Mitutoyo

Catalogue No. MAP 16

MEASURING INSTRUMENTS CATALOGUE

Mitutoyo Asia Pacific
2016-2017

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.

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.

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.

Appearance and Specifications

Appearance and specifications are subject to change without prior notice for product improvement.
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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Mitutoyo

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For better communication with our customers

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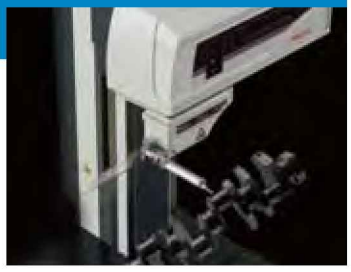
To measure surface roughness, waviness, profile, roundness and straightness

L Surftest
Contracer
Formtracer
Roundtest

L-1 — L-44



To enhance reliability and quality of products

M Hardness Testing Machines

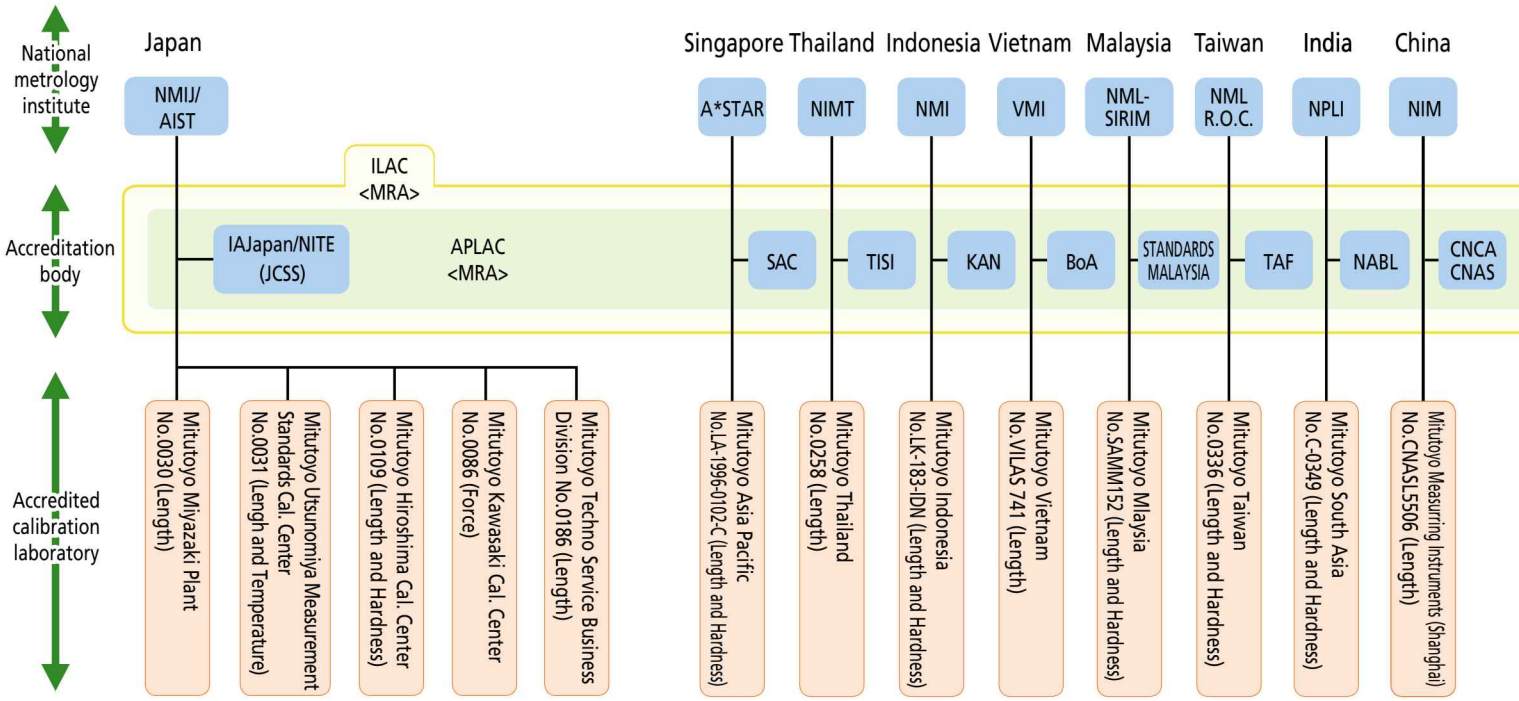
M-1 — M-14

Mitutoyo

Offering Reliable Traceability Worldwide

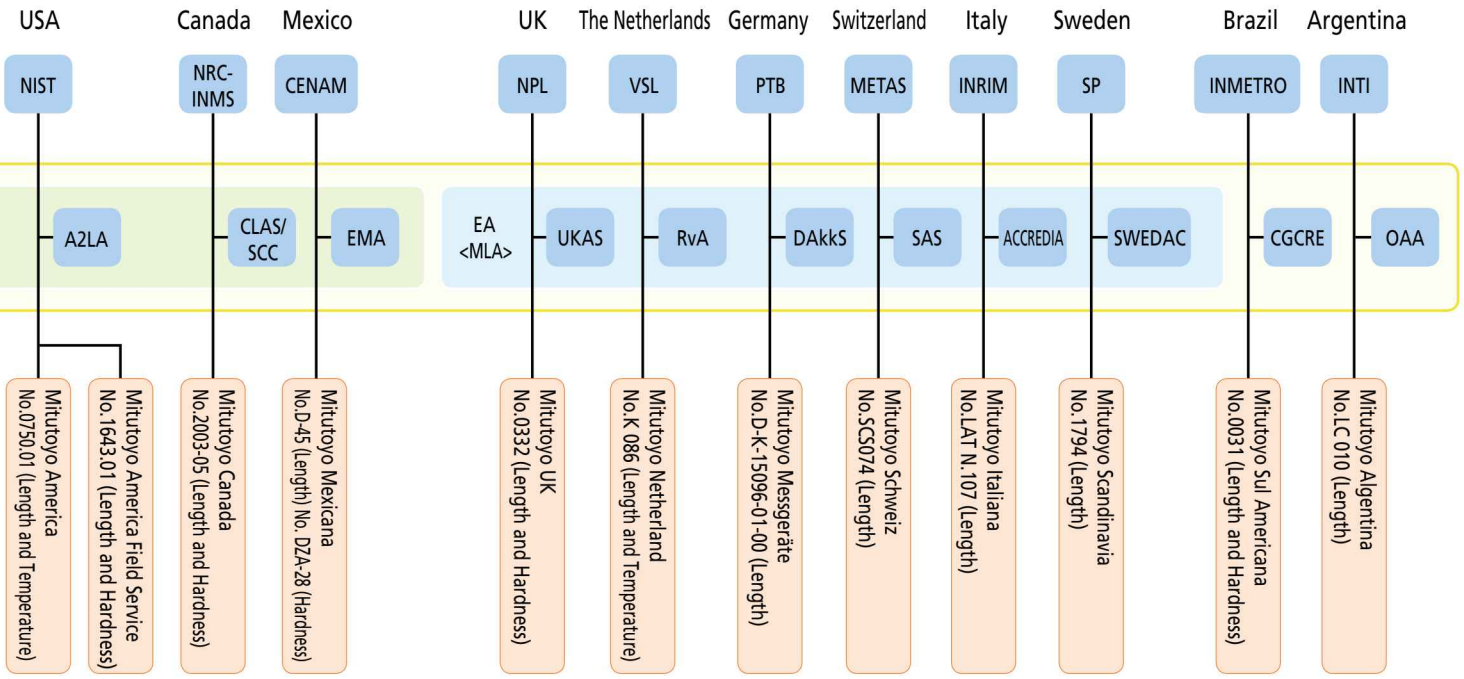
Calibration laboratories worldwide

Mitutoyo has built a network for comprehensive support of calibration of precision measuring products in the global market. To provide calibration services on a global scale, Mitutoyo has calibration laboratories that have received ISO/IEC 17025 certification, an international standard, from accredited organizations in each of the countries in which Mitutoyo operates in Japan and abroad.



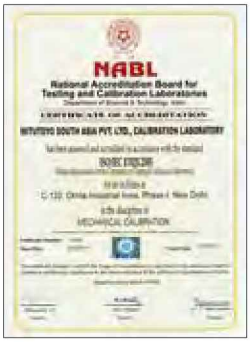
- Japan
  - AIST :National Institute of Advanced Industrial Science and Technology
  - NMIJ :National Metrology Institute of Japan
  - IAJapan :International Accreditation Japan
  - NITE :National Institute of Technology and Evaluation
  - JCSS :Japan Calibration Service System
- Singapore
  - A*STAR :Agency for Science, Technology and Research
  - SAC :Singapore Accreditation Council
- Thailand
  - NIMT :National Institute of Metrology (Thailand)
  - TISI :Thai Industrial Standard Institute
- Indonesia
  - NMI :Puslit Metrologi-LPI
  - KAN :Komite Akreditasi Nasional
- Vietnam
  - VMI :Vietnam Metrology Institute
  - NABL :BUREAU OF ACCREDITATION
- Malaysia
  - NML-SIRIM :National Metrology Laboratory-Standards and Industrial Research Institute of Malaysia
  - STANDARDS MALAYSIA :Department of Standards Malaysia
- Taiwan
  - NML R.O.C. :National Measurement Laboratory R.O.C.
  - TAF :Taiwan Accreditation Foundation
- India
  - NPLI :National Physical Laboratory of India
  - NABL :National Accreditation Board for Testing and Calibration Laboratories
- 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 Assesment
- USA
  - 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.
- UK
  - NPL :National Physical Laboratory
  - UKAS :United Kingdom Accreditation Service
- The Netherland
  - VSL :Van Swinden Laboratorium
  - RvA :Raad voor Accreditatie
- Germany
  - PTB :Physikalisch-Technische Bundesanstalt
  - DAkkS :Deutsche Akkreditierungsstelle GmbH

Note: The above are domestic and international locations where Mitutoyo provides ISO/IEC 17025 accredited calibration services.
(As of 18th December, 2015)



- Switzerland
  METAS :Federal Institute of Metrology
  SAS :Swiss Accreditation Service
- Italy
  INRIM :Istituto Nazionale di Ricerca Metrologica
  ACCREDIA :L'ENTE ITALIANO DI ACCREDITAMENTO
- Sweden
  SP :SP Technical Research Institute of Sweden
  OSWEDAC :Swedish Board for Accreditation and Conformity Assessment
- Brazil
  INMETRO :Instituto Nacional de Metrologia Qualidade e Tecnologia
  CGCRE :Coordenação Geral de Acreditação do INMETRO
- Algentina
  INTI :Instituto Nacional de Tecnologia Industrial
  OAA :Organismo Argentino de Acreditación

ILAC :International Laboratory Accreditation Cooperation
APLAC :Asia-Pacific Laboratory Accreditation Cooperation
MRA :Mutual Recognition Arrangement
EA :Europian co-operation for Accreditation
MLA :Multilateral Agreement



Name of each National metrology institutes and Accreditation bodies are based on our survey.

Offering High-level Calibration Services Worldwide

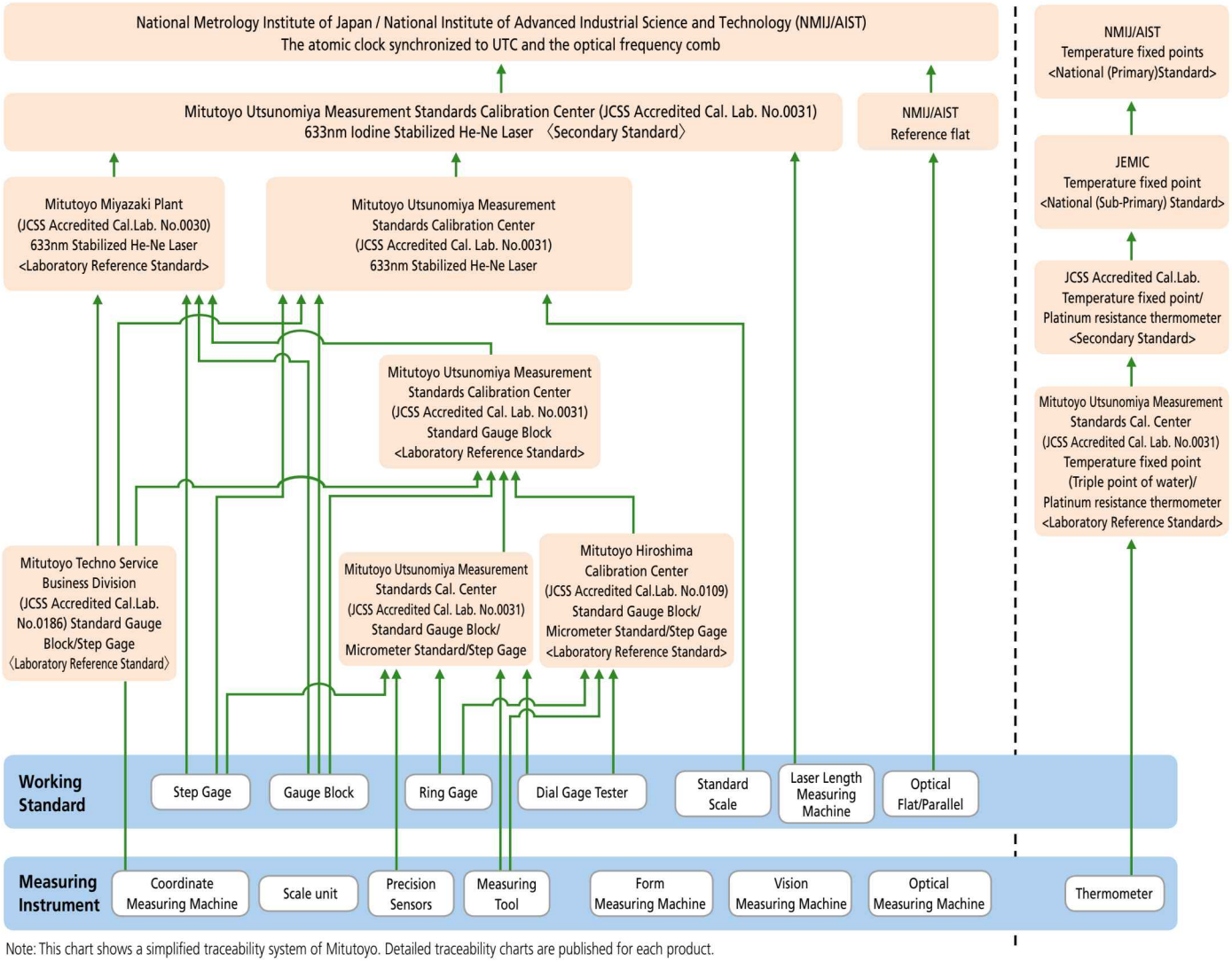
Based on highest measurement capabilities of the same level as national standards

Traceability system

Mitutoyo's traceability system is made possible through an in-house calibration organization certified by the ISO/IEC 17025 international standard, with length standards directly related to national standards (atomic clock synchronized to UTC and the optical frequency comb) at the highest level. National standards are mutually recognized by CIPM, and the certified calibration organization is mutually recognized by ILAC, so that the establishment and maintenance of traceability for Mitutoyo products is achieved both in Japan and globally.

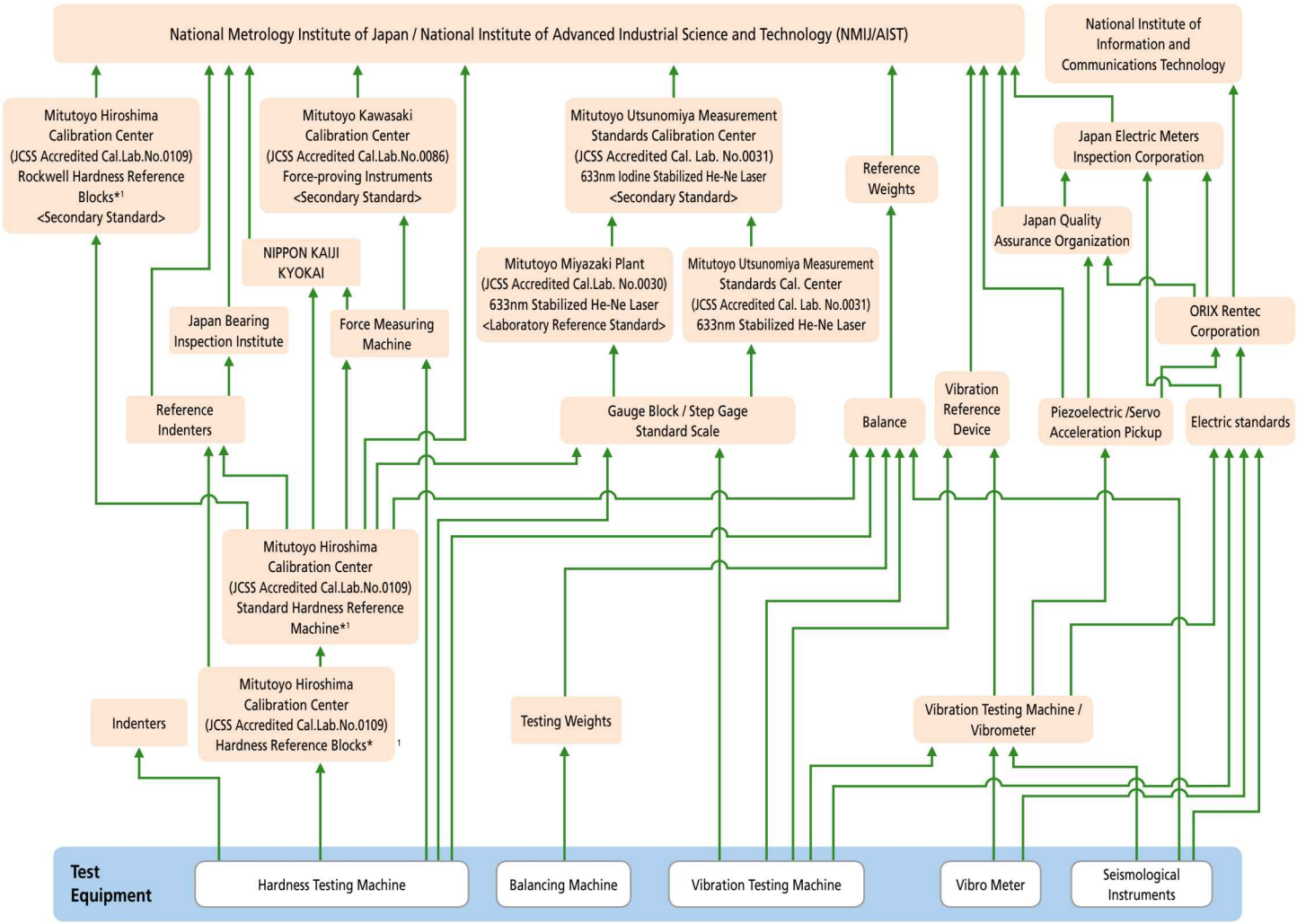
Certificate of JCSS accredited laboratory (Mitutoyo Utsunomiya Measurement Standards Calibration Center)

Traceability of length field



Note: This chart shows a simplified traceability system of Mitutoyo. Detailed traceability charts are published for each product.

Traceability of Test Equipment

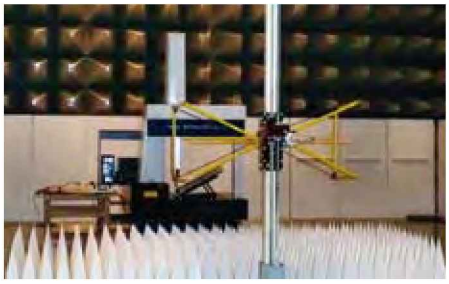


*1 The scope of JCSS accreditation is from 20HRC up to 65HRC in the Rockwell Hardness Testing Machines and the Hardness Reference Blocks.
Note: This chart shows a simplified traceability system of Mitutoyo. Detailed traceability charts are published for each product.
(As of December, 2015)

Conformance to CE Marking

Conformance to CE Marking

In order to improve safety, each plant has programs to comply with the Machinery Directives, the EMC Directives, and the Low Voltage Directives. 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 1 part of a machine that may cause injury to 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 wave or which is influenced by electromagnetic wave from outside.
Low Voltage Directive	Equipment (device) that uses AC voltage of 50 - 1000V or DC voltage of 75 - 1500V.

Response to RoHS Directive

The RoHS Directive*1 restricts the use of chemical substances in Europe.
Certain electronic equipment containing the specified 6 substances (lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE)) over the quantities determined in the Directive have been prohibited for sale in Europe since July 1, 2006.
The RoHS Directive was revised on July 1, 2011. We will continue to contribute to global environment protection and work so all of our products conform to the RoHS Directive.

*1 RoHS Directive: Directive 2011/65/EU of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Response to WEEE Directive

The WEEE Directive*2 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.

*2 WEEE Directive: Directive 2012/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment.

Response to REACH Regulation

REACH Regulation*3 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 (a substance of very high concern (SVHC)) 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.

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

Features of Mitutoyo Small Tool Instruments

High Accuracy Digimatic Micrometer with resolution of 0.0001mm

Resolution: 0.0001mm

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

MDH-25M
0.1 reading µm
High Accuracy
DIGIMATIC MICROMETER

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.

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

IP65

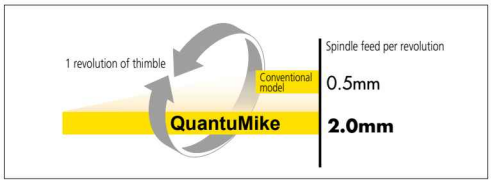
IP66

IP67

IP66

QuantuMike with 2mm/rev Spindle Feed

IP65



Faster measurement is achieved by using a finer thread which feeds the spindle by 2mm per revolution of the thimble instead of the standard 0.5mm. 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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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. Electrostatic, electromagnetic and a combination of electrostatic and optical methods are used in implementing this capability but the key enabling feature is Mitutoyo's patented technology of building absolute positional information into the scale so it can be read at start up. These linear encoders are widely used in Mitutoyo's measuring instruments as the in-built length standard and their use greatly contributes to the generation of highly reliable measurement data in industry, especially in harsh environments where contamination by cutting fluids, coolants and dust must not affect performance.

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 20,000 hours)*2 under normal use.

*1: Unless the battery is removed.
*2: In the case of the ABSOLUTE Digimatic caliper (electrostatic capacitance model).

IP65

IP66

IP67

IP is a trademark of Mitutoyo Corporation.

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 Sø50mm and greater	A Sø50mm object probe shall not fully penetrate enclosure*
2	Protected against solid foreign objects of Sø12.5mm and greater	A Sø12.5mm object probe shall not fully penetrate enclosure*
3	Protected against solid foreign objects of Sø2.5mm and greater	A Sø2.5mm object probe shall not fully penetrate enclosure*
4	Protected against solid foreign objects of Sø1.0mm and greater	A Sø1.0mm 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 degrees	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.

TÜVRheinland CERTIFIED
www.tuv.com
ID 0000006683

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.

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

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.

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.

INDEX FOR APPLICATIONS

STANDARDS

MEASUREMENT OF INSIDE DIMENSIONS

MEASUREMENT OF OUTSIDE DIMENSIONS

ANGLE MEASUREMENT

DEPTH MEASUREMENT

HEIGHT MEASUREMENT

MEASUREMENT OF COMPLEX 3D PARTS

COMPARISON MEASUREMENT

Mitutoyo

STEP MEASUREMENT

MEASUREMENT OF ELASTIC PARTS

MEASUREMENT OF SHEET METALS

NON-CONTACT MEASUREMENT

MULTI-POINT MEASUREMENT

MEASURING INSTRUMENTS TO BE USED AS SENSOR

MEASUREMENT OF FORM (SURFACE ROUGHNESS, ROUNDNESS), SQUARENESS, AND PARALLELISM

MEASUREMENT OF CENTER-TO-CENTER DISTANCES

SCREW THREAD MEASUREMENT

MEASUREMENT OF GEARS

HARDNESS MEASUREMENT

MEASUREMENT ASSOCIATED WITH SEMICONDUCTOR/LCD FABRICATION

Mitutoyo

DIGITAL READOUT AND POSITION FEEDBACK OF MACHINE TOOLS

STATISTICAL PROCESS CONTROL

MEASUREMENT IN ROLL FORMING

NUMERICAL INDEX

Mitutoyo

Mitutoyo

ALPHABETICAL INDEX

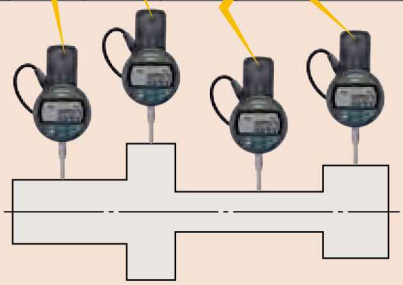
Mitutoyo

Mitutoyo

Mitutoyo

New Products

	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 V2.0

Refer to pages A-10–A-12 for details.

Digimatic Gage / PC Data Input Device

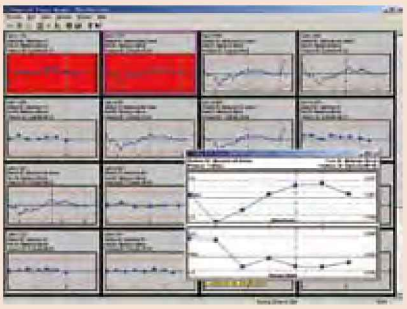
USB Input Tool IT-016U

Refer to page A-6 for details.

Measurement Data Wireless Communication System

U-WAVE

Refer to pages A-7–A-9 for details.

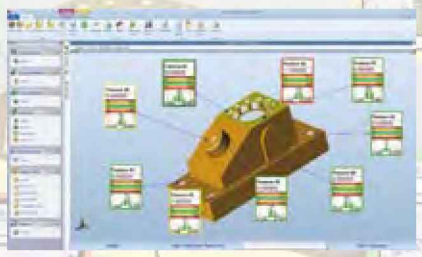


Measurement Data Network System

MeasurLink

Refer to pages A-15–A-19 for details.

Measurement Data Management



INDEX

Example of Measurement Data Management Sy

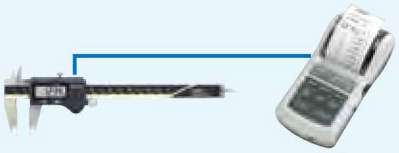
A system for recording and analyzing measurement results from various Mitutoyo measuring instruments for quality assurance purposes.

A

Implementation Step 1

Recording measurement results

No more transcribing



Measurement data can be easily printed. Data can be output to a PC for statistics calculations.

DP-1VR A-13

Direct data input to a PC

Connecting cable-integrated USB-ITN

USB Input Tool Series A-5

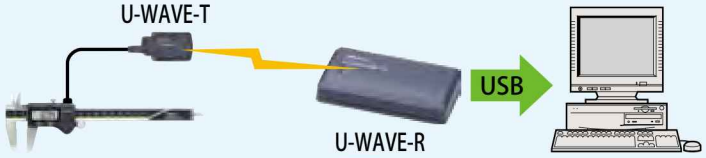
Lineup of three models with different output specifications
IT-012U/IT-016U/IT-007R

Input Tool Series A-6

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

Multiplexer MUX-10F A-14

Wireless

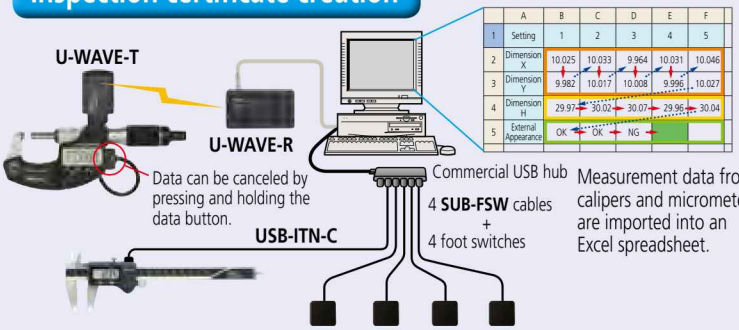


U-WAVE A-7

Implementation Step 2

Software dedicated to inspection and quality control

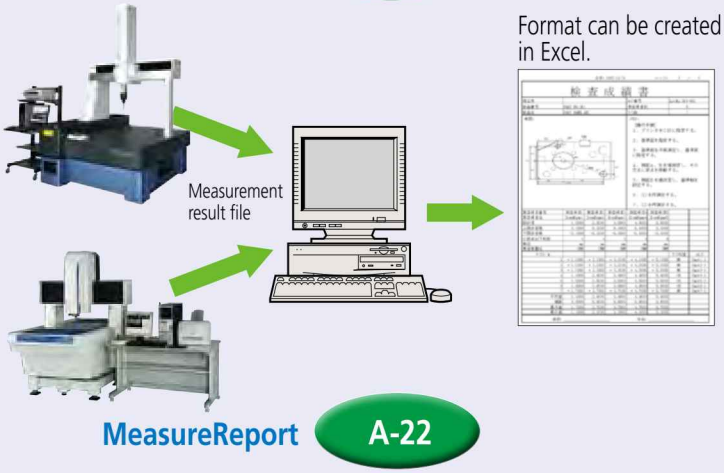
Inspection certificate creation



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

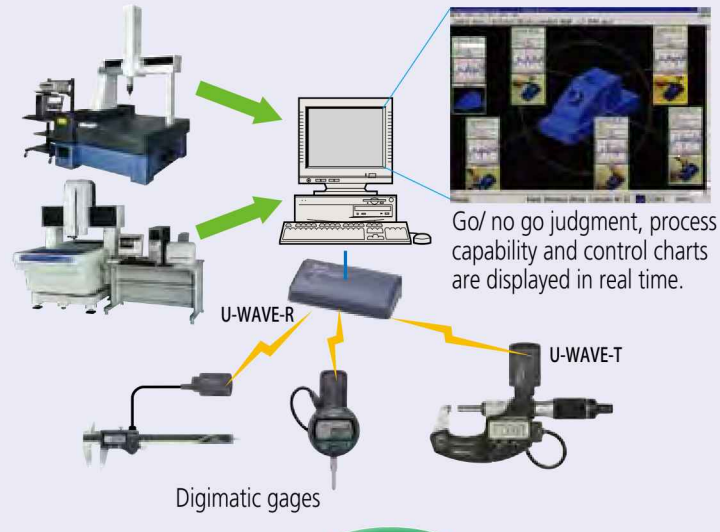
USB-ITPAK A-10

Format can be created in Excel.



