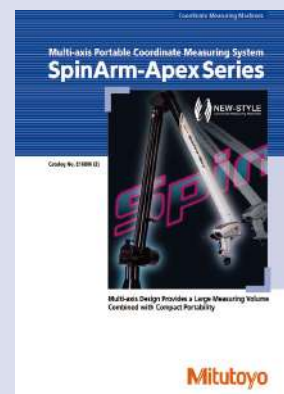
*3 Guaranteed accuracy temperature: 18 to 22 °C (temperature change: 2.0 °C per hour max.)

- The **SpinArm-Apex** Series is a multi-joint 3D measurement system with an extremely large measurement space and excellent portability, eliminating the need to move workpieces to the location where the measurement device is installed.
- Workpieces can be approached from any direction, enabling measurement of workpieces with complex shapes.
- A new feature that automatically locks the device at its home position dramatically increases operability.
- Counterbalanced for easier operation.
- SurfaceMeasure, a non-contact line-laser probe, can be used together with a hard probe.



SurfaceMeasure Series

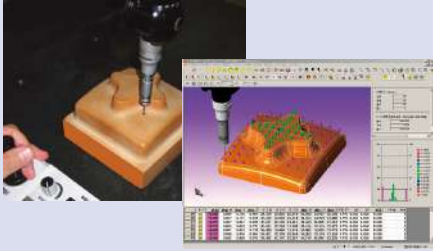
Note: Not for use in, or export to, the United States of America.



Refer to the **SpinArm-Apex** Series Brochure (**E16006**) for more details.

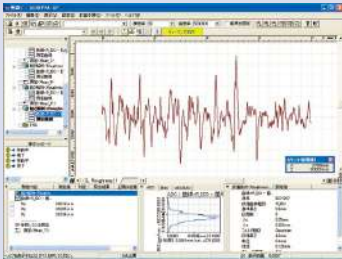
CAT1000S [Curved surface evaluation program]

This software is used for free-form surface evaluation and online/offline teaching. It is possible to display measurement results on CAD data in various ways.



SURFPAK-SP [Analysis program]

This is a software program as used for the SURFTEST roughness probe for a CMM. With this program, surface roughness analysis conforming to standards such as ISO, JIS, ANSI, and VDA are available. Cooperation with MCOSMOS enables fully automatic dimensional measurement and surface roughness measurement.



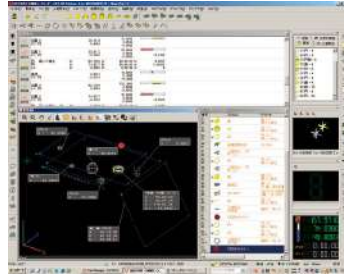
**Software for Manual/CNC Coordinate Measuring Machines
 MCOSMOS**

MCOSMOS software modules

| | GEOPAK | CAT1000P | CAT1000S | SCANPAK |
|-----------|--------|----------|----------|---------|
| MCOSMOS-1 | ✓ | | | |
| MCOSMOS-2 | ✓ | ✓ | ✓ | |
| MCOSMOS-3 | ✓ | ✓ | ✓ | ✓ |

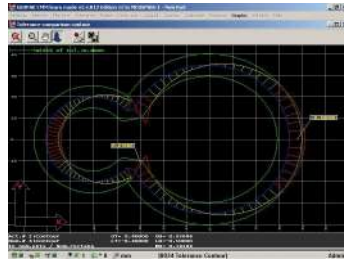
GEOPAK [General purpose measurement program]

This is the basic software for dimension measurement. The enhanced graphic functionality allows real time drawing of the measurement result, and the best-fit function, previously optional, and even the geometrical deviation drawing function are now provided as standard.



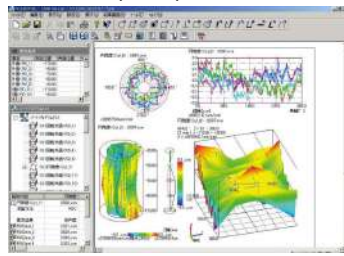
SCANPAK [Contour measurement program]

This software enables measurement/evaluation of two-dimensional sectional contours. The data output function to CAD, etc. that had been optional before is now provided as standard.



ROUNDPAK-CMM

The functionality of analysis software as used for roundness measuring machines is now available on MCOSMOS. As well as roundness and cylindricity evaluation, various filters are also available.

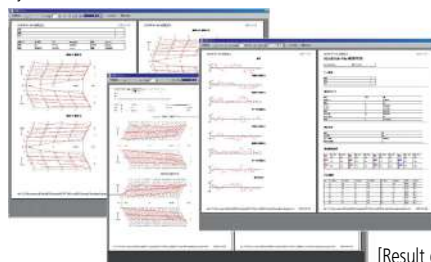


GEARPAK-Worm [Gear evaluation program]

This is a program for evaluation of tooth form based on worm measurement data obtained from CNC CMMs.

GEARPAK-Bevel/Hypoid [Gear production support/evaluation program]

This is a program for evaluation of tooth form, pitch error, etc., based on measurement data from bevel or hypoid gears obtained by CNC CMM.

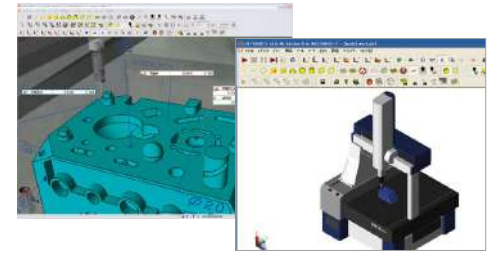


[Result drawing]

- **MCOSMOS** is the data processing program family for the CMM that runs on Windows.

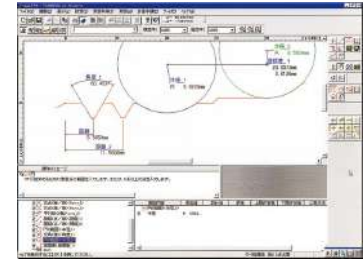
CAT1000P [Online/Offline teaching program]

This software is used for online/offline teaching. The interference check function is also added so that programming error when off-line can be prevented. In addition to SAT and STEP (standard functions) as CAD data that can be imported, CATIA V4/V5, PARASOLID, etc. are supported (optional).



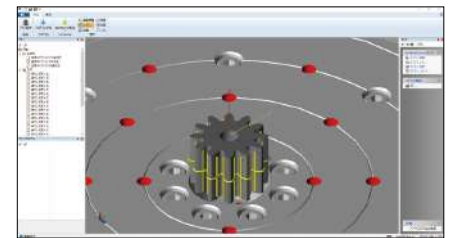
FORMTRACEPAK-AP [Analysis program]

This program is used for minutely analyzing two-dimensional curved lines captured by SCANPAK.



GEARPAK-Express Cylindrical [Gear evaluation program]

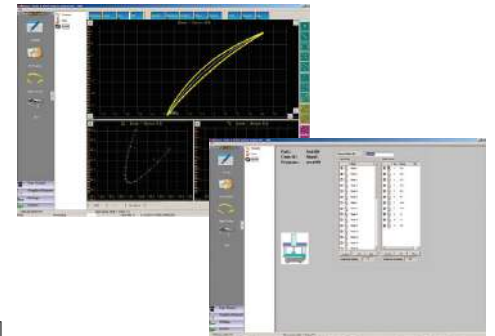
This is a program for evaluation of involute gear teeth obtained from CNC CMMs, and tooth profile based on cylindrical gear measurement data.



[Result drawing]

MAFIS Express [Blade measurement/Evaluation program]

This software program enables creation of measurement programs and measurement and analysis of blades and blisks. A part program for measurement can be automatically created just by selecting required contents and evaluation conditions. The measurement results will be displayed in a report including 2D graphics.



Refer to the **MCOSMOS Software Brochure (E16008)** for more details.

