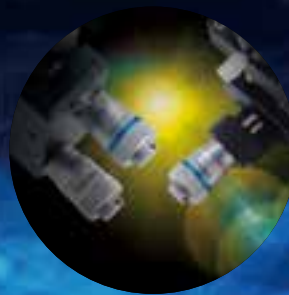


Sensors and Embedded Equipment (Contact Sensors/Non-Contact Sensors/Scale Units)





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.

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Index color-coding

Mitutoyo's assorted precision measuring instruments are color-coded in groups for clear distinction.

The product groups listed here are the categories at right.

Sensor Systems

Digital Scale and DRO Systems

Small Tool Instruments

Contents

Features

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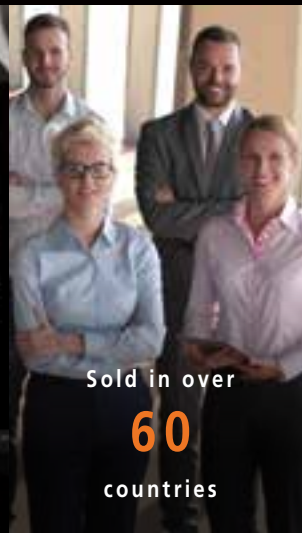
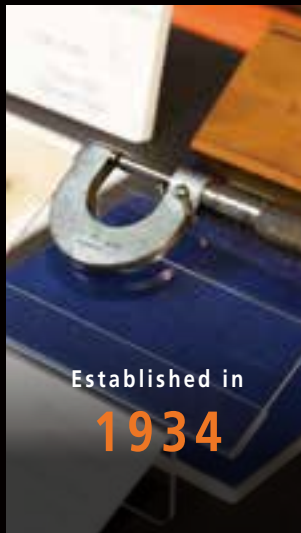
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Leading company in the precision measurement industry

Mitutoyo

Mitutoyo: from measuring tools to measuring devices,
and then to sensors and equipment embedded units



Small Tool Instruments

Micrometers/Calipers/Height Gages/
Depth Gages/Bore Gages/
Dial Gages/Lever-type dial indicators



Measuring Machines

Coordinate Measuring Machines/Vision Measuring Systems/
Form Measurement/Hardness Testing Machines/
Optical Measuring/X-Ray CT System/
In-line Inspection System



Sensors and Embedded Equipment

Contact Sensor/Non-contact Sensor/Scale Units/
Optical Measuring/Micrometer Heads

Mitutoyo is a leading company in the precision measurement industry and a comprehensive manufacturer of precision measuring instruments with more than 5,500 products. Through “measuring,” our manufacturing customers are able to make informed adjustments to maintain dimensional control of their output and reduce waste.

Over the 90 years since our founding in 1934, Mitutoyo has independently developed and produced a wide variety of precision measuring devices, including parts, from micrometer measuring tools to coordinate measuring machines.

This puts Mitutoyo in a strong and qualified position amongst our competitors to deliver ultra-precision sensors and equipment embedded units. Initially these types of products were only used in-house; then their high-precision, functionality, and stability became apparent and, in response to rising market demand, we decided to offer them as products.

They are now supporting many customers on site.



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Mitutoyo sensors support "measuring"

Mitutoyo's precision sensors are used and trusted in various industries for their accuracy.

5 industries which rely on our support

Bearing Industry
Electric Vehicle xEV
Lens Industry
Medical Device and Pharmaceutical Industries
Semiconductor Industry

Bearing Industry

Since the accuracy required of bearing rolling elements is now on the level of nanometers (nm), needs for technologies to measure rolling elements are ever increasing. Mitutoyo has outstanding solutions that meet the needs for high-accuracy measurement of bearings.



Machine Tools/Industrial Machinery



Automobiles



Industrial Robots



Wind Power Generation

Rolling Element
(Balls/Cylindrical rollers/
Tapered rollers)



The High-Accuracy Linear Gage LGH and Laser Scan Micrometer LSM, in combination with dedicated jigs, enable efficient measurement of the outer diameters of balls and cylindrical rollers.

Listed items are examples. Various other manufacturing industries are also supported by Mitutoyo sensors.

Electric Vehicle xEV

Supporting the development and production of Electric Vehicles xEV

Wiring Harness

A specialized micrometer is used for measuring the height of crimped contacts on wiring harnesses.

Coil

A laser scan micrometer that allows high speed, high resolution measurement is effective at measuring the outside diameter of coils used for rotors.

Lithium-ion Battery

Control over the thickness of the separators that insulate the positive electrode from the negative electrode is absolutely essential for the manufacturing process of lithium-ion batteries (which are subject to explosion or fire risk). The Litematic is best suited to this thickness measurement thanks to a low measuring force that minimizes distortion of the material. Also, a measuring microscope is used to check for any contamination inside a laminate-type lithium-ion battery.



Lens Industry

Mitutoyo offers solutions to measure a wide variety of lenses from research and development to preproduction and mass production.

Lenses



- In-vehicle Camera
- Monitoring Camera
- Smart Phone Camera
- Drone Camera
- Action Camera



The Litematic allows desktop measurement of a lens' thickness. This machine enables measurement of an easily-deformed, thin-walled lens with a low measuring force of 0.01N (minimum).

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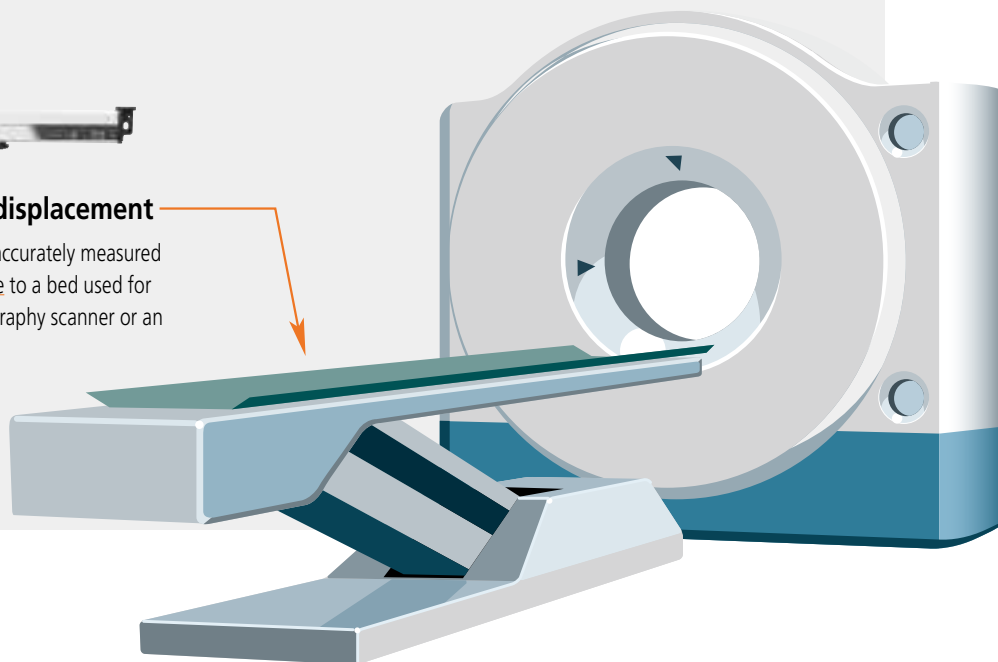
Medical Device and Pharmaceutical Industries

For various fields including the research, development and production of medical devices and pharmaceutical goods

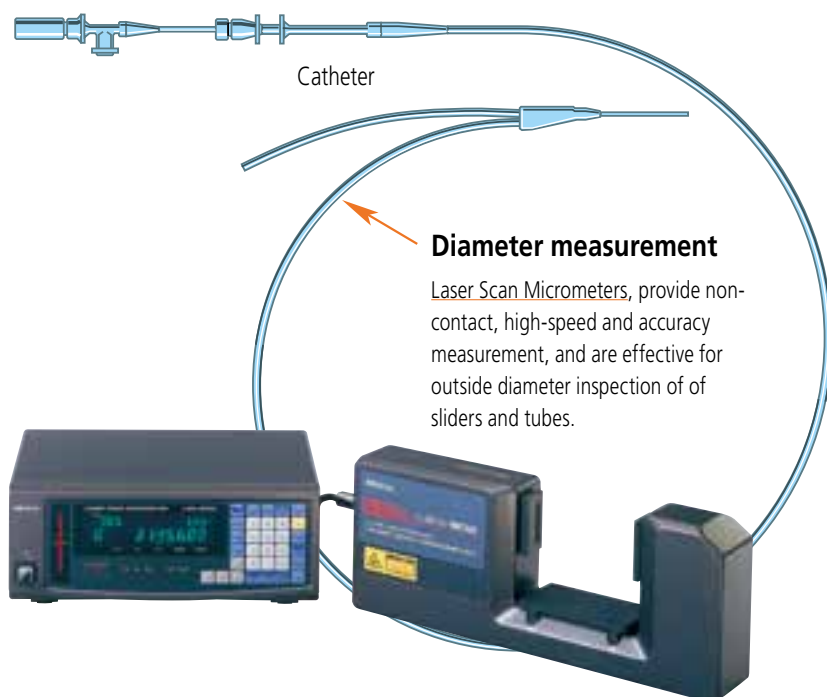
X-ray computed tomography scanners

Detection of bed displacement

Bed displacement can be accurately measured by mounting a Linear Scale to a bed used for an X-ray computed tomography scanner or an MRI device.



Injector/Catheter



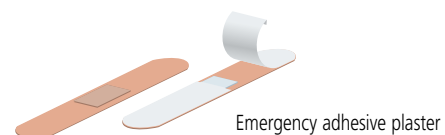
Catheter

Diameter measurement

Laser Scan Micrometers, provide non-contact, high-speed and accuracy measurement, and are effective for outside diameter inspection of sliders and tubes.

Suture needle tip angle measurement is possible too.

Poultice, plaster, emergency adhesive plaster, etc.



Emergency adhesive plaster



Plaster

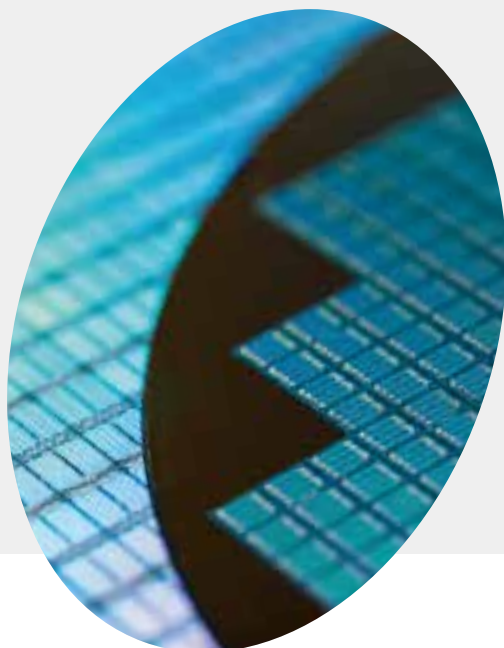
Soft material object

The Litematic is appropriate for measuring deformable workpieces. Measurement of thickness is accomplished with low measuring force, and minute impact on the base.



Listed items are examples. Various other manufacturing industries are also supported by Mitutoyo sensors.

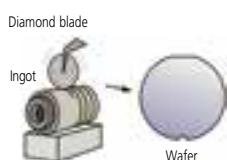
Semiconductor Industry



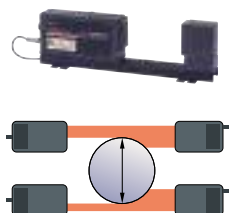
Measurement solutions for a wide range of fields in the semiconductor manufacturing industry, which is growing rapidly following a shift to production of electric vehicles, expansion of services in line with the implementation of 5G, etc.

In semiconductor manufacturing processes, we provide precision inspection and stable measurement via sensors.

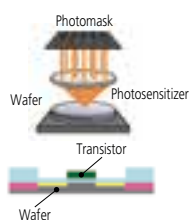
Wafer manufacture



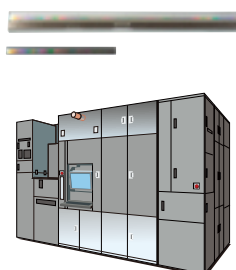
■ External diameter of ingot
Laser Scan Micrometer



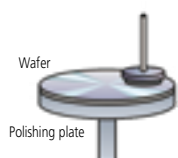
Pattern formation to Element formation



■ Lithography equipment
High-accuracy Linear Scale



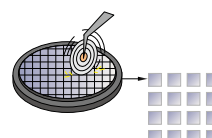
Flattening CMP (Chemical Mechanical Polishing)



■ Wafer thickness
High-accuracy Linear Gage LGH,
High-accuracy/
resolution Measuring Machine
Litematic VL-50



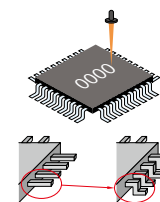
Dicing



■ Chip thickness
LGH



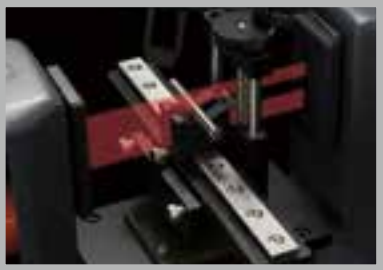
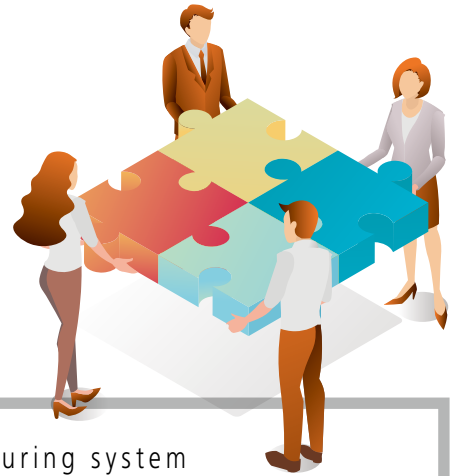
Marking to Lead forming



■ Lead width, Pitch, Gap
Laser Scan Micrometer



Examples of solutions through "measuring"



High accuracy non-contact measuring system
Laser Scan Micrometer

Realizing high-speed 100% inspection with the Laser Scan Micrometer

The Laser Scan Micrometer LSM realizes stable, high-speed continuous measurement without increased labor

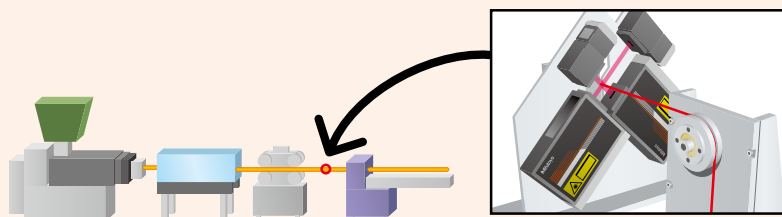
Conventional issues

- To enhance reliability, we need to shift to 100% inspection from spot inspection using outer diameter measurement of optical fiber, enamel wires, and various other wires.
- Manual spot inspection renders measured values unstable.

Mitutoyo

proposes solutions

With high-accuracy, ultra-high-speed measurement of 3200 scans/second, we realize stable, high-speed continuous measurement



Expected effects

- Stable measurement enabled by eliminating errors among operators
- High-speed 100% inspection on the production line enabled without increasing labor



High-accuracy length measuring machine
Litematic

Stable, high-accuracy measurement of separator film thickness with carbide spherical contact points

In thickness measurement of separator film for lithium-ion secondary batteries, product accuracy demands have shifted from 3 to 5 μm or so to 1 μm or less, making it difficult to adjust the parallelism of flat contact points and base surfaces to a level reaching the required accuracy. The introduction of carbide spherical contact points has realized stable high-accuracy measurement with low measurement force.

Conventional issues

With product accuracy demands reaching 1 μm or less, it was difficult to adjust the parallelism of flat contact points and base surfaces.

Mitutoyo

proposes solutions

The use of carbide spherical contact points has realized stable high-accuracy measurement with low measurement force in film thickness measurement



With flat contact points, a minimal tilt will cause the edge to deform the film, preventing stable measurement



With gently rounded spherical contact points, only the faintest dent results, with stable measurement enabled through consistent contact in the same state

Expected effects

- Measured values no longer fluctuate due to parallelism errors, improving measurement repeatability

In low-measurement-force measurement with carbide spherical contact points, high-accuracy thickness measurement without deformation is possible even for soft workpieces like film

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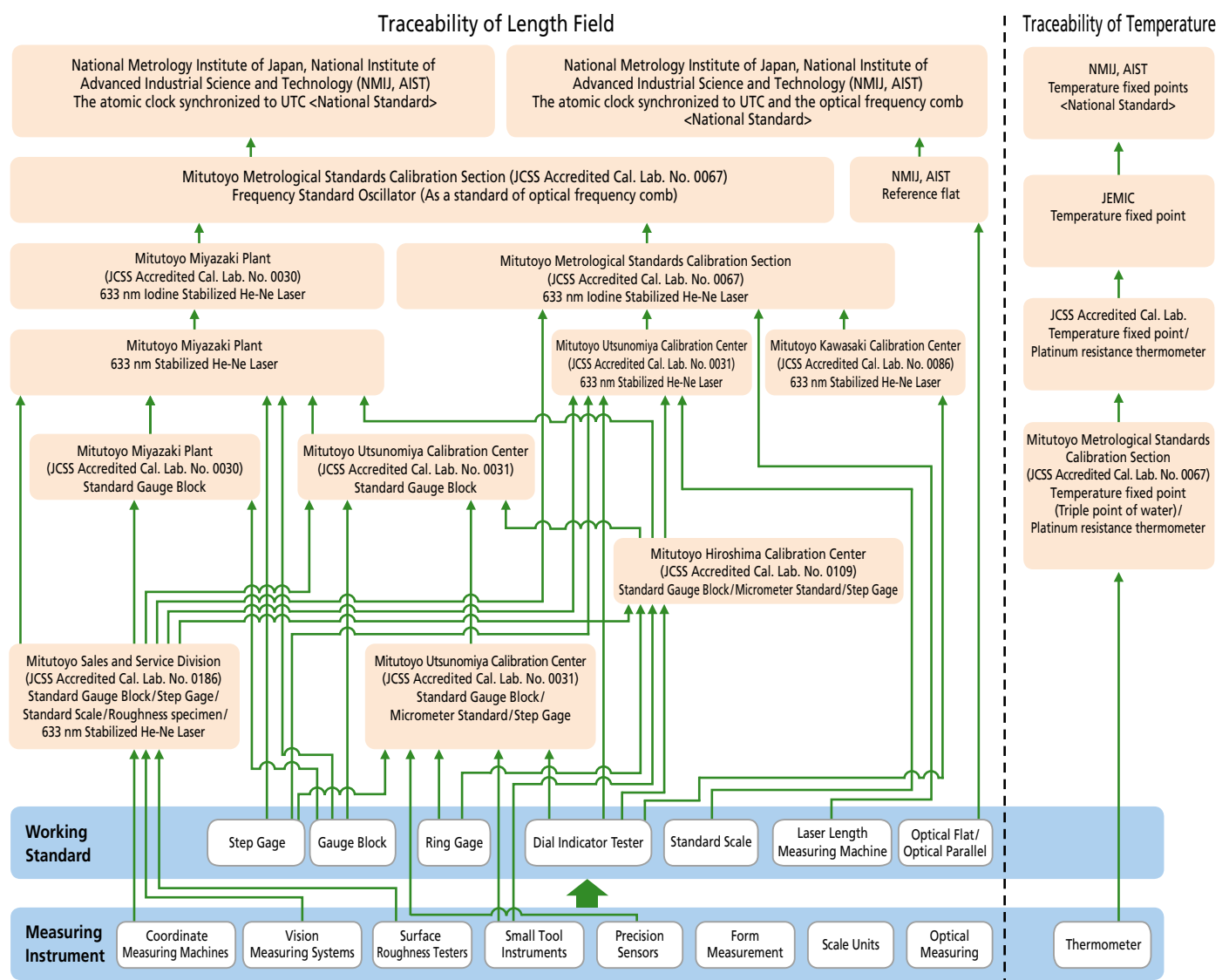
6

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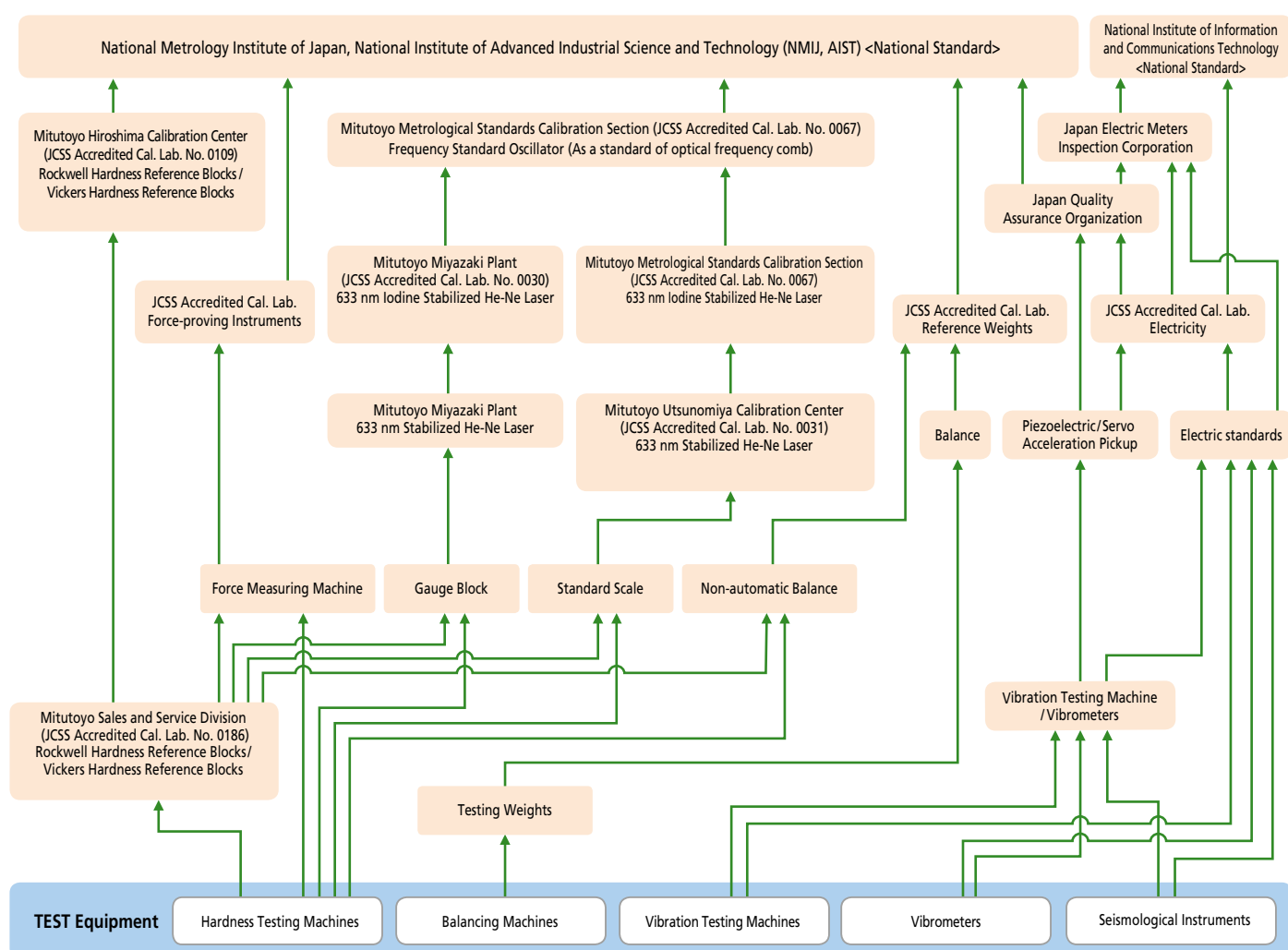
The traceability system supporting Mitutoyo precision

Mitutoyo ensures and maintains traceability of various types of precision measuring instruments by holding standards of length and other physical quantities that are directly traceable to the national standards for use in calibrating the working standards used for the calibration of measuring instrument products supplied to industry. Furthermore, Mitutoyo offers a temperature calibration service which is indispensable for high-accuracy length measurement. In addition, Mitutoyo ensures and maintains traceability of its test equipment such as hardness testing machines and vibrometers.

Traceability of Mitutoyo Standards



Traceability of Test Equipment



Note: This chart shows a simplified traceability system of a part of Mitutoyo products. Detailed traceability charts are published for each product.
(As of July, 2022)

For the latest information, please refer to our website. <https://www2.mitutoyo.co.jp/eng/>

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Meaning of Symbols

ABSOLUTE Linear Encoder

ABSOLUTE™

ABSOLUTE is a trademark of Mitutoyo Corporation.

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

Advantages:

1. No count error occurs even if you move the slider or spindle extremely rapidly.
2. You do not have to reset the system to zero when turning on the system after turning it off^{*1}.
3. As this type of encoder can drive with less power than the incremental encoder, the battery life is prolonged to about 5 years (continuous operation of 18,000 hours)^{*2} under normal use.

^{*1} Unless the battery is removed.

^{*2} In the case of ABSOLUTE Digimatic calipers and ABSOLUTE coolant proof calipers.

IP Codes (IEC 60529:2013, JIS C 0920:2003)

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]



(IP: International Protection)



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

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

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

Third characteristic numeral	Degrees of protection against oil	Abstract
F	Oil-resistant	Drops or splashes of oil from any direction cause no harmful effects.
G	Oil-proof	Protection against entry of oil droplets or splashes from all directions.

The protection levels against oil are specified only in the appendix of JIS C 0920.

IP is a trademark of Mitutoyo Corporation.

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.

MeasurLink® ENABLED marks



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

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.

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

- Regarding the products corresponding to the five marks above, see each product page for details.
- For details, contact the nearest Mitutoyo sales office.

Chapter 1

LG

Linear Gage

Supporting the construction of various automatic devices and automatic measuring devices

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LINEAR GAGE



Mitutoyo Precision Gage Heads

Full Lineup of Gage Heads from
Ultra-high Precision to
Excellent Cost-performance Types

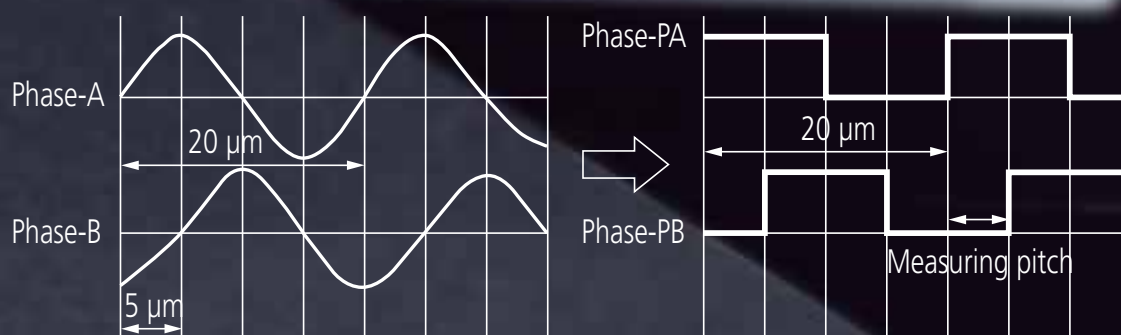
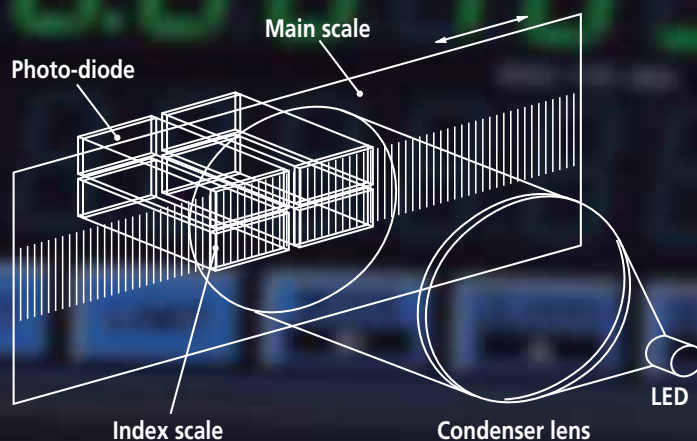
Contact Sensor

Non-contact Sensor

Measurement principle

Optical transmission-type linear encoders

The gage heads mainly use optical transmission-type linear encoders, the principle of which is shown below. In this type, the light source (LED) and the detector element (photodiode) face each other with the main scale and index scale (20 μm pitch) positioned between them. As the scale moves with respect to the detector, the intensity of the light passing through the window in the index scale varies constantly. At this time, two synchronized sine-wave signals having a relative 90-degree phase difference are output. These signals are then amplified and split electrically (with additional waveforms inserted) and output as 0.1 μm , 0.5 μm or 1 μm square-wave signals.



Gage Heads/Display units

[Gage Heads]

Environment-Resistant

LG100



IP67 G



Measuring range: 10 mm/25 mm/50 mm
Resolution: 1 μ m/0.5 μ m/0.1 μ m

Refer to page 1-5

Slim Type

LG200*



IP67 G



Measuring range: 10 mm
Resolution: 1 μ m/0.5 μ m/0.1 μ m

Refer to page 1-9

*Function of reference point detection on counter is disabled

[Conversion plug]

Conversion plug
21HZA196

Conversion plug
21HZA195

Digimatic output Type

LGS



IP66



Measuring range: 12.7 mm
Resolution: 10 μ m

Refer to page 1-15

High-accuracy Type

LGH



Measuring range: 10 mm
Resolution: 0.01 μ m/0.005 μ m

Refer to page 1-19

[Display units]

DIN rail-mounted Type

EJ-102N



2-axis input, subtraction calculations
8 units can be connected

Refer to page 1-31



Panel mount

EH-102Z



2-axis input, subtraction calculations
Multi-function

Refer to page 1-48



EH-101P (1 axis) EH-102P (2 axes)



Multi-function

Refer to page 1-48



EH-102D



2-axis input, subtraction calculations
Multi-function

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Compact display Unit

EC-101D



1-axis input

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[Interface Unit/Software]

Interface Unit

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PROFINET 21HZA187

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EtherNet/IP 21HZA188

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EtherCAT 21HZA264

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USB 21HZA149

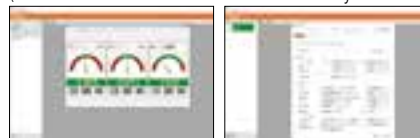
Refer to page 1-31



Setup tool for EJ counters

LG QuickSetupTool

(can be downloaded for free from the Mitutoyo website)



Refer to page 1-34

Measurement data acquisition software

SENSORPAK



Refer to page 1-63



LG100

- High-accuracy gage head suitable for in-line and in-laboratory use.
- Assures the expected repeatability (2σ) in the full measurement range and the narrow-range precision.
- Protection grade IP67G with sliding durability of 50 million times and more*¹ and adoption of highly oil-resistant materials.
*¹ 10 mm range models (Actual value from in-house tests)
- All models have the origin point signal output function to restore the origin point position after recovery from problems such as overspeed.
- It can be connected to a compact counter (**EJ** counter) suitable for in-line use or building into a device or a multifunctional counter (**EH** counter)*² suitable for use in measurement rooms.

*² A conversion plug is required.

542-190/542-191/542-192

IP67 G

542-190

542-193/542-194/542-195

IP67 G

542-193

542-196/542-197

IP67 G

542-196

Specifications

Order No.	542-190	542-191	542-192	542-193	542-194	542-195	542-196	542-197
Measuring range	10 mm			25 mm			50 mm	
Resolution	1 μm	0.5 μm	0.1 μm	1 μm	0.5 μm	0.1 μm	1 μm	0.5 μm
Measuring accuracy (20 °C) L=arbitrary measuring length (mm)	1.5 + L/50 μm		0.8 + L/50 μm	1.5 + L/50 μm		0.8 + L/50 μm	1.5 + L/50 μm	
Small range accuracy	0.5 μm (Arbitrary 20 μm range)							
Repeatability: 2 σ (20 °C)	0.3 μm							
Reference mark repeatability: σ (20 °C)	σ≤0.5 μm (at a constant reference point passing speed less than 300 mm/s in the same direction)							
Contact point downwards	1.4 N or less			4.6 N or less			5.7 N or less	
Contact point horizontal	1.3 N or less			4.3 N or less			5.3 N or less	
Contact point upwards	1.2 N or less			4.0 N or less			4.9 N or less	
Position detection method	Optical transmission-type Linear encoder							
Maximum response speed	1,500 mm/s		400 mm/s	1,500 mm/s		400 mm/s	1,500 mm/s	
Output signal	90° phase difference, differential square wave (RS-422A equivalent)							
Minimum edge intervals	500 ns (2 MHz)	250 ns (4 MHz)		500 ns (2 MHz)	250 ns (4 MHz)		500 ns (2 MHz)	250 ns (4 MHz)
Output signal pitch	4 μm	2 μm	0.4 μm	4 μm	2 μm	0.4 μm	4 μm	2 μm
Reference mark position (Phase-Z)	Approx. 3 mm from contact point tip (lowest rest point)			Approx. 5 mm from contact point tip (lowest rest point)				
Mass	Approx. 260 g			Approx. 300 g			Approx. 400 g	
Contact point	ø3 mm carbide tipped (fixing screw: M2.5 (P=0.45) ×5), standard contact point: 901312							
Stem	ø8 mm			ø15 mm				
Bearing	Linear ball type							
Output cable length	2 m (directly from casing)							
Connector	Plug: HR10A-10P-10P (HIROSE), Compatible receptacle: HR10A-10R-10S (HIROSE), Compatible connector: HR10A-10J-10S (HIROSE)							
Operating temperature (humidity)	0 to 50 °C (RH 20 to 80%, non-condensing)							
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)							
Standard accessories	Wrench for contact point: 538610			Wrench for contact point: 210187				

Dimensions

542-190/542-191/542-192

(screw top view)

Thrust stem
02ADB68T

Clamp nut
02ADB68Z

M9.5x0.5

Cable length=2m

M9.5x0.5
(mounting thread)

Ø8 "max" for thrust stem

Stroke
10.6 max

Dimensions with an optional thrust stem installed

542-193/542-194/542-195

Technical drawing showing dimensions and components for the 542-193/542-194/542-195 cable assembly.

Dimensions (mm):

- Overall length: 841
- Top section height: 45
- Top section diameter: $\varnothing 14.7$
- Top section length: 43
- Top section diameter: $\varnothing 18$
- Top section length: 61.7
- Top section diameter: $\varnothing 15$
- Top section length: 34
- Top section diameter: $\varnothing 18$
- Top section length: 114.7
- Top section diameter: $\varnothing 14$
- Top section length: 13.8
- Top section diameter: $\varnothing 12$
- Top section length: 93.6
- Top section diameter: $\varnothing 12$
- Top section length: 65
- Top section diameter: $\varnothing 12$
- Top section length: 24
- Top section diameter: $\varnothing 12$
- Top section length: 24.2
- Top section diameter: $\varnothing 12$
- Top section length: 2
- Top section diameter: $\varnothing 12$
- Top section length: 8.6
- Top section diameter: $\varnothing 12$
- Top section length: 20.6
- Top section diameter: $\varnothing 12$
- Top section length: 0.6
- Top section diameter: $\varnothing 12$
- Top section length: 20
- Top section diameter: $\varnothing 12$
- Top section length: 30.7
- Top section diameter: $\varnothing 12$
- Top section length: 8.6
- Top section diameter: $\varnothing 12$

Components and Labels:

- Thrust stem 02ADN371
- Clamp nut 02ADB682
- M18x1
- M14x0.5 (adjustment thread for thrust stem)
- Stroke 20 mm (over 20 mm)
- Cable length=2 m

Dimensions with an optional thrust stem installed

[illegible]

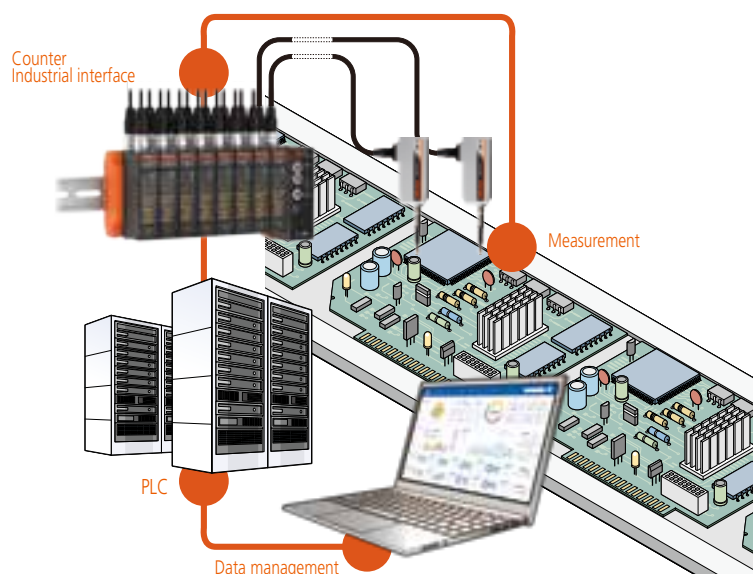
Cable length=2 m

43

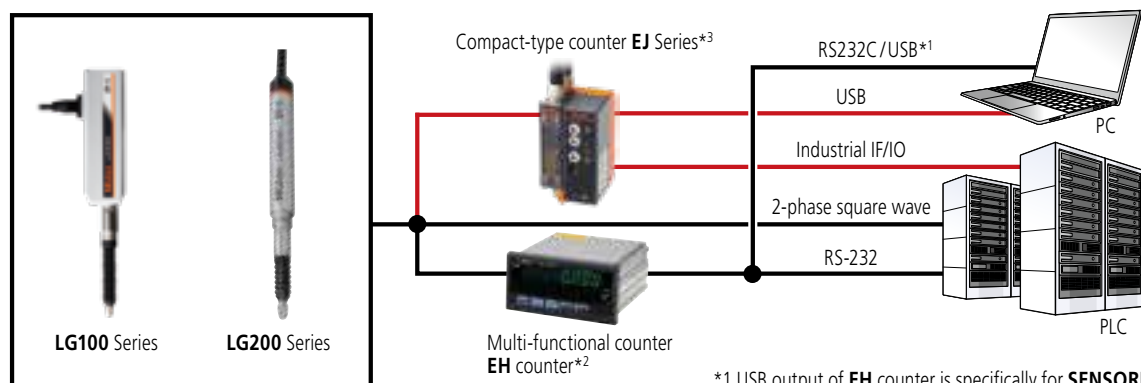
HR10A-10P-10P (HIROSE)

ø14.7

Enables real-time measurement and data management



System configuration



^{*1} USB output of **EH** counter is specifically for **SENSORPAK**.

^{*2} A conversion plug is required for connecting to **EH** counter.

^{*3} Conventional gages can be connected using conversion cables.
(Please contact us for details of connectable gages.)

Optional accessories

Air lifter

For 10 mm range models: **02ADE230**

For 25 mm range models: **02ADE250**

For 50 mm range models: **02ADE270**

Note 1: Required air pressure: 0.2 to 0.4 MPa
(With a 0.1 μm resolution type: 0.2 MPa)

Note 2: Spindle extends when air is supplied.



Rubber boot (spare)

For 10 mm range models: **21HAA331**

For 25 mm range models: **21HZA176**

For 50 mm range models: **21HZA184**



Thrust stem set

For 10 mm range models: **02ADB680**

(Thrust stem: **02ADB681**,

Clamp nut: **02ADB682**)

For 25/50 mm range models: **02ADN370**

(Thrust stem: **02ADN371**,

Clamp nut: **02ADB692**)

This is a combination of thrust stem and a clamp nut.

Note 3: Dimensions are shown in the external
dimensions drawing of the product.



Spanner wrench

For 10 mm range models: **02ADB683**

For 25/50 mm range models: **02ADB693**

If required spanner wrench is required for tightening.

If using multiple gages, a thrust stem set is required for
each gage and one spanner wrench.

Conversion plug

Connection to EH-101P/102P: **21HZA195**

Connection to EH-102Z: **21HZA196**

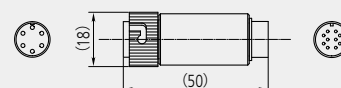
Extension cable

5 m: **21HZA197**

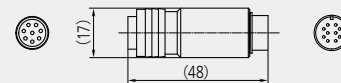
10 m: **21HZA198**

20 m: **21HZA199**

Note 4: Connectable up to 3 pieces, 20 m at maximum.



21HZA195 (Standard type)



21HZA196 (With origin point mark)



- Slimmer body with approx. 1/5 cross section compared with **542-190 (LG100)**.
- High-accuracy gage head suitable for in-line and in-laboratory use.
- Assures the expected repeatability (2σ) in the full measurement range and the narrow-range precision.
- Protection grade IP67G with sliding durability of 100 million times and more*¹ and adoption of highly oil-resistant materials.
- It can be connected to a compact counter (**EJ** counter) suitable for in-line use or building into a device or a multifunctional counter (**EH** counter)*² suitable for use in measurement rooms.

*1 Actual value from in-house tests.

*2 A conversion plug is required.

542-186/542-187/542-188



Specifications

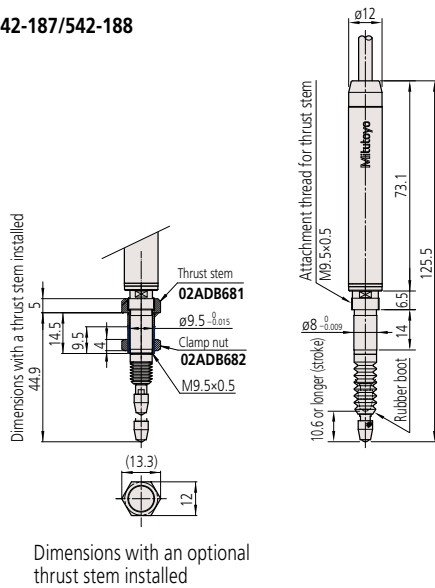
Order No.		542-188	542-187	542-186
Measuring range		10 mm		
Resolution		0.1 μm	0.5 μm	1 μm
Measuring accuracy (20 °C)		(0.8 + L/50) μm L=arbitrary measuring length (mm)	(1.5 + L/50) μm L=arbitrary measuring length (mm)	
Small range accuracy		0.5 μm (Arbitrary 20 μm range)		
Repeatability: 2 σ (20 °C)		0.3 μm		
Measuring force	Contact point downwards	0.8 N or less		
	Contact point horizontal	0.75 N or less		
	Contact point upwards	0.7 N or less		
Position detection method		Optical transmission-type Linear encoder		
Maximum response speed		400 mm/s	1500 mm/s	
Output signal		90° phase difference, differential square wave (RS-422A equivalent)		
Minimum edge intervals		250 ns (4 MHz)		500 ns (2 MHz)
Output signal pitch		0.4 μm	2 μm	4 μm
Mass		Approx. 210 g		
Contact point		ø3 mm carbide-tipped (fixing screw: M2.5 (P=0.45) ×5), standard contact point 901312		
Stem		ø8 mm		
Bearing		Linear ball type		
Output cable length		Approx. 2.5 m (directly from casing)		
Connector		Plug: HR10A-10P-10P (HIROSE), Compatible receptacle: HR10A-10R-10S (HIROSE),Compatible connector: HR10A-10J-10S (HIROSE)		
Operating temperature (humidity)		0 to 50 °C (RH 20 to 80%, non-condensing)		
Storage temperature (humidity)		-10 to 60 °C (RH 20 to 80%, non-condensing)		
Standard Accessories		Wrench for contact point: 538610		

LG200

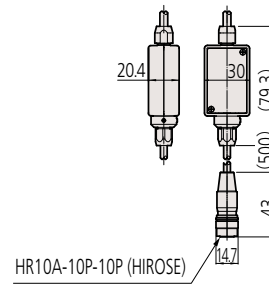
Dimensions

Unit: mm

542-186/542-187/542-188



Connector



Optional accessories

Air lifter

02ADE230

Note 1: Required air pressure: 0.2 to 0.4 MPa
(With a 0.1 μ m resolution type: 0.2 MPa)

Note 2: Spindle extends when air is supplied.

Rubber boot

21HAA331 (spare)

Thrust stem set

02ADB680

(Thrust stem: 02ADB681,

Clamp nut: 02ADB682)

This is a combination of thrust stem and a clamp nut.



Extension cable

5 m: 21HZA197

10 m: 21HZA198

20 m: 21HZA199

Note 3: Connectable up to 3 pieces, 20 m at maximum.



Conversion plug

Connection to EH-101P/102P: 21HZA195

Connection to 542-073 : 21HZA196

Note: Connectable to EH-102Z but the function of reference point detection is disabled.



Spanner wrench

02ADB683

If required spanner wrench is required for tightening.
If using multiple gages, a thrust stem set is required for each gage and one spanner wrench.

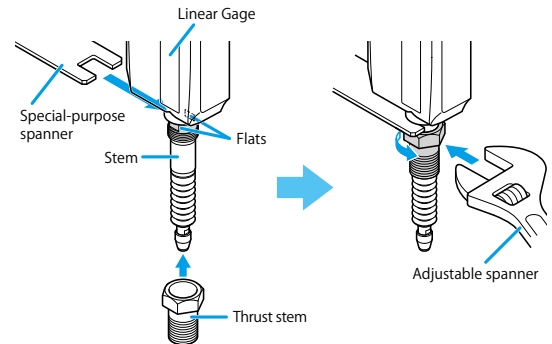
Custom order example

- Measuring force change
- Cable length change (less than 2 m)
- Connector change

Clamping Procedure

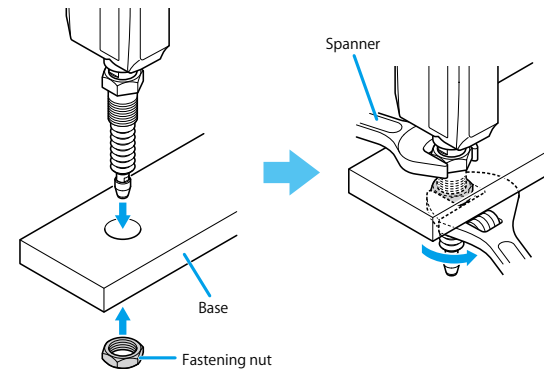
1 Attach the thrust stem on the Linear Gage.

1. Fit the optional special-purpose spanner to the flats at the base of Linear Gage's stem.
2. Bring the thrust stem over the stem and then turn it with an adjustable spanner to fasten it while firmly holding the stem with the special-purpose spanner.



2 Assemble the Linear Gage (with thrust stem attached) into the base (tool or jig).

1. Insert the Linear Gage (with thrust stem attached) into the mounting hole on the base (tool or jig).
2. Thread the fastening nut onto the thrust stem from the spindle side, and then securely tighten the fastening nut with an adjustable spanner while holding the thrust stem with a spanner to keep it from moving.



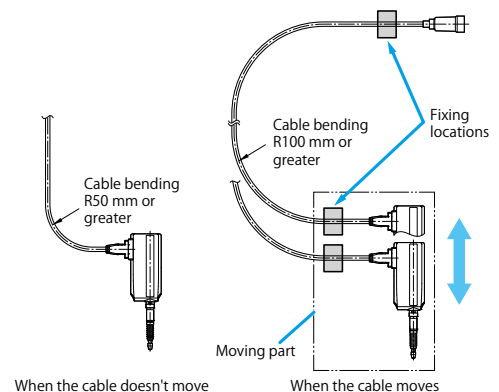
Tips

LG100-110, LG100-0510, LG100-0110: Use the base with a thickness of 6 mm to 10.5 mm.
 LG100-125, LG100-0525, LG100-0125, LG100-150, LG100-0550: Use the base with a thickness of 10 mm to 13 mm.

Fastening the Cable

When movement of a Linear Gage attached to the tool or jig causes repeated flexing of the cable, make sure that the cable is fixed in a manner that maintains a bending radius of at least 100 mm.

- When the cable doesn't move (The cable is fixed)
 ⇒ Cable bending R50 mm or greater
- When the cable moves (When cables are repeatedly bent)
 ⇒ Cable bending R100 mm or greater



NOTICE Shows risks that could result in property damage.

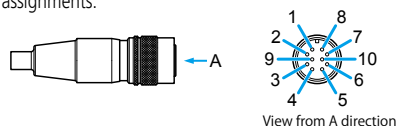


- Fix the cable to the tool or jig so that it does not put any strain on the Linear Gage.
- Do not bend the cable more than the cable's rated bending radius. Bends that are too tight can result in broken cable wires. The bending radius is not warranted.



Output Signals

• Pin assignments:



Pin No.	Signal name	Pin No.	Signal name
1	PA	7	N.C
2	PA	8	PZ*
3	N.C	9	+5V
4	PB	10	GND
5	PB	Shell	FG
6	N.C		

* LG200: N.C

• Linear Gage power supply

Power supply voltage: 5 V (4.8 V-5.2 V), voltage ripple not greater than 0.2 Vpp

Maximum power consumption: 80 mA (using recommended circuit connection)

• Compatible receptacle and jack

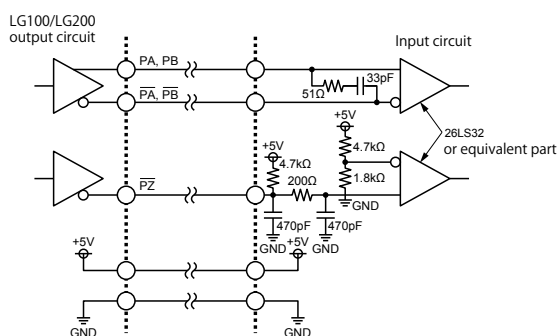
Receptacle: HR10A-10R-10S (HIROSE)

Jack: HR10A-10J-10S (HIROSE)

Tips

The receptacle and jack are required to connect to devices other than Mitutoyo counters.

Recommended Circuit



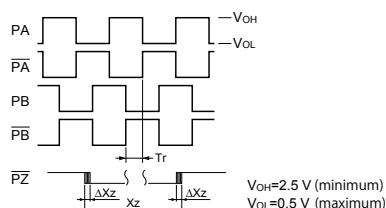
Tips

Always use a line driver IC or differential amplifier circuit for generating the signal. Lack of differential amplification will make the signal vulnerable to noise.

Output Signal Chart

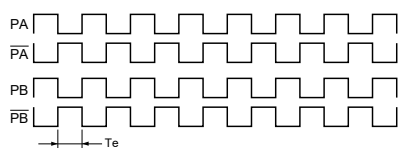
This product provides the following two output signal patterns. During circuit design, make sure that the receive circuit provides for error detection.

● Normal output (when the spindle is pressed in)



● Error output

When extreme waveform disruption occurs due to vibration or impact, or in the case of high-speed movement, the pulse generation circuit may exceed response limits. In this case, the output signal switches to error pulse output, synchronizing the A phase and B phase of the two-phase square wave signal; use this for error detection.



- Output condition: Speed of spindle movement \leq Linear Gage response speed^{*1*2}
- Tr: Output pulse edge interval (normal output; see table below)
- Output delay time^{*3}: Not more than 1 μ s
- ΔXz : Repeatability of origin position (edge reproducibility) as 0.5 μ m (by traversing the origin in the same direction at a constant speed of 300 mm/s or less)
- Xz: Origin signal pulse width=approx. 40 μ m-60 μ m (reference)

• Output conditions: The Linear Gage enters the error state and the special pattern indicated in the figure above is output under the following conditions:

Speed of spindle movement $>$ Linear Gage response speed^{*1*2}

• Te: Output pulse edge interval (error output; see table below)

Minimum edge interval under different conditions

Resolution	Tr (normal condition)	Te (error condition)
1 μm	500 ns	500 ns
0.5 μm	250 ns	
0.1 μm		

*1 Even if the output condition (speed) is satisfied, an error may be output due to noise or a slight speed fluctuation caused by vibration. Error output while in the stopped state may indicate an instrument fault.

*2 For Linear Gage response speed, see "Specifications".

*3 Indicates the time required for the counter pulse to catch up with the spindle position.