MeasureReport A-22

Statistical Process Control



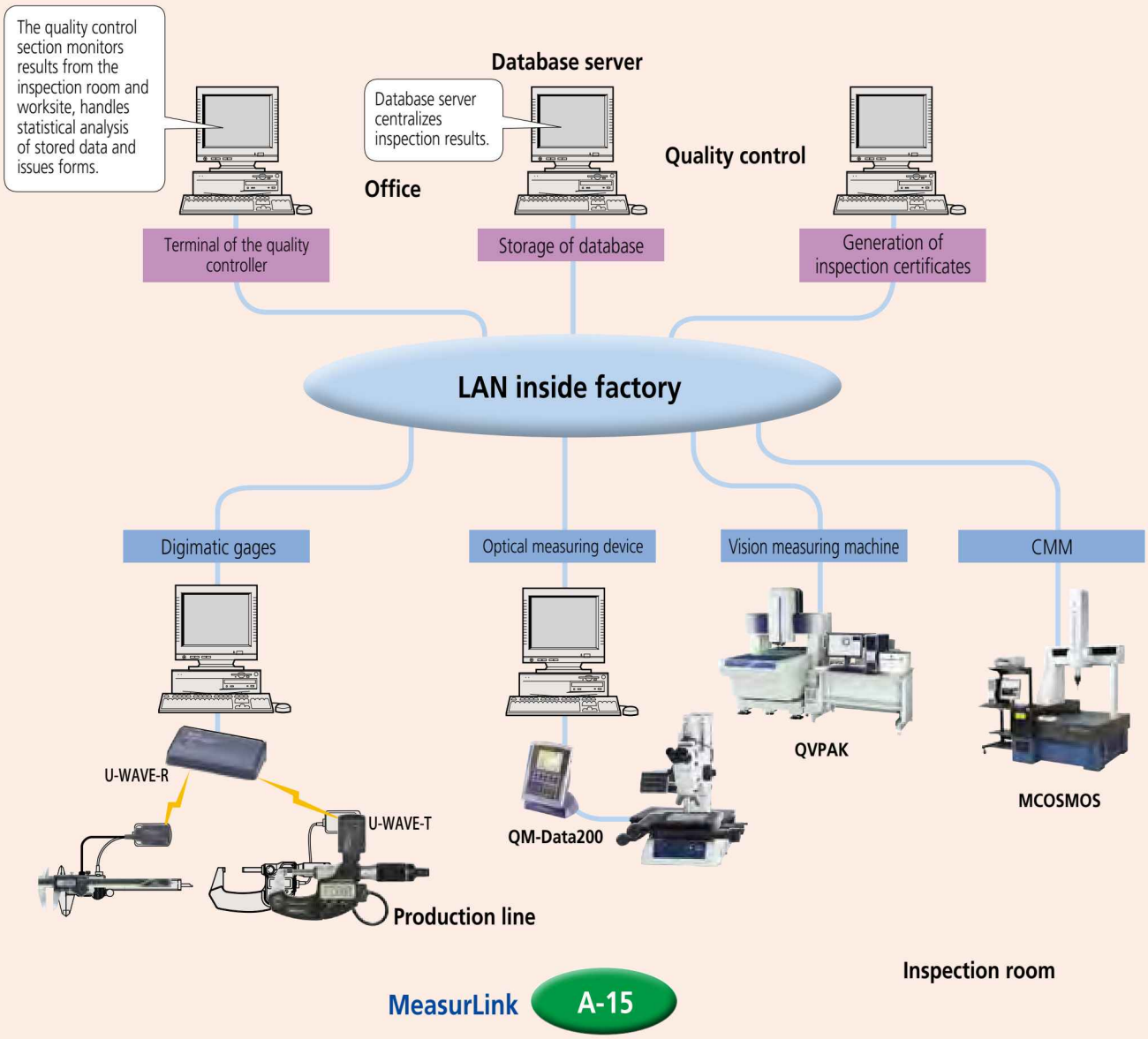
Go/ no go judgment, process capability and control charts are displayed in real time.

MeasurLink A-15

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



MeasurLink A-15

Measurement Data Management

Convenient data collection tool and quality control software

Digimatic Gage / PC Data Input Device
SERIES 264 — USB Input Tool Direct

A

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.

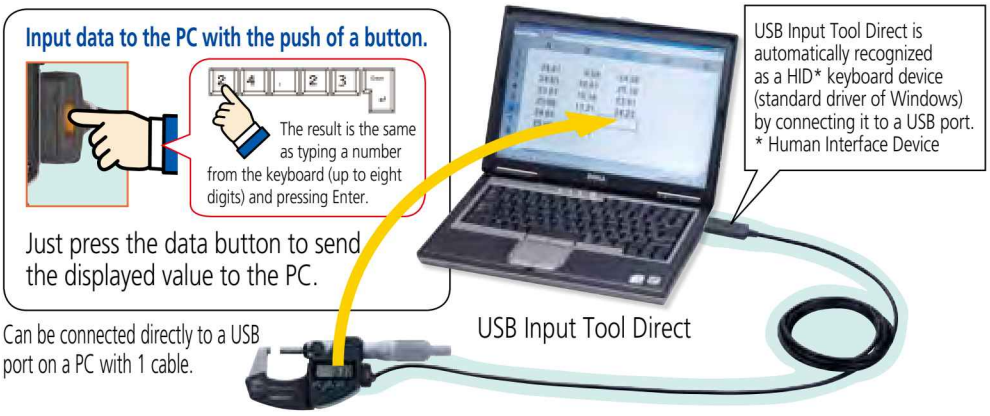
Use USB-ITN standalone as a dedicated interface for digimatic indicators compatible with HID keyboard devices.

In common with the popular model IT-012U, 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-10 to A-12 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 V2.0 to improve the operational efficiency of daily inspections such as sampling tests or complete inspections of mass-produced product.



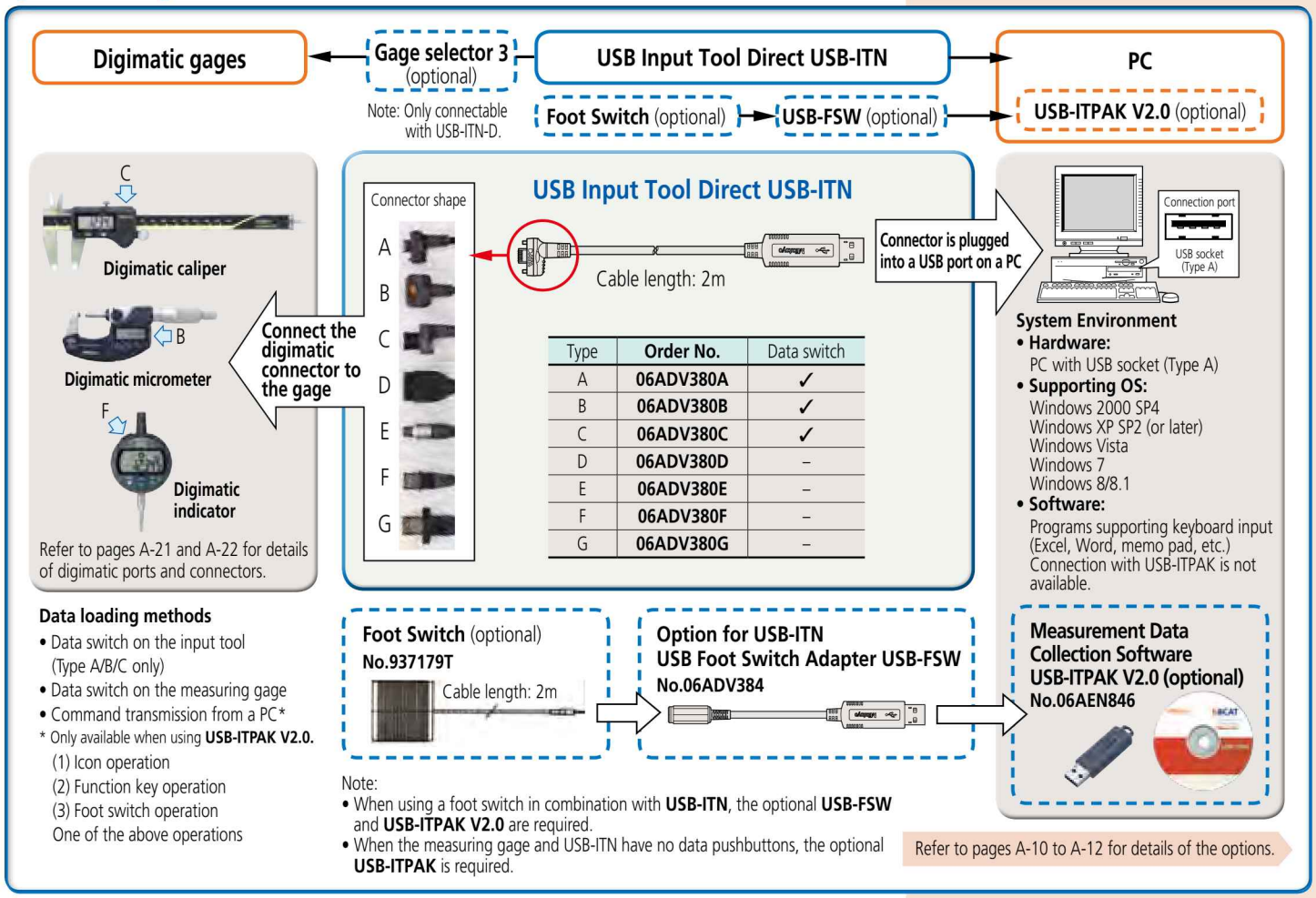

USB-ITN

Main specification

- Output compatibility: USB1.1 and USB2.0
- Supporting driver software: Switchable between 2 items below
  (1) When using standalone: HID keyboard device*
  (2) When using with USB-ITPAK V2.0: Virtual COM port (VCP)
- Communication speed: 12Mbps (Full Speed)
- Power supply: USB bus power
- Mass: 59g
- USB2.0 certificate
- Conforms to EMC Directives.

*Since this device is compatible with Windows standard driver software, dedicated driver software is not required.

System Configuration



Type	Order No.	Data switch
A	06ADV380A	✓
B	06ADV380B	✓
C	06ADV380C	✓
D	06ADV380D	–
E	06ADV380E	–
F	06ADV380F	–
G	06ADV380G	–

Refer to pages A-10 to A-12 for details of the options.

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

USB Keyboard Signal Conversion Type IT-016U / IT-007R

The IT-012U, a popular USB input tool that enables easy data recording, has been upgraded. For the same price, usability is improved with extended functionality to help you do inspection work more efficiently.

IT-016U

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 ø4mm to ø18mm. Durability of the push button increases from 1 million to 10 million operations.
- May be used with optional software USB-ITPAK V2.0. Enables efficient routine inspection work, for example, in mass production.

RS-232C Communication Conversion Type IT-007R

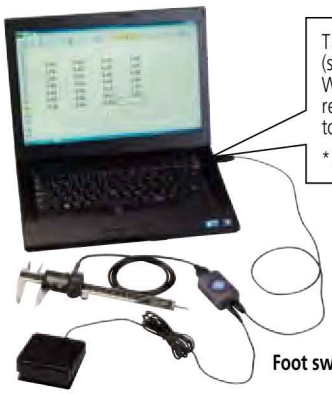
Input tool for RS-232C communication best suited for communication control of the software!

IT-007 R

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

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.



Foot switch

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

* HID (Human Interface Device)

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 V2.0: Virtual COM port (VCP)
Communication speed: 12Mbps (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.

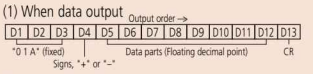
Specifications of IT-007R RS-232C Communication

- Output specification: RS-232C compliant

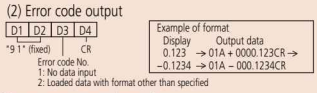
Communication method: Full duplex
Communication speed: 2400bps (fixed)
Bit configuration: Start bit 1
Data length 8
(Most significant bit, 0 (fixed))
Parity, None
Stop bit 1
Flow control: None
Home position: DCE (modem definition)

- Data format

(1) When data output



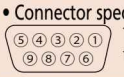
(2) Error code output



- Data request signal

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

- Connector specification and power supply from the PC

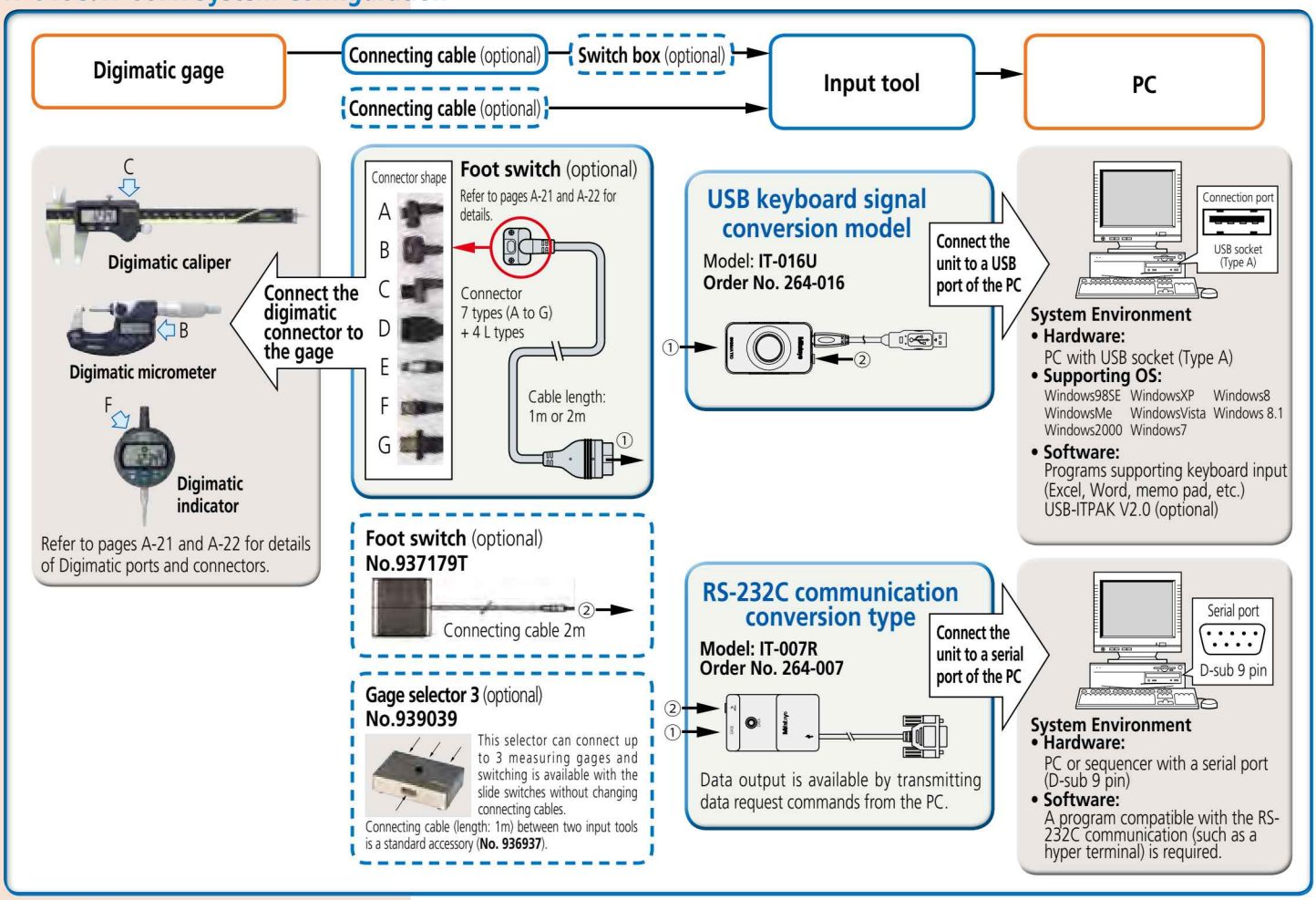


This product operates while accumulating the power supplied from the PC. A second or more input interval is required.

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

IT-016U/IT-007R System Configuration



Mitutoyo

Measurement Data Management

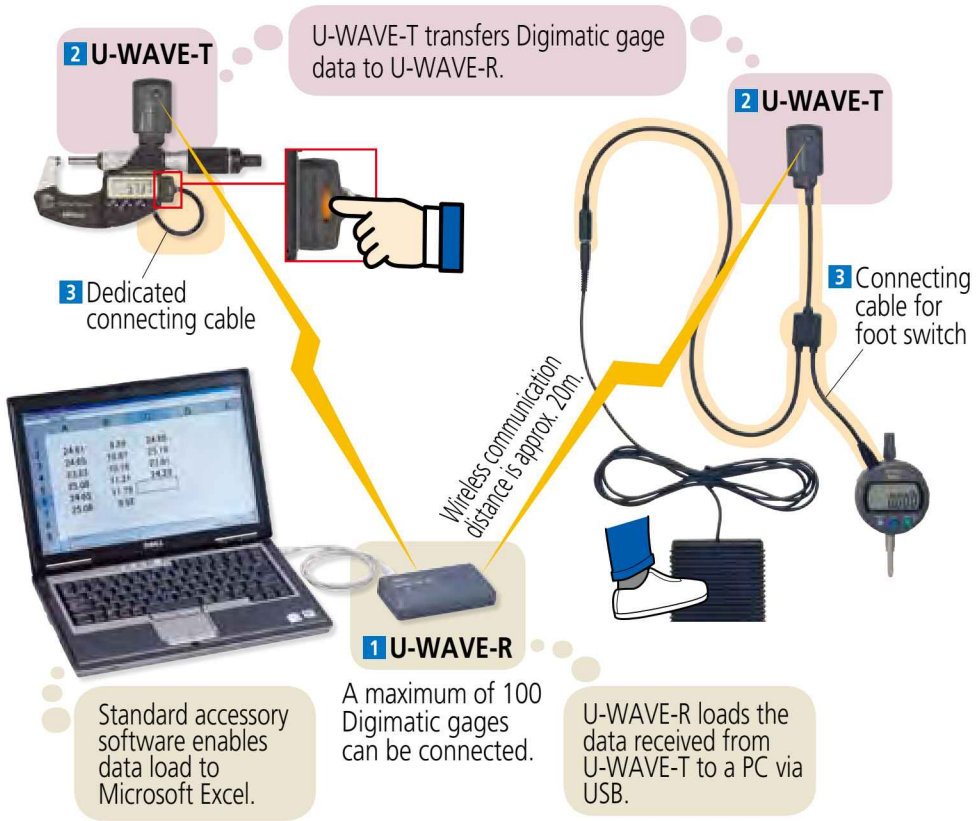
Convenient data collection tool and quality control software

Measurement data wireless communication system U-WAVE

A

- 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 V2.0 supports U-WAVE
  Loading multiple measurement data into separate Excel sheets, or simultaneous measurement using the special event drive is now available without the need for macro programming. (Automatic loading in a certain interval is available with the timer function.)

U-WAVE system configuration



Data from Digimatic gages can be loaded to a PC easily by using items 1 to 3 below.

1 U-WAVE-R

Receives data from U-WAVE-T and loads to a PC via USB.

Model	U-WAVE-R
Order No.	**02AZD810D**
Power supply	USB bus power system
Number of U-WAVE-R units that can be connected to one PC	Up to 16
Number of U-WAVE-T units that can be connected	Up to 100
External dimensions	140×80×31.6mm
Mass	130g

U-WAVE-R main unit

USB2.0 cable (1m) attached

U-WAVEPAK

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*

* Revision history (U-WAVEPAK)
  Ver1.010 or later is compatible with 32/64-bit OS.
  Ver1.020 or later is compatible with Windows 8.
  Ver1.021 or later is compatible with Windows 8.1.

Main specifications
- Setup of dedicated driver software (USB and virtual COM port)
- Initial setting of ID number and frequency selection (required only once for first time)
- Load data to Microsoft Excel or Notepad through data interface function
- Note: Cannot be connected to a device other than a PC (such as DP-1VR, PDA, or controller).

U-WAVE system communication specifications

• Wireless communication

Conformity standards	ARIB STD-T66 (Japan)*
Wireless standards	Conform to IEEE802.15.4
Wireless communication distance	Approx. 20m (within visible range)
Wireless communication speed	250 kbps
Transmission output	1mW (0dBm) or less
Modulation method	DS-SS (Direct Sequence - Spread Spectrum) Resistant to interfering signals and noise
Communication frequency	2.4GHz band (ISM band: Universal frequency)
Used band	15 channels (2.405 to 2.475GHz at intervals of 5MHz) The noise search function avoids interference with other communication devices.

* According to the Radio Regulations, the use of this product is permitted in the countries listed below. This product must not be used in other countries or areas.

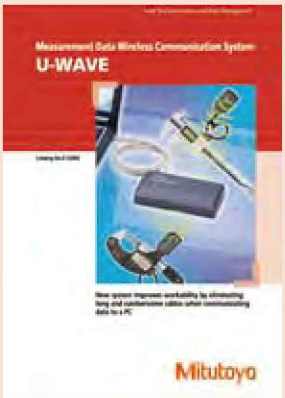
Use of U-WAVE is allowed in the following countries:
This product is a radio equipment classified in the 2.4GHz Band Wide-band Low Power Data Communication System. To use this product, conformity to the radio law of each county is required. The use of U-WAVE sold in Japan is permitted in the countries listed below.

Applicable models	• 02AZD810D • 02AZD880D • 02AZD730D
Area	Country
Asia	Japan, Indonesia, Thailand, Vietnam, Malaysia, Philippines, India
North America	US, Canada
Europe	27 EU member nations (UK, France, Germany, Italy, Netherlands, Belgium, Luxembourg, Spain, Portugal, Austria, Sweden, Finland, Denmark, Bulgaria, Cyprus, Czech, Slovakia, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Poland, Romania, Slovenia) 4 EFTA member nations (Norway, Switzerland, Iceland, Liechtenstein) Turkey

Countries, which permit the use of U-WAVE purchased from Mitutoyo Overseas Operations or Agents/Distributors in the intended use destination are listed below.

Area	Country
Asia	Singapore, South Korea
Central and South America	Mexico, Costa Rica, Brazil

U-WAVE cannot be used in countries other than the above.

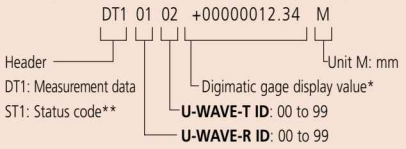


Refer to the Measurement Data Wireless Communication System leaflet (E12000) for more details.

Measurement data wireless communication system U-WAVE

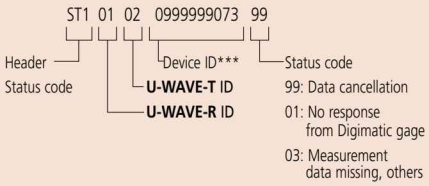
• Data format

Example of format when the Digimatic gage displays 12.34



* Data interface function is switchable to "Measurement value only"
e.g.) +00000012.34

** Example of status code format



*** Unique number assigned to **U-WAVE** at shipment

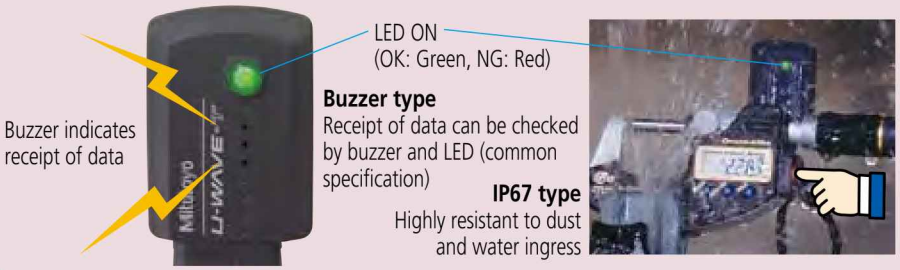
Notes on identification of measurement data and multiple systems operation

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.

2 U-WAVE-T

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

Model	**U-WAVE-T** (IP67 type)	**U-WAVE-T** (buzzer type)
Order No.	**02AZD730D**	**02AZD880D**
Protection Rating	IP67	None
Data reception indication	LEDs	Buzzer and LEDs
Power supply	Lithium battery CR2032×1	
Battery life	Approx. 400,000 transmissions	
Dimensions	44×29.6×18.5 mm	
Mass	23 g	



3 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-21 and A-22 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 Part Nos.	Connecting cable for foot switch Part Nos.
(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**

7 types of connector

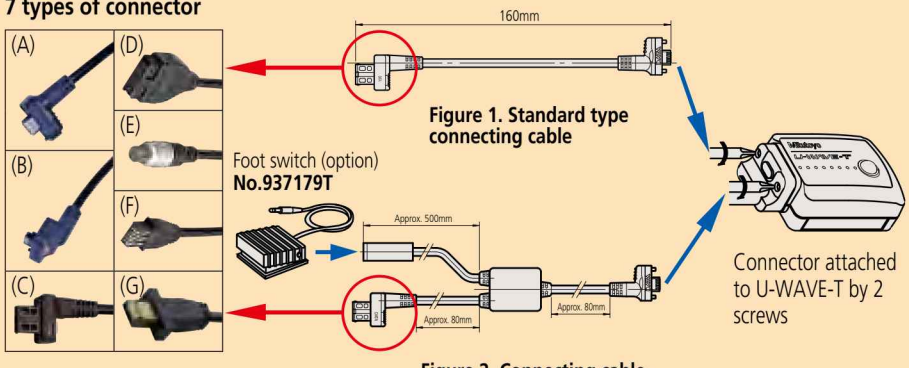


Figure 2. Connecting cable for foot switch

Measurement Data Management

Convenient data collection tool and quality control software

Measurement Data Management
U-WAVE

A

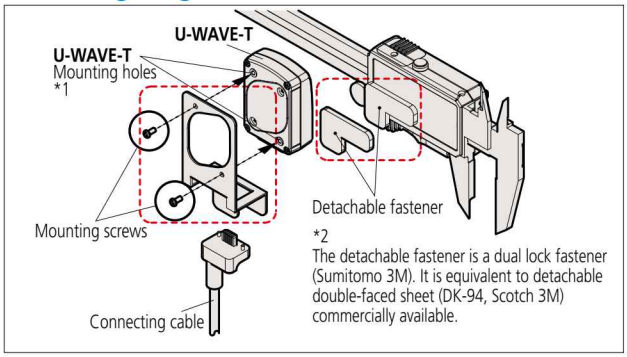
Optional Accessories for U-WAVE-T

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
Part No.02AZE200
Standard accessories
- Detachable fasteners: 1 set
- Mounting screw 2pcs.

Mounting diagram (No.02AZE200)



*2
The detachable fastener is a dual lock fastener (Sumitomo 3M). It is equivalent to detachable double-faced sheet (DK-94, Scotch 3M) commercially available.

*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.

Application examples of the mounting plate

Super Caliper CD67-S15PM

Front view Rear view

QuantuMike MDE-25MJ

Front view Rear view

Digimatic Indicator ID-C112XB

Front view Rear view

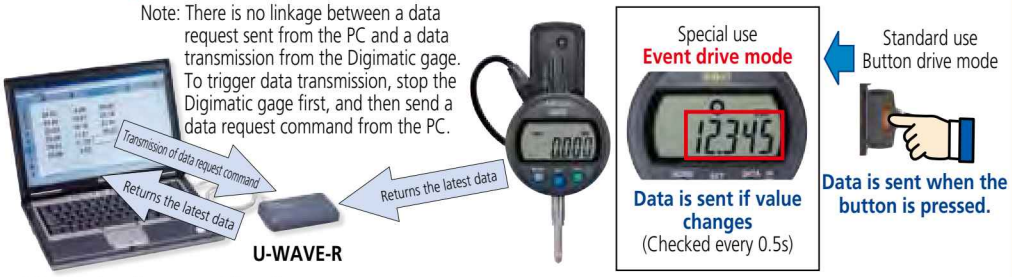
Application example of the 'event drive' mode

Data request support from PC. Special order U-WAVEPAK (Event drive)

For standard type U-WAVE, the currently displayed data can be sent by pressing the data switch.
This is called "button drive mode".
In the "event drive 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 drive" is enabled by the special order U-WAVEPAK (Event drive).
In the event drive 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 V2.0, a special order U-WAVEPAK (Event drive) is required.

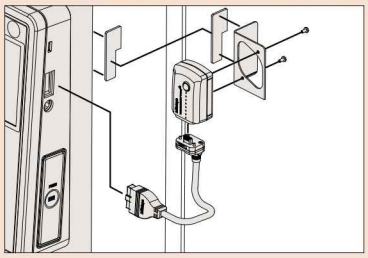
Note: There is no linkage between a data request sent from the PC and a data transmission from the Digimatic gage. To trigger data transmission, stop the Digimatic gage first, and then send a data request command from the PC.

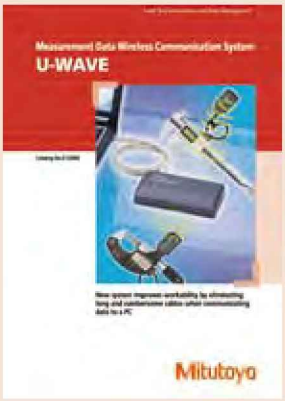


When using the event drive please note:
- The battery life is shorter than in normal mode.
  The battery lasts approximately 20 days with continuous use.
  Switching to the button mode when the battery is not in use extends the battery life.
- When using several Digimatic gages (U-WAVE-T), communication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

U-WAVE-T mounting plate for QM-Height
Order No.02AZE990
Standard accessories
- Detachable fasteners: 1 set
- Mounting screw: 2 pcs

Mounting diagram for QM-Height (02AZE990)





Refer to the Measurement Data Wireless Communication System leaflet (E12000) for more details.

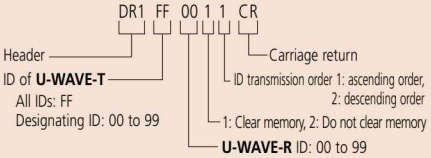
Special order U-WAVEPAK (Event drive)

This is a special order product. For the latest pricing, please contact your dealer or the nearest Mitutoyo Service Center.
Product configuration: Program on CD

For **U-WAVE-R** and **U-WAVE-T**, please purchase the standard model.
Install this special order **U-WAVEPAK** (Event drive) and gain the ability to perform setups without using the standard accessory **U-WAVPAK**.

A program to send a data request command is separately required to load data to a PC.
Event drive supporting software:
- **USB-ITPAK V2.0** (timer input enabled)
- **MeasureReport** (function key operation)

Example of data request command - All Data Output:



Order No.

Model No.	**USB-ITPAK V2.0**
Order No.	**06AEN846**

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

USB-ITPAK V2.0 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 Windows7 Windows8 Windows8.1
Supported Excel versions *2	Excel 2000 Excel 2002 Excel 2003 Excel 2007 Excel 2010 Excel 2013
Hard disk	Free space of more than 10MB
CD-ROM drive	For program installation
USB port *3	2 ports or more
Monitor resolution	800×600, 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), and Simplified Chinese
- Operation manual (PDF file)
  Japanese, English, German

Order No. Price

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

Foot Switch Adapter USB-FSW

Common optional software IT-016U/USB-ITN and U-WAVE

Measurement data collection software USB-ITPAK V2.0 (IT-007R are not supported)

Upgraded USB-ITPAK now supports U-WAVE, a wireless communication system.
Both wired connection (IT-016U/USB-ITN) and wireless system (U-WAVE) are supported.

New functions of USB-ITPAK V2.0

- Supports the U-WAVE wireless communication system
- Timer input function
- Measurement date/time display
- Others: Compatible with Windows 8, 64-bit OS, and Russian included in the operating language selection

USB-ITPAK V2.0 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 V2.0 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 V2.0

- **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-12 for details).
- **Control item and instruction at data input** (Note 1: Not available during individual measurement, Note 2: Not available during simultaneous measurement in the event drive mode)

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	✓ (Note 1)	✓ (Note 1)	✓	✓ (Note 2)	✓
Data cancel	✓ (Note 1)	✓ (Note 1)	✓	✓ Press and hold (Note 2)	–
Data skip	✓ (Note 1)	✓ (Note 1)	✓	–	–
Character input (example: OK or NG etc.)	–	–	✓ Pre-registered character strings	–	–

- **Number of connectable gages** (Note 3: The actual number can be less depending on the system configuration.)

Available devices	Maximum number of connection (total of (1), (2), and (3))	Others
(1) **IT-016U/USB-ITN** (2) **USB-FSW** (3) **U-WAVE-R** (Up to 100 gages can be per one unit of **U-WAVE**. **U-WAVE-T** ID: 00 to 99)	For Windows 2000/XP Up to 100 units (Note3) For Windows Vista/7/8 Up to 20 units (Note3) (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**.

- **Data loading time:** when using **USB-ITN**, 0.2s to 0.3s per gage unit
  U-WAVE event drive mode: 0.5s data refresh interval
- **Timer input function** (only in simultaneous measurement)
  Input interval (time): 0.1s (Note 4) to 24 hours at maximum
  (Note 4: If a shorter time is set, a priority is given to the longer time compared with the actual communication time.)
- **Measurement date/time display function** (available in sequential and simultaneous measurements)
  The display format is subject to the setting of the Excel sheet.

USB Foot Switch Adapter USB-FSW

This USB adapter for connecting a PC is required when using the Foot Switch (**No. 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.)