Coordinate Measuring Machines

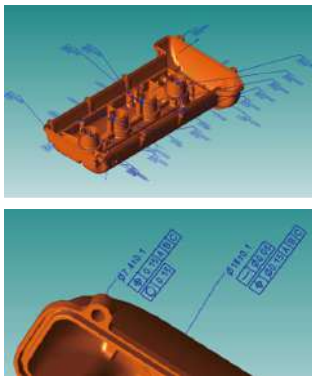
Precision measuring technology in three dimensions

Automatic measurement program generation software **MiCAT Planner**

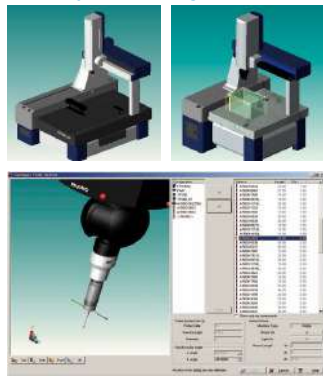
One-click programming that changes the relationship between people and precision measurement

- Identifies tolerance information included in 3D models with Product and Manufacturing Information (PMI), defines measurement locations and creates a measurement program fully automatically. Also, even with the 3D CAD model without PMI, the measurement program can be created automatically just by adding tolerance information on **MiCAT Planner**. This is more efficient than the conventional teaching model.
- Through its optimization function, the software estimates the shortest route for measurement with the minimum of probe repositioning and tool changing, and creates a program that enables measurement in the minimum possible time.
- Utilizing the rule editor function to set the measurement rules prevents variation in measurement quality between program writers.

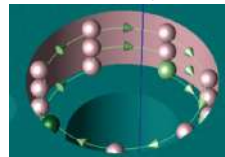
CAD data with tolerances



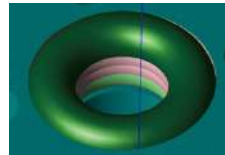
CMM System configuration



User-defined measurement rules (number of locations to measure with tolerance information and sampling method, etc.)

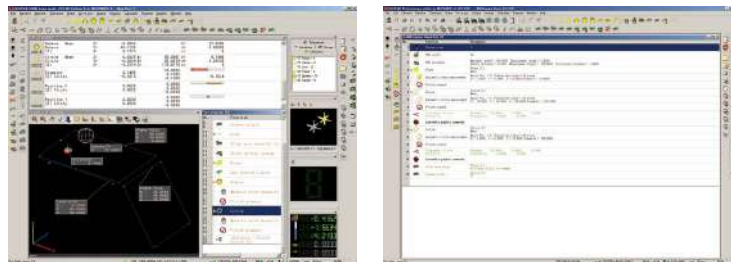


Example of sampling method: contact measurement



Example of sampling method: scanning measurement

Instantly and automatically creates a measurement program



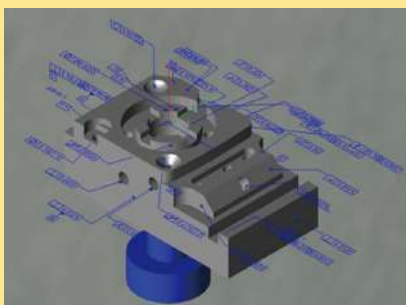
An optimized measurement program for MCOSMOS

Case study

Compare the measurement part-programming time for a test piece.

- Programming in 2D drawing: **approx 45 to 60 minutes**
- Programming using 2D drawing + 3D CAD: **approx 15 to 20 minutes**
- Create with **MiCAT Planner** (using 3D CAD model + PMI): **approx. 3 minutes!**

Note: The measurement rules are defined in advance.



Part-programming time
Reduced by up to 95 % !!
 Guarantee a
dramatically reduced development phase
 and at the same time improve product quality.

Tolerance information add function

Lets you add tolerances in the software even for 3D CAD models containing no tolerance information. Automatically create optimal measuring programs based on the added tolerance specifications.

Supported languages

Available in 16 languages



Refer to the **MiCAT Planner** Brochure (E16019) for more details.

- The flying spot type is capable of scanning difficult parts, such as this impeller, precisely and achieves highest scanning accuracy in the class (in the case of **SurfaceMeasure 201FS**).

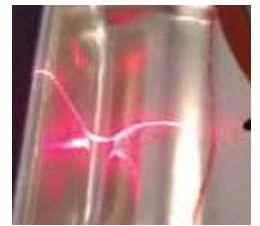


Non-contact type laser probe SurfaceMeasure

- Ultra-high speed data collection**
 The **SurfaceMeasure** probe works by emitting laser beams onto the workpiece to collect coordinate values from its surface, and can collect data at the ultra-high speed of 75,000 points/second.*
 * When using **SurfaceMeasure 606/610/1010**
- Powder-less measurement**
 Automatic configuration of the camera sensitivity and the laser intensity settings according to the environment and materials enable establishing a simple and comfortable laser-scanning environment since measurement is now powder and spray free.
- Advantages of non-contact type**
 Non-contact measurement enables measurement of materials that can be easily deformed by contact measurement, including plastics or thin, elastic parts.
- Evaluation cases**
 The collected point cloud data can be used by various optional software in a wide range of applications, such as editing, plane creation, comparison using CAD data and more.



Measurement of color sample plate



Measurement of glossy parts



403/606/610/1010



606T

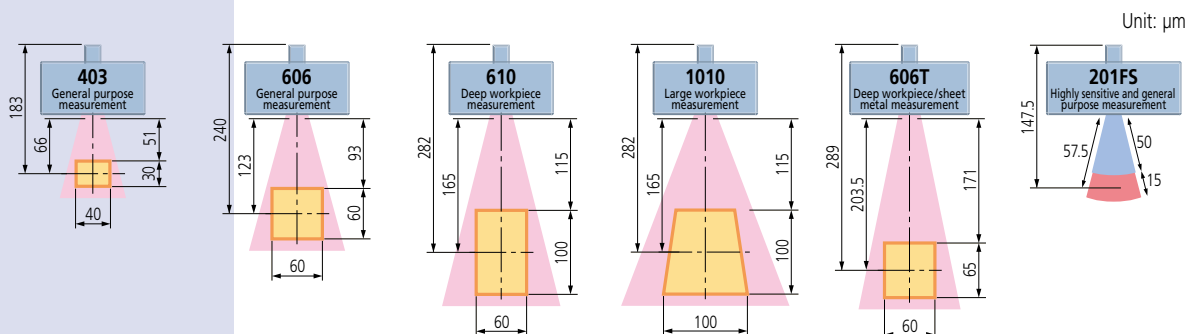


201FS

SPECIFICATIONS

| | | SurfaceMeasure 403 | SurfaceMeasure 606 | SurfaceMeasure 610 | SurfaceMeasure 1010 | SurfaceMeasure 606T | SurfaceMeasure 201FS | |
|--------------------------|--------------|---|--------------------|--------------------|---------------------|---------------------|----------------------|---------------|
| Laser irradiation method | | Line Laser (single) | | | | Line Laser (cross) | Flying spot | |
| Max. scan width | | 40 mm | 60 mm | 60 mm | Max. 100 mm | 3×65 mm | Max. 23 mm | |
| Max. scan depth | | 30 mm | 60 mm | 100 mm | 100 mm | 65 mm | 15 mm | |
| Working distance | | 66 mm | 123 mm | 165 mm | 165 mm | 203.5 mm | 57.5 mm | |
| Scanning error* | | 8 μm | 12 μm | 15 μm | 18 μm | 17 μm | 1.8 μm | |
| Max. Acquisition rate | | 60,000 points/sec | 75,000 points/sec | | | 3×25,500 points/sec | 25,000 points/sec | |
| Mass | | 430 g | 430 g | 400 g | 400 g | 480 g | 500 g | |
| Laser Class | | EN/IEC Class2 [EN/IEC 60825-1 (2014)] | | | | | | |
| Laser Type | | Red-light semiconductor | | | | | | Semiconductor |
| Line Laser | Wave length | 660 nm | | | | | | 670 nm |
| | Power output | 4 mW | | | | | | 1 mW |
| Point Laser | Wavelength | — | | | | | | — |
| | Power output | — | | | | | | — |

* According to Mitutoyo's acceptance procedure. (1σ /sphere measurement, probe alone.)