Maintenance

■ Replacing the Contact Point

Before mounting or removing a contact point, place the included spanner over the flats at the end of the spindle. Position a soft cloth to cover the knurled section of the contact point to avoid damaging it. Hold the included spanner so that no rotational force is applied to the spindle during the removal/installation process. Remove or install the contact point as per the diagram. The contact point can be replaced in accordance with customer specifications.

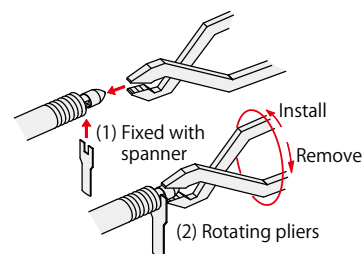
NOTICE



When replacing the contact point, always use the included contact point replacement key spanner to hold the spindle stationary. Application of force through the spindle to the internal sensor can damage the sensor and render the Linear Gage inoperable.

Tips

- After attaching the contact point, make sure that it is not loose.
- Note that a change of contact point may change external dimensions and measuring force and limit movement in the direction of measurement. Also note that instrument error resulting from change of the contact point (perpendicularity, for example when replaced with a flat contact point) will have a cumulative effect on measurement accuracy.



Installation and removal of contact point

■ Replacing the Rubber Boot

NOTICE

Damage to the rubber boot can lead to associated damage. Avoid such damage by preventively replacing the rubber boot.

Tips

For the rubber boot, see "Optional accessories".

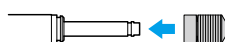
- 1 (For spindle with a 10 mm measuring range only)**
Remove the contact point from the tip of the spindle.



- 2** Remove the rubber boot, and then use alcohol, etc. to clean all oil and contaminants from the rubber boot attachment grooves.



- 3** Fit the new rubber boot large-opening first onto the spindle



- 4** Apply a small amount of silicone-based contact cement to the rubber boot attachment grooves.



NOTICE



When doing so, be very careful to avoid getting contact cement on the spindle. Any contact cement on the spindle can damage it or render it inoperable.

- 5** Stretch the rubber boot so that both of its ends engage the rubber boot attachment grooves. Attach the rubber cap so that it does not twist.



- 6 (For spindle with a 10 mm measuring range only)**
Reinstall the contact point on the spindle.

"NOTICE" shows risks that could result in property damage.

LGS-1012P



- ABSOLUTE electrostatic capacitance type encoder makes it possible to maintain the reference point even when the power is switched off.
- Excellent protection against dust and splashing water (IP66) on the factory floor.

ABSOLUTE™

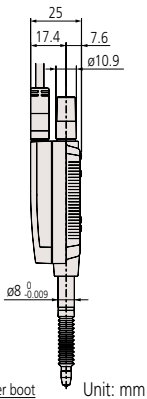
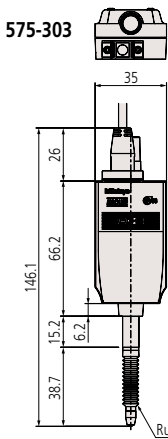
575-303



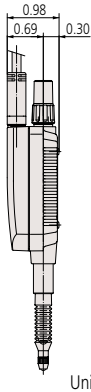
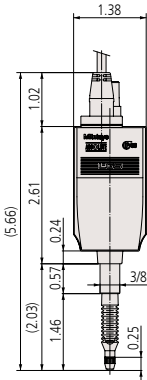
Specifications

Order No.	575-303	575-313
Measuring range	12.7 mm	0.5 in
Resolution	10 μm	0.0005 in
Measuring accuracy (20 °C)	15 μm	0.0008 in
Measuring force	Contact point downwards	2.0 N or less
	Contact point horizontal	1.8 N or less
	Contact point upwards	1.6 N or less
Position detection method	ABSOLUTE electrostatic capacitance type linear encoder	ABSOLUTE electrostatic capacitance type linear encoder
Response speed	Unlimited (not applicable to scanning measurement)	Unlimited (not applicable to scanning measurement)
Output	Digimatic output	Digimatic code
Mass	Approx. 190 g	Approx. 190 g
Protection Level	Equivalent to IP66 (only gage head)	Equivalent to IP66 (only gage head)
Contact point	ø3 mm carbide-tipped (fixing screw: M2.5 (P=0.45) ×5), standard contact point: 901312	ø3 mm carbide tipped (fixing screw: 4-48 UNF), standard contact point: 21BZB005
Stem	ø8 mm	ø9.52=3/8 in DIA
Bearing	Plain type	Plain type
Output cable length	2 m (directly extended from the main unit)	2 m (directly extended from the main unit)
Operating temperature (humidity)	0 to 40 °C (RH 20 to 80%, non-condensing)	0 to 40 °C (RH 20 to 80%, non-condensing)
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)	-10 to 60 °C (RH 20 to 80%, non-condensing)

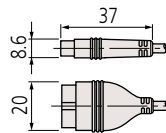
Dimensions



575-313



Connector
Unit: mm



LGS-1012P

Contents

Features

1

2

3

4

5

6

7

Optional accessories

Rubber boot (spare)

238774

Air lifter (metric)

903594

Air lifter (inch)

903598

SPC cable extension adapter

02ADF640

Extension cable for Digimatic gages (0.5 m)

02ADD950

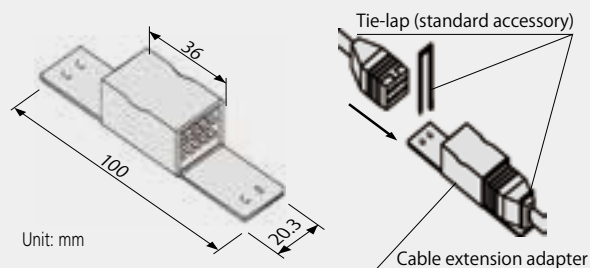
Extension cable for Digimatic gages (1 m)

936937

Extension cable for Digimatic gages (2 m)

965014

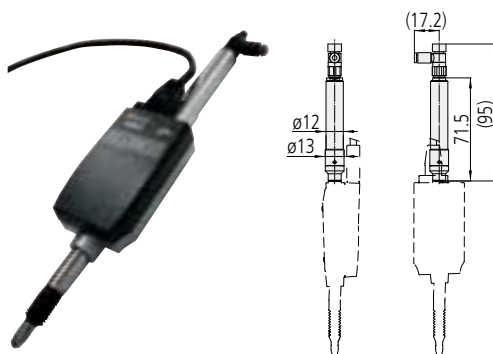
Note: When connecting an extension cable, an SPC cable extension adapter is required.



Custom order example

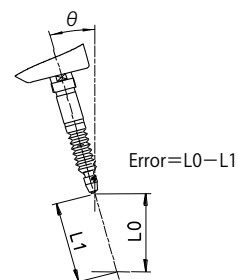
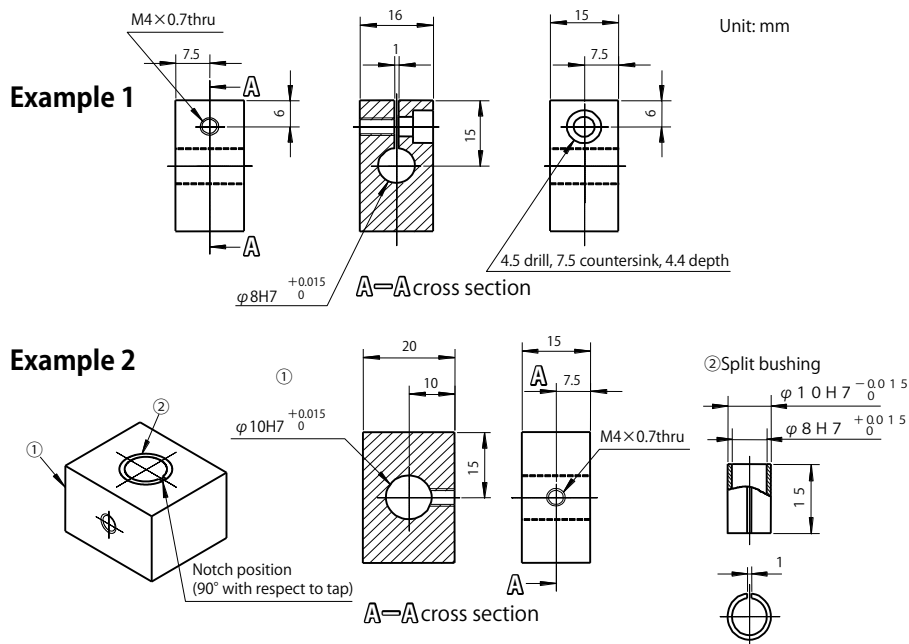
- Measuring force change
- Cable length change
- Connector change

Air lifter for LGS-1012P



Clamping Procedure

To mount the gage on another instrument or a fixture, clamp the $\varnothing 8$ stem.
It is recommended to use a slotted holder or a split bushing for the mount structure.
(Recommended tightening torque in Example 1: 60 - 80 N·cm)





Maintenance

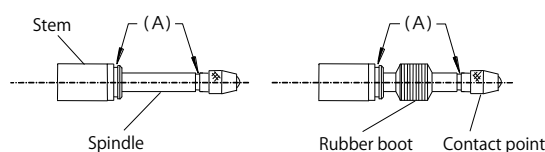
■ Replacing the contact point

Cover the contact point with soft cloth and grip with pliers to remove it.
Reverse the procedure to install the replacement contact point.

■ Replacing the rubber boot

Preventive replacement before being damaged is recommendable. (The rubber boot is available as an optional accessory.)

1) Remove the old rubber boot, then eliminate the dust and dirt in the grooves (part A) or the stem and spindle.



2) Insert a rubber boot between the stem and contact point, directing the greater inside diameter end to the stem.

3) Apply a small amount of silicone adhesive to the grooves (part A), and seal both ends of the rubber boot.

Tips

If the adhesive is applied to the spindle slider, the spindle will not slide properly. Great care must be exercised.

SERIES 542 — High-accuracy/resolution Type

LGH

- This series has achieved very high accuracy combined with a resolution of 0.01/0.005 μm (according to model), practically equivalent to that of a laser interferometer, and a wide measuring range of 10 mm.
- A compact body design makes a significant contribution to a downsizing of this gage itself, which is best suited for calibration/evaluation of master gages as well as measurement of high-precision parts and as a length measuring sensor incorporated into high-precision positioning/control units.
- A low measuring force model is available for those applications where measurement of easily deformed or damaged workpieces is required.
- Every **LGH** Series gage is bundled with a dedicated counter.



Gage head
542-715

- This model is equipped with a newly developed optical reflection-type linear encoder, achieving an excellent resolution of 0.01 μm , a measuring accuracy of 0.2 μm and a measuring range of 10 mm at a low price.
- Maximum operating speed has been improved by a factor of 2.8 times (250 mm/s \rightarrow 700 mm/s) while maintaining very high accuracy.



Gage head
542-720

- This model is equipped with a newly developed ultra-high precision transmission type linear encoder, achieving the outstanding resolution of 0.005 μm (5 nm).
- Exceptional measuring accuracy of 0.1 μm has been attained over the wide measuring range of 10 mm. This series is most suited for calibration/evaluation of master gages where its wide measuring range is a great advantage.

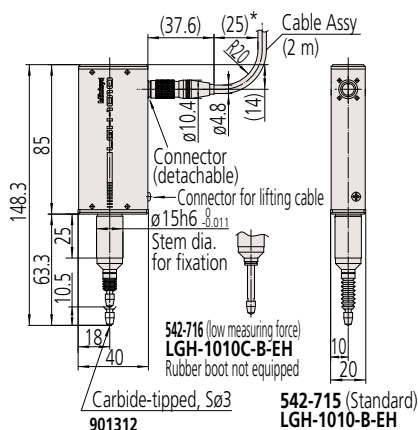


Dedicated counter

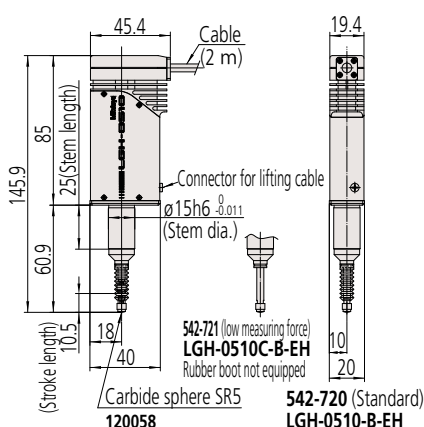
Dimensions

Unit: mm

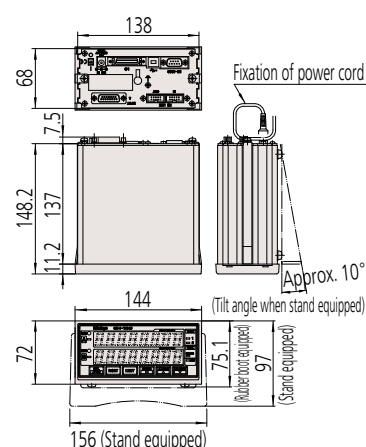
542-716



542-721



Dedicated counter (set)



* Minimum bending radius or minimum dressed dimension

Specifications

Type		Resolution 0.01 μm / Accuracy 0.2 μm model	
Order No.		542-715 (Standard)	542-716 (Low measuring force)
Measuring range		10 mm	
Resolution		0.01 μm (0.05 μm, 0.1 μm, 0.5 μm, 1 μm can be selected from the counter)	
Measuring accuracy (20 °C)* ¹		0.2 μm	
Repeatability (20 °C)* ¹		0.1 μm (2 σ)	
Retrace error (20 °C)* ¹		0.1 μm	
Measuring force	Contact point downwards	0.65 N or less	Approx. 0.12 N
	Contact point horizontal	0.55 N or less	Not applicable
	Contact point upwards	0.45 N or less	Not applicable
Position detection method		Optical reflection type linear encoder	
Detectable operation speed		In normal measurement: 700 mm/sec; for peak detection: 120 mm/sec	
Mass of gage head		Approx. 370 g	
Contact point		Carbide tipped, Sϕ3 mm (M2.5 (P=0.45) ×5 mm), standard contact point 901312	
Stem		ϕ15 mm	
Bearing		Linear ball type	
Output cable length		Approx. 2 m	
Operating temperature/humidity		0 to 40 °C (Reference temperature 20 °C)/20 to 80% RH (non-condensing)	
Storage temperature/humidity		-10 to 60 °C/20 to 80% RH (non-condensing)	
Counter Specifications			
Display range		± 999.99999 mm	
Functions		Zero-set, preset, direction switch, tolerance judgment (3 steps/5 steps), RS-LINK	
Peak hold function		Yes	
Interface		RS-232C, USB (only for SENSORPAK), Digimatic (Printer: DP-1VA LOGGER)* ³ , I/O Connector	
External output		• RS-232C: counting data • Digimatic output: counting data* ³ • I/O connector: counting data (simplified BCD), tolerance judgment result, simplified analog output	
External control		Zero-set, preset, data hold, peak measurement mode selection, peak clear	
Power supply		Supplied AC Adapter, or +12 to 24 V DC, max. 700 mA	
Power consumption		8.4 W (max. 700 mA), Ensure at least 1 A power supply per unit.	
Mass of counter		Approx. 900 g (AC Adapter excluded)	
Standard accessories		Wrench for contact point, rubber boot, stand, washer (for counter), AC Adapter, AC cord, DC plug, user's manual, inspection certificate	

Type		Resolution 0.005 μm / Accuracy 0.1 μm model	
Order No.		542-720 (Standard)	542-721 (Low measuring force)
Measuring range		10 mm	
Resolution		0.005 μm (0.01 μm, 0.05 μm, 0.1 μm can be selected from the counter)	
Measuring accuracy (20 °C)* ¹		0.1 μm	
Repeatability (20 °C)* ¹		0.02 μm (2 σ)	
Retrace error (20 °C)* ¹		0.05 μm	
Measuring force	Contact point downwards	0.65 N or less	Approx. 0.1 N
	Contact point horizontal	0.55 N or less	Not applicable
	Contact point upwards	0.45 N or less	Not applicable
Position detection method		Ultra-high accuracy transmission type linear encoder	
Detectable operation speed		In normal measurement: 250 mm/sec	
Mass of gage head		Approx. 370 g	
Contact point		Carbide sphere SR5 (M2.5 (P=0.45) ×5 mm), standard contact point 120058	
Stem		ø15 mm	
Bearing		Linear ball type	
Output cable length		Approx. 2 m	
Operating temperature/humidity		15 to 25 °C (Reference temperature 20 °C)/30 to 60% RH (non-condensing)	
Storage temperature/humidity		-10 to 60 °C/20 to 80% (non-condensing)* ²	
Counter Specifications			
Display range		± 99.999995 mm	
Functions		Zero-set, preset, direction switch, tolerance judgment (3 steps/5 steps), RS-LINK	
Peak hold function		No	
Interface		RS-232C, USB (only for SENSORPAK), Digimatic (Printer: DP-1VA LOGGER)* ³ , I/O Connector	
External control		• RS-232C: counting data • Digimatic output: counting data* ³ • I/O connector: counting data (simplified BCD), tolerance judgment result, simplified analog output	
External control		Zero-set, preset, data hold	
Power supply		Supplied AC Adapter, or +12 to 24 V DC, max. 700 mA	
Power consumption		8.4 W (max. 700 mA), Ensure at least 1 A power supply per unit.	
Mass of counter		Approx. 900 g (AC Adapter excluded)	
Standard accessories		Wrench for contact point, rubber boot, stand, washer (for counter), AC Adapter, AC cord, DC plug, user's manual, inspection certificate	

*1 Applies when used with counter.

*2 The storage temperature/humidity after unpacking are the same as the operating temperature/humidity.

*3 Digimatic output shall be up to 6 digits of data. For data of 7 digits or more, all digits will not be output to the display.

Typical applications

Master gage calibration/evaluation



Inspection of high-precision parts

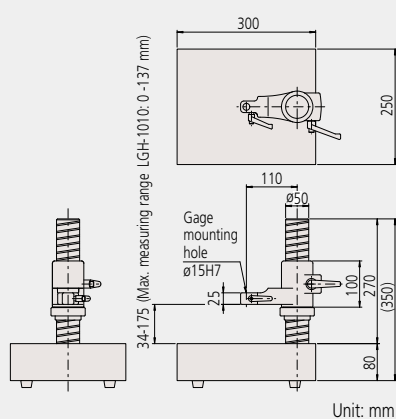


Needle contact-point mounting example

Optional accessories

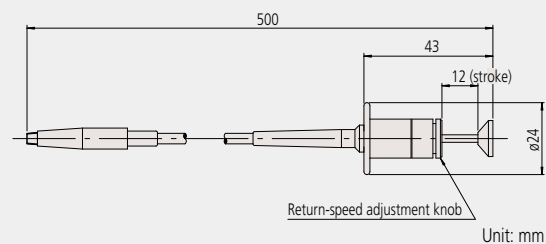
Measuring stand

971750

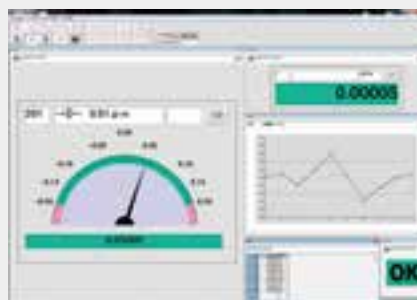


Release with damper

971753



SENSORPAK



I/O output connector

02ADB440



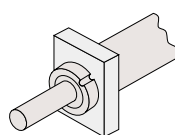
Rubber boot

238772 (Spare for 542-715 and 542-720)

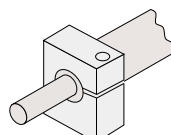
Gage Head Mounting Fixtures

Plain Stem and Stem with Clamp Nut

The stem used to mount a linear gage head is classified as a "plain type" or "clamp nut type" as illustrated below. The clamp nut stem allows fast and secure clamping of the linear gage head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does require a split-fixture clamping arrangement or adhesive fixing. However, take care so as not to exert excessive force on the stem.



Stem with clamp nut



Plain stem

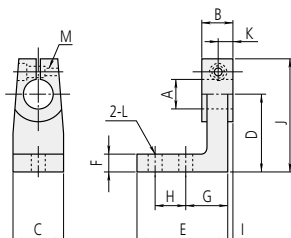
Plain stem mounting fixtures

To mount a gage head with an 8 mm diameter stem, use a 9.5 mm diameter stem bushing.

546288  $\varnothing 9.5 \times 15$

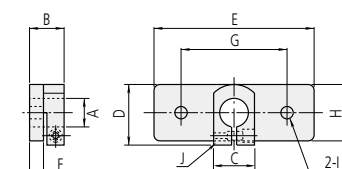
546343  $\varnothing 9.5 \times 8.5$

Unit: mm



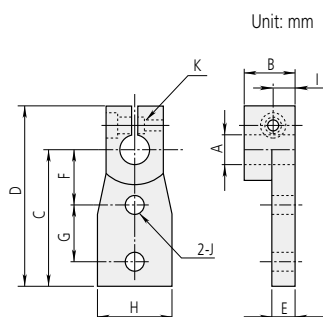
Order No.	303560	303569
A	A-2	B-2
B	$\varnothing 9.5$	$\varnothing 9.5$
C	9	14.5
D	15	20
E	20	30
F	23	35
G	5	7
H	11	16
I	8	12
J	1.5	3.25
K	32.5	42.5
L	4.5	7.25
M	$\varnothing 3.4$	$\varnothing 4.5$
	M3x0.5	M3x0.5

Unit: mm



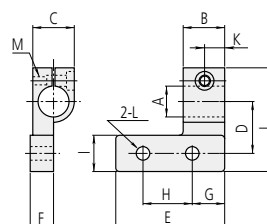
Order No.	303562	303571
A	A-4	B-4
B	$\varnothing 9.5$	$\varnothing 9.5$
C	9	14.5
D	15	15
E	20	22.5
F	40	60
G	3	5
H	30	40
I	15	20
J	$\varnothing 3.4$	$\varnothing 4.5$
	M3x0.5	M3x0.5

Unit: mm



Order No.	303564	303573
A	A-6	B-6
B	$\varnothing 9.5$	$\varnothing 9.5$
C	9	14.5
D	30	40
E	42.5	52.5
F	4	6
G	15	18
H	10	15
I	15	20
J	4.5	7.25
K	$\varnothing 3.4$	$\varnothing 4.5$
	M3x0.5	M3x0.5

Unit: mm



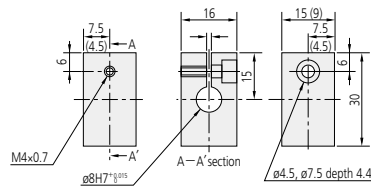
Order No.	303566	303575
A	A-8	B-8
B	$\varnothing 9.5$	$\varnothing 9.5$
C	9	14.5
D	15	15
E	15	20
F	25	40
G	8.5	8.5
H	7.5	10
I	10	10
J	10	15
K	32.5	40
L	4.5	7.25
M	$\varnothing 3.4$	$\varnothing 4.5$
	M3x0.5	M3x0.5

Example of plain-stem mounting

- The recommended clamping torque is 0.4 to 0.5 Nm. (Example1)
Overly tightening the stem will prevent smooth movement of the spindle.

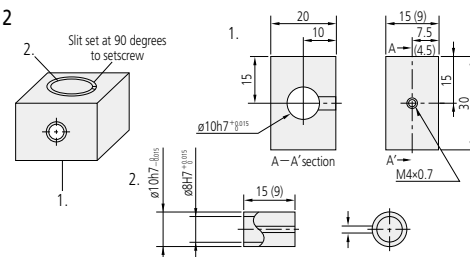
Unit: mm

Example 1



Unit: mm

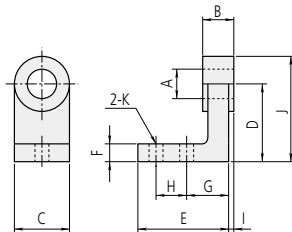
Example 2



Stem with clamp nut type fixtures

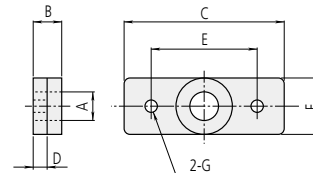
Stem with clamp nut type linear gauge can be used as it is.

Unit: mm



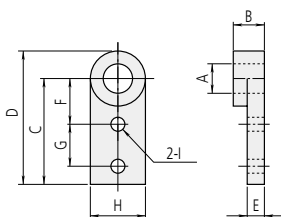
Order No.	303568
A	B-1
B	ø9.5
C	20
D	30
E	35
F	7
G	16
H	12
I	1.75
J	40
K	ø4.5

Unit: mm



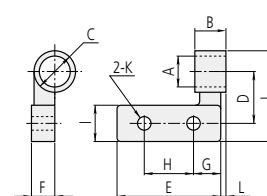
Order No.	303570
A	B-3
B	ø9.5
C	20
D	30
E	35
F	7
G	16
H	12
I	1.75
J	40
K	ø4.5

Unit: mm



Order No.	303572
A	B-3
B	ø9.5
C	40
D	50
E	6.5
F	18
G	15
H	20
I	ø4.5

Unit: mm



Order No.	303574
A	B-7
B	ø9.5
C	11.5
D	ø15
E	20
F	40
G	8.5
H	10
I	20
J	15
K	35
L	ø4.5
	1.25

Gage Head Accessories

Gage Head Mounting Fixtures

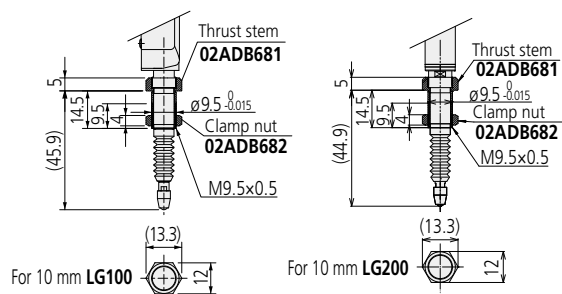
Mounting with a thrust stem

A thrust stem is available as an option for the **LG100**, and **LG200** gage heads. Installing a thrust stem on the stem allows direct mounting, simply by drilling a hole in a section of suitable thickness on the fixture.



For 10 mm **LG100/LG200** Components Thrust stem: **02ADB681**
Clamp nut: **02ADB682**
Wrench: **02ADB683**

Unit: mm



Note: A mounting section with a thickness of 6 through 10.5 mm is suitable.

With the use of a thrust stem and clamp nut, a gage fixture can be arranged simply by drilling a 9.5 mm dia. hole. A gage can be secured firmly with ease with this arrangement.

Tips

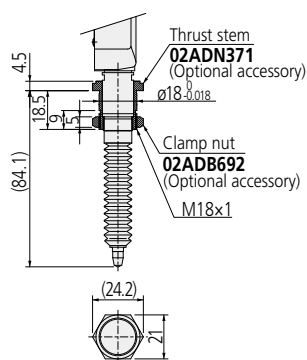
In attaching a thrust stem, be sure to fix the stem first with a dedicated wrench (**02ADB683**). An excessive force applied between the gage main body and stem may cause damage to the gage.



Both the dedicated wrench (**02ADB683**) and M9.5×0.5 threaded section are for mounting a thrust stem. Do not use them for any purpose other than mounting a thrust stem.

For 25 mm **LG100** Components Thrust stem: **02ADN371**
Clamp nut: **02ADB692**
Wrench: **02ADB693**

Unit: mm



Note: A mounting section with a thickness of 10 through 12 mm is suitable.

With the use of a thrust stem and clamp nut, a gage fixture can be arranged simply by drilling an 18 mm dia. hole. A gage can be secured firmly with ease with this arrangement.

Tips

In attaching a thrust stem, be sure to fix the stem first with a dedicated wrench (**02ADB693**). An excessive force applied between the gage main body and stem may cause damage to a gage.

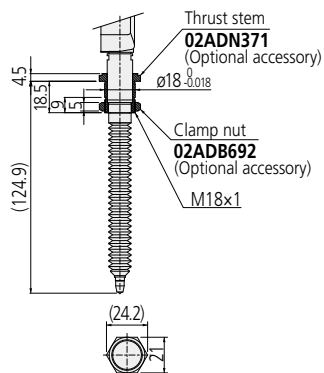


Both the dedicated wrench (**02ADB693**) and M14×0.5 threaded section are for mounting a thrust stem. Do not use them for any purpose other than mounting a thrust stem.

For 50 mm **LG100**

Components Thrust stem: **02ADN371**
 Clamp nut: **02ADB692**
 Wrench: **02ADB693**

Unit: mm



With the use of a thrust stem and clamp nut, a gage fixture can be arranged simply by drilling an 18 mm dia. hole. A gage can be secured firmly with ease with this arrangement.

Tips

In attaching a thrust stem, be sure to fix the stem first with a dedicated wrench (**02ADB693**). An excessive force applied between the gage main body and stem may cause damage to a gage.



Both the dedicated wrench (**02ADB693**) and M14×0.5 threaded section are for mounting a thrust stem. Do not use them for other purpose than mounting a thrust stem.

Note: A mounting section with a thickness of 10 through 12 mm is suitable.

Specifications

Compatible gage		LG100/LG200 10 mm	LG100 25/50 mm
Order No.	Thrust stem set*	02ADB680	02ADN370
	Thrust stem	(02ADB681)	(02ADN371)
	Clamp Nut	(02ADB682)	(02ADB692)
	Wrench	02ADB683	02ADB693
Gage mounting hole diameter (nominal)		ø9.5 mm	ø18 mm
Recommended plate thickness (mounting section)		6 to 10.5 mm	10 to 12 mm

* A thrust stem set is comprised of a thrust stem and clamp nut. A dedicated wrench is required for tightening.
 To use more than one gage, purchase thrust stem sets for the number of gages plus a special spanner.

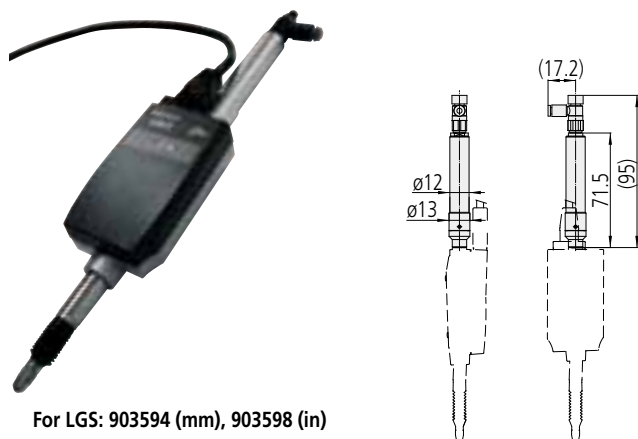
Gage Head Accessories

Optional Accessories

Air Lifter

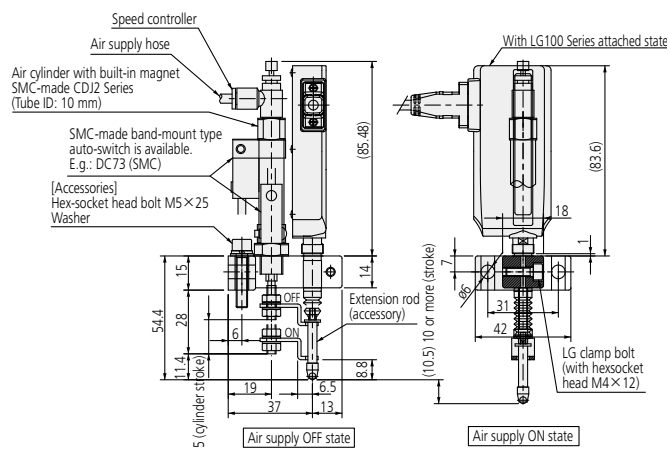
- Advances or retracts the spindle of a gage head by using a pneumatic cylinder.
- Automatic measurement is possible by using a solenoid valve.

Air lifting unit LGS



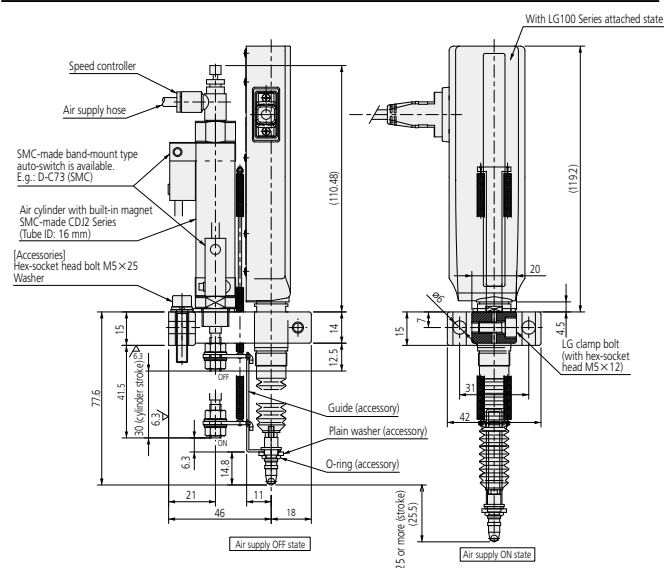
For 10 mm LG100/LG200: 02ADE230

Unit: mm



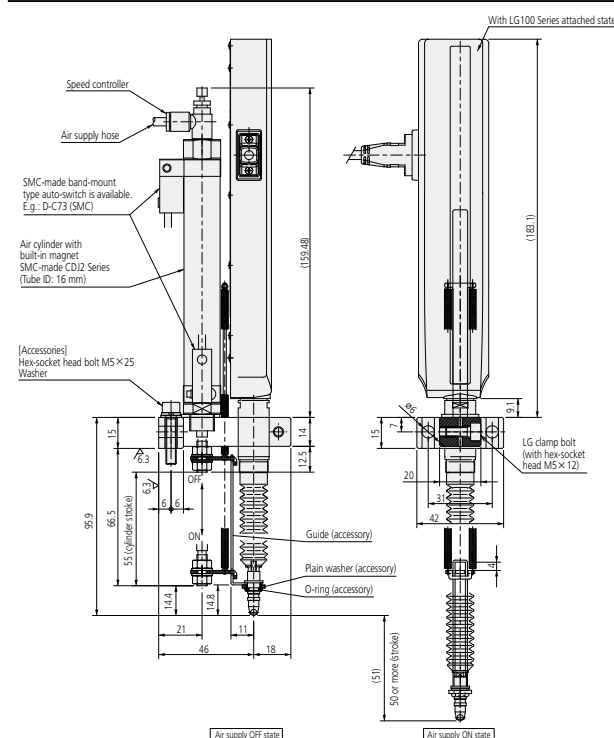
For 25 mm LG100: 02ADE250

Unit: mm



For 50 mm LG100: 02ADE270

Unit: mm



Specifications

Order No.	903594	903598	02ADE230	02ADE250	02ADE270
Stroke	10 mm	0.4 in	10 mm	25 mm	50 mm
Compatible gage head	LGS-1012P		LG100/LG200 Series (10 mm only)		
Air supply	0.5 MPa		0.2 to 0.4 MPa (With a 0.1 μm resolution type: 0.2 MPa)*		
Mass	60 g		150 g	250 g	300 g

* An overspeed error may occur depending on the usage environment and conditions. In case of an error, adjust the air pressure and flow rate to be used.

Optional Accessories

Spare rubber boot

Protects the spindle bearing of a gage head from dust.



■ Specifications

Order No.	Compatible Gage head
21HAA331	LG100/LG200 (for 10 mm range model)
21HZA176	LG100 (for 25 mm range model)
21HZA184	LG100 (for 50 mm range model)
238774	LGS-1012P

Extension signal cable for LG100/LG200

A signal cable from the head to the receiver circuitry can be extended. Maximum number of connectable cables is limited to 3, and the maximum total extension length is limited to 20 m.

Custom order: Flexible cable type

Custom order: Customizable cable length



■ Specifications

Order No.	Cable length
21HZA197	5 m
21HZA198	10 m
21HZA199	20 m

Extension cable for Digimatic gages

Order No.	Cable length
02ADD950	0.5 m
936937	1 m
965014	2 m



Lifting lever and attachment holder

This holder is attached between the spindle and the contact point for fixing the lifting lever.

Example of attaching the lifting lever



■ Specifications

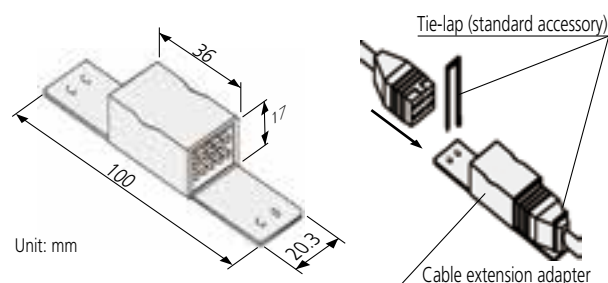
Order No.	
02ADG181	Attachment holder
137693	Lifting lever

Digimatic cable extension adapter

02ADF640 Mass: 15 g

This adapter can be used when the **LGS-1012P** gage head is to be connected to a display unit where the provided cable length is not sufficient for this connection.

- Available for **LGS-1012P**.
- Available for **EC-101D, EH-102D**
- Do not join more than one piece of this product together for use.



Gage Head Accessories

Optional Accessories

Measuring stand



Granite comparator stand
BSG-30HX 215-156-10

Base material	Granite
Base size (mm)	W 250×D 300×H 95
Base flatness	3.5 μm
Fine adjustment	Square thread
Stem size (mm)	ø20, ø9.53, ø8 with bush

LG100 25 mm/50 mm. When using the stand at 25 mm/50 mm stroke, separately obtain a ø15 bushing (**21JAA331**).



Comparator stand
BSC-30HX 215-505-10

Base material	Hardened steel, Grooved measuring stage
Base size (mm)	W 179×D 255×H 89 (Measuring stage □150×H25)
Base flatness	2.3 μm
Fine adjustment	Square thread
Stem size (mm)	ø20, ø9.53, ø8 with bush

LG100 25 mm/50 mm. When using the stand at 25 mm/50 mm stroke, separately obtain a ø15 bushing (**21JAA331**).

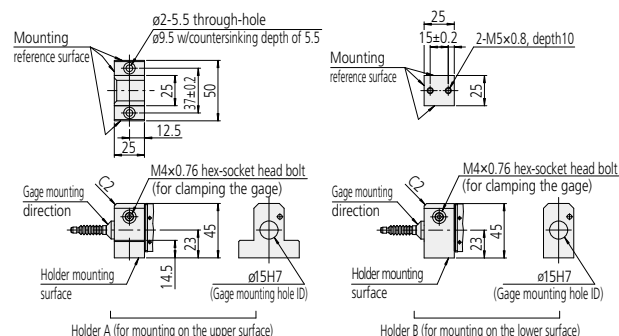
Mounting holder A, B

Useful when the **LGH** is mounted on an alternate fixture rather than the regular measuring stand.

Holder A **971751** Mass: 250 g

Holder B **971752** Mass: 180 g

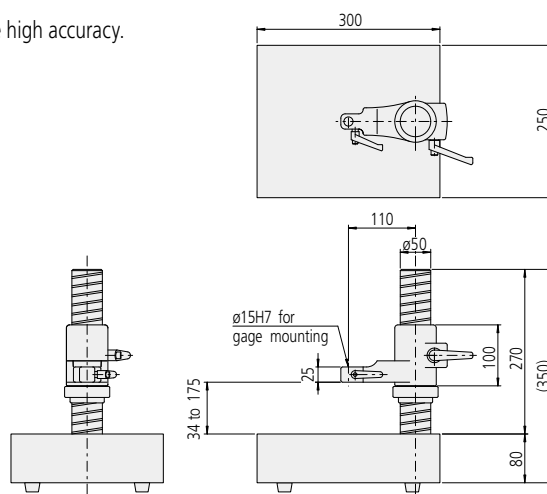
Unit: mm



Measuring stand for Laser Hologage 971750

Unit: mm

This **LGH** stand greatly helps the gage to achieve high accuracy.
Mass: 25 kg

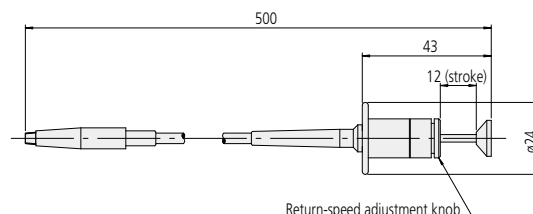


Release with damper

Spindle-lift release for the LGH. A sudden drop of the spindle is prevented by the return-speed adjustment knob.

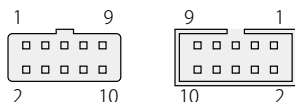
971753 Mass: 50 g

Unit: mm



Digimatic Code

Pin assignments and signals



- Compatible socket:
Sumitomo 3M: V Low-Proheader
Model: 7610-5002XX or equivalent

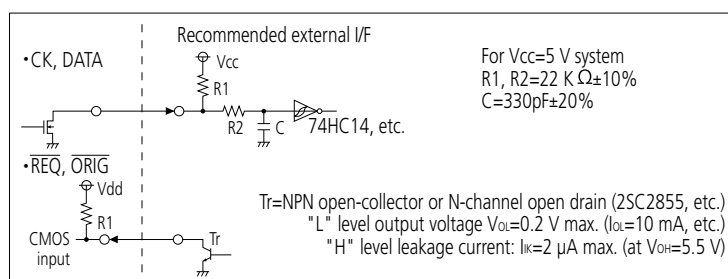
Pin No.	Signal	I/O	Description
1	GND	—	Signal ground
2	DATA	Output	Measurement data-output terminal
3	CK	Output	Synchronized clock-output terminal
4*	N.C.	—	Not used
5	REQ	Input	Input for data transmission request from external device
6*	ORIG	Input	Input for absolute-origin setting signal
7*	N.C.	—	Not used
8*	N.C.	—	Not used
9*	+5 V	—	Power supply (+5 V \pm 10%)
10*	GND (F.G.)	—	Frame ground

* **LGS** uses a unique specification.
All others use the common Digimatic output specification (10-pin, square).

I/O electrical specifications

- Output terminal format: CK, DATA
N-channel open drain
Maximum output current:
400 μ A max. (when $V_{OL}=0.4$ V)
Output withstand voltage: -0.3 V to 7 V

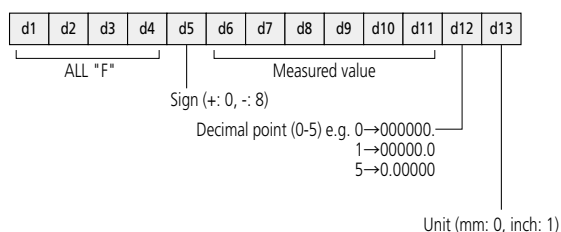
- Input terminal format: REQ, ORIG
Pull-up CMOS input
Internal power supply voltage: $V_{dd}=1.35$ to 1.65 V
Pull-up resistance: $R1=10$ to 100 K Ω
"H" level input voltage: $V_{IH}=1.1$ V min.
"L" level input voltage: $V_{IL}=0.3$ V max.



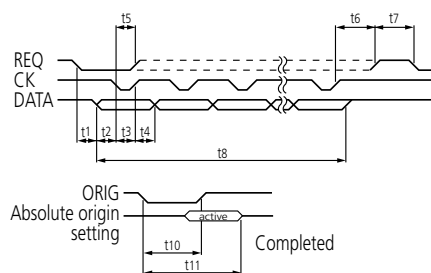
Note: Since the power supply voltages are different between the gage side and the external device side, be sure to use an open collector or open drain circuit. Do not use CMOS output or similar.

Data format

- Data is output as 13-digit (52-bit) based on 4 bits=1 digit.
- Data is output in order from d1 to d13. Each digit is output in the order of LSB to MSB.



Timing chart



LGS

Symbol	min.	max.
t1*	30 μ s	95 ms
t2	15 μ s	—
t3	100 μ s	—
t4	100 μ s	—
t5	0 μ s	—
t6*	—	100 μ s
t7*	100 μ s	—
t8*	—	30 ms
t10*	1.5 s	—
t11*	—	4 s

- Note 1: The specifications indicated by an asterisk (*) are applicable only to **LGS**. All other Digimatic output specifications are common to all models.
- Note 2: Read data only when CK is at the "L" level.
- Note 3: Do not input REQ signal (fixed at "H") while the absolute origin is being set (during t11).
- Note 4: If t5, t6 and t7 are satisfied and REQ is continuously input, an output is obtained from **LGS** at intervals of approximately 95 ms.
- Note 5: Start inputting ORIG and REQ after two or three seconds have elapsed (the estimated time required for internal circuit/sensor to stabilize) following power-on.

Counter Specifications

EJ-102N Counter, Interface Unit: CC-Link, PROFINET, EtherNet/IP, EtherCAT, USB

- A small, high-speed, space-saving counter for linear gage suitable for in-line and in-laboratory use. It brings visibility into the production site, improves productivity, and enables data accumulation.
- Up to 8 compact counters (**EJ** counters) can be linked providing the capacity to connect up to 16 gages.
- On a DIN rail, each unit can be connected directly without using cables, so it takes up minimal space. All linked units and gages can be driven by a single power source.
- Data can be output through an industrial interface (CC-Link) by linking a compact counter (**EJ** counter) with an interface unit. Constant data monitoring and positional management are performed. A USB interface is also provided for easy connection with a computer.
- Enables sum difference operations between 2 gages connected to the same counter.

Counter unit

EJ-102N



Interface unit

CC-Link



PROFINET



EtherNet/IP



EtherCAT



USB



Image of mounting



Specifications

Order No.		542-080	542-081
Model		EJ-102N	
Unit		mm	inch/mm
Resolution		0.005, 0.001, 0.0005, 0.0001 (mm)	0.0002, 0.00005, 0.00002, 0.000005 (inch)/ 0.005, 0.001, 0.0005, 0.0001 (mm)
Number of linear gage connection ports		2	
Supported gage signal		Differential square wave, differential square wave with reference point mark	
Maximum input frequency		5 MHz	
User Interface	Display	Negative sign + 8 digits and indicator (1 gage value displayed, manually switchable)	
	Number of keys	4	
External I/O	Number of I/O ports	Input: 4 ports (Ch switch, peak clear, data hold, preset) Output: 4 ports (Err/ALLGO, Tolerance judgment)	
	Compatible communication standards	CC-Link, USB (Supported with optional interface units)	
Max. number of linked units		EJ Counter 8 units + 1 (optional) interface unit (Max. number of linear gage connections: 16)	
Power supply	Input voltage	10 V to 27 V DC	
	Power consumption	1 unit only: 3 W or less (Includes 2 linear gages) Max. number of links: 30 W or less (Interface unit and 16 linear gages included)	
Operating temperature (humidity)		0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity)		-10 to 60 °C (RH 20 to 80%, non-condensing)	
Mass		Approx. 120 g	

Specifications

Order No.	21HZA186	
Model	Interface unit CC-Link	
Applicable interface	USB 2.0 Full Speed	
	CC-Link Ver. 1.10	
	CC-Link Ver. 2.00	
User Interface	Display	POWER (green), RUN (green), ERROR (red), EJ-CONNECT (green)
	Switch	Rotary switch×3 (Exchange number settings×2, communication speed settings×1)
Functions	Common protocols for USB and CC-Link, Readout of current value*2, Current value hold (software hold), Parameter setting on EJ counter, Tolerance judgment value settings, Preset value settings, preset/zero-set clear, peak clear, error clear *2 Only Ver. 2.00 is supported with CC-Link.	
Power supply	Power is supplied from EJ-102N (542-080/542-081) (Cannot be charged via USB)	
Operating temperature (humidity)	0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)	

Order No.	21HZA187	
Model	Interface unit PROFINET	
Applicable interface	PROFINET RT (RT Class1)/USB 2.0 Full Speed	
User Interface	POWER (green), NETWORK (green/red), MODULE (green/red), LINK PORT1 (green), LINK PORT2 (green), EJ-CONNECT (green)	
Functions	Common protocols for USB and PROFINET, Readout of current value, Current value hold (software hold), Parameter setting on EJ counter, Tolerance judgment value settings, Preset value settings, preset/zero-set clear, peak clear, error clear	
Power supply	Power is supplied from EJ-102N (542-080/542-081) (Cannot be charged via USB)	
Operating temperature (humidity)	0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)	

Order No.	21HZA188	
Model	Interface unit EtherNet/IP	
Applicable interface	EtherNet/IP	
User Interface	POWER (green), NETWORK (green/red), MODULE (green/red), LINK PORT1 (green/amber), LINK PORT2 (green/amber), EJ-CONNECT (green)	
Functions	Common protocols for USB and EtherNet/IP Readout of current value, Current value hold (software hold), Parameter setting on EJ counter, Tolerance judgment value settings, Preset valuesettings, preset/zero-set clear, peak clear, error clear	
Power supply	Power is supplied from EJ-102N (542-080/542-081) (Cannot be charged via USB)	
Operating temperature (humidity)	0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)	

Order No.	21HZA264	
Model	Interface unit EtherCAT	
Applicable interface	EtherCAT	
User Interface	POWER (green), RUN (green), ERROR (red), L/A IN (green), L/A OUT (red), EJ-CONNECT (green)	
Functions	Common protocols for USB and EtherCAT Readout of current value, Current value hold (software hold), Parameter setting on EJ counter, Tolerance judgment value settings, Preset valuesettings, preset/zero-set clear, peak clear, error clear	
Power supply	Power is supplied from EJ-102N (542-080/542-081) (Cannot be charged via USB)	
Operating temperature (humidity)	0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)	

Order No.	21HZA149	
Model	Interface unit USB	
Applicable interface	USB 2.0 Full Speed	
User Interface	POWER (green)	
Functions	Readout of current value, Current value hold (software hold), Parameter setting on EJ counter, Tolerance judgment value settings, Preset value settings, preset/zero-set clear, peak clear, error clear	
Power supply	Power is supplied from EJ-102N (542-080/542-081) (Cannot be charged via USB)	
Operating temperature (humidity)	0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity)	-10 to 60 °C (RH 20 to 80%, non-condensing)	

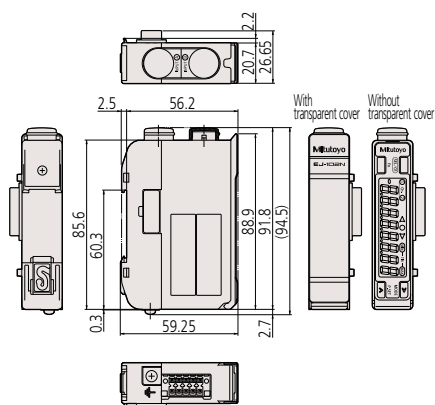
Connectable linear gage Series	Conversion cable (optional)
LG100/LG200	Not necessary
LGF-Z	Necessary (21HZA194)
LGF/LGK/LGB/LG	Necessary (21HZA193)

Counter Specifications

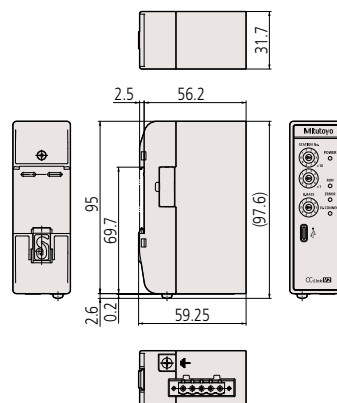
Dimensions

Unit: mm

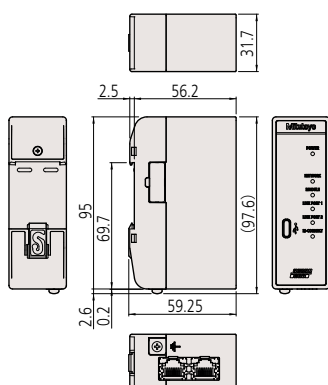
EJ-102N



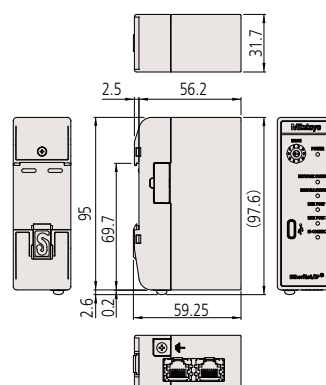
Interface unit CC-Link



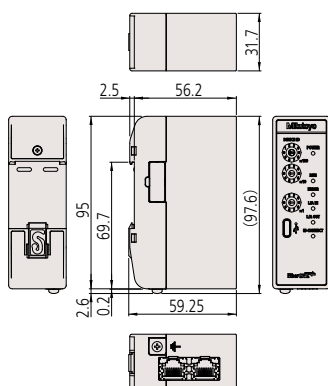
Interface unit PROFINET



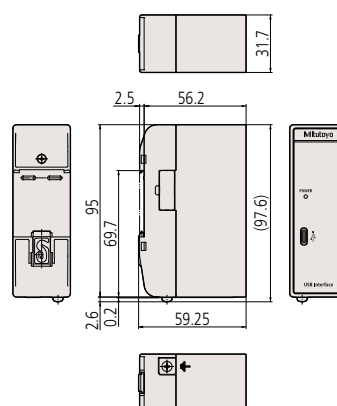
Interface unit EtherNet/IP



Interface unit EtherCAT



Interface unit USB



Note 1: Can be mounted on DIN rail. Case material: PC, POM

SOFTWARE LG QuickSetupTool

A configuration tool is available for use with the **EJ** counter when connected via the optional USB interface.
All kinds of settings normally carried out with counter operating keys can now be easily applied from a computer.
Measurement value display and operation results can also be viewed on a PC.