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

Mitutoyo

Measurement Data Management

Convenient data collection tool and quality control software

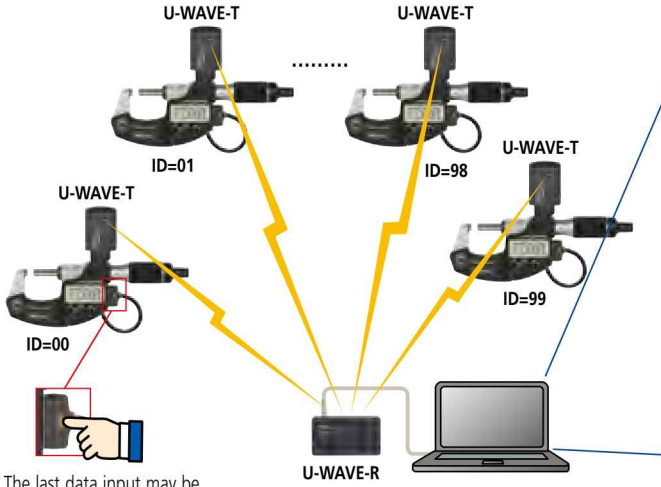
Measurement Data Management
USB-ITPAK V2.0 USB-ITPAK V2.0 (Not available for IT-007R)

A

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

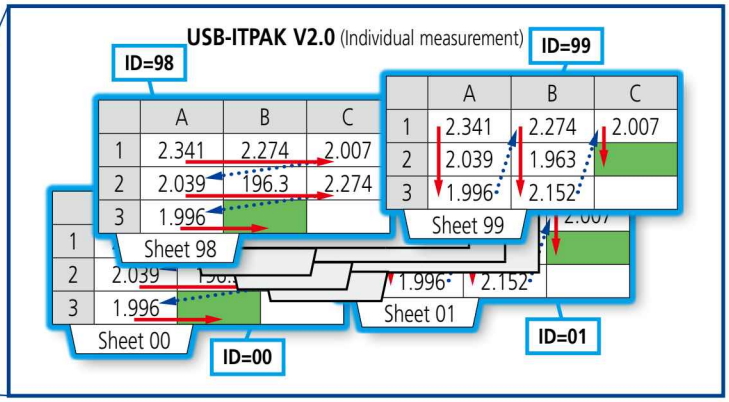
Data from multiple Digimatic gages sent to separate Excel sheets



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

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

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

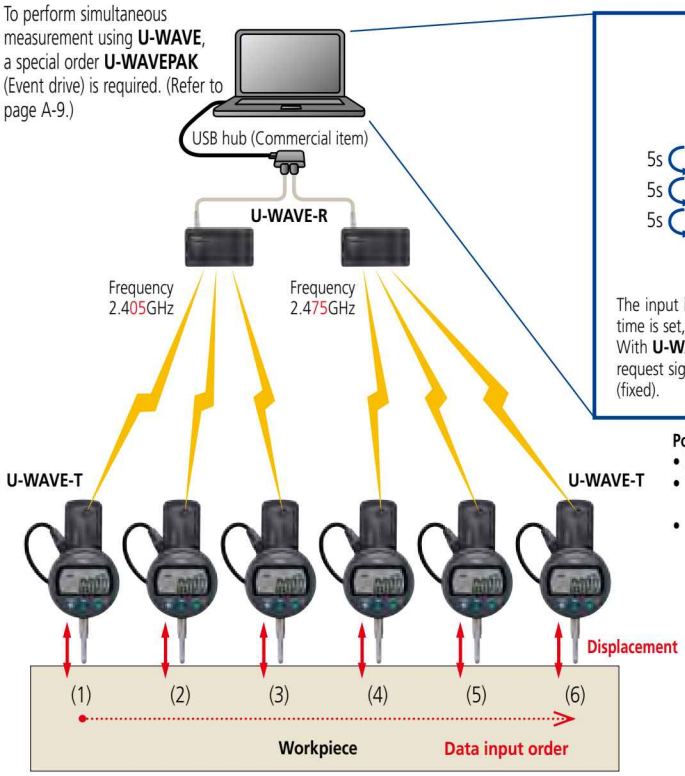


Entry point can be specified per gage (by **U-WAVE-T** ID).
- Specifying an Excel file: Excel Book (full path) + sheet name
- Specifying data input cells (example: A1:C3)
- Specifying cursor move (right or down)

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**, a special order **U-WAVEPAK** (Event drive) is required. (Refer to page A-9.)



If using **USB-ITPAK V2.0** supporting **U-WAVE** event drive, arbitrary timer input is allowed without the need for macro programming.

USB-ITPAK V2.0 simultaneous measurement + timer input (example: 5s 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							

5s
5s
5s

The input interval can be arbitrarily set by 0.1s 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 0.5s is set for the input interval. This is because the data request signal is issued before the data comes in, based on the event drive data refresh interval that is set to 0.5s (fixed).

Points to note when performing simultaneous measurement using U-WAVE and USB-ITPAK V2.0
- Besides **U-WAVE**, a special order **U-WAVEPAK** (Event drive) is required.
- 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.

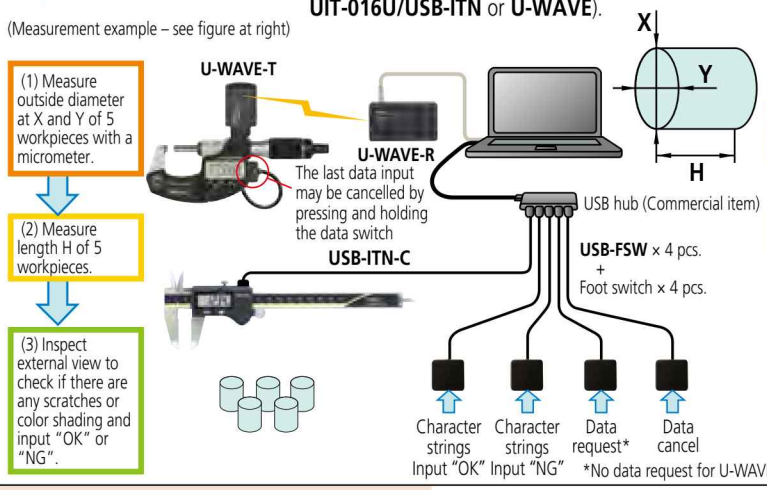
Create Microsoft Excel input procedures with USB-ITPAK V2.0 to handle data from U-WAVE or the USB Input Tool Direct

Measurement applications of USB-ITPAK V2.0 (Three examples of how USB-ITPAK V2.0 can be deployed are shown below)

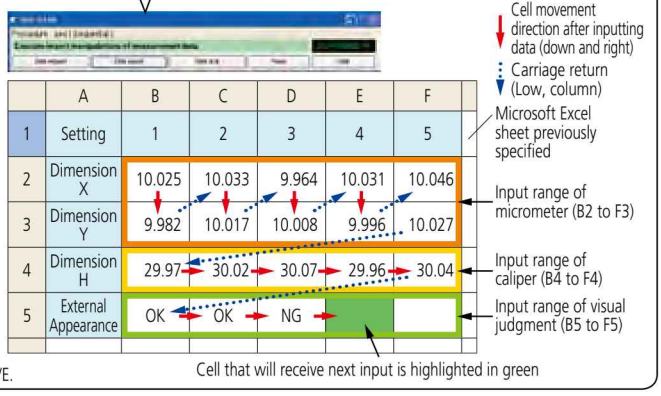
Sequential measurement

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

(Measurement example – see figure at right)



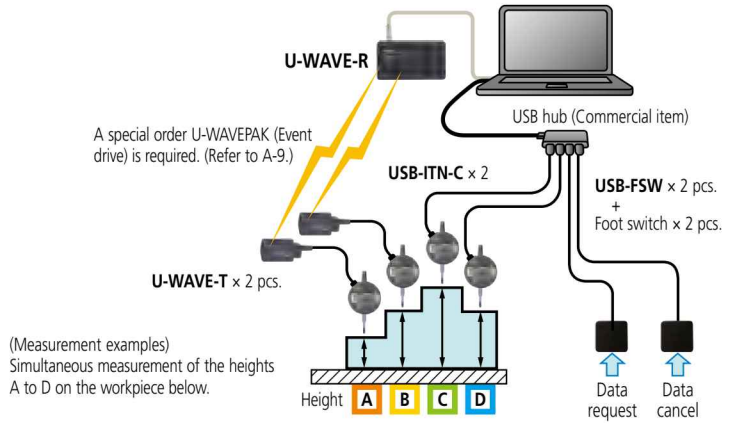
When a measuring procedure is executed, a window (as below) is displayed. "Data request*", "Data cancel*", "Data skip*", "Aborting", "Complete" can be specified.
* These operations can be allocated to the function key or foot switch (via USB-FSW).

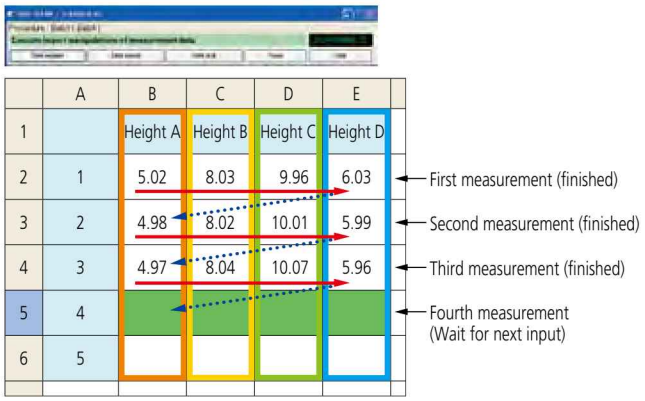


	A	B	C	D	E	F
1	Setting	1	2	3	4	5
2	Dimension X	10.025	10.033	9.964	10.031	10.046
3	Dimension Y	9.982	10.017	10.008	9.996	10.027
4	Dimension H	29.97	30.02	30.07	29.96	30.04
5	External Appearance	OK	OK	NG		

Simultaneous measurement

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



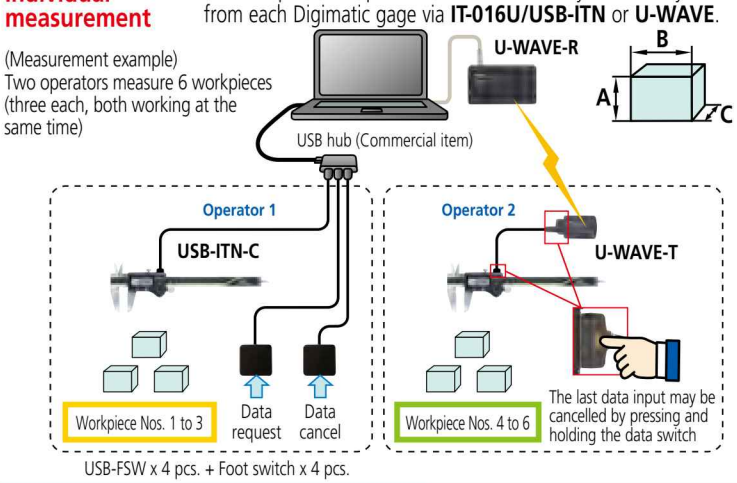


	A	B	C	D	E
1		Height A	Height B	Height C	Height D
2	1	5.02	8.03	9.96	6.03
3	2	4.98	8.02	10.01	5.99
4	3	4.97	8.04	10.07	5.96
5	4				
6	5				

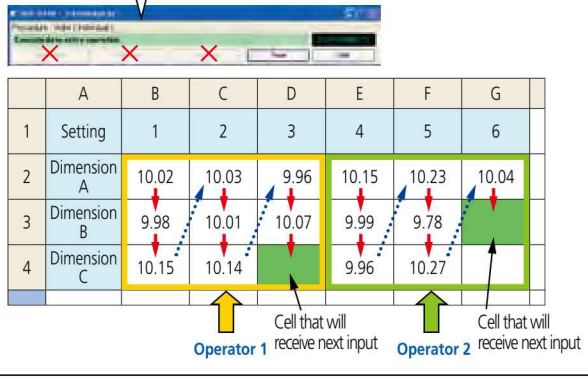
Individual measurement

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	

Notes on using USB-ITPAK:
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.

Mitutoyo

Measurement Data Management

Convenient data collection tool and quality control software

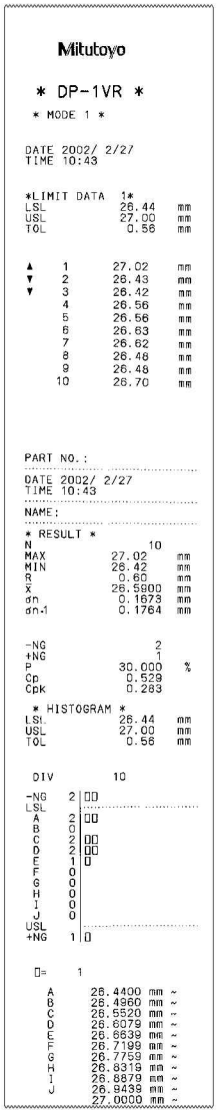
Data processing printer for quality control
SERIES 264 — Digimatic Mini-Processor DP-1VR

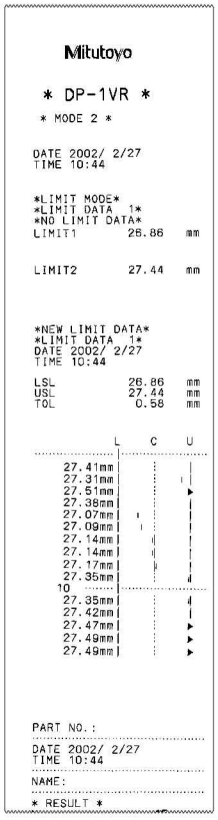
A

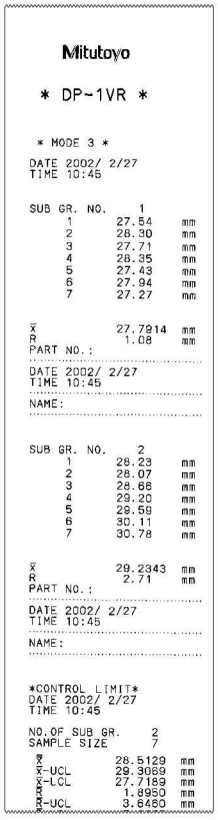
- This is a palm-sized printer used to print measurement data from Digimatic gages or to perform statistical analysis.
- The versatile DP-1VR printer not only prints measurement data, but performs a variety of statistical analyses, draws histograms and D-charts and also performs complex operations on X-bar R control charts.
- Equipped with RS-232C output and GO/NG judgment output as standard functions, this processor delivers the high reliability expected from an advanced quality inspection machine.
- This line thermal printer enables fast and quiet printing.

264-504
DP-1VR

Examples of printout







Statistical calculations

Mode 0	Modes 1,2	Mode 3
GO/±NG judgment	N : Number of data MAX : Maximum value MIN : Minimum value R : Range X̄ : Average value σn : Standard deviation of the sample (N) σn-1 : Sample standard deviation (N-1) -NG : Number of data smaller than lower limit value +NG : Number of data larger than upper limit value P : Fraction defective Cp : Process capability index Cpk : Process capability index (process target centered)	N : Number of data MAX : Maximum value MIN : Minimum value n : Number of subgroup (Max.10) X̄ : Average value of subgroup R : Range of subgroup R̄ : Mean value X̄-UCL : Upper control limit R̄ : Mean (R control) R-UCL : Upper control limit (R control) R-LCL : Lower control limit (R control)

Specifications

- **Order No.: 264-504**
- Model: DP-1VR
- Data processing capacity:
  Mode 0: 100000 data items
  Modes 1,2: 9999 data items
  Mode 3: Sample size (10 x subgroup 9999=99990 data)
  Upper/lower limit value 5 pairs can be held in memory
- Output : (1) RS-232C output level (TTL)
  function (2) GO/±NG judgment output (+NG, GO, -NG)
- Input timer: Input intervals
  0.25s, 1s, 5s, 30s, 1min, 30min, 60min
- Printing method: Thermal line printer 384 dots/char
- Character specification: Normal character 24 x 16 dots / Large character 36 x 24 dots
- Printing speed: 0.5s per line (using AC adapter)
- Printing line: 10000 lines of normal characters per roll
  7000 lines of large characters per roll
- Printing paper: High durability thermo-sensitive paper
  Width 58mm x length 48m
  Note: Printed characters do not fade if a printout is stored in a cool dark place, but if it is to be used for official documents, or stored more than 5 years, it is recommended that a copy be made.
- Power supply: 2 power methods
  (1) AC adapter 100V (6VDC, 1000mA) supplied as a standard accessory.
  (2) 4pcs. of LR6/AA size (alkaline or Ni-Mh)
- Battery life: 10000 lines (5s/line using a 1600mAh Ni-Mh battery)
  Note: This is a typical value and is not guaranteed.
- External dimensions: 94 (W) x 201 (D) x 75.2 (H) mm
- Mass: 390g (main unit)
- Optional Accessories:
  (1) RS-232C changing cable
  For connection with a PC
  Cable length 1m, D-sub 9 pin
  (2) RS-232C counter cable
  For connection with KA counter
  Cable length 1m, D-sub 25 pin
  (3) GO/±NG judgment cable
  Cable length 2m, D-sub 10 pin terminal/separate wires
  (4) Foot switch
- Consumable items:
  Printing paper (10 rolls)

RS-232C communication specification (Output specification)

- Output signal level: TTL
- Communication method: Half-duplex
- Communication speed: 1200/2400/4800/9600/19200
- Bit configuration: Start bit 1 bit
  Data length: 7/8 bit
  Parity check: Even/odd/none
  Stop bit: 2 bit
- Data format

When data output

Number of bytes	1	2	3	4	5	6	7	8	9	10	11	12	13
Data	0	1	A	Model	MSD							LSD	CR

Data parts (Floating decimal point)
Model: + or –
Measurement item
Channel No.
Code No.

Example of format

Display of a Digimatic gage	Output data
0.123	01A+0000.123CR

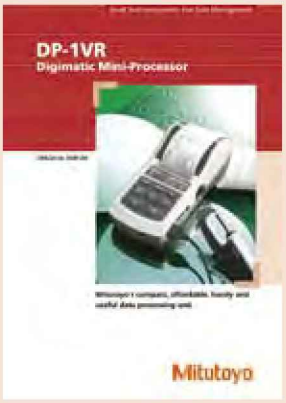
Error code

Number of bytes	1	2	3	4
Data	9	1	Error code	CR

Error code: 1 (No data input)
2 (Loaded data with the format other than specified)
9 (System error head temperature error, overflow, power supply/voltage error, head up, paper error)
Channel No.
Error format

Data request command

Number of bytes	1	2
Data	1 or A	CR



Refer to the DP-1VR leaflet (E4209) for more details.

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 an external device such as a PC.
  Up to four measuring instruments with Digimatic output can be connected.

264-002
MUX-10F

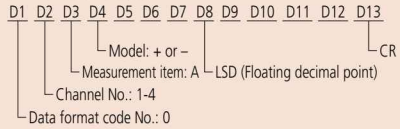
Specifications

- **Order No.: 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: 300/600/1200/2400/9600/19200bps
- Connector specification:

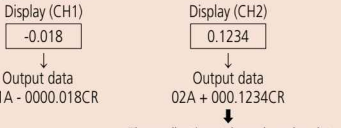
Pin No.	Signal	Function	in/out
1	CD		out
2	RD	Received data	out
3	TD	Communication data	in
4			
5	GND	Ground	
6	DR		out
7			
8	CS		out
9			

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

- Data format
  (1) When data output

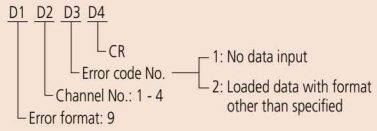


(2) Example of format



The smallest input channel number data is output first in the output stream, with the others following in ascending order.

(3) Error code output



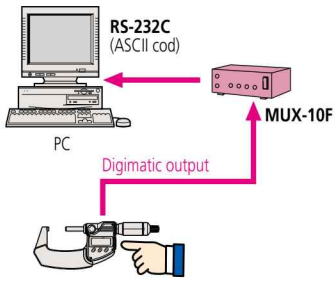
- Power supply: AC adapter (9V, 500mA)
  External dimensions: 91.4 (W) x 92.5 (D) x 50.4 (H) mm

Note: Communication software is not attached.

Usage Example

Data input using the data button on the Digimatic gage

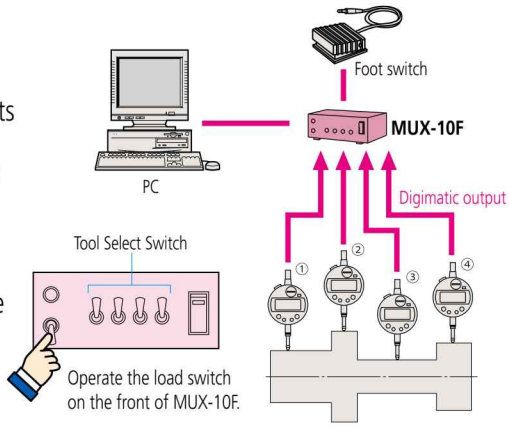
- If the Digimatic gage has a data button, data is sent to the MUX-10 from the gage, converted to RS-232C and sent out.



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-10 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.

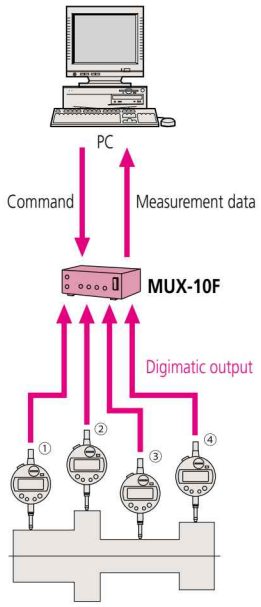


Data input using the external commands

- Data from a specified measuring gage connected to MUX-10F can be polled (ch 1- 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.



Mitutoyo

Measurement Data Management

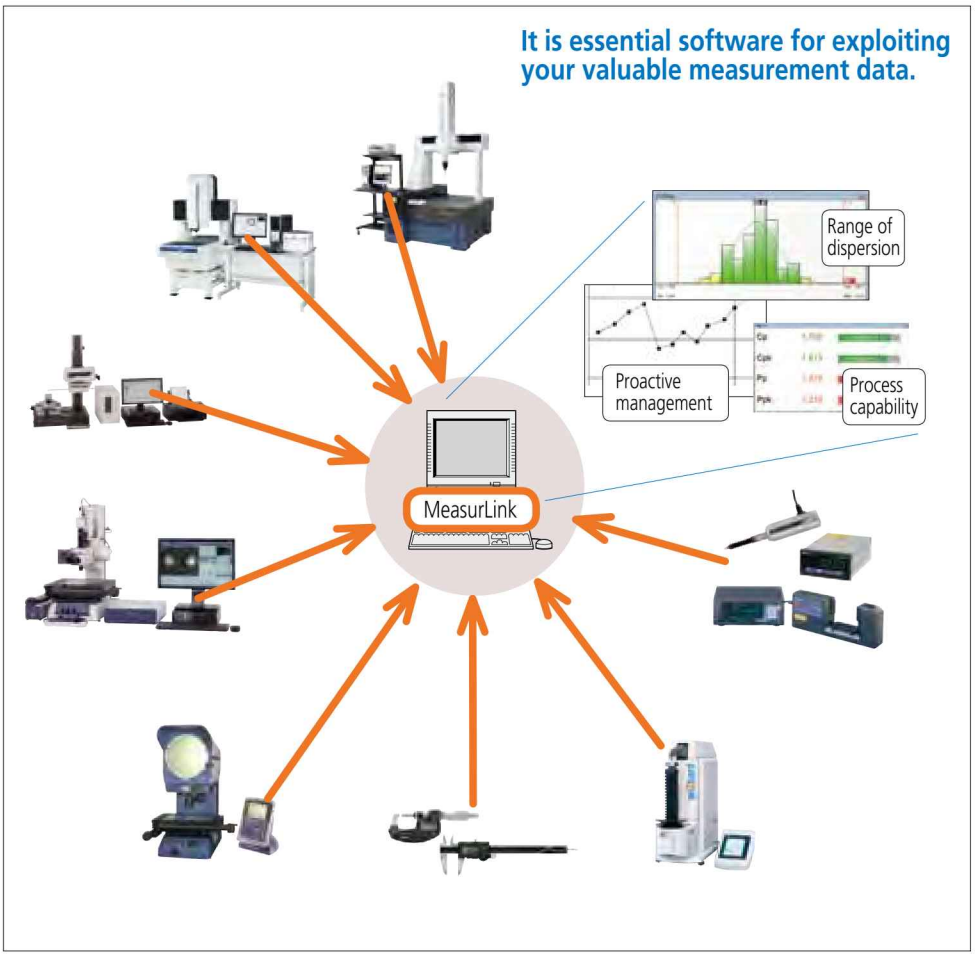
Convenient data collection tool and quality control software

Measurement Data Network System MeasurLink

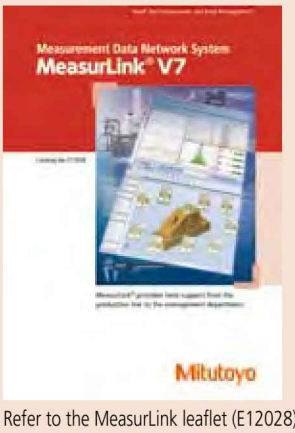
A

- 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.

Data from Mitutoyo measuring instruments are visually displayed in real-time in the inspection room or line side



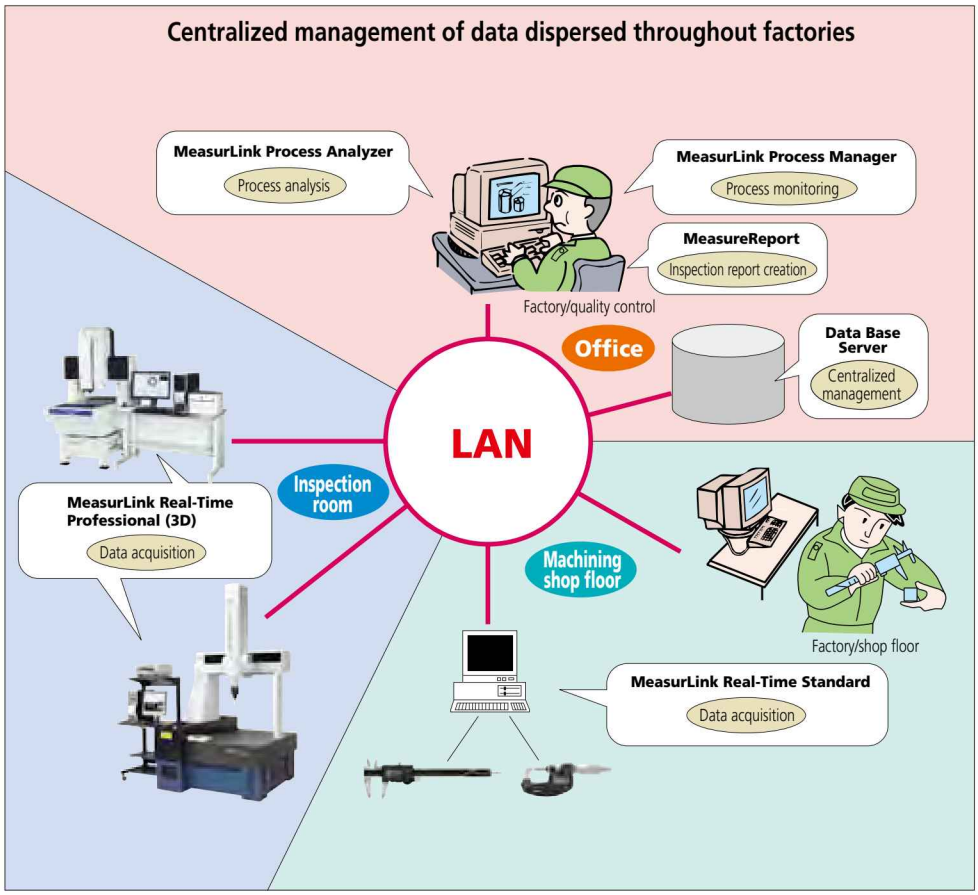
MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
MeasurLink



Refer to the MeasurLink leaflet (E12028) for more details.

- MeasurLink supports anything from stand-alone, small-scale systems to large-scale systems utilizing a PC network environment. Expansion from a stand-alone installation to a network system can easily be performed, allowing a gradual upgrade from a single-test operation in one section to a full-scale operation.

Centralized measurement data management by networking



Mitutoyo

Measurement Data Management

Convenient data collection tool and quality control software

A

MeasurLink V7 Data Collection/Analysis Software

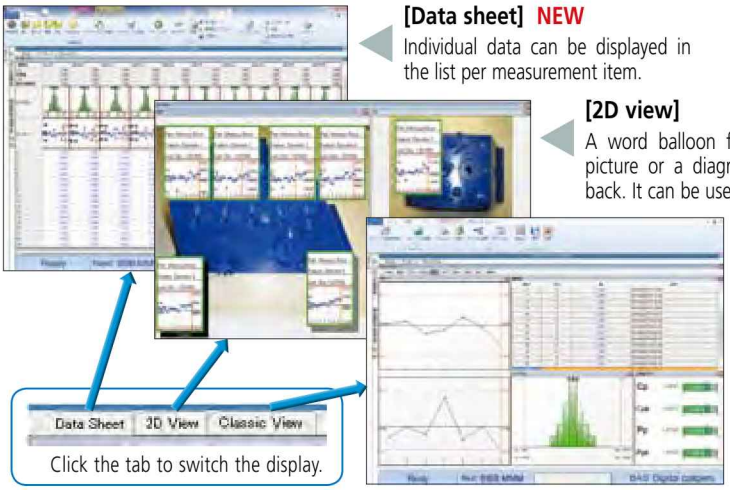
Real-Time Standard (RT Std)
Real-Time Professional (RT Pro)
Real-Time Professional 3D (RT Pro 3D)

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.)

MeasurLink Real-Time common functions

• Various data views

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



[Data sheet] NEW
Individual data can be displayed in the list per measurement item.

[2D view]
A word balloon function is available having a picture or a diagram of the workpiece on the back. It can be used as work process instructions.

[Classic SPC view]
Graphs and lists can be freely selected to display data of single measurement item. It is useful to check detailed information such as date and time of the acquired data.

• Adding traceability information

Traceability information for each workpiece can be added, for example, serial no., rod 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 occurred.

• Alarm function

The operator is notified when "Out of Tolerance" or "Out of Control Limit" occurs.
The method of notification can be selected from a pop-up window, e-mail (Fig.1), or log file recording.

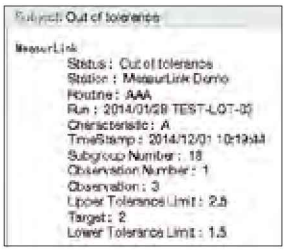


Fig.1 Alarm notification by E-mail

• 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)

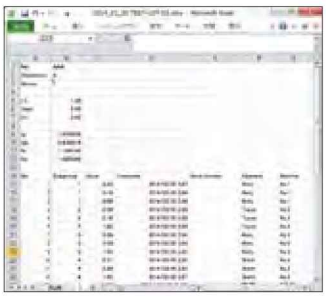


Fig.2 Export to Excel

RT Std/Pro/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-016/USB-ITN VCP or HID
IT-012U (HID)
Wireless (D-sub 9 pin) IT-007R MUX-10F, DP-1VR, and others

- 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, Meta chart, Indicator bar, multivariate data control chart, etc.
[Statistics]
Maximum value, Minimum value, Standard deviation, Average ±3/4/6, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio

- Alarm function

[Target items]
· Out of tolerance
· 1 point exceeds control limit line (following are related to management chart)
· Consecutive 9 points in one side from 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
  · MMeasurement 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

10 languages are supported.
· Japanese, English, French, German, Dutch, Spanish, Swedish, Polish, Italian, Turkish· Japanese, English, French, German, Dutch, Spanish, Swedish, Polish, Italian, Turkish

MeasurLink V7 common functions

• Operating environments
[Operating System]
· Windows7 (32bit/64bit)
[Data base]
· Microsoft SQL Server 2005
Standard / Workgroup Edition
· Microsoft SQL Server 2008
Standard / Enterprise Edition
· Sybase and Oracle are not supported.

RT Pro/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 V5.3 or later
· Roundness instruments: ROUNDPAK V5.6 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 ASCII file to be imported.

RT Pro 3D Common functions

• Screen display mode when collecting data
· 3D view

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

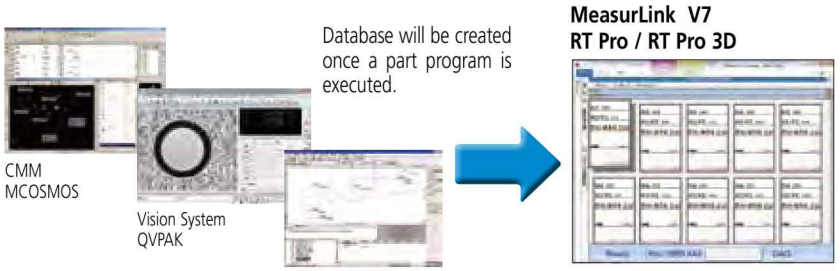
Functions		Data collection software		
		Real-Time Standard	Real-Time Professional	Real-Time Professional 3D
Collected data display	Classic SPC view	●	●	●
	Data sheet	●	●	●
	2D view	●	●	●
	3D view (HOOPS)			●
Data extract	Filter		●	●
Input from tools and devices	Measuring tools (RS-232C, USB)	●	●	●
	Measuring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

A

• 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.