Coordinate Measuring Machines

Precision measuring technology in three dimensions

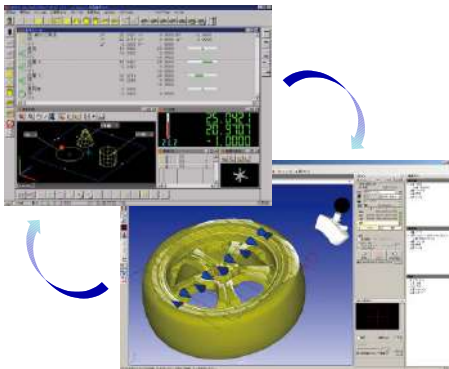
MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world
metrology software
cmm

Point Cloud Processing Software for Coordinate Measuring Machines MSURF

- **MSURF** is a software program that enables users to perform operations from measurement to evaluation on the same platform when the non-contact line laser probe, **SurfaceMeasure**, is used. Eight software modules are provided according to the task.

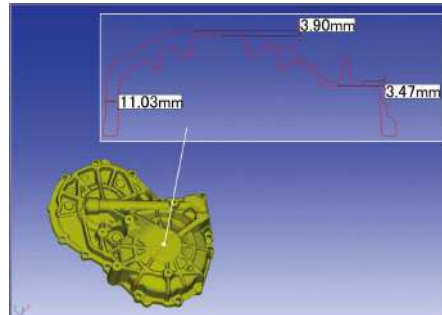
MSURF-S

Calculates point cloud data measured by CNC CMM with **SurfaceMeasure**. It generates scanning paths by defining the scanning start position, length, and width.

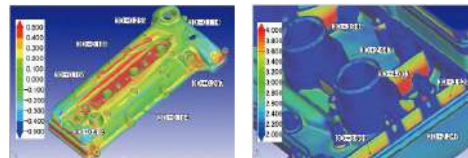


MSURF-I

Conducts analysis or comparison verification of measured point cloud data in reference to nominal data (supporting CAD data import).

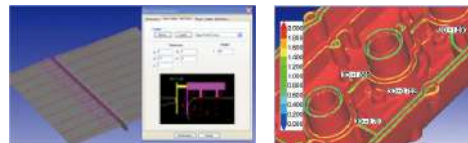


Section evaluation (dimensional calculation)



Error color-coded map

Thickness color-coded map



Evaluation of step/clearance

Surface curvature evaluation

MSURF-MESH PRO

This software is provided with various functions such as filtering point cloud data and mesh data. The software is enhanced by adding functions to standard ones. It also enables functions such as mesh data thinning-out, highlighting, interpolation and outlier removal that are unavailable as standard.

Note: **MSURF-MESH PRO** has the optional functions of **MSURF-I**.

MSURF-PLANNER RUN

MSURF-PLANNER RUN is optional software required to execute and edit measurement macros created by **MSURF-PLANNER**.

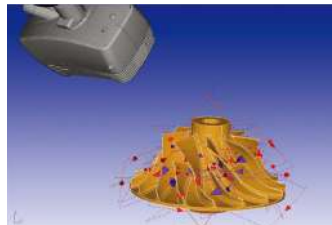
Note 1: **MSURF-PLANNER RUN** is optional software added to **MSURF-S** or **MSURF-G**.

Note 2: This optional software is not required for a PC with **MSURF-PLANNER** installed.

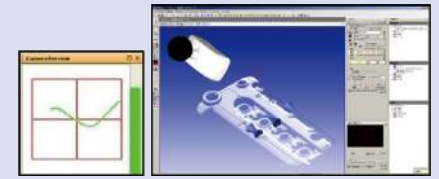
MSURF-PLANNER

MSURF-PLANNER is software to automatically create measurement macros (surface form, feature form) for the line laser probe from 3D CAD data.

Optimized data (travel path, number of probe head revolutions, etc.) of a measurement path will contribute to improvements in productivity.



Automatic generation of measurement macros by **MSURF-PLANNER**



Note: If not using the **ACR3** probe changer, probe replacement is performed manually.

MSURF-G

MSURF-G is the off-line version of **MSURF-S**. It allows users to create measurement programs in advance of actual measurements on a CMM by using CAD data. Therefore, users can start measurement immediately at the time a real workpiece is ready. Since **MSURF-S** is a standalone PC application, only requiring installation by the user, it helps preserve valuable CMM time exclusively for productive measurement.

Note: **MSURF-G** cannot be combined with **MSURF-S**.

SP25M

Compact high accuracy type scanning probe

This compact, multifunctional and highly accurate scanning probe is only 25 mm in diameter, which enables it to access shrouded workpiece features. Data collection is by scanning measurement, ultra-high precision point measurement and center alignment point measurement. The probe can be attached to a probe head (PH10M/10MQ) to automatically change the orientation allowing for maximum flexibility in measurement.



Scanning probes

MPP-310Q

Ultra-high accuracy and low measuring force scanning probe

This ultra-high precision scanning probe incorporates built-in XYZ scales for highest-accuracy performance. The compact size of this probe is ideal for low measuring force and high speed scanning. Data collection can be performed by scanning measurement, ultra-high precision point measurement and center alignment measurement.



SP80

High accuracy scanning probe (supports long styli)

A highly accurate stylus up to 500 mm in length (both horizontally and vertically) can be installed on this probe. This ultra-high precision scanning probe allows data collection by scanning measurement, ultra-high precision point measurement and center alignment point measurement.



MPP-10

Probe for effective thread-depth measurement

This is the only probe in the world that is dedicated to measure effective screw-thread depth on a CNC CMM. The probe can also attach to a probe head (PH10M/10MQ) to change the orientation to measure bores in various directions.



REVO-2

High speed 5-axis scanning head

This high-speed scanning head delivers high accuracy measurement while delivering high-throughput. Contact measurement with a stylus that can be up to 500 mm in length increases flexibility and makes simultaneous 5-axis measuring with non-step indexing possible.



Non-contact probes

SurfaceMeasure

Non-contact type laser probe

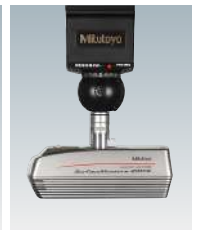
This compact, high accuracy, non-contact type laser probe is designed for use with CNC CMMs. The scanning probe automatically adjusts to workpiece surface characteristics to deliver highly efficient measurements. Automatic laser intensity and camera sensitivity adjust according to the environment and the workpiece material, for simpler and more comfortable laser scanning.



SurfaceMeasure 606



SurfaceMeasure 606T



SurfaceMeasure 201FS

QVP

QUICK VISION probe

This CNC CMM Quick Vision Probe utilizes Mitutoyo's technology in a vision measuring machine for totally-automated video measurement.



CF20

Centering microscope for CMMs

This centering microscope enables measurement of small holes or elastic bodies that are very difficult to measure using a contact measurement method such as with a touch-trigger probe. It also allows a CMM to be used as a very large microscope.



CCTV Monitor System for CMM (optional)



A probe for roughness measurement

SURFTTEST

Probe for surface roughness measurement

Mounting this probe on a CMM enables surface roughness measurement and analysis to be included in fully automatic CNC measurement cycles. This probe is compatible with an automatic probe changer, and therefore can be automatically replaced with another type of probe for 3D coordinate measurement. A wide variety of roughness analyses can be performed using the dedicated evaluation program.



Touch-trigger probes

TP7M



High accuracy touch-trigger probe

This high-accuracy touch-trigger probe has an excellent repeatability figure of $2\sigma \leq 0.25 \mu\text{m}$. A long stylus, up to 150 mm in length, can be installed.

TP200



Compact high-accuracy touch-trigger probe

This compact, high accuracy, touch-trigger probe is only 13.5 mm in diameter, making it an ideal choice where high-accuracy measurement inside narrow or shrouded workpiece features is needed. Styli auto-changing (optional) is supported.

TP20



Compact touch-trigger probe

This compact touch-trigger probe is only 13.2 mm in diameter, making it an ideal choice for probing deep inside narrow or shrouded workpiece features. Styli auto-changing (optional) is supported when mounted on a CNC CMM.