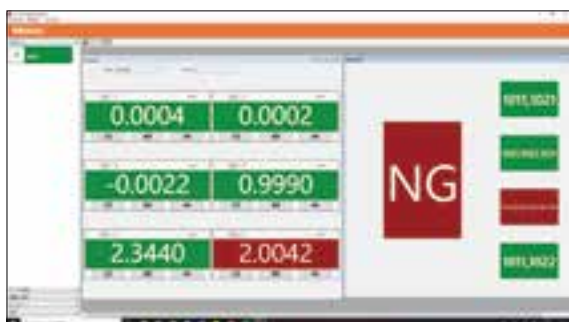
Note 2: This software can be used free of charge and downloaded from the Mitutoyo website.
<https://www.mitutoyo.co.jp/eng/contact/products/lg/>



Parameter setting



Chart



General settings

Recommended system environment

OS: Windows10 Pro 32 bit/64 bit
Display: 1600×1200 or more
Memory: 1024 MB or more
Communication method: USB2.0 (Full speed)
USB connector: Type C connector
Note 3: USB device drivers are standard Windows drivers.

Optional accessories

- AC adapter: **357651**
- AC cable*: **02ZAA000** (Japan)
02ZAA010 (USA)
02ZAA020 (EU)
02ZAA030 (UK)
02ZAA040 (China)
02ZAA050 (Korea)
- DC jack with pin terminal for EJ counter: **21HZA209***

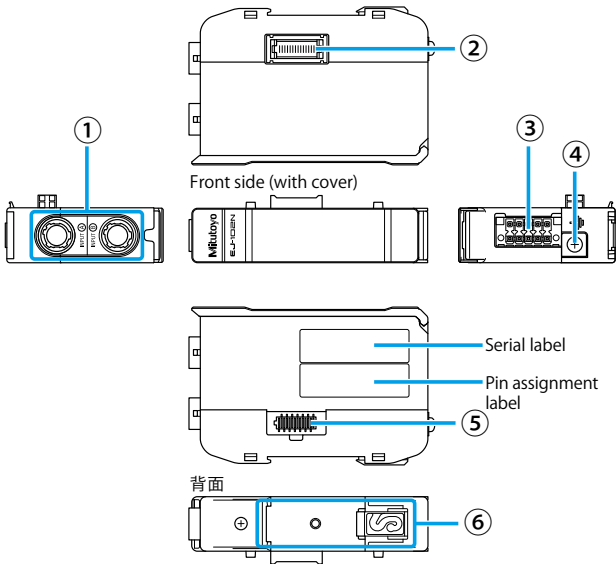
* Necessary when using the AC adapter

Counter Specifications



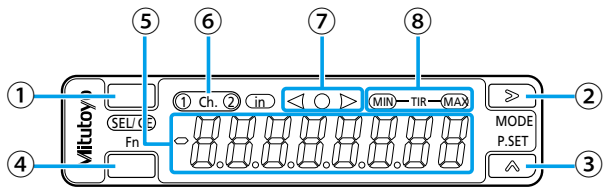
Part Names EJ-102N Compact Display Unit

■ Main Unit



No.	Name	Description
①	Linear Gage input connector (INPUT A/B)	Linear Gages can be connected to each of inputs A and B. The Linear Gage connected to INPUT A is referred to as the A-axis, and that connected to INPUT B as the B-axis.
②⑤	Connector for linking counter	Allows connection to another EJ Counter or optional interface unit.
③	I/O connector	For connection to the power supply or external equipment using the provided connector plug.
④	Grounding terminal	For connection to ground using the provided ground lead and ground plate.
⑥	DIN rail attachment point	Used for attaching the counter to a DIN rail.

■ Display (Under Cover)



Operation key

No.	Name	Description
①	[SEL/CE] key	Switches the channel. Moves between items when making various settings. Cancels errors when pressed together with the [Fn] key.
②	[MODE] (>) key	Switches the peak mode. Moves between digits when making various settings. When pressed together with the [Fn] key, enters the parameter setting screen.
③	[P.SET] (^) key	Preset. Clears preset or peak values when pressed together with the [Fn] key. When setting preset / tolerance or parameter values, increases the value of the selected digit.
④	[Fn] key	Starts and ends setting of preset/tolerance values.

Numeric and indicator display screen

No.	Name	Description
⑤	Numeric display	Displays numeric values.
⑥	Displays the channel (Ch.).	The selected channel (Ch.) lights. Content of individual channel (Ch.) display varies according to the setting of Parameter Number 03.
⑦	Tolerance indicator	Indicates the result of tolerance judgment. ◀ ○ ▶ is displayed when an error occurs.
⑧	Peak indicators	Displays the selected peak mode. When off : The current value is displayed. When only MAX is lit: The maximum value is displayed. When only MIN is lit: The minimum value is displayed. When both MAX and MIN are lit: The run-out width (maximum value - minimum value) is displayed.



Power Supply Connection

■ Power Supply Connection

Make power supply connection by one of the following means.

- Direct input from a DC power supply
- Use the optional AC adapter

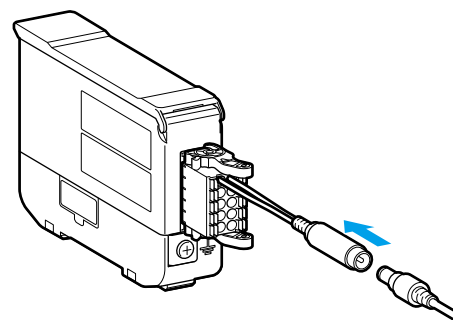
Tips

When using input from a DC power supply:

- Prepare a power supply capable of supplying 10 V DC–27 V DC (30 W).
- Never use this power source with other electric equipment that runs at a high voltage and/or large current.
- Use a power cable with a length of less than 30 m, and make a one-to-one connection between the EJ Counter and an insulated power supply.
- The EJ Counter uses an internal ground which connects to ground internally.
- When using this product connected to a Linear Gage with resolution of 0.0001 mm (0.1 μ m), please use with a DC power noise filter.

When using an AC adapter:

- Prepare the following three optional accessories.
DC jack with pin terminals, AC adapter and AC cable.



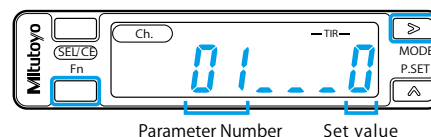
Counter Specifications

Basic Parameters

Setting Procedure

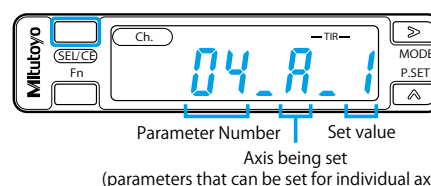
1 Press and hold the [Fn] key, and then press the [MODE] (>) key.

» Display enters the parameter setting screen.



2 Display the Parameter Number of the parameter to be set.

The Parameter Number changes each time you press the [SEL/CE] key.



Tips

- With some parameters, values are set separately for the A-axis and B-axis. For parameters that are set separately for the A-axis and B-axis, the setting screen for the A-axis is displayed first, and then the setting screen for the B-axis appears upon pressing the [SEL/CE] key.
- You can cycle through the Parameter Numbers in reverse order by pressing the [SEL/CE] key together with the [Fn] key.

3 Change the set value.

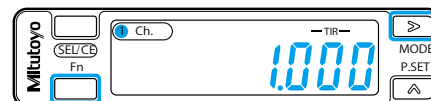
The set value of the displayed Parameter Number changes each time you press the [P.SET] (^) key.

Tips

- For settings that have two digits, you can move between digits by pressing the [MODE] (>) key.
- The set value can be decreased by pressing the [P.SET] (^) key together with the [Fn] key.

4 Press and hold the [Fn] key, and then press the [MODE] (>) key.

- » The setting is applied.
- » Display enters the counter display screen.



Basic Parameters

Basic measurement parameters

Be sure to make these settings before starting measurement.

Tips

Incorrect parameter settings will prevent correct measurement results or cause display of an error.

No.	Set value	Peraxis setting	Set value: Operation	Default value	Description
04	Linear Gage resolution (minimum reading)	✓	0: 0.005 mm (5 μm), 0.0002 in 1: 0.001 mm (1 μm), 0.00005 in 2: 0.0005 mm (0.5 μm), 0.00002 in 3: 0.0001 mm (0.1 μm), 0.000005 in	1	Set the minimum reading according to the resolution of the connected Linear Gage. Tips <ul style="list-style-type: none"> • Correct values will not be displayed if the settings do not match the resolution of the connected Linear Gage. • The unit for minimum reading is "in" when Parameter Number 22 is set to "1".
05	Origin detection function	N/A	0: Disabled 1: Enabled	0	Selects whether the origin function is enabled or disabled when a Linear Gage with an origin point mark is connected.
06	Counter direction	✓	0: + direction 1: - direction	0	Sets the relationship between the direction in which the numeric value changes and the direction of movement of the Linear Gage spindle.
07	Origin detection direction	✓	0: + direction 1: - direction	0	When a Linear Gage with an origin mark is connected, selects the direction of the spindle of the Linear Gage for origin detection.
22	Unit selection (EJ-102NE only)	N/A	0: mm (mm/s) 1: in (in/s)	0	The unit for displayed values can be set to "mm" or "in". Tips <ul style="list-style-type: none"> • Changing this setting clears the preset and tolerance values. • The default value is not restored even if the parameters are re-initialized. • The resolution of the Linear Gage is fixed to "in".

■ Advanced Parameters

No.	Set value	Peraxis setting	Set value: Operation	Default value
01	Key protect	N/A	0: No key protect 1: Key protect	0
02	Origin initialization (Origin clear)	N/A	0: Do not initialize. 1: Initialize.	0
03	Display mode selection	N/A	For details, see "■ Appended table".	0
08	Tolerance judgment setting	N/A	0: 3-step tolerance judgment 1: 5-step tolerance judgment 2: No tolerance judgment	0
09	Display at startup	N/A	0: Counter stand-by 1: Counter displayed	0
10	ERR/ALLGO selection (I/O input/output setting)	N/A	0: Used as ERR 1: Used as ALLGO	0
11	Channel coupling selection (I/O input/output setting)	N/A	0: Do not couple channels 1: Couple channels	0
12	Origin re-detection (I/O input/output setting)	N/A	0: Disabled 1: Only eff active for the axis that is dependent on the channel selected by 1/2 SEL. 2: Axis dependent on Ch. 1 and axis dependent on Ch. 2.	0
13	Preset by I/O input (I/O input/output setting)	N/A	0: Executed only for the channel selected by 1/2 SEL. 1: Executed for both channels.	0
14	Ch affected by the CLEAR signal (I/O input/output setting)	N/A	0: Executed only for the channel selected by 1/2 SEL. 1: Executed for both channels.	0
15	Peak value preset	N/A	0: Disabled 1: Enabled	0
16	Smoothing	N/A	0: No smoothing (update at 5 ms intervals). 1: The average of 16 measurements is displayed (update at 80 ms intervals). 2: The average of 32 measurements is displayed (update at 160 ms intervals).	0
17	Speed sampling cycle	N/A	0: 10 ms 1: 50 ms 2: 100 ms	0
18	Hide the lowest-order digit.	N/A	0: Display all digits. 1: Hide the lowest-order digit.	0
19	Arbitrary ID specification	N/A	00 to 49: ID numbers assigned automatically. 50 to 99: Arbitrary ID numbers assigned (ID numbers specified).	01
20	Power saving function	N/A	00: Display always lit 01 to 99: Display goes out after the specified interval passes (specification unit: minutes).	00
21	Parameter initialization	N/A	0: Do not initialize. 1: Initialize.	0

■ Appended table

Set value	Ch.1	Ch.2
0	A-axis counter	B-axis counter
1	Sum (A+B)	B-axis counter
2	Difference (A-B)	B-axis counter
3	A-axis counter	Sum (A+B)
4	A-axis counter	Difference (A-B)
5	A-axis speed	B-axis speed
6	A-axis counter	A-axis speed
7	B-axis counter	B-axis speed

Data Input/Output

This product supports input and output of data through the I/O connector, and through the optional interface unit. For further details about the product and its use, please refer to downloadable EJ Counter User's Manual No. 99MBC139 on the Mitutoyo website.

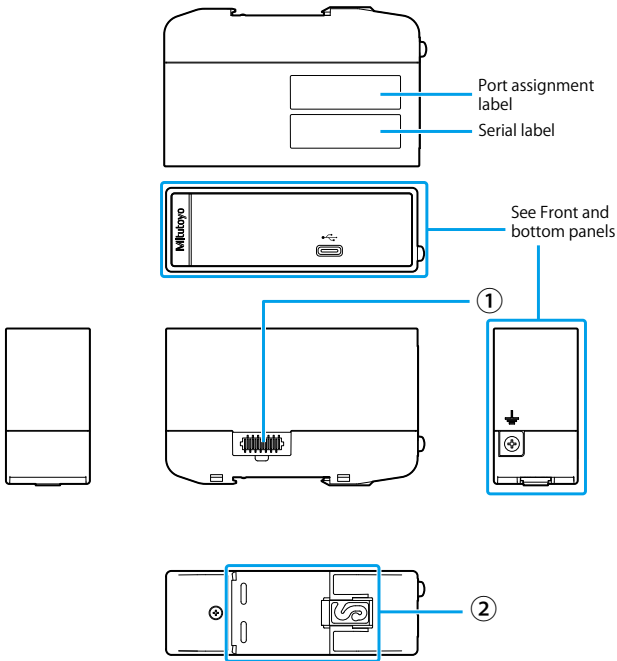
Counter Specifications



Part Names

EJ-102N Counter, Interface Unit: CC-Link, PROFINET, EtherNet/IP, EtherCAT, USB

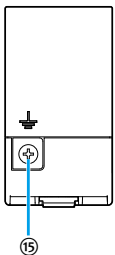
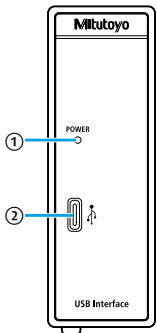
Main Unit (Common to All Models)



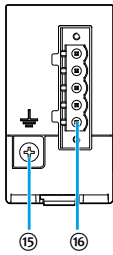
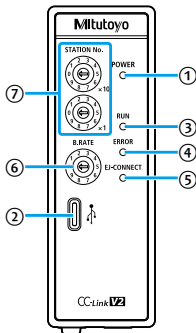
No.	Name	Description
①	Connector for linking counter	Connect to an EJ Counter.
②	DIN rail attachment point	Used for attaching this product to a DIN rail.

Front and bottom panels

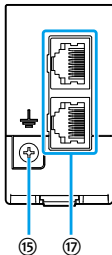
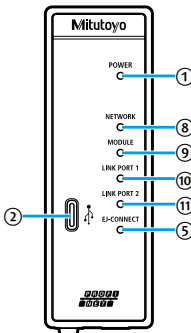
Interface Unit
USB



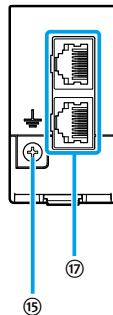
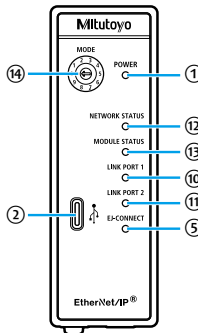
Interface Unit
CC-Link



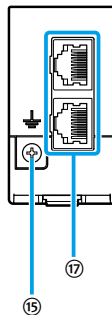
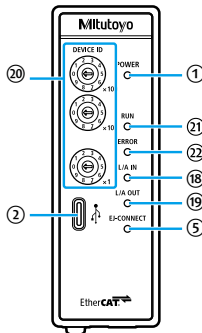
Interface Unit
PROFINET




Interface Unit
EtherNet/IP



Interface Unit
EtherCAT



No.	Name	Description
①	[POWER] indicator	Lights when power is supplied to the unit.
②	[RUN] indicator	Lights when the unit is connected to a CC-Link network.
③	[ERROR] indicator	Lights or flashes to indicate a CC-Link communication error. Lit Indicates an error in setting of the CC-Link communication ([STATION No.] switch) at the time of power-on. Flashing Indicates the version or baud rate setting ([B.RATE] switch) was changed while the power was on.
④	[EJ-CONNECT] indicator	Lights during communication between the unit and an EJ Counter. Lights off or flashes to indicate an error during communication with an EJ Counter.
⑤	USB connector (Type-C)	Allows USB connection to a PC.
⑥	[B.RATE] switch	Sets the CC-Link version and baud rate.
⑦	[STATION No.] switches	Sets the CC-Link station number. The [x10] switch sets the ten's place and the [x1] switch sets the one's place.
⑧	[NETWORK] indicator	When lit green Lights green to indicate that connection has been established to a PLC or other master device and that the unit is in the RUN state. When flashing green Flashes green to indicate that connection has been established to a PLC or other master device, but that the master device is in the STOP state. When flashing red Flashes red to indicate that the station name has not been set or that there is a problem with the IP address setting. When Off Off when connection has not been established to a PLC or other master device.
⑨	[MODULE] indicator	When lit green Lights green when power is supplied to the unit and the status is normal. When flashing green Flashes green to indicate that the interface unit has generated an alert.
⑩	[LINK PORT 1] indicator	Lights or flashes during communication through LINK PORT 1 of the Ethernet-type interface communication connector.
⑪	[LINK PORT 2] indicator	Lights or flashes during communication through LINK PORT 2 of the Ethernet-type interface communication connector.
⑫	[NETWORK STATUS] indicator	When lit green Lights green when connection to the scanner has been normally established. When flashing green Flashes green when an IP address has been allocated, but connection to the scanner has not been established. When lit red Lights red when IP address duplication is detected. When flashing red Flashes red when a scanner connection timeout occurs. When flashing alternately green and red Flashes green and red alternately during performance to the product's power-on self-diagnostic test.
⑬	[MODULE STATUS] indicator	When lit green Lights green when connection to the scanner has been established and a program has been executed on the scanner. When flashing green Flashes green when connection to the scanner has not been established, or connection to the scanner has been established but a program has not been executed on the scanner yet. When lit red or flashing red Lights red or flashes red when an error occurs on the product. If the red light remains on and the operation is not restored after verifying EJ Counter and power supply connection, the product may be defective. When flashing alternately green and red Flashes green and red alternately during performance to the product's power-on self-diagnostic test.
⑭	[MODE] switch	Sets the IP address mode. 0: Fixed IP mode Non-0: USB setting mode
⑮	Grounding terminal	Connect to ground using the provided ground wire. Tips <ul style="list-style-type: none"> The provided ground wire is to be used only for connecting the ground terminal on the interface unit to the ground terminal on the EJ Counter. Overall grounding of coupled units is to be made using the ground wire provided with the EJ Counter. For details, see  the separate "Compact Display Unit for Linear Gage EJ Counter User's Manual".
⑯	CC-Link communication connector	Connect to a CC-Link network using the provided connector plug and commercially-available CC-Link compliant cable.
⑰	EtherNet/IP communication connector (RJ45 connector)	Connect to an EtherNet/IP network using a commercially-available LAN cable (compatible with the EtherNet/IP communication standard). The port on the DIN rail side (at the bottom of the illustration) is PORT 1, and the one on the front side (at the top of the illustration) is PORT 2. Tips Use STP communication cables of type Cat.5e or higher, or EtherNet/IP-compatible cables that conform with TCP/IP requirements.
⑱	[L/A IN] indicator	Lights or flashes during communication through EtherCAT IN of the EtherCAT communication connector.
⑲	[L/A OUT] indicator	Lights or flashes during communication through EtherCAT OUT of the EtherCAT communication connector.
⑳	[DEVICE ID] switch	Sets the Device ID of this product (0 to 999). When the Device ID is set to 0, the product is not used. Sets the hundreds place with [x100] switch, the tens place with the [x10] switch, and the ones place with the [x1] switch
㉑	[RUN] indicator	Indicates the EtherCAT communication status of the product. Off Power is off or the product is in the initialized state. Lit The product is in the operational state. Flashing The product is in the pre-operational state. Single flash The product is in the safe-operational state.
㉒	[ERROR] indicator	Flashes in the event of an EtherCAT communication error. Off No abnormality. Flashing Receipt of incorrect communication settings from the master device. Single flash Communication data abnormality. Double flash Communication timeout detected. Flickering Initialization error.

Tips

For details on the settings on various interface units, download the full manual for individual models from Mitutoyo's web site.

Counter Specifications



Specifications

■ Functions (Common to All Models)

Output data	Current value *Depends on parameter settings
EJ Counter operation/ settings	Current value hold (software hold) Preset/zero set clear Peak hold clear Error clear Parameter setting/verification Tolerance judgment setting/verification Presets and zero set setting/verification

■ Interfaces

USB

Models providing	All models
USB	USB 2.0 Full Speed
Maximum baud rate	12 Mbps
Port used	Virtual COM port
Connector type	Type-C

CC-Link

Models providing	Part No. 21HZA186 Interface Unit CC-Link
CC-Link Ver.	Ver. 1.10 or Ver. 2.00.
Station type	Remote device station
Number of occupied stations	Ver. 1.10: 2 stations Ver. 2.00: 4 stations (extended cyclic, 4x)
Connector plug	Connector plug type: 1908732 (PHOENIX CONTACT)
Communication cable	CC-Link compliant cable

PROFINET

Models providing	Part No. 21HZA187 Interface Unit PROFINET
PROFINET	PROFINET RT (RT Class1)
Conformance class	Class B
Communication port	RJ45×2 ports (IP20)
Communication cable	STP communication cables of type Cat.5e or higher, or PROFINET-compatible TCP/IP cables * Compatible with both cross cables and straight cables
Maximum baud rate	100 Mbps, full duplex

EtherNet/IP

Model	Part No. 21HZA188 Interface Unit EtherNet/IP
Communication port	RJ45×2 ports (IP20)
Communication cable	STP communication cables of type Cat.5e or higher, or EtherNet/IP-compatible cables that conform with TCP/IP requirements * Compatible with both cross cables and straight cables
Baud rate	Automatic switching by auto-negotiation 10 Mbps / 100 Mbps Full duplex/half duplex
RPI	1 ms-3200 ms (During cyclic communication)
DLR *1	Valid (Ethernet ring topology)
ACD *2	Valid (IP address duplication detection)

*1 Device Level Ring

*2 Address Conflict Detection

Ether CAT

Model	Part No. 21HZA264 Interface Unit EtherCAT
Communication port	RJ45×2 ports (IP20)
Communication cable	STP communication cables of type Cat.5e or higher, or EtherCAT-compatible cables
Baud rate	100 Mbps, full duplex
Device ID	1-999 * If set to 0, Device ID is not used.
Sync mode	Free Run mode

Note: EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Tips

For detailed specification, download the full manual for the different models from Mitutoyo's web site.

Counter Specifications

EC Counter – Only for Digimatic output

For Digimatic output gage head

- Employs the DIN size (96×48 mm) and mount-on-panel configuration, which greatly facilitates incorporation into a system.
- Can either produce tolerance judgment output or Digimatic output.

EC-101D (542-007*)
GO/NG judgment output or Digimatic output (selectable) type



Functions

- Preset
- Tolerance judgment (3 steps)

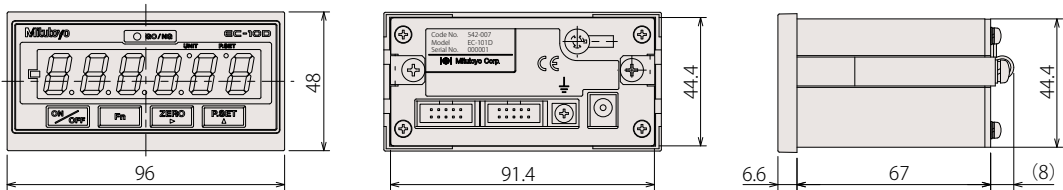
Specifications

Order No.		542-007*
Model		EC-101D
Resolution		0.01 mm (± 9999.99)/0.0005 in (± 99.9995 in)/0.001 in (± 999.999 in) 0.001 mm (± 9999.999)/0.00005 in (± 9.99995 in)/ 0.0001 in (± 99.999 in) [Automatic setting by gage]
Display		Sign plus 6 digits (Green LED)
Tolerance judgment display		LED display (3 steps: Amber, Green, Red)
External output (switching type)	Tolerance judgment output	–NG, OK, +NG (open-collector)
	Data output	Digimatic output
Control input		External PRESET, external HOLD
Power supply	Voltage	Supplied AC adapter, or 9 to 12 V DC
	Consumption	4.8 W (max. 400 mA) Ensure at least 1 A is available per unit.
Operating/storage temperature		Operation: 0 to 40 °C/Storage: –10 to 50 °C
External dimensions		96 (W) ×48 (H) ×84.6 (D) mm
AC adapter		AC adapter: 12BAR954 AC cable: 12BAK729 (Japan), 12BAK730 (U.S.), 12BAK731 (EU), 12BAK734 (UK), 12BAK732 (China), 12BAK733 (Korea)
Applicable head		LGS, ID
Mass		500 g
Optional accessories		Connecting cable for Digimatic Mini-processor 936937 (1 m), 965014 (2 m) DC plug PJ-2 214938 I/O cable (2 m): 21HZA222

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

Dimensions

Unit: mm

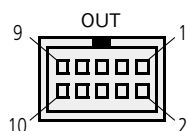


Input/output specifications

1) Compatible plug

MIL type connector FAS-10-17 (YAMAICHI), XG4M-1030-T (OMRON)

2) Pin assignment



Pin No.	I/O	Description	Function	Optional I/O cable color
1		COM	Connected to the internal GND	Amber/black
2	O	+NG	Tolerance output: The relevant output terminal falls to L.	Amber/red
3	O	GO	At an error display [+NG=-NG=L]	Yellow/black
4	O	-NG		Yellow/red
5	I	HOLD	HOLD input	Bright green/black
6	I	P.SET	PRESET input (to cancel the error)	Bright green/red
			Other than the above listed shall be unconnected.	

Note 1: Output from each pin in the Digimatic output mode may differ from those which are described in the table above. After setting the output mode, connect the cable.

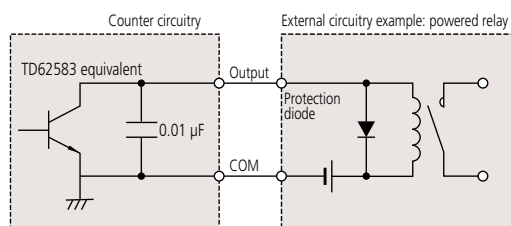
Note 2: One end of the I/O cable consists of separate wires for connection as appropriate.

The cable's F.G wire (with solderless terminal, green) should be connected to the grounding terminal of the main unit.

3) I/O circuit

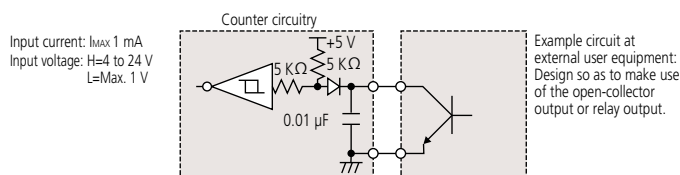
1. Output circuit (-NG, GO, +NG)

Transistor is "ON" when the open-collector output is "L".



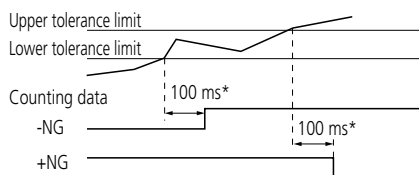
2. Input circuit (PSET, HOLD)

Input is valid when the line is "L".



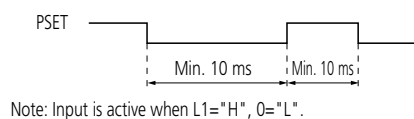
4) Timing chart

1. Tolerance judgment output



* Varies depending on the gage. (Values are for LGD)

2. External preset/HOLD



Note: Input is active when L1="H", 0="L".

5) Optional

I/O cable (2 m)
21HZA222



Digimatic Mini-processor
DP-1VA LOGGER
264-505

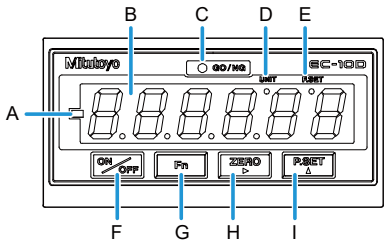


Counter Specifications



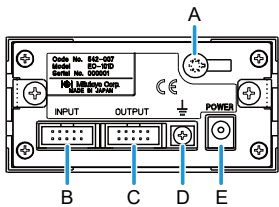
Part Names and Functions

Front side of the main body



Symbol	Name	Description
A	Sign indicator	Indicates the sign of a counter value or a setting value. Lights when the displayed value fills all available digits and the value is also negative.
B	Display	Displays the counter value from the connected Linear Gage.
C	Tolerance judgment indicator	Indicates the tolerance judgment result from the Linear Gage by color.
D	UNIT indicator	<ul style="list-style-type: none">Blinks while a HOLD signal is being input when the I/O connector is connected.Lights when an E unit has been selected for the corresponding parameter.
E	P. SET indicator	Lights when you set a Preset value.
F	[ON/OFF] key	Turns on or off the display.
G	[Fn] key	Switches to setup mode where you can set tolerance values or the Preset value. Tips When setting parameters, this advances the parameter number.
H	[ZERO] key	Sets the current value shown on the Display to 0. Tips <ul style="list-style-type: none">When setting a parameter, this advances the set value.When setting the tolerance, Preset, or optional constant value, this increases the value of the selected digit.
I	[P.SET] key	<ul style="list-style-type: none">Displays the Preset value.Cancels an error. Tips <ul style="list-style-type: none">When setting a parameter, this advances the set value.When setting the tolerance, Preset, or optional constant value, this increases the value of the selected digit.

Rear side of the main body



Symbol	Name	Description
A	Cable clamp	For securing the power cable.
B	Linear Gage input connector	For connecting a Linear Gage.
C	OUTPUT connector (I/O connector)	For connecting an I/O connecting cable.
D	Grounding terminal	For connecting a grounding wire.
E	DC jack	For connecting the AC adapter.

Supported Linear Gages

The following table shows the Linear Gages supported by this product and their features:

Model No.	Supported Linear Gages	Feature
EC-101D	LGD, LGS, etc. (ID and SD are also supported)	<ul style="list-style-type: none">Digimatic output typeABS function (no need for master setting)

Tips

- Counter values will not be displayed correctly on the Counter in the following cases.
- If the gage that is connected displays a counter value that is more than 6 digits (whole-number digits + fractional digits).
 - If the resolution (minimum reading) is 0.1 mm or more and less than 1 mm.



Parameter Setting

The settings of the Linear Gage that you will use, the display of the Counter, and external output are specified by setting parameters. Set parameters before you begin measuring.

■ Procedure for Setting Parameters

Parameters are set in Parameter mode. As an example, this section explains the operational procedure for setting the Counter direction (the direction in which the spindle of a Linear Gage is pressed in) to the minus (-) direction.

1 Connect the power.

» The Counter enters the stand-by state.



2 Press and hold [Fn], and then press [P.SET].

» The Counter enters Parameter mode. (The set value of parameter number 00 will blink.)



3 Press [P.SET] once to set the value to 1 (parameter setting).

» Parameters can now be modified. (The set value remains blinking.)



Tips

If the setting value is 0, you can view the parameter values, but you cannot change them.

4 Repeatedly press [Fn] to advance the parameter number to 11.

» The current value of parameter number 11 will blink. (Parameter number 11 sets the Counter direction.)



5 Repeatedly press [P.SET] to set the value to 1 (" - " direction).

» The value will be set to 1. (The Counter direction will be set to the " - " direction.)



6 Press and hold [Fn], and then press [P.SET].

» The Counter will return to the stand-by state.



Counter Specifications

Basic Parameters

This section explains the basic parameters related to measuring. Be sure to set these settings before measuring.

Tips

Correct measurement results may not be obtained if the settings are incorrect.

[Parameter number] /Setting item	Description	Default value
[00] Parameter mode	Used to view or modify parameters. 0: View parameters 1: Set parameters 2: Set an optional constant value ^{*1}	0
[11] Counter direction	Sets whether the numeral will increase or decrease when the spindle of the Linear Gage is pushed in. 0: + direction 1: - direction	0
[12] Counting method	Sets the counting method according to the type of the Linear Gage to be connected. ^{*2} 0: INC 1: ABS 2: Multi-Unit	1
[15] Unit system selection ^{*3}	The unit for displayed values can be set to "mm" or "E units". E=1/25.4 mm. After the unit is set, the default value will not be restored even if the parameters are re-initialized. 0: mm 1: E 5/100,000 reading ^{*4} 2: E 1/10,000 reading ^{*4} 3: mm (when connecting an E gage, 1/10,000 reading)	0

^{*1} The optional constant value setting is available only when the value of parameter number 16 is set to 3.

^{*2} Select "0: INC" when an INC (incremental) type Linear Gage is connected. Either "0: INC" or "1: ABS" can be selected when an ABS (absolute) type Linear Gage is connected.

When "0: INC" is selected:

Count and display the current position of the Linear Gage when starting up the Counter. Perform Zero setting, etc., when resetting the display value.

When "1: ABS" is selected:

The Counter memorizes the Linear Gage origin (0 point) when starting up the Counter and displays the counting value from the origin. The origin that was memorized will be remained even if the Counter is re-started.

When you connect the Multi-Unit, set the value to 2. Do not set the SELECT switch of the Multi-Unit to "EX".

^{*3} The Preset value and tolerance value that had been set will be cleared if the setting is changed.

^{*4} When an E type gage is connected, the minimum reading of the Counter will be the resolution of the gage.

Advanced Parameters

This section explains the parameters related to the display, functions, and external output of the Counter. Configure the settings appropriate to your application.

[Parameter number] /Setting item	Description	Default value
[10] Parameter initialization ^{*1}	If you set the value of this parameter to 1, the set values for all parameters, except for the unit setting, can be reset to their default values (initialized). Once this setting has been enabled, this parameter is reset so its set value is 0 (do not initialize). 0: Do not initialize 1: Initialize	0
[14] Display at startup	Selects stand-by state or Counter display to display at startup. 0: [-----] display 1: 0.000	0
[16] Calculation with a constant	Sets whether to multiply the counter value by a predetermined factor, by an arbitrary factor, or to not multiply it. The value obtained by multiplying the counter value by the set constant value will be displayed as the measurement result. 0: Do not calculate 1: 2 times 2: 10 times 3: Arbitrary value	0
[17] Hide the lowest-order digit	Hides the lowest-order digit. However, the lowest-order digit will be included in printouts. 0: Display all digits 1: Hide the lowest-order digit	0
[20] Tolerance judgment/Digimatic output switchover	Switches between tolerance judgment result output and Digimatic output. 0: Tolerance judgment result output 1: Digimatic output	1
[29] Digimatic input WAIT ^{*2}	Sets the wait time for the Digimatic input signal. Change this when the Counter cannot read the input signals from a Digimatic device. 0: No wait 1: 200 ms WAIT 2: 400 ms WAIT	0
[35] Key protect	Key operations can be disabled to prevent operation errors. 0: Key operation enabled 1: Key operation disabled	0

^{*1} The Preset value and tolerance value that had been set will be cleared if the setting is changed.

^{*2} The display speed can be changed. When you connect the Multi-Unit, set the value to 1.

EH Counter - Panel mount, Multi-function Type with RS-232C Communication Functions

- 1-axis display type, and 2-axis independent display type or 2-axis type that can display sum/difference calculation results are available.
- Multi-functional counter with functions of zero-set, preset, and tolerance judgment
- Equipped with an RS-232C interface as standard. This allows data transfer to a personal computer, etc.
- A multi-point measuring system can easily be built up with the built-in networking function (RS link). (Max. 10 points)
- Employs the DIN size (144×72 mm) and mount-on-panel configuration, which greatly facilitates incorporation into a system.

EH-101P (542-075)

For differential square-wave output gage head (single axis)



EH-102P (542-071)

For differential square-wave output gage heads (2 axes)



EH-102Z (542-073)

For differential square-wave output gage heads with Origin Point Mark (2 axes)



EH-102D (542-072)

For Digimatic code output gage heads (2 axes)



Specifications

1-axis input type and 2-axis input type counters are available.

Order No.	542-075* ¹	542-071* ¹	542-073* ¹	542-072* ¹
Model	EH-101P	EH-102P	EH-102Z	EH-102D
Number of axes to be displayed	1 axis	2 axes		
Maximum input frequency	2.5 MHz (2-phase square wave)			—
Resolution	0.01 mm/0.005 mm/0.001 mm/0.0005 mm/0.0001 mm 0.0005 in/0.00005 in/0.00005 in/0.000005 in/0.000005 in (selection by the parameter)			Automatic setting by gage
Tolerance judgment display	LED display (3 steps: Amber, Green, Red/5 steps: Amber, Amber flashing, Green, Red flashing, Red)			
Interface	RS-232C/USB/parameter selection via Digimatic (only DP-1VA LOGGER , Digimatic Mini-processor can be connected) (USB used only with SENSORPAK) Selection by parameter from 3-step, 5-step, or digit BCD Total tolerance judgment output (when tolerance function is enabled) Analog output (1 V to 4 V)			
Input/output	Control output	Open-collector		
	Control input	Display BANK switching, peak mode, presetting, display hold, hold per axis: open-collector		
Power supply	Voltage	Supplied AC adapter (Jack input)		
	Consumption	8.4 W (max. 700 mA) Ensure at least 1 A is available per unit.		
Operating temperature (humidity)	0 to 40 °C (RH 20 to 80%, non-condensing)			
Storage temperature (humidity)	-10 to 50 °C (RH 20 to 80%, non-condensing)			
External dimensions	144 (W) ×72 (H) ×156.7 (D) mm			
Optional accessories	I/O output connector (with cover): 02ADB440			
Standard accessories	AC adapter: 357651 /AC cable: 02ZAA000 , AC cable (Japan): 02ZAA000 * ¹ , AC cable (USA): 02ZAA010 * ¹ , AC cable (EU): 02ZAA020 * ¹ , AC cable (UK): 02ZAA030 * ¹ , AC cable (China): 02ZAA040 * ¹ , AC cable (Korea): 02ZAA050 * ¹			
Applicable gage head	LG100/LG200 A conversion plug 21HZA195 is required* ²		LG100/LG200 (A conversion plug 21HZA196 is required)	LGS, ID
Mass	Approx. 760 g	Approx. 800 g	Approx. 800 g	Approx. 800 g

*¹ To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

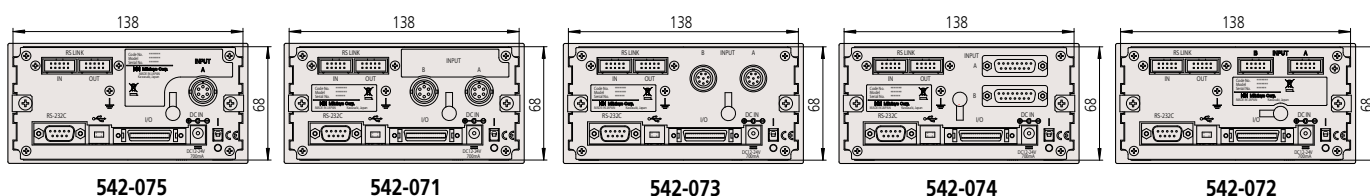
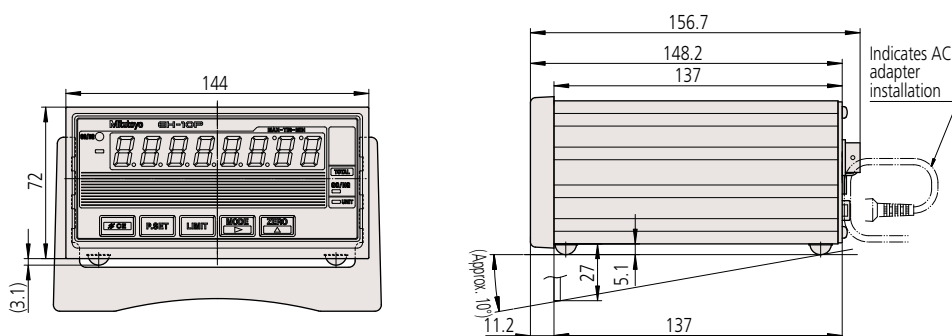
For those models of the Order No. with Suffix "1", an AC adapter is not supplied as a standard accessory.

*² The origin point detection function is disabled.

Counter Specifications

Dimensions

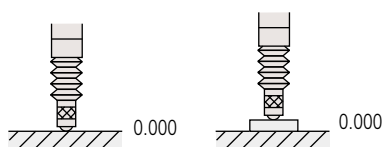
Unit: mm



Functions

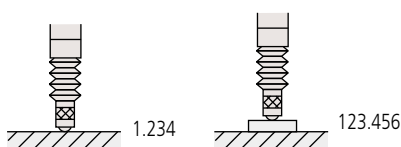
Zero-set

Sets the displayed value to 0 at any position of the spindle.



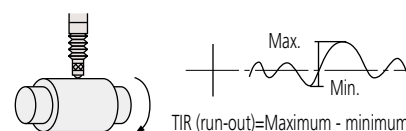
Preset

Presets the display at any value. Counting begins at the preset value.



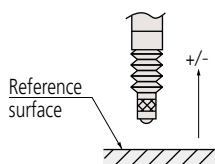
Peak hold/TIR measurement

Allows switching to the measurement mode for maximum value, minimum value, and run out value (maximum - minimum), in addition to the normal measurement mode.



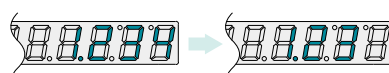
Direction switch

Selects the counting direction of (+) or (-), whichever is convenient with a given direction of spindle movement.



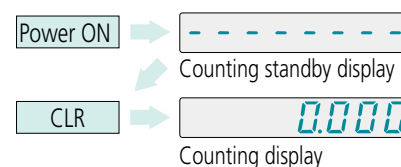
Minimum reading digit change

To improve visualization of measurement data, the least significant digit can be extinguished. (However, the display via RS-232C and printing to a printer are performed down to the least significant digit.)



Counting standby (to prevent malfunction at start-up)

This prevents malfunction due to power interruption, etc.



Tolerance judgment indication/output

Sets two (or four) desired tolerances for three (or five) stages. Judgment results can be output to an external device.

Sum/difference calculation

Enables measurement of thickness or step height using two gages.

External control

Zero set, preset and display hold can be controlled from the I/O terminals.

Error message display

The counter displays an error message when a gage-head over-speed or breakage situation occurs. It outputs the error signal from the I/O terminal.

Communication via RS-232C interface

RS-232C allows communication with a personal computer. It allows not only the reading of measured values but also data transmission to the counter and remote operations, such as when changing various settings.

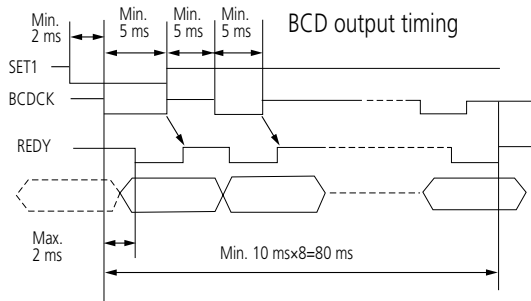
Digimatic output

Digimatic Mini-processor **DP-1VA LOGGER**. (RS-232C function is not available when the gage is connected to **DP-1VA LOGGER**).

BCD Output

Simultaneously outputs at channels [A] and [B] in groups of 4 bits.

1) Timing chart



2) Data format

	LSD (Least significant digit)				MSD (Most significant digit)	
	D1	D2	D3	D4	D8	
A/B_bit0	1×10^0	1×10^0	.....	.....	1×10^7	
A/B_bit1	2×10^0	2×10^0	.....	.....	2×10^7	
A/B_bit2	4×10^0	4×10^0	.....	.....	4×10^7	
A/B_bit3	8×10^0	8×10^0	.....	.....	8×10^7	
A/B_SIGN	SIGN	BANK	PEAK1	PEAK2		

+: H -: L		PEAK1	PEAK2
BANK1: L	NOM	L	L
BANK2: H	MAX	H	L
	MIN	L	H
	TIR	H	H

Data output example

	D1	D2	D3	D4	D5	D6	D7	D8
Bits 0-3	1	0	6	5	4	3	2	1
SIGN	L							

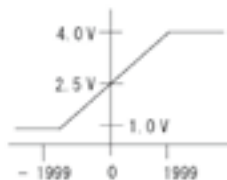
- 1 2 3 4 5 6 0 1

Note: Negative logic output is possible for SIGN, BANK, PEAK, DATA (PNo.21=1).

Simple analog output

Monitoring of output waveforms is possible with an analog recorder connected.

1) Output specification



2) Measuring range

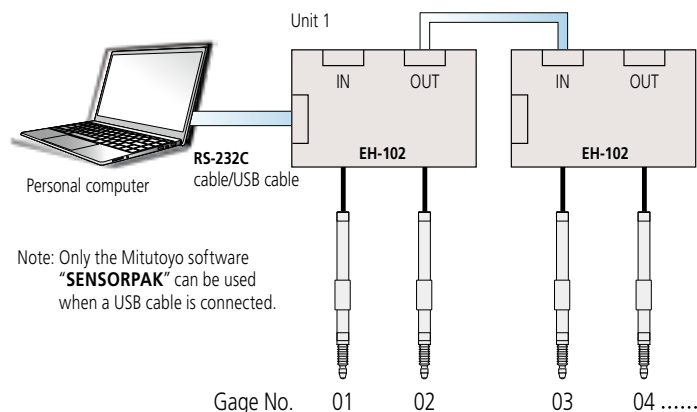
Parameter No.30	Measuring range (mm)/Resolution (mm)		
	10 μm gage	1 μm gage	0.1 μm gage
0	$\pm 19.99 (0.01)$	$\pm 1.999 (0.001)$	$\pm 0.1999 (0.0001)$
1	$\pm 199.90 (0.1)$	$\pm 19.990 (0.01)$	$\pm 1.9990 (0.001)$
2	$\pm 1999.00 (1)$	$\pm 199.900 (0.1)$	$\pm 19.9900 (0.01)$

RS Link* Function

It is possible to connect a maximum of 10 counter units together to carry a maximum of 20 channels of multi-point measurement at a time.

For this connection use a dedicated RS link cable; **02ADD950** (0.5 m), **936937** (1 m) or **965014** (2 m) (The maximum total length of RS link cables permitted for the entire system is 10 m.)

* Patent registered (Japan, U.S.), Patent pending (E.U.)



Note: Only the Mitutoyo software "SENSORPAK" can be used when a USB cable is connected.

Counter Specifications

RS-232C Communication Functions

Makes it possible not only to log measured values but also make various remote settings including the zero-setting of a counter, etc.
To communicate data with a PC, terminal software is needed that should be provided by the customer.

Command format	Corresponding output	Function
GA**CRLF	G#**, +01234.567CRLF	Outputs the [Displayed value] through RS-232C
CN**CRLF	CH**CRLF	Switches the display to the [Current value]
CX**CRLF	CH**CRLF	Switches the display to the [Maximum value]
CM**CRLF	CH**CRLF	Switches the display to the [Minimum value]
CW**CRLF	CH**CRLF	Switches the display to the [TIR (runout)]
CR**CRLF	CH**CRLF	Zeraset
CL**CRLF	CH**CRLF	Clears the peak value
CP**, +01234567CRLF	CH**CRLF	Inputs the preset value
CD**, +01234567CRLF	CH**CRLF	Inputs tolerance value S1
CE**, +01234567CRLF	CH**CRLF	Inputs tolerance value S2
CF**, +01234567CRLF	CH**CRLF	Inputs tolerance value S3
CG**, +01234567CRLF	CH**CRLF	Inputs tolerance value S4
CS**CRLF	CH**CRLF	Cancels the error
CK**CRLF	CH**, \$CRLF (\$=0 or 1)	Checks the HOLD status

** : denotes a gage channel number between 01 and 99 ("00" means all channels).

: denotes the type of data [N: Current value, X: Maximum value, M: Minimum value, W: TIR (runout)].

CRLF: CR (carriage return), LF (line feed).

Note 1: For presetting and tolerance limit setting, enter each value consisting of a sign and 8 digits of numeric value without a decimal point.

Note 2: Perform the tolerance limit setting in the order of CD and CG for the case of 3-step tolerance judgment, and in the order of CD, CE, CF, and CG for the case of 5-step tolerance judgment.

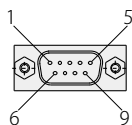
Note 3: The RS communication function will be suspended during key operation (e.g. setting parameters, preset values, or tolerance limits). It automatically resumes the command and data output operation when the gage is recovered to such a condition that the counting is possible.

Note 4: For canceling the counting-standby state, use CS00CRLF (specification of all channels).

RS-232C specifications

1) Compatible plug: D-sub9 pin (female), inch thread specification

2) Pin assignment



Receptacle
D-sub9 pin (male)
inch thread specification

Pin No.	Description	I/O	Function
2	RXD	IN	Receive data
3	TXD	OUT	Send data
4	DTR	OUT	Data terminal ready
5	GND	—	Ground
6	DSR	IN	Data set ready
7	RTS	OUT	Request to send
8	CTS	IN	Clear to send
1, 9	N.C.	—	Connection impossible

3) Communication specifications (conforming to EIA RS-232C)

Home position	DTE (Data Terminal Equipment) Use a cross-type cable.
Communication method	Half-duplex, teletype protocol
Data transfer rate	4800, 9600, 19200 bps
Bit configuration	Start bit: 1 Data bits: (7, 8) ASCII, upper-case characters Number of parity bits: None, even, odd Number of stop bits: 2
Setting the communication conditions	Set via parameters.

Standard Accessories

Order No.	Part name	No. of pcs.
—	Washer (small-round, plain washer: nominal 4)	6
357651	AC adapter	1
02ZAA000	AC cord	1
—	DC plug	1
214938	Stand	1
—	Rubber foot (SJ-5303: 3M)	4
99MBC018	User's Guide	1

Optional accessories**I/O connector**

Plus for external I/O receptacle

02ADB440 (with cover)

Connecting cable for Digimatic Mini-processor

Outputs measurement data from a counter to Digimatic Mini-processor
DP-1VA LOGGER.

936937 (1 m)

965014 (2 m)

Connecting cable for "RS link"

This cable is to serially connect a counter during use of "RS link".