Once storage is created, data is automatically written in the database every time the part program is executed, and the statistical result will be displayed.

• Filtering function

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

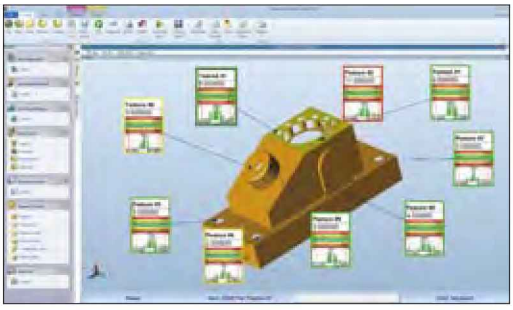
• Import function

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

MeasurLink Real-Time Professional 3D functions

• 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.

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Measurement Data Management

Convenient data collection tool and quality control software

A

MeasurLink V7 Optional Process Analysis Software for Administrators

Process Analyzer Lite (PA Lite)

Process Analyzer Professional (PA Pro)

Process Analyzer is an optional software package provided for administrators who are authorized to access the database created by MeasurLink Real-time for the purpose of checking and analyzing measurement results. Two types of packages are made available: Process Analyzer Lite, the basic version; and the full-spec Process Analyzer Professional version. (see Table 1)

• PA Lite is base version for viewing the measurement database.

Data stored in the MeasurLink database can be checked from a selected list.

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 the Windows Explorer.

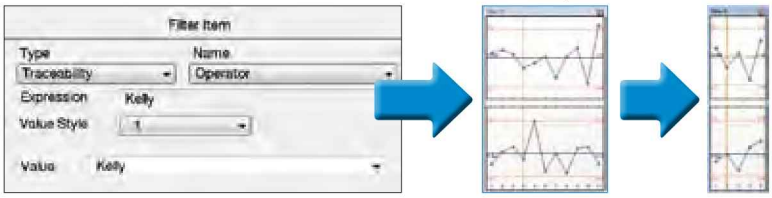
• PA Pro is a full-spec package that provides additional data check and analysis capability.

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

• 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.

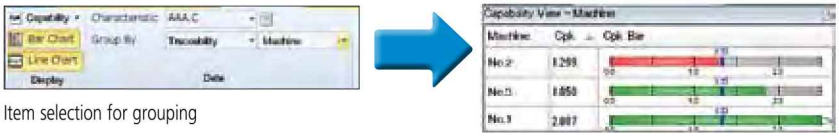
Example) Filtering data by an operator name .... Displays statistical analysis result in charts (Xbar-R, for example).



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

Table 1 Process Analyzer functional comparison (an option available for administrators)

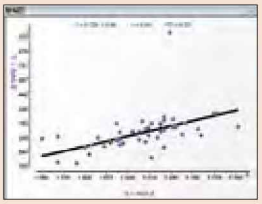
Function		Process analysis software	
		Process Analyzer Lite	Process Analyzer Professional
Result display	Classic SPC view	●	●
	Data sheet	●	●
	2D view	●	●
Data extract	Filter		●
Data processing	Data file merging, Copying, Editing		●
Masking	Archive data		●

PA Lite/PA Pro common functions

• Statistical Analysis result
[Chart]
Xbar-R, Xbar-S, X-Rs control charts, Histogram, Run chart, Pre-control chart, Tear chart, Meta chart, Indicator bar, multivariate data control chart, etc.
[Statistics]
Maximum value, Minimum value, Standard deviation, Average ±3/4/6, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio
• 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.



• Data processing capability
Files can be managed by merging, copying, and editing. Also, the data archive function allows inclusion of the archived data in the Real-Time list.

Main specifications of MeasureReport

- Document creation:
  Automatic creation of template sample style (Number of items x 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 x Max. 2,000 workpieces
  (3) MeasurLink database import
  Max. 200 items x Max. 2,000 workpieces or
  Max. 2,000 items x 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
- Function of comment output to the inspection table:
  30 items including part number and lot number can be input.
- Function of workpiece drawing output to the inspection table:
  Image files (bmp, jpg) can be displayed in arbitrary position.
- 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

- Up to MeasurLink Version 6.2 can be exported.

Measure Report operation environment (recommended)

- OS: Windows 2000 SP3 or later / Windows XP SP2 or later / Windows Vista / Windows 7
- Spreadsheet software:
  Excel 2000/2002/2003/2007/2010/2013
- CPU: 500MB or more
- Memory: 500MB or more
- Hard disk: 2GB or more free space
- Display: 1024 x 576 or larger
- Media drive: CD-ROM drive*
- Communication port: RS-232C port D-sub 9 pin
- Others: Keyboard and mouse supported by OS

* Uses when installing

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).
- An inspection table can be generated by inputting data from a Digimatic measuring gage via the interface. Calculation results of optical measuring machine, QM-Data 200 and the counter values for the X-axis and Y-axis output through RS-232C can be processed in the same way.
- An original Excel form can be generated by using an attached sample form as a template and making simple edits (such as copy and paste).
- 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 of each measuring machine (PC data processing)

CMM
MCOSMOS, MICROPAK2700
MICROPAK700

Measurement result file

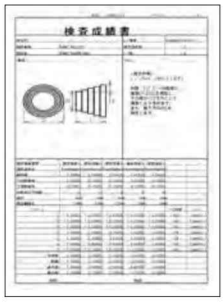
Vision Measuring Systems
QVPAK, QSPAK
QIPAK

Measurement result file

Optical Instruments
Vision Unit
QSPAK

Measurement result file

Measurement result file conversion ① Select and extract data, design value, tolerance value, etc., and output to specified Excel format.



Example of inspection table created.

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 measurement machines can be combined in 1 inspection table.

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Measurement Data Management

Convenient data collection tool and quality control software

Digimatic Data Cable Selector (including USB Input Tool Direct)

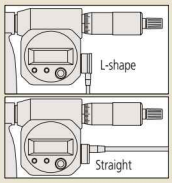
USB Input Tool Direct USB-ITN 	Connector type	(A) Water-proof type with output button	(B) Water-proof type with output button	(C) Straight type with output button	(CR) L type with output switch (cable outlet is right)
	Model No. Order No.	**USB-ITN-A 06ADV380A**	**USB-ITN-B 06ADV380B**	**USB-ITN-C 06ADV380C**	No applicable models USB-ITN-C is available Refer to the following figure.

IT-016U/IT-007R/DP-1VR/MUX-10F/ EC Counter 	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. 1m	**05CZA624**	**05CZA662**	**959149**	**04AZB512**
	Order No. 2m	**05CZA625**	**05CZA663**	**959150**	**04AZB513**

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-23.	Connector type	Ⓐ Water-proof type with output button	Ⓑ Water-proof type with output button	Ⓒ Straight type with output button	Ⓒ L type with output switch (cable outlet is right)
	Picture of gage connector				
	Data switch	Available	Available	Available	Available

Digimatic ports on gage	Picture of Digimatic port				
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 6 digits • Laser Scan Micrometers • Litematic • Linear gage counter (EH) • High-Accuracy Digimatic Micrometer (293-100/293-130)	Applicable models	• Digimatic caliper **500-776/500-777**, etc. **500-712-20/500-713-20**, etc. **500-712** etc. **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.	• Digimatic micrometer **293-100/293-130** **293-140-30/293-141-30**, etc. **293-230-30** etc. **340-251-30/340-252-30** • 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.	• 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. • Digital height master **515-374/515-376**, etc	• Digimatic micrometer **293-582/293-583**, etc. **389-514/389-714**  Type C straight connectors are available, but may interfere with thimble operation.

(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 waterproof type
USB-ITN-D **06ADV380D**	**USB-ITN-E** **06ADV380E**	**USB-ITN-F** **06ADV380F**	No applicable models USB-ITN-F is available			**USB-ITN-G** **06ADV380G**

(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 waterproof 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 waterproof 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-EAVE 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 waterproof type
						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
						
• Digimatic indicator **ID-H** **ID-F** (Note1) • 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**	• Digimatic micrometer **293-666/293-667**, etc. **227-201** etc. **369-411/369-412**, etc.. • Hardness testing machines **HM-100** **HM-200** **HV-100** **HR-300/400/500** **HH-411**	• Digimatic indicator **ID-CX**, **ID-C (Peak-Value Hold Type)** (Note1), **ID-C (Calculation type)**, **ID-C (Bore Gage Type)**, **ID-U** (Note2), **ID-SS** (Note1), **ID-SX** (Note1) • Digimatic height gage **192-663-10/192-613-10/570-322/570-227**, etc. (Flat L-shape, cable outlet is right) • ABS boremetic **568-361/568-362**, etc. • Digimatic bore gage **511-501/511-502**, etc. • Scale unit **572-460/572-560/** **572-480-10/572-580-10**, etc. • Hardness testing machines **HH-300** • Digimatic depth gage **Digimatic type** (**ID-CX**)				• Digimatic indicator **ID-N** **ID-B**

Measurement Data Management

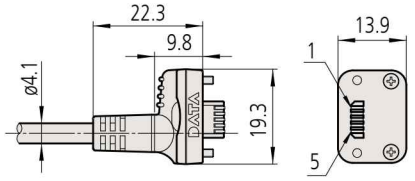
Convenient data collection tool and quality control software

Digimatic data cable specifications (Dimensions)

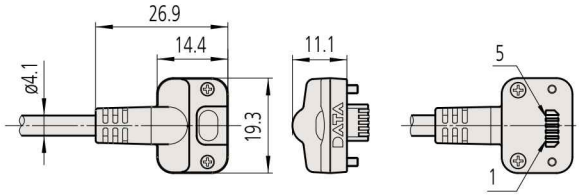
Gage connector dimensions

A

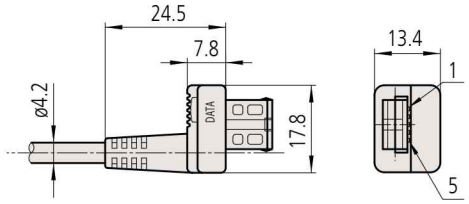
(A) (1) **No.06ADV380A** (2) **No.05CZA624** (1m) **No.05CZA625** (2m) (3) **No.02AZD790A** (Standard) **No.02AZE140A** (FSW)



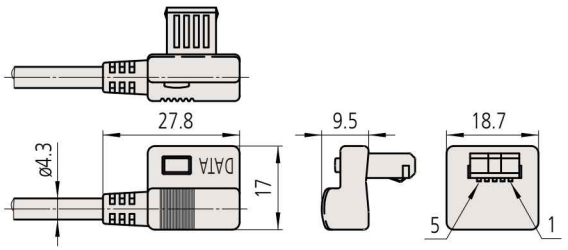
(B) (1) **No.06ADV380B** (2) **No.05CZA662** (1m) **No.05CZA663** (2m) (3) **No.02AZD790B** (Standard) **No.02AZE140B** (FSW)



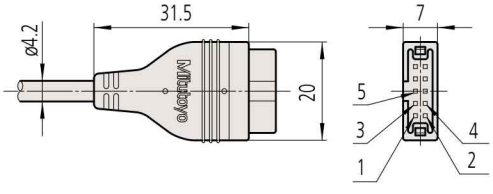
(C) (1) **No.06ADV380C** (2) **No.959149** (1m) **No.959150** (2m) (3) **No.02AZD790C** (Standard) **No.02AZE140C** (FSW)



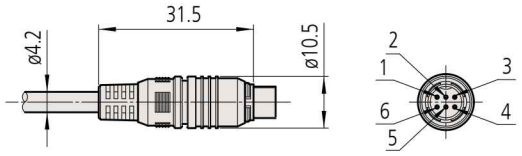
(CR) (1) No applicable models (2) **No.04AZB512** (1m) **No.04AZB513** (2m) (3) No applicable models



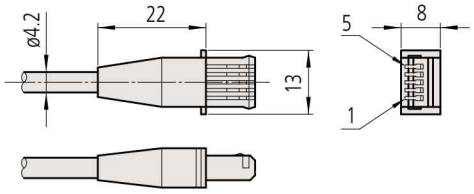
(D) (1) **No.06ADV380D** (2) **No.936937** (1m) **No.965014** (2m) (3) No.02AZD790D (Standard) No.02AZE140D (FSW)



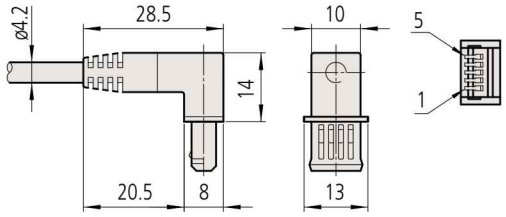
(E) (1) **No.06ADV380E** (2) **No.937387** (1m) **No.965013** (2m) (3) **No.02AZD790E** (Standard) **No.02AZE140E** (FSW)



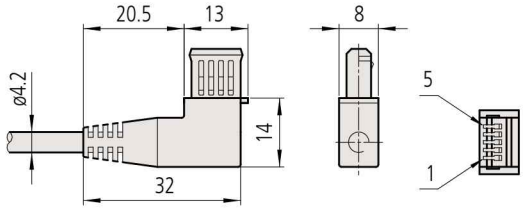
(F) (1) **No.06ADV380F** (2) **No.905338** (1m) **No.905409** (2m) (3) **No.02AZD790F** (Standard) **No.02AZE140F** (FSW)



(FB) (1) No applicable models (2) **No.905689** (1m) **No.905690** (2m) (3) No applicable models

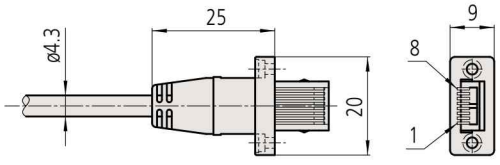


(FR) (1) No applicable models (2) **No.905691** (1m) **No.905692** (2m) (3) No applicable models



(FL) and (FR) is symmetrical and the same size.

(G) (1) **No.06ADV380G** (2) **No.21EAA194** (1m) **No.21EAA190** (2m) (3) **No.02AZD790G** (Standard) **No.02AZE140G** (FSW)



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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

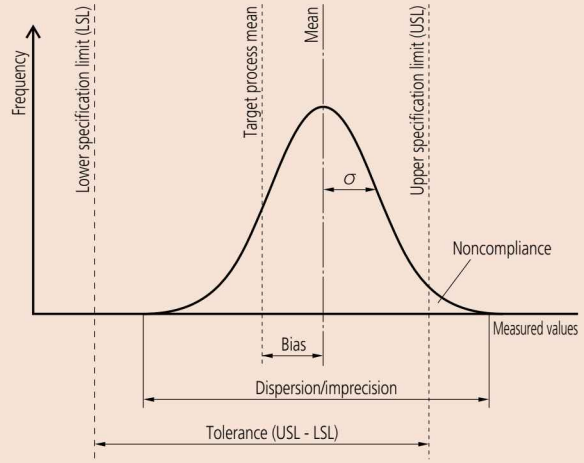
Number of product items in the sample.

Bias

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

Dispersion

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 measured 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 ±3 σ or 6σ when the quality characteristic output from the process shows normal distribution. σ (sigma) indicates standard deviation.

Process capability index (PCI or Cp)

A measure of how well the process can operate within the tolerance limits of the target characteristic. It should always be significantly greater than one. 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 ($\overline{X}$) 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 ±3σ from the mean.

Bilateral tolerance

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

USL: Upper specification limit
LSL: Lower specification limit

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

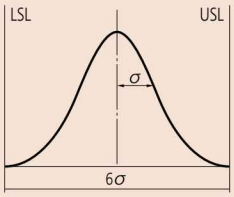
$$Cp = \frac{USL-\overline{X}}{3\sigma}$$

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

$$Cp = \frac{\overline{X}-LSL}{3\sigma}$$

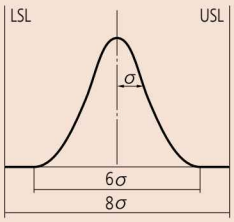
Specific examples of a process capability index (Cp) (bilateral tolerance)

Cp = 1



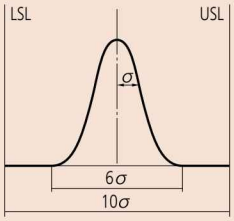
The process capability is barely achieved as the 6 sigma process limits are coincident with the tolerance limits.

Cp = 1.33



The process capability is the minimum value that can be generally accepted as it is no closer than 1 sigma to the tolerance limits.

Cp = 1.67



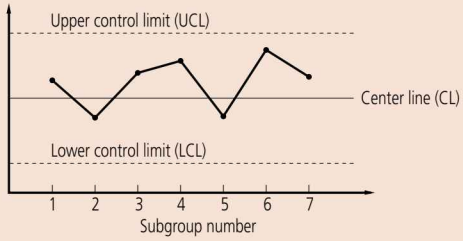
The process capability is sufficient as it is no closer than 2 sigma to the tolerance limits.

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

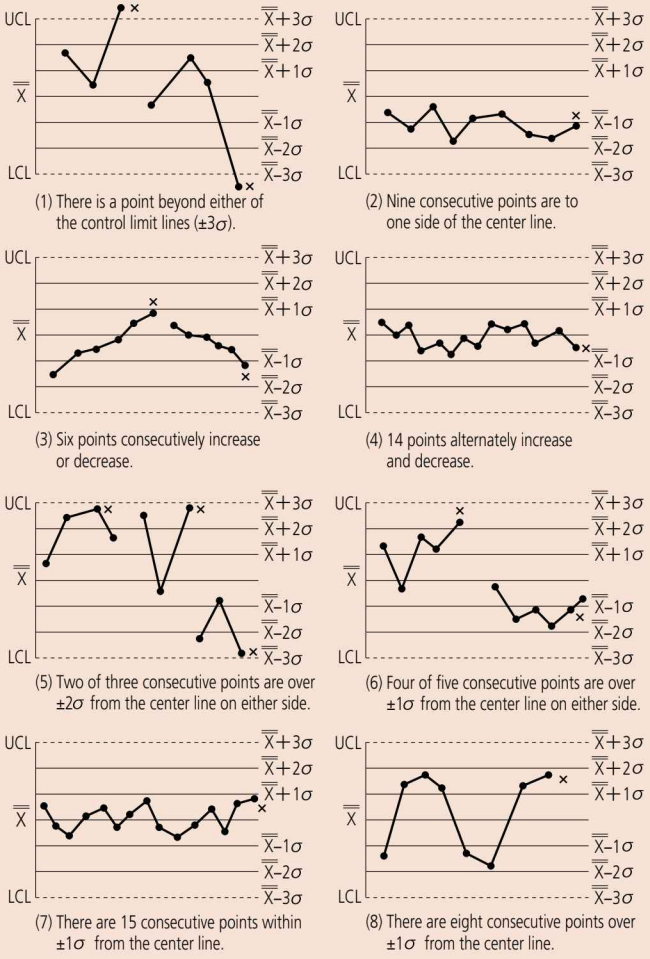
These causes of variation are of relatively low importance. Chance causes are technologically or economically impossible to eliminate even if they can be identified.

$\bar{X}$-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 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.



(1) There is a point beyond either of the control limit lines (±3σ).

(2) Nine consecutive points are to one side of the center line.

(3) Six points consecutively increase or decrease.

(4) 14 points alternately increase and decrease.

(5) Two of three consecutive points are over ±2σ from the center line on either side.

(6) Four of five consecutive points are over ±1σ from the center line on either side.

(7) There are 15 consecutive points within ±1σ from the center line.

(8) There are eight consecutive points over ±1σ from the center line.

Note: This part of 'Quick Guide to Precision Measuring Instruments' (A-25 to A-26) 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

Mitutoyo

New Products

High-Accuracy Digimatic Micrometer

Refer to pages B-3 – B-4 for details.

QuantuMike

Refer to pages B-5 – B-6 for details.

Coolant Proof Micrometers

Refer to pages B-7 – B-8 for details.

Digimatic Micrometer Heads

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

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

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

B

Small Tool Instruments
Micrometers
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Micrometers

Micrometer Heads

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Mitutoyo

Micrometer

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

High-Accuracy Digimatic Micrometer SERIES 293

- Enabling 0.1µm 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 0.1µm resolution ABS (absolute) rotary sensor*1 and high-accuracy screw machining technology to reduce the instrumental error to ±0.5µm, 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 (0.0001mm/0.0005mm), function lock and preset.
- Carbide-tipped measuring faces

Function lock

293-100

- High-Accuracy Digimatic Micrometer received GOOD DESIGN AWARD 2011.

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page X for details.

ABSOLUTE™ Absolute Encoder

Technical Data

Measuring force: 7 to 9N
Power supply: Lithium battery (CR2032) x 1
Battery life: Approx. two years when used under normal conditions

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 0.1µm measurement is not required, the resolution can be switched to 0.5µm.
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 (**No.04AAB969A**: **293-100**
No.04AAB969B: **293-130**) x 1
Lithium battery CR2032 (1 pc),
for initial operational checks (standard accessory)
Spanner (**No.200877**) x 1
Screwdriver (**No.04AAB985**) x 1
Cleaning paper for measuring faces
Inspection certificate

With heat shield* attached

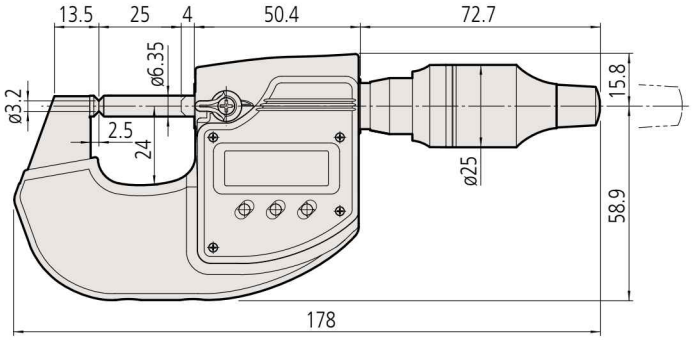
Heat shield

Optional accessories

Connecting cables with output switch
1m: **No. 05CZA662**
2m: **No. 05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **No. 06ADV380B**
Connecting cables for **U-WAVE-T** (160mm)
No. 02AZD790B
For foot switch: **No. 02AZE140B**
Refer to page B-68 for details.
Cleaning paper for measuring faces (1000sheet): **No.04AZB581**

DIMENSIONS

Unit: mm



SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	Anvil/spindle faces	Mass
293-100	0 - 25mm	0.0001mm/ 0.0005mm (switchable)	±0.5µm	ø3.2mm	400g

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	Anvil/spindle faces	Mass
293-130	0 - 1"	.000005"/.00002" 0.0001mm/0.0005mm (switchable)	±.00002"	ø3.2mm	400g

* Excluding quantizing error

Mitutoyo

Micrometer

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

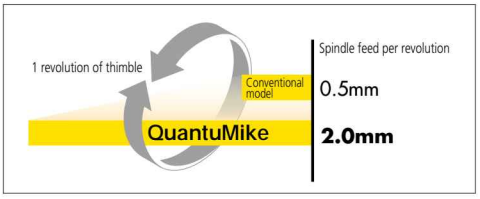
QuantuMike
SERIES 293 — IP65 Micrometer with 2mm/rev Spindle Feed

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

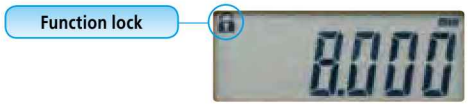
www.tuv.com
ID 1419032586

An inspection certificate is supplied as standard. Refer to page X for details.

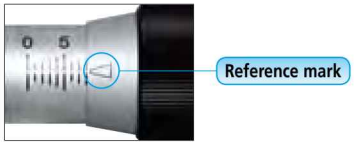
- Advanced pioneering technology has created the next generation of micrometer, the most revolutionary advance in micrometer technology since James Watt invented the instrument.
- Faster measurement is achieved by using a coarser thread which feeds the spindle by 2mm per revolution of the thimble. This 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.



- The patented ratchet thimble mechanism* helps ensure repeatable results by transmitting microvibrations along the spindle to the contact face to provide a constant measuring force and encourage good contact with the workpiece. The ratchet works from the thimble as well as the speeder so it is always easy to use – even when making measurements one-handed. The sound of the ratchet provides the user with a sense of confidence and the speeder enables the rapid spindle feed needed when measuring widely different dimensions.

*Patent registered (in Japan, USA, China, Germany, UK and France)

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

293-140-30

293-143-30

293-142-30

293-143-30

293-143-30

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

- 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-5 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.

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 12N*3
Battery: **SR44** (1 pc), **938882**, for initial operational checks (standard accessory)
Length standard: Electromagnetic rotary sensor
Battery life: Approx. 1.2 years under normal use
Standard accessories: Reference bar, 1 pc (except for 0-25mm (0-1") models)
Spanner (**No. 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
1m: **No. 05CZA662**
2m: **No. 05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **No. 06ADV380B**
Connecting cables for **U-WAVE-T** (160mm)
No. 02AZD790B
For foot switch: **No. 02AZE140B**
Refer to page B-68 for details.

SPECIFICATIONS

Metric

	Order No.	Range	Resolution	Accuracy*1	Flatness	Parallelism	Mass
with SPC data output	**293-140-30**	0 - 25mm	0.001mm	±1µm	0.3µm	1µm	265g
	293-141-30	25 - 50mm					325g
	293-142-30	50 - 75mm				2µm	465g
	293-143-30	75 - 100mm		±2µm			620g
without SPC data output	**293-145-30**	0 - 25mm		±1µm		1µm	265g
	293-146-30	25 - 50mm					325g
	293-147-30	50 - 75mm				2µm	465g
	293-148-30	75 - 100mm		±2µm			620g

*1 Excluding quantizing error

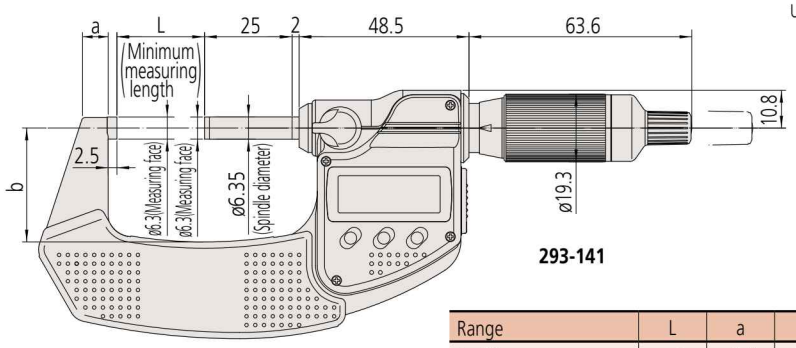
Inch/Metric

	Order No.	Range	Resolution	Accuracy*1	Flatness	Parallelism	Mass
with SPC data output	**293-180-30**	0 - 1"	.00005"/ 0.001mm	±.00005"	.000012"	.00004"	265g
	293-181-30	1" - 2"					325g
	293-182-30	2" - 3"				.00008"	465g
	293-183-30	3" - 4"		±.0001"			620g
without SPC data output	**293-185-30**	0 - 1"		±.00005"		.00004"	265g
	293-186-30	1" - 2"					325g
	293-187-30	2" - 3"				.00008"	465g
	293-188-30	3" - 4"		±.0001"			620g

*1 Excluding quantizing error

DIMENSIONS

Unit: mm

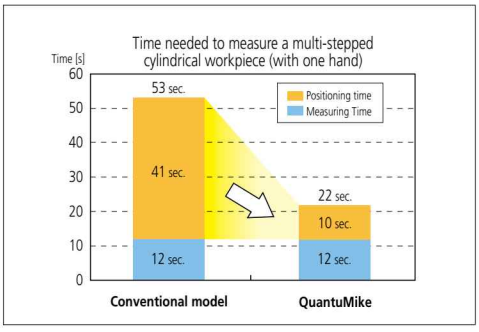


293-141

Range	L	a	b
0 - 25mm	0	6.5	25
25 - 50mm	25	7.3	32.5
50 - 75mm	50	10.1	47
75 - 100mm	75	11.5	60

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

- 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-5 for details.)
- Two types of constant-force devices are available: Ratchet Stop and Ratchet Thimble.
- Measuring faces: Carbide

293-230-30

GOOD DESIGN AWARD 2014

293-252-30

293-234-30
With ratchet thimble

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 0000040191

An inspection certificate is supplied as standard. Refer to page X for details.

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:	0.3µm/.000012"
Dust/water protection level:	IP65 (IEC60529) *2
Measuring force:	5 to 10N (ratchet thimble type is 7 to 12N.)*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 0-25mm (0-1") models) Spanner (**301336**), 1 pc

*2 Rustproofing shall be applied after use.
*3 Refer to page B-6 for details.

Optional accessories

(Only for models with data output function)
Connecting cables with output switch
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T** (160mm)
02AZD790B
For foot switch: **02AZE140B**
Refer to page B-68 for details.

These are dedicated connecting cables for Coolant Proof micrometers.

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 (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*4 :
Models equipped with this function have an output port for transferring measurement data to a Statistical Process Control (SPC) system.
*4: 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	Resolution	Accuracy*	Parallelism	Constant-force device	Mass
with SPC data output	**293-230-30**	0 - 25mm	0.001mm	±1µm	1µm	With ratchet stop	270g
	293-231-30	25 - 50mm					330g
	293-232-30	50 - 75mm			2µm		470g
	293-233-30	75 - 100mm		±2µm			625g
	293-250-30	100 - 125mm			3µm		600g
	293-251-30	125 - 150mm					740g
	293-252-30	150 - 175mm		±3µm			800g
	293-253-30	175 - 200mm			4µm		970g
	293-254-30	200 - 225mm					1100g
	293-255-30	225 - 250mm		±4µm			1270g
	293-256-30	250 - 275mm					1370g
	293-257-30	275 - 300mm			5µm		1590g
	293-234-30	0 - 25mm		±1µm	1µm	With ratchet thimble	280g
	293-235-30	25 - 50mm					340g
	293-236-30	50 - 75mm			2µm		480g
	293-237-30	75 - 100mm		±2µm			635g
without SPC data output	**293-240-30**	0 - 25mm	0.001mm	±1µm	1µm	With ratchet stop	270g
	293-241-30	25 - 50mm					330g
	293-242-30	50 - 75mm			2µm		470g
	293-243-30	75 - 100mm		±2µm			625g
	293-244-30	0 - 25mm		±1µm	1µm	With ratchet thimble	280g
	293-245-30	25 - 50mm					340g
	293-246-30	50 - 75mm			2µm		480g
	293-247-30	75 - 100mm		±2µm			635g

* Excluding quantizing error
• All-Digit preset type: models over 125mm (5″) measuring range

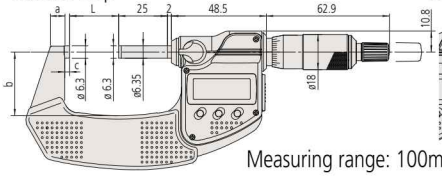
Inch/Metric

	Order No	Range	Resolution	Accuracy*	Parallelism	Constant-force device	Mass
with SPC data output	**293-330-30**	0 - 1"	.00005" /0.001mm	±.00005″	.00004"	With ratchet stop	270g
	293-331-30	1" - 2"					330g
	293-332-30	2" - 3"			.00008"		470g
	293-333-30	3" - 4"					625g
	293-350-30	4" - 5"	.0001" /0.001mm	±.0001″	.00012"		600g
	293-351-30	5" - 6"					740g
	293-352-30	6" - 7"		±.00015″			800g
	293-353-30	7" - 8"			.00016"		970g
	293-354-30	8" - 9"					1100g
	293-355-30	9" -10"		±.0002″			1270g
	293-356-30	10" - 11"					1370g
	293-357-30	11" - 12"			.0002"		1590g
	293-334-30	0 - 1"	.00005" /0.001mm	±.00005″	.00004"	With ratchet thimble	280g
	293-335-30					With friction thimble	275g
	293-336-30	1" - 2"					335g
without SPC data output	**293-340-30**	0 - 1"	.00005" /0.001mm	±.00005″	.00004"	With ratchet stop	270g
	293-341-30	1" - 2"					330g
	293-342-30	2" - 3"			.00008"		470g
	293-343-30	3" - 4"		±.0001″			625g
	293-344-30	0 - 1"		±.00005″	.00004"	With ratchet thimble	280g
	293-345-30	1" - 2"					340g
	293-346-30	2" - 3"			.00008"		480g
	293-347-30	3" - 4"		±.0001″			635g
	293-348-30	0 - 1"		±.00005″	.00004"	With friction thimble	275g

* Excluding quantizing error
• All-Digit preset type: models over 125mm (5″) measuring range

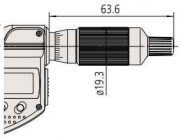
DIMENSIONS

Ratchet stop

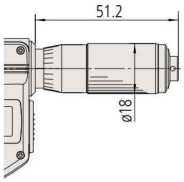


Measuring range: 100mm or less

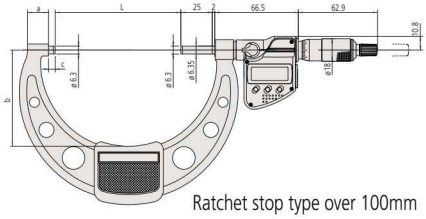
Ratchet thimble type



Friction thimble type



Unit: mm



Ratchet stop type over 100mm

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

Micrometer

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

Digimatic outside micrometers SERIES 293

- 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.)
- Constant-force device: ratchet stop
- 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.)
- Measuring faces: Carbide

293-582

SPECIFICATIONS

Metric

Order No.	Range	Accuracy*	Flatness	Parallelism
293-582	300 - 325mm	±6µm	0.6µm	5µm
293-583	325 - 350mm			
293-584	350 - 375mm			
293-585	375 - 400mm	±7µm		6µm
293-586	400 - 425mm			
293-587	425 - 450mm			
293-588	450 - 475mm	±8µm		7µm
293-589	475 - 500mm			

* Excluding quantizing error

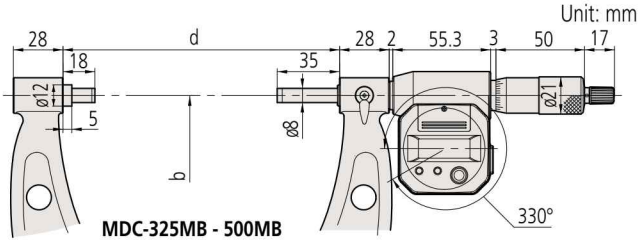
Inch/Metric

Order No.	Range	Accuracy*	Flatness	Parallelism
293-782	12"-13"	±.0003"	.000024"	.0002"
293-783	13"-14"			
293-784	14"-15"			
293-785	15"-16"	±.00035"		.00024"
293-786	16"-17"			
293-787	17"-18"			
293-788	18"-19"	±.0004"		.00028"
293-789	19"-20"			

* Excluding quantizing error

DIMENSIONS

Unit: mm



MDC-325MB - 500MB

Range	b	d
300 - 325	187	353
325 - 350	199	378
350 - 375	212	403
375 - 400	224	428
400 - 425	236	453
425 - 450	248	478
450 - 475	261	503
475 - 500	273	528

Technical Data

Resolution: 0.001mm or .0001"/0.001mm
Measuring force: 10 to 15N
SR44 (2 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 1.8 years under normal use
Length standard: Electromagnetic rotary sensor
Standard accessories: Reference bar, 1 pc
Spanner (200154), 1 pc

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 (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.
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.
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.
Data output:
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.