Coordinate Measuring Machines

Precision measuring technology in three dimensions

MH20i

Touch-trigger probe with manual probe head

This touch-trigger probe equipped with a manual probe head is designed for use with manual CMMs. The probe head may be manually indexed to 168 positions.



MH20

Touch-trigger probe with manual probe head

This touch-trigger probe equipped with a manual probe head is designed for use with manual CMMs. The probe head can be manually positioned to the desired orientation.



PH20

5-axis control touch-trigger system

Thanks to unique "head touches", it is possible to measure by movement of the probe head itself instead of moving the CMM elements. Also, measuring time can significantly be shortened by means of 5-axis concurrent control and stepless positioning angle.



Probe heads

PH10M/10MQ

Motorized probe heads

These heads allow automatic control of positioning (up to 720 directions) of the mounted probe. It is possible to mount not only a touch-trigger probe but also any scanning probe, vision probe, laser probe, screw-thread depth probe, etc. Auto-changing is available (optional).



▲ Mounting example of touch-trigger probe

MIH

Manually indexable head

This probe head allows manual positioning (up to 720 directions) of the mounted probe (for TP200/TP20/TP2-5W). A probe extension of up to 300 mm in length can be attached.



▲ Mounting example of touch-trigger probe

PH1

Manual probe head

This manual probe head is designed for use with the TP200/TP20 touch-trigger probes.

The attached probe is manually positioned in the desired orientation to suit the measuring task.

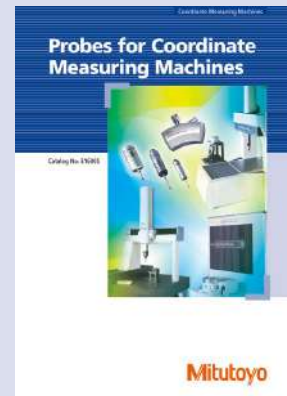


▲ Mounting example of touch-trigger probe

PH6M

Fixed probe head

A fixed probe head with autojoint connector for use with TP7M or SP25M.

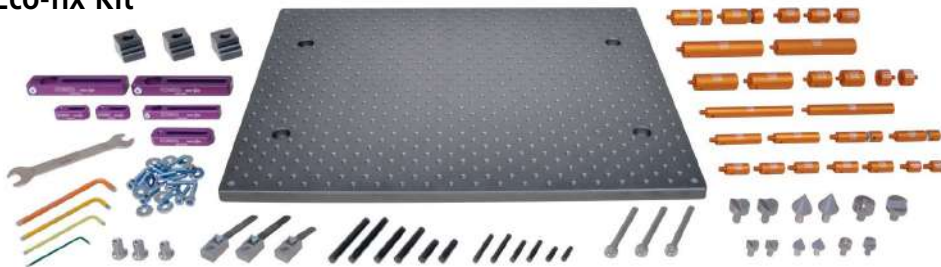


Refer to the Probes for Coordinate Measuring Machines Brochure (E16005) for more details.

Clamping System

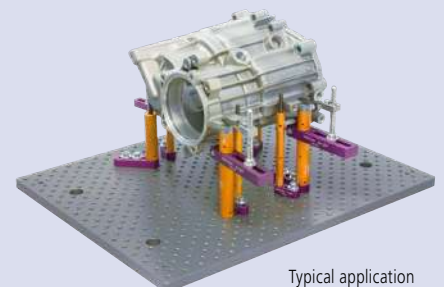
- A workpiece can be mounted on a CMM's measuring table using a variety of combinations of **Eco-Fix** clamping components. A dedicated fixturing jig is not necessary.
- Economical starter kits "**Eco-fix Kit S**" and "**Eco-fix Kit L**" are available as shown below.
- Using the optional receiver plate set relieves you of the trouble of positioning the workpiece.

Eco-fix Kit



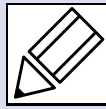
Eco-fix Kit L

Receiver plate set (optional)



Typical application

Quick Guide to Precision Measuring Instruments



Coordinate Measuring Machines

Performance Assessment Method of Coordinate Measuring Machines

Regarding the performance assessment method of CMM, a revision of ISO 10360 Series was issued in 2003, and was partially revised in 2009. The following describes the standard inspection method including the revised content.

Table 1 ISO 10360 Series

| | Item | ISO Standard No. | Year of issue |
|---|--------------------------------|------------------|---------------|
| 1 | Terms | ISO 10360-1 | 2000 |
| 2 | Length measurement | ISO 10360-2 | 2009 |
| 3 | Rotary table equipped CMM | ISO 10360-3 | 2000 |
| 4 | Scanning measurement | ISO 10360-4 | 2000 |
| 5 | Single/Multi-styli measurement | ISO 10360-5 | 2010 |
| 6 | Software inspection | ISO 10360-6 | 2001 |

Maximum Permissible Length Measurement Error $E_{0, MPE}$ [ISO 10360-2: 2009]

Using the standard CMM with specified probe, measure 5 different calibrated lengths 3 times each in 7 directions within the measuring volume (as indicated in Figure 1), making a total of 105 measurements.

If these measurement results, including the allowance for the uncertainty of measurement, are equal to or less than the values specified by the manufacturer, then it proves that the performance of the CMM meets its specification. The result of OK/NG is required to be judged considering the uncertainties. The maximum permissible error (standard value) of the test may be expressed in any of the following three forms (unit: μm).

$$\begin{aligned}
 E_{0, MPE} (MPE_E) &= A + L/K \leq B \\
 E_{0, MPE} (MPE_E) &= A + L/K \\
 E_{0, MPE} (MPE_E) &= B
 \end{aligned}
 \left\{ \begin{array}{l}
 A: \text{Constant } (\mu\text{m}) \text{ specified by the manufacturer} \\
 K: \text{Dimensionless constant specified by the manufacturer} \\
 L: \text{Measured length (mm)} \\
 B: \text{Upper limit value } (\mu\text{m}) \text{ specified by the manufacturer}
 \end{array} \right.$$

Note: ISO 10360-2: 2009 requires measurement in 4 different directions and recommends measurement parallel to each axis, while ISO 10360-2: 2001 specified the measurement "in 7 arbitrary directions."

The following error definitions were added in ISO 10360-2: 2009.

Maximum Permissible Length Measurement Error / Length Measurement Error when stylus offset is 150 mm $E_{150, MPE}$ [ISO 10360-2: 2009]

In addition to length measurement in 7 directions, ISO 10360-2: 2009 specifies measuring in 2 lines over the diagonal YZ or XZ plane with probe offset as shown in Figure 2.

Note: The stylus offset is set at 150 mm as default.

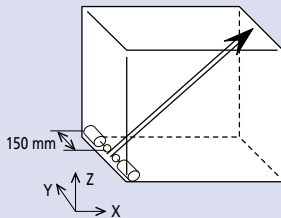


Figure 2 Length measurement error when Z-axis stylus offset is 150 mm

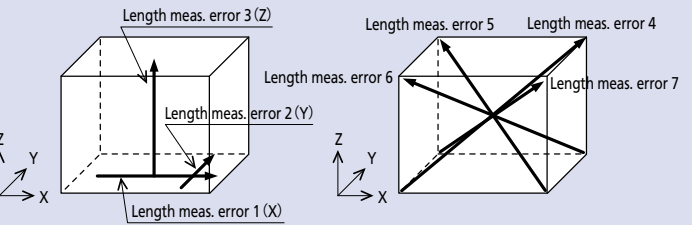


Figure 1 Measuring directions to obtain length measurement error

Maximum Permissible Limit of the Repeatability Range of Length Measurement $R_{0, MPL}$ [ISO 10360-2: 2009]

Calculate the maximum value from the results of three repeated measurements.