02ADD950 (0.5 m)

936937 (1 m)

965014 (2 m)

Counter Specifications

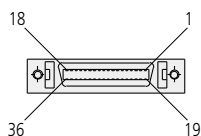
Input/output specifications

I/O connector pin assignment

1) Suitable plug

02ADB440 (with cover) Optional accessory

2) Pin assignment



Socket:
10236-52A2
(3M) equivalent

Suitable plug
10136-3000PE (3M: Plug)
10336-52A0-008 (3M: Cover)
DX40M-36P (HIROSE: Plug)
DX30M-36-CV (HIROSE: Cover)

			Tolerance judgment output mode	BCD output mode	
Pin No.	I/O	Description	Function	Description	Function
1, 2	—	COM	Internally connected to GND	COM	Internally connected to GND
3	O	AL1	[A] Upper row tolerance · Output "L" only for output-relevant terminal · When any error is displayed, AL1, AL5="L" AL2, AL3, AL4="H"	A_bit0	[A] Upper row data
4	O	AL2		A_bit1	
5	O	AL3		A_bit2	
6	O	AL4		A_bit3	
7	O	AL5		A_SIGN	
8	I/O	ALLGO	Total tolerance result output "H"=OK "L"=NG	READY	"L"=data is valid
9	O	RS_EXT			
10	O	NOM	Normal output "L"=Normal output, "H"=abnormal output		
11	O	BL1	[B] Lower row tolerance · Output "L" only for output-relevant terminal · When any error is displayed, BL1, BL5="L" BL2, BL3, BL4="H" [2-axis model]	B_bit1	B_Bit0 [B] Lower row data [2-axis model]
12	O	BL2		B_bit2	
13	O	BL3		B_bit3	
14	O	BL4		B_SIGN	
15	O	BL5			
16 to 21			Not connected		
22	O	A_ANG	A-ch analog output		
23	O	B_ANG	B-ch analog output [2-axis model]		
24	—	AGND	Analog GND		
25	I	SET1	Enter the setting value with SET in advance, and determine it with MODE and DISP		
26	I	SET2			
27	I	SET3			
28	I	DISP			
29	I	MODE	Specifies the BANK to be displayed: Combined operation with SET		
30	I	BCDCK	Switching of peak value: Combined operation with SET		
31	I	EXTTRG	Specifies the BCD output: Combined operation with SET		
32	I	A_HOLD	USB trigger		
33	I	B_HOLD	[A] ch HOLD (Upper row display HOLD)* ¹		
34	I	HOLD	[B] ch HOLD (Lower row display HOLD)* ¹ [2-axis model]		
35	I	PA	HOLD/Error canceling error input* ²		
36	I	PB	[A] Upper row preset/Peak clear (in the peak HOLD mode)		
			[B] Lower row preset/Peak clear (in the peak HOLD mode) [2-axis model]		

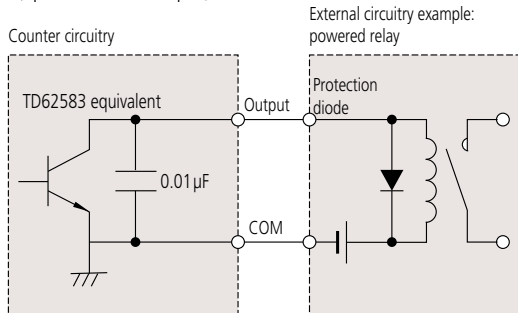
*1 During input the decimal point will be flashing.

*2 During input the UNIT indicator will be flashing.

3) I/O circuit

1. Output circuit:

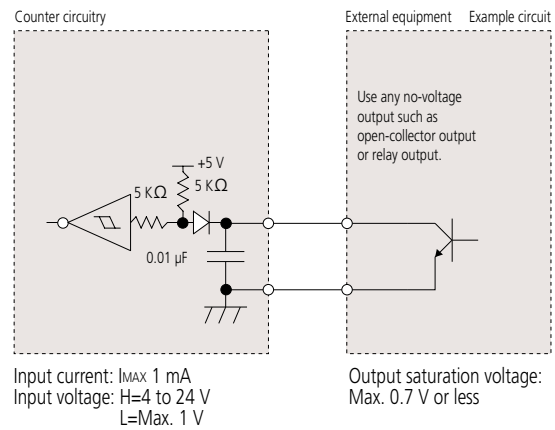
NOM, AL1 to AL5, BL1 to BL5 Transistor is "ON" to drive the line to "L" (open-collector output).



Supply voltage: Max. 24 V
Output current: Max. 10 mA
Output saturation voltage: Max. 0.7 V

2. Input circuit:

PA, PB (only with 542-062), HOLD Input is valid when the line is "L".

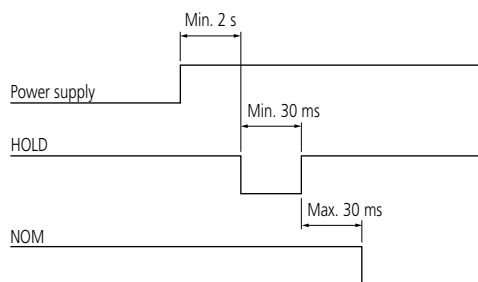


Input current: I_{MAX} 1 mA
Input voltage: H=4 to 24 V
L=Max. 1 V

Output saturation voltage: Max. 0.7 V or less

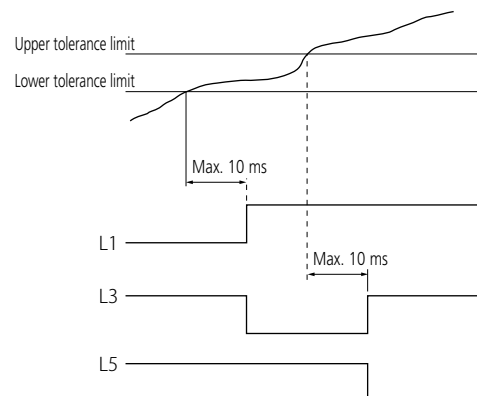
4) Timing chart

1. Power ON characteristics

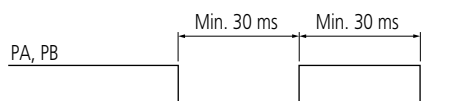


Note: With the RS link established the reference counter will be the one that was powered on last.

2. Tolerance judgment result output period

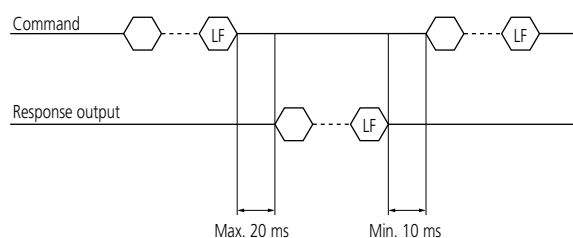


3. External preset (PA, PB) input



Note: Excluding the period during key input, RS-232C communication or Digimatic processing.

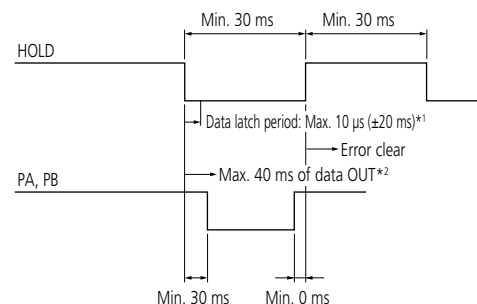
5. RS-232C command input and response output



Note: Excluding the period during key input, RS-232C communication or Digimatic processing.

4. Peak clear input

(After inputting HOLD, or simultaneous input with the preset value)



*1 () represents the case either in peak mode or in such a mode that an input of HOLD triggers RS-232C output.

*2 Case in such a the mode that input of HOLD triggers RS-232C output.

Note: The PRESET indicator will be flashing during the input operation of HOLD.



Supported Linear Gages

The following table shows the Linear Gages supported by this product and their features:

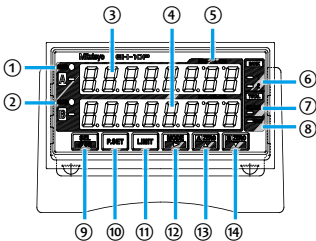
Model No.	Number of axes	Supported Linear Gages	Feature
EH-102P	2 axes	LG100, LG200, LGF-L-B, LGK, LGB, LGB2, LG, LGM, etc.	<ul style="list-style-type: none">Differential square-wave output typeHigh resolution down to 0.1 μmHigh-speed response of 1.5 m/s (LGF)
EH-101P	1 axis		
EH-102Z	2 axes	LG100, LG200 (Origin point detection function is disabled), LGF-ZL-B, etc.	Scale reference-point signal output type (The origin can be restored even if the power switch is turned off)
EH-102D		LGD, LGS-1012P, etc. (ID and SD are also supported)	<ul style="list-style-type: none">Digimatic output typeABS function (no need for master setting)



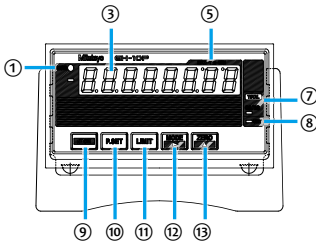
Part Names and Functions

Front Side of the Main Body

EH-102P/EH-102Z/EH-102S/EH-102D
(2-axis model)



EH-101P
(1-axis model)

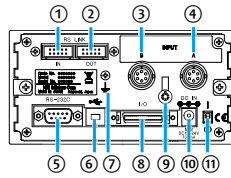


Symbol	Name	Description
①	Tolerance judgment indicator A	Indicates the tolerance judgment result of the Linear Gage (INPUT A) connected to the Linear Gage input connector A by color.
②	Tolerance judgment indicator B	Indicates the tolerance judgment result of the Linear Gage (INPUT B) connected to the Linear Gage input connector B by color.
③	Display A	Displays the counter value from INPUT A.
④	Display B	Displays the counter value from INPUT B.
⑤	Peak mode indicator	Indicates the Peak-mode type.
⑥	BANK indicator	Indicates the currently selected BANK number.
⑦	Total Judgment indicator	Indicates the result of the total tolerance judgment by color.
⑧	UNIT indicator	<ul style="list-style-type: none">Blinks while a HOLD signal is being input when the I/O connector is connected.Lights when an E unit has been selected for the corresponding parameter.
⑨	[SEL]/[CE] key	<ul style="list-style-type: none">Cancels an operation or an error.Selects Display A or B.
⑩	[P.SET] key	Sets a Preset value. Tips When setting parameters, this selects the parameter number.

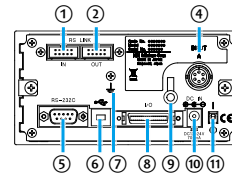
Symbol	Name	Description
⑪	[LIMIT] key	Sets the tolerance value.
⑫	[MODE] key	Sets Peak mode. Tips When setting the tolerance, Preset, or optional constant value, this moves the current input digit from left to right.
⑬	[A_ZERO]/[ZERO] key	Sets the current value in Display A to 0. Tips <ul style="list-style-type: none">When setting a parameter, this advances the set value.When setting the tolerance, Preset, or optional constant value, this increases the value of the selected digit.
⑭	[B_ZERO] key	Sets the current value in Display B to 0. Tips When setting the tolerance, Preset, or optional constant value, this decreases the value of the selected digit.

■ Rear Side of the Main Body

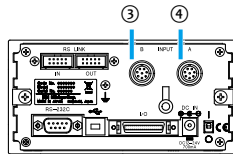
EH-102P (2-axis model)



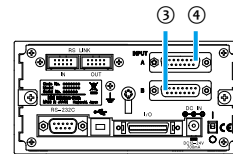
EH-101P (1-axis model)



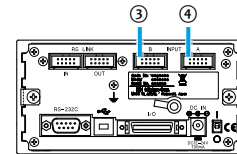
EH-102Z



EH-102S



EH-102D



Tips

The shape and position of the Linear Gage input connectors differ by model.

Symbol	Name	Description
①	RS_LINK connector (IN)	For connecting an RS LINK connection cable. Also used for the SENSORPAK dongle.
②	RS_LINK connector (OUT)	For connecting an RS LINK connection cable. Also used for Digimatic output.
③	Linear Gage input connector B	For connecting a Linear Gage. The Linear Gage connected to this is referred to as INPUT B.
④	Linear Gage input connector A	For connecting a Linear Gage. The Linear Gage connected to this is referred to as INPUT A.
⑤	RS-232C connector	For connecting an RS-232C connecting cable.
⑥	USB connector	For connecting a USB connecting cable.
⑦	Grounding terminal	For connecting a grounding wire.
⑧	I/O connector	For connecting an I/O connecting cable.
⑨	Cable clamp	For securing the power cable.
⑩	DC jack	For connecting the AC adapter.
⑪	Power switch	For turning the power on and off.

Counter Specifications



Setting Parameters

The settings of the Linear Gage that you will use, the display of the Counter, and external output are specified by setting parameters. Set parameters before you begin measuring.

2-axis models have 4 internal counters that are referred to as "CEL", and depending on the Display mode setting, 6 types of counter values can be specified for each CEL separately.

■ Procedure for Setting Parameters

Parameters are set in Parameter mode. As an example, the procedure for using the Linear Gage with a resolution of 5 μm for EH-102P is explained.

1 Turn on the power switch.

» The Counter enters the stand-by state.



2 Press and hold [P.SET], and then press [A_ZERO]/[ZERO].

» The Counter enters Parameter mode.



Parameter number Set value

3 Press [P.SET] repeatedly to advance the parameter number to 12.

» The current value of parameter number 12 of INPUT A will be displayed.

(Parameter number 12 sets the resolution.)



Parameter number INPUT Set value
 number

4 Repeatedly press [A_ZERO]/[ZERO] to set the set value to 1 (resolution: 5 μm).

» The value of INPUT A will be set to 1 (the Linear Gage resolution of INPUT A will be set to 5 μm).



Parameter number INPUT Set value
 number

5 Press [P.SET].

» The current value of parameter number 12 of INPUT B will be displayed.

Tips

For 1-axis models, the parameter number will advance. Proceed to step 8.

6 Repeatedly press [A_ZERO]/[ZERO] to set the set value to 1 (resolution: 5 μm).

» The value of INPUT B will be set to 1 (the Linear Gage resolution of INPUT B will be set to 5 μm).



Parameter number INPUT Set value
 number

7 Press [P.SET].

» The set value will be applied.

8 Press and hold [P.SET], and then press [A_ZERO]/[ZERO].

» The Counter will return to the standby state.



Basic Parameters

This section explains the basic parameters related to measuring. Be sure to set these settings before measuring.

Tips

- Correct measurement results may not be obtained if the settings are incorrect.
- The circles in the Counter model columns in the following table indicate whether a parameter number that is displayed on the Counter is valid or invalid (●: valid, ○: invalid).

No.	Setting item	Description/Allowable values	Counter model			Default value
			P	Z	D	
00	Parameter mode	Used for setting/saving/loading parameters or setting the optional constant value. 0: Parameter setting 2: Constant value setting 4: Load parameters 1: CEL-specific parameter setting 3: Save parameters	●	●	●	0
05	Origin detection function	Selects whether the origin is restored when a Linear Gage with an origin point mark is connected. 0: Disabled 1: Enabled	○	●		0
09	Unit system selection	The unit for displayed values can be set to "mm" or "E units". E=1/25.4 mm. After the unit is set, the default value will not be restored even if the parameters are re-initialized. 0: mm 2: E 1/10,000 reading 1: E 5/100,000 reading 3: mm (E 1/10,000 reading when connecting, EH-D only)	●	●	●	0
10	Linear Gage output signal pitch* ¹	Sets the signal pitch when connected to Linear Gages that output sine-waves. It can be set per axis. 0: 20 μm 2: 0.25 μm 1: 4 μm				2
11	Counter direction	Sets whether the numeral will increase or decrease when the spindle of the Linear Gage is pushed in. It can be set per axis. 0: + direction 1: - direction	●	●	●	0
12	Linear Gage resolution* ¹	Sets the resolution of the Linear Gage that is to be connected to. It can be set per axis. EH-P/Z 0: 10 μm 1: 5 μm 2: 1 μm 3: 0.5 μm 4: 0.1 μm 5: 0.1 μm (exclusive for 542-711-1 and 542-712-1) EH-S* ² 0: 10 μm 1: 5 μm 2: 1 μm 3: 0.5 μm 4: 0.1 μm 5: 0.05 μm 6: 0.01 μm 7: 0.005 μm 8: 0.001 μm EH-D* ³ 0: INC 1: ABS	●	●	●	EH-P/Z 2 EH-D 1

*¹ The Preset value and tolerance value that had been set will be cleared if the setting is changed.

*² The setting range depends on the value set for parameter number 10.

Parameter number 10 = 0: setting range 0 to 4

Parameter number 10 = 1: setting range 2 to 6

Parameter number 10 = 2: setting range 4 to 8

*³ Select "0: INC" when the Linear Gage that is to be connected to is an INC model. "0: INC" or "1: ABS" can be selected when the Linear Gage is an ABS model.

When "0: INC" is selected:

Match the counter value of both the Linear Gage and the Counter when starting up the Counter. Perform Zero setting, etc., on the Linear Gage side when performing measurement with the values matched.

When "1: ABS" is selected:

The Counter memorizes the origin (0 point) that was set at Counter startup. The origin that was memorized will be valid even if the Counter is re-started.

Counter Specifications

Advanced Parameters

This section explains the parameters related to the display, functions, and external output of the Counter. Configure the settings appropriate to your application.

Tips

The circles in the Counter model columns in the following table indicate whether a parameter number that is displayed on the Counter is valid or invalid (●: valid, ○: invalid).

No.	Setting item	Description/Allowable values	Counter model			Default value
			P	Z	D	
01	Parameter initialization	If you set the value of this parameter to 1, the set values for all parameters, except for the unit setting, can be reset to their default values (initialized). Once this setting has been enabled, this parameter is reset so its set value is 0 (do not initialize). 0: Do not initialize 1: Initialize	●	●	●	0
02	Key protect	Key operations can be disabled to prevent operation errors. 0: Key operation enabled 1: Key operation disabled	●	●	●	0
06	Display mode selection* ¹ (2-axis models only)	Selects the UNIT (counting method) that is assigned to each CEL. The UNIT to be set can be selected as desired.	●	●	●	
07	Display at startup	Selects stand-by state or Counter display (origin detection wait state for EH-102Z) to display at startup. EH-P/S/D EH-Z 0: [-----] display 0: [-----] display 1: 0.000 1: Origin detection wait state	●	●	●	EH-P/D 0 EH-Z 0
13	μ decimal point display (2-axis models only)	If enabled, the decimal point will be displayed at the μm position. This is available if the Linear Gage resolution is 0.05 μm or less. Example: 0.001.00 (1 μm) 0: Not displayed 1: Displayed	●	●	●	0
14	Sum/Difference calculation	Specifies the calculation method when Sum/Difference calculation measurement (UNIT C) is selected in parameter number 06. For 1-axis models, this is not available. 0: A + B 1: A - B	●	●	●	0
15	Smoothing	Averages the counter value and then displays it. (This reduces fluctuation of the lowest-order digit.) You can specify the number of measurements to average. 0: None 1: Display the average of 16 measurements 2: Display the average of 32 measurements	●	●	○	0
16	Peak value Preset	Sets whether to perform presetting based on the peak value during Peak mode. 0: Disabled 1: Enabled	●	●	●	0
18	Speed sampling cycle (EH-102P/Z/S only)	In Display mode selection, selects the sampling cycle when Speed display is selected. 0: 0 ms 1: 50 ms 2: 100 ms	●	●		0
19	Digimatic input WAIT	Sets the wait time for the Digimatic input signal. Change this when the Counter cannot read the input signals from a Digimatic device. 0: No WAIT 1: 100 ms WAIT 2: 200 ms WAIT			●	0
20	Tolerance output/ BCD output switchover* ¹	Switches between tolerance judgment result output and BCD output. 0: 3-step tolerance 1: 5-step tolerance 2: BCD output	●	●	●	0
21	BCD output logic* ¹	Selects whether to use positive logic (0) or negative logic (1) for BCD output. 0: DATA [L] (sign H) 1: DATA [H] (sign L)	●	●	●	0
24	RS-232C/USB/ Digimatic output switchover* ²	Selects which output terminal to use. 0: RS-232C 1: USB 2: Digimatic	●	●	●	0
25	Data transfer speed* ²	Selects the data transfer speed for RS-232C. 0: 4800 bps 1: 9600 bps 2: 19200 bps	●	●	●	1
26	Parity check* ²	Selects the parity check method for RS-232C. 0: None 1: Odd numbered 2: Even numbered	●	●	●	2
27	Data bit* ²	Selects the length of the data bit for RS-232C. 0: 7 bit 1: 8 bit	●	●	●	0
28	Output trigger* ²	Selects the output trigger method for RS-232C. 0: RS-232C command (normal state) 1: RS-232C command (with channel synchronization function) HOLD trigger	●	●	●	0
30	Analog output range	Selects the range (resolution range) of the measurement of the analog output. 0: 1999 to -1999 1: 19990 to -19990 2: 199900 to -199900	●	●	●	0
31	Origin detection direction	When a Linear Gage with an origin mark is connected, selects the direction of the spindle of the Linear Gage for origin detection. It can be set per axis. 0: + direction 1: - direction	○	●		0
32	Origin re-detection* ³	When a Linear Gage with an origin mark is connected, sets whether to wait for the origin to be detected without turning off the power in the case of an abnormal stop. 0: Disabled 1: Enabled	○	●		0
33	Origin initialization (when the power switch is on)	When a Linear Gage with an origin mark is connected, initializes the origin when the power is on. After the initialization, the set value will be returned to 0 (do not initialize). 0: Do not initialize 1: Initialize	○	●		0

*¹ The Preset value and tolerance value that had been set will be cleared if the setting is changed.

*² Turn off the power switch after changing the setting. The setting will be applied when you turn on the power switch again.

*³ When the setting is enabled, the Counter will wait for the origin re-detection when the HOLD signal is raised. If the HOLD signal is input again during origin re-detection, the origin re-detection function will be canceled (except during error detection).

■ CEL-Specific Parameters

Each parameter shown below is set separately for each CEL.

Tips

- To set CEL-specific parameters, set 1 as the value for parameter 00. The parameter number will switch to parameter number 40 for 2-axis models, and to parameter number 41 for 1-axis models.
- The circles in the Counter model columns in the following table indicate whether a parameter number that is displayed on the Counter is valid or invalid (●: valid, ○: invalid).

No.	Setting item	Description/Allowable values	Counter model			Default value
			P	Z	D	
40	Individual CEL display ^{*1} (2-axis models only)	Selects the UNIT (counting method) to be displayed for each CEL when Display mode is set to "Option". 0: UNIT A (Count A) 1: UNIT B (Count B) 2: UNIT C (A ± B) 3: UNIT D (Speed A) (except for EH-D) 4: UNIT E (Speed B) (except for EH-D) 5: UNIT F (memory)	●	●	●	
41	Calculation with a constant	Sets whether to multiply the internal counter value by a predetermined value, by an arbitrary value, or to not multiply it. The value obtained by multiplying the internal counter value by the set constant value will be displayed as the measurement result. 0: Do not calculate 1: 1/2 times 2: 2 times 3: 10 times 4: Arbitrary value	●	●	●	0
42	Hide the lowest-order digit	Hides the lowest-order digit. However, the lowest-order digit will be included in RS-232C output and in printouts. 0: Display all digits 1: Hide the lowest-order digit	●	●	●	0

^{*1} The Preset value and tolerance value that had been set will be cleared if this setting is changed.

■ Details of Display Mode Selection (Parameter Number 06)

On 2-axis models, Display mode can be selected by setting parameter number 06 as follows:

Tips

The Display mode also controls the number of output data for the external output function (Digimatic output and RS-232C output).

When setting up the system using the external output function, pay attention to the number of output data.

e.g. Selecting the setup value 1: Two selected BANK data are output with the Digimatic output; four data items are output by the displayed data output (GA00CRLF) with the RS-232C output.

Selecting the setup value 5: One selected BANK data is output with the Digimatic output; one data item is output by the displayed data output (GA00CRLF) with the RS-232C output.

Set value	Display mode	BANK1		BANK2	
		CEL1	CEL2	CEL3	CEL4
0 (Default value)	Coordinate display	UNIT A (Count A)	UNIT B (Count B)	UNIT A (Count A)	UNIT B (Count B)
1	Sum/Difference calculation display	UNIT C (A ± B)	UNIT A (Count A)	UNIT C (A ± B)	UNIT B (Count B)
2	Dual display	UNIT A (Count A)	UNIT A (Count A)	UNIT B (Count B)	UNIT B (Count B)
3	Memory display	UNIT A (Count A)	UNIT F (Memory)	UNIT B (Count B)	UNIT F (Memory)
4	Speed display	UNIT A (Count A)	UNIT D (Speed A)	UNIT B (Count B)	UNIT E (Speed B)
5	Optional display (1 CEL)	UNIT A to F	—	—	—
6	Optional display (2 CELs)	UNIT A to F	UNIT A to F	—	—
7	Optional display (4 CELs)	UNIT A to F	UNIT A to F	UNIT A to F	UNIT A to F

Counter Specifications

■ Display mode types

• Coordinate display (set value: 0)

Displays 2 sets of coordinates using the BANK function.

Tips

- The origin and tolerance can be set separately for INPUT A and INPUT B.

• Sum/Difference calculation display (set value: 1)

Displays the Sum/Difference calculation for thickness or step measurement.

Tips

- Set sum (A + B) or difference (A - B) by parameter number 14.
- Connect Linear Gages that have the same resolution to INPUT A and INPUT B.

• Dual display (set value: 2)

In Peak mode measurement, the peak value and the counter value of one Linear Gage are displayed simultaneously. The peak value is displayed on Display A, and the counter value is displayed on Display B.

You can switch between INPUT A and INPUT B using the BANK function.

• Memory display (set value: 3)

Saves the current value on Display A in Display B. In addition to the most recently saved data, the maximum value and the minimum value from past data can also be read out. The saved data will not be cleared even if the power switch is turned off.

Tips

- The memory unit is shared between BANK1 and BANK2. Connect Linear Gages that have the same resolution.
- The B_HOLD signal can be used to write to or clear the memory externally.

• Speed display (set value: 4) (EH-102P/EH-102Z/EH-102S only)

Displays the moving speed of the Linear Gage's spindle simply.

In addition to the current speed, it displays the maximum speed when the maximum value (MAX) is selected in Peak mode.

Tips

- Specify the speed sampling cycle by parameter number 18.
- The value is displayed in mm/sec. The display of the last 1 to 3 digits may be fixed depending on the speed sampling cycle.
- The maximum speed in the reverse direction is displayed when the minimum value (MIN) is selected in Peak mode.
- This type is not applicable to feedback control.



External Input/Output Function

This product is equipped with the following interfaces that enable the connection of external equipment.

Interface	Parameter setting (No. 24)	Connectable equipment	Functions
Digimatic output	2	Digimatic Mini-Processor (DP-1VR)	• Printing the measurement data, statistical calculation results, etc.
USB	1	PC (for SENSORPAK)	• Data output to a PC
RS-232C	0	PC, PLC	• Data output to a PC, PLC • Control from external system
I/O connector	—	Equipment such as a switch or control unit	• Data output to PLC • External control of Counter

Tips

PLC: programmable logic controller

■ Digimatic Output Function

You can print the measurement data by connecting to a Digimatic Mini-Processor (**DP-1VR**), which is sold separately. When connecting, connect the Digimatic cable to the RS_LINK connector (OUT) of the Counter.

Tips

- A maximum of 6 digits can be printed. When Counter displays the value in 7 or 8 digits, the last 6 digits will be printed. For example, when "12.34567 mm", which has 7 digits, is output, it will be printed as "2.34567 mm".
- Set the DP-1VR to compatible mode. For details about the setting method and operations, see the User's Manual for DP-1VR.

■ USB Communication Function

By installing **SENSORPAK** (Mitutoyo product) on a PC, you can load measurement data from a Counter to the PC by connecting the Counter to the PC with a USB connecting cable (A-B type). A USB connecting cable is not supplied. You must provide one.

Tips

- The USB port for communication with **SENSORPAK**.
- For details about **SENSORPAK**, see the **SENSORPAK** User's Manual.

■ RS-232C Communication Function

By connecting to a PC or PLC via RS-232C, you can load measurement data and manipulate various settings of the Counter through remote operation. You can also save and load parameters.

Tips

RS-232C Data Output Duration

The maximum output duration of the command to output all data (GA00CRLF) can be calculated with the following formula:
Maximum output duration [ms] = Number of connected Counters × 5 + Number of connection channels × 17 (8.5) + 6 (3)

Tips

Transmission rate is 9600bps. The values enclosed in () show the case of 19200 bps.

Calculation example:

1 EH-102 + 1 Linear Gage channel = Max. 28 (16.5) ms

10 EH-102 + 20 Linear Gage channels = Max. 396 (223) ms

Tips

Processing time of the PC is not included.

Counter Specifications

Measurement data acquisition software for EH SENSORPAK

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- This software facilitates loading measurement data onto a personal computer from a linear gage counter with RS-232C output (EH), or from a Litematic display (VL).
- 20 channels (max.) of measurement data can be processed.
- Arithmetical calculations and maximum width calculations can be performed using the measurement data.
- Exporting measurement data into MS-Excel format is supported.
- Real time graphical display by means of bar-graph or meter is provided.



Measurement screen 1



Meter screen 2



Chart screen 3

Specifications

Order No.	SEONSORPAK
Product configuration	Program disk (CD-ROM), license key, operation manual
Compatible devices	Mitutoyo RS_LINK compatible devices <ul style="list-style-type: none"> •LGH Series (USB, RS-232C) •EH counter (USB, RS-232C) •Litematic VL (RS-232C)
Connecting cable	A cable should be prepared to the following specifications: Accessory <ul style="list-style-type: none"> •RS-232C connection: I/O cable (21HZA137)*¹ Commercial product <ul style="list-style-type: none"> •USB connection: USB cable (type A - type B) •RS-232C connection: RS-232C cross cable*¹
Number of connectable gages	Max. 20 units (when 10 units of EH counter for linear gage are connected via RS-Link)
Display* ²	Display format: counting, bar graph, indicator, chart, and table Display cycle: 0.3 s (when 20 gage units are connected, 1-window display, and no Excel output)
Calculation	Calculation (up to 30 items) between designated gages is available. Calculation items: Sum, difference, total, average, maximum, minimum, range (maximum–minimum), calculation with a constant
Tolerance judgment	Per item: Displays the result in colors (3-step tolerance: red/green/red; 5-step tolerance: red/yellow/green/yellow/red) Total judgment: Displays in colors (red/green) by monitoring the multiple gages and calculation result
Recording* ²	Items: channel values, calculation result, tolerance judgment, total tolerance judgment, timestamp Max. number of records: 60000 for software recording (with 6 gages connected); up to 27000 (with 20 gages connected) Output function: Direct output to Excel, CSV file output (compatible with MeasurLink [®]) Recording trigger: key, timer, external TRG
Input/output* ³	Input: TRG for recoderding (HOLD) Output: Total tolerance judgment result
System environment	DOS/V compatible PC environment CPU: Pentium4 2 GHz or more, Memory: 2 GB or more, Hard disk: 2 GB or more free space OS: Windows 7 (32 bit/64 bit), Windows 8.1 (32 bit/64 bit), Windows 10 (64 bit)

*1 If the PC is not equipped with an RS-232C port, please contact the nearest Mitutoyo sales office/service center.

*2 Display cycle and the maximum number of records differ depending on the environment (specification of PC, number of connected gages, display format and communication setting).

*3 With use of the I/O cable (accessory). When an I/O cable is not used, the I/O connector of connector of the counter alternatively functions.
 (Refer to the user's manual of the counter in use.)

Linear Gage Accessories (Optional)

Optional gage head accessories

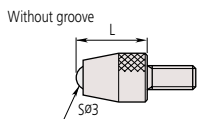
■ Various Contact Points/Extension Rods (Interchangeable dial indicator contact points are also available.)

- All threads of interchangeable contact points are M2.5 (P=0.45) × 5 mm.
- If any contact point is replaced with another, firmly attach it so that it cannot become loosened during use. (Recommended tightening torque=50 N · cm)
- A carbide contact point is particularly good at resisting to abrasion.

■ ø3 mm Ball Points

Unit: mm

Standard contact point.

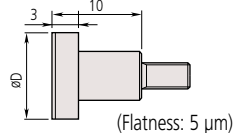
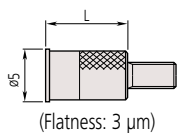


L (mm)	Material	Carbide	Carbide	Plastic
7.3	Order No.	901312	120047	901994
14	Order No.	21JAA225	—	—
15	Order No.	120049	120051	—
17	Order No.	21JAA224	—	—
20	Order No.	137391	137392	—
22	Order No.	21JAA226	—	—
25	Order No.	120053	120055	—
30	Order No.	21AAA252	21AAA253	—

■ Flat Points

Unit: mm

Convenient to use if the feature to be measured is convex.



L	Order No.
8	131365
10	21AAA340

D	Order No.
10	101117
15	21AAA341
20	21AAA342
25	21AAA343
30	21AAA344

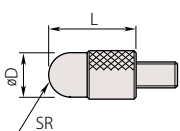


If perpendicularity to the stem and parallelism with the reference plane are required using a flat contact point, extra adjustment in conjunction with the linear gage is necessary. Consult with Mitutoyo as a custom-made option.

■ Shell Type Points

Unit: mm
Material: Hardened steel

Contact point with a large radius. Optimal for use on flat surfaces.

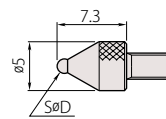


øD	SR	L	Order No.
5	2.5	5	101386
		10	101118
		15	137393
		20	101387
		25	101388
		30	21AAA254

■ Ball Points

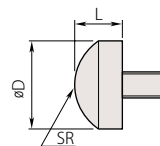
Unit: mm
Material: Hardened steel

Convenient to measure a depressed feature on a workpiece.



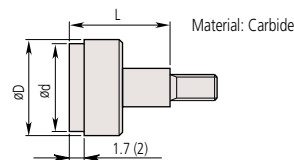
SoD	Spherical tip material	Order No.
1	Carbide	21AAA349
1.5		21AAA350
1.8	Hardened steel	101122
2.5		21AAA351
4	Carbide	21AAA352

■ Spherical Points

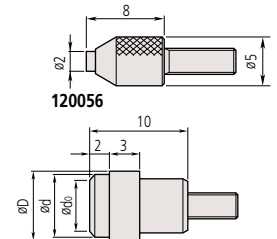
Unit: mm
Material: Hardened steel

D	ø5.5	ø8	ø10
SR	5	5	7
L	3	5	5
Order No.	111460	125258	101119

■ Flat Points (Carbide)

Unit: mm
Flatness: 3 µm

ød	D	L	Flatness	Order No.
4.3	5.2	5	3 µm	120041
6.5	7	5		120042
9.5	10.5	5		120043
15	17	10	5 µm	21AAA345
20	22	10		21AAA346
25	27	10		21AAA347
30	32	10		21AAA348



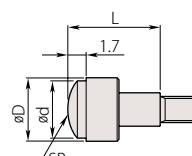
ødo	ød	øD	Order No.
3	6.4	7	137255
4.5	8	9	137399

(Flatness: 3 µm)



If perpendicularity to the stem and parallelism with the reference plane are required using a flat contact point, extra adjustment in conjunction with the linear gage is necessary. Consult with Mitutoyo as a custom-made option.

■ Spherical Points (Carbide)

Unit: mm
Material: Carbide
(spherical tip surface only)

L	D	ø5.2	ø7.5	ø10.5
SR	5	7	10	—
5	Order No.	120058	—	—
10	Order No.	—	120059	120060

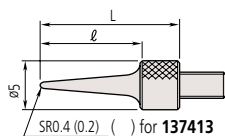
Note: Diameter d is available up to ø40 as a custom order.

Linear Gage Accessories (Optional)

Needle Points

Unit: mm
Material: Hardened steel

Suitable for probing the bottom of a groove or hole.



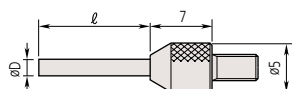
Note: Contact Mitutoyo to inquire about specifications such as tip SR: 0.2 or more and l : up to 40.

Order No.	l	L
101121	11	15
137413	13	17
21AAA255	21	25
21AAA256	31	35

Needle Points (Carbide)

Unit: mm
Material: Carbide

Suitable for probing the bottom of a groove or hole.



D	l	3	5	8	10	13
ø0.45	Order No.	120066	21AAA329	—	—	—
ø1	Order No.	120065	21AAA330	21AAA331	21AAA332	—
ø1.5	Order No.	—	21AAA335	—	21AAA336	120064
ø2	Order No.	—	—	137257	—	—

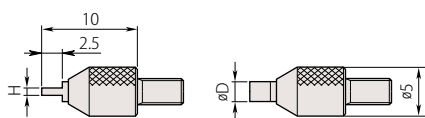
D	l	18	20	28	40
ø1	Order No.	—	21AAA333	—	21AAA334
ø1.5	Order No.	—	21AAA337	—	21AAA338
ø2	Order No.	21AAA257	—	21AAA258	21AAA339

Note: A different specification is available as a custom order.

Blade Points (Carbide)

Unit: mm
Material: Carbide

Convenient for cylinder measurement, etc.



D	H	0.4	0.6	1
ø2	Order No.	120061	120062	—
ø4	Order No.	—	—	120063

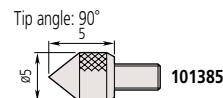
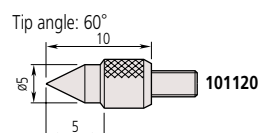


If perpendicularity to the stem, parallelism with the reference plane, and different contact point orientation are required using a blade contact point, extra adjustment in conjunction with the linear gage is necessary. Consult with Mitutoyo as a custom-made option.

Conical Points

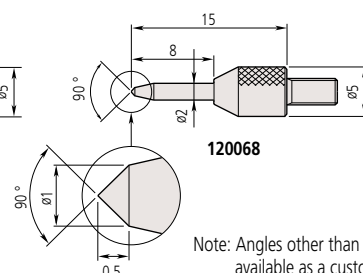
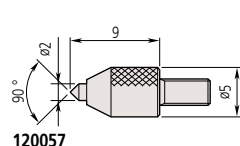
Unit: mm
Material: Hardened steel

Used for positioning the measurement point. Since it can damage a workpiece easily, it is not suitable for use on soft materials.



90° Conical Points (Carbide)

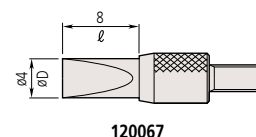
Unit: mm
Material: Carbide



Knife Edge Point (Carbide)

Unit: mm
Material: Carbide

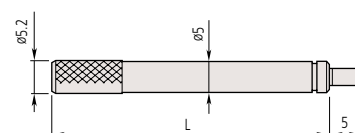
Suitable for measuring narrow groove diameter, etc.



Note: Diameter D more than ø0.5 and length/ between 5 and 40 are available as a custom order.

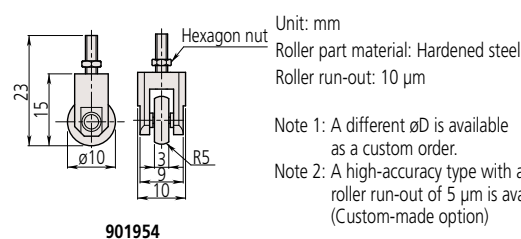
Extension Rods

Unit: mm
Material: Stainless steel



L	Order No.	L	Order No.
10	303611	55	21AAA259G
15	21AAA259A	60	304146
20	303612	65	21AAA259H
25	21AAA259B	70	21AAA259J
30	303613	75	21AAA259L
35	21AAA259C	80	21AAA259M
40	21AAA259D	90	304147
45	21AAA259E	100	303614
50	21AAA259F		

Roller Points



Unit: mm
Roller part material: Hardened steel
Roller run-out: 10 μ m
Note 1: A different ϕD is available as a custom order.
Note 2: A high-accuracy type with a roller run-out of 5 μ m is available. (Custom-made option)

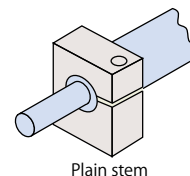
Quick Guide to Precision Measuring Instruments

Quick Guide to Precision Measuring Instruments

Gage Head

■ Plain Stem

The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does require a split-fixture clamping arrangement or adhesive fixing. However, take care so as not to exert excessive force on the stem.



■ Measuring Force

This is the force exerted on a workpiece during measurement by the contact point of a linear gage head, at its stroke end, expressed in newtons.

■ Comparative Measurement

A measurement method where a workpiece dimension is found by measuring the difference in size between the workpiece and a master gage representing the nominal workpiece dimension.

■ Ingress Protection Code

Protection code	Type	Level	Description
IP66	Protection against contact with the human body and foreign objects	6: Dust tight	Protection from dust ingress Complete protection against contact
	Protects against exposure to water	6: Water-resistant type	Water jets directed against the enclosure from any direction shall have no harmful effects.
IP67	Protection against contact with the human body and foreign objects	6: Dust tight	Protection from dust ingress Complete protection against contact
	Protects against exposure to water	7: Immersion-protection	Protection against the effects of immersion in water between 1 cm and 1 m for 30 minutes
IP□□G	Oil-proof	—	Protection against entry of oil droplets or splashes from all directions.

■ Precautions in Mounting a Gage Head

- Insert the stem of the gage into the mounting clamp of a measuring unit or a stand and tighten the clamp screw.
- Notice that excessively tightening the stem can cause problems with spindle operation.
- Never use a mounting method in which the stem is clamped by direct contact with a screw.
- Never mount a linear gage by any part other than the stem.
- Mount the gage head so that it is in line with the intended direction of measurement. Mounting the head at an angle to this direction will cause an error in measurement.
- Exercise care so as not to exert a force on the gage through the cable.

■ Precautions in Mounting LGH Series

To fix the LGH Series, insert the stem into the dedicated stand or fixture. Recommended hole diameter on the fixing side: 15 mm $+0.034/+0.014$



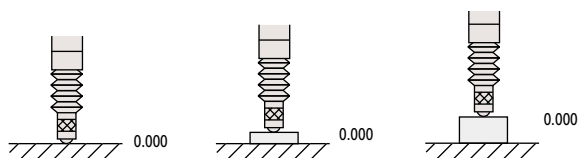
- Machine the clamping hole so that its axis is parallel with the measuring direction. Mounting the gage at an angle will cause a measuring error.
- When fixing the LGH Series, do not clamp the stem too tightly. Over-tightening the stem may impair the sliding ability of the spindle.
- If measurement is performed while moving the LGH Series, mount it so that the cable will not be strained and no undue force will be exerted on the gage head.

Quick Guide to Precision Measuring Instruments

Counter

■ Zero-setting

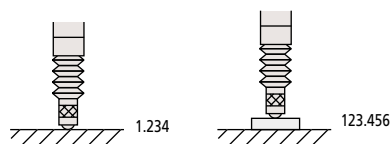
The display value can be set to 0 (zero) at any position of the spindle.



Note: Perform the zero-setting beyond 0.2 mm stroke from the rest position.
This puts the spindle in the guaranteed accuracy region.

■ Presetting

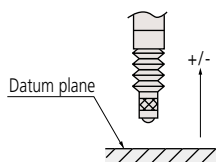
Any numeric value can be set on the display unit for starting the count from this value.



Note: Perform the zero-setting beyond 0.2 mm stroke from the rest position.
This puts the spindle in the guaranteed accuracy region.

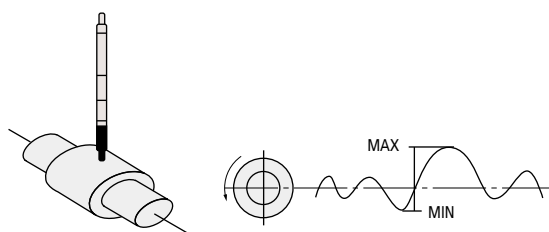
■ Direction Changeover

The measuring direction of the gage spindle can be set to either plus (+) or minus (-) of count.



■ MAX, MIN, TIR Settings

The display unit can hold the maximum (MAX) and minimum (MIN) values, and the run out value (TIR) during measurement.



■ Tolerance Setting

Tolerance limits can be set in various display units for automatically indicating if a measurement falls within those limits.

■ Open-collector Output

An external load, such as a relay or a logic circuit, can be driven from the collector output of an internal transistor which is itself controlled by a Tolerance Judgment result, etc.

■ Digimatic Code

A communication protocol for connecting the output of measuring tools with various Mitutoyo data processing units. This allows output connection to a Digimatic Mini-processor DP-1VA LOGGER for performing various statistical calculations and creating histograms, etc.

■ BCD Output

A system for outputting data in binary-coded decimal notation.

■ RS-232C Output

A serial communication interface in which data can be transmitted bi-directionally under the EIA Standards. For the transmission procedure, refer to the specifications of each measuring instrument.

■ CC-Link

An abbreviation of Control & Communication Link, the new open field network developed by Mitsubishi Electric Corporation. It is a high-speed field network that allows for control and communication at the same time.

Before using the gage head

Avoid installing the gage in locations where:

- The gage will be exposed to direct sunlight, or where the ambient temperature may drop below 0 °C or exceed 50 °C*.
- The relative humidity may drop below 20% RH or exceed 80% RH, or where a sudden change in temperature may cause condensation.
- The gage would be subject to corrosive gas, or where combustible materials are placed nearby.
- The gage is subject to air containing significant amounts of dust, salt or iron powder.
- The gage is subject to direct vibration or shock.
- The gage may come in contact with splashed water, oil or chemicals. (The gage system components are not designed for protection against water, oil or chemical attack, except for the gage unit.)
- Electronic noise is likely to affect the gage.

Our Linear gage Series products conform to the EMC Directive and the UK's Electromagnetic Compatibility Regulations.

- EMC Directive/Electromagnetic Compatibility Regulations: EN61326-1

Preventing electrical interference

- Bundling the sensor cable with high-voltage lines or power lines may cause the gage to malfunction. The sensor cable run should be completely separate.

Power supply to the display unit

- If a generic switching regulator is used, provide grounding via the frame's ground terminal or ground terminal of the power supply.
- If a malfunction occurs due to superimposed noise on the power-supply line, use a DC-regulated power supply that incorporates an isolation transformer.

About grounding

- Avoid sharing the frame ground (F.G.) terminal of this unit with the high-power line grounding but separately connect it to Class 3 Grounding.

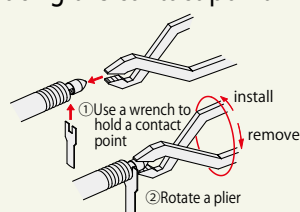
Handling precautions

- This product is a precision measuring instrument. Avoid dropping or otherwise subjecting it to impact.
 - The spindle of the gage head is connected to the body via a spring. Be careful not to pull the spindle in the extending direction or rotate it with force. Doing so may cause permanent distortion and damage to the spring.
 - The gage is shipped with a standard contact point (901312) installed on the spindle. This contact point can be replaced with a different type that best suits the shape of the workpiece feature to be measured. (See page 1-64, 1-65, 1-68.)
- When installing or removing a contact point, locate the key wrench provided in the wrench groove in order to keep the spindle from rotating. Then grip the contact point with pliers to install or remove it. When gripping the contact point with pliers, insert a piece of felt or other soft packing between the jaws and the point to protect it from damage.
- Do not use both ends of the stroke as an origin (zero) point.

Precautions in mounting a Linear gage

The following illustrate important points to which customers should pay attention. Refer to these when using gage heads and counters.

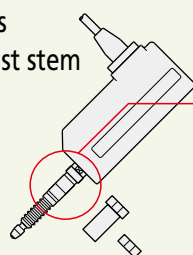
Replacing the contact point



【How to install/remove the contact point】

The contact point is interchangeable according to the application. When installing or removing a contact point, locate the key wrench provided in the wrench groove in order to keep the spindle from rotating. Then grip the contact point with pliers to install or remove it. When gripping the contact point with pliers, insert a piece of felt or other soft packing between the jaws and the point to protect it from damage.

LG100/LG200 Series Mounting the thrust stem



If the thrust stem is retrofitted, the gage can be fixed more steadily and easily only by drilling a $\phi 9.5$ hole on a plate with a thickness of about 10 mm. To mount the thrust stem, fit the special wrench (optional) in the wrench groove in the middle of the main unit, and then fasten the clamp nut with the standard-supplied wrench while holding the knurled part by hand. Take care not to hold the cable receptacle on the main unit, otherwise the gage may be damaged due to torque caused by twisting.

Note 1 Refer to page 1-25, 1-26.

Precautions in mounting a Linear gage

Applies to all linear gages

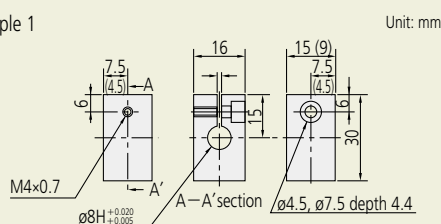
Mounting the gage head

- Insert the stem of the gage into the mounting clamp of a measuring unit or a stand and tighten the clamp screw.
- Notice that excessively tightening the stem can cause problems with spindle operation.
- Never use a mounting method in which the stem is clamped by direct contact with a screw.
- Never mount a linear gage by any part other than the stem.
- Mount the gage head so that it is in line with the intended direction of measurement. Mounting the head at an angle to this direction will cause an error in measurement.
- Exercise care so as not to exert a force on the gage through the cable.

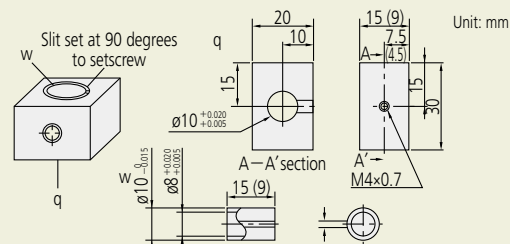
Examples of the plain-stem mount

- The recommended clamping torque is 0.4 to 0.5 Nm. Over-tightening the stem clamp will prevent smooth movement of the spindle. Ensure the spindle can move freely after clamping.

Example 1



Example 2



About dust/water protection

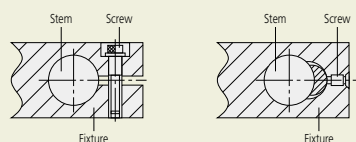
- All the protective structures of the fine linier gages are equivalent to IP54 (DIN 40050-1/IEC529 standard).
- The preamplifiers and counters are not designed to be dust-or water-proof. Install them in places where they will not come into direct contact with dust, water or oil.
- When an extension cable is used, seal the preamplifier connection and connectors completely, making sure no portion is left exposed.
- If the cable cover is damaged, water or other liquids may enter the gage due to capillary effect, causing gage failure. If the cable cover becomes damaged it should be repaired or replaced immediately.
- Handle the gage with due caution to make sure that the rubber boot will not be damaged by scuffing, etc. If the rubber boot is damaged, the gage can no longer be protected from dust or water ingress. When damage is found, repair or replace the boots immediately.
- The rubber material used for the boots and seals does not provide complete protection against coolants and chemicals, which are becoming increasingly complex in composition. If rubber parts are found to have deteriorated significantly, contact your nearest Mitutoyo office.
- The gage must not be disassembled, since it will break the seals of various components. Never attempt to disassemble the gage. Doing so will prevent the gage from functioning to its original specifications.

LGH Type

Mounting the gage

A LGH can be mounted by inserting its stem in the mounting hole of a dedicated stand or other equipment.