Optional accessories

Connecting Cables
Recommended cables:
L-Type (does not interfere with operating the thimble.)
1m: **04AZB512**
2m: **04AZB513**
Straight type (may interfere with operating the thimble.)
1m: **959149**
2m: **959150**
Refer to page B-68 for detailed information about recommended cables.

SERIES 293 — Digimatic outside micrometers

- Extended battery life of approximately 2.4 years.
- An economical price is achieved through simple design and excluding the data output function.
- One switch operation (Origin Set) for easy use.
- Equipped with Ratchet Stop for constant measuring force.
- Measuring faces: Carbide

293-821-30

GOOD DESIGN AWARD 2014

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page X for details.

Technical Data

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Length standard: Electromagnetic rotary sensor
Standard accessories: Reference bar, 1 pc
Spanner (301336), 1 pc

Functions

Zero-setting:
A brief press on the ORIGIN button sets display to zero at the current spindle position (zero-setting), which allows easy comparison measurement.
Auto power ON/OFF:
The reading on the LCD disappears after this instrument is idle for about 20 minutes, but the reading is retained. Turning the spindle causes the reading on the LCD to reappear.

SPECIFICATIONS

Metric With ratchet stop / Measuring force: 5 - 10N

Order No.	Range	Resolution	Accuracy*
293-821-30	0 - 25mm	0.001mm	±2µm

* Excluding quantizing error

Inch/Metric With ratchet stop / Measuring force: 5 - 10N

Order No.	Range	Resolution	Accuracy*
293-831-30	0 - 1"	.00005"/0.001mm	±.0001"

* Excluding quantizing error

Inch/Metric With friction thimble / Measuring force: 5 - 10N

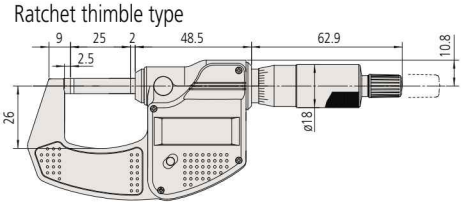
Order No.	Range	Resolution	Accuracy*
293-832-30	0 - 1"	.00005"/0.001mm	±.0001"

* Excluding quantizing error

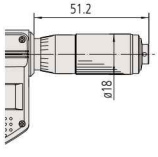
DIMENSIONS

Unit: mm

Ratchet thimble type



Friction thimble type



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.

ABSOLUTE™ Absolute Encoder

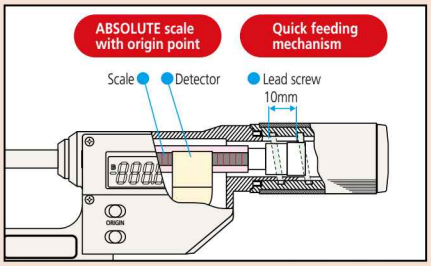
IP54 Dust-proof (IP54)

IP Codes

Level 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.
Level 4: Protected against splashing water.
Water splashed against the enclosure from any direction shall have no harmful effects.

Technical Data

Resolution: 0.001mm, .00005"/0.001mm
Accuracy: Refer to the list of specifications.
Measuring force: 5 - 10N
SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 3 years under normal use
(1 year for No. 293-667, 668, 669, 677, 678, 679)
Length standard: Electrostatic capacity absolute sensor
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-30mm (0-1.2") models)
Maximum response speed: without limit
The non-rotating spindle enables even inexperienced operators to perform measurements repeatably and accurately.



Optional accessories

Connecting cables
1m: **937387**
2m: **965013**
USB Input Tool Direct
USB-ITN-E (2m): **06ADV380E**
Connecting cables for **U-WAVE-T**
02AZD790E 160mm
For foot switch: **02AZE140E**
Refer to page B-68 for details.

Quickmike
SERIES 293 — IP54 ABSOLUTE Digimatic Micrometers

- The Quickmike provides a speedy spindle feed of 10mm 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.
- Measuring faces: Carbide
- Supplied with a Ratchet Stop for constant measuring measuring force.
- The lineup includes Blade Micrometer types (refer to page B-48), Disk Micrometer types (refer to page B-35 for details) and Crimp Height Micrometer types (refer to page B-52).

293-668

293-667

293-666

293-669

SPECIFICATIONS

Metric

Order No.	Range	Accuracy*	Flatness	Parallelism	Mass	Output function
293-661-10	0 - 30mm	±2µm	0.3µm	2µm	275g	Without
293-666						With
293-667	25 - 55mm				355g	
293-668	50 - 80mm	±3µm			525g	
293-669	75 - 105mm			3µm	625g	

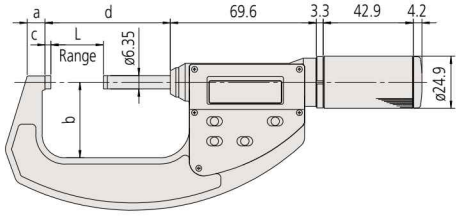
* Excluding quantizing error

Inch/Metric

Order No.	Range	Accuracy*	Flatness	Parallelism	Mass	Output function
293-676	0 - 1.2"	±.0001"	.000012"	.00008"	275g	With
293-677	1" - 2.2"				355g	
293-678	2" - 3.2"	±.00015"			525g	
293-679	3" - 4.2"			.00012"	625g	

* Excluding quantizing error

DIMENSIONS



Unit: mm

Range	L	a	b	c	d
0 - 30	0	7	25	2	34.8
25 - 55	25	8.5	36	2.8	59.8
50 - 80	50	10.3	47		84.8
75 - 105	75	10.7	60		109.8

Mitutoyo

Micrometer

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

ABSOLUTE Digimatic Micrometers
SERIES 227 — with Adjustable Measuring Force

- 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 workpiece.
- 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

227-201

ABSOLUTE™ Absolute Encoder

Technical Data

Flatness: 0.3µm/.000012"
Parallelism: 2µm/.00008"
Measurement posture: horizontal orientation only
(Recommended spindle inclination: within ±3°)
SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 3 years under normal use
(1 year for No.227-203, 206, 207, 213, 216, 217)
Length standard: Electrostatic capacity absolute sensor
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-15mm (0-.6") / 0-10mm (0-.4") models)
Screwdriver (210183), 1 pc

Functions

Adjustable measuring force mechanism
Hold
Origin point setting
ABS measurement system
Low voltage alarm
Data output
Presetting (**No.227-203, 206, 207, 213, 216, 217**)

Optional accessories

Connecting cables
1m: **937387**
2m: **965013**
USB Input Tool Direct
USB-ITN-E (2m): **06ADV380E**
Connecting cables for **U-WAVE-T**
02AZD790E 160mm
For foot switch: **02AZE140E**
Refer to page B-68 for details.

SPECIFICATIONS

Metric

Order No.	Range	Measuring force	Resolution	Accuracy*	Measuring force	Accuracy of the selected measuring force*1	Repeatability of measuring force*1	Mass
227-201	0 - 15mm	0.5N - 2.5N	0.001mm	±2µm	0.5, 1.0, 1.5, 2.0, 2.5 N	± (0.1+ the selected measuring force/10) N	within 0.1 N	300g
227-203	15 - 30mm							380g
227-205	0 - 10mm	2N - 10N			2, 4, 6, 8, 10 N	± (0.4+ the selected measuring force/10) N	within 0.4 N	340g
227-206	10 - 20mm							425g
227-207	20 - 30mm							415g

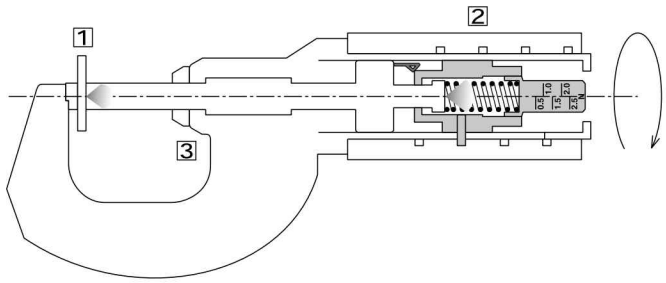
* Excluding quantizing error

Inch/Metric

Order No.	Range	Measuring force	Resolution	Accuracy*	Measuring force	Accuracy of the selected measuring force*1	Repeatability of measuring force*1	Mass
227-211	0 - .6"	0.5N - 2.5N	.00005"/ 0.001mm	±.0001"	0.5, 1.0, 1.5, 2.0, 2.5 N	± (0.1+ the selected measuring force/10) N	within 0.1 N	300g
227-213	.6"- 1.2"							380g
227-215	0 - .4"	2N - 10N			2, 4, 6, 8, 10 N	± (0.4+ the selected measuring force/10) N	within 0.4 N	340g
227-216	.4"- .8"							425g
227-217	.8"- 1.2"							415g

* Excluding quantizing error
* 1: These values are guaranteed used in a horizontal orientation (within ±3 degrees)

Constant-measuring-force mechanism



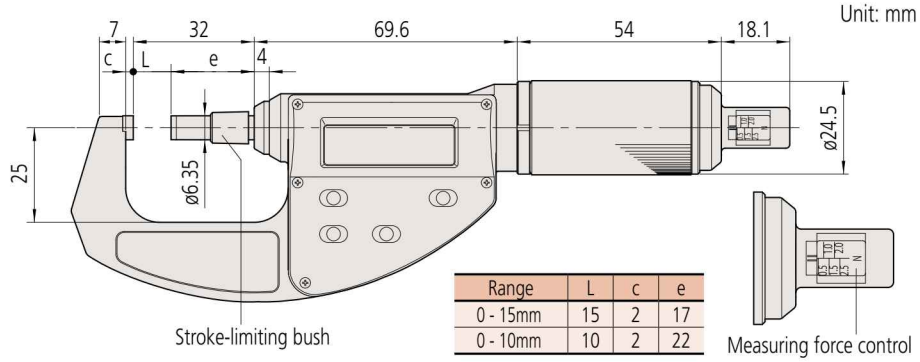
1 Measuring force is generated by the action of trapping a workpiece between the spindle face and the anvil.
2 The constant-force unit applies the specified measuring force.
3 When the preset measuring force is reached, the count on the LCD is automatically held and the hold symbol appears.
(To cancel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

Adjustable measuring force

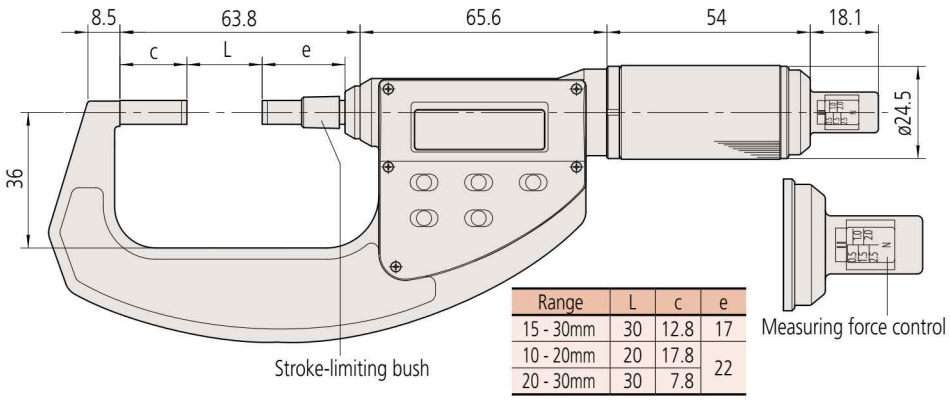
To preset the measuring force, adjust the measuring force setting scale on the thimble with the screwdriver supplied.

DIMENSIONS

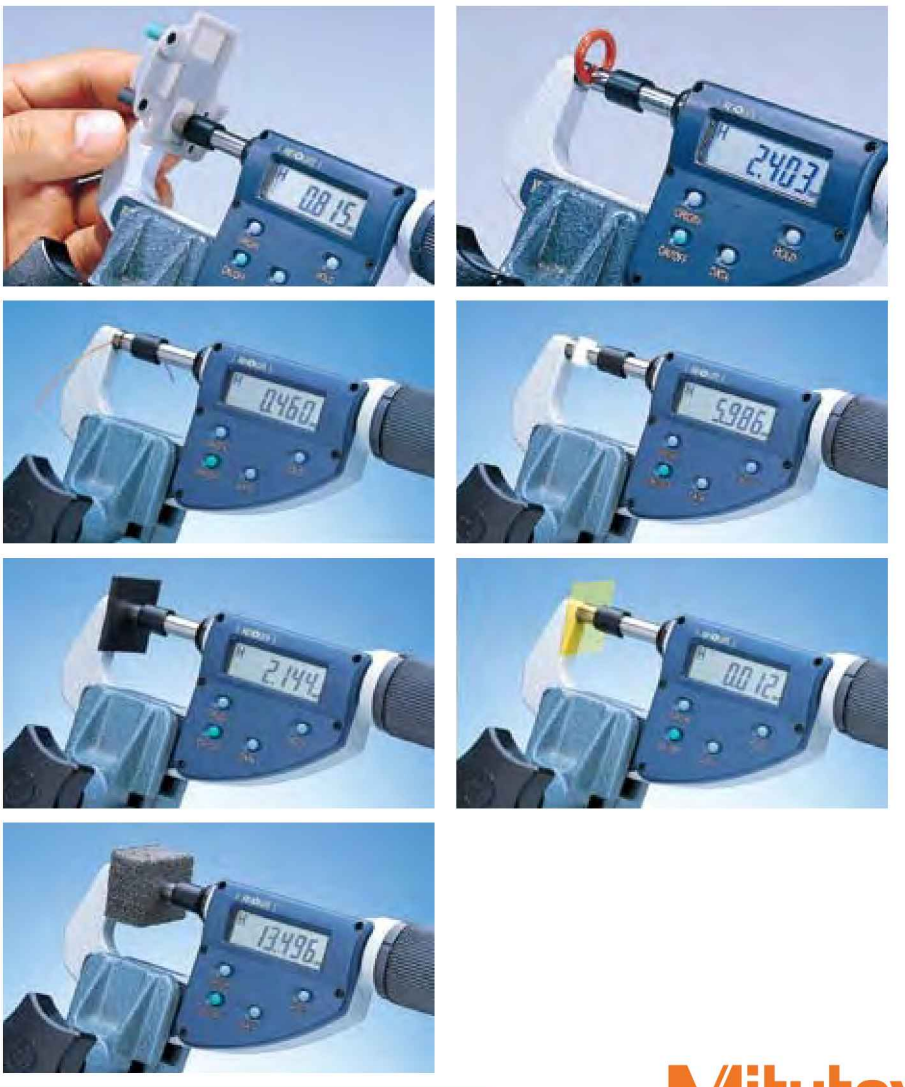
Unit: mm



Range	L	c	e
0 - 15mm	15	2	17
0 - 10mm	10	2	22



Range	L	c	e
15 - 30mm	30	12.8	17
10 - 20mm	20	17.8	22
20 - 30mm	30	7.8	



Mitutoyo

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.
- A ratchet stop or a friction thimble for a constant measuring force.
- Measuring faces: Carbide

Ratchet stop
102-301

An inspection certificate is supplied as standard.
Refer to page X for details.

Common specifications:
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25mm models)
Spanner (301336), 1 pc
(for measuring range 0-25mm/25-50mm models)
Spanner (200877), 1 pc
(for measuring range 50-75mm/75-100mm models)

Ratchet stop type

Friction thimble type

SPECIFICATIONS

Metric

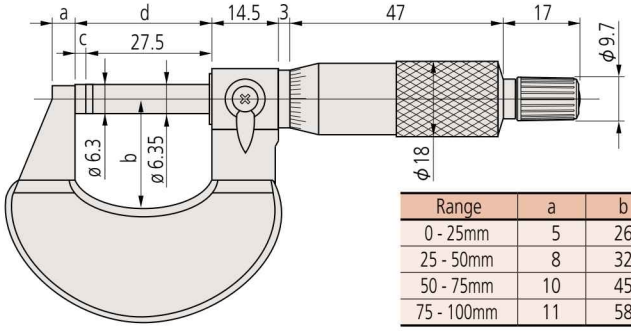
Order No.	Range	Graduation	Accuracy	Flatness	Parallelism	Constant-force device
102-301	0 - 25mm	0.01mm	±2μm	0.6μm	2μm	Ratchet stop
102-311		0.001mm	±1μm	0.3μm	1μm	
102-313						friction thimble
102-302	25 - 50mm	0.01mm	±2μm	0.6μm	2μm	Ratchet stop
102-312		0.001mm	±1μm	0.3μm	1μm	
102-303	50 - 75mm	0.01mm	±2μm	0.6μm	2μm	
102-304	75 - 100mm		±3μm		3μm	

Metric Micrometer set

Order No.	Range	Models included
102-911-40	0 - 100mm (Four micrometers per set)	• **102-301** **102-302** **102-303** **102-304** • 3 micrometer standards

DIMENSIONS

Unit: mm



Range	a	b	c	d
0 - 25mm	5	26	2.8	30.3
25 - 50mm	8	32		55.3
50 - 75mm	10	45		80.3
75 - 100mm	11	58		105.3

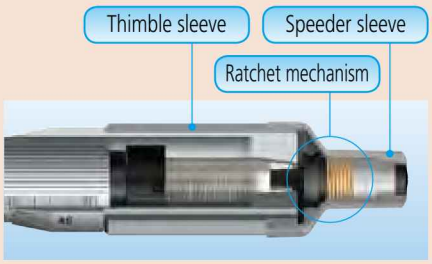
PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page X for details.

Technical Data

Flatness: 0.6µm/.000024"
Parallelism: 2µm/.00008"
Measuring force: 5-10N
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25mm (0-1") models)
Spanner (301336), 1 pc

Internal structure

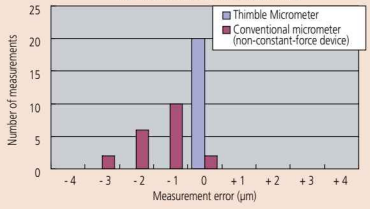


Greatly improved accuracy and repeatability

Measurement results of one-handed operation

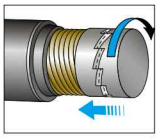
A beginner performed a test by measuring a workpiece 20 times using a conventional micrometer and a Ratchet Thimble Micrometer.

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

102-701

102-708

SPECIFICATIONS

Metric

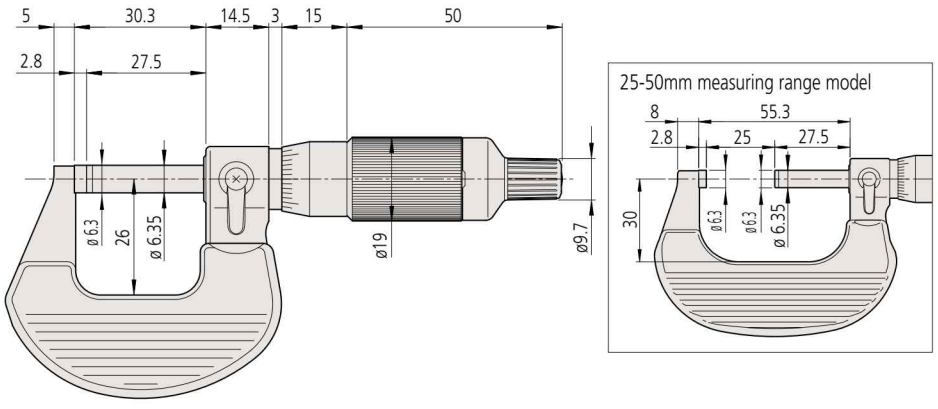
Order No.	Range	Graduation	Accuracy	Mass
102-701	0 - 25mm	0.01mm	±2µm	180g
102-707		0.001mm		
102-702	25 - 50mm	0.01mm		270g
102-708		0.001mm		

Inch

Order No.	Range	Graduation	Accuracy	Mass
102-717	0 - 1"	.0001"	±.0001"	180g
102-718	1" - 2"			270g

DIMENSIONS

Unit: mm



Micrometer

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

Outside Micrometers
SERIES 103

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

103-137

103-139-10

Metric With ratchet stop

Order No.	Range	Graduation	Accuracy
103-137	0 - 25mm	0.01mm	±2µm
103-129		0.001mm	
103-138	25 - 50mm	0.01mm	
103-130		0.001mm	
103-139-10	50 - 75mm	0.01mm	±3µm
103-140-10	75 - 100mm		
103-141-10	100 - 125mm		
103-142-10	125 - 150mm		±4µm
103-143-10	150 - 175mm		
103-144-10	175 - 200mm		
103-145-10	200 - 225mm		±5µm
103-146-10	225 - 250mm		
103-147-10	250 - 275mm		
103-148-10	275 - 300mm		±6µm
103-149	300 - 325mm		
103-150	325 - 350mm		
103-151	350 - 375mm		±7µm
103-152	375 - 400mm		
103-153	400 - 425mm		
103-154	425 - 450mm		±8µm
103-155	450 - 475mm		
103-156	475 - 500mm		
103-157	500 - 525mm		±9µm
103-158	525 - 550mm		
103-159	550 - 575mm		
103-160	575 - 600mm		±10µm
103-161	600 - 625mm		
103-162	625 - 650mm		
103-163	650 - 675mm		±11µm
103-164	675 - 700mm		
103-165	700 - 725mm		
103-166	725 - 750mm		±12µm
103-167	750 - 775mm		
103-168	775 - 800mm		
103-169	800 - 825mm		±13µm
103-170	825 - 850mm		
103-171	850 - 875mm		
103-172	875 - 900mm		±14µm
103-173	900 - 925mm		
103-174	925 - 950mm		
103-175	950 - 975mm		±15µm
103-176	975 - 1000mm		

Inch With ratchet stop

Order No.	Range	Graduation	Accuracy
103-177	0 - 1"	.001"	±.0001"
103-131		.0001"	
103-178	1" - 2"	.001"	
103-132		.0001"	
103-179	2" - 3"	.001"	±.00015"
103-180	3" - 4"		
103-181	4" - 5"		
103-182	5" - 6"		±.0002"
103-183	6" - 7"		
103-184	7" - 8"		
103-185	8" - 9"		±.00025"
103-186	9" - 10"		
103-187	10" - 11"		
103-188	11" - 12"		±.0003"
103-189	12" - 13"		
103-190	13" - 14"		
103-191	14" - 15"		±.00035"
103-192	15" - 16"		
103-193	16" - 17"		
103-194	17" - 18"		±.0004"
103-195	18" - 19"		
103-196	19" - 20"		
103-197	20" - 21"		±.00045"
103-198	21" - 22"		
103-199	22" - 23"		
103-200	23" - 24"		±.0005"
103-201	24" - 25"		
103-202	25" - 26"		
103-203	26" - 27"		±.00055"
103-204	27" - 28"		
103-205	28" - 29"		
103-206	29" - 30"		±.0006"
103-207	30" - 31"		
103-208	31" - 32"		
103-209	32" - 33"		±.00065"
103-210	33" - 34"		
103-211	34" - 35"		
103-212	35" - 36"		±.0007"
103-213	36" - 37"		
103-214	37" - 38"		
103-215	38" - 39"		±.00075"
103-216	39" - 40"		

Inch With friction thimble

Order No.	Range	Graduation	Accuracy
103-135	0 - 1"	.0001"	±.0001"
103-136	1" - 2"		

An inspection certificate is supplied as standard.
Refer to page X for details.

Technical Data

Flatness: 0.6µm/.000024" for models up to 300mm/12"
1µm/.00004" for models over 300mm/12"
Parallelism:
(2 + R/100) µm, R = max, range (mm)
[.00008+.00004 (R/4)]", R = max, range (inch)
*fraction rounded down
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25mm (0-1") models)
Spanner (301336), 1 pc
(for maximum measuring range up to 300mm (12"))
Spanner (200154), 1 pc
(for maximum measuring range 325mm (13") or over)

103-904-10

103-905-10

103-906

Metric Micrometer set / With ratchet thimble

Order No.	Range	Models included
103-927-10	0 - 75mm (3 pcs./set)	**103-137, 103-138, 103-139-10,** 2 micrometer standards
103-913-50	0 - 150mm (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 - 300mm (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 - 300mm (12 pcs./set)	All micrometers of **103-913-50** and **103-915-10** in one set, 11 micrometer standards

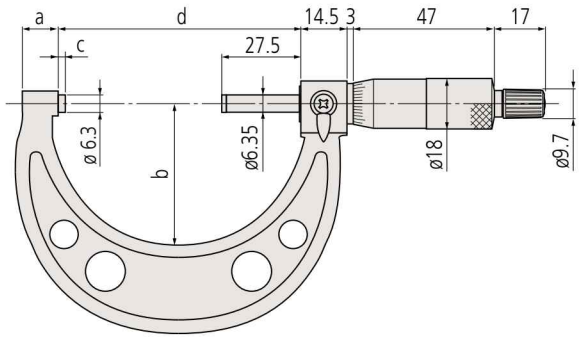
Inch Micrometer set / With ratchet thimble

Order No.	Range	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

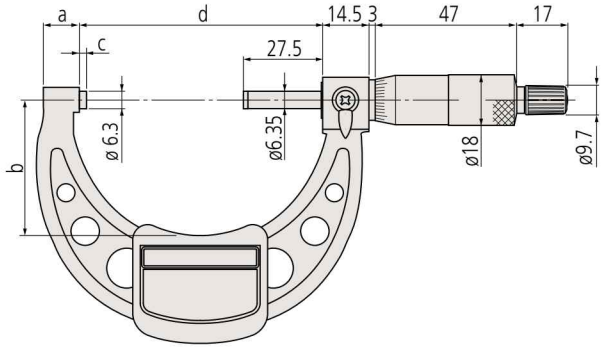
DIMENSIONS

Unit: mm

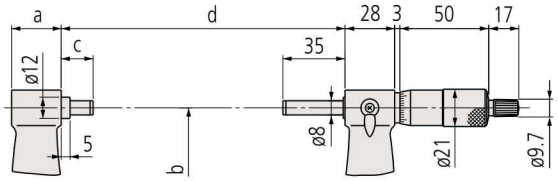
Models up to 75mm measuring range



Models 75mm to 300mm



Models over 300mm measuring range



Range	a	b	c	d
0 - 25mm	9	28	2.5	30
25 - 50mm	10	38		55
50 - 75mm	12	47		80
75 - 100mm	14	58		105
100 - 125mm	16.7	77	5.3	132.8
125 - 150mm	18.8	92	5.7	158.2
150 - 175mm	19.1	104	6.1	183.6
175 - 200mm	18.2	115	6.3	208.8
200 - 225mm	16.8	128	6.7	234.2
225 - 250mm	18	141	5.5	258

Range	a	b	c	d
250 - 275mm	18	153	6.5	284
275 - 300mm		166		309
300 - 325mm	28	187	18	353
325 - 350mm		199		378
350 - 375mm		212		403
375 - 400mm		224		428
400 - 425mm		236		453
425 - 450mm		248		478
450 - 475mm		261		503
475 - 500mm		273		528

Range	a	b	c	d
500 - 525mm	28	307	40	575
525 - 550mm			15	
550 - 575mm		332	40	625
575 - 600mm			15	
600 - 625mm		355	40	675
625 - 650mm			15	
650 - 675mm		382	40	725
675 - 700mm			15	
700 - 725mm		405	40	775
725 - 750mm			15	
750 - 775mm		430	40	825
775 - 800mm			15	
800 - 825mm		455	40	875
825 - 850mm			15	
850 - 875mm		480	40	925
875 - 900mm			15	
900 - 925mm		505	40	975
925 - 950mm			15	
950 - 975mm		530	40	1025
975 - 1000mm			15	

Mitutoyo

Micrometer

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

B

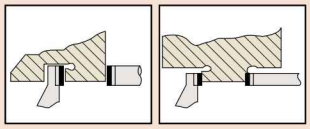
Outside Micrometers
SERIES 101

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

101-114

Technical Data

Flatness: .000024"
Parallelism: .00008" for models up to 3"
.00012" for models over 3"
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-1" models)
Spanner (301336), 1 pc
(for measuring range 0-1" / 1-2" models)
Spanner (200877), 1 pc
(for measuring range 2-3" / 3-4" models)



SPECIFICATIONS

Inch With ratchet stop

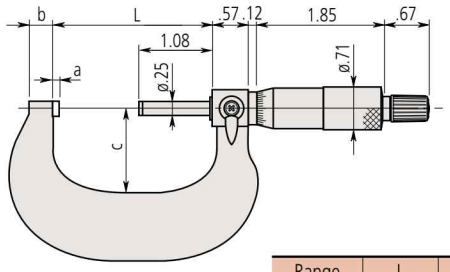
Order No.	Range	Graduation	Accuracy
101-113	0 - 1"	.0001"	±.0001"
101-114	1" - 2"		
101-119	2" - 3"		
101-120	3" - 4"		±.00015"

Inch With friction thimble

Order No.	Range	Graduation	Accuracy
101-117	0 - 1"	.0001"	±.0001"
101-118	1" - 2"		

DIMENSIONS

Unit: inch



Range	L	a	b	c
0 - 1"	1.18	.10	.20	1.10
1 - 2"	2.16	.08	.31	1.28
2 - 3"	3.19	.11	.33	1.77
3 - 4"	4.19	.11	.33	2.28

Note: The shape of the thimble is different on the model with a friction thimble.