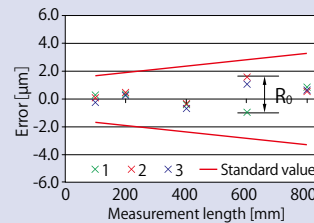


Figure 3 Repeating range of length measurement

Maximum Permissible Radial Four-Axis Error MPE_{FR} , Maximum Permissible Tangential Four-Axis Error MPE_{FT} , and Maximum Permissible Axial Four-Axis Error MPE_{FA} [ISO 10360-3: 2000]

The test procedure under this standard is to place two standard spheres on the rotary table as shown in Figure 4. Rotate the rotary table to a total of 15 positions including 0° , 7 positions in the plus (+) direction, and 7 positions in the minus (-) direction and measure the center coordinates of the two spheres in each position. Then, add the uncertainty of the standard sphere shape to each variation (range) of radial direction elements, connecting direction elements, and rotational axis direction elements of the two standard sphere center coordinates. If these calculated values are less than the specified values, the evaluation test is passed.

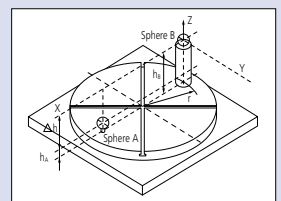


Figure 4 Evaluation of a CMM with a rotary table

Maximum Permissible Scanning Probing Error MPE_{THP} [ISO 10360-4: 2000]

This is the accuracy standard for a CMM if equipped with a scanning probe. The test procedure under this standard is to perform a scanning measurement in 4 planes on the standard sphere and then, for the least squares sphere center calculated using all the measurement points, calculate the radial range (dimension 'A' in Figure 5) within which all measurement points exist. Based on the least squares sphere center calculated above, calculate the radial distance between the calibrated standard sphere radius and the maximum measurement point and the minimum measurement point, and take the larger distance (dimension 'B' in Figure 5). Add an extended uncertainty that combines the uncertainty of the stylus tip shape and the uncertainty of the standard test sphere shape to each A and B dimension. If both calculated values are less than the specified values, this scanning probe test is passed.

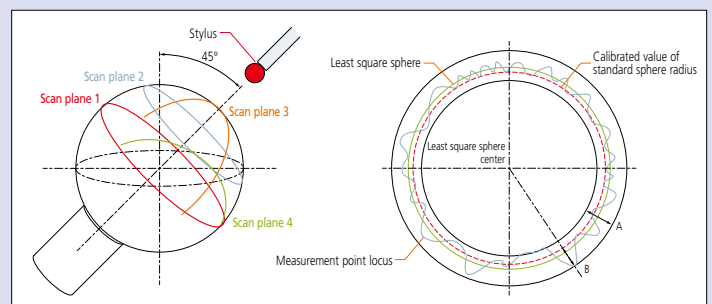


Figure 5 Target measurement planes for the maximum permissible scanning probing error and its evaluation concept

Maximum Permissible Single Stylus Form Error $P_{FTU, MPE}$ [ISO 10360-5: 2010]

This measurement was included in the dimensional measurement in ISO 10360-2: 2001. However, it is specified as "CMMs using single and multiple stylus contacting probing systems" in ISO 10360-5: 2010.

The measurement procedure has not been changed, and the following procedure should be performed.

Measure the defined target points on a standard sphere (25 points, as in Figure 6) and use all the results to calculate the center position of the sphere by the least squares method.

Then, calculate the radial distance from the center position of the sphere by the least squares method for each of the 25 measurement points, and obtain the radial difference $R_{max} - R_{min}$. If this difference, to which a compound uncertainty of forms of the stylus tip and the standard test sphere are added, is equal to or less than the specified value, it can be judged that the probe has passed the test.

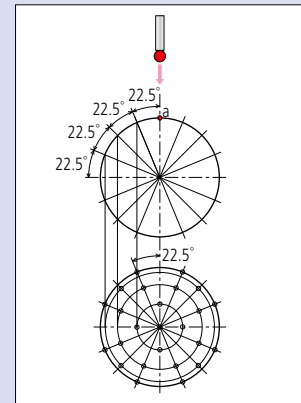


Figure 6 Target points of measurement for Single Stylus Form Error

Measurement Uncertainty of the CMM

Measurement uncertainty is an indication used for evaluating reliability of measurement results.

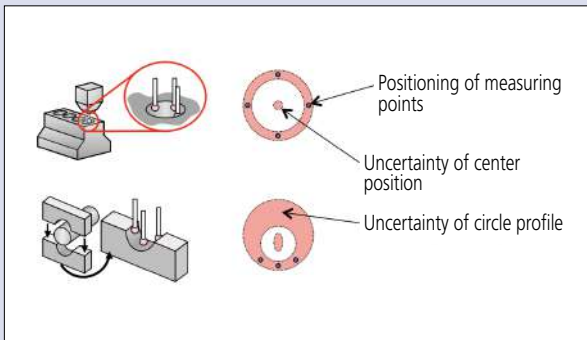
In ISO 14253-1: 1998, it is proposed to consider the uncertainty when evaluating the measurement result in reference to the specification.

However, it is not easy to estimate the uncertainty of the measurement performed by a CMM.

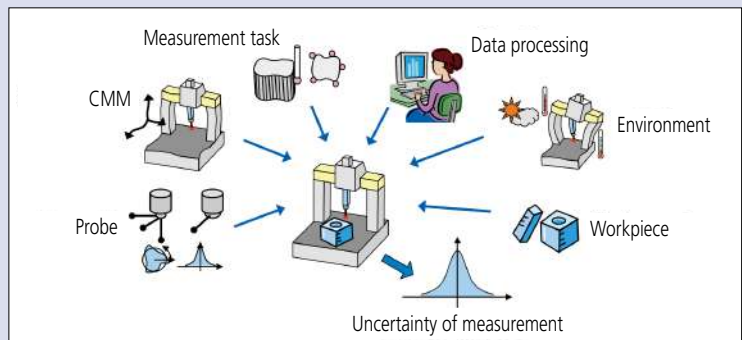
To estimate the uncertainty of the measurement, it is necessary to quantify each source of uncertainty, and determine how it propagates to the measurement result. The CMM is subject to all types of settings that determine how the measurement should be performed, such as measurement point distribution, or datum definition, according to the drawing instruction or operator's intention. This fact makes it harder to detect the sources of uncertainty influencing the result. Taking circle measurement as an example, just a difference of one measurement point and its distribution causes the necessity of recalculation of the uncertainty.

Also, there are many sources of uncertainty to be considered with the CMM and their interactions are complex.

Because of the above, it is almost impossible to generalize on how to estimate measurement uncertainty of the CMM.



Example of circle measurement by CMM



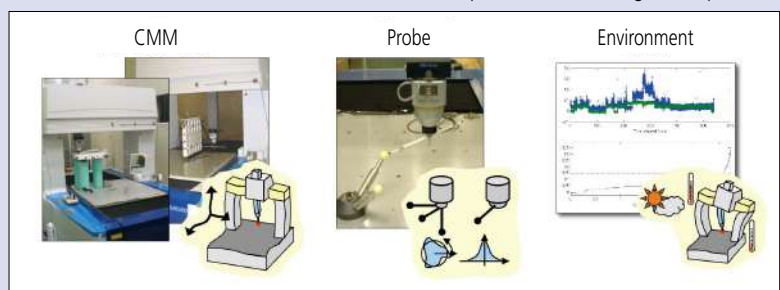
Major contributions that cause uncertainty in CMM measurement results

Measurement uncertainty of the CMM and the Virtual CMM software

The Virtual CMM software* enables straightforward, automated estimation of the measurement uncertainty of a CMM. The software simulates a CMM on a PC based on its machine characteristics and performs virtual (simulated) measurements. The simulated measurements are performed according to the part program created by the machine operator. The machine's performance is evaluated from experimental values based on geometrical characteristics of the actual machine, probing characteristics, and temperature environment, etc., and the measurement uncertainty of the CMM is estimated by the software package.

ISO15530 Part 4 (ISO/TS 15530-4 (2008)) defines how to verify the validity of task-specific measurement uncertainty using computer simulations.

Virtual CMM conforms to this specification.



Quantification of CMM uncertainty elements by experiment

* Virtual CMM is a software package originally developed by PTB (Physikalisch-Technische Bundesanstalt).