Recommended mounting
hole diameter in fixture: **15 mm** $+0.024$
 $+0.006$



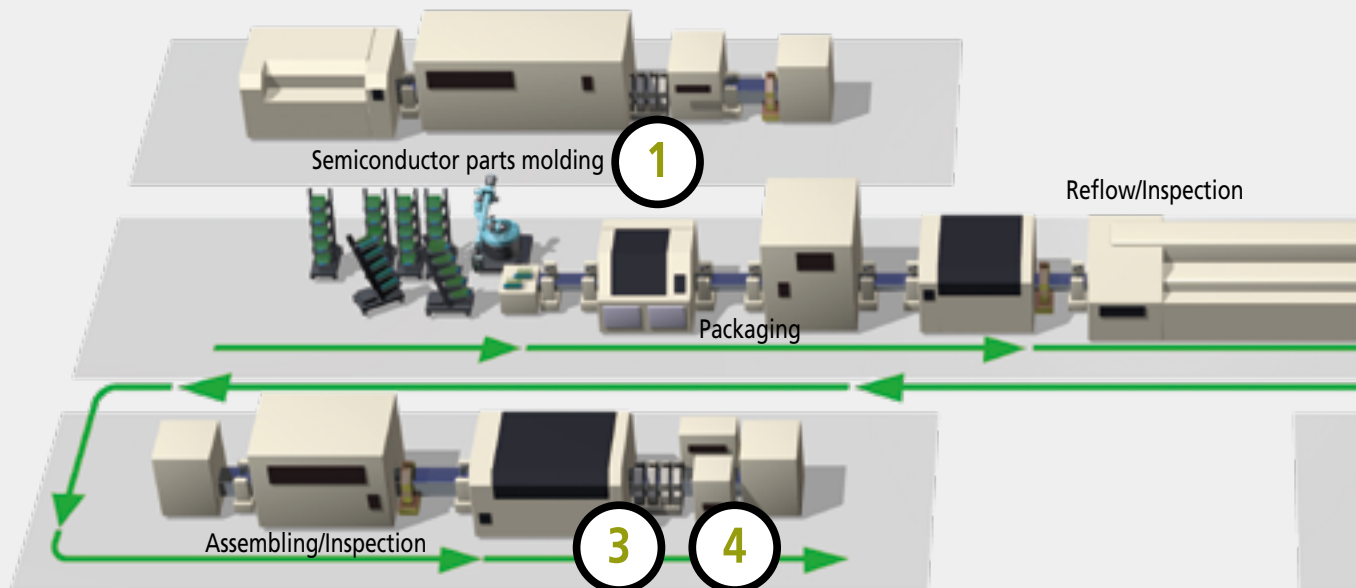
- The mounting hole shall be machined parallel with the direction of measurement. Cosine-effect measurement error will occur if the gage is misaligned with this direction.
- Excessive force in tightening the stem will affect smooth spindle motion and should be avoided.
- In applications where a LGH is subject to movement, ensure that the mounting is designed to avoid the cable being dragged when in motion.

Precautions for measurement:

- To help ensure accuracy, allow 30 minutes warm-up time for the system after powering ON.
- Allow sufficient time for temperature stabilization for both the gage and workpieces to be measured.
- Thoroughly clean the contact point and all surfaces to be measured before measurement to avoid accuracy degradation due to dust or grease.
- Be aware of possible overspeed errors if the contact point is allowed to drop significantly from surface to surface on the workpiece. Appropriate measuring procedures should always be used with due consideration for the part features.

Applications

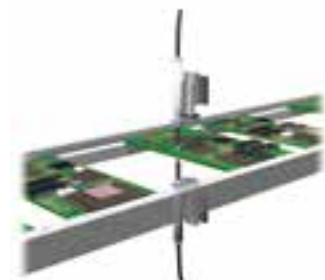
Precision Parts Manufacturing



1 Roll gap measurement



2 PCB thickness measurement

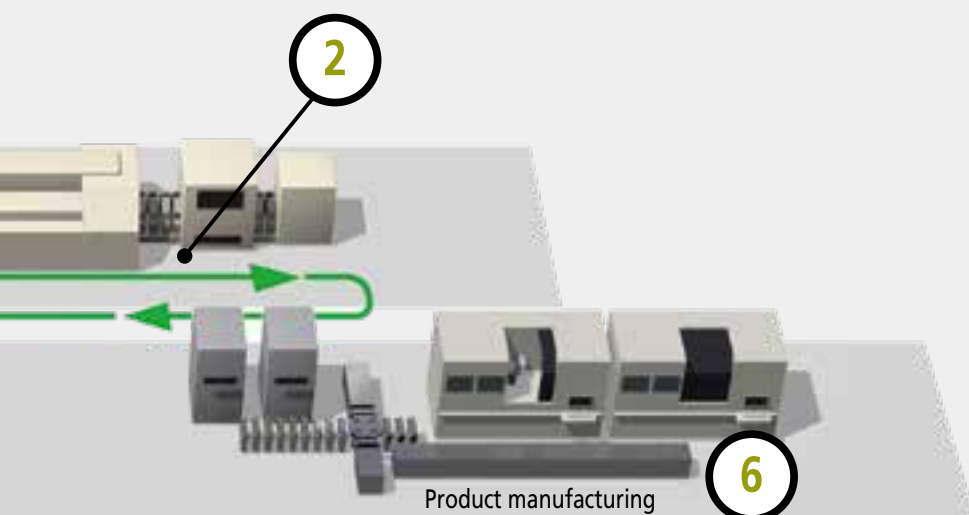


5 Measurement of crimping height

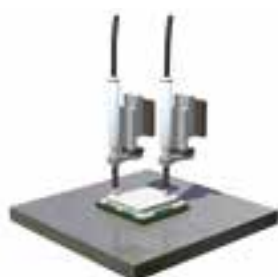


6 FPD board multipoint measurement





3 Chip parallelism measurement



4 Seating check

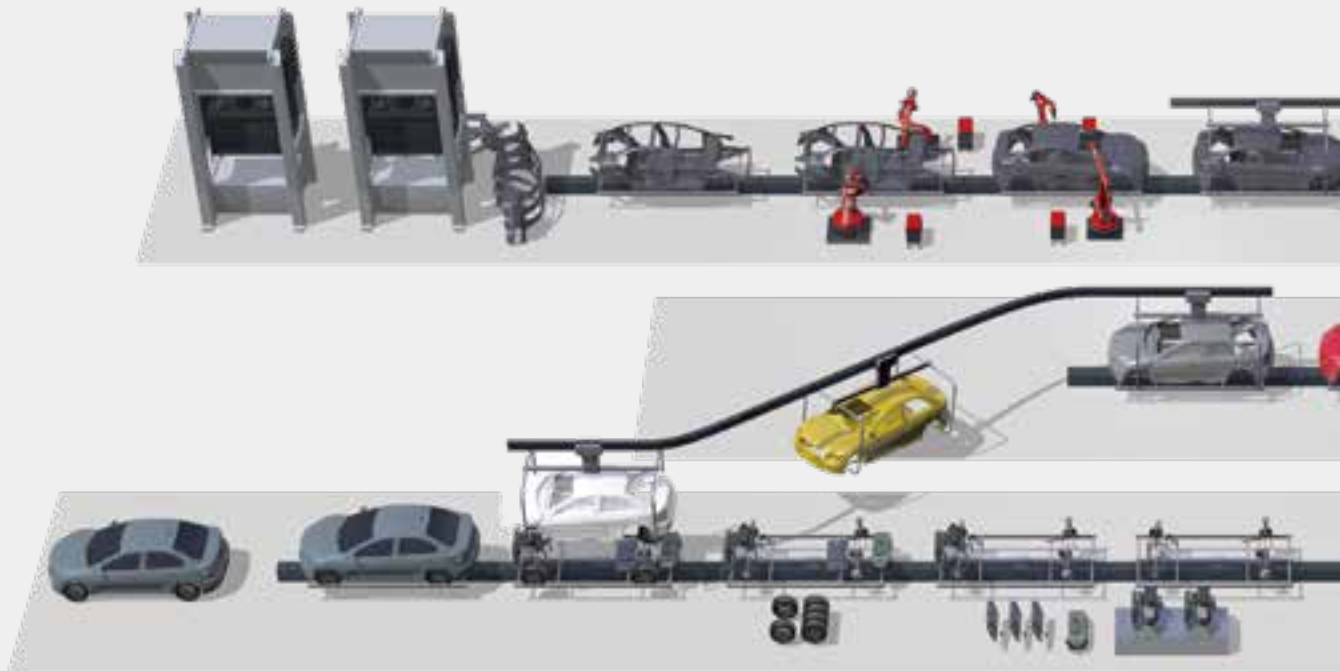


7 Parallelism measurement of copying machine parts



Applications

Automobile Manufacturing Process



① Cam-lift measurement



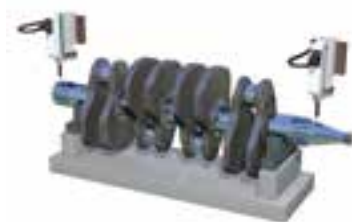
② Brake disk multipoint measurement

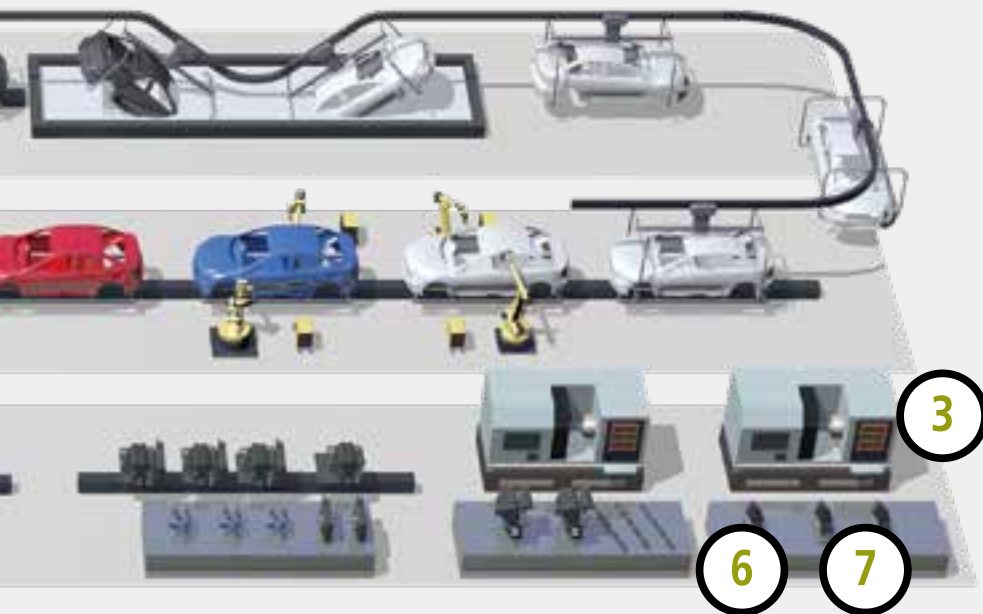


⑤ Flatness measurement



⑥ Workpiece height detection

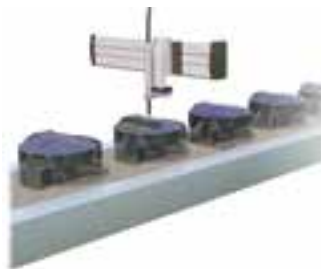




3 Machine device tool length measurement



4 Workpiece discrimination



7 Workpiece runout measurement



8 Inspection fixture



Contact Sensor

Non-contact Sensor

Chapter 2

ID

Digimatic Indicator

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

ABSOLUTE Digimatic Indicator ID-SX2	2-1
ABSOLUTE Digimatic Indicator ID-CNX	2-3
ABSOLUTE Digimatic Indicator ID-N/B	2-7
ABSOLUTE Digimatic Indicator ID-C (Peak-Value Hold Type).....	2-11
ABSOLUTE Digimatic Indicator ID-C (Bore Gage Type)	2-13
ABSOLUTE Digimatic Indicator ID-C (Calculation Type)	2-15
ABSOLUTE Digimatic Indicator ID-C (Signal Output Function Type)	2-19
ABSOLUTE Digimatic Indicator ID-U	2-21
Digimatic Indicator ID-H	2-23
High-performance ABS Digimatic Indicator ID-F	2-25
Display unit EC counter	2-28
Origin setting of Digimatic Indicators	2-29
Optional Accessories	2-30

ABSOLUTE Digimatic Indicator ID-SX2 SERIES 543

- Cost-effective oriented design

ID-SX2 indicators come with the minimum of functionality for ease of use. There is a choice of models in the lineup allowing selection of 0.01 mm, 0.001 mm or inch-based measurement resolutions.

- IP53 dust/water protection level

The models listed below also provide IP53 dust/water protection level specifications: **543-794(B)-10**, **543-795(B)-10** and **543-796(B)-10**

- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



Tips

For details of each mark, see Intro page 13.

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IP53 dust/water protection level*

Level 5: Dust protection

While complete protection against intrusion of dust is not provided, protection is adequate to prevent dust intrusion in amounts that would inhibit the prescribed operations and safety of the electronic equipment.

Level 3: Protection against spraying water

The product suffers no harmful effects when subjected to water sprayed at an angle of up to 60° on both sides.

For details on the dust/water protection level test conditions, refer to IEC 60529: 2001 and JIS C 0920: 2003.

* IP code is the degree of protection against the intrusion of solid foreign objects and water. Mitutoyo offers a lineup of coolant proof, **ID-N/B** indicators that have excellent resistance to oil, water and dust and so are suitable for use in environments that include splashing cutting fluid. (Refer to page **ID-N/B** for details.)

Refer to "Optional accessories" on page 2-30.

Specifications

Metric		ISO/JIS Type					ASME/ANSI/AGD type			
Order No.	Range (mm)	Resolution (mm)	Maximum permissible error* ¹ (mm)			Measuring force MPL (N)	Back type	Battery life* ³	Net mass (g)	Dust/Water protection level* ⁴
			MPE _E * ²	Hysteresis MPE _H	Repeatability MPE _R					
543-790-10	12.7	0.001	0.003	0.002	0.002	1.5 or less	With lug	Approx. 18,000 hours (Continuous use)	150	IP42
543-790B-10						Flat	140			
543-794-10		2.5 or less	With lug	Approx. 5 years (Normal use)	155	IP53				
543-794B-10					Flat		155			
543-781-10		0.01	0.02	0.02	0.01	1.5 or less	With lug	Approx. 20,000 hours (Continuous use)	150	IP42
543-781B-10							Flat		140	

Inch/Metric										
Order No.	Range	Resolution	Maximum permissible error* ¹			Measuring force MPL (N)	Back type	Battery life* ³	Net mass (g)	Dust/Water protection level* ⁴
			MPE _E * ²	Hysteresis MPE _H	Repeatability MPE _R					
543-791-10	0.5 in/12.7 mm	0.00005 in / 0.001 mm	±0.0001 in / 0.003 mm	0.0001 in / 0.002 mm	0.0001 in / 0.002 mm	1.5 or less	With lug	Approx. 18,000 hours (Continuous use)	150	IP42
543-791B-10							Flat		140	
543-792-10		0.0001 in / 0.001 mm	±0.0001 in / 0.003 mm	0.0001 in / 0.002 mm	0.0001 in / 0.002 mm	2.5 or less	With lug	Approx. 5 years (Normal use)	165	IP53
543-792B-10							Flat		140	
543-793-10		0.00005 in / 0.001 mm	±0.0001 in / 0.003 mm	0.0001 in / 0.002 mm	0.0001 in / 0.002 mm	1.5 or less	With lug	Approx. 20,000 hours (Continuous use)	165	IP42
543-793B-10							Flat		140	
543-795-10		0.00005 in / 0.001 mm	±0.0001 in / 0.003 mm	0.0001 in / 0.002 mm	0.0001 in / 0.002 mm	2.5 or less	With lug	Approx. 5 years (Normal use)	155	IP53
543-795B-10							Flat		155	
543-796-10		0.00005 in / 0.001 mm	±0.0001 in / 0.003 mm	0.0001 in / 0.002 mm	0.0001 in / 0.002 mm	1.5 or less	With lug	Approx. 20,000 hours (Continuous use)	155	IP42
543-796B-10							Flat		155	
543-782-10		0.0005 in / 0.01 mm	±0.0010 in / 0.02 mm	0.0010 in / 0.02 mm	0.0005 in / 0.01 mm	1.5 or less	With lug	Approx. 5 years (Normal use)	150	IP42
543-782B-10							Flat		140	
543-783-10		0.0005 in / 0.01 mm	±0.0010 in / 0.02 mm	0.0010 in / 0.02 mm	0.0005 in / 0.01 mm	1.5 or less	With lug	Approx. 5 years (Normal use)	165	IP42
543-783B-10							Flat		140	

*1 These values apply at 20 °C.

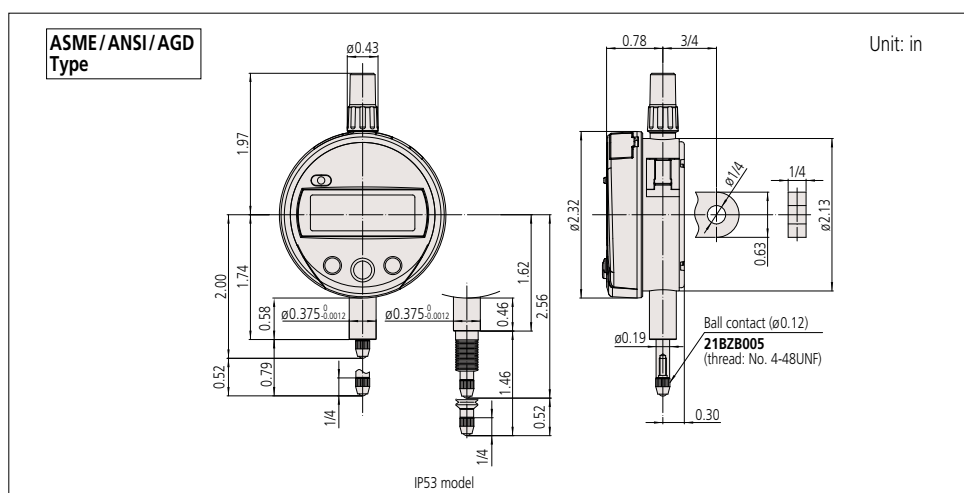
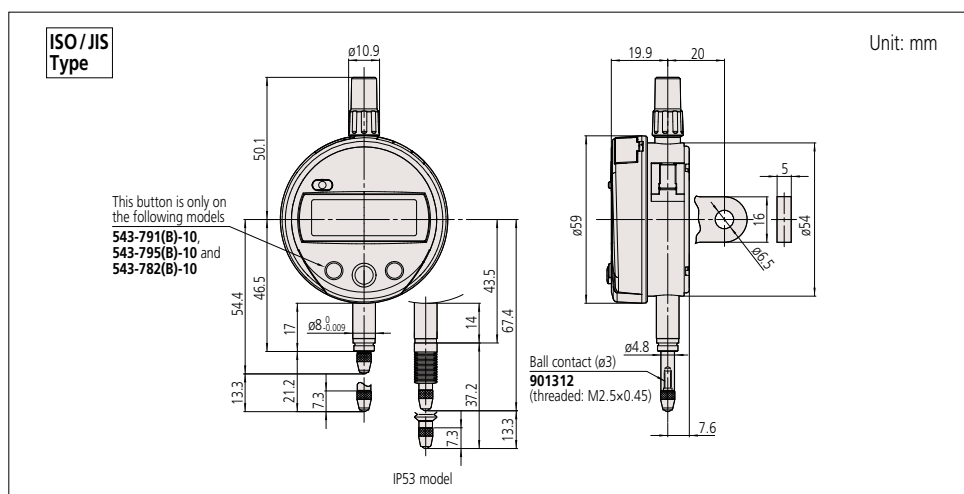
*2 Error of indication for the total measuring range

*3 The battery life varies, depending on the number of times a Digimatic indicator is used as well as the way it is used. The values listed above are approximations.

*4 This is only valid when the data socket cover is in place. Does not apply if the cover is removed, a lifting accessory is attached, or a connecting cable is attached.

Note: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page 2-29.

Dimensions



Technical data

- Display: 6-digit LCD, sign
- Usable orientation: All
- Scale type: ABSOLUTE electrostatic linear encoder
- Battery: SR44 (1 pc.), **938882** for initial operational checks (standard accessory)
- Maximum response speed: Unlimited (except for scanning measurement)

Functions

- Origin set (Zero-setting)
- Measuring direction switching
- Data output
- Low battery voltage alarm display
- Error alarm display

Refer to "Optional accessories" on page 2-30.

ABSOLUTE Digimatic Indicator ID-CNX SERIES 543 — Standard Type

- Supports bidirectional communication between the **ID-C** and the computer, enabling data output to a computer and setting of various functions of **ID-C** from a computer.
- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Tolerance judgment can be performed by setting upper and lower tolerance limits.
The judgment result (GO/NO-GO) can be displayed in full-size characters.
- An analog bar indicator has been integrated to make upper/lower limit and turnover point reading more comfortable.
- Battery life of approx. 2.5 years under normal use has been achieved with only one battery.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



Measuring range
12.7 mm
543-700B



Low measuring
force model
543-705B



Measuring range
25.4 mm
543-720B



Measuring range
50.8 mm
543-730B

Tips

For details of each mark, see Intro page 13.

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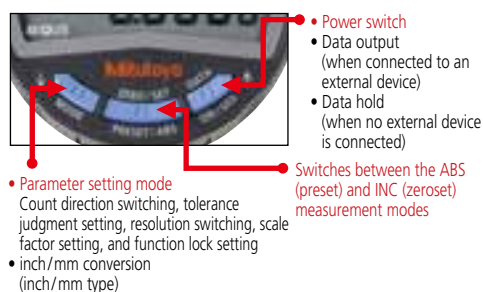
• Large LCD

A large LCD with an analog bar graph to improve the readability of measurement values.



• Three large buttons

The ease of use has been greatly enhanced thanks to these three large buttons. The user can freely set any frequently used function to the buttons.



• Calibration schedule warning

An icon is displayed on the LCD to notify the user of the set calibration schedule. This function facilitates the proper precision management of the measuring instrument.



The calibration schedule warning icon starts blinking at a set time (e.g. 1 week before the calibration date) before the limit. If the limit is exceeded, the entire screen starts blinking to notify the user.

• 330° rotary display

The display can be rotated 330°, allowing use at a position where you can easily read the measurement value.



Specifications

Metric									
Order No.		Range (mm)	Resolution (mm)	Maximum permissible error MPE*1 (mm)			Measuring force MPL (N)	Net mass (g)	
w/lug	Flat back			MPE _E *3	Hysteresis MPE _H	Repeatability MPE _R		w/lug	Flat back
543-700	543-700B	12.7	0.0005/ 0.001/0.01 (selectable)	0.003	0.002	0.002	1.5 or less	175	165
543-705*2	543-705B*2						0.4 to 0.7	170	160
—	543-720B						1.8 or less	—	195
—	543-730B	50.8		0.005			2.3 or less	—	260
543-710	543-710B	12.7	0.01	0.02	0.02	0.01	0.9 or less	170	160
543-715*2	543-715B*2						0.2 to 0.5	165	155
—	543-725B						1.8 or less	—	190
—	543-735B	50.8		0.04			2.3 or less	—	245

*1 These values apply at 20 °C.

*2 Low measuring force

*3 Error of indication for the total measuring range

Inch/ Metric									
Order No.		Range	Resolution	Maximum permissible error MPE*1			Measuring force MPL (N)	Net mass (g)	
w/lug	Flat back			MPE*3	Hysteresis MPEH	Repeatability MPEr		w/lug	Flat back
543-701	543-701B	0.5 in/ 12.7 mm	0.00002/ 0.00005/ 0.0001/ 0.0005 in (selectable)	±0.00012 in /0.003 mm	0.00008 in /0.002 mm	0.00008 in /0.002 mm	1.5 or less	175	165
543-702	543-702B						1.5 or less	195	165
543-706*2	543-706B*2						0.4 to 0.7	170	160
543-707*2	543-707B*2	1 in/ 25.4 mm		±0.0002 in /0.005 mm	0.00008 in /0.002 mm	0.00008 in /0.002 mm	0.4 to 0.7	190	160
—	543-721B						1.8 or less	—	195
—	543-722B						1.8 or less	—	195
—	543-731B	2 in/ 50.8 mm	0.01 mm (selectable)	±0.0002 in /0.005 mm	0.00008 in /0.002 mm	0.00008 in /0.002 mm	2.3 or less	—	260
—	543-732B	2.3 or less					—	260	
543-711	543-711B	0.5 in/ 12.7 mm	0.0005 in/ 0.01 mm	±0.001 in /0.02 mm	0.001 in /0.02 mm	0.0005 in /0.01 mm	0.9 or less	170	160
543-712	543-712B						0.9 or less	190	160
543-716*2	543-716B*2						0.2 to 0.5	165	155
543-717*2	543-717B*2	1 in/ 25.4 mm		±0.0015 in /0.04 mm	0.001 in /0.02 mm	0.0005 in /0.01 mm	0.2 to 0.5	185	155
—	543-726B						1.8 or less	—	190
—	543-727B						1.8 or less	—	190
—	543-736B	2 in/ 50.8 mm		±0.0015 in /0.04 mm	0.001 in /0.02 mm	0.0005 in /0.01 mm	2.3 or less	—	245
—	543-737B	2.3 or less					—	245	

*1 These values apply at 20 °C.

*2 Low measuring force

*3 Error of indication for the total measuring range

Refer to "Optional accessories" on page 2-31.

Dimensions

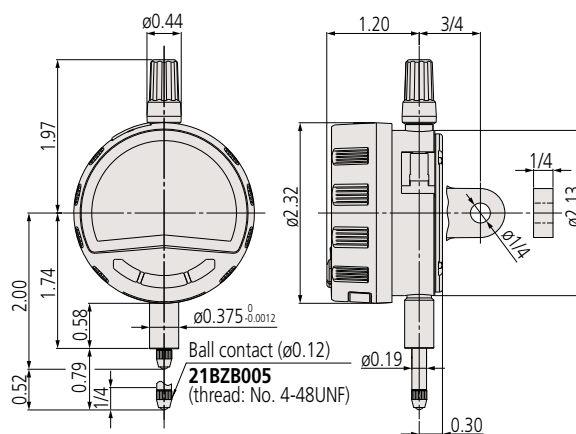
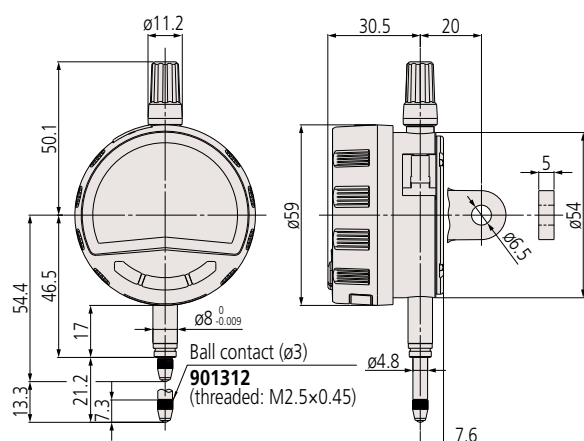
12.7 mm range models

ISO/JIS
Type

Unit: mm

ASME/ANSI/AGD
Type

Unit: in



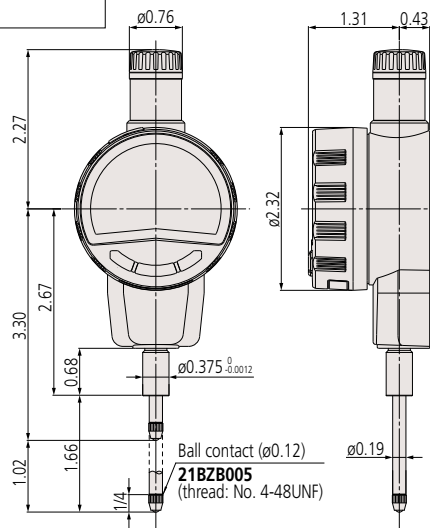
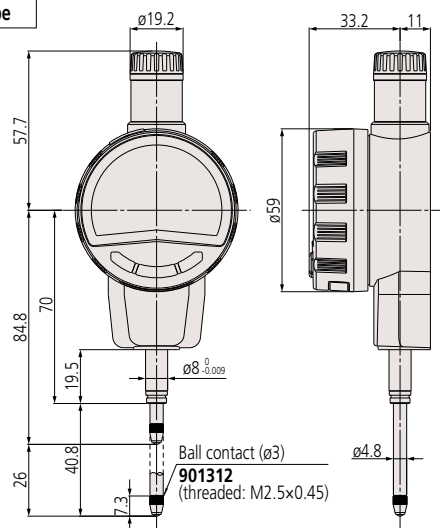
25.4 mm range models

ISO/JIS
Type

Unit: mm

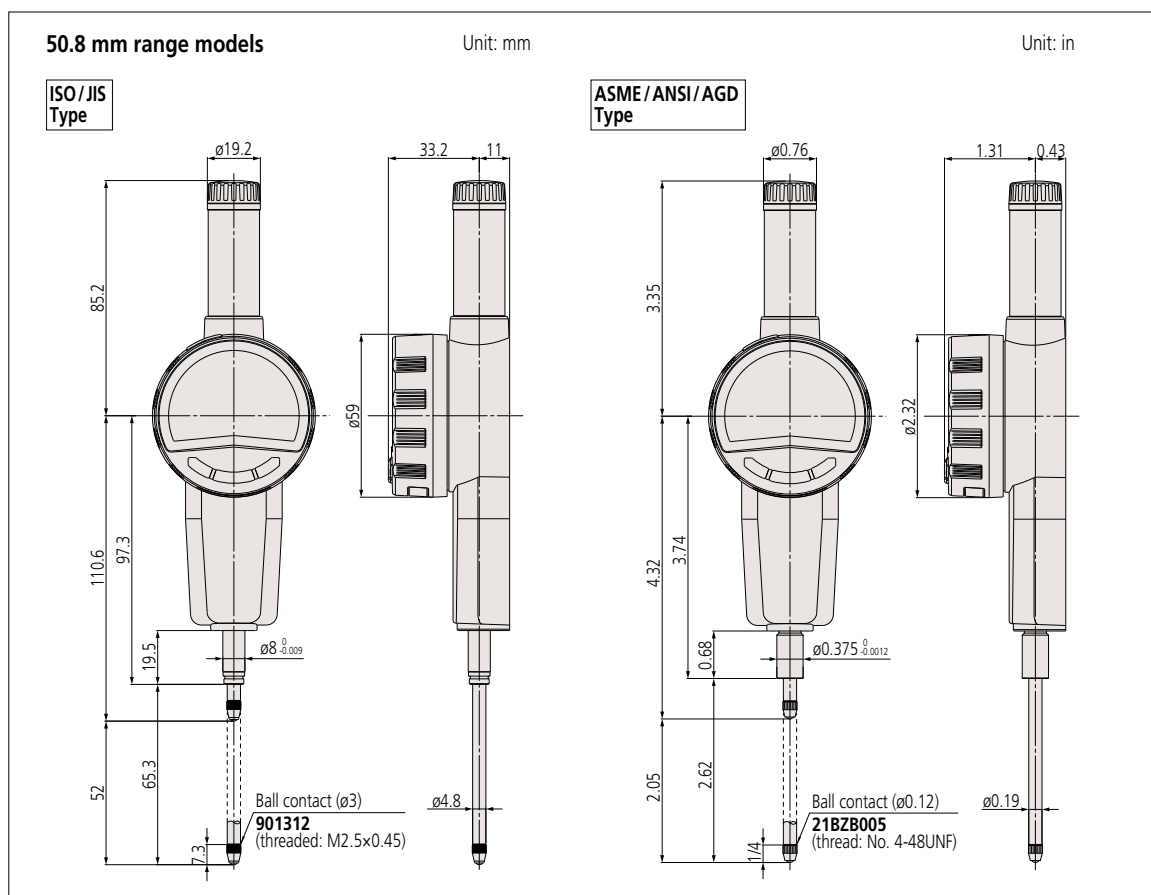
ASME/ANSI/AGD
Type

Unit: in



Note: Products with an Order No. suffixed "B" have a plain back, and other models have a center-lug back.

Refer to "Optional accessories" on page 2-31.



Note: Products with an Order No. suffixed "B" have a plain back, and other models have a center-lug back.

Technical data

- Display: 7-digit LCD, sign, and analog bar
- Battery: CR2032 (1 pc.) for initial operational checks (standard accessory)
- Battery life: Approx. 2,700 hours of continuous use.

- Approx. 2.5 years under normal use.
Note: Depends on use of the indicator. The above values are reference values.
- Maximum response speed: Unlimited (except for scanning measurement)

Functions

- Peak detection (MAX/MIN)
- Runout range measurement (MAX - MIN)
- Zero-setting (INC system)
- Presetting (ABS system)
- Measuring direction switching
- Tolerance judgment
- Resolution switching
(For 0.0005 mm or 0.00002 inch resolution type)
- Simple calculation: $f(x) = Ax$
- Function Lock
- Calibration schedule warning
- Auto power ON/OFF
- Data output
- Display value holding
(when no external device is connected)
- 330° rotary display
- Low battery/voltage alarm display
- Error alarm display

Spindle orientation for measurement

- Standard models with measuring range 12.7 mm: Usable in all orientations.
- Models with measuring range 25.4 or 50.8 mm:
Usable between the contact point pointing downward and spindle in horizontal orientation. To use the contact point pointing upward, the auxiliary spindle spring (optional) is required.
- Low measuring force model: See "Setting measuring force on low measuring force models" below.

Setting measuring force on low measuring force models

- The measuring force of models with low measuring force can be set by combining standard accessory springs and weights.

543-715(B)/716(B)/717(B)

Spindle orientation	Spring	Weight (approximately 0.1 N)	Maximum measuring force (N)
Pointing vertically downward	Yes	Yes	0.5 or less
	Yes	No	0.4 or less
	No	Yes	0.3 or less
	No	No	0.2 or less
Horizontal	Yes	No	0.3 or less

Note: Operation using configurations other than shown above is not guaranteed.

543-705(B)/706(B)/707(B)

Spindle orientation	Spring	Weight (approximately 0.1 N)	Maximum measuring force (N)
Pointing vertically downward	Yes	Yes	0.7 or less
	Yes	No	0.6 or less
	No	Yes	0.4 or less
	No	No	Not guaranteed

Note: Operation using configurations other than shown above is not guaranteed.

Refer to "Optional accessories" on page 2-31.

ABSOLUTE Digimatic Indicator ID-N/B SERIES 543 — with Dust/Water Protection Conforming to IP66

- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Rated to IP66: can be used satisfactorily even in adverse environments where the indicator is subject to splashing by cutting fluid or coolant.
- Slim body design (body width: only 35 mm) is advantageous in multipoint measurement situations where space is restricted. The LCD readout can also be rotated 180° to allow reading from the most convenient direction.
- Succeeded in digitalization of the Back Plunger type widely used for dial indicators for **ID-B**.
A 5 mm-stroke plunger with a higher degree of accuracy has been implemented by adopting a direct reading scale for plunger displacement.
- Tolerance judgment can be performed by setting upper and lower tolerance limits. The judgment result (GO/NO-GO) can be displayed in full-size characters.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



Rated to IP66 water- and dust-proofing standard and oil resistance improved.



Body width 35 mm



LCD readout reversal function

Tips

For details of each mark, see Intro page 13.



IP66 dust/water protection level

Level 6: Dust-proof

No ingress of dust allowed.

Level 6: Protected against powerful water jets

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

For details on the dust/water protection level test conditions, refer to IEC 60529: 2001 and JIS C 0920: 2003.

Refer to "Optional accessories" on page 2-32.

Specifications

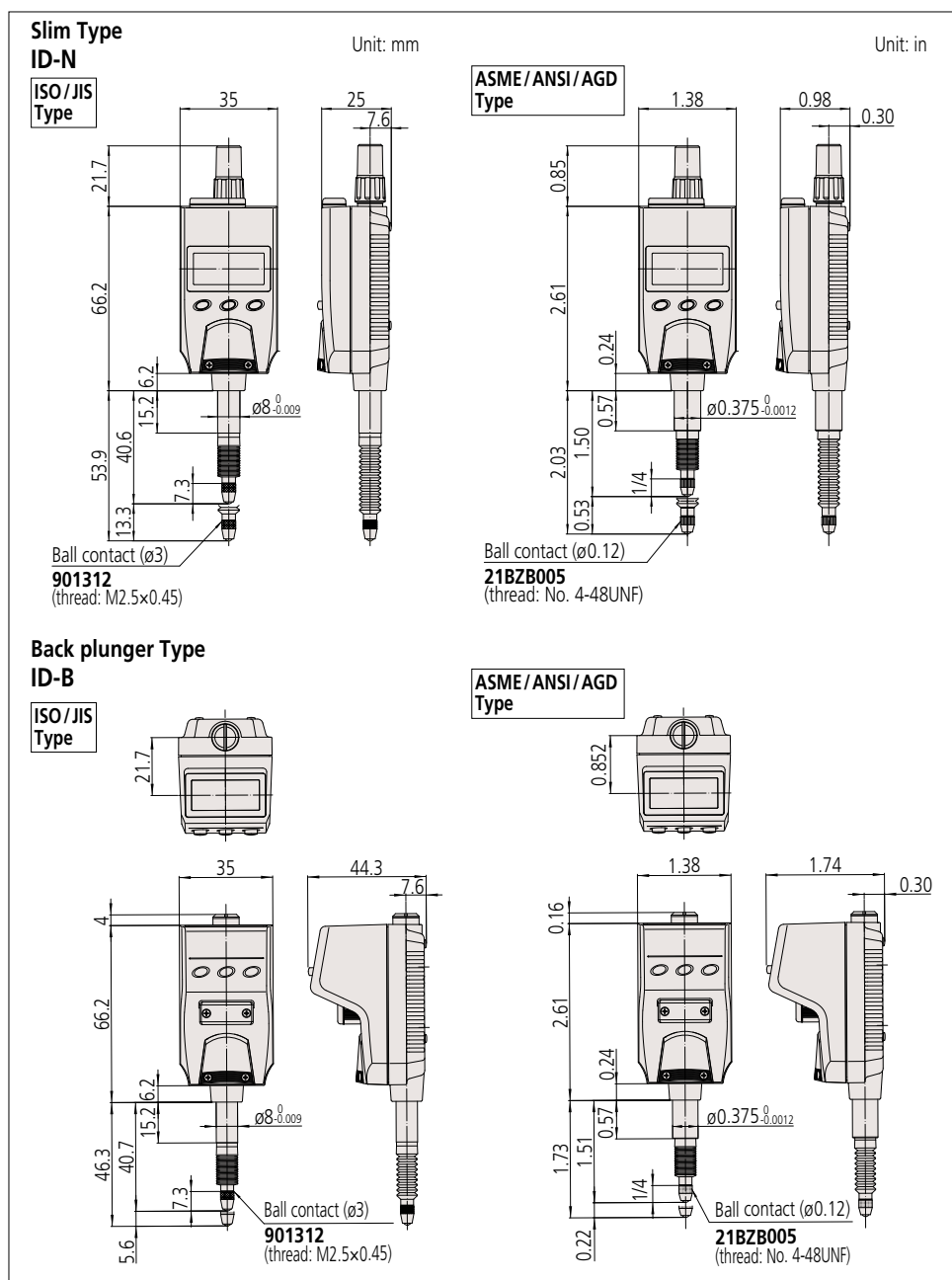
Metric							ISO/JIS type	ASME/ANSI/AGD type
Order No.	Range (mm)	Resolution (mm)	Maximum permissible error (mm)			Measuring force MPL (N)		
			MPE _E *	Hysteresis MPE _H	Repeatability MPE _R			
543-570	12.7	0.01	0.02	0.02	0.01	2.5 or less		Slim type
543-580	5.0					2.0 or less		Back Plunger type
543-575	12.7	0.01/0.001 (selectable)	0.01/0.003	0.002	0.002	2.5 or less		Slim type
543-585	5.0					2.0 or less		Back Plunger type

Inch / Metric							ISO/JIS type	ASME/ANSI/AGD type
Order No.	Range (in)	Resolution	Maximum permissible error			Measuring force MPL (N)		
			MPE _E *	Hysteresis MPE _H	Repeatability MPE _R			
543-571	0.5	0.0005 in/0.01 mm	±0.001 in/0.02 mm	0.001 in/0.02 mm	0.0005 in/0.01 mm	2.5 or less		Slim type
543-581	0.2					2.0 or less		Back Plunger type
543-576	0.5	0.00005/0.0005 in/0.001/0.01 mm (selectable)	±0.0001 in/0.003 mm	0.0001 in/0.002 mm	0.0001 in/0.002 mm	2.5 or less		Slim type
543-586	0.2					2.0 or less		Back Plunger type

* Error of indication for the total measuring range

Note: One silver oxide button cell (SR44) for monitor included

Dimensions



Refer to "Optional accessories" on page 2-32.

Typical applications



Functions

- Zero-setting (INC system)
- Presetting (ABS system)
- Measuring direction switching
- Tolerance judgment
- LCD readout reversal
- Resolution switching
(For 0.001 mm or 0.00005 in resolution type)
- Data output
- Display value holding
(when no external device is connected)
- Low battery voltage alarm display
- Error alarm display

Refer to "Optional accessories" on page 2-32.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Peak-Value Hold Type

- Run-out/MAX-MIN Hold function enables GO/NG judgment*1 for peak or difference values.
- Five buttons, status icons, and clear button indications allow for easy operation of a wide variety of functions.
- Wide LCD and new analog bar graph are now standard on all models.
- The ABS (absolute) scale restores the last origin position*2 automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- By using the parameter setup kit (optional) and the dedicated software, the functions and the parameters can be configured using a computer.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

*1 Tolerance judgment results cannot be output.

*2 Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



543-300-10

Tips

For details of each mark, see Intro page 13.

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Specifications

Metric		ISO/JIS type				ASME/ANSI/AGD type			
Order No. (w/lug, flat back)	Range (mm)	Resolution (mm)	Maximum permissible error (mm)			Measuring force MPL (N)	Power supply	Battery life (normal use)*2	Net mass (g)
			MPE _E *1	Hysteresis MPE _H	Repeatability MPE _R				
543-300-10	12.7	0.001/ 0.01 (selectable)	0.003	0.002	0.002	1.5 or less	CR2032x1 pc.	Approx. 1 year	180
543-300B-10*3									170

Inch / Metric

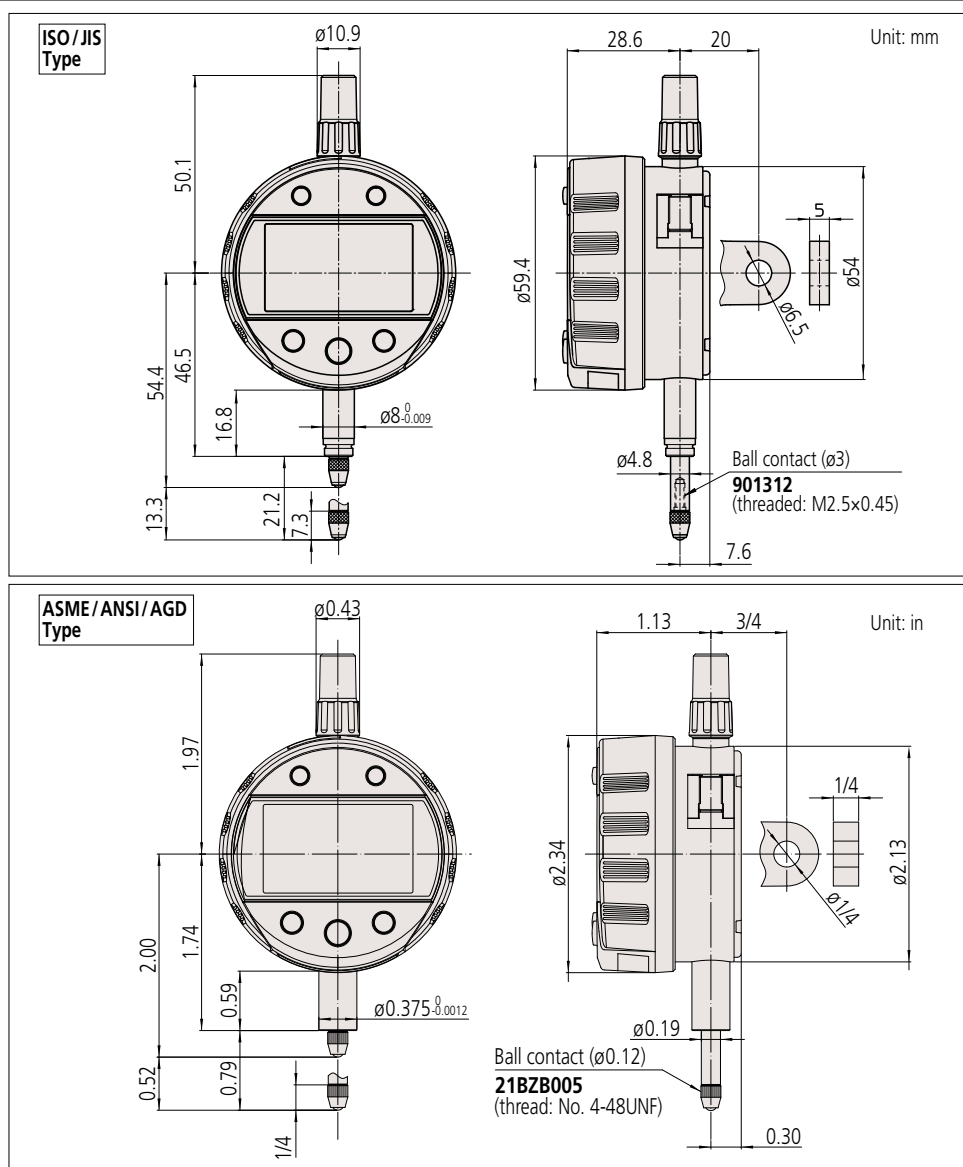
Order No. (w/lug, flat back)	Range	Resolution	Maximum permissible error			Measuring force MPL (N)	Power supply	Battery life (normal use)*2	Net mass (g)
			MPE _E *1	Hysteresis MPE _H	Repeatability MPE _R				
543-301-10	0.5 in/ 12.7 mm	0.00005/ 0.0001/	±0.00010 in /0.003 mm	0.00010 in /0.002 mm	0.00010 in /0.002 mm	1.5 or less	CR2032x1 pc.	Approx. 1 year	180
543-301B-10*3		0.0005 in,							170
543-302-10		0.001/0.01 mm							195
543-302B-10*3		(selectable)							170

*1 Error of indication for the total measuring range

*2 Applies only if not connected to a data processor. Battery life depends on use of the indicator. Use the above value as a guide only.

*3 Flat back

Dimensions



Functions

- Peak detection (MAX/MIN)
- Runout (MAX - MIN) Hold

Note: Peak detection

- 1) Sampling rate: 50 readings/s
- 2) Capturing speed: 50 µm/s (max.)

- Zeroset (INC system)
- Preset function (ABS system)
- Measuring direction switching
- Tolerance judgment (3 pairs of ABS, INC memory function)
- Resolution selection

- Simple calculation $f(x) = Ax$
- Analog bar resolution selection
- Key lock
- in/mm conversion (inch/mm type)
- Display hold (when no external device is connected)
- Data output
- External PC setting input
- Display rotation (330°)
- Low battery voltage alarm display
- Error alarm display

Refer to "Optional accessories" on page 2-33.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Bore Gage Type

- Dedicated to inside measurement with minimum-value Hold and tolerance judgment functions*¹.
Use together with a Mitutoyo bore gage.
- Five buttons, status icons, and clear button indications allow for easy operation of a wide variety of functions.
- Wide LCD and new analog bar graph are now standard on all models.
- Can store up to three sets of master reference values and tolerances, alleviating the need for multiple settings to master gages.
- The ABS (absolute) scale restores the last origin position*² automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- By using the parameter setup kit (optional) and the dedicated software, the functions and the parameters can be configured using a computer.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

*1 Tolerance judgment results cannot be output.

*2 Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



543-310B-10



Typical application
The Bore Gage is optional.

Tips

For details of each mark, see Intro page 13.

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■The ABSOLUTE Digimatic Bore Gage



ABSOLUTE Digimatic Bore Gages, which integrate the display with a bore gage measuring unit, are also available.
Please contact your local Mitutoyo sales office.

Refer to "Optional accessories" on page 2-34.

Specifications

Metric

ISO/JIS type ASME/ANSI/AGD type

Order No.	Range (mm)	Resolution (mm)	Maximum permissible error (mm)			Measuring force MPL (N)	Power supply	Battery life (normal use)*2	Net mass (g)
			MPE _E *1	Hysteresis MPE _H	Repeatability MPE _R				
543-310B-10	12.7	0.001/0.01 (selectable)	0.003	0.002	0.002	1.5 or less	CR2032 x1 pc.	Approx. 1 year	170

Inch/Metric

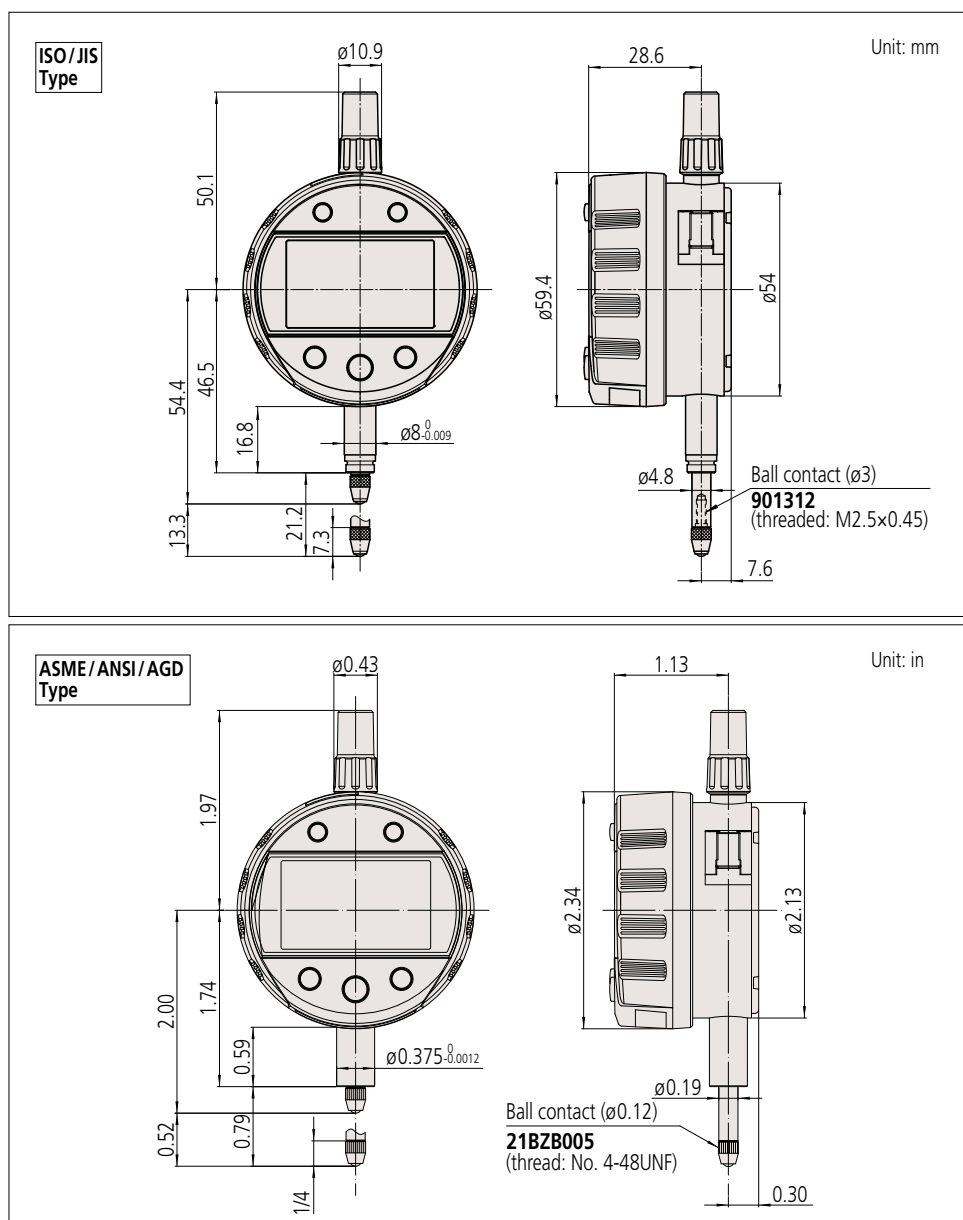
Order No.	Range	Resolution	Maximum permissible error			Measuring force MPL (N)	Power supply	Battery life (normal use)*2	Net mass (g)
			MPE _E *1	Hysteresis MPE _H	Repeatability MPE _R				
543-311B-10	0.5 in/12.7 mm	0.00005/0.0001/0.0005 in, 0.001/0.01 mm (selectable)	±0.00010 in / 0.003 mm	0.00010 in / 0.002 mm	0.00010 in / 0.002 mm	1.5 or less	CR2032 x1 pc.	Approx. 1 year	170
543-312B-10									

*1 Error of indication for the total measuring range

*2 Applies only if not connected to a data processor. Battery life depends on use of the indicator. Use the above value as a guide only.