Digit Outside Micrometers
SERIES 193

Technical Data

Counter Reading : 0.01mm or .001"
Flatness: 0.6µm/.000024"
Parallelism:
(2 + R/100)µm, R = max. range (mm)
[.00008" + .00004(R/4)]" R = max. range (inch)
fraction rounded down
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25mm (0-1") models)
Spanner (301336), 1 pc

- Mechanical digit counter with 0.01mm or .001" resolution for quick and error-free reading.
- Measuring faces: Carbide
- Equipped with Ratchet Stop for constant measuring force.

193-101

193-111

193-112

SPECIFICATIONS

Metric With ratchet stop

Order No.	Range	Graduation	Accuracy
193-101	0 - 25mm	0.01mm	±2µm
193-111		0.001mm	
193-102	25 - 50mm	0.01mm	
193-112		0.001mm	
193-103	50 - 75mm	0.01mm	
193-113		0.001mm	
193-104	75 - 100mm	0.01mm	±3µm
193-114		0.001mm	

Inch With ratchet stop

Order No.	Range	Graduation	Accuracy
193-213	2" - 3"	.0001"	±.0001"
193-214	3" - 4"		±.00015"

Inch With friction thimble

Order No.	Range	Graduation	Accuracy
193-211	0 - 1"	.0001"	±.0001"
193-212	1" - 2"		

Metric Micrometer set

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

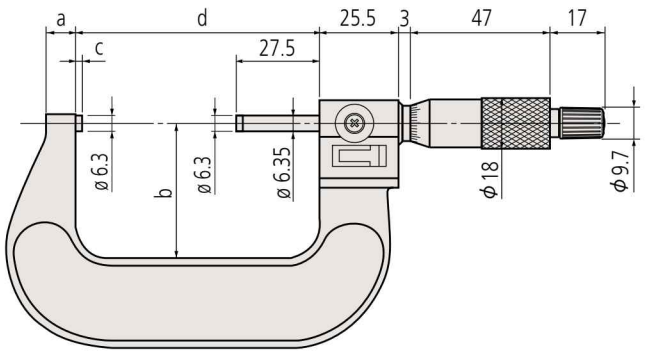
Inch Micrometer set

Order No.	Range	Models included
193-923	0 - 3" (3 pcs./set)	• **193-211, 193-212, 193-213** • 2 micrometer standards

DIMENSIONS

Unit: mm

Models up to 100mm measuring range



Range	a	b	c	d
0 - 25mm	5	26	2.5	30
25 - 50mm	8	32	2.0	55
50 - 75mm	9	45		80
75 - 100mm		57		105

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Micrometer

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Outside Micrometers
SERIES 406 — Digimatic straight line micrometer outside micrometer

- Non-rotating spindle.
- Equipped with Ratchet Stop for constant measuring force.

406-250-30

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 0-25mm (0-1") models)
Spanner (301336), 1 pc

Optional accessories

Connecting cables
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
SPC cables for **U-WAVE** w/ data switch (160mm):
02AZD790B
For foot switch: **02AZE140B**
(Refer to page B-68 for details.)

Metric

Order No.	Range	Resolution	Accuracy*	Flatness	Parallelism
406-250-30	0 - 25mm	0.001mm	±3µm	0.3µm	3µm
406-251-30	25 - 50mm				
406-252-30	50 - 75mm				
406-253-30	75 - 100mm		±4µm		4µm

* Excluding quantizing error

Inch/Metric

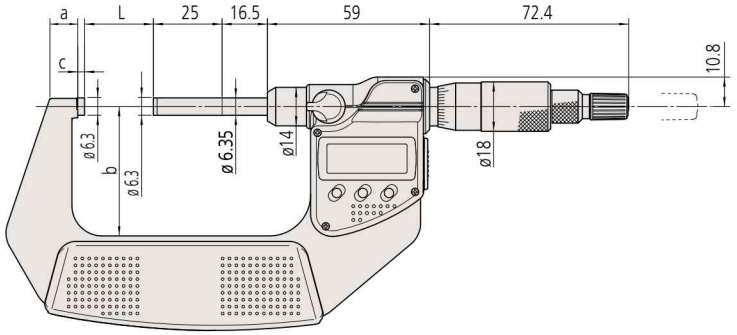
Order No.	Range	Resolution	Accuracy*	Flatness	Parallelism
406-350-30	0 - 1"	.00005"/ 0.001mm	±.00015"	.000012"	.00012"
406-351-30	1" - 2"				
406-352-30	2" - 3"				
406-353-30	3" - 4"		±.0002"		.00016"

* Excluding quantizing error

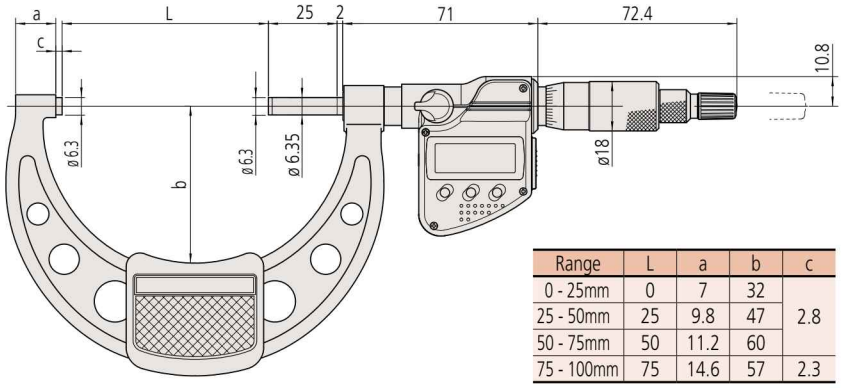
DIMENSIONS

Unit: mm

Digital models up to 75mm measuring range



Digital models over 75mm measuring range



Range	L	a	b	c
0 - 25mm	0	7	32	2.8
25 - 50mm	25	9.8	47	
50 - 75mm	50	11.2	60	
75 - 100mm	75	14.6	57	2.3

Technical Data

Flatness: 0.6µm/.000024"
Parallelism:
(2 + R/100)µm, R = max. measuring range (mm)
fraction rounded down
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25mm models)
Spanner (301336), 1 pc

Typical indicator choice

Dial indicator (0.01mm) / **2046SB**
Dial indicator (0.001mm) / **2109SB-10**
ABS Digimatic Indicator (0.01mm) / **543-400B**
ABS Digimatic Indicator (0.001mm) / **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/±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: 3mm

107-201
(Indicator shown is optional)

SPECIFICATIONS

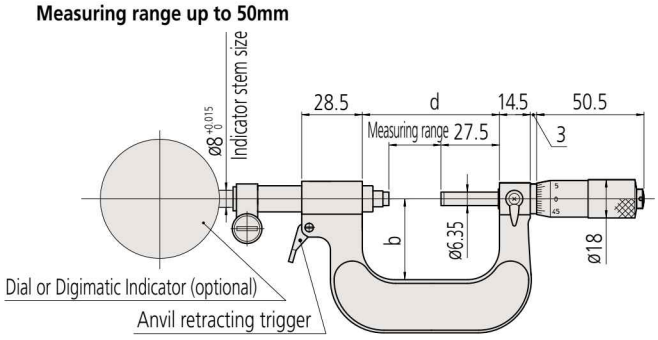
Metric

Order No.	Range	Accuracy
107-201	0 - 25mm	±2µm
107-202	25 - 50mm	
107-203	50 - 75mm	
107-204	75 - 100mm	±3µm
107-205	100 - 125mm	
107-206	125 - 150mm	
107-207	150 - 175mm	±4µm
107-208	175 - 200mm	

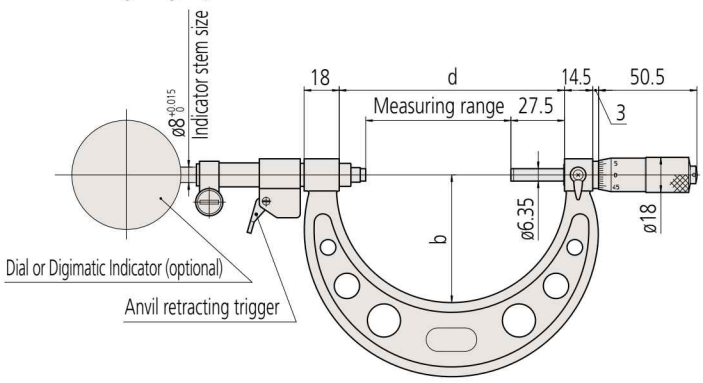
DIMENSIONS AND MASS

Unit: mm

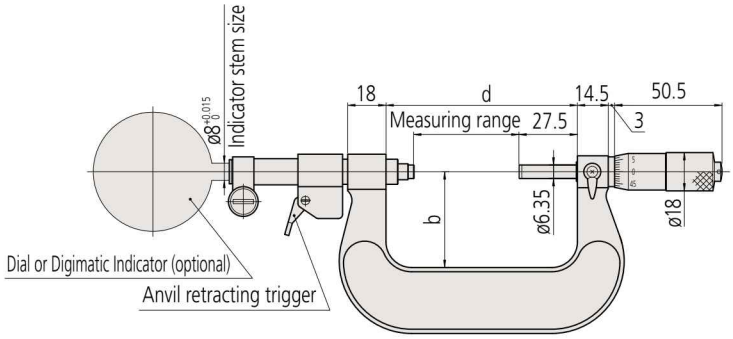
Measuring range up to 50mm



Measuring range up to 200mm



Measuring range up to 75mm



Range	b	d
0 - 25mm	30	39.5
25 - 50mm	38	64.5
50 - 75mm	45	90
75 - 100mm	65	115.6
100 - 125mm	79	140.6
125 - 150mm	93	165.6
150 - 175mm	105	190.5
175 - 200mm	118	214.5

Micrometer

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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 0000040191

Outside Micrometers
SERIES 340, 104 — with Interchangeable Anvils

- Wide measuring range with interchangeable anvils.
- Measuring face of the spindle is carbide tipped (standard model).
- IP 65 water/dust protection (series 340).
  * Models with a measuring range up to 300mm.
- Equipped with Ratchet Stop for constant measuring force.

104-136

340-251-30

IP Codes (series 340)

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:
0.6µm/ .000024" for models up to 300mm/ 12"
1.0µm/ .00004" for models over 300mm/ 12"
Parallelism:
2µm/ .00008" for models up to 75mm/ 3"
3µm/ .00012" for models up to 150mm/ 6"
(2+R/100)µm for models over 150mm,
R=max. range (mm)
Fraction rounded up
±[.00008" + .00004 (R/4)]" For models over 6"
R= max. range (inch)
Fraction rounded up
Accuracy:
±(4+R/75)µm, R = max. range (mm)
±[.00016"+.00004(R/3)]" R = max. range (inch)
(excluding quantizing error for digital models)
Fraction rounded up
Excluding quantizing error

SPECIFICATIONS

Metric

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

Inch/Metric

Order No.	Range	Resolution	Interchangeable anvils	Setting Standard Qty	Setting Standard Size	Micrometer head stroke
Digimatic (LCD)						
340-251-30	0 - 6"	.00005"/ 0.001mm	6pcs.	5	1"- 5"	1"
340-252-30	6" - 12"	.0001"/ 0.001mm		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	Graduation	Interchangeable anvils	Setting Standard Qty	Setting Standard Size	Micrometer head stroke
Analog						
104-171*	0 - 50mm	0.01mm	1pcs.	1	25mm	25mm
104-139A	0 - 100mm		4pcs.	3	25-75mm	
104-135A	0 - 150mm		6pcs.	5	25-125mm	
104-161A	50 - 150mm		4pcs.	4	50-125mm	
104-140A	100 - 200mm				100-175mm	
104-136A	150 - 300mm		6pcs.	6	150-275mm	
104-141A	200 - 300mm		4pcs.	4	200-275mm	
104-142A	300 - 400mm				300-375mm	
104-143A	400 - 500mm				400-475mm	
104-144A	500 - 600mm				500-575mm	
104-145A	600 - 700mm				600-675mm	
104-146A	700 - 800mm				700-775mm	
104-147A	800 - 900mm				800-875mm	
104-148A	900 - 1000mm				900-975mm	

* The frame is fitted with a heat shield.

Inch

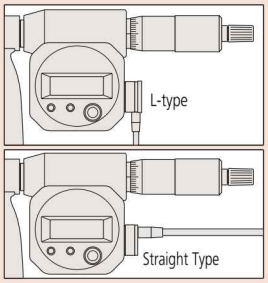
Order No.	Range	Interchangeable anvils	Graduation	Setting Standard Qty	Setting Standard Size	Micrometer head stroke
Analog						
104-165	0 - 2"	1pcs.	.0001"	1	1"	
104-149	0 - 4"	4pcs.	.001"	3	1" - 3"	
104-137	0 - 6"	6pcs.		5	1" - 5"	
104-162	2" - 6"	4pcs.		4	2" - 5"	
104-150	4" - 8"				4" - 7"	
104-138	6" - 12"	6pcs.		6	6" - 11"	
104-151	8" - 12"	4pcs.		4	8" - 11"	
104-152	12" - 16"				12" - 15"	
104-201	12" - 18"	6pcs.		6	12" - 17"	
104-153	16" - 20"	4pcs.		4	16" - 19"	
104-202	18" - 24"	6pcs.		6	18" - 23"	
104-154	20" - 24"	4pcs.		4	20" - 23"	
104-155	24" - 28"				24" - 27"	
104-203	24" - 30"	6pcs.		6	24" - 29"	
104-156	28" - 32"	4pcs.		4	28" - 31"	
104-204	30" - 36"	6pcs.		6	30" - 35"	
104-157	32" - 36"	4pcs.		4	32" - 35"	
104-158	36" - 40"				36" - 39"	
104-205	36" - 42"	6pcs.		6	36" - 41"	

Battery for series 340

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use
(for series 340-2XX)
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 300mm (12"))
Spanner (200154), 1 pc
(for maximum measuring range 400mm (16") or over)

Optional accessories

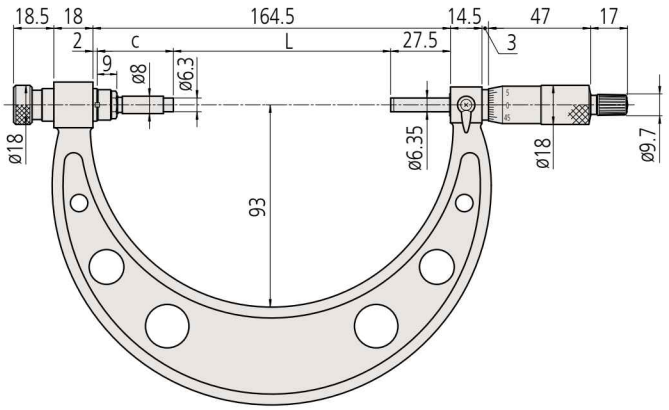
Connecting cables for
340-251-30 & **340-252-30, 340-351-30** & **340-252-30**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
SPC cables for U-WAVE w/ data switch (160mm):
02AZD790B
For foot switch: **02AZE140B**
Connecting cables for
340-520/1/2/3/4/5/6, 340-720/1/2/3 models
Recommended cables:
L-Type (does not interfere with operating the thimble.)
1m: **04AZB512**
2m: **04AZB513**
Straight type (may interfere with operating the thimble.)
1m: **959149**
2m: **959150**



DIMENSIONS

104-135A

Unit: mm

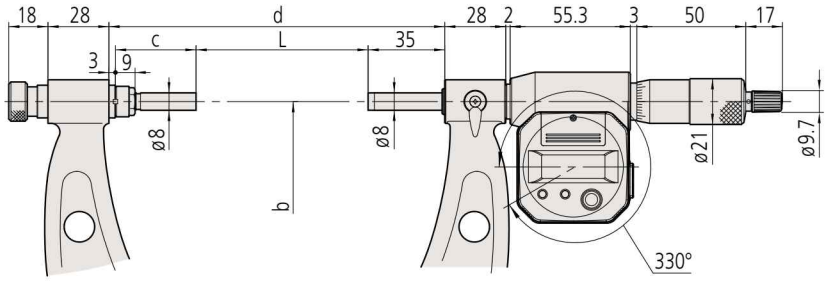


Interchangeable anvil

		L : Range (mm)					
Range	0 to 150mm models	0 - 25	25 - 50	50 - 75	75 - 100	100 - 125	125 - 150
Range	150 to 300mm 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

		L : Range (mm)			
Range	300 to 400mm models	300 - 325	325 - 350	350 - 375	375 - 400
Range	400 to 500mm models	400 - 425	425 - 450	450 - 475	475 - 500
Range	500 to 600mm models	500 - 525	525 - 550	550 - 575	575 - 600
Range	600 to 700mm models	600 - 625	625 - 650	650 - 675	675 - 700
Range	700 to 800mm models	700 - 725	725 - 750	750 - 775	775 - 800
Range	800 to 900mm models	800 - 825	825 - 850	850 - 875	875 - 900
Range	900 to 1000mm 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 400mm up to 1000mm



		L : Range (mm)				b	d
Range	300 to 400mm models	300 - 325	325 - 350	350 - 375	375 - 400	224	425
Range	400 to 500mm models	400 - 425	425 - 450	450 - 475	475 - 500	273	525
Range	500 to 600mm models	500 - 525	525 - 550	550 - 575	575 - 600	332	625
Range	600 to 700mm models	600 - 625	625 - 650	650 - 675	675 - 700	382	725
Range	700 to 800mm models	700 - 725	725 - 750	750 - 775	775 - 800	430	825
Range	800 to 900mm models	800 - 825	825 - 850	850 - 875	875 - 900	480	925
Range	900 to 1000mm models	900 - 925	925 - 950	950 - 975	975 - 1000	530	1025
	Order No.	**304001**	**304002**	**304003**	**304004**		
	c: Overall (mm)	87	62	37	12		
	Interchangeable anvil	M3	M4	M5	M6		

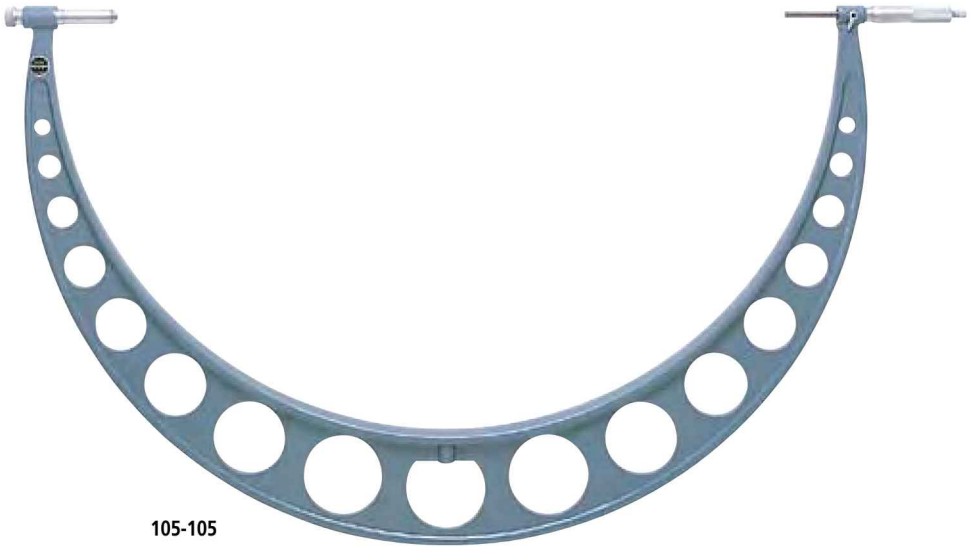
Mitutoyo

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.
- 50mm/2" spindle stroke
- Measuring faces: Carbide
- Equipped with Ratchet Stop for constant measuring force.



105-105

Technical Data

Flatness: 1.3µm
Parallelism:
(2 + R/100)µm, R = max. range (mm)
fraction rounded down
Accuracy:
±(6+R/75)µm, R = max. range (mm)
fraction rounded up
Standard accessories: Spanner (200154), 1 pc

Anvil Extension Collar

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

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

SPECIFICATIONS

Metric

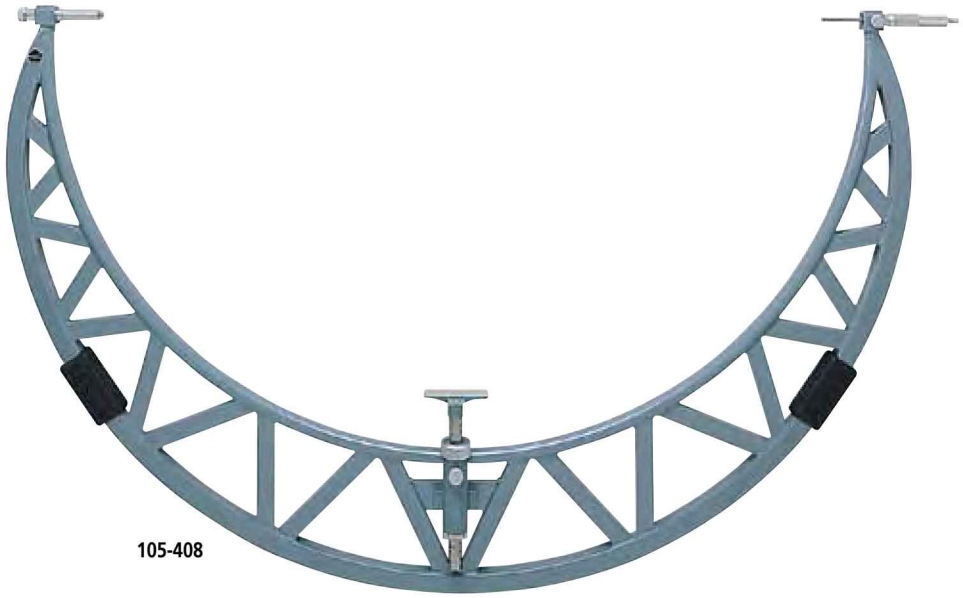
Order No.	Range	Graduation	Extension Collars	Setting Standard
105-103	500 - 600mm	0.01mm	1 pc (50mm)	2 pcs.
105-104	600 - 700mm			
105-105	700 - 800mm			
105-106	800 - 900mm			
105-107	900 - 1000mm			

Technical Data

Flatness: 1.3µm/.000052"
Parallelism:
(2 + R/100)µm, R = max. Range (mm)
[.00008" + .00004(R/4)]", R = max. Range (inch)
fraction rounded down
Accuracy:
±(6+R/75)µm, R = max. Range (mm)
±[.0003" + .00005"(R/3)]", R = max. range (inch)
fraction rounded up
Standard accessories: Spanner (200154), 1 pc

Outside micrometers
SERIES 105 — with Anvil Extension Collars

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



105-408

B

SPECIFICATIONS

Metric

Order No.	Range	Graduation	Extension Collars	Setting Standard (pcs)
(every 100mm)				
105-408	1000 - 1100mm	0.01mm	1 pc (50mm)	2
105-409	1100 - 1200mm			
105-410	1200 - 1300mm			
105-411	1300 - 1400mm			
105-412	1400 - 1500mm			
105-413	1500 - 1600mm			
105-414	1600 - 1700mm			
105-415	1700 - 1800mm			
105-416	1800 - 1900mm			
105-417	1900 - 2000mm			
(every 200mm)				
105-418	1000 - 1200mm	0.01mm	2 pcs (50mm, 100mm)	4
105-419	1200 - 1400mm			
105-420	1400 - 1600mm			
105-421	1600 - 1800mm			
105-422	1800 - 2000mm			

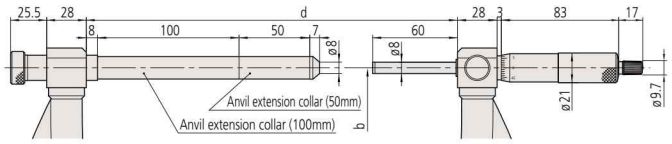
Inch

Order No.	Range	Graduation	Extension Collars	Setting Standard (pcs)
105-428	40" - 44"	.001"	1 pc (2")	2
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

Over 1200mm up to 2000mm

Unit: mm



Range	b	d
1000 - 1200mm	500 - 600	1225
1200 - 1400mm	600 - 700	1425
1400 - 1600mm	700 - 800	1625
1600 - 1800mm	800 - 900	1825
1800 - 2000mm	900 - 1000	2025

a: distance to workpiece stop

Mitutoyo

Micrometer

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

Caliper Type Micrometers SERIES 343, 143

- Effective for measuring workpiece features where access is difficult.
- Measuring faces: Carbide
- Equipped with Ratchet Stop for constant measuring force.

343-250-30

143-101

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
343-250-30	0 - 25mm	0.001mm	±5µm
343-251-30	25 - 50mm		±6µm
343-252-30	50 - 75mm		±7µm
343-253-30	75 - 100mm		±8µm

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
343-350-30	0 - 1"	.00005"/ 0.001mm	±.00025"
343-351-30	1" - 2"		±.0003"
343-352-30	2" - 3"		±.00035"
343-353-30	3" - 4"		±.0004"

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy
Analog			
143-101	0 - 25mm	0.01mm	±5µm
143-102	25 - 50mm		±6µm
143-103	50 - 75mm		±7µm
143-104	75 - 100mm		±8µm
143-105	100 - 125mm		±9µm
143-106	125 - 150mm		
143-107	150 - 175mm		±10µm
143-108	175 - 200mm		
143-109	200 - 225mm		±11µm
143-110	225 - 250mm		
143-111	250 - 275mm		±12µm
143-112	275 - 300mm		

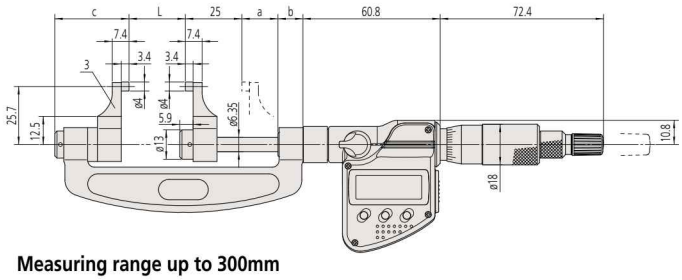
Inch

Order No.	Range	Graduation	Accuracy
Analog			
143-121	0 - 1"	.001"	±.00025"
143-122	1" - 2"		±.0003"
143-123	2" - 3"		±.00035"

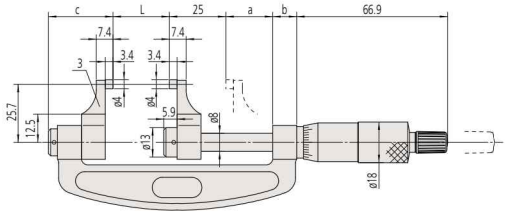
DIMENSIONS

Measuring range up to 100mm

Unit: mm



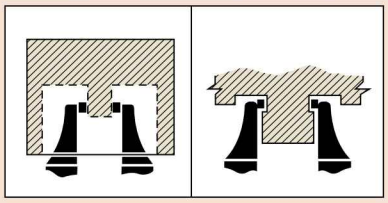
Measuring range up to 300mm



Range	L	a	b	C
Digimatic (LCD)				
0 - 25mm	0	16	11.1	32.9
25 - 50mm	25			
50 - 75mm	50			
75 - 100mm	75			
Analog				
0 - 25mm	0	20.3	11.1	28.6
25 - 50mm	25			
50 - 75mm	50			
75 - 100mm	75			
100 - 125mm	100			
125 - 150mm	125			
150 - 175mm	150			
175 - 200mm	175			
200 - 225mm	200	16.3	15	32.5
225 - 250mm	225			
250 - 275mm	250			
275 - 300mm	275			

Technical Data

Flatness: 0.3µm/.000012"
Parallelism: (3+R/75)µm, R = max. range (mm)
[.00012"+.00004(R/3)]" R = max. range (inch)
fraction rounded down



Battery for series 343

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 343)
Length standard: Electromagnetic rotary sensor (for series 343)
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25mm (0-1") models)
Spanner (301336), 1 pc

Optional accessories for series 343

Connecting cables
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T**
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 for details.

Technical data

Accuracy: ±(2+R/75)µm, R = max. range (mm) fraction rounded up

Standard accessories: Spanner (301336), 1 pc

Screw Thread Micrometers SERIES 125

- Fixed anvil type to suit 60° threads
- Directly indicates screw pitch diameter (no need for calculation)
- Equipped with Ratchet Stop for constant measuring force.

125-103

B

SPECIFICATIONS

Metric

Order No.	Thread to be measured (Metric/Unified)	Range	Graduation
125-101	0.4 - 0.5mm/64 - 48TPI	0 - 25mm	0.01mm
125-102	0.6 - 0.9mm/44 - 28TPI		
125-103	1 - 1.75mm/24 - 14TPI		
125-104	2 - 3mm/13 - 9TPI		
125-105	3.5 - 5mm/8 - 5TPI		
125-106	0.4 - 0.5mm/64 - 48TPI	25 - 50mm	
125-107	0.6 - 0.9mm/44 - 28TPI		
125-108	1 - 1.75mm/24 - 14TPI		
125-109	2 - 3mm/13 - 9TPI		
125-110	3.5 - 5mm/8 - 5TPI		

Metric

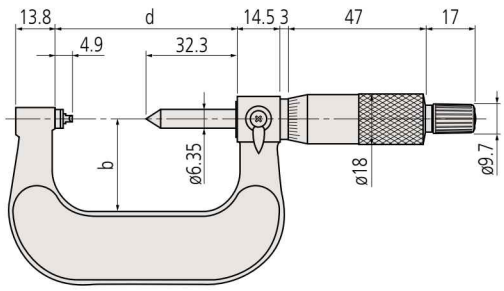
Order No.	Thread to be measured (Metric/Unified)	Range	Graduation
125-111	0.6 - 0.9mm/44 - 28TPI	50 - 75mm	0.01mm
125-112	1 - 1.75mm/24 - 14TPI		
125-113	2 - 3mm/13 - 9TPI		
125-114	3.5 - 5mm/8 - 5TPI		
125-115	5.5 - 7mm/4.5 - 3.5TPI		
125-116	0.6 - 0.9mm/44 - 28TPI	75 - 100mm	
125-117	1 - 1.75mm/24 - 14TPI		
125-118	2 - 3mm/13 - 9TPI		
125-119	3.5 - 5mm/8 - 5TPI		
125-120	5.5 - 7mm/4.5 - 3.5TPI		

* A setting standard is supplied with each model (except for 0-25mm measuring range).
The setting standard is for metric threads (unified) 60°.

DIMENSIONS

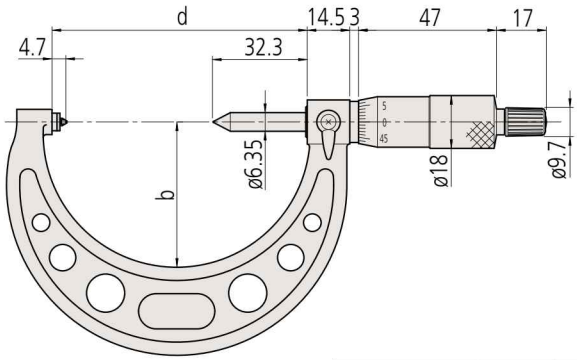
Unit: mm

No.125-101,125-106



Range	b	d
0 - 25mm	25	37.2
25 - 50mm	32	62.2

No.125-111,125-116



Range	b	d
50 - 75mm	49	87
75 - 100mm	63	112

Mitutoyo

Micrometer

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

Screw Thread Micrometers
SERIES 326, 126 — Interchangeable Anvil / Spindle Tip Type

- Anvils and spindle tips are interchangeable in matching pairs to enable measurement of Metric/Unified or Whitworth threads.
- Direct reading of screw pitch diameter (no need for calculation)
- Equipped with Ratchet Stop for constant measuring force.
- Interchangeable anvils / spindle tips are optional.