Relevant parts of ISO 15530: Geometrical Product Specifications (GPS) – Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement –

Part 3: Use of calibrated workpieces or measurement standards

Part 4: Evaluating task-specific measurement uncertainty using simulation [Technical Specification]

Corporate Overview



Domestic Network



Overseas Network



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| Download service at Mitutoyo website | U-13 |

Domestic Network

Providing the highest quality services is our mission. In order to support a broad range of customer needs, Mitutoyo is strengthening its network to enable support to be provided even more quickly and effectively. We are expanding our circle of trust with customers through our integrated service system, which ranges from consultations and proposals to after-sales support.



Sendai Sales Office



Utsunomiya Sales Office



Suwa Sales Office



Osaka Sales Office



Fukuoka Sales Office



Kawasaki Plant



Tsukuba Laboratory



Utsunomiya Operations



Kiyohara Plant



- Headquarters
- Sales
- Service Center
- Calibration Center
- M³ Solution Center
- Mitutoyo Institute of Metrology
- Research and Development
- Manufacturing



Headquarters

Headquarters

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Tsukuba Resident Office TEL: (029) 839-9139

Niigata Sales Office

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Mitutoyo's global sales and service network

Mitutoyo helps improve product quality through measurement.





■ Mitutoyo Group Companies
■ Agents/Distributors

For more information about Mitutoyo Group Companies and Agents/Distributors, refer to the website below:
<https://www.mitutoyo.co.jp/global.html> (See also page U-14)



M³ Solution Center

M³ = Mitutoyo, Measurement, Metrology

Specialists in each field meet each customer's needs in detail

In order to meet the precise needs of customers, Mitutoyo has built a domestic sales network. Along with strengthening the company's ability to rapidly and accurately satisfy customer needs, the company has also built an extensive after-sales network. Mitutoyo has also created its M³ Solution Centers that are specifically designed to address measurement-related challenges from customers. Here, effective solutions to out-of-the ordinary requirements can be found through demonstrations of the company's products, and latest technology, in combination with consultations with Mitutoyo's metrology experts.

M³ Solution Center-Illinois (U.S.A.)



M³ Solution Center Ingolstadt (Germany)



Mitutoyo Canada Inc. (Canada)



M³ Solution Center TOULOUSE (France)



Through M³ Solution Centers across the world, we offer optimum measuring solutions to our customers.

In recent years, as the reduction of lead times has become a major theme in manufacturing, in the category of large measuring equipment such as coordinate measuring machines, including car body CMMs and form measuring instruments, demand for CNC machines (computer numerical control automated measuring machines) has been rising. Moreover, along with a similar increase in demand for 3D CAD, non-contact measurement using laser sensor probes has become common for 3D measuring machines. By providing M³ Solution Centers in various locations across the world, Mitutoyo is in a position to propose the use of its technologies in the fields of hardware, software, sensors, automatic control, handling systems, and the various types of tools, combined with thirdparty technologies, to answer customers' issues relating to advanced measurement.

A network spanning Japan, Asia, Europe, and America provides solutions to all kinds of problems on a global basis.

Our mission is to provide optimum solutions tailored to the measurement-related needs of our customers in a speedy and accurate manner. In order to effectively respond to the various requests and tasks given us by customers all around the world, Mitutoyo has set up M³ Solution Centers that promote our measuring technologies to a worldwide audience. Our collaborative network, which spans Japan, Asia, Europe, and America, allows us to respond to needs on a global basis.

M³ Solution Center Taichung (Taiwan)



M³ Solution Center (Singapore)



MSA Gurgaon Technical Center (India)



M³ Solution Center (South Korea)



Measuring instrument accompanied with an inspection certificate

As part of quality assurance, Mitutoyo will attach data at the time of factory shipment*1 to the products listed in page U-12.*2 Also, if calibration of the measuring instrument is requested at the time of purchase, we will issue, at a separate charge, a calibration certificate that proves traceability with the reference gage. If you wish to request calibration, please contact your local Mitutoyo sales office.

- *1 For some products whose purchase date cannot be identified, the inspection data at the time of factory shipment cannot be used in the calibration certificate. For details, please contact your local Mitutoyo sales office.
- *2 The products are listed in the series name. There are some models that will not be accompanied with an inspection certificate.



- For the details of the inspection items to be included in the inspection certificate, please contact your local Mitutoyo sales office.
- If you have a request on inspection items, contact your local Mitutoyo sales office.



| CERTIFICATE OF INSPECTION / 検査成績書 | | Issue No./発行番号 |
|---|---------------------------------|---|
| 1. Item/対象製品 Product name/品名: Digimatic Micrometer Model/型号: MDC-23MX Code No./コード番号: 293-140-30 | | 16007087 |
| 2. Result of Inspection/検査結果 Inspection standard: Mitutoyo standard | | Measuring Range/測定範囲: 0-25 mm Permissible Error/許容誤差: 0.00 μm Serial No./製造番号: 44901007 |
| Performance/性能 | | Standard temperature/標準温度: 20 °C |
| Flatness of measuring face / 平面度 | Avril / アブリル Spindle / スピンドル | Permissible error / 許容誤差 Measured value / 測定値 |
| Parallelism of measuring faces / 平行度 | | |
| Measuring length / 測定長 (mm) | Permissible error / 許容誤差 | Error / 偏差 Uncertainty of measurement / 測定の不確かさ |
| 0.00 | 0 | 0 |
| 4.50 | ± 1 | U = 1.1 (k=2) |
| 12.50 | | |
| 17.50 | | |
| 19.50 | | |
| 25.00 | | |
| Traceability to: NMJ/AIST by JCSS No.0030.NIST via No.082/20099 12° No.021/214303 07 PTB via No.503087B14* | | |
| 3. Judgment / 総合判定: Passed / 合格 | | |
| 4. QC Manager / 検査責任者: [Signature] | | |
| Mitutoyo Corporation | | |

QuantuMike
293-140-30



| CERTIFICATE OF INSPECTION / 検査成績書 | | Issue No./発行番号 |
|--|------------------------|---|
| Product name/品名: Digimatic Caliper/ディジタリックノギス Model/型号: 500-702-20 Code No./コード番号: 50070220 | | 42770394 |
| Measuring range/測定範囲: 0-150mm Minimum indicator/最小指示量: 0.001mm Standard temperature/標準温度: 20°C | | Measuring Range/測定範囲: 0-150 mm Permissible Error/許容誤差: 0.001 mm Serial No./製造番号: 00000000 |
| Inspection standard: Mitutoyo standard | | Standard temperature/標準温度: 20 °C |
| Inspection result/検査結果 | | Accuracy (The error width) / 表示精度 (誤差幅): 2.5 (or less) |
| 1. Result of inspection/検査結果 | | 2. Overall judgment/総合判定: Passed / 合格 |
| (1) Appearance/外觀: Good / 良 | | Chief inspector/検査員: M.Sato |
| (2) Function/機能: Good / 良 | | Mitutoyo Corporation |
| (3) Performance/性能 | | |
| Characteristics/検査項目 | Permissible Error/許容誤差 | Measured Value/測定値 |
| Accuracy (The error width) / 表示精度 (誤差幅) | 2.5 (or less) | 0.9 |

IP67 ABSOLUTE Coolant Proof Caliper
500-702-20



| CERTIFICATE OF INSPECTION / 検査成績書 | | Issue No./発行番号 |
|---|------------------------|--|
| Product name/品名: Digimatic Indicator Model/型号: ID-H0560 Code No./コード番号: 543-563-1E Serial No./製造番号: 15040253 | | 4207485278 |
| Measuring range/測定範囲: 0.0-9.9 mm | | Resolution/最小表示量: 0.001 mm Temperature/温度: 20°C Inspection standard: Mitutoyo Standard |
| 1. Result of inspection/検査結果 | | Unit / 単位: μm |
| (1) Appearance/外觀: Good / 良 | | Permissible Error/許容誤差: 2.5 (or less) |
| (2) Function/機能: Good / 良 | | Measured Value/測定値: 0.9 |
| (3) Performance/性能 | | |
| Characteristics/検査項目 | Permissible Error/許容誤差 | Measured Value/測定値 |
| Accuracy (The error width) / 表示精度 (誤差幅) | 2.5 (or less) | 0.9 |
| 2. Overall judgment/総合判定: Passed / 合格 | | Chief inspector/検査員: M.Sato |
| Mitutoyo Corporation | | |