Note: Flat-back type only.

Dimensions



Functions

- Minimum value detection
Note: Peak detection
 - 1) Sampling rate: 50 readings/s
 - 2) Capturing speed: 50 μm/s (max.)
- Preset (3 Preset values can be stored)
- Tolerance judgment (3 sets of upper and lower limits can be stored)
- Resolution selection
- Analog bar resolution selection
- Key lock
- Display hold (when no external device is connected)
- Data saving/calling (when no external device is connected)
- Data output
- External PC setting input
- Display rotation (330°)
- Low battery voltage alarm display
- Error alarm display

Refer to "Optional accessories" on page 2-34.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Calculation Type

- Calculation function operates on spindle displacement.
Entering the appropriate formula factors for a fixture dedicated to the application enables direct measurement readout, thereby eliminating any need for the conversion tables previously needed for those applications where fixtures are typically used.
- Five buttons, status icons, and clear button indications allow for easy operation of a wide variety of functions.
- Wide LCD and new analog bar graph are now standard on all models.
- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- By using the parameter setup kit (optional) and the dedicated software, the functions and the parameters can be configured using a computer.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



543-342B-10

Tips

For details of each mark, see Intro page 13.

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Specifications

Metric				ISO/JIS type		ASME/ANSI/AGD type			
Order No.	Range (mm)	Resolution (selectable)	Maximum permissible error* ¹ (mm)			Measuring force MPL (N)	Power supply	Battery life (normal use)* ⁴	Net mass (g)
			MPE _E * ²	Hysteresis MPE _H	Repeatability MPE _R				
543-340B-10	12.7	12 steps* ⁴	0.003	0.002	0.002	1.5 or less	CR2032x1 pc.	Approx. 1 year	170
543-590B-10	25.4					1.8 or less* ³			190
543-595B-10	50.8					2.3 or less* ³			260

Inch/Metric									
Order No.	Range	Resolution (selectable)	Maximum permissible error* ¹			Measuring force MPL (N)	Power supply	Battery life (normal use)* ⁴	Net mass (g)
			MPE _E * ²	Hysteresis MPE _H	Repeatability MPE _R				
543-341B-10	0.5 in	12 steps* ⁴	±0.0001 in /0.003 mm	0.0001 in /0.002 mm	0.0001 in /0.002 mm	1.5 or less	CR2032x1 pc.	Approx. 1 year	170
543-342B-10	/12.7 mm								
543-591B-10	1 in					1.8 or less* ³			190
543-592B-10	/25.4 mm								
543-596B-10	2 in					2.3 or less* ³			260
543-597B-10	/50.8 mm								

*¹ Valid for resolution set to 0.001 mm/0.00005 in and coefficients A=1, B=0 and C=0.

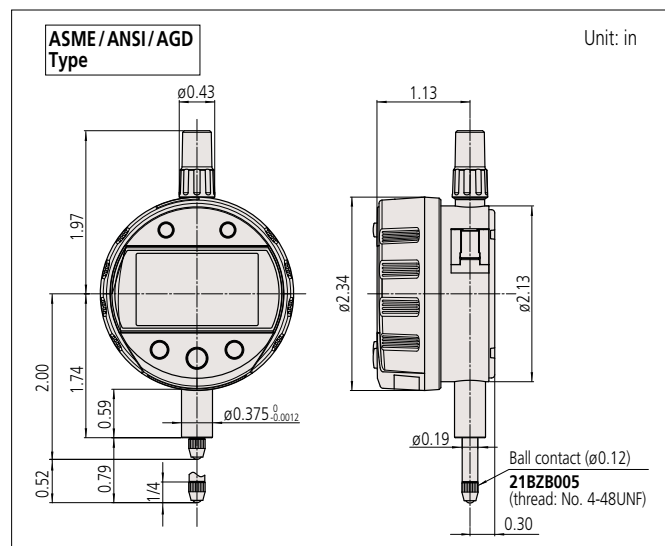
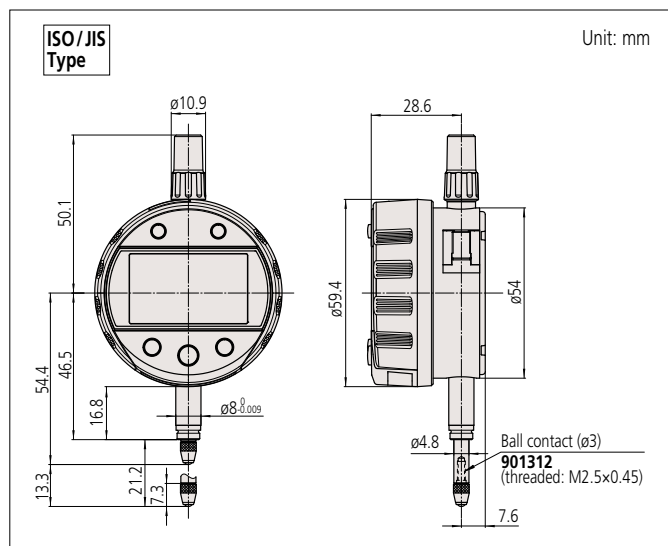
*² Error of indication for the total measuring range

*³ Applies for a spindle orientation between the spindle pointing vertically downward to the spindle horizontal.

*⁴ Applies only if not connected to a data processor. Battery life depends on use of the indicator. Use the above value as a guide only.

Note: Flat-back type only.

Dimensions



Functions

- Calculation $f(x') = Ax' + B + Cx'^{-1}$
($x' = x + \text{offset}$)

- Peak detection (MAX/MIN)
- Runout (MAX - MIN) Hold

Note: Peak detection

- 1) Sampling rate: 10 readings/s
- 2) Capturing speed: 10 $\mu\text{m/s}$ (max.)

Settings can be changed to:

- 1) Sampling rate: 50 readings/s
 - 2) Capturing speed: 50 $\mu\text{m/s}$ (max.)
- Zero-setting (INC system)
 - Preset (ABS system)
 - Tolerance judgment
(3 pairs of ABS, INC memory function)
 - Analog bar resolution selectable
 - Key lock

- Display hold (when no external device is connected)
- Data output
- External PC setting input
- Display rotation (330°)
- Low battery voltage alarm display
- Error alarm display
- Resolution switching*

Resolution (mm)			Resolution (in)		
0.0002	0.005	0.1	0.00001	0.0002	0.005
0.0005	0.01	0.2	0.00002	0.0005	0.01
0.001	0.02	0.5	0.00005	0.001	0.02
0.002	0.05	1	0.0001	0.002	0.05

* Since the calculation resolution is one micrometer (0.001 mm), using sub-micrometer resolution settings may result in the 4th-place digit being unreliable, particularly when B is set to a very low value and C=0. It does not change at all with certain combinations of calculation coefficient (for example, A=1, B=C=0). The 3rd-place digit representing micrometers (if displayed) is always reliable.

Refer to "Optional accessories" on page 2-35.

Typical applications

Ball diameter



Outside diameter



Outside radius



Countersink diameter



Examples of measuring various features

Item		D=Countersink diameter/Groove width; H=Countersink depth/Groove depth			R=Outside radius of round object		R=Inside radius of round object	R=Outside radius of round object	
Fixture type*1									
Contact point		Cone	Ball	Cone	—				
Measuring method x: Spindle displacement									
Calculation		D=Ax	D=Ax+B	H=Ax+B	D=Ax	R=Ax	R=Ax+B+Cx ⁻¹	R=A(x+d)+B+C(x+d) ⁻¹	
Coefficient values	A	$-2 \tan \frac{\theta}{2}$	$-2 \tan \frac{\theta}{2}$	-1	$-2 \tan \frac{\theta}{2}$	$-\frac{\sin \frac{\theta}{2}}{1 - \sin \frac{\theta}{2}}$	$\frac{1}{2}$	$-\frac{1}{2}$	$\frac{1}{2}$
	B	0	$2r \left(\frac{1}{\cos \frac{\theta}{2}} - \tan \frac{\theta}{2} \right)$	$r \left(\frac{1}{\sin \frac{\theta}{2}} - 1 \right) - \frac{d}{2 \tan \frac{\theta}{2}}$	0	0	-r	r	-r
	C	0	0	0	0	0	$\frac{L^2}{2}$	$-\frac{L^2}{2}$	$\frac{L^2}{2}$
Origin offset value (function ON/OFF)		d (OFF)	0 (OFF)	0 (OFF)	0 (OFF)	0 (OFF)	0 (OFF)	0 (OFF)	d (ON)
ORIGIN-set position (x=0 position)									
Displayed measurement value at ORIGIN-set position (Value displayed when x=0)		0	Value of coefficient B	0	0	0	Err 30* ² (Overflow error of Display value)	Depends on value of d	

*1 A dedicated fixture for a workpiece can be made to order.

*2 The error is cleared when the measured value returns to the displayable range as a result of moving the spindle.

ABSOLUTE Digimatic Indicator ID-C SERIES 543 — Signal Output Function Type

- Enables GO/NG judgment to be output to external equipment for a measurement result against the peak values set. Solid-state switching provides high reliability by avoiding metallic switch contacts.
- The signal can be output to an external device such as a sequencer. The GO/NG judgment result is also indicated by the green/red LED and the signs on LCD.
- A peak-detection function makes runout measurements easy.
- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Provided with a 4 m cable.
- External power supply required is 5-24 VDC/100 mA (max.).
- Dust-water protection level: IP54.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



Tips

For details of each mark, see Intro page 13.



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Specifications

Metric

ISO/JIS type ASME/ANSI/AGD type

Order No.	Range (mm)	Resolution (mm)	Maximum permissible error (mm)			Measuring force MPL (N)	Net mass (g)
			MPE _E *1	Hysteresis MPE _H	Repeatability MPE _R		
543-350-10	12.7	0.001/0.01 (selectable)	0.003	0.002	0.002	2.5 or less	295
543-350B-10*2							285

Inch / Metric

Order No.	Range	Resolution	Maximum permissible error			Measuring force MPL (N)	Net mass (g)
			MPE _E *1	Hysteresis MPE _H	Repeatability MPE _R		
543-351-10	0.5 in / 12.7 mm	0.00005/0.0001/ 0.0005 in, 0.001/0.01 mm (selectable)	±0.00010 in / 0.003 mm	0.0001 in / 0.002 mm	0.0001 in / 0.002 mm	2.5 or less	295
543-351B-10*2							285
543-352-10							295
543-352B-10*2							285

*1 Error of indication for the total measuring range

*2 Flat back

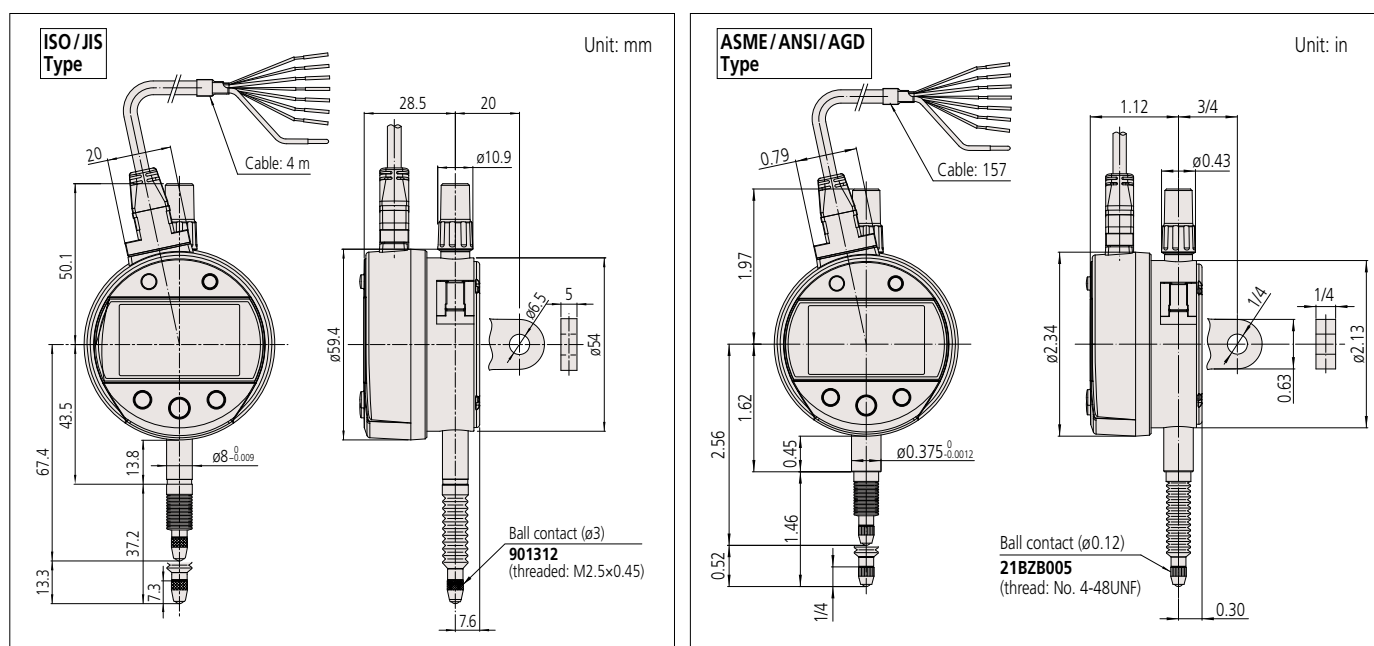
Note 1: LCD readout does not rotate.

Note 2: MAX/MIN holding: sample rate is 100 readings/s; max. rate of change of reading is 100 µm/s or less.

Note 3: Standard contact point: **901312** (ISO/JIS type), **21B2B005** (ANSI/AGD type)

Refer to "Optional accessories" on page 2-36.

Dimensions



Functions

- Signal output
(-NG/OK/+NG, N-ch open drain, logical invert is available)
- Remote control (peak start preset/zero-set)
- Peak detection (MAX/MIN)
- Runout range measurement (MAX - MIN)
- Zero-setting (INC system)
- Presetting (ABS system)
- Measuring direction switching
- Tolerance judgment (3 pairs of ABS, INC memory function)
- Resolution switching
- Simple calculation: $f(x) = Ax$
- Key lock
- Calibration mode (Signal output in Digimatic code format)
- Error alarm display

Output signals and LCD display

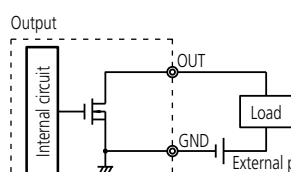
Wire	- NG	OK	+ NG	ABS data composition error
Orange (- NG)	Low	High	High	High
Green (OK)	High	Low	High	High
Brown (+ NG)	High	High	Low	High
LED	Red	Green	Red	Red flashing
LCD	◀	○	▶	"x.xx E" indication

Note: Logical invert is available.

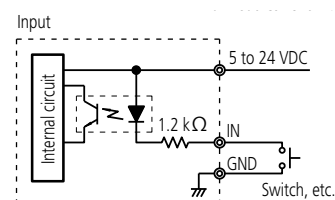
I/O Specifications

Wire	Signal	I/O	Description
Black	- V (GND)	—	Connected to minus (-) terminal
Red	+ V	—	Power supply (5 to 24 VDC)
Orange	- NG	O	Tolerance judgment result
Green	OK	O	output: Only the terminal corresponding to a judgment result is set to the low level.
Brown	+ NG	O	External input terminal: If the relevant terminal is set to the low level, its signal becomes true.
Yellow	PRESET_RECALL ZERO	I	
Blue	PEAK_START	I	
Shield	FG	—	Connected to GND (Earth)

Note: Measurement data cannot be output.



Load voltage: 5 to 24 VDC
Max. load current: 100 mA or less



Input current: Max. 20 mA

Refer to "Optional accessories" on page 2-36.

ABSOLUTE Digimatic Indicator ID-U SERIES 575 — Slim and Economical Design

- General-purpose slim indicator with a measuring range of 25.4 mm and a resolution of 0.01 mm.
- Cost-effective and user-friendly type with basic functions.
- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Battery life: approx. 20,000 hours in continuous use.
- Easy-to-read large LCD readout with a character height of 8 mm.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.



575-121

Tips

For details of each mark, see Intro page 13.

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Specifications

Metric ISO/JIS type ASME/ANSI/AGD type

Order No.	Range (mm)	Resolution (mm)	Maximum permissible error (mm)			Measuring force MPL (N)
			MPE _E *	Hysteresis MPE _H	Repeatability MPE _R	
575-121	25.4	0.01	0.02	0.02	0.01	1.8 or less

Inch / Metric

Order No.	Range	Resolution	Maximum permissible error			Measuring force MPL (N)
			MPE _E *	Hysteresis MPE _H	Repeatability MPE _R	
575-122	1 in /	0.0005 in /	±0.001 in / 0.02	0.001 in /	0.0005 in /	1.8 or less
575-123	25.4 mm	0.01 mm	mm	0.02 mm	0.01 mm	

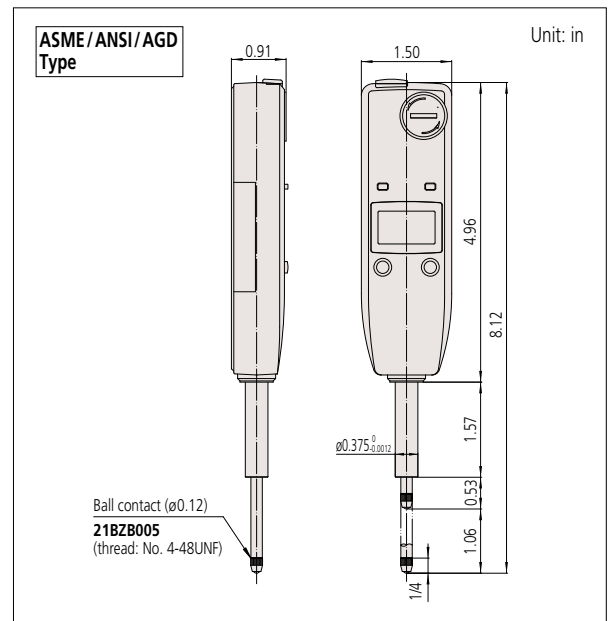
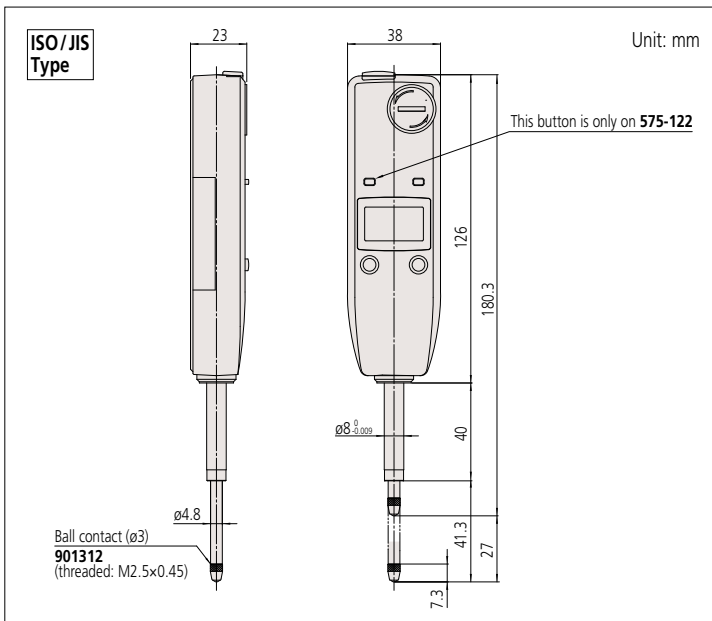
* Error of indication for the total measuring range

- Display: 5-digit LCD, sign
- Battery: SR44 (1 pc.), **938882** for initial operational checks (standard accessory)
- Battery life: Approx. 20,000 hours of continuous use.
Approx. 5 years under normal use.

Note: It varies depending on use frequency and method. Please take the values as rough indications.

- Lifting lever: **21EAA426** (standard accessory)

Dimensions



Functions

- Origin set (Zero-setting)
- Measuring direction switching
- Data output
- Low battery voltage alarm display
- Error alarm display

Refer to "Optional accessories" on page 2-37.

Digimatic Indicator ID-H SERIES 543 — High Accuracy and High Functionality Type

- A top-level digital indicator that supports high accuracy and multi-functional measurement.
- Take advantage of its high accuracy backed up by 0.0005 mm/0.00002 inch resolution, remote control functionality via a handheld controller (or an RS-232C interface) and easy runout measurements with the well-established analog bar display.
- With the optional remote controller, operations such as zero-setting and presetting can be made without touching the indicator body, thereby avoiding disturbance to the set-up.
- An advanced, remote control system can be implemented with the built-in RS-232C interface and a PC.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.



Remote controller (optional)



543-561

543-563

Tips

For details of each mark, see Intro page 13.

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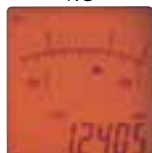


- Functionality meets the needs of diverse measurement applications.

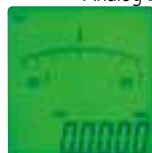
Tolerance judgment

OK

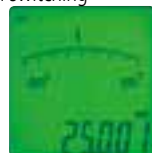
NG



Analog bar display



Resolution switching



- Measuring maximum value, minimum value and runout (MAX - MIN)

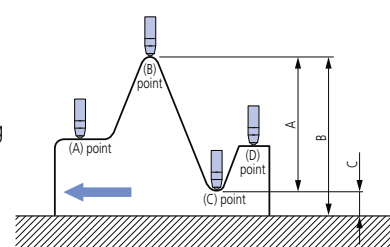
Maximum value/minimum value measurement



Difference/runout measurement



Example: Indicator traces between points <A> to <D>
Difference (or Total Runout) is displayed as <A>. Dimensions (maximum value) and <C> (minimum value) can be retrieved from memory with a simple key sequence or using the remote control (optional).



Specifications

Metric ISO/JIS type ASME/ANSI/AGD type

Order No. *1	Range (mm)	Resolution (mm)	Maximum permissible error (mm)			Measuring force MPL (N)	Net mass (g)
			MPE _E *2	Hysteresis MPE _H	Repeatability MPE _R		
543-561	30.4	0.0005/ 0.001	0.0015	0.0015	0.001	2.0 or less	290
543-563	60.9	(selectable)	0.0025	0.0025		2.5 or less	305

Inch/Metric

Order No. *1	Range	Resolution	Maximum permissible error			Measuring force MPL (N)	Net mass (g)
			MPE _E *2	Hysteresis MPE _H	Repeatability MPE _R		
543-562	1.2 in / 30.4 mm	0.00002 / 0.00005 / 0.0001 in, 0.0005 / 0.001 mm (selectable)	±0.00006 in / 0.0015 mm	0.00006 in / 0.0015 mm	0.00004 in / 0.001 mm	2.0 or less	300
543-564	2.4 in / 60.9 mm	(selectable)	±0.0001 in / 0.0025 mm	0.0001 in / 0.0025 mm		2.5 or less	

*1 To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, and no suffix is required for Japan.

*2 Error of indication for the total measuring range

Note 1: The indicator can output SPC (Digimatic) data consisting of up to 6 digits in full. If the data consists of 7 digits the first digit is not output (example: 123.4565 mm is output as 23.4565 mm).

Note 2: Regarding origin setting, refer to "Origin Setting of Digimatic Indicators" on page 2-29.

Note 3: The orientation for use can be from vertical (contact point pointing downward) to horizontal (spindle in horizontal orientation).

• Display: 7-digit LCD, sign, and analog bar with 2-color backlight

• Power supply: 5.9 V DC (via AC adapter) **06AGZ369***

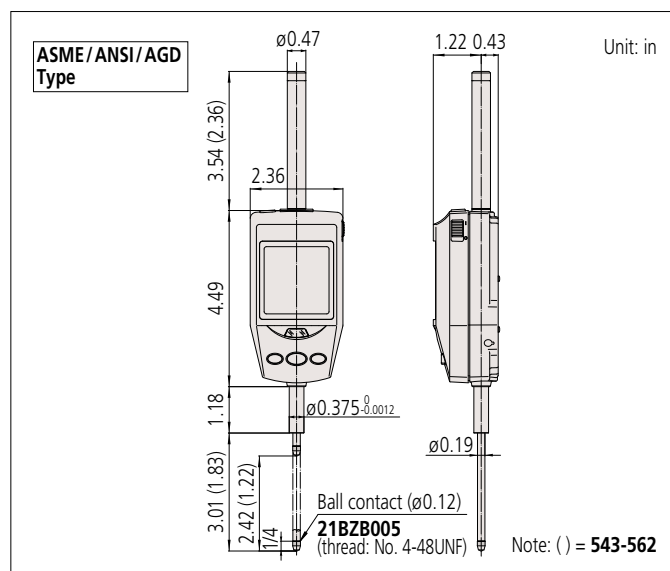
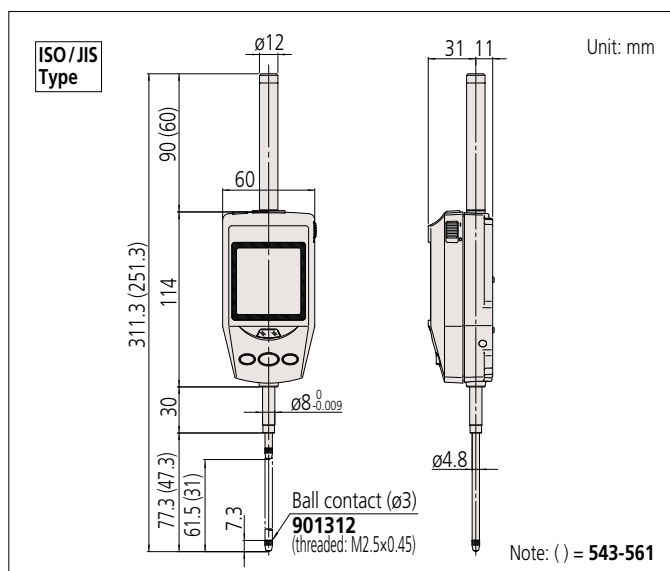
* To denote your AC line voltage add the following suffixes. **JA** for North America and Japan, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China.

• Positional detection method: Photoelectric-type reflection linear encoder

• Maximum response speed: 1000 mm/s

• Lifting lever: **21EAA426** (standard accessory)

Dimensions



High-performance ABS Digimatic Indicator ID-F SERIES 543 — with Back-lit LCD Screen

- Supports bidirectional communication between the **ID-F** and the computer, enabling data output to a computer and setting of various functions of **ID-F** from a computer.
- The face can be rotated 330° to maintain the ease of use and readability of the characters and the bar even when the **ID-F** is used horizontally or at an angle.
- GO/±NG judgment function: If a judgment result shows an out of tolerance condition, the display backlighting changes from green to red.
- An analog bar indicator has been integrated to make upper/lower limit and turnover point reading more comfortable.
- The ABS (absolute) scale restores the last origin position* automatically when the indicator is turned on, and realizes high reliability by eliminating over-speed errors.
- Easy-to-read large LCD readout with the height of the characters has been increased from 8.5 mm with the previous model to 11 mm (about 1.5 times as much).
- External power supply type: an AC adapter is a standard accessory. Does not require battery replacement.
- The maximum resolution is 0.5 μm (0.0005 mm). With a indication error corresponding to 0.0025 mm, this indicator can be used in high-precision applications.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems.

* Refer to "Origin Setting of Digimatic Indicators" on page 2-29.

Green indication
for GO judgment



Red indication for
±NG judgment



543-851



543-853

Tips

For details of each mark, see Intro page 13.

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Refer to "Optional accessories" on page 2-39.

Technical data

- Display: 7-digit LCD, sign, and analog bar with 2-color backlight
- Power supply: 5.9 V (via AC adapter) **06AGZ369***
- Lifting lever: **21EAA426** (standard accessory)

* To denote your AC line voltage add the following suffixes. **JA** for North America and Japan, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China.

Functions

- Peak detection (MAX/MIN)
- Runout range measurement (MAX - MIN)
- Zero-setting (INC system)
- Presetting (ABS system)
- Measuring direction switching
- Tolerance judgment
- Resolution switching
- Simple calculation $f(x) = Ax$
- Analog resolution selection
- Data hold (when not connected to an external device)
- Function Lock
- Calibration schedule warning
- Data output
- Display rotation (330°)
- Error alarm display

Contact Sensor

Non-contact Sensor

Display unit EC counter

SERIES 542 — Low-cost, Modular Type Display Unit

- -NG, OK and +NG tolerance judgment results can be displayed.
- Can be set to produce either tolerance judgment output or Digimatic output.
- Small size (96×48 mm) which conforms to DIN standards.



542-007

Tips

For details of each mark, see Intro page 13.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

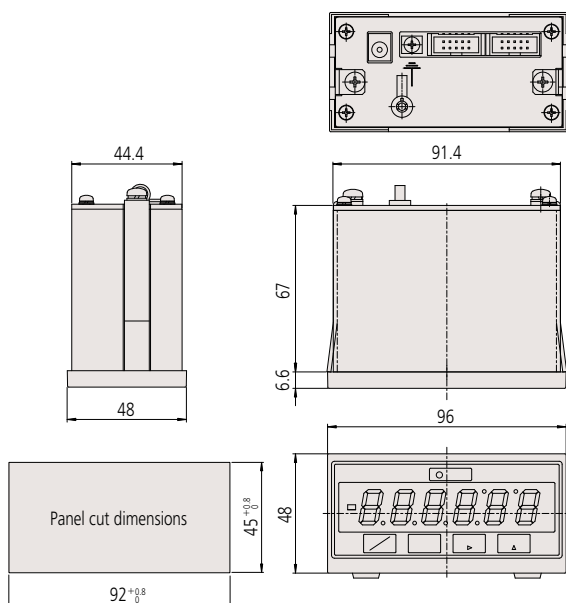
Specifications

Order No.	542-007*
Resolution () indicates maximum display range	0.01 mm (± 9999.99)/0.0005 in (± 99.9995 in)/0.001 in (± 999.999 in) 0.001 mm (± 9999.999)/0.00005 in (± 9.99995 in)/0.0001 in (± 99.999 in) [automatic setting by gage]
Tolerance judgment display	LED display (3 steps: Amber, Green, Red)
External output (switching type)	Tolerance judgment output: -NG, OK, +NG (open-collector) Data output: Digimatic output
Control input	External PRESET, external HOLD
Operating temperature	0 to 40 °C (RH 20 to 80%, no condensation)
Storage temperature	-10 to 50 °C (RH 20 to 80%, no condensation)
External dimensions	96 (W) × 48 (H) × 84.6 (D) mm
Power Supply	AC adapter: 12BAR954 AC cable: 12BAK729 (Japan), 12BAK730 (U.S.), 12BAK731 (EU), 12BAK734 (UK), 12BAK732 (China), 12BAK733 (Korea)
Standard Accessories	AC adapter, AC cable, rubber feet
Mass	500 g

* To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, and no suffix is required for Japan.

Dimensions

Unit: mm



Functions

- Preset
- Tolerance judgment (3 steps)

Origin setting of Digimatic Indicators



Repeatability in the range of 0.2 mm from the lowest rest point is not guaranteed for Digimatic indicators. When setting the origin or presetting a specific value, be sure to lift the spindle at least 0.2 mm from the lowest rest point.

Accessories for ID-SX2

Optional accessories

Lifting

Lifting lever	21EZA198
Lifting knob	21EZA105
Lifting cable	21JZA295

SPC Cable (For measurement data output)

905338	(1 m)
905409	(2 m)

USB Input Tool Direct Cable

06AFM380F (2 m)

Note: Please separately purchase **USB-ITPAK** since there is no data output switch on the measurement instrument.

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type):	264-020
IT-007R (RS-232C Communication Conversion Type):	264-007

Connecting Cables for U-WAVE-T

02AZD790F	(160 mm)
02AZE140F	(for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Contact points for Mitutoyo's digimatic indicators

Interchangeable backs

Measuring stands

Accessories for ID-CNX

Optional accessories

Lifting

Lifting lever: **21EZA198** (12.7 mm/0.5 inch type)

Lifting cable: **21JZA295**

(stroke 12.7 mm: 12.7 mm/0.5 inch type)

Lifting knob: **21EZA105** (12.7 mm/0.5 inch type)*¹

21EZA197 (25.4 mm/1 inch type)

21EZA200 (50.8 mm/2 inch type)

Lifting lever: **21EAA426** (for measuring range: 25.4 and 50.8 mm)

(supplied with 25.4 mm and 50.8 mm models as standard.)

*1 Not available for low measuring force models.

Auxiliary spindle spring

02ACA571 (25.4 mm/1 inch type)*²

02ACA773 (50.8 mm/2 inch type)*²

*2 Required when orienting the indicator upside down.

SPC Cable

06AGL011 (1 m)

06AGL021 (2 m)

USB Input Tool Direct Cable

06AGQ001F (2 m)

Measurement data collection software

USB-ITPAK V3.0 (paid-for version): **06AGR543**

Note: Parameter setting (from PC side) is possible when using the free version of USB-ITPAK V3.0 from the Mitutoyo website. The paid-for version unlocks additional features.

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020**

IT-007R (RS-232C Communication Conversion Type):

264-007

Connecting Cables for U-WAVE-T

02AZG011 (160 mm)

For foot switch: **02AZG021**

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Contact points for Mitutoyo's digimatic indicators

Interchangeable backs

Measuring stands

Accessories for ID-N/B

Optional accessories

Lifting knob (only for ID-N)

21EZA105 (ISO/JIS type)

21EZA150 (ASME/ANSI/AGD type)

Spindle can be manually lifted. Remove the spindle cap for **ID-N** and attach the lifting knob to the spindle. Note that water resistance is not maintained in this configuration.

Typical application using the lifting knob



Lifting knob

Rubber boot

For oil resistance (NBR) **21EAA423** (for **ID-N**)

21AAB562 (for **ID-B**)

For durability (silicone) **238774** (for **ID-N**)

21EAA212 (for **ID-B**)

SPC cable

21EAA194 (1 m)

21EAA190 (2 m)

Bifurcated connecting cable with zero-setting terminal

21EAA210 (1 m)

21EAA211 (2 m)

Two of the wires inside the cable are separated for zero setting without touching the SET switch on the main body. Use these wires in combination with commercially available switches. Zero setting is performed by briefly connecting these two wires together (less than a second), and ABS preset & recall by connecting for a second or more.



SPC cable



Bifurcated connecting cable with zero-setting terminal

USB Input Tool Direct Cable

06AFM380G (2 m)

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020**

IT-007R (RS-232C Communication Conversion Type):

264-007

Connecting Cables for U-WAVE-T

02AZD790G (160 mm)

02AZE140G (for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Lug

21EZA145 (ISO/JIS type)

21EZA146 (ASME/ANSI/AGD type)

Arm for ID-B

made-to-order

Contact points for Mitutoyo's digimatic indicators

Accessories for ID-C (Peak-Value Hold Type)

Optional accessories

Lifting

Lifting lever **21EZA198**Lifting knob **21EZA105**

SPC Cable

905338 (1 m)**905409** (2 m)

USB Input Tool Direct Cable

06AFM380F (2 m)

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020****IT-007R** (RS-232C Communication Conversion Type): **264-007**

Connecting Cables for U-WAVE-T

02AZD790F (160mm)**02AZE140F** (for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Parameter setup kit

21EZA313

Note: Parameter setting software (can be downloaded for free from the Mitutoyo website) is also required.



Parameter setup kit



Parameter setting software

Accessories for ID-C (Bore Gage Type)

Optional accessories

SPC Cable

905338 (1 m)

905409 (2 m)

USB Input Tool Direct Cable

06AFM380F (2 m)

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020**

IT-007R (RS-232C Communication Conversion Type): **264-007**

Connecting Cables for U-WAVE-T

02AZD790F (160mm)

02AZE140F (for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Parameter setup kit

21EZA313

Note: Parameter setting software (can be downloaded for free from the Mitutoyo website) is also required.

Accessories for ID-C (Calculation Type)

Optional accessories

Lifting

Lifting lever **21EZA198**Lifting knob **21EZA105**

SPC Cable

905338 (1 m)**905409** (2 m)

USB Input Tool Direct Cable

06AFM380F (2 m)

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020****IT-007R** (RS-232C Communication Conversion Type): **264-007**

Connecting Cables for U-WAVE-T

02AZD790F (160mm)**02AZE140F** (for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Parameter setup kit

21EZA313

Note: Parameter setting software (can be downloaded for free from the Mitutoyo website) is also required.

Accessories for ID-C (Signal Output Function Type)

Optional accessories

Lifting^{*1}

Lifting lever **21EZA198**

Lifting knob **21EZA105**

^{*1} Dust-water protection is not guaranteed.

Digimatic power supply unit

21EZA345

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, and no suffix is required for Japan.

Used in the calibration mode when executing automatic inspection using i-Checker **IC2000**.

In such a case, purchase connecting cable **21EAA194** (1 m), or **21EAA190** (2 m).

Note: It can't be used as a power supply when using in the normal mode.

Contact points for Mitutoyo's digimatic indicators

Interchangeable backs (water proof)

Accessories for ID-U

Optional accessories

Spindle lifting cable

21JZA295 (stroke: 10 mm)

SPC Cable

905338 (1 m)

905409 (2 m)

USB Input Tool Direct Cable

06AFM380F (2 m)

Note: Please separately purchase **USB-ITPAK** since there is no data output switch on the measurement instrument.

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020**IT-007R (RS-232C Communication Conversion Type): **264-007**

Connecting Cables for U-WAVE-T

02AZD790F (160mm)

02AZE140F (for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Contact points for Mitutoyo's digimatic indicators

Measuring stands

Accessories for ID-H

Optional accessories

Remote controller

21EZA099

Lifting cable(stroke 30 mm)

21JZA295

Lifting knob

21EZA101

SPC Cable

936937 (1 m)

965014 (2 m)

USB Input Tool Direct Cable

06AFM380D (2 m)

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020**

IT-007R (RS-232C Communication Conversion Type): **264-007**

Connecting Cables for U-WAVE-T

02AZD790D (160mm)

02AZE140D (for foot switch)

RS-232C Connecting cable (2 m)

21EAA131

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Lug-on-center back

101040 (ISO/JIS type)

101306 (ASME/ANSI/AGD type)

Contact points for Mitutoyo's digimatic indicators

Granite comparator stands

Comparator stands



Accessories for ID-FNX

Optional accessories

Lifting knob

21EZA197 (25.4 mm/1 inch type)

21EZA200 (50.8 mm/2 inch type)

Auxiliary spindle spring

02ACA571 (25.4 mm/1 inch type)

02ACA773 (50.8 mm/2 inch type)

SPC Cable

06AGL011 (1 m)

06AGL021 (2 m)

USB Input Tool Direct Cable

06AGQ001F (2 m)

Note: Use one per ID-FNX indicator.

Measurement data collection software

USB-ITPAK V3.0 (paid-for version): **06AGR543**

Note: Parameter setting (from PC side) is possible when using the free version of USB-ITPAK V3.0 from the Mitutoyo website. The paid-for version unlocks additional features.

Input Tool Series

IT-020U (USB Keyboard Signal Conversion Type): **264-020**

IT-007R (RS-232C Communication Conversion Type): **264-007**

Connecting Cables for U-WAVE-T

02AZG011 (160 mm)

02AZG021 (for foot switch)

Digimatic Mini-Processor

DP-1VA LOGGER: **264-505**

Note: To denote your AC line voltage add the following suffixes. **A** for North America, **D** for Europe, **E** for UK, **K** for Korea, **DC** for China, **B** for Oceania without AC adapter and no suffix is required for Japan.

Contact points for Mitutoyo's digimatic indicators

Interchangeable backs

Measuring stands

Chapter 3

MH

Micrometer Head

Embedded measuring instruments/ Precise feeding device

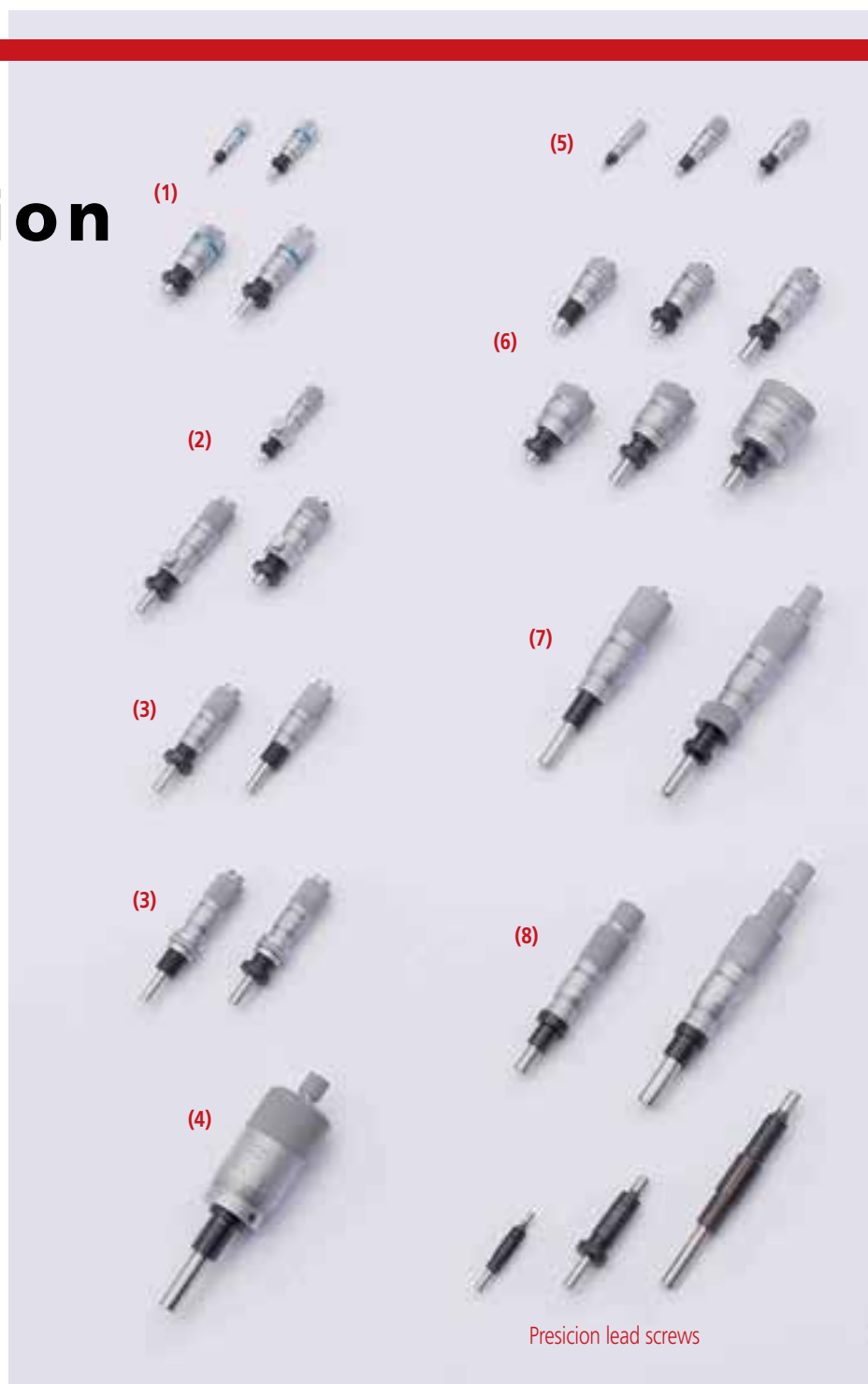
Micrometer Head Selection Guide	3-1
SERIES 164, 350 Digimatic Type	3-3
SERIES 148 Small/Ultra-small Type	3-9
SERIES 148 Short Thimble with Choice of Diameter	3-13
SERIES 148 Small Standard Type	3-17
SERIES 148 Small Thimble Diameter Standard Type	3-21
SERIES 149 Small Standard Type with Carbide-Tipped Spindle	3-25
SERIES 150 Medium-sized Standard Type	3-29
SERIES 151 Medium-sized Standard Type with 8 mm Diameter Spindle	3-33
SERIES 148 Locking-screw Type	3-37
SERIES 153 Non-rotating Spindle Type	3-41
SERIES 152 Quick Spindle Feed of 1 mm/rev	3-43
SERIES 148 Fine Spindle Feed of 0.1 mm/rev	3-45
SERIES 148 Fine Spindle Feed of 0.25 mm/rev	3-49
SERIES 110 Differential Screw Thread Translator (Extra-Fine Feed) Type	3-51
SERIES 152 Large Thimble Type	3-53
SERIES 152 XY-Stage Type	3-55
SERIES 197 Long Stroke Non-rotating Spindle	3-56
SERIES 153 High Accuracy and Resolution	3-57
SERIES 250 Digit Counter Type	3-58
Micro Jack	3-59
Micrometer Head Mounting Fixtures	3-61
Precision Leadscrews	3-63
Quick Guide to Precision Measuring Instruments	3-65

Micrometer Head Selection Guide

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

Mounted on measuring instruments and precision instruments, micrometer heads are used for various purposes including measurement, feeding and positioning. Recent developments in technology have seen the micrometer head widely utilized in precise feeding devices and cross-travel stages on laser instruments and manipulators, in addition to the usual duties on measurement jigs. In parallel with the application expansion, the customer's needs have increased. To meet customer demands, Mitutoyo provides standard micrometer heads with different measuring ranges, stem type and body size. Furthermore, high-performance types of Digimatic Micrometer Head, 0.1 mm spindle-pitch models (standard 0.5 mm), etc., are now available for the new applications. Mitutoyo also provides customization services for special applications. Micrometer heads with customized spindle tips and precision leadscrews manufactured to customer specification can be offered even in one-off quantities.

• Also refer to "Quick Guide to Precision Measuring Instruments" from page 3-65.



Precision lead screws

Range	Main feature of head		Series	Page
1 mm/0.02 in	High-function	Differential Screw Translator (Extra-Fine Feed) Type	110	3-51
2.5 mm/0.05 in	High-function	Differential Screw Translator (Extra-Fine Feed) Type (11)		3-51
5 mm/0.2 in	High-function	Fine Spindle Feed of 0.1 mm/rev (1)	148	3-46
	Standard	Small/Ultra-small Type (5)		3-9
6.5 mm/0.25 in	Standard	Locking-screw Type (2)		3-37 to 3-39
	High-function	Fine Spindle Feed of 0.1 mm/rev (1)		3-45
		Fine Spindle Feed of 0.25 mm/rev		3-49
	Standard	Small/Ultra-small Type (5)		3-9
10 mm	Standard	Short Thimble with Choice of Diameter (6)		3-13
		Large Thimble Type (13)	152	3-55
13 mm/0.5 in	High-function	Locking-screw Type (2)	148	3-38
		Fine Spindle Feed of 0.25 mm/rev	110	3-49
		Differential Screw Translator (Extra-Fine Feed) Type (11)		3-51
	Standard	Short Thimble with Choice of Diameter (6)	148	3-13
		Small Standard Type (3)		3-17
15 mm/0.5 in	High-function	Small Thimble Diameter Standard Type (10)		3-21
		Non-rotating Spindle Type (8)	153	3-41



Range	Main feature of head		Series	Page
15 mm/0.5 in	High-function	Quick Spindle Feed of 1 mm/rev (4)	152	3-43
	Standard	Small Standard Type with Carbide-Tipped Spindle (9)	149	3-25
25 mm/1 in	Digimatic	Clear digital display, Non-rotating spindle and IP 65 rated version (16)	350	3-3
		Clear digital display, Non-rotating spindle		3-5
	High-function	Non-rotating Spindle Type (8)	153	3-41
		Quick Spindle Feed of 1 mm/rev		3-43
		Large Thimble Type	152	3-53
		XY-Stage Type (14)		3-55
		High Accuracy and Resolution	153	3-57
		Digit Counter Type	250	3-58
	Standard	Medium-sized Standard Type (7)	150	3-29
		Medium-sized Standard Type with 8 mm Diameter Spindle	151	3-33
50 mm/2 in	Digimatic	Clear digital display (15)	164	3-3
	High-function	Rapid feed and positioning enabled with spindle pitch 1 mm	152	3-43
		Large-diameter thimble enables resolution 5x that of the standard type		3-53
	Standard	Long Stroke Non-rotating Spindle	197	3-56
		Medium-sized Standard Type with 8 mm Diameter Spindle (12)	151	3-33
60 - 75 mm	Micro Jack	Even stone surface plates can be accurately jacked up	7	3-59

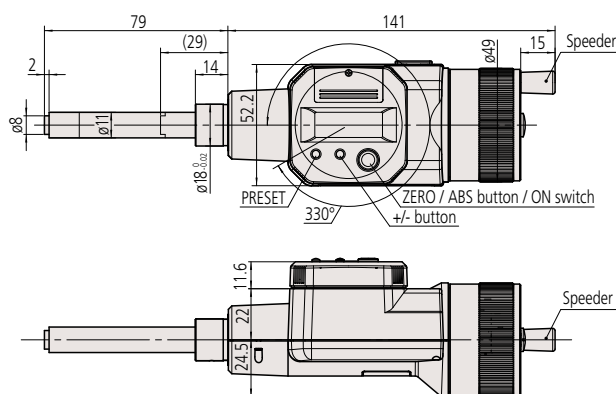
Micrometer Heads SERIES 164, 350 Digimatic Type

- Equipped with digital display and output.
- 350-28X-30, 350-261-30, 350-38X-30 and 350-361-30 are protection grade IP65, water-proof Digimatic micrometer heads.
- Digimatic models can be easily integrated into statistical process control and measurement systems.

Dimensions

Unit: mm

Plain stem



164-163 Rotatable display Mass: 490 g

(): with spindle fully retracted.

Special sizes and specifications

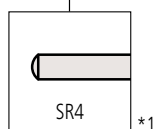
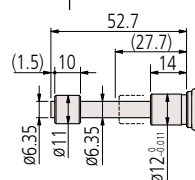
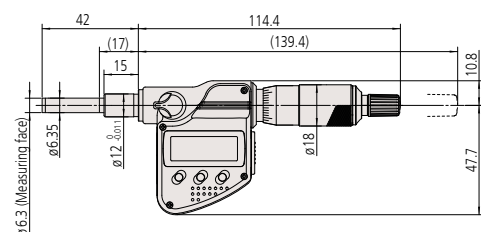


Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

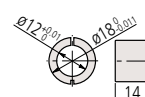
Dimensions

Unit: mm

Plain stem

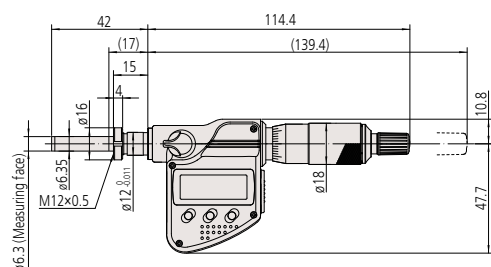


*1 Other dimensions are the same as **350-281-30**.



Bush (standard accessory)
350-261-30

Stem locknut



*2 Other dimensions are the same as **350-282-30**.
(): with spindle fully retracted.



Dust- and Water- Protected

U-WAVE/fit

Measurement Data Wireless Communication System
Bluetooth® communication enables wireless transfer of measurement data from digimatic micrometers and callipers to PCs, smartphones, tablets and such other devices.