326-251-30

126-125

Interchangeable anvils / spindle tips (optional)

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
326-251-30	0 - 25mm	0.001mm	±4μm
326-252-30	25 - 50mm		
326-253-30	50 - 75mm		
326-254-30	75 - 100mm		±5μm

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
326-351-30	0 - 1"	.00005"/ 0.001mm	±.0002"
326-352-30	1" - 2"		
326-353-30	2" - 3"		
326-354-30	3" - 4"		±.00025"

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy
Analog			
126-125	0 - 25mm	0.01mm	±4μm
126-126	25 - 50mm		
126-127	50 - 75mm		
126-128	75 - 100mm		±5μm
126-129	100 - 125mm		
126-130	125 - 150mm		
126-131	150 - 175mm		±6μm
126-132	175 - 200mm		
126-133	200 - 225mm		
126-134	225 - 250mm		±7μm
126-135	250 - 275mm		
126-136	275 - 300mm		

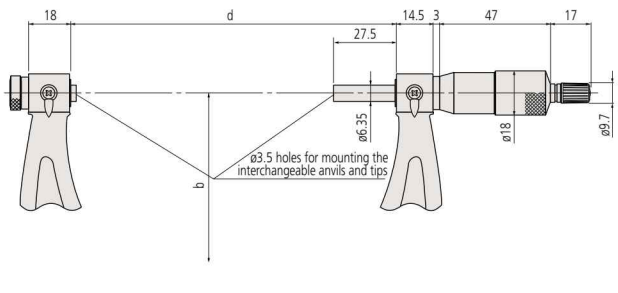
Inch

Order No.	Range	Graduation	Accuracy
Analog			
126-137	0 - 1"	.001"	±.0002"
126-138	1" - 2"		
126-139	2" - 3"		
126-140	3" - 4"		±.00025"
126-141	4" - 5"		
126-142	5" - 6"		
126-143	6" - 7"		±.0003"

Notes: 1) A matching setting standard is supplied with each model (except for 0-25mm measuring range). (Refer to page B-63 for details.)
The setting standard is for metric threads (unified) 60°.
2) For functional details of series 326, refer to series 293.
Please note that origin setting of these models is free-digit preset type. Also, connecting cables (optional) have to be a waterproof type.

DIMENSIONS

Unit: mm



Range	b	d
0 - 25mm	25	39.5
25 - 50mm	32	64.5
50 - 75mm	45	90
75 - 100mm	65	115.6
100 - 125mm	79	140.6
125 - 150mm	93	165.6
150 - 175mm	105	190.5
175 - 200mm	118	214.5
200 - 225mm	131	240.5
225 - 250mm	144	265.5
250 - 275mm	156	290.5
275 - 300mm	169	314.5

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.

TÜVRheinland CERTIFIED
www.tuv.com ID 0000040191

IP Codes (series 326)

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

Battery for series 326

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 326)
Length standard: Electromagnetic rotary sensor (for series 326)
Standard accessories: Spanner (301336), 1 pc

Optional accessories

Connecting cables
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for U-WAVE-T
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 for details.

Optional accessories

Sets of interchangeable anvils / spindle tips

- For Metric/Unified threads (pair)

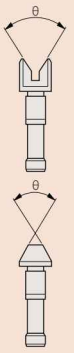
Order No.	Matching anvils/spindle tips included
126-800	0.4 - 0.5mm/64 - 48TPI (**126-801**) 0.6 - 0.9mm/44 - 28TPI (**126-802**) 1 - 1.75mm/24 - 14TPI (**126-803**) 2 - 3mm/13 - 9TPI (**126-804**) 3.5 - 5mm/8 - 5TPI (**126-805**) 5.5 - 7mm/4.5 - 3.5TPI (**126-806**)

- For Whitworth threads (pair)

Order No.	Matching anvils/spindle tips included
126-810	60 - 48TPI (**126-811**) 48 - 40TPI (**126-812**) 40 - 32TPI (**126-813**) 32 - 24TPI (**126-814**) 24 - 18TPI (**126-815**) 18 - 14TPI (**126-816**) 14 - 10TPI (**126-817**) 10 - 7TPI (**126-818**) 7- 4.5TPI (**126-819**) 4.5 - 3.5TPI (**126-820**)

Technical description

- Anvils / spindle tips



Allowable error of the angle of anvils and spindle tips

Type	Metric (Unified)	Whitworth (Unified)	Half angle error
Pitch (mm), Nominal designation of threads per inch		W1	±30'
	M1 (U1)	W2	±30'
		W3	±20'
	M2 (U2)	W4	±20'
		W5	±15'
	M3 (U3)	W6	±15'
	M4 (U4)	W7	±10'
		W8	±10'
	M5 (U5)	W9	±10'
	M6 (U6)	W10	±10'

Note) This chart indicates the difference between the angle made by anvil's contact faces and spindle's axes and the half angle with error α.
Metric/Unified θ = 60°
Whitworth θ = 55°

Technical Data

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.
- Optional anvils / spindle tips for screw thread measurement (matching V and cone) are also available.

116-101

SPECIFICATIONS

Metric

Order No.	Range	Graduation	Accuracy
116-101	0 - 25mm	0.01mm	±4µm
116-102	25 - 50mm		

* 116-102 is 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.
* 116-106 is 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.

Inch

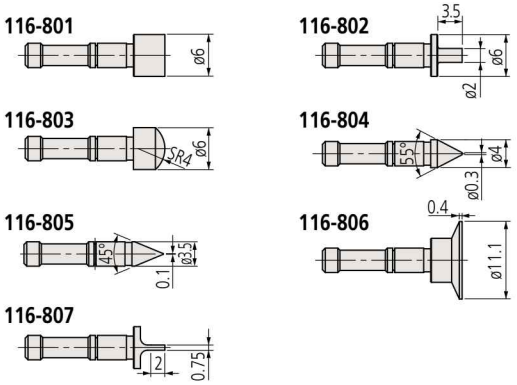
Order No.	Range	Graduation	Accuracy
116-105	0 - 1"	.001"	±.0002"
116-106	1" - 2"		

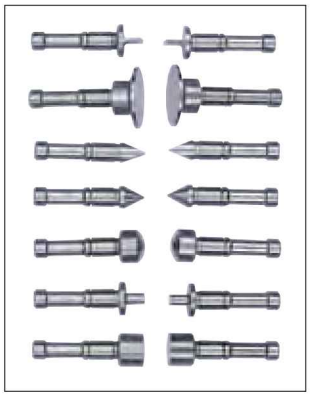
* 116-106 is provided with a plain setting standard (167-141) and a 60°-thread setting standard (167-294) for adjusting the minimum range point according to the application.

Optional accessories

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	**116-801 - 116-807** Set Anvils / spindle tips set (7 pairs)

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

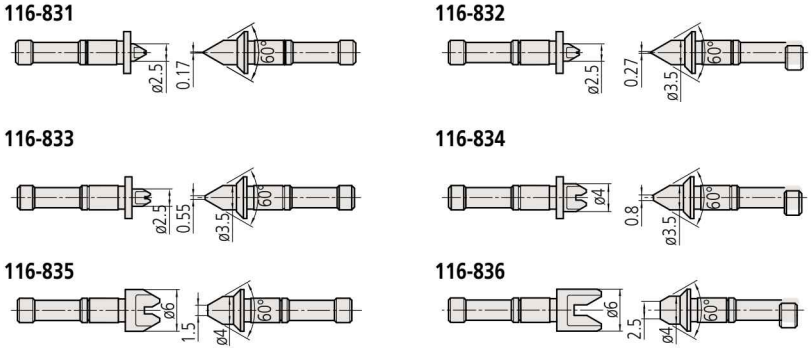




Interchangeable contact points (optional)

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

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



Mitutoyo

Micrometer

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

3-Wire Units
SERIES 313

- Enables measurement of the pitch diameter of screw threads with a standard micrometer.
- Determination of the pitch diameter: refer to "Quick Guide to Precision Measuring Instruments".

Technical Data
Accuracy of wire diameter: ±2µm

B

952141

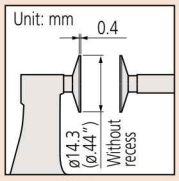
SPECIFICATIONS

3-Wire Units set

Order No.	Set	Wire dia. (mm)	Support spindle dia. (mm)
313-101	18	0.170 - 3.200	ø6.35

Order No. (One pair) (Support spindle dia.) ø6.35mm (.25"DIA.)	Wire dia. (mm)	Pitch		
		Metric thread (mm)	Unified thread (thread per inch)	Whitworth thread (thread 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

Anvil dimensions



( ): Inch model

Technical Data

Standard accessories: Spanner (301336), 1 pc

Paper Thickness Micrometers
SERIES 169 — Non-Rotating Spindle Type

- For paper thickness measurement.
- Non-rotating spindle.
- Equipped with Ratchet Stop for constant measuring force. (8.02±0.8N)

169-101

SPECIFICATIONS

Metric

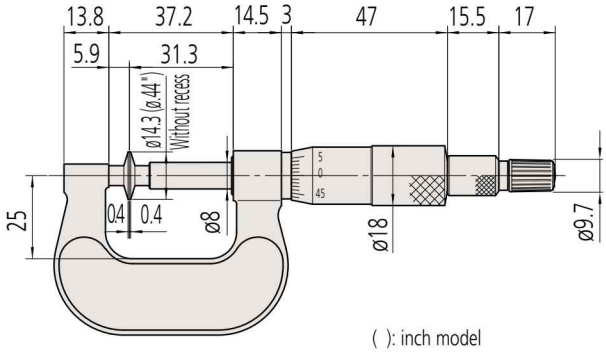
Order No.	Range	Graduation	Accuracy	Flatness	Parallelism
169-101	0 - 25mm	0.01mm	±4µm	1µm	3µm

Inch

Order No.	Range	Graduation	Accuracy	Flatness	Parallelism
169-103	0 - 1"	.001"	±.0002"	.00004"	.00015"

DIMENSIONS

Unit: mm



( ): inch model

Micrometer

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

Disk Micrometers
SERIES 323, 223, 123

- Measures "root tangent length" of spur gears and helical gears.
- Determination of the root tangent length: refer to "Quick Guide to Precision Measuring Instruments".
- Equipped with Ratchet Stop for constant measuring force.
- Supplied with a setting standard (except for 0-25mm/0-1" measuring range).

123-103

123-101

323-250-30

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	Anvil dia.	Measurable module
Digimatic (LCD)					
323-250-30	0 - 25mm	0.001mm	±4µm	ø20mm	0.5 - 6
323-251-30	25 - 50mm				
323-252-30	50 - 75mm		±6µm		
323-253-30	75 - 100mm				

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	Anvil dia.	Measurable module
Digimatic (LCD)					
323-350-30	0 - 1"	.00005"/ 0.001mm	±.0002"	.787"	0.5 - 6
323-351-30	1" - 2"				
323-352-30	2" - 3"		±.0003"		
323-353-30	3" - 4"				

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy	Anvil dia.	Measurable module
Mechanical counter model					
223-101	0 - 25mm	0.01mm	±4µm	ø20mm	0.5 - 6
223-102	25 - 50mm				
Analog					
123-101	0 - 25mm	0.01mm	±4µm	ø20mm	0.5 - 6
123-113*					
123-102	25 - 50mm				
123-114*					
123-103	50 - 75mm		±6µm		
123-115*					
123-104	75 - 100mm				
123-116*					
123-105	100 - 125mm		±7µm	ø30mm	0.7 - 11
123-106	125 - 150mm				
123-107	150 - 175mm		±8µm		
123-108	175 - 200mm				
123-109	200 - 225mm				
123-110	225 - 250mm		±9µm		
123-111	250 - 275mm				
123-112	275 - 300mm				

* The measuring disks have carbide tips.

Inch

Order No.	Range	Graduation	Accuracy	Anvil dia.	Measurable module
Mechanical counter model					
223-125	0 - 1"	.001"	±.0002"	.787"	0.5 - 6
Analog					
123-125	0 - 1"	.001"	±.0002"	.787"	0.5 - 6
123-126	1" - 2"				
123-127	2" - 3"		±.0003"		
123-128	3" - 4"				

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 0000040191

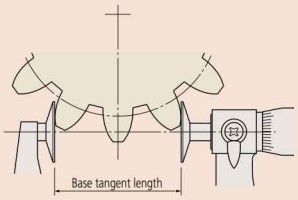
IP Codes (series 323)

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: 1µm/.00004" for models up to 100mm/4"
1.6µm/.000063" for models over 100mm/4"
Parallelism: 4µm for models up to 50mm
.0002" for models up to 2"
6µm for models up to 100mm
.0003" for models up to 4"
(5+R/75)µm for models over 100mm,
R = max. range (mm)
fraction rounded up

Root tangent length of gear (En)



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 0-25mm (0-1") models)
Spanner (301336), 1 pc

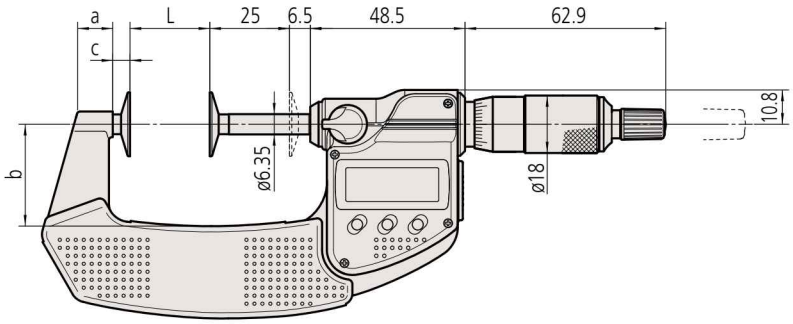
Optional accessories for series 323

Connecting cables
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T**
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 for details.

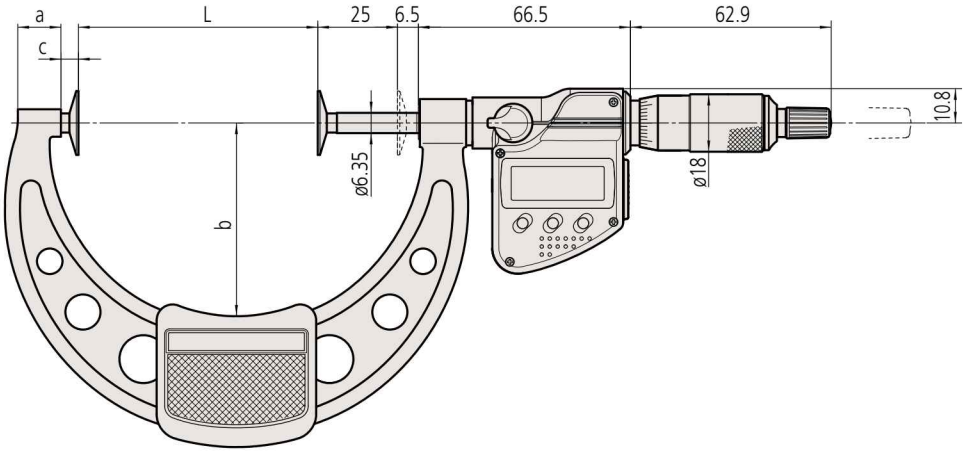
DIMENSIONS

Digital models up to 75mm measuring range

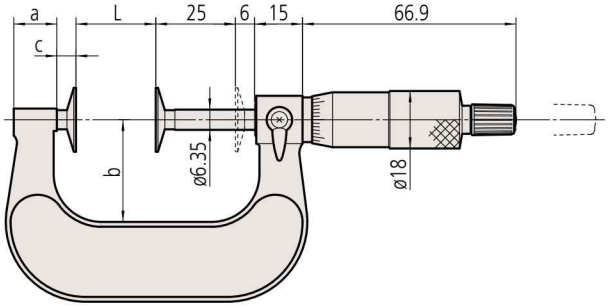
Unit: mm

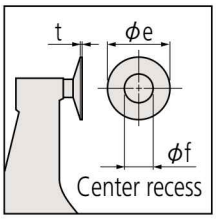


Digital models up to 100mm measuring range

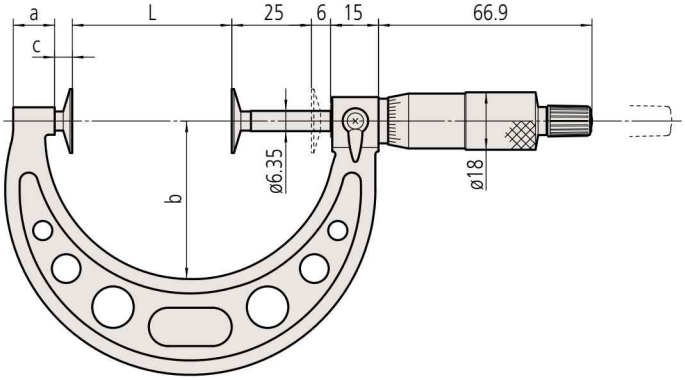


Analog models up to 50mm measuring range





Analog over 50mm measuring range



Range	L	a	b	c	e	f	t
Digimatic (LCD)							
0 - 25mm	0	9.2	25	4.5	20	8	0.7
25 - 50mm	25	11	31	5.4			
50 - 75mm	50	12.2	50	5.5			
75 - 100mm	75	14	60	5.5			
Analog							
0 - 25mm	0	13.8	25	5.7	20	8 (9.8)	0.7 (0.7)
25 - 50mm	25		32				
50 - 75mm	50	12	49	5.5			
75 - 100mm	75	14	63				
100 - 125mm	100	12	79	6	30	12	1
125 - 150mm	125	15	94				
150 - 175mm	150	16	106				
175 - 200mm	175	15	118				
200 - 225mm	200	14	130				
225 - 250mm	225		143				
250 - 275mm	250	15	156				
275 - 300mm	275		169				

* 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

- 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".
- Interchangeable ball anvils / spindle tips for various gear modules (0.5-5.25) are optional.
- Equipped with Ratchet Stop for constant measuring force.
- Ball anvil / spindle tips: optional.

324-251-30

124-173

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
324-251-30	0 - 25mm	0.001mm	±4µm
324-252-30	25 - 50mm		
324-253-30	50 - 75mm		
324-254-30	75 - 100mm		±5µm

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
324-351-30	0 - 1"	.00005"/ 0.001mm	±.0002"
324-352-30	1" - 2"		
324-353-30	2" - 3"		
324-354-30	3" - 4"		±.00025"

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy
Analog			
124-173	0 - 25mm	0.01mm	±4µm
124-174	25 - 50mm		
124-175	50 - 75mm		
124-176	75 - 100mm		±5µm
124-177	100 - 125mm		
124-178	125 - 150mm		
124-179	150 - 175mm		±6µm
124-180	175 - 200mm		
124-181	200 - 225mm		
124-182	225 - 250mm		±7µm
124-183	250 - 275mm		
124-195	275 - 300mm		

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.

TÜVRheinland CERTIFIED
www.tuv.com ID 0000040191

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	ø0.8	0.5 - 0.55	50
124-802	ø1.0	0.6 - 0.65	45
124-803	ø1.191 (3/64")	0.7 - 0.8	35 - 30
124-821	ø1.5	0.9 - 1	28 - 26
124-804	ø1.588 (1/16")	0.9 - 1	28 - 26
124-805	ø2.0	1.25	22
124-806	ø2.381 (3/32")	1.5	17
124-822	ø2.5	1.5	17
124-807	ø3.0	1.75	15
124-808	ø3.175 (1/8")	—	14
124-823	ø3.5	2	13
124-809	ø3.969 (5/32")	2	13
124-810	ø4.0	2.25	11
124-824	ø4.5	2.5	10
124-811	ø4.763 (3/16")	2.5	10
124-812	ø5.0	2.75	9
124-813	ø5.556 (7/32")	3.0 - 3.25	8
124-814	ø6.0	3.5	7
124-815	ø6.35 (1/4")	3.75	7
124-816	ø7.0	4.0	6.5
124-817	ø7.144 (9/32")	4.25	6
124-818	ø7.938 (5/16")	4.5	5.5
124-819	ø8.0	4.75	5.5
124-820	ø8.731 (11/32")	5.0 - 5.25	5

* ø2mm or less/ carbide-tipped type

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 0-25mm (0-1") models)
Spanner (301336), 1 pc

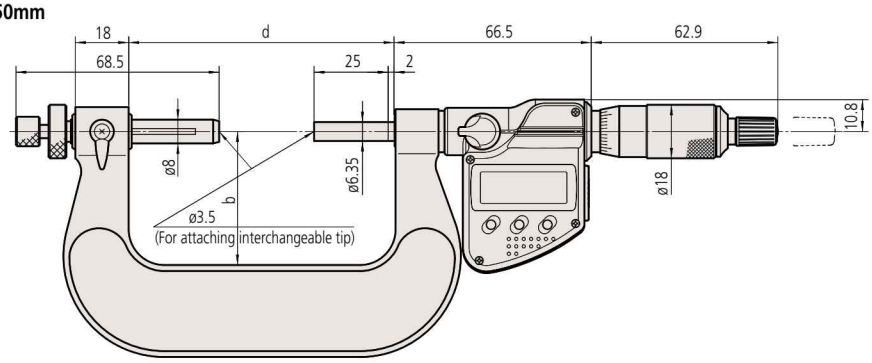
Optional accessories

Connecting cables for **series 324**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
SPC cables for U-WAVE w/ data switch (160mm):
02AZD790B
For foot switch: **02AZE140B**
(Refer to page B-68 for details.)

DIMENSIONS

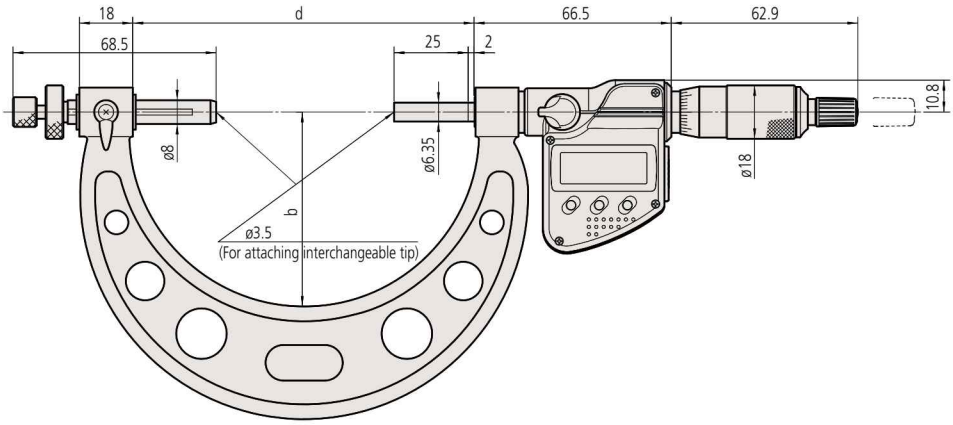
Unit: mm

Digital models up to 50mm



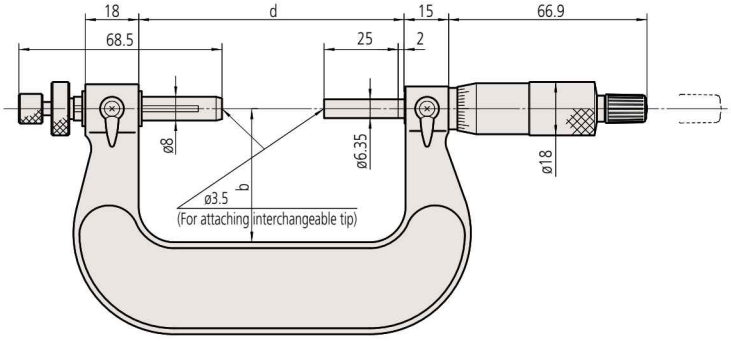
Range	b	d
0 - 25mm	32	64.5
25 - 50mm	45	89.5

Digital models over 50mm up to 100mm



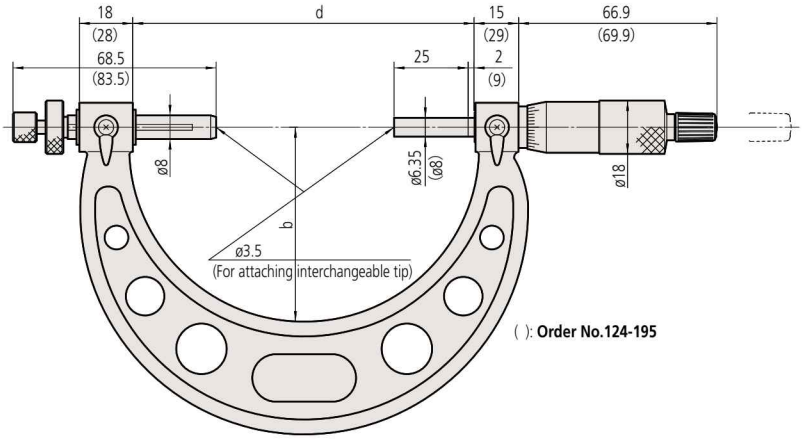
Range	b	d
50 - 75mm	65	115.1
75 - 100mm	79	140.1

Analog models up to 50mm



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

Analog models over 50mm up to 300mm



( ): **Order No.124-195**

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

Mitutoyo

Micrometer

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

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

- Measures "root tangent length" of spur gears and helical gears.
- Determination of the root tangent length: refer to "Quick Guide to Precision Measuring Instruments".
- 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 0-25mm/0-1" measuring range).

Digimatic (LCD)
369-250-30

Quickmike type (LCD)
369-411

IP54 ABSOLUTE

Quickmike type with adjustable measuring force (LCD)
227-221

ABSOLUTE

169-201

SPECIFICATIONS

Metric

	Order No.	Range	Resolution	Accuracy*	Anvil dia.	Flatness	Parallelism	Measuring force
Digimatic (LCD)	**369-250-30**	0 - 25mm	0.001mm	±4µm	ø20	1µm	4µm	—
	369-251-30	25 - 50mm						
	369-252-30	50 - 75mm		±6µm			6µm	
	369-253-30	75 - 100mm						
Quickmike type (LCD)	**369-411**	0 - 30mm		±4µm			4µm	—
	369-412	25 - 55mm						
Quickmike type adjustable measuring force (LCD)	**227-221**	0 - 15mm			ø14.3		3µm	0.5N - 2.5N
	227-223	0 - 10mm						2N - 10N

* Excluding quantizing error

Metric

	Order No.	Range	Graduation	Accuracy	Anvil dia.	Flatness	Parallelism	Measuring force
Analog	**169-201**	0 - 25mm	0.01mm	±4µm	ø20	1µm	4µm	—
	169-202	25 - 50mm						
	169-205	50 - 75mm		±6µm			6µm	
	169-207	75 - 100mm						

Inch/Metric

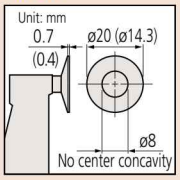
	Order No.	Range	Resolution	Accuracy*	Anvil dia.	Flatness	Parallelism	Measuring force
Digimatic (LCD)	**369-350-30**	0 - 1"	.00005"/ 0.001mm	±.0002"	ø20	.00004"	.0002"	—
	369-351-30	1" - 2"						
	369-352-30	2" - 3"		±.0003"			.0003"	
	369-353-30	3" - 4"						
Quickmike type (LCD)	**369-421**	0 - 1.2"		±.0002"			.0002"	—
	369-422	1" - 2.2"						

* Excluding quantizing error

Inch

	Order No.	Range	Graduation	Accuracy	Anvil dia.	Flatness	Parallelism
Analog	**169-203**	0 - 1"	.001"	±.0002"	ø20	.00004"	.0002"
	169-204	1" - 2"					
	169-206	2" - 3"		±.0003"			.0003"
	169-208	3" - 4"					

Anvil



( ): Adjustable measuring force type

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. 1 year under normal use (for series 369-4XX)
Approx. 3 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 0-10mm / 0-15mm / 0-25mm / 0-30mm (0-1"/0-1.2") models)
Spanner (301336), 1 pc (for series 169-2XX, 369-2XX, 3XX)
Screwdriver (No.210183), 1pc (for series 227-2XX)

Optional accessories

- Connecting cables
  for **369-250-30** to **369-253-30, 369-350-30** to **369-353-30**
  1m: **05CZA662**
  2m: **05CZA663**
- **USB Input Tool Direct**
  USB-ITN-B (2m): **06ADV380B**
- SPC cables for U-WAVE w/ data switch (160mm): **02AZD790B**
  For foot switch: **02AZE140B**
  (Refer to page B-68 for details.)
- SPC cables for Quickmike and micrometers with adjustable measuring force device
  937387: SPC cable (1m)*
  965013: SPC cable (2m)*
- only for Quickmike and micrometers with adjustable measuring force device
  06ADV380E : USB Input Tool Direct with data switch(2m)
  02AZD790E : SPC cable for U-WAVE (160mm)
  For footswitch: **02AZE140E**

Quickmike

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

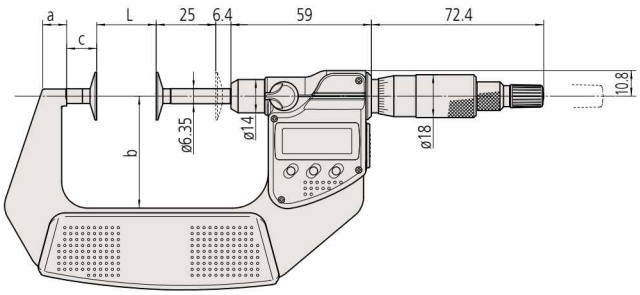
Quickmike type with adjustable measuring force

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

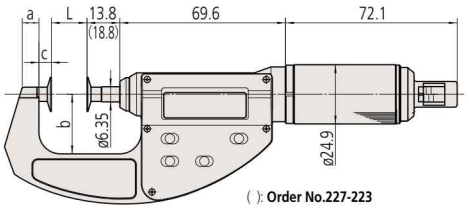
DIMENSIONS

Unit: mm

Digital models up to 75mm

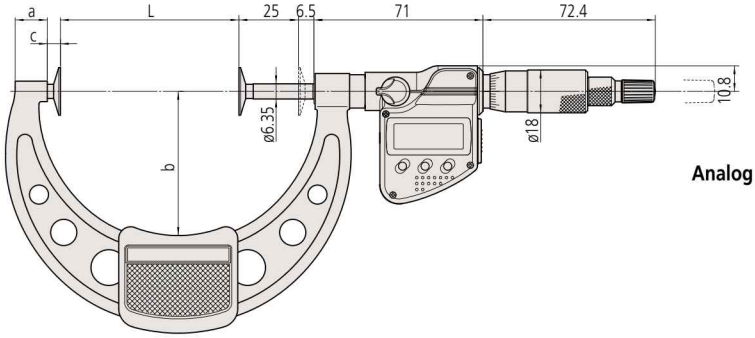


Adjustable measuring force type

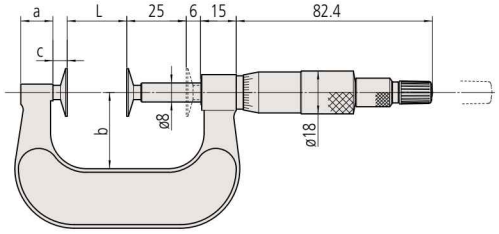


( ): Order No.227-223

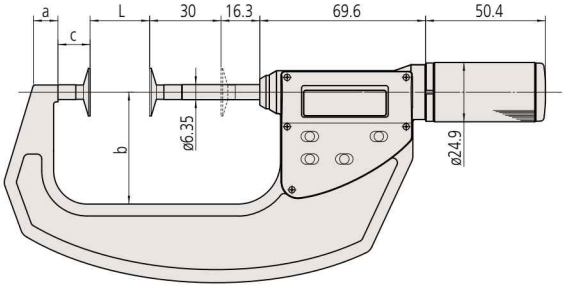
Digital models over 75mm



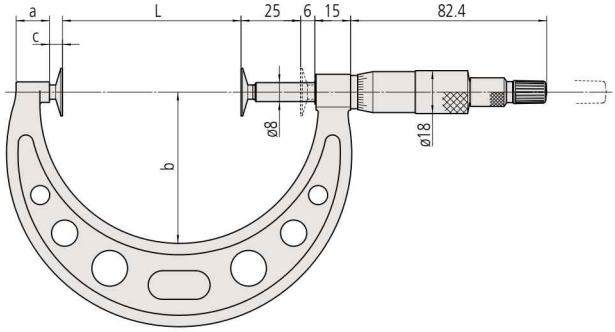
Analog models up to 50mm



Quickmike type



Analog models over 50mm



Digital models

Range	L	a	b	c
0 - 25mm	0	7	32	12.9
25 - 50mm	25	9.8	47	
50 - 75mm	50	11.2	60	
75 - 100mm	75	13.5		5.5
0 - 30mm*	0	8.5	36	13.5
25 - 55mm*	25	10.3	47	

*Quickmike type

Analog models

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

Mitutoyo

Micrometer

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

Sheet Metal Micrometers SERIES 389, 118

- 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	Resolution	Accuracy*	Throat depth	Measuring surfaces
Digimatic (LCD)					
389-251-30	0 - 25mm	0.001mm	±4µm	150mm	F-F
389-261-30					S-F
389-271-30					S-S
389-514			±5µm	300mm*1	F-F
389-252-30	25 - 50mm		±4µm	150mm	F-F
389-262-30					S-F
389-272-30					S-S

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	Throat depth	Measuring surfaces
Digimatic (LCD)					
389-351-30	0 - 1"	.00005"/ 0.001mm	±.0002"	6"	F-F
389-361-30					S-F
389-371-30					S-S
389-714			±.00025"	12"*1	F-F
389-352-30	1"- 2"		±.0002"	6"	F-F
389-362-30					S-F
389-372-30					S-S

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy	Throat depth	Measuring surfaces
Analog					
118-101	0 - 25mm	0.01mm	±4µm	100mm	F-F
118-102				150mm	
118-114					S-F
118-118					S-S
118-103			±5µm	300mm*	F-F
118-110	25 - 50mm		±4µm	150mm	F-F
118-126					S-S

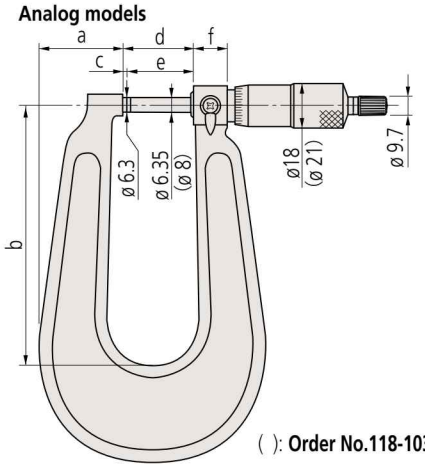
*1 Models with a 300mm (12") throat are equipped with a stand for convenience of measurement in the horizontal orientation as standard.