Digimatic Indicators
543-563



| CERTIFICATE OF INSPECTION / 検査成績書 | | Issue No./発行番号 |
|---|---------------------------------|---|
| 1. Item/対象製品 Product name/品名: Outside Micrometer Model/型号: M11-22 Code No./コード番号: 102-701 | | 1502515A |
| 2. Result of Inspection/検査結果 Inspection standard: Mitutoyo standard (1) | | Measuring Range/測定範囲: 0-25 mm Permissible Error/許容誤差: 0.01 mm Serial No./製造番号: 14364308 |
| Performance/性能 | | Standard temperature/標準温度: 20 °C |
| Flatness of measuring face / 平面度 | Avril / アブリル Spindle / スピンドル | Permissible error / 許容誤差 Measured value / 測定値 |
| Parallelism of measuring faces / 平行度 | | |
| Measuring length / 測定長 (mm) | Permissible error / 許容誤差 | Error / 偏差 Uncertainty of measurement / 測定の不確かさ |
| 0.00 | 0 | 0 |
| 7.00 | ± 2 | U = 1.1 (k=2) |
| 12.50 | | |
| 17.50 | | |
| 22.50 | | |
| 25.00 | | |
| Traceability to: NMJ/AIST by JCSS No.0030.NIST via No.082/20099 12° No.021/214303 07 PTB via No.503087B14* | | |
| 3. Judgment / 総合判定: Passed / 合格 | | |
| 4. QC Manager / 検査責任者: [Signature] | | |
| Mitutoyo Corporation | | |

Ratchet Thimble Micrometer
102-701

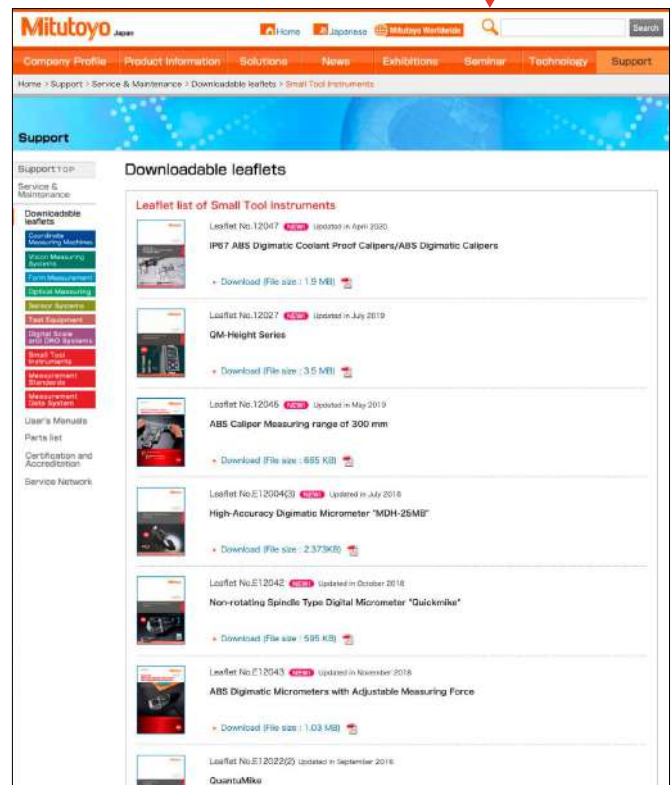
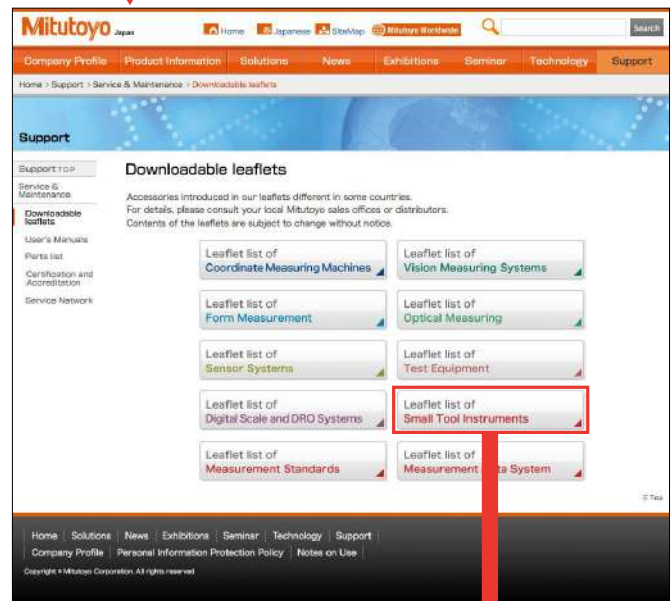
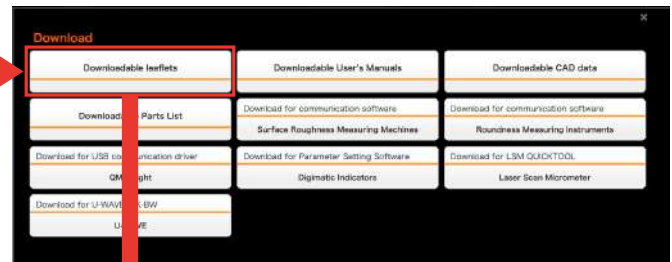
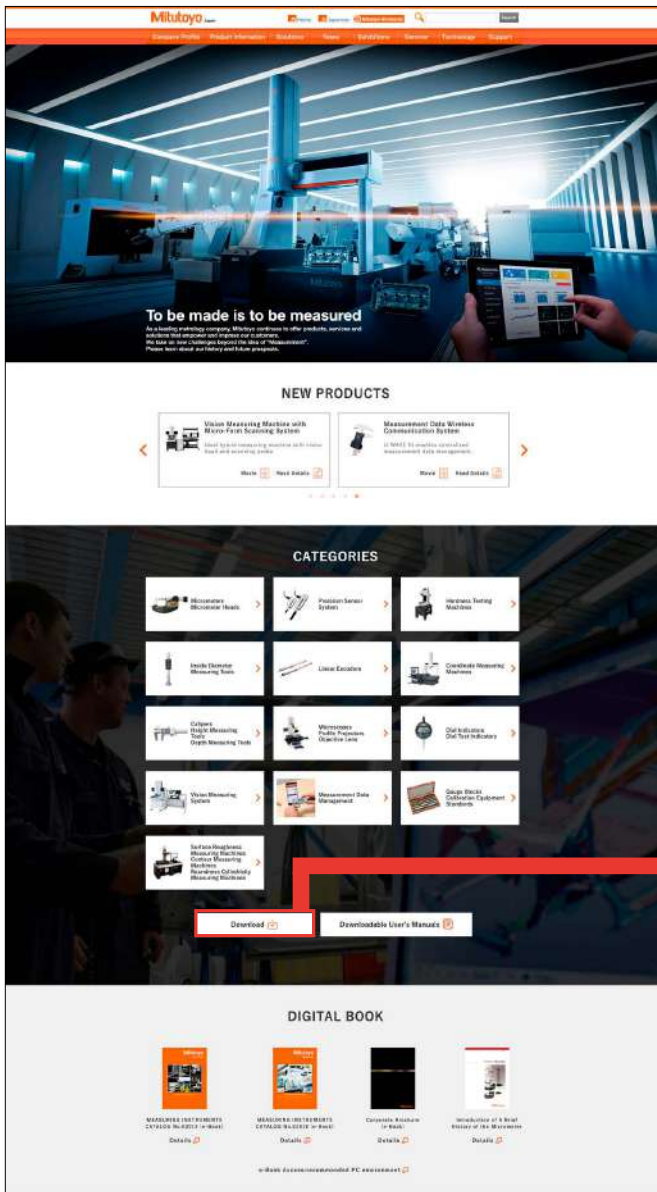
| | Products Name | Page |
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| Micrometers (only for models with the range of 0 to 25 mm and 25 to 50 mm) | High-Accuracy Digimatic Micrometer | B-3 to B-4 |
| | QuantuMike | B-5 to B-6 |
| | Coolant Proof Micrometers | B-7 to B-8 |
| | Digimatic Outside Micrometers | B-9 |
| | Outside Micrometers | B-13 |
| | Ratchet Thimble Micrometer | B-14 |
| | Outside Micrometers | B-15 to B-16 |
| Inside Diameter Measuring Tools | Digimatic Holtest | C-3 to C-6 |
| | Holtest | C-7 to C-10 |
| | Holtest (Type II) | C-11 to C-12 |
| | ABSOLUTE Borematic | C-13 to C-16 |
| | Inside Micro Checker | C-26 |
| Calipers | IP67 ABSOLUTE Coolant Proof Caliper | D-3 to D-4 |
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| High Precision Height Measuring Tools | Linear Height | D-51 to D-52 |
| | QM-Height | D-53 to D-54 |
| Depth Gages | Depth Micro Checker | D-61 |
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| | ZERO CERA Blocks | E-6 |
| | Metric/Inch Rectangular Gauge Block Sets | E-7 to E-10 |
| | Micrometer Inspection Gauge Block Sets | E-11 to E-12 |
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| | ABSOLUTE Digimatic Indicator ID-SX | F-5 to F-6 |
| | ABSOLUTE Digimatic Indicator ID-CX | F-7 to F-9 |
| | ABSOLUTE Digimatic Indicator ID-N/B | F-10 to F-11 |
| | ABSOLUTE Digimatic Indicator ID-C (Peak-Value Hold Type) | F-12 to F-13 |
| | ABSOLUTE Digimatic Indicator ID-C (Bore Gage Type) | F-14 to F-15 |
| | ABSOLUTE Digimatic Indicator ID-C (Calculation Type) | F-16 to F-17 |
| | ABSOLUTE Digimatic Indicator ID-C (Signal Output Function Type) | F-19 to F-20 |
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| | Digimatic Indicator ID-H | F-22 to F-23 |
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Note: Some products mentioned above will not be accompanied with an inspection certificate as standard.