Applicable models: **350-28X-30, 350-261-30, 350-38X-30 and 350-361-30**

Special sizes and specifications

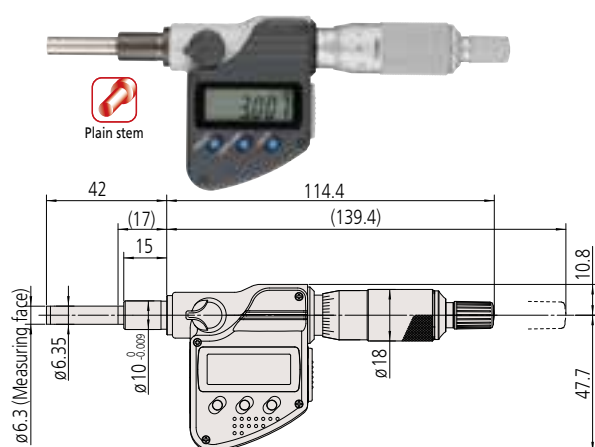


Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

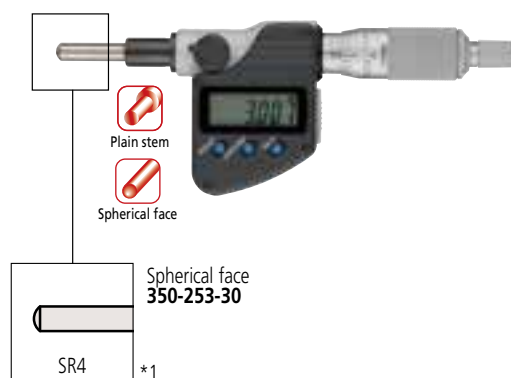
Dimensions

Unit: mm

Plain stem

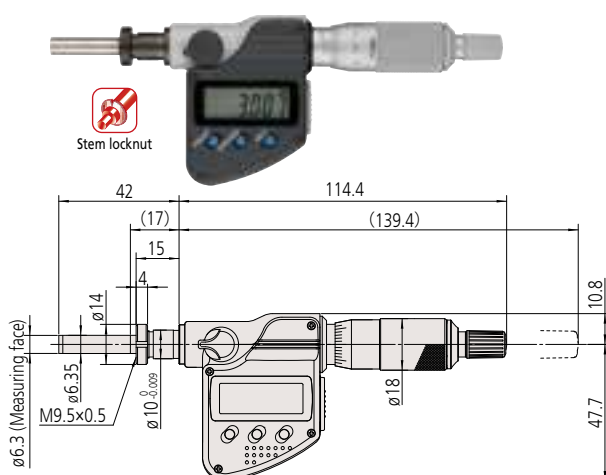


350-251-30
(Stem dia. 10 mm, for general use) Mass: 230 g

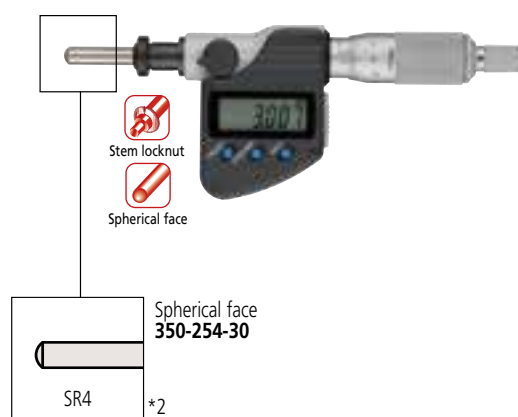


*1 Other dimensions are the same as **350-251-30**.

Stem locknut



• Fixture thickness: 11.5 mm
350-252-30
(Stem dia. 10 mm, for general use) Mass: 230 g



*2 Other dimensions are the same as **350-252-30**.
(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric

Order No.	Range (mm)	Resolution (mm)	Graduation (mm)	Stem	Stem dia. (mm)	Spindle end	Graduation features	Maximum permissible error J_{MPE} (μm)
164-163	0 - 50	0.001	—	Plain	18	Flat (carbide tip)	Standard	±3
350-251-30* ¹	0 - 25		0.01	W/clamp nut	10	Spherical (SR4) (carbide tip)		
350-252-30* ¹				Plain				
350-253-30* ¹				W/clamp nut				
350-254-30* ¹				Plain	12	Flat (carbide tip)		
350-281-30* ²				W/clamp nut		Spherical (SR4) (carbide tip)		
350-282-30* ²				Plain				
350-283-30* ²				W/clamp nut				Flat
350-284-30* ²				Plain				
350-261-30* ²				Plain				

Inch / Metric

Order No.	Range (in)	Resolution	Graduation	Stem	Stem dia. (in)	Spindle end	Graduation features	Maximum permissible error J_{MPE} (in)
164-164	0 - 2	0.00005 in/ 0.001 mm	—	Plain	0.709	Flat (carbide tip)	Standard	±0.00015
350-351-30*1	0 - 1		0.001 in/ 0.01 mm	W/clamp nut	0.375	Spherical (SR4) (carbide tip)		
350-352-30*1				Plain				
350-353-30*1				W/clamp nut				
350-354-30*1				Plain	0.5	Flat (carbide tip)		
350-381-30*2				W/clamp nut		Spherical (SR4) (carbide tip)		
350-382-30*2				Plain				
350-383-30*2				W/clamp nut				Flat
350-384-30*2				Plain				
350-361-30*2				Plain				

*1 These models are not water-proof. (Origin setting of these models is by presetting.)

*2 IP65 dust/water protection type. Stem diameter of IP65 type is 12 mm. (Origin setting of these models is by presetting.)

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Battery for **series 350**
SR44 (1 pc.), **938882** for initial operation checks (standard accessory)
- Battery for **Series 164**
SR44 (2 pcs.), **938882** for initial operation checks (standard accessory)
- Battery life
Approx. 2.4 years under normal use (for **350-XXX**)
Approx. 1.8 years under normal use (for **164-163, 164**)
- Positional detection method
Electromagnetic induction type rotary encoder (**series 164,350**)
- Standard accessory
Screwdriver (**05CAA952**), 1 pc. (for **164-163, 164**)
Electromagnetic rotary sensor Spanner (**301336**), 1 pc. (for **350-XXX**)
- Functions (**series 164**)
Origin point setting (ABS measurement system):
Resets the ABS origin at the current spindle position to the minimum value of the measuring 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.
Data output:
Equipped with output port for transferring measurement data to a Statistical Process Control (SPC) and measurement system.
Auto power ON/OFF:
The reading on the LCD disappears after this instrument is idle for about 20 minutes, but the reading and measurement mode are retained. Turning the spindle causes the reading on the LCD to reappear.
Error alarm:
In case of an overflow on the LCD or a computing error, an error message appears on the LCD and the measuring function stops. This prevents an instrument from giving an erroneous reading. Also, when the battery voltage drops to a certain level, the low-battery indicator appears well before the micrometer becomes unusable.
- Measuring face: Carbide tip
Hardness: 90 HRA or more
Lapped
- Scale finishing: Satin-chrome plated

IP65 dust/water protection level

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

Order No.	Type	Description
959149	C	Connecting cables for series 164 (1 m)
959150	C	Connecting cables for series 164 (2 m)
06AFM380C	C	USB Input Tool Direct for series 164 (2 m)
02AZD790C	C	Connecting cables for U-WAVE-T (160 mm): for series 164
02AZE140C	C	Connecting cables for U-WAVE-T For foot switch: for series 164
05CZA662	B	Connecting cables (1 m): for series 350 (IP65)
05CZA663	B	Connecting cables (2 m): for series 350 (IP65)
06AFM380B	B	USB Input Tool Direct for series 350 (IP65) (2 m)
02AZD790B	B	Connecting cables for U-WAVE-T (160 mm): for series 350 (IP65)
02AZE140B	B	Connecting cables for U-WAVE-T For foot switch: for series 350 (IP65)
264-622	IP67	U-WAVE-TM
264-623	Buzzer	U-WAVE-TM
264-626	IP67	U-WAVE-TMB
264-627	Buzzer	U-WAVE-TMB
02AZF310	IP67/ buzzer	Connecting unit for U-WAVE-TM/TMB*

* Cannot be used with **164-163** and **164-164**

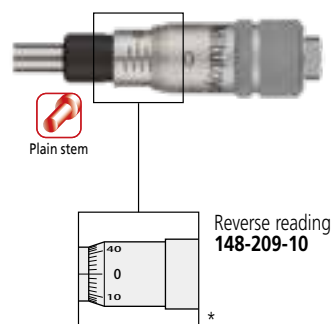
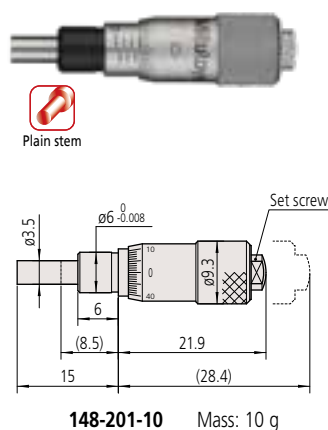
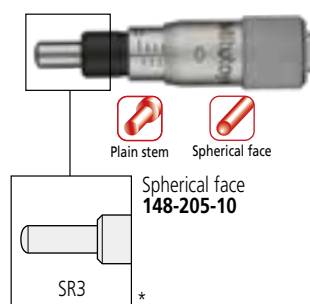
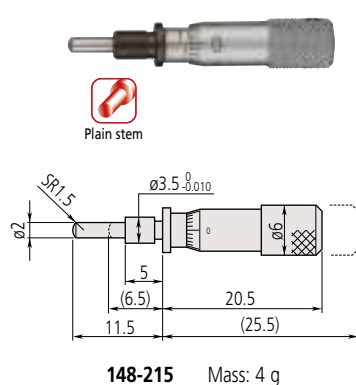
Micrometer Heads SERIES 148 — Small/Ultra-small Type

- Miniature micrometer heads for ease of incorporating into machines.

Dimensions

Unit: mm

Plain stem



* Other dimensions are the same as 148-201-10.
(): with spindle fully retracted.

Special sizes and specifications

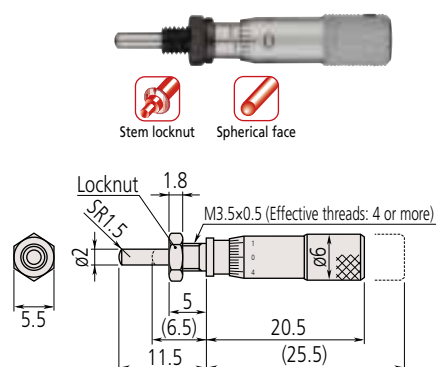


Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Dimensions

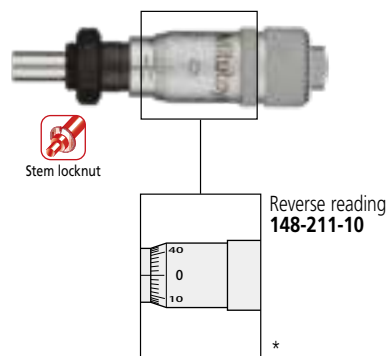
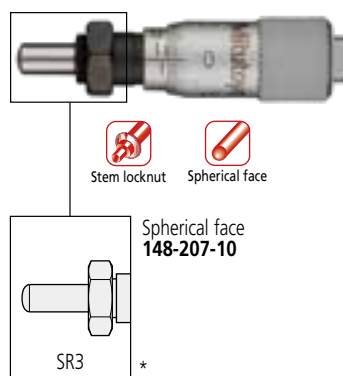
Unit: mm

Stem locknut

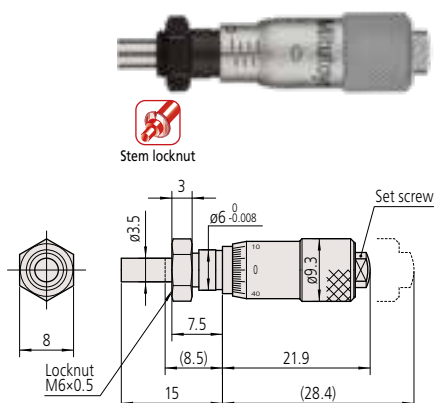


- Fixture thickness: 3 mm Mass: 4 g

148-216



* Other dimensions are the same as **148-203-10**.
(): with spindle fully retracted.



- Fixture thickness: 4 mm Mass: 10 g

148-203-10

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Contents

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Specifications

Metric

Order No.	Range (mm)	Stem dia. (mm)	Stem	Spindle end	Graduation	Maximum permissible error J_{MPE} (μm)
148-215	0 - 5	3.5	Plain	Spherical (SR1.5)	Standard	±5
148-216			W/clamp nut			
148-201-10	0 - 6.5	6	Plain	Flat		
148-203-10			W/clamp nut			
148-205-10			Plain	Spherical (SR3)		
148-207-10			W/clamp nut			
148-209-10			Plain	Flat	Reverse reading	
148-211-10			W/clamp nut			

Inch

Order No.	Range (in)	Stem dia. (in)	Stem	Spindle end	Graduation	Maximum permissible error J_{MPE} (in)
148-217	0 - 0.2	0.156	Plain	Spherical (SR1.5)	Standard	±0.00025
148-218			W/clamp nut			
148-202-10	0 - 0.25	0.25	Plain	Flat		
148-204-10			W/clamp nut			
148-206-10			Plain	Spherical (SR3)		
148-208-10			W/clamp nut			
148-210-10*			Plain	Flat	Reverse reading	
148-212-10*			W/clamp nut			

*Made-to-order models

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Range: 0 - 5 mm
0 - 6.5 mm
0 - 0.2 in
0 - 0.25 in
- Graduation: 0.02 mm,
0.01 mm or 0.001 in
- Maximum permissible error: J_{MPE} ±5 μm or ±0.00025 in
- Measuring face: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing: Satin-chrome plated

Micrometer Heads

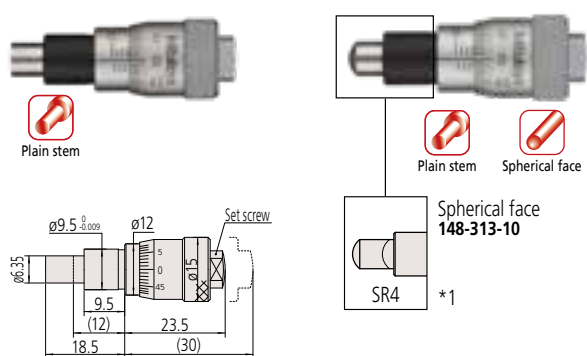
SERIES 148 — Short Thimble with Choice of Diameter

- Short body design maintains measuring range for limited space applications.
- Available in three thimble diameters to provide ease-of-reading options.

Dimensions

Unit: mm

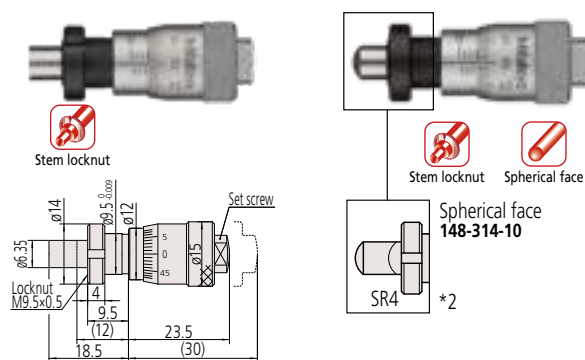
Plain stem



Mass: 26 g
148-301-10 Thimble diameter: 15

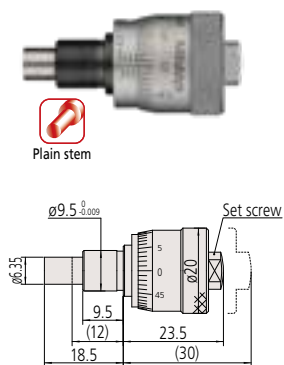
*1 Other dimensions are the same as **148-301-10**.

Stem locknut

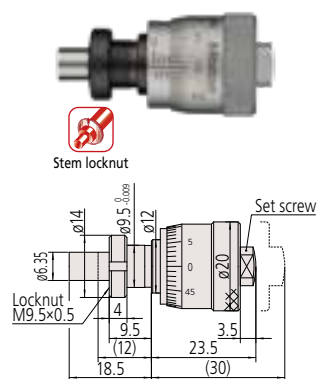


• Fixture thickness: 6 mm Mass: 26 g
148-302-10 Thimble diameter: 15

*2 Other dimensions are the same as **148-302-10**.



Mass: 39 g
148-303-10 Thimble diameter: 20



• Fixture thickness: 6 mm Mass: 39 g
148-304-10 Thimble diameter: 20

(): with spindle fully retracted.

Special sizes and specifications

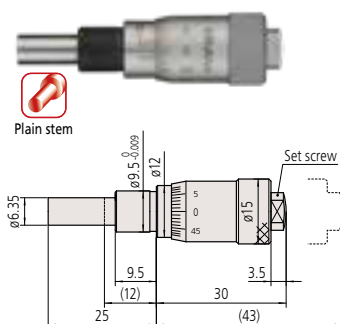


Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

Dimensions

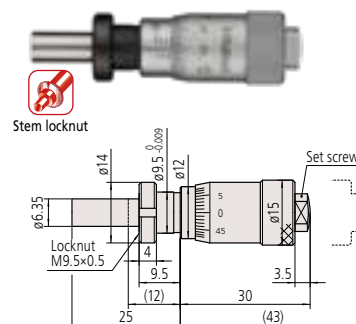
Unit: mm

Plain stem

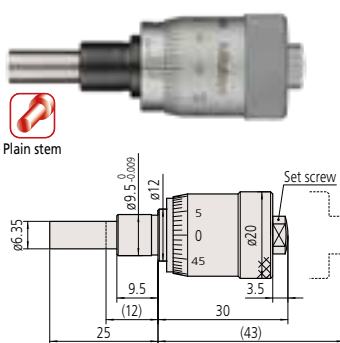


Mass: 35 g
148-307-10 Thimble diameter: 15

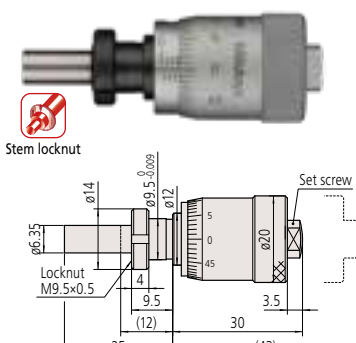
Stem locknut



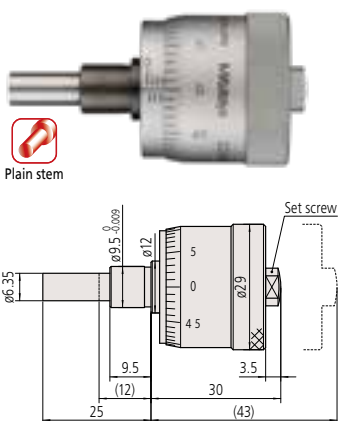
• Fixture thickness: 6 mm Mass: 35 g
148-308-10 Thimble diameter: 15



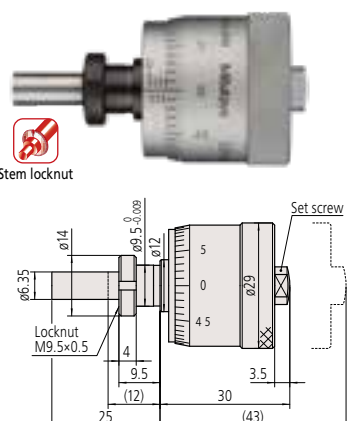
Mass: 55 g
148-309-10 Thimble diameter: 20



• Fixture thickness: 6 mm Mass: 55 g
148-310-10 Thimble diameter: 20



Mass: 103 g
148-311-10 Thimble diameter: 29



• Fixture thickness: 6 mm Mass: 103 g
148-312-10 Thimble diameter: 29

(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric								
Order No.	Range (mm)	Maximum permissible error <i>J</i> _{MPE} (μm)	Stem dia. (mm)	Stem	Spindle end	Special features		
148-301-10	0 - 6.5	±2	9.5	Plain	Flat	15 mm thimble dia.		
148-302-10				W/clamp nut				
148-303-10				Plain		Spherical (SR4)	20 mm thimble dia.	
148-304-10				W/clamp nut				
148-313-10				Plain	15 mm thimble dia.			
148-314-10				W/clamp nut	Flat			
148-307-10	0 - 13			Plain		15 mm thimble dia.		
148-308-10				W/clamp nut				
148-309-10				Plain		20 mm thimble dia.		
148-310-10				W/clamp nut				
148-311-10				Plain		29 mm thimble dia.		
148-312-10				W/clamp nut				
Inch								
Order No.	Range (in)	Maximum permissible error <i>J</i> _{MPE} (in)	Stem dia. (in)	Stem	Spindle end	Special features		
148-351-10	0 - 0.25	±0.0001	0.375	Plain	Flat	0.59 in thimble dia.		
148-352-10				W/clamp nut				
148-353-10				Plain		0.79 in thimble dia.		
148-354-10	0 - 0.5			W/clamp nut				
148-357-10				Plain		0.59 in thimble dia.		
148-358-10				W/clamp nut				
148-359-10				Plain	0.79 in thimble dia.			
148-360-10				W/clamp nut				

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Range: 0 - 6.5 mm
0 - 13 mm
0 - 0.25 in
0 - 0.5 in
- Graduation: 0.01 mm or 0.001 in
- Maximum permissible error: $J_{MPE} \pm 2 \mu$ m or ± 0.0001 in
- Measuring face: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing: Satin-chrome plated

Micrometer Heads

SERIES 148 — Small Standard Type

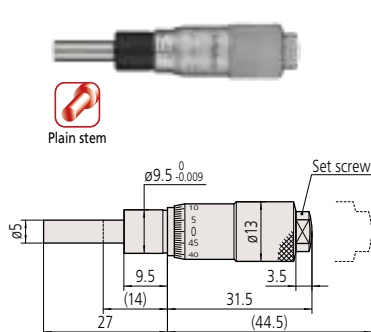
- Measuring range of 13 mm.

Dimensions

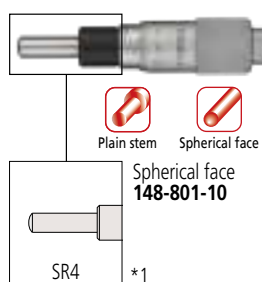
Unit: mm

Plain stem

Mass: 30 g

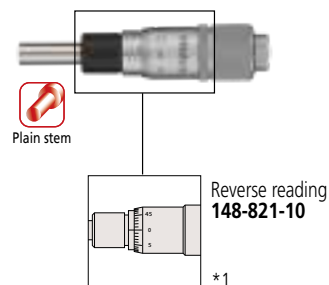


148-104-10



Spherical face
148-801-10

*1



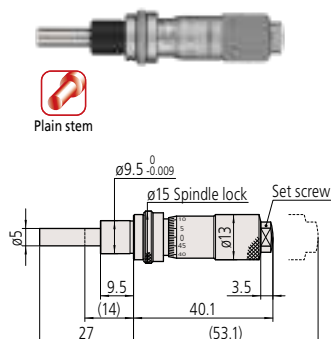
Reverse reading
148-821-10

*1

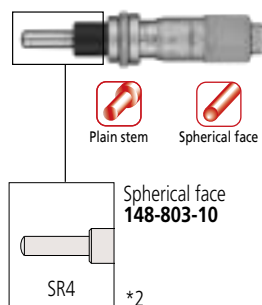
*1 Other dimensions are the same as 148-104-10.

Plain Stem and Spindle Lock

Mass: 40 g

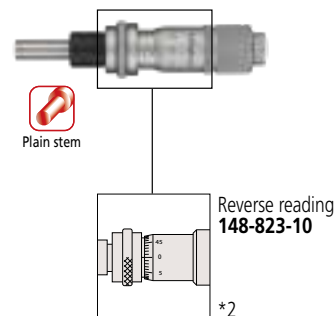


148-121-10



Spherical face
148-803-10

*2



Reverse reading
148-823-10

*2

*2 Other dimensions are the same as 148-121-10.
(): with spindle fully retracted.

Special sizes and specifications



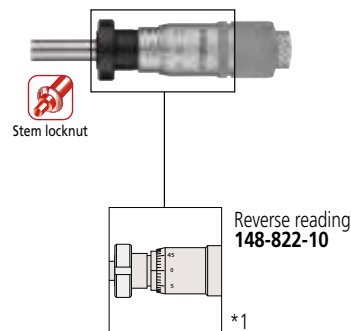
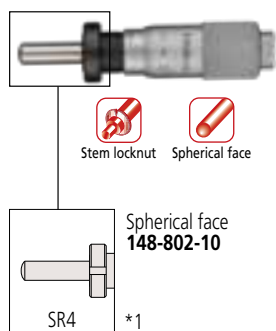
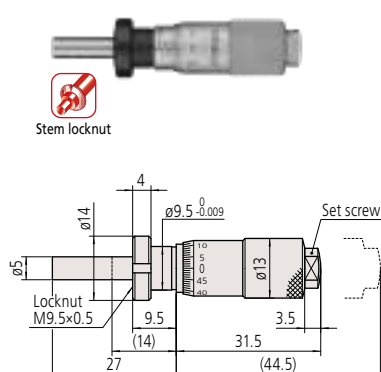
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Dimensions

Unit: mm

Stem locknut

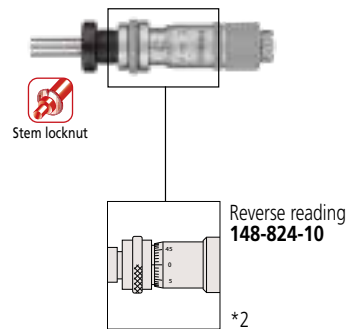
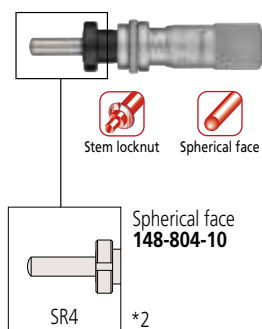
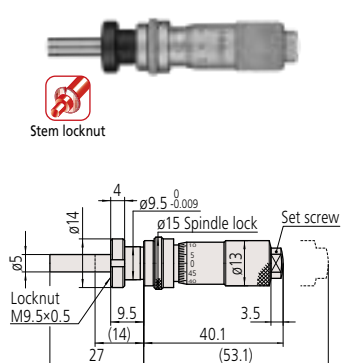
Mass: 35 g



*1 Other dimensions are the same as **148-103-10**.

Stem Locknut and Spindle Lock

Mass: 45 g



*2 Other dimensions are the same as **148-120-10**.
(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric						
Order No.	Range (mm)	Maximum permissible error <i>J</i> _{MPE} (μm)	Stem dia. (mm)	Stem	Spindle end	Graduation features
148-104-10	0 - 13	±2	9.5	Plain	Flat	Standard
148-103-10				W/clamp nut		
148-121-10				Plain*		
148-120-10				W/clamp nut*		
148-801-10				Plain	Spherical (SR4)	
148-802-10				W/clamp nut		
148-803-10				Plain*		
148-804-10				W/clamp nut*		
148-821-10				Plain	Flat	Reverse reading
148-822-10				W/clamp nut		
148-823-10				Plain*		
148-824-10				W/clamp nut*		

* With spindle lock

Inch						
Order No.	Range (in)	Maximum permissible error <i>J</i> _{MPE} (in)	Stem dia. (in)	Stem	Spindle end	Graduation features
148-112-10	0 - 0.5	±0.0001	0.375	Plain	Flat	Standard
148-111-10*2				W/clamp nut		
148-123-10				Plain*1		
148-122-10				W/clamp nut*1		
148-811-10				Plain	Spherical (SR4)	
148-812-10				W/clamp nut		
148-813-10				Plain*1		
148-814-10				W/clamp nut*1		
148-831-10				Plain	Flat	Reverse reading
148-832-10				W/clamp nut		
148-833-10				Plain*1		
148-834-10				W/clamp nut*1		

*¹ With spindle lock

*² Made-to-order models

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Range: 0 - 13 mm or 0 - 0.5 in
- Graduation: 0.01 mm or 0.001 in
- Maximum permissible error: J_{MPE} ±2 μm or ±0.0001 in
- Measuring face: Alloy tool steel
 - Hardness: 60 HRC or more
 - Lapped
- Scale finishing: Satin-chrome plated

Micrometer Heads

SERIES 148 — Small Thimble Diameter Standard Type

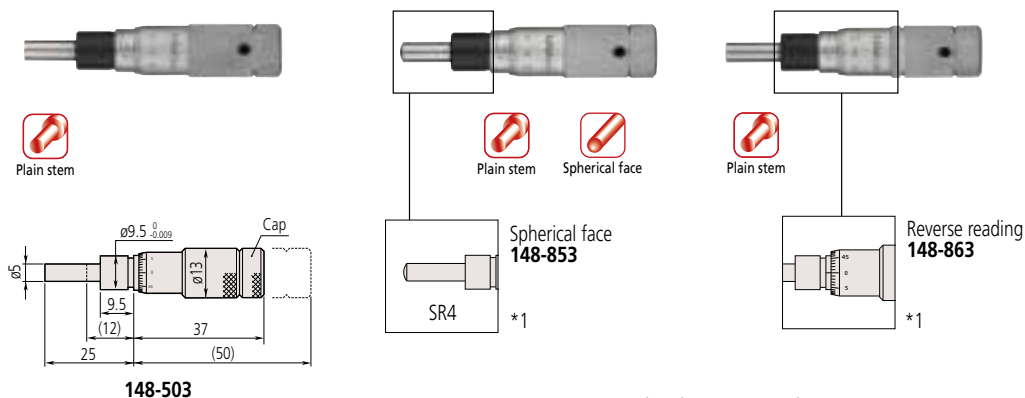
- Measuring range of 13 mm.
- The thimble can be set to zero at any position by loosening the setscrew.

Dimensions

Unit: mm

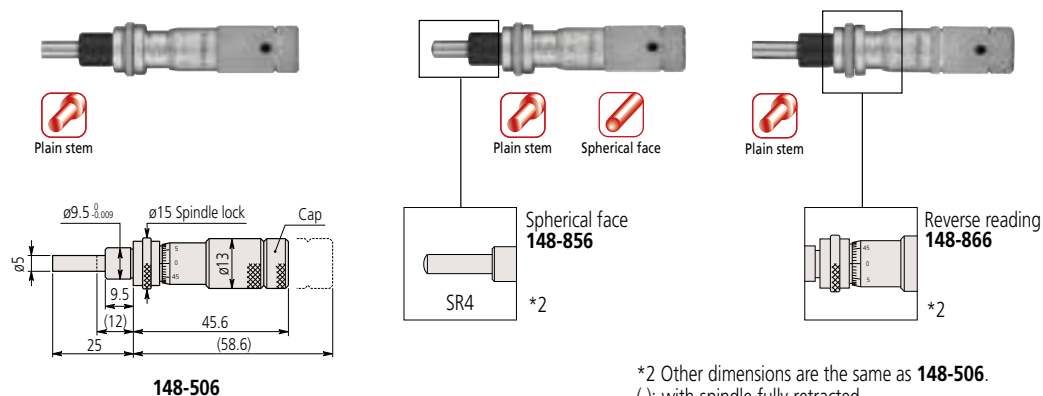
Plain stem

Mass: 35 g



Plain Stem and Spindle Lock

Mass: 35 g



Special sizes and specifications



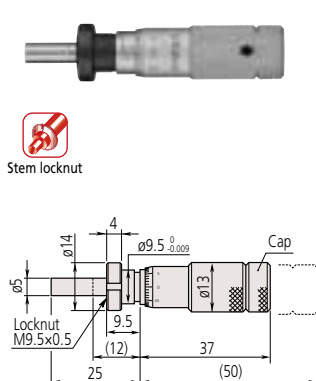
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Dimensions

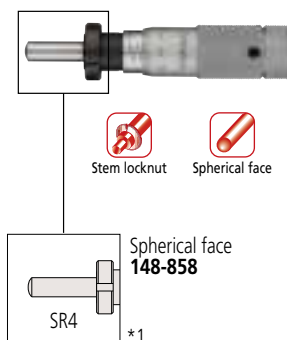
Unit: mm

Stem locknut

Mass: 40 g



Stem locknut



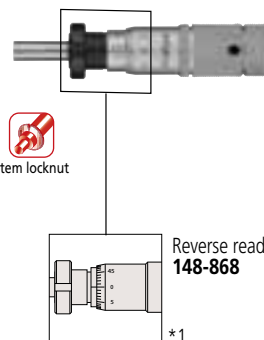
Stem locknut



Spherical face

Spherical face
148-858

*1



Stem locknut

Reverse reading
148-868

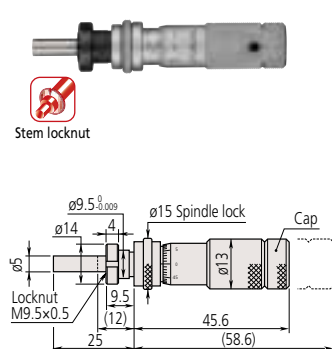
*1

• Fixture thickness: 6 mm
148-508

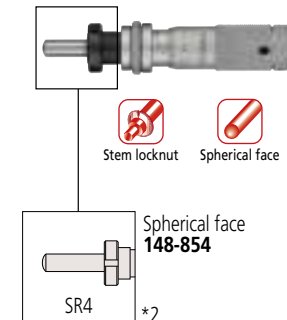
*1 Other dimensions are the same as **148-508**.

Stem Locknut and Spindle Lock

Mass: 40 g



Stem locknut



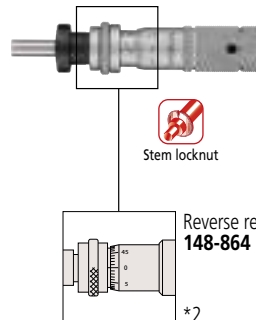
Stem locknut



Spherical face

Spherical face
148-854

*2



Stem locknut

Reverse reading
148-864

*2

• Fixture thickness: 6 mm
148-504

*2 Other dimensions are the same as **148-504**.
(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

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Specifications

Metric						
Order No.	Range (mm)	Maximum permissible error <i>J</i> _{MPE} (μm)	Stem dia. (mm)	Stem	Spindle end	Special features
148-503	0 - 13	±2	9.5	Plain	Flat	Standard
148-508				W/clamp nut		
148-506				Plain* ¹		
148-504				W/clamp nut* ¹		
148-853				Plain	Spherical (SR4)	
148-854				W/clamp nut* ¹		
148-863				Plain	Flat	Reverse reading
148-864				W/clamp nut* ¹		
148-858* ²				W/clamp nut	Spherical (SR4)	Standard
148-866* ²				Plain* ¹	Flat	Reverse reading
148-856* ²				Plain* ¹	Spherical (SR4)	Standard
148-868* ²				W/clamp nut	Flat	Reverse reading

*1 With spindle lock

*2 Made-to-order models

Inch						
Order No.	Range (in)	Maximum permissible error J_{MPE} (in)	Stem dia. (in)	Stem	Spindle end	Special features
148-501	0 - 0.5	±0.0001	0.375	Plain	Flat	Standard
148-507*2				W/clamp nut		
148-505				Plain*1		
148-502				W/clamp nut*1		
148-851				Plain	Spherical (SR4)	
148-852				W/clamp nut*1		
148-861				Plain	Flat	Reverse reading
148-862				W/clamp nut*1		

*1 With spindle lock

*2 Made-to-order models

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Range: 0 - 13 mm or 0 - 0.5 in
- Graduation: 0.01 mm or 0 - 0.5 in
- Maximum permissible error: J_{MPE} ±2 μm or ±0.0001 in
- Measuring face: Alloy tool steel
Hardness: 60 HRC or more, Lapped
- Scale finishing: Satin-chrome plated

Micrometer Heads

SERIES 149 — Small Standard Type

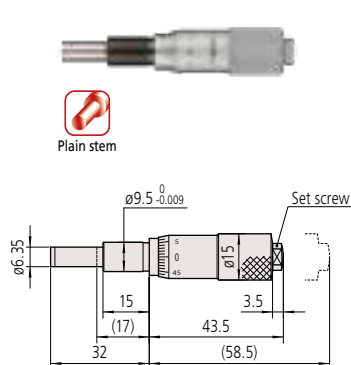
with Carbide-Tipped Spindle

- Carbide-tipped spindle provides high abrasion resistance.

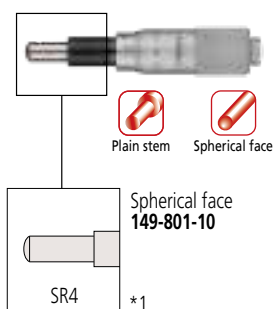
Dimensions

Unit: mm

Plain stem Mass: 55 g

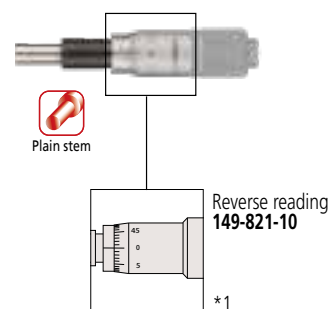


149-132-10



Spherical face
149-801-10

*1

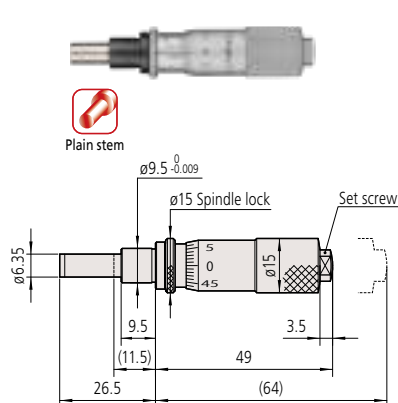


Reverse reading
149-821-10

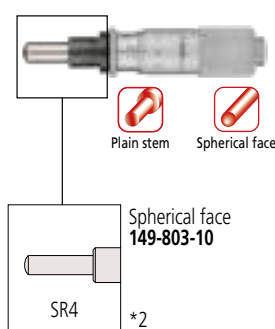
*1

*1 Other dimensions are the same as 149-132-10.

Plain Stem and Spindle Lock Mass: 55 g

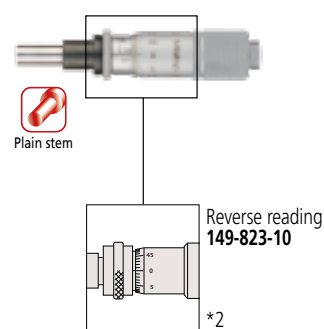


149-183-10



Spherical face
149-803-10

*2



Reverse reading
149-823-10

*2

*2 Other dimensions are the same as 149-183-10.
(): with spindle fully retracted.

Special sizes and specifications



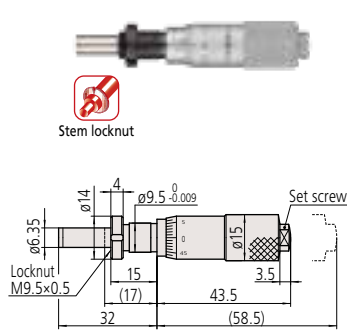
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Dimensions

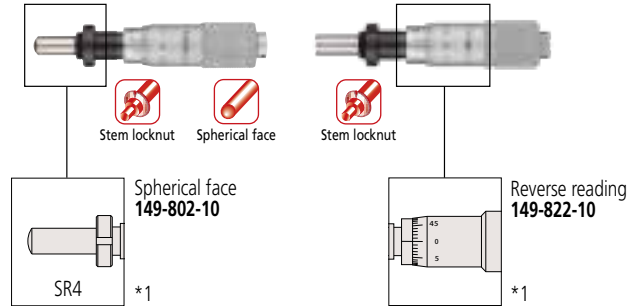
Unit: mm

Stem locknut

Mass: 60 g



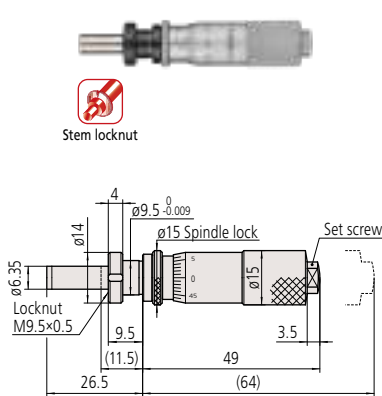
• Fixture thickness: 11.5 mm
149-131-10



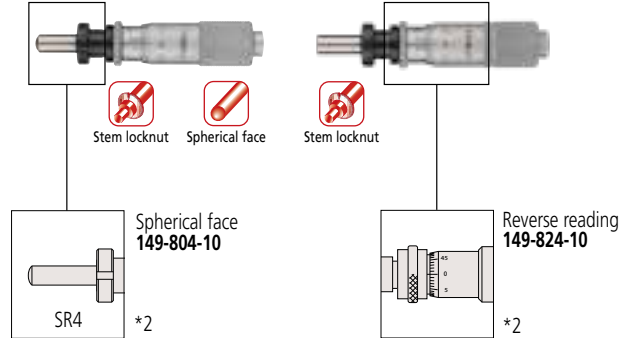
*1 Other dimensions are the same as **149-131-10**.

Stem Locknut and Spindle Lock

Mass: 60 g



• Fixture thickness: 6 mm
149-184-10



*2 Other dimensions are the same as **149-184-10**.
(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric

Order No.	Range (mm)	Maximum permissible error J_{MPE} (μm)	Stem dia. (mm)	Stem	Spindle end	Graduation features
149-132-10	0 - 15	±2	9.5	Plain	Flat (carbide tip)	Standard
149-131-10				W/clamp nut		
149-183-10				Plain* ¹		
149-184-10				W/clamp nut* ¹		
149-801-10				Plain	Spherical (SR4) (carbide tip)	
149-802-10				W/clamp nut		
149-821-10				Plain	Flat (carbide tip)	Reverse reading
149-822-10				W/clamp nut		
149-803-10* ²				Plain* ¹	Spherical (SR4) (carbide tip)	Standard
149-804-10* ²				W/clamp nut* ¹		
149-823-10* ²				Plain* ¹	Flat (carbide tip)	Reverse reading
149-824-10* ²				W/clamp nut* ¹		

Inch

Order No.	Range (in)	Maximum permissible error J_{MPE} (in)	Stem dia. (in)	Stem	Spindle end	Graduation features
149-148-10	0 - 0.5	±0.0001	0.375	Plain	Flat (carbide tip)	Standard
149-147-10				W/clamp nut		
149-185-10* ³				Plain* ¹		
149-182-10				W/clamp nut* ¹		
149-811-10				Plain	Spherical (SR4) (carbide tip)	
149-812-10				W/clamp nut		
149-831-10* ²				Plain	Flat (carbide tip)	Reverse reading
149-832-10* ²				W/clamp nut		Standard
149-181* ²				Plain* ¹		

*¹ With spindle lock *² Made-to-order models *³ W/ratchet (**149-181**) is available
Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Range: 0 - 15 mm or 0 - 0.5 in
- Graduation: 0.01 mm or 0.001 in
- Maximum permissible error: J_{MPE} ±2 μm or ±0.0001 in
- Measuring face: Carbide tip
 - Hardness: 90 HRA or more
 - Lapped
- Scale finishing: Satin-chrome plated

Micrometer Heads

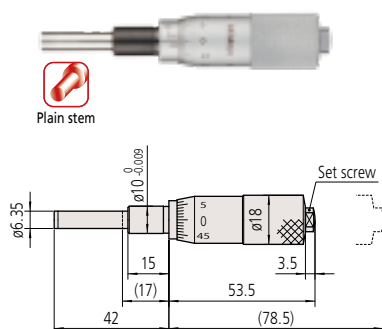
SERIES 150 — Medium-sized Standard Type

- Measuring range of 25 mm.

Dimensions

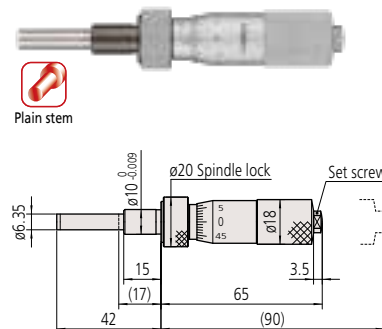
Unit: mm

Plain stem



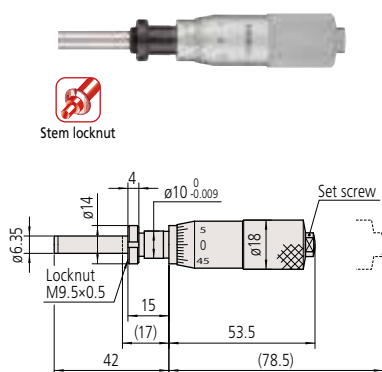
150-196-10 Mass: 95 g

Plain Stem and Spindle Lock



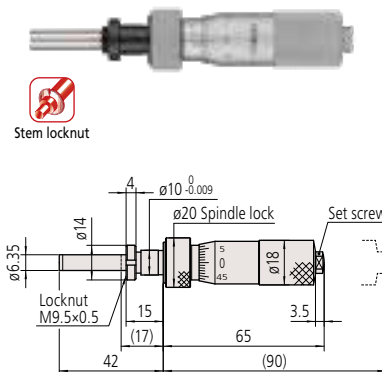
150-211-10 Mass: 115 g

Stem locknut



Fixture thickness: 11.5 mm
150-195-10 Mass: 110 g

Stem Locknut and Spindle Lock



Fixture thickness: 11.5 mm
150-212-10 Mass: 115 g

(): with spindle fully retracted.

Special sizes and specifications



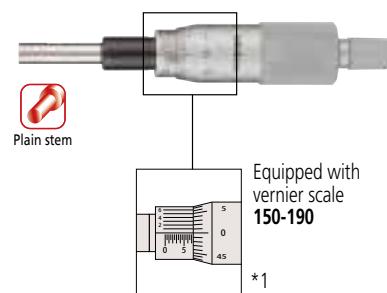
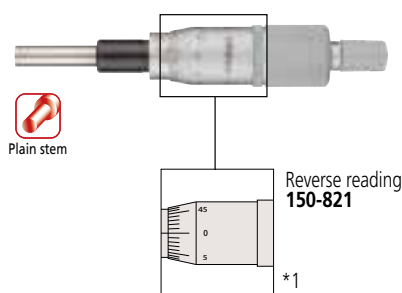
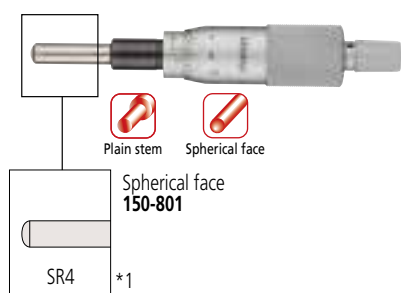
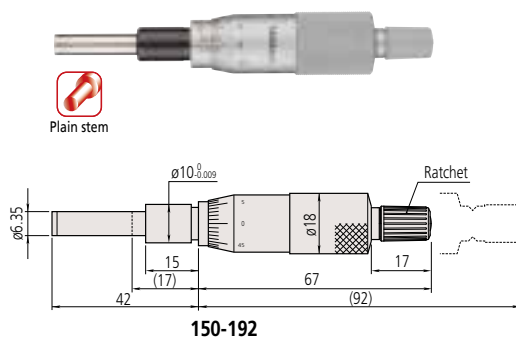
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Dimensions

Unit: mm

Plain stem

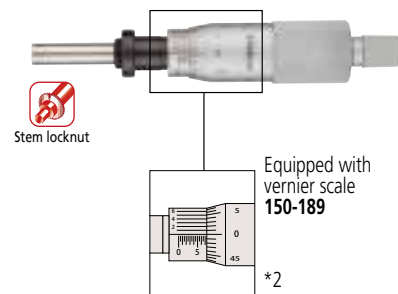
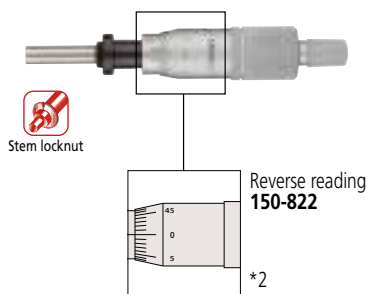
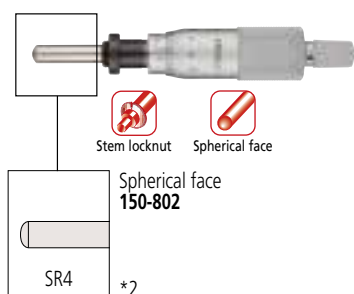
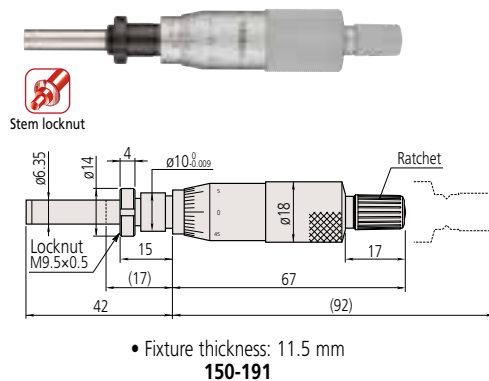
Mass: 95 g



*1 Other dimensions are the same as 150-192.

Stem locknut

Mass: 100 g



*2 Other dimensions are the same as 150-191.
() : with spindle fully retracted.

Special sizes and specifications



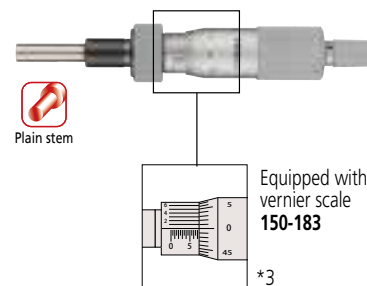
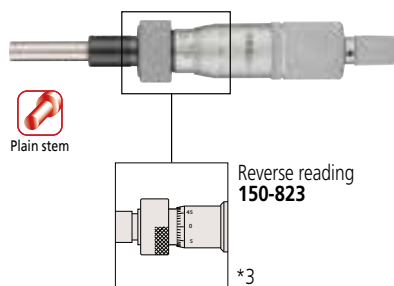
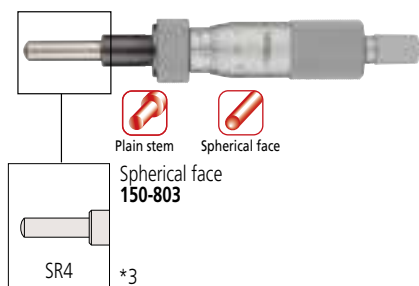
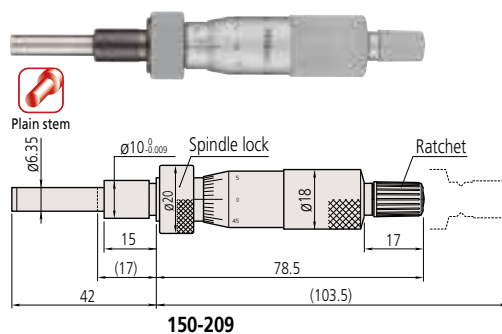
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Dimensions

Unit: mm

Plain Stem and Spindle Lock

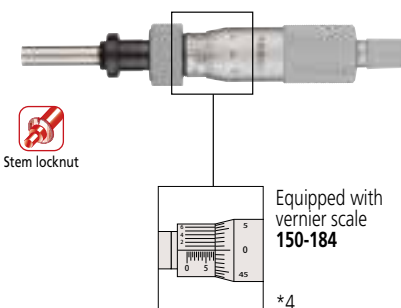
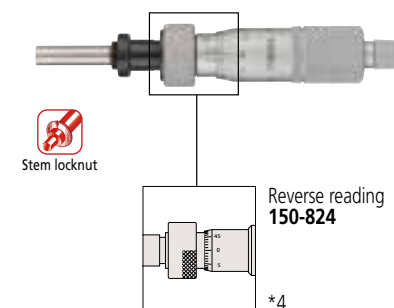
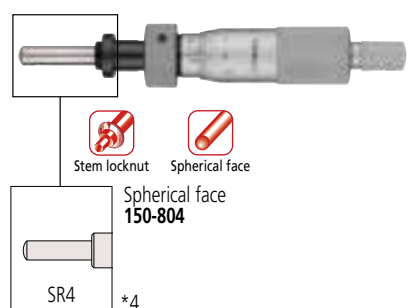
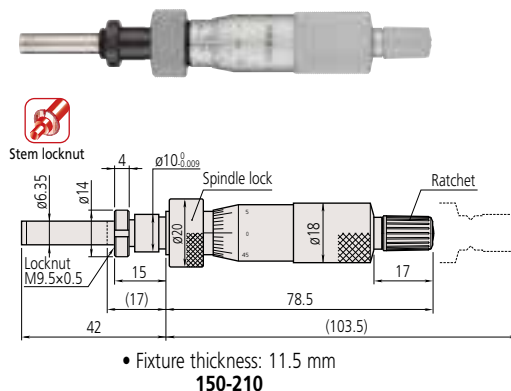
Mass: 110 g



*3 Other dimensions are the same as 150-209.