Inch

Order No.	Range	Graduation	Accuracy	Throat depth	Measuring surfaces
Analog					
118-129	0 - 1"	.0001"	±.0002"	6"	F-F
118-116					S-F
118-120					S-S
118-107		.001"	±.00025"	12"	F-F
118-112	1"- 2"		±.0002"	6"	

DIMENSIONS

Analog models

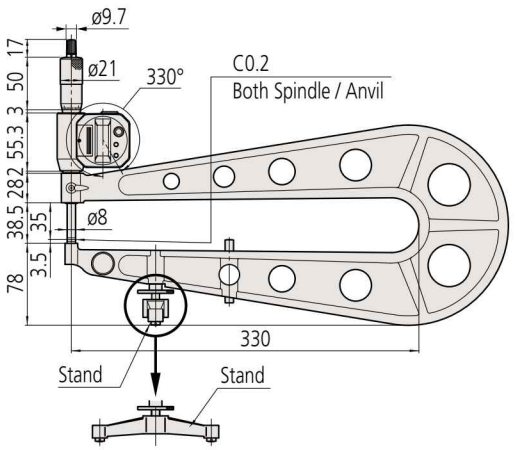


( ): **Order No.118-103**

Order No.	a	b	c	d	e	f
118-101	34	110	2.5	30	27.5	14.5
118-102 118-114 118-118	43	160				
118-103	78	330	3.5	38.5	35	28
118-110	41	165	2.5	55	27.5	14.5

389-514

Unit: mm



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

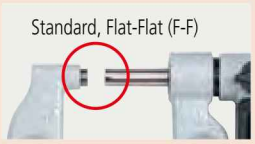
(Refer to page X for details.)

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: 0.6µm/.000024" for models with 150mm/6" throat
1µm/.00004" for models with 300mm/12" throat
Parallelism: 3µm/.00012"
Quantizing error (**series 389**): excluding ±1 count

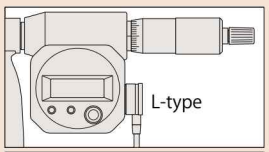


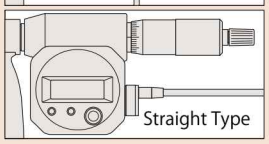
Battery for series 389

SR44 (1pc), **938882, 2pcs: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 0-25mm (0-1") 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

- Connecting cables for **Series 389** (excluding **389-514** and **389-714**)
  1m: **05CZA662**
  2m: **05CZA663**
- **USB Input Tool Direct USB-ITN-B** (2m): **06ADV380B**
- SPC cables for **U-WAVE**, **series 389** (excluding **389-514** and **389-714**)
  w/ data switch (160mm): **02AZD790B**
  For foot switch: **02AZE140B**
- Connecting ccables for **389-514, 389-714**
- Recommended cables: L-Type (does not interfere with operating the thimble.)
  1m: **04AZB512**
  2m: **04AZB513**
- Straight type (may interfere with operating the thimble.)
  1m: **959149**
  2m: **959150**





Refer to page B-68 for detailed information about recommended cables.

Sheet Metal Micrometer
SERIES 119

Technical Data
Standard accessories: Spanner (200168), 1 pc

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

119-202

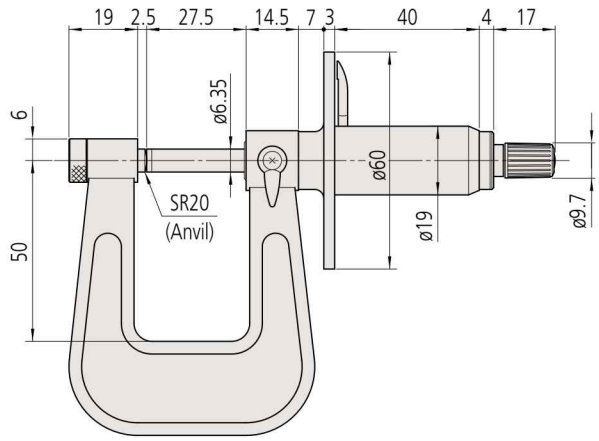
SPECIFICATIONS

Metric

Order No.	Range	Graduation	Accuracy	Throat depth
119-202	0 - 25mm	0.01mm	±4µm	50mm

DIMENSIONS

Unit: mm



B

Mitutoyo

Micrometer

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

Tube Micrometers
SERIES 395, 115, 295

- 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.

395-251-30

115-115

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	øD
Digimatic (LCD)				
395-251-30	0 - 25mm	0.001mm	±2µm	ø15
395-252-30	25 - 50mm			
395-253-30	50 - 75mm			ø19
395-254-30	75 - 100mm		±3µm	ø20

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	øD
Digimatic (LCD)				
395-351-30	0 - 1"	.00005"/ 0.001mm	±.0001"	ø.59"
395-352-30	1" - 2"			
395-353-30	2" - 3"			ø.75"
395-354-30	3" - 4"		±.00015"	ø.79"

* Excluding quantizing error

Metric

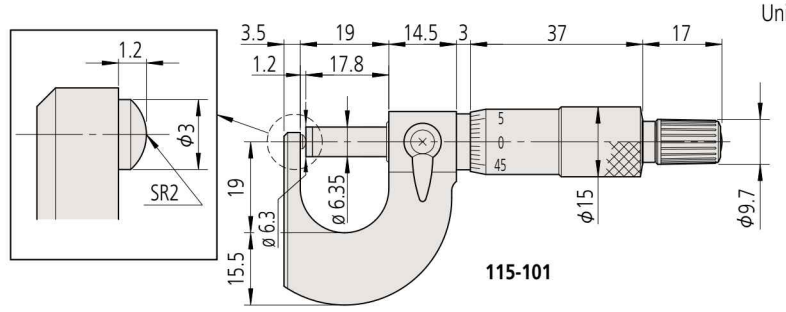
Order No.	Range	Graduation	Accuracy	øD
Analog				
115-101	0 - 15mm	0.01mm	±3µm	ø5.5
115-115	0 - 25mm			ø10
115-116	25 - 50mm			ø11
115-117	50 - 75mm			ø17
115-118	75 - 100mm		±4µm	ø18
Mechanical counter model				
295-115	0 - 25mm		±3µm	ø10

Inch

Order No.	Range	Graduation	Accuracy	øD
Analog				
115-153	0 - 1"	.0001"	±.00015"	ø.40"
Mechanical counter model				
295-153	0 - 1"	.0001"	±.00015"	ø.40"

DIMENSIONS

Unit: mm



115-101

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.

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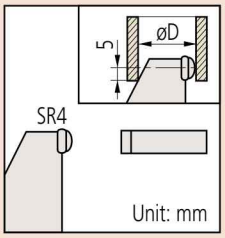
(Refer to page X for details.)

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: 0.6µm/ .000024" (**series 115** & **295**)
0.3µm/ .000012" (**series 395**)



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 0-15mm/0-25mm (0-1") 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**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T**
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 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.

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.

395-271-30

115-215

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	øD
Digimatic (LCD)				
395-271-30	0 - 25mm	0.001mm	±2µm	ø15
395-272-30	25 - 50mm			
395-273-30	50 - 75mm			ø19
395-274-30	75 - 100mm		±3µm	ø20

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	øD
Digimatic (LCD)				
395-371-30	0 - 1"	.00005"/ 0.001mm	±.0001"	ø.59"
395-372-30	1" - 2"			
395-373-30	2" - 3"			ø.75"
395-374-30	3" - 4"		±.00015"	ø.79"

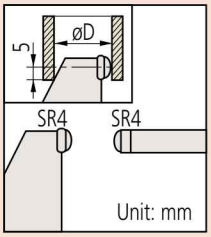
* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy	øD
Analog				
115-201	0 - 15mm	0.01mm	±3µm	ø5.5
115-215	0 - 25mm			ø10
115-216	25 - 50mm			ø11
115-217	50 - 75mm			ø17
115-218	75 - 100mm		±4µm	ø18
Mechanical counter model				
295-215	0 - 25mm	0.01mm	±3µm	ø10

Inch

Order No.	Range	Graduation	Accuracy	øD
Analog				
115-253	0 - 1"	.0001"	±.00015"	ø.40"
115-242	1 - 2"	.001"		ø.44"
115-243	2 - 3"			ø.67"
Mechanical counter model				
295-253	0 - 1"	.0001"	±.00015"	ø.40"



Battery for series 395

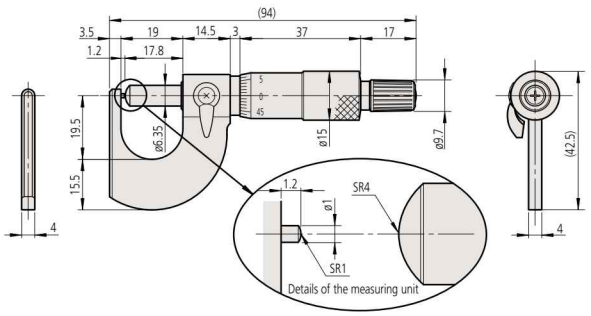
SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 395)
Length standard: Electromagnetic rotary sensor (for series 395)
Standard accessories: Reference bar, 1 pc (except for measuring range 0-15mm/0-25mm (0-1") models)
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**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T**
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 for details.

DIMENSIONS

Unit: mm



115-201

Mitutoyo

Micrometer

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

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

- Spindle face: Carbide
- series 395: IP65 spherical and cylindrical anvil type digital micrometers
- Equipped with Ratchet Stop for constant measuring force.

395-261-30

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.

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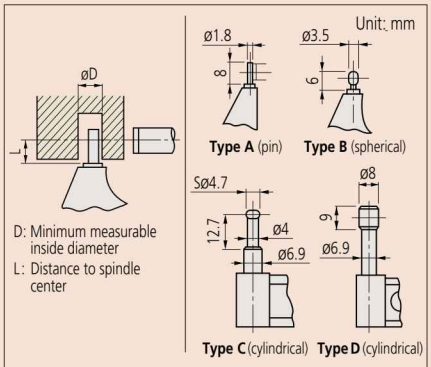
(Refer to page X for details.)

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)



Anvil	D	L
Type A	2	4
Type B	3.6	
Type C	4.8	12
Type D	8.2	22

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
395-261-30	0 - 25mm	0.001mm	±3µm	Type A
395-262-30				Type B
395-263-30				Type C
395-264-30				Type D

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
395-362-30	0 - 1"	.00005"/ 0.001mm	±.00015"	Type B
395-363-30				Type C
395-364-30				Type D

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy	Remarks
Analog				
115-302	0 - 25mm	0.01mm	±3µm	Type A
115-308				Type B
115-303	25 - 50mm			Type A
115-309				Type B
115-315	0 - 25mm			Type C
115-316				Type D

Inch

Order No.	Range	Graduation	Accuracy	Remarks
Analog				
115-305	0 - 1"	.001"	±.00015"	Type A
115-313		.0001"		Type C
115-314				Type D

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 0-25mm (0-1") models)
Spanner (301336), 1 pc

Optional accessories

Connecting cables for **series 395**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T**
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 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.

(Refer to page X for details.)

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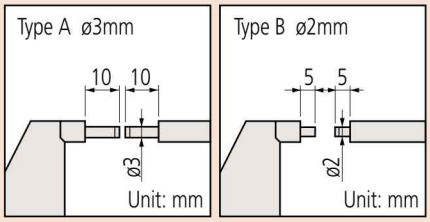
IP Codes (series 331)

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.

Technical Data

Flatness: 0.3µm/ .000012"
Parallelism: (2+R/100)µm, R = max. range (mm)
[.00008" + .00004(R/4)]" R = max range (inch)
fraction rounded down



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 0-25mm (0-1") models)
Spanner (301336), 1 pc

Optional accessories

Connecting cables for **series 331**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
Connecting cables for **U-WAVE-T**
02AZD790B 160mm
For foot switch: **02AZE140B**
Refer to page B-68 for details.

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.

331-251-30

111-115

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
331-251-30	0 - 25mm	0.001mm	±2µm	Type A
331-252-30	25 - 50mm			
331-253-30	50 - 75mm			
331-254-30	75 - 100mm		±3µm	
331-261-30	0 - 25mm		±2µm	Type B
331-262-30	25 - 50mm			
331-263-30	50 - 75mm			
331-264-30	75 - 100mm		±3µm	

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
331-351-30	0 - 1"	.00005"/ 0.001mm	±.0001"	Type A
331-352-30	1" - 2"			
331-353-30	2" - 3"			
331-354-30	3" - 4"		±.00015"	
331-361-30	0 - 1"		±.0001"	Type B
331-362-30	1" - 2"			
331-363-30	2" - 3"			
331-364-30	3" - 4"		±.00015"	

* Excluding quantizing error

Metric

Order No.	Range	Graduation	Accuracy	Remarks
Analog				
111-215	0 - 25mm	0.01mm	±3µm	Type B
111-115	0 - 25mm			Type A
111-116	25 - 50mm			
111-117	50 - 75mm			
111-118	75 - 100mm		±4µm	
111-119	100 - 125mm			
111-120	125 - 150mm			
111-121	150 - 175mm		±5µm	
111-122	175 - 200mm			
111-123	200 - 225mm			
111-124	225 - 250mm		±6µm	
111-125	250 - 275mm			
111-126	270 - 300mm			
Mechanical counter model				
131-115	0 - 25mm		±3µm	Type A

Inch

Order No.	Range	Graduation	Accuracy	Remarks
Analog				
111-166	0 - 1"	.0001"	±.00015"	Type A

Micrometer

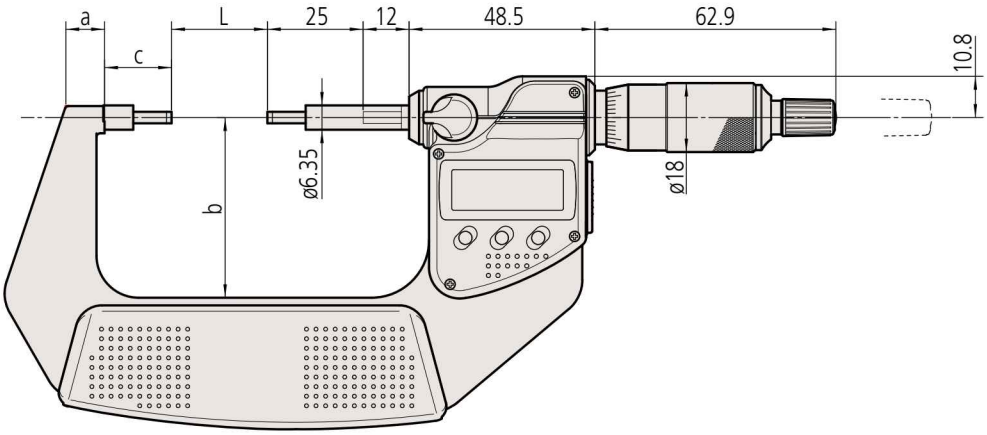
The origin of Mitutoyo's trustworthy brand of small tool instruments

DIMENSIONS

Digital Models

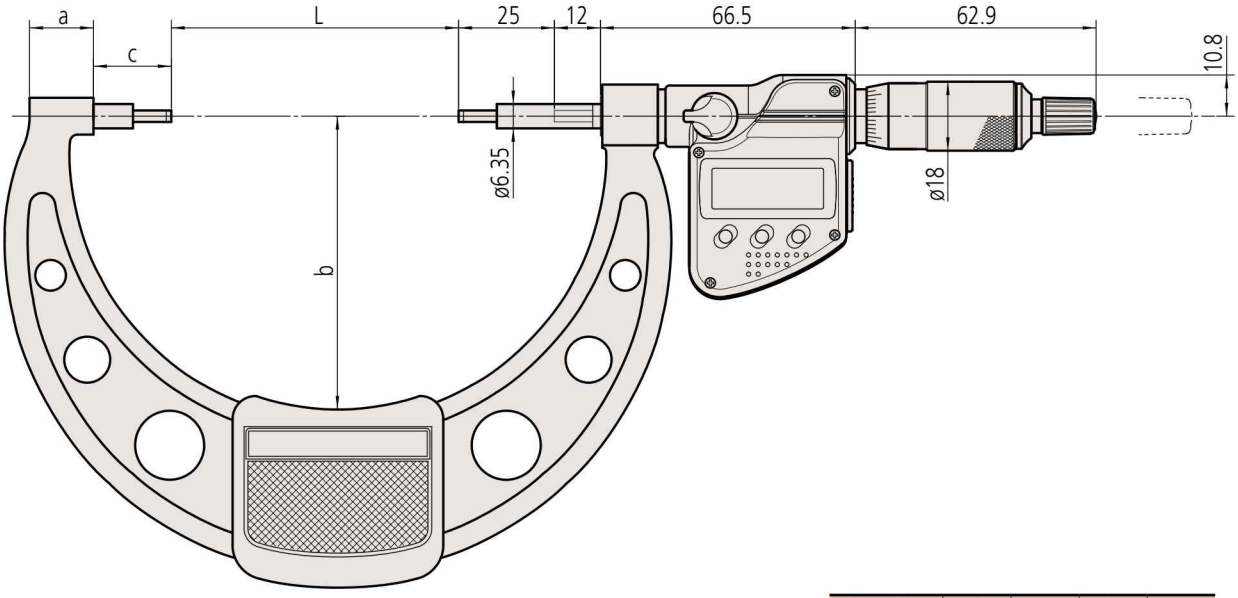
Unit: mm

Models up to 75mm measuring range



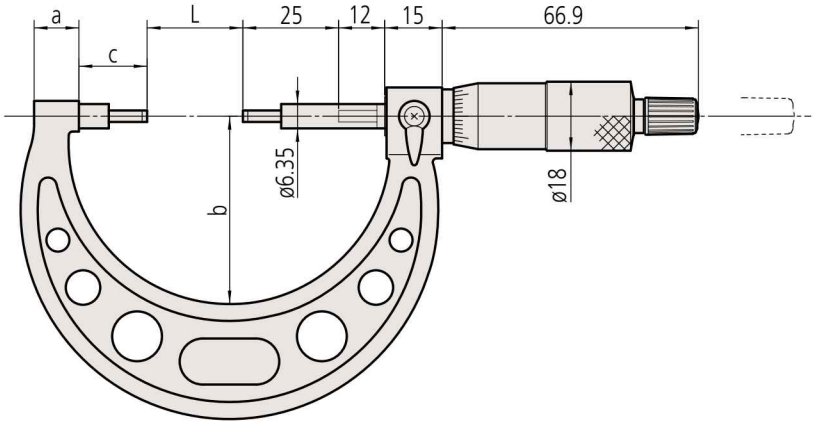
Digital Models

Models over 75mm measuring range



Analog Models

Models up to 300mm measuring range



Order No.	L	a	b	c
331-251-30	0	7.3	32.5	17.5
331-261-30	0			
331-252-30	25	10.1	47	
331-262-30	25			
331-253-30	50	11.5	60	
331-263-30	50			
331-254-30	75	16.7	76	20.3
331-264-30	75			
111-215	0	10	38	17.5
111-115	0			
111-116	25	12	49	
111-117	50	14	60	
111-118	75	16.7	79	20.3
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	

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

(Refer to page X for details.)

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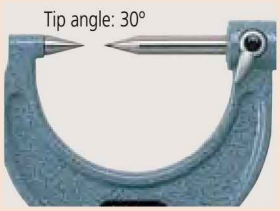
ID 0000040191

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.

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 0-25mm (0-1") models)
Spanner (301336), 1 pc

Optional accessories

Connecting cables for **series 342**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
SPC cables for **U-WAVE** w/ data switch (160mm):
02AZD790B
For foot switch: **02AZE140B**
(Refer to page B-68 for details.)

Point Micrometers
SERIES 342, 142, 112

- Pointed spindle and anvil for measuring the web thickness of drills, small grooves, keyways, and other hard-to-reach features.
- The measuring points (carbide tipped) have approximately 0.3mm radius.
- series 342: IP65 Digimatic micrometers
- Equipped with Ratchet Stop for constant measuring force.

342-251-30

112-201

SPECIFICATIONS

Metric

Order No.	Range	Resolution	Accuracy*	Point
Digimatic (LCD) (With carbide tip)				
342-251-30	0 - 25mm	0.001mm	±2µm	15°
342-252-30	25 - 50mm			
342-253-30	50 - 75mm			
342-254-30	75 - 100mm		±3µm	
342-261-30	0 - 25mm		±2µm	30°
342-262-30	25 - 50mm			
342-263-30	50 - 75mm			
342-264-30	75 - 100mm		±3µm	

* Excluding quantizing error

Inch/Metric

Order No.	Range	Resolution	Accuracy*	Point
Digimatic (LCD) (With carbide tip)				
342-351-30	0 - 1"	.00005"/ 0.001mm	±.0001"	15°
342-352-30	1 - 2"			
342-353-30	2 - 3"			
342-354-30	3 - 4"		±.00015"	
342-361-30	0 - 1"		±.0001"	30°
342-362-30	1 - 2"			
342-363-30	2 - 3"			
342-364-30	3 - 4"		±.00015"	

* Excluding quantizing error

Metric

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

Inch

Order No.	Range	Graduation	Accuracy	Point
Analog		.001"		
112-177	0 - 1"		±.00015"	15°
112-178	1" - 2"			
112-225	0 - 1"			30°
112-226	1" - 2"			
Analog (With carbide tip)				
112-189	0" - 1"		±.00015"	15°
112-190	1" - 2"			
112-191	2" - 3"			
112-237	0 - 1"			30°
112-238	1" - 2"			
Mechanical counter model				
142-177	0 - 1"		±.00015"	15°
142-225				30°

Mitutoyo

Micrometer

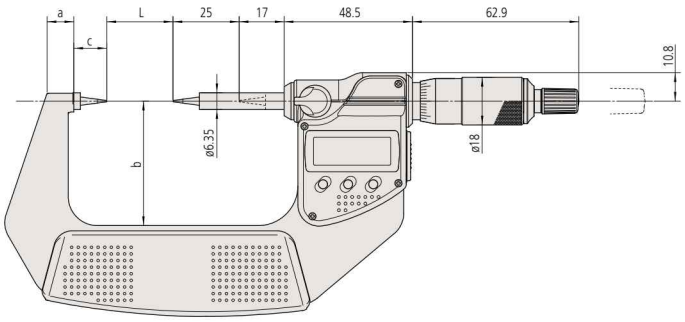
The origin of Mitutoyo's trustworthy brand of small tool instruments

B

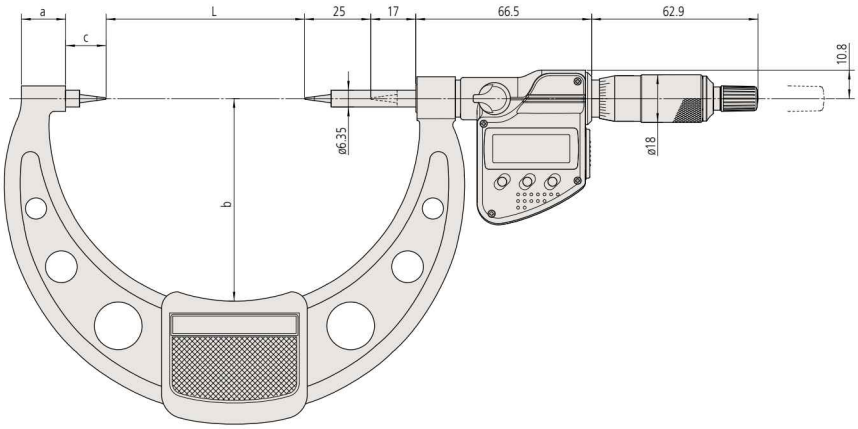
DIMENSIONS

Unit: mm

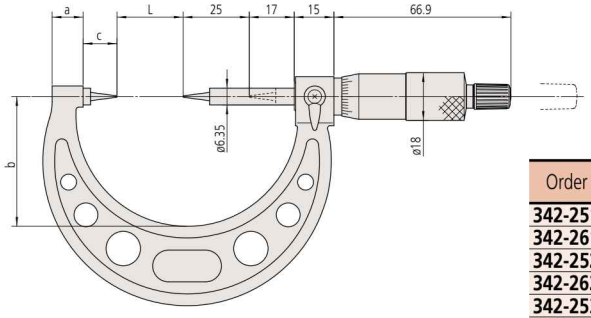
Digital models up to 75mm measuring range

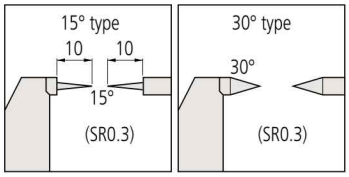


Digital models over 75mm measuring range



Analog models measuring range





Order No.	L	a	b	c	Frame thickness*1
342-251-30	0	7.3	32.5	12.5	(11.2)
342-261-30					
342-252-30	25	10.1	47		(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	12.5	(9)
112-154	25	12	49		(10)
112-155	50	14	60		(11)
112-156	75	16.7	79	15.3	(13)

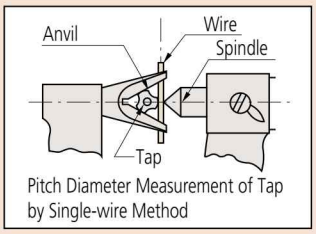
*1 Digimatic type: thickness over heat shield

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:
Spanner (301336), 1 pc
(for Digimatic type)
(Maximum measuring range up to 55mm/1.6")*1
(Maximum measuring range up to 45mm/1")*2
Spanner (200877), 1 pc
(for maximum measuring range 70mm or over)*1
(for maximum measuring range 65mm or over)*2
*1 For analog type with 3-flute cutting tools.
*2 For analog type with 5-flute cutting tools.

Optional accessories

Connecting cables for **series 314**
1m: **05CZA662**
2m: **05CZA663**
USB Input Tool Direct
USB-ITN-B (2m): **06ADV380B**
SPC cables for **U-WAVE** w/ data switch (160mm):
02AZD790B
For foot switch: **02AZE140B**
(Refer to page B-68 for details.)



Pitch Diameter Measurement of Tap by Single-wire Method

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

- Measures the outside diameter of cutting tools (such as taps, reamers, end mills) which have three or five flutes.
- Measures pitch diameter: refer to "Quick Guide to Precision Measuring Instruments" on page B-73.
- Measuring faces: Carbide
- Equipped with Ratchet Stop for constant measuring force.

314-251-30

114-121

114-102

114-101

Mitutoyo

Micrometer

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

SPECIFICATIONS

Metric For 3-flute cutting tools

Order No.	Range	Resolution	Accuracy*	Remarks	Anvil
Digimatic (LCD)					
314-251-30	1 - 15mm	0.001mm	±4µm	w/groove	60°
314-252-30	10 - 25mm				
314-253-30	25 - 40mm		±5µm	—	
314-261-30	1 - 15mm		±4µm	—	
314-262-30	10 - 25mm			—	

*Excluding quantizing error

Metric For 3-flute cutting tools

Order No.	Range	Graduation	Accuracy	Remarks	Anvil
Analog Anvil, Spindle (With carbide tip)					
114-204	2.3 - 25mm	0.01mm	±4µm	—	60°
Analog Spindle (With carbide tip)					
114-101	1 - 15mm		±4µm	w/groove	
114-102	10 - 25mm				
114-103	25 - 40mm		±5µm	—	
114-104	40 - 55mm		±6µm	—	
114-105	55 - 70mm			—	
114-106	70 - 85mm		±7µm	—	
114-161	1 - 15mm		±4µm	—	
114-162	10 - 25mm			—	

Metric For 5-flute cutting tools

Order No.	Range	Resolution	Accuracy	Remarks	Anvil
Analog Anvil, Spindle (With carbide tip)					
114-137	2.3 - 25mm	0.01mm	±4µm	—	108°
Analog Spindle (With carbide tip)					
114-121	5 - 25mm		±4µm	w/groove	
114-122	25 - 45mm		±5µm	—	
114-123	45 - 65mm		±6µm	—	
114-124	65 - 85mm		±7µm	—	
114-165	5 - 25mm		±4µm	—	

Inch/Metric For 3-flute cutting tools

Order No.	Range	Resolution	Accuracy*	Remarks	Anvil
Digimatic (LCD)					
314-351-30	.05 - .6"	.00005"/ 0.001mm	±.0002"	w/groove	60°
314-352-30	.4" - 1"				
314-353-30	1" - 1.6"		±.00025"	—	
314-361-30	.05 - .6"		±.0002"	—	
314-362-30	.4" - 1"			—	

*Excluding quantizing error

Inch For 3-flute cutting tools

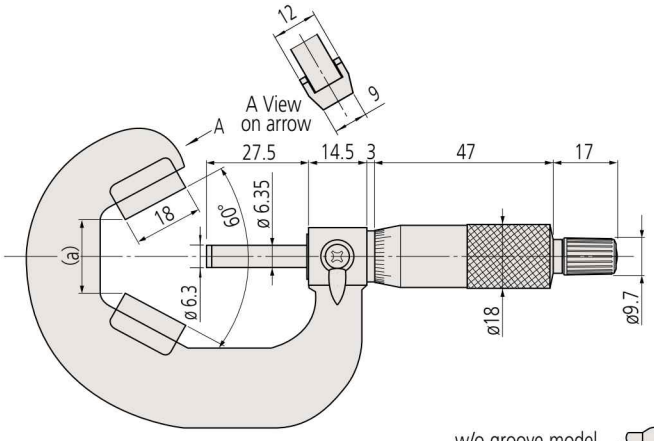
Order No.	Range	Graduation	Accuracy	Remarks	Anvil
Analog Spindle (With carbide tip)					
114-163	.05" - .6"	.001"	±.0002"	—	60°
114-113	1" - 1.6"		±.00025"	—	

Inch For 5-flute cutting tools

Order No.	Range	Graduation	Accuracy	Remarks	Anvil
Analog Spindle (With carbide tip)					
114-135	.09" - 1"	.0001"	±.0002"	—	108°

DIMENSIONS

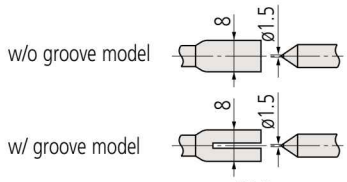
Unit: mm

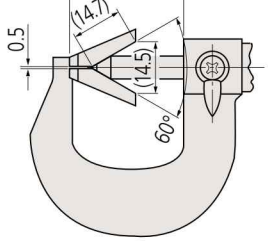


114-103

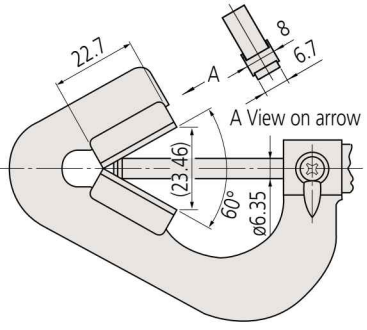
For 3-flute cutting tools

Range	(a)
10 - 25mm	6.2
25 - 40mm	19.14
40 - 55mm	32.13
55 - 70mm	45.12
70 - 85mm	58.11





114-101



114-204