Download service at Mitutoyo website

Download of the catalog is available from the top page of Mitutoyo website by the following procedures:

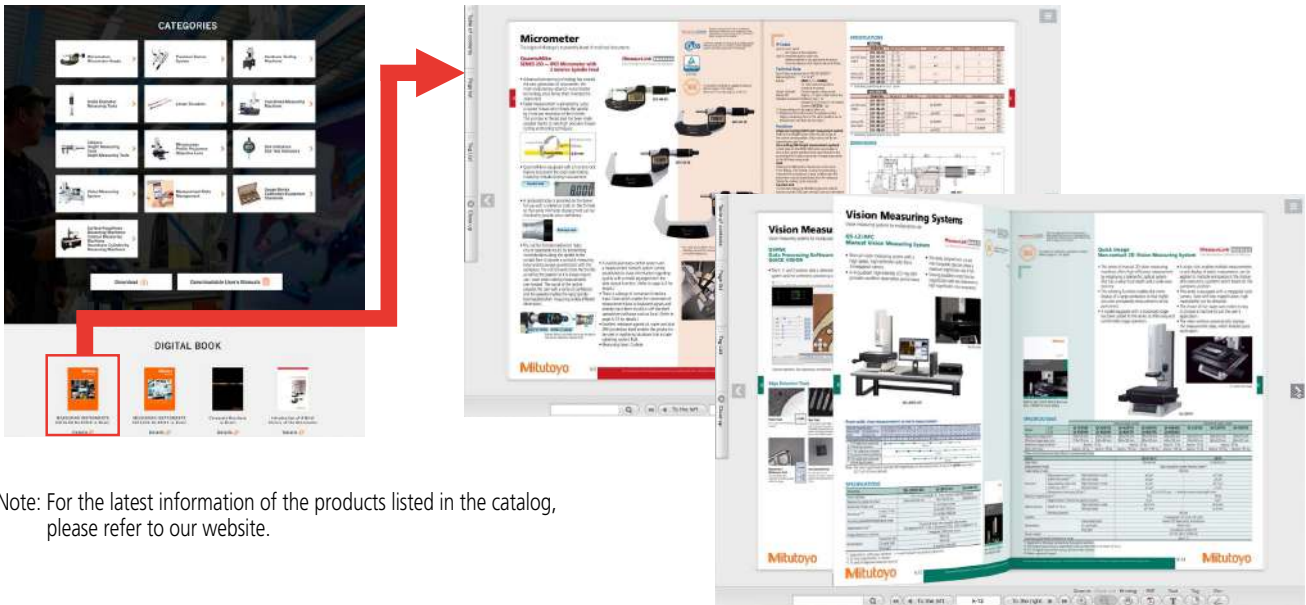


If you are interested in any of our products listed in the General Catalog, please contact your local Mitutoyo sales office referring to page U-5 and U-6, or visit Mitutoyo local corporations website accessing from MITUTOYO Worldwide top page. Also, the catalog can be downloaded in the PDF data (partially excluded) at our website. (See the above image.)

URL: <https://www.mitutoyo.co.jp>

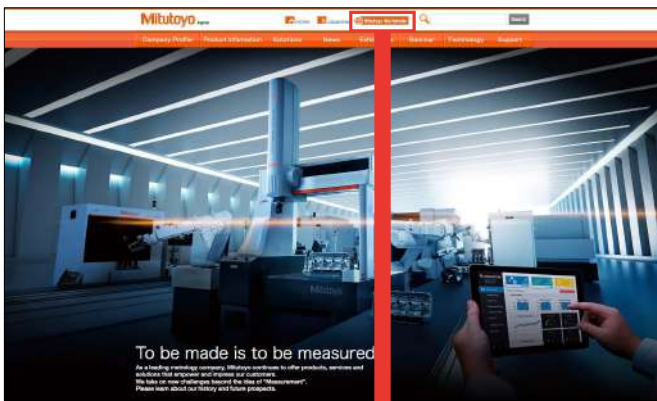
English version of General Catalog digital book

Mitutoyo Measuring Instrument General Catalog is available in the form of digital book at our website. You can look through all pages of the catalog on your screen as though turning pages of a book. Please note that it will require approximately two months after the catalog release until the updated version of the digital book is uploaded.



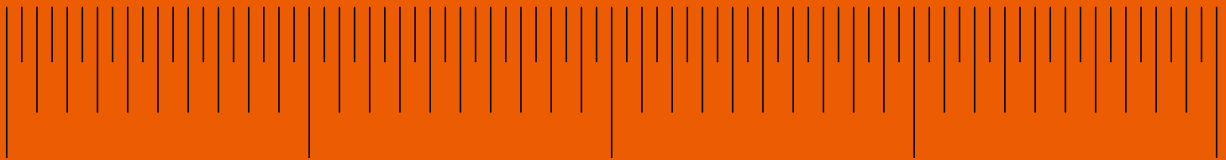
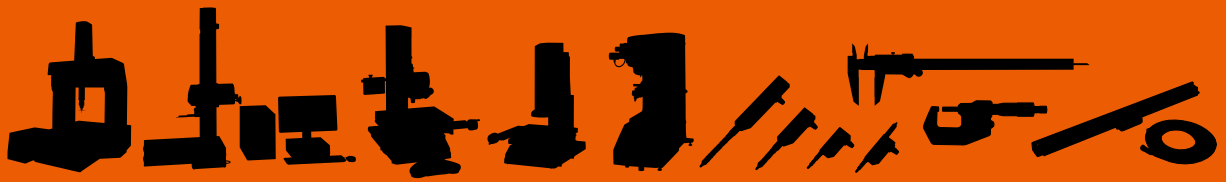
Note: For the latest information of the products listed in the catalog, please refer to our website.

MITUTOYO Worldwide



This page will guide you to each Mitutoyo local corporations.





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