Stem Locknut and Spindle Lock

Mass: 115 g



*4 Other dimensions are the same as 150-210.
(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric						
Order No.	Range (mm)	Maximum permissible error J_{MPE} (μm)	Stem dia. (mm)	Stem	Spindle end	Special features
150-192	0 - 25	± 2	10	Plain	Flat (carbide tip)	Standard
150-191				W/clamp nut		
150-209				Plain* ¹		
150-210				W/clamp nut* ¹		
150-801				Plain	Spherical (SR4) (carbide tip)	
150-802				W/clamp nut		
150-821				Plain	Flat (carbide tip)	Reverse reading
150-822				W/clamp nut		W/vernier (0.001 mm)
150-190				Plain		
150-189				W/clamp nut		
150-183* ²				Plain* ¹		
150-184				W/clamp nut* ¹		W/o ratchet stop
150-196-10				Plain		
150-195-10				W/clamp nut		
150-211-10				Plain* ¹		
150-212-10				W/clamp nut* ¹		
150-803* ²				Plain* ¹	Spherical (SR4) (carbide tip)	Standard
150-804* ²				W/clamp nut* ¹	Flat (carbide tip)	Reverse reading
150-823* ²				Plain* ¹		
150-824* ²				W/clamp nut* ¹		

Inch						
Order No.	Range (in)	Maximum permissible error J_{MPE} (in)	Stem dia. (in)	Stem	Spindle end	Special features
150-208	0 - 1	± 0.0001	0.375	Plain	Flat (carbide tip)	Standard
150-207				W/clamp nut		
150-213* ²				Plain* ¹		
150-214* ²				W/clamp nut* ¹		
150-811				Plain	Spherical (SR4) (carbide tip)	
150-812				W/clamp nut		
150-831				Plain	Flat (carbide tip)	Reverse graduation
150-832				W/clamp nut		W/vernier (0.0001 in)
150-206				Plain		
150-205* ²				W/clamp nut		
150-215* ²				Plain* ¹		
150-216* ²				W/clamp nut* ¹		W/o ratchet stop
150-198-10				Plain		
150-197-10				W/clamp nut		
150-217* ²				Plain* ¹		
150-218* ²				W/clamp nut* ¹		

*1 With spindle lock *2 Made-to-order models

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

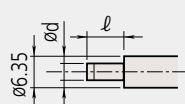
Technical data

- Range: 0 - 25 mm or 0 - 1 in
- Graduation: 0.01 mm, 0.001 mm (w/vernier)
0.001 in or 0.0001 in (w/vernier)
- Maximum permissible error: $J_{MPE} \pm 2 \mu m$ or ± 0.0001 in
- Measuring face: Carbide tip (Only long spindle model is alloy tool steel)
Hardness: 90 HRA or more (Only long spindle model is 60 HRC or more)
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications

▼ Examples of special support

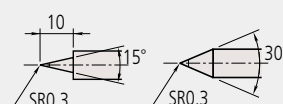
- Spindle tip spline shape
Applicable to **MHN1-25** and **MHN2-25**



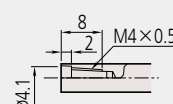
Standard specifications	d	l
MHN1-25	2	5
MHN2-25	3	10

Unit: mm

- Spindle tip point shape
Applicable to **MHN1-25** and **MHN2-25**



- Spindle tip with female thread
Applicable to **MHN1-25** and **MHN2-25**



Micrometer Heads

SERIES 151 — Medium-sized Standard Type with 8 mm Diameter Spindle

- Larger spindle ($\varnothing 8$ mm) for heavy-duty applications (normally $\varnothing 6.35$ mm).

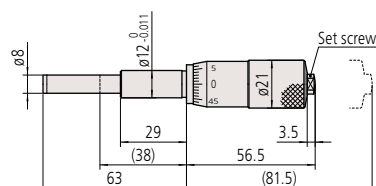
Dimensions

Unit: mm

Plain stem



Plain stem

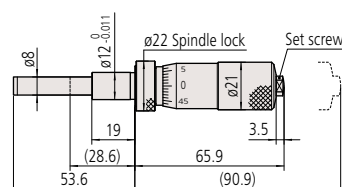


151-227-10
Mass: 150 g

Plain Stem and Spindle Lock



Plain stem

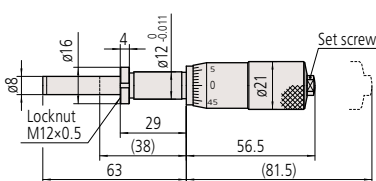


151-225-10
Mass: 165 g

Stem locknut



Stem locknut

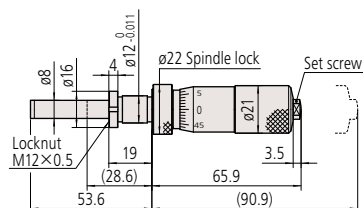


- Fixture thickness: 25.5 mm
- 151-228-10**
Mass: 155 g

Stem Locknut and Spindle Lock



Stem locknut



- Fixture thickness: 15.5 mm
- 151-226-10**
Mass: 165 g

(): with spindle fully retracted.

Special sizes and specifications

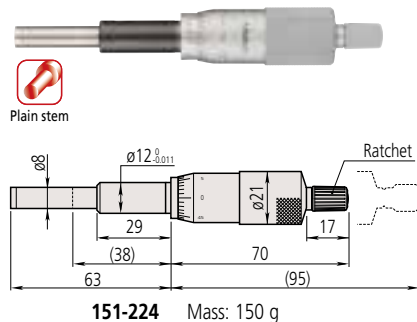


Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

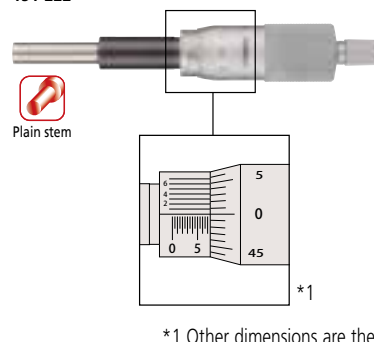
Dimensions

Unit: mm

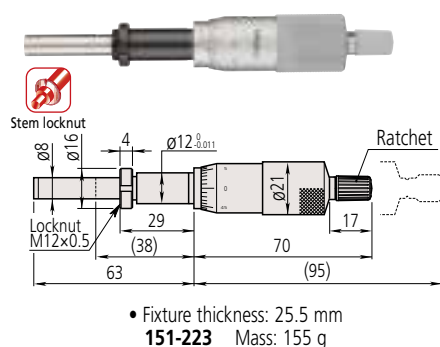
Plain stem



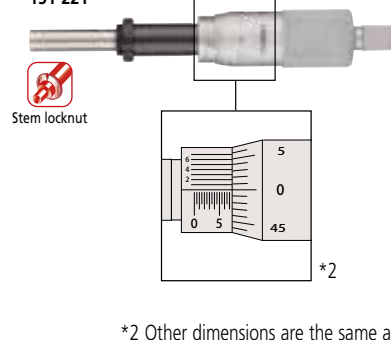
Equipped with vernier scale
151-222



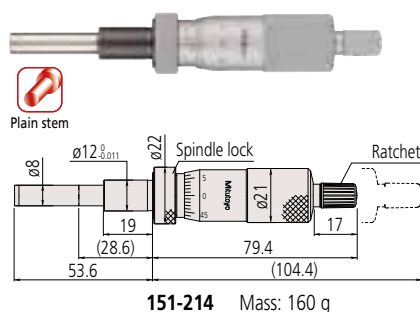
Stem locknut



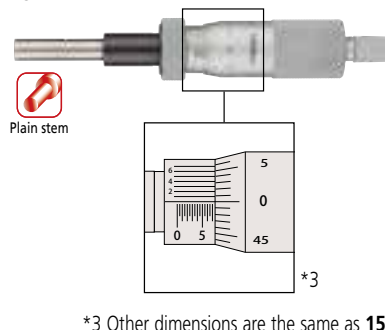
Equipped with vernier scale
151-221



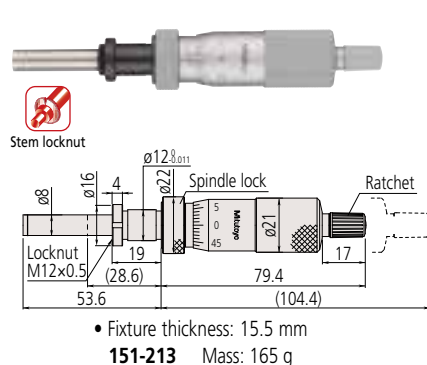
Plain Stem and Spindle Lock



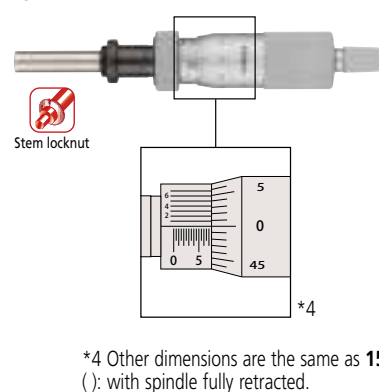
Equipped with vernier scale
151-212



Stem Locknut and Spindle Lock



Equipped with vernier scale
151-211

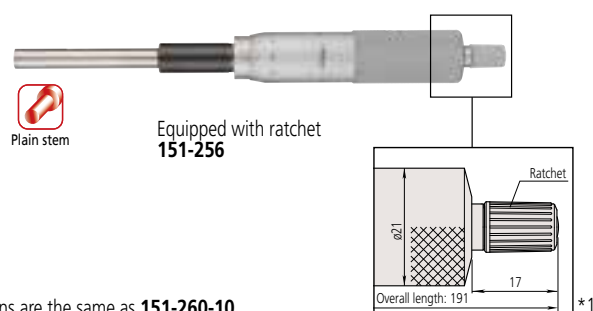
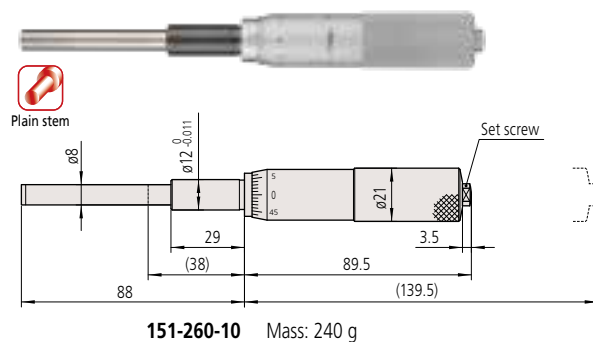


Special sizes and specifications



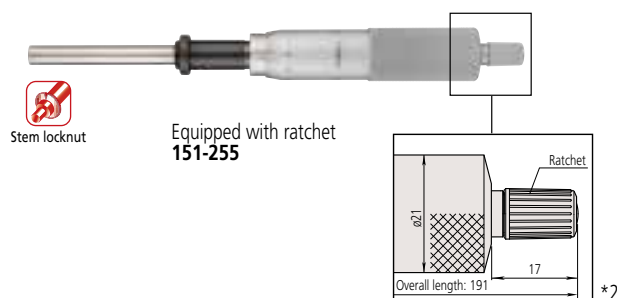
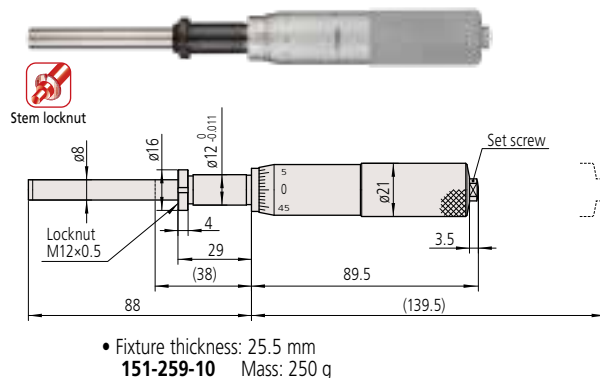
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Plain stem



*1 Other dimensions are the same as 151-260-10.

Stem locknut



*2 Other dimensions are the same as 151-259-10.

(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

Specifications

Metric						
Order No.	Range (mm)	Maximum permissible error J_{MPE} (μm)	Stem dia. (mm)	Stem	Spindle end	Special features
151-224	0 - 25	± 2	12	Plain	Flat (carbide tip)	—
151-223				W/clamp nut		
151-214*2				Plain*1		
151-213*2				W/clamp nut*1		
151-222				Plain		W/vernier (0.001 mm)
151-221				W/clamp nut		
151-212*2				Plain*1		
151-211*2				W/clamp nut*1		
151-227-10				Plain		W/o ratchet stop
151-228-10				W/clamp nut		
151-225-10				Plain*1		
151-226-10				W/clamp nut*1		
151-256	0 - 50	± 4		Plain		—
151-255				W/clamp nut		W/o ratchet stop
151-260-10				Plain		
151-259-10				W/clamp nut		W/o ratchet stop

*1 With spindle lock

*2 Made-to-order models

Inch						
Order No.	Range (in)	Maximum permissible error J_{MPE} (in)	Stem dia. (in)	Stem	Spindle end	Special features
151-240	0 - 0.1	± 0.0001	0.5	Plain	Flat (carbide tip)	—
151-239				W/clamp nut		W/vernier (0.0001 in)
151-238				Plain		
151-237				W/clamp nut		W/o ratchet stop
151-241-10*2				Plain*1		
151-242-10*2				W/clamp nut*1		W/o ratchet stop (0.0001 in)
151-243-10*2				Plain*1		
151-244-10*2	0 - 0.2	± 0.0002		W/clamp nut*1		—
151-272				Plain		
151-271				W/clamp nut		—

*1 With spindle lock

*2 Made-to-order models

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Range: 0 - 25 mm
0 - 50 mm
0 - 0.1 in
0 - 0.2 in
- Graduation: 0.01 mm, 0.001 mm (w/vernier)
0.001 in or 0.0001 in (w/vernier)
- Maximum permissible error: $J_{MPE} \pm 2 \mu\text{m}$
 $\pm 4 \mu\text{m}$
 ± 0.0001 in
 ± 0.0002 in
- Measuring face: Carbide tip (Only long spindle model is alloy tool steel)
Hardness: 90 HRA or more (Only long spindle model is 60 HRC or more)
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications

▼ Examples of special support

- Spindle tip shape **SR8**

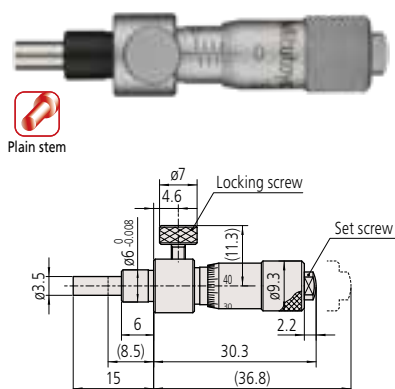
Micrometer Heads SERIES 148 — Locking-screw Type

- Locking screw provides secure locking at any position of the spindle.
- Position of the locking screw is the same as the sleeve index line.

Dimensions

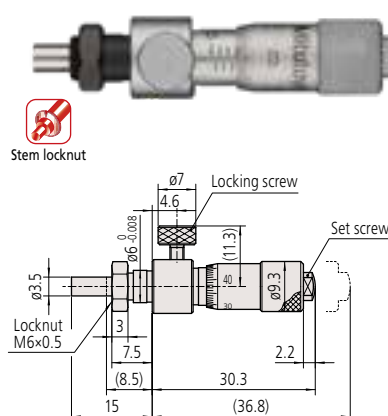
Unit: mm

Plain stem



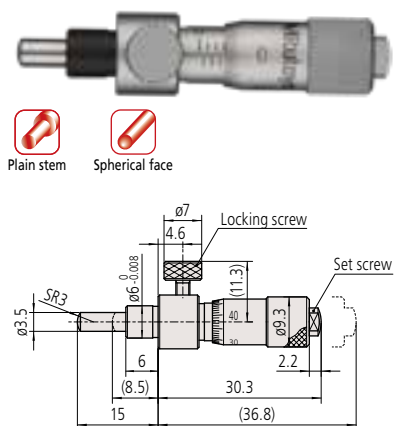
148-220-10 Mass: 16 g

Stem locknut



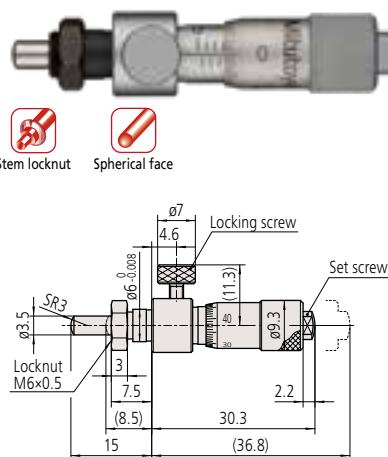
• Fixture thickness: 4 mm
148-221-10 Mass: 17 g

Plain stem



Spherical face (SR3)
148-222-10 Mass: 16 g

Stem locknut



Spherical face (SR3) • Fixture thickness: 4 mm
148-223-10 Mass: 17 g

(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

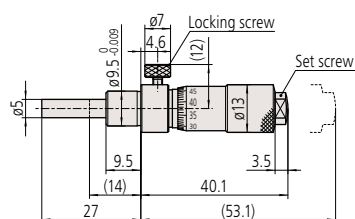
Dimensions

Unit: mm

Plain stem



Plain stem

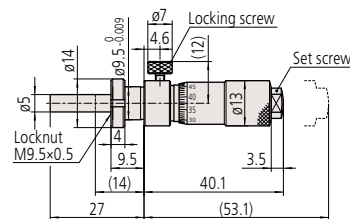


148-150-10 Mass: 40 g

Stem locknut



Stem locknut



• Fixture thickness: 6 mm
148-151-10 Mass: 43 g

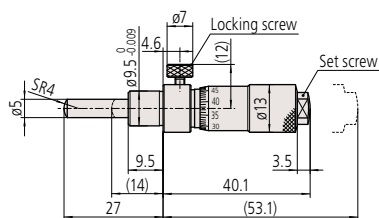
Plain stem



Plain stem



Spherical face



Spherical face (SR4)
148-152-10 Mass: 40 g

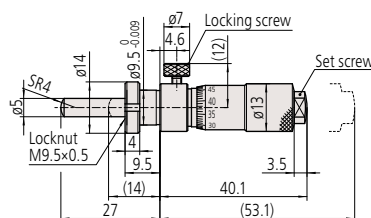
Stem locknut



Stem locknut



Spherical face



Spherical face (SR4) • Fixture thickness: 6 mm
148-153-10 Mass: 43 g



Secure spindle

Locking screw

(): with spindle fully retracted.

Special sizes and specifications

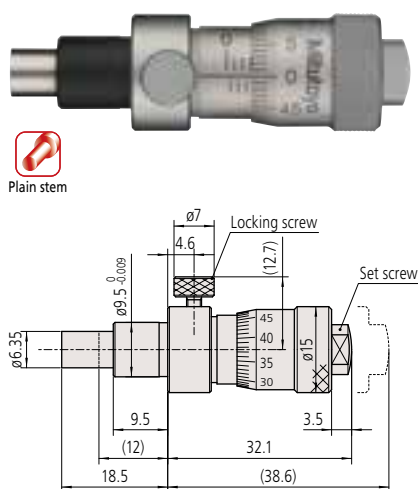


Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

Dimensions

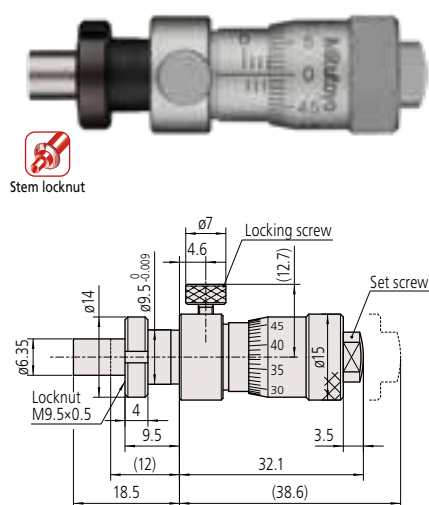
Unit: mm

Plain stem



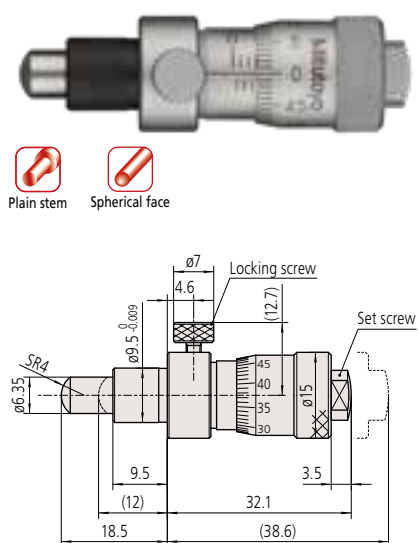
148-316-10 Mass: 40 g

Stem locknut



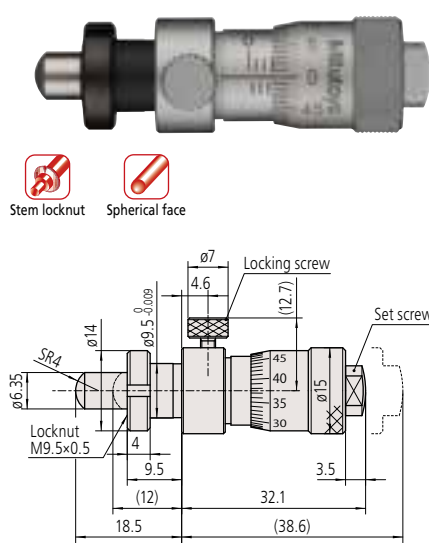
• Fixture thickness: 6 mm
148-317-10 Mass: 43 g

Plain stem



Spherical face (SR4)
148-318-10 Mass: 40 g

Stem locknut



Spherical face (SR4) • Fixture thickness: 6 mm
148-319-10 Mass: 43 g

(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric													
Order No.	Range (mm)	Graduation (mm)	Stem dia. (mm)	Stem	Spindle end	Graduation features	Maximum permissible error J_{MPE} (μm)						
148-220-10	0 - 6.5	0.01	6	Plain	Flat	Standard	±5						
148-221-10				W/clamp nut									
148-222-10				Plain	Spherical (SR3)								
148-223-10				W/clamp nut									
148-150-10	0 - 13		9.5	Plain	Flat		Standard	±2					
148-151-10				W/clamp nut									
148-152-10				Plain	Spherical (SR4)								
148-153-10				W/clamp nut									
148-316-10	0 - 6.5			9.5	Plain				Flat	Standard	±2		
148-317-10					W/clamp nut								
148-318-10					Plain				Spherical (SR4)				
148-319-10					W/clamp nut								
Inch													
Order No.	Range (in)	Graduation (in)	Stem dia. (in)	Stem	Spindle end	Graduation features		Maximum permissible error J_{MPE} (in)					
148-230-10	0 - 0.25	0.001	0.25	Plain	Flat	Standard		±0.00025					
148-231-10				W/clamp nut									
148-232-10				Plain	Spherical (SR3)								
148-233-10				W/clamp nut									
148-160-10	0 - 0.5		0.375	0.375	Plain		Flat	Standard	±0.0001				
148-161-10					W/clamp nut								
148-162-10					Plain		Spherical (SR4)						
148-163-10					W/clamp nut								
148-326-10	0 - 0.25				0.375		0.375			Plain	Flat	Standard	±0.0001
148-327-10										W/clamp nut			
148-328-10										Plain	Spherical (SR4)		
148-329-10										W/clamp nut			

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Alloy tool steel
Hardness: 60 HRC or more
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications

- ▼ Examples of special support
- Spindle tip shape **SR8**

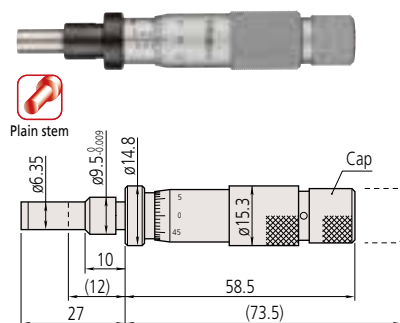
Micrometer Heads

SERIES 153 — Non-rotating Spindle Type

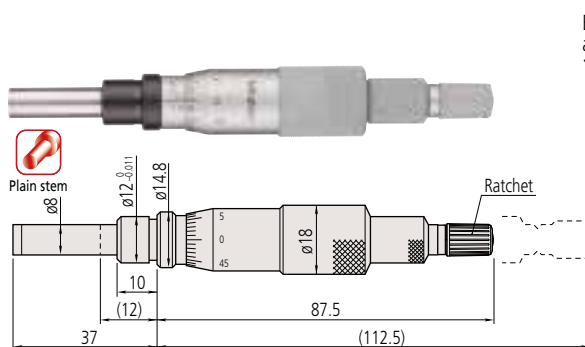
- Micrometer head with non-rotating spindle.
- Torsion-free feed reduces workpiece deformation and wear.

Dimensions

Unit: mm

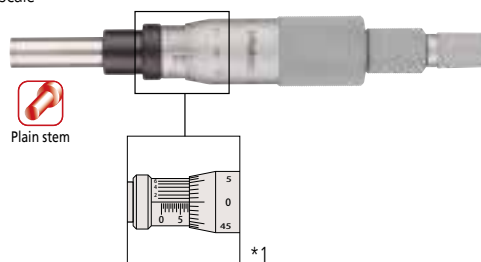


153-101 Mass: 70 g

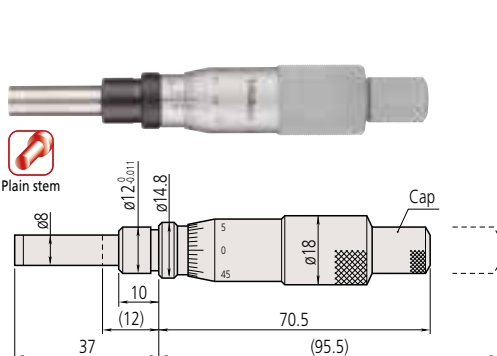


153-201 Mass: 125 g

Equipped with ratchet and vernier scale
153-202

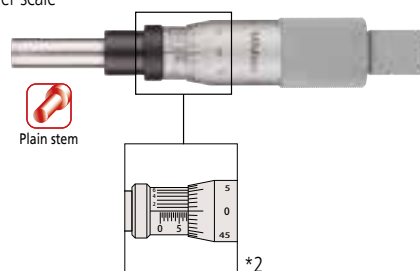


*1 Other dimensions are the same as **153-201**.



153-203 Mass: 125 g

Without ratchet / Equipped with vernier scale
153-204



*2 Other dimensions are the same as **153-203**.
(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Specifications

Metric

Order No.	Range (mm)	Graduation (mm)	Graduation features	Stem dia. (mm)	Stem	Spindle end	Spindle pitch (mm)	Maximum permissible error J_{MPE} (μm)
153-101	0 - 15	0.01	Standard	9.5	Plain	Flat (carbide tip)	0.5	±3
153-201*1	0 - 25	0.001	W/vernier (0.001 mm)	12				
153-202*1		0.01	Standard					
153-203		0.001	W/vernier (0.001 mm)					
153-204		0.001	W/vernier (0.001 mm)					

Inch

Order No.	Range (in)	Graduation (in)	Special features	Stem dia. (in)	Stem	Spindle end	Spindle pitch (in)	Maximum permissible error J_{MPE} (in)	
153-108* ²	0 - 0.5	0.001	W/vernier (0.0001 in)	0.375	Plain	Flat (carbide tip)	0.025	±0.00015	
153-205* ¹	0 - 1		Standard	0.5					
153-206* ¹			0.0001						W/vernier (0.0001 in)
153-207			0.001						Standard
153-208			0.0001						W/vernier (0.0001 in)

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

*1 With ratchet stop

*2 Made-to-order model

Technical data

- Measuring face: Carbide tip,
Hardness: 90 HRA or more,
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications

▼ Examples of special support

- Spindle tip shape
SR4 (153-101), SR8 (153-203)

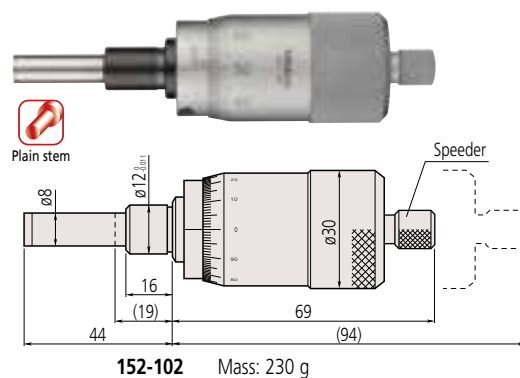
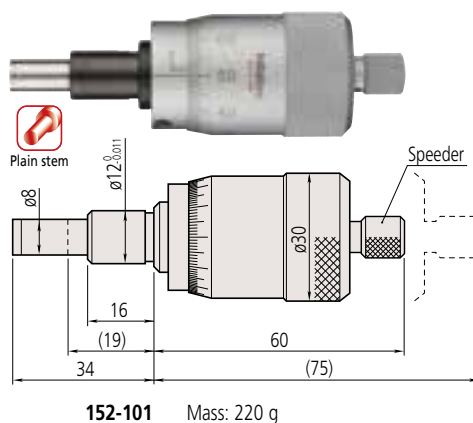
Micrometer Heads

SERIES 152 — Quick Spindle Feed of 1 mm/rev

- Micrometer head with 1 mm spindle pitch enables quick feeding and positioning.
- The larger screw thread also provides greater load-bearing capacity than a standard head.

Dimensions

Unit: mm



(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

Specifications

Metric

Order No.	Range (mm)	Graduation (mm)	Stem dia. (mm)	Stem	Spindle end	Spindle pitch (mm)	Maximum permissible error J_{MPE} (μm)
152-101	0 - 15	0.01	12	Plain	Flat (carbide tip)	1	±2
152-102	0 - 25						

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Carbide tip,
Hardness: 90 HRA or more,
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications

- ▼ Examples of special support
 - Spindle tip shape **SR8**

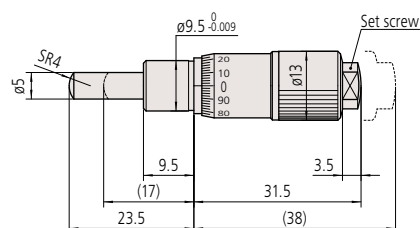
Micrometer Heads SERIES 148 — Fine Spindle Feed of 0.1 mm/rev

- Highly accurate 0.1 mm pitch thread is only one-fifth of that used for a standard-pitch head (0.5 mm).
- External dimensions are compatible with standard 0.5 mm pitch heads.
- Usable for semiconductor equipment table feed, optical axis adjustment equipment fine feed, etc.

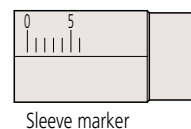
Dimensions

Unit: mm

Plain stem

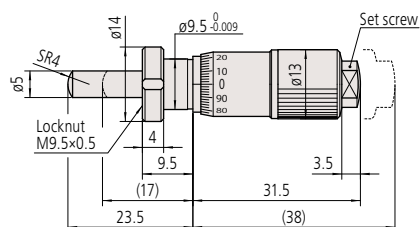


148-142-10 Mass: 31 g



Sleeve marker

Stem Locknut

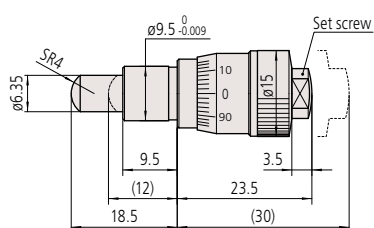


• Fixture thickness: 6 mm
148-143-10 Mass: 34 g

Dimensions

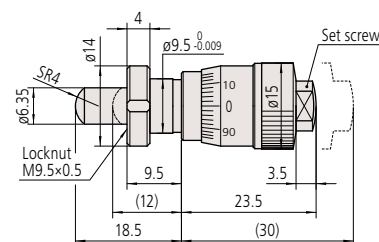
Unit: mm

Plain stem

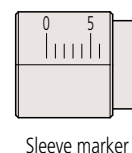


148-342-10 Mass: 29 g

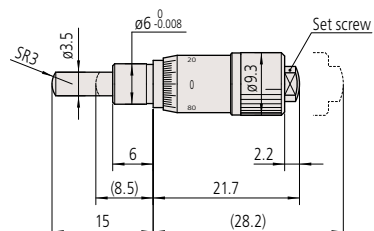
Stem locknut



• Fixture thickness: 6 mm
148-343-10 Mass: 31 g

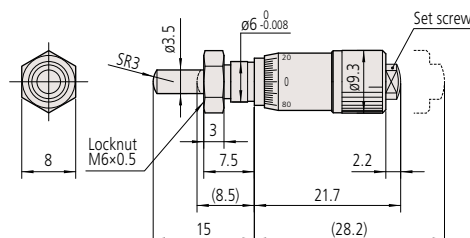


Plain stem

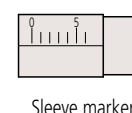


148-242-10 Mass: 10 g

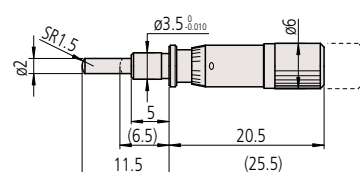
Stem locknut



• Fixture thickness: 4 mm
148-243-10 Mass: 10 g

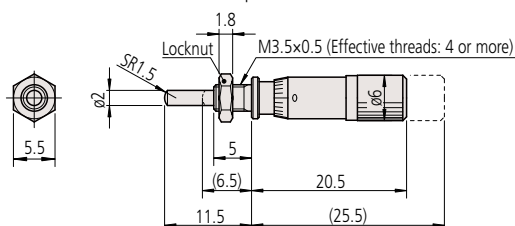


Plain stem

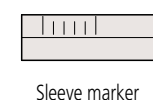


148-244 Mass: 4 g

Stem locknut



• Fixture thickness: 3 mm
148-245 Mass: 5 g



(): with spindle fully retracted.

Specifications

Metric								
Order No.	Range (mm)	Graduation (mm)	Stem dia. (mm)	Stem	Spindle end	Spindle pitch (mm)	Maximum permissible error <i>J_{MPE}</i> (μm)	Special features
148-142-10	0 - 6.5	0.002	9.5	Plain	Spherical (SR4)	0.1	±2	—
148-143-10				W/clamp nut				
148-342-10				Plain				
148-343-10				W/clamp nut				
148-242-10	0 - 5	0.004	6	Plain	Spherical (SR3)	0.1	±5	Thicker & shorter thimble
148-243-10				W/clamp nut				
148-244				Plain				
148-245				W/clamp nut				
			3.5	Plain	Spherical (SR1.5)	0.1	±5	Small thimble diameter
				W/clamp nut				

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Alloy tool steel,
Hardness: 60 HRC or more,
Lapped
- Scale finishing: Satin-chrome plated

Spindle pitch



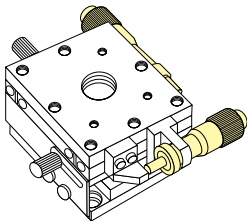
Pitch=0.1 mm



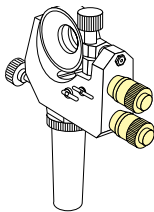
Pitch=0.5 mm

Typical applications

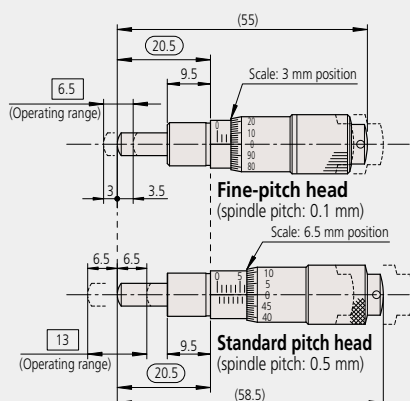
- Semiconductor-wafer positioning machinery and optical component alignment units, etc.
- Precision X-Y table positioning



- Precision adjustment of mirror in holder



Comparison of Mounting Dimensions Between a Fine-pitch Head and a Standard-pitch Head at the Mid-range Travel Position.



Note: While the fine-pitch micrometer head has a measuring range of 6.5 mm, the standard head has a larger range of 13 mm.
When replacing a standard head, the fine-pitch type can use the common range in the middle of the spindle travel. The standard and compact types of fine-pitch head are otherwise completely interchangeable.

Micrometer Heads

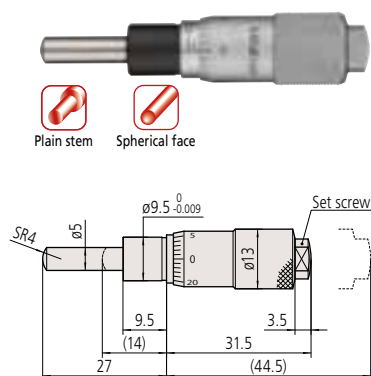
SERIES 148 — Fine Spindle Feed of 0.25 mm/rev

- Micrometer head with 0.25 mm spindle pitch is convenient for fine-feed and fine-positioning applications.

Dimensions

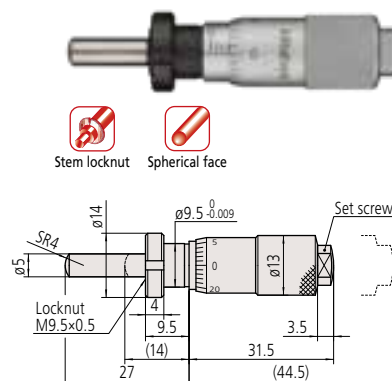
Unit: mm

Plain Stem

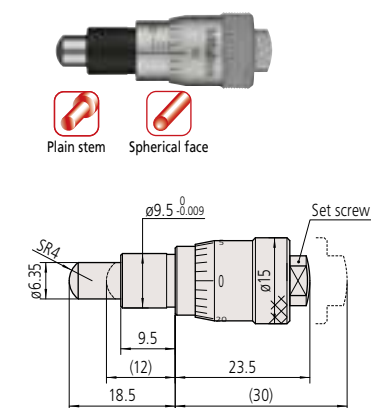


148-132-10 Mass: 30 g

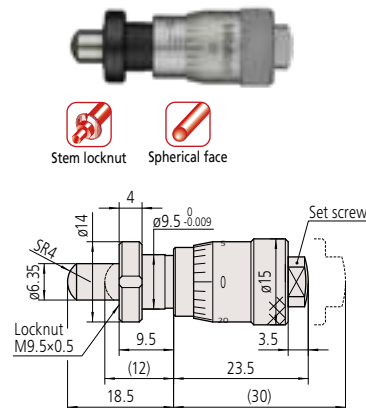
Stem Locknut



• Fixture thickness: 6 mm
148-133-10 Mass: 35 g



148-322-10 Mass: 30 g



• Fixture thickness: 6 mm
148-323-10 Mass: 35 g

() : with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

Specifications

Metric

Order No.	Range (mm)	Graduation (mm)	Stem dia. (mm)	Stem	Spindle end	Spindle pitch (mm)	Maximum permissible error J_{MPE} (μm)		
148-132-10	0 - 13	0.01	9.5	Plain	Spherical (SR4)	0.25	±2		
148-133-10				W/clamp nut					
148-322-10	0 - 6.5			Plain					
148-323-10				W/clamp nut					

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Alloy tool steel,
Hardness: 60 HRC or more,
Lapped
- Scale finishing: Satin-chrome plated

Micrometer Heads

SERIES 110 — Differential Screw Thread Translator (Extra-Fine Feed) Type

- The differential movement of spindle thread and nut allows ultra-fine feeding.

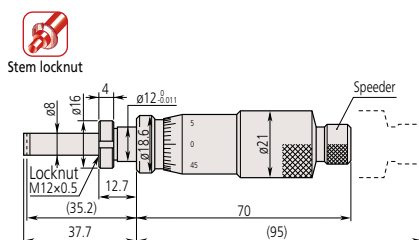
Dimensions

Unit: mm

- Differential movement mechanism with double spindle.
- Non-rotating spindle.
- Fixture thickness: 9.5 mm



Equipped with vernier scale



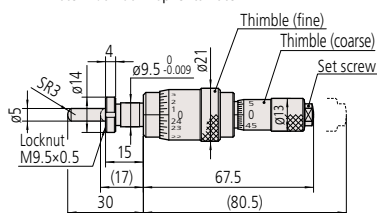
110-101

110-102 Equipped with vernier scale

- Dual thimble
- Fixture thickness: 11.5 mm



Stem locknut Spherical face

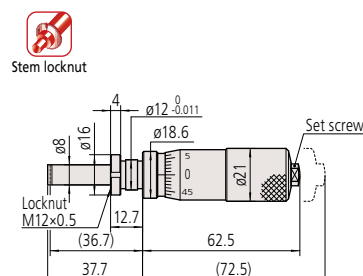


110-502-10 Mass: 95 g

- Differential movement mechanism with double spindle.
- Non-rotating spindle.
- Fixture thickness: 9.5 mm



Equipped with vernier scale



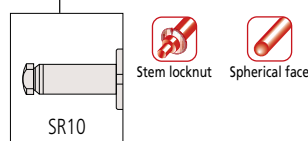
110-105-10

110-106-10 Equipped with vernier scale Mass: 150 g

Spherical face



Equipped with vernier scale



110-107-10

110-108-10 Equipped with vernier scale

(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

Specifications

Metric					
Order No.	Range (mm)		Graduation (mm)		Graduation features
110-101	0 - 2.5		0.001		Standard
110-102			0.0001		Fine
110-105-10			0.001		Standard
110-106-10	0 - 1		0.0001		Fine
110-107-10			0.001		Standard
110-108-10			0.0001		Fine
110-502-10	Thimble (fine)	0 - 0.2	Thimble (fine)	0.0005	Dual scales; 0.2 mm fine-feed range
	Thimble (coarse)	0 - 13	Thimble (coarse)	0.01	
Order No.	Stem dia. (mm)	Stem	Spindle end		Maximum permissible error J_{MPE}^{*2} (μm)
110-101	12	W/clamp nut	Flat (carbide tip)		±5/±1.5
110-102					±3/±1.5
110-105-10			Spherical (SR10) (carbide tip)		
110-106-10					
110-107-10			Spherical		
110-108-10					
110-502-10	9.5		±3/±1.5		
Inch					
Order No.	Range (in)		Graduation (in)		Graduation features
110-111	0 - 0.05		0.00002		Standard
110-112			0.000005		Fine
110-115-10 ^{*1}			0.00002		Standard
110-116-10 ^{*1}	0 - 0.02		0.000005		Fine
110-117-10 ^{*1}			0.00002		Standard
110-118-10 ^{*1}			0.000005		Fine
110-504-10	Thimble (fine)	0 - 0.006	Thimble (fine)	0.00002	Dual scales; 0.2 mm/0.006 in fine-feed range
	Thimble (coarse)	0 - 0.5	Thimble (coarse)	0.001	
Order No.	Stem dia. (in)	Stem	Spindle end		Maximum permissible error J_{MPE}^{*2} (in)
110-111	0.5	W/clamp nut	Flat (carbide tip)		±0.00025/±0.00006
110-112					±0.00015/±0.00006
110-115-10 ^{*1}			Spherical (SR10) (carbide tip)		
110-116-10 ^{*1}					
110-117-10 ^{*1}			Spherical		
110-118-10 ^{*1}					
110-504-10	0.375		±0.00015/±0.00006		

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Carbide tip (**110-502-10/504-10** are alloy tool steel),
Hardness: 90 HRA or more (Only **110-502-10/504-10** are 60 HRC or more),
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications

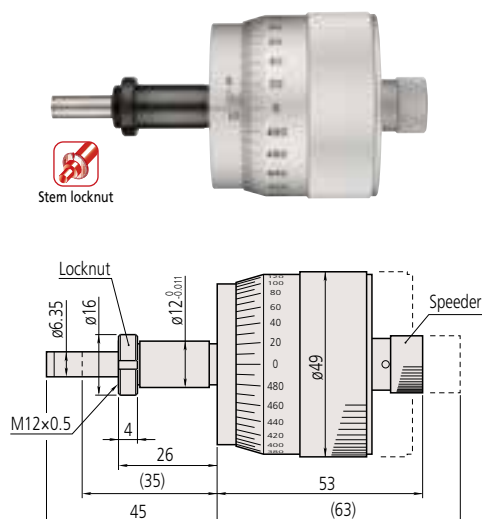
- ▼ Examples of special support
- Spindle tip shape **SR8**

Micrometer Heads SERIES 152 — Large Thimble Type

- Large-diameter thimble for fine adjustment and positioning.

Dimensions

Unit: mm



- Fixture thickness: 22.5 mm
152-283 Mass: 190 g

(): with spindle fully retracted.

Special sizes and specifications



Products with special sizes and specifications can be made to order. For details, contact the nearest Mitutoyo sales office.

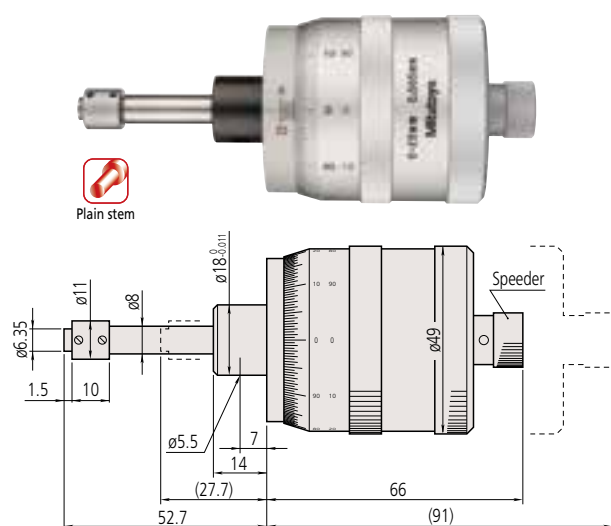
Micrometer Heads

SERIES 152 — XY-Stage Type

- Micrometer heads especially designed for accurate cross-travel stage control in X and Y axes.

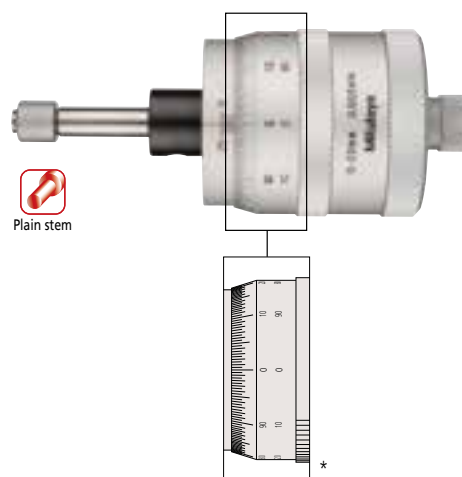
Dimensions

Unit: mm



152-390 Mass: 270 g

- The thimble can be rotated to a better reading position while maintaining the spindle position.



152-389

* Other dimensions are the same as **152-390**.
(): with spindle fully retracted.

Specifications

Metric								
Order No.	Range (mm)	Graduation (mm)	Graduation features	Stem dia. (mm)	Stem	Spindle end	Spindle pitch (mm)	Maximum permissible error J_{MPE} (μm)
152-390	0 - 25	0.005	for Y axis, bidirectional	18	Plain	Flat (with anti-rotation device)	1	±2
152-389								

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Carbide tip (**152-389/390** are alloy tool steel),
Hardness: 90 HRA or more (**152-389/390** are 60 HRC or more),
Lapped
- Scale finishing: White anodized aluminum

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

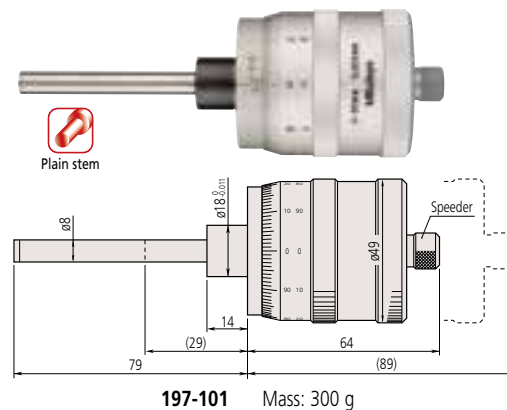
Micrometer Heads

SERIES 197 — Long Stroke Non-rotating Spindle

- Large thimble micrometer head with non-rotating spindle.
- Floating thimble allows easy zero setting at any spindle position.
- Dual-spindle mechanism for quick feed of 1 mm/rev (standard models: 0.5 mm/rev).

Dimensions

Unit: mm



(): with spindle fully retracted.

Specifications

Metric

Order No.	Range	Graduation	Graduation features	Stem dia.	Stem	Spindle end	Spindle pitch	Maximum permissible error J_{MPE}
197-101	0 - 50 mm	0.005 mm	Bidirectional	18 mm	Plain	Flat (carbide tip)	1 mm	$\pm 5 \mu\text{m}$

Inch

Order No.	Range	Graduation	Graduation features	Stem dia.	Stem	Spindle end	Spindle pitch	Maximum permissible error J_{MPE}
197-201	0 - 2 in	0.0002 in	Bidirectional	0.709 in	Plain	Flat (carbide tip)	0.05 in	$\pm 0.0001 \text{ in}$

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Carbide tip,
Hardness: 90 HRA or more,
Lapped
- Scale finishing: White anodized aluminum

Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

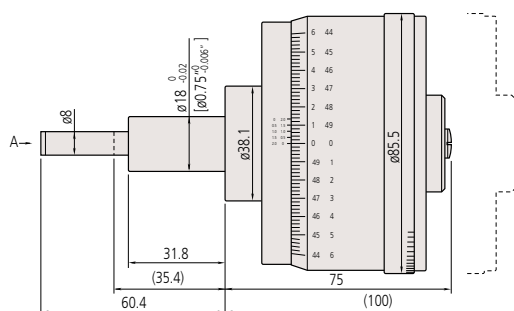
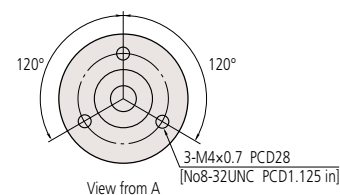
Micrometer Heads

SERIES 153 — High Accuracy and Resolution

- Fine graduation and high resolution model.
- Non-rotating spindle type.

Dimensions

Unit: mm



153-301 Mass: 765 g
153-302 Mass: 775 g

[]: **153-302**
 (): with spindle fully retracted.

Specifications

Metric

Order No.	Range	Graduation	Graduation features	Stem dia.	Stem	Spindle end	Spindle pitch	Maximum permissible error J_{MPE}^*
153-301	0 - 25 mm	0.0005 mm (vernier)	Bidirectional	18 mm	Plain	Flat (carbide tip)	0.5 mm	$\pm 1/\pm 0.5 \mu m$

Inch

Order No.	Range	Graduation	Graduation features	Stem dia.	Stem	Spindle end	Spindle pitch	Maximum permissible error J_{MPE}^*
153-302	0 - 1 in	0.00001 in (vernier)	Bidirectional	0.75 in	Plain	Flat (carbide tip)	0.025 in	± 0.00005 in/ ± 0.00003 in

* Wide range/narrow range

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Carbide tip,
Hardness: 90 HRA or more,
Lapped
- Scale finishing: White anodized aluminum

Special sizes and specifications



Products with special sizes and specifications can be made to order.
 For details, contact the nearest Mitutoyo sales office.

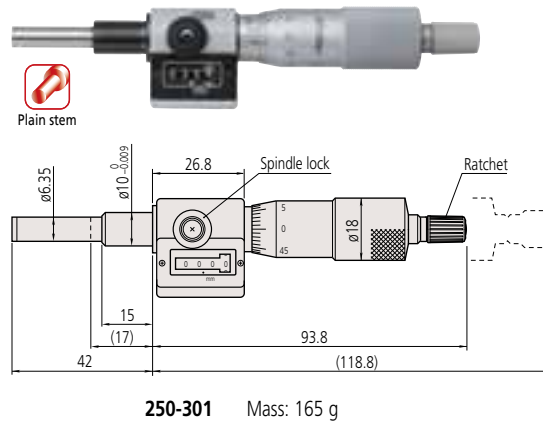
Micrometer Heads

SERIES 250 — Digit Counter Type

- Digit counter for easy reading of spindle movement.

Dimensions

Unit: mm



(): with spindle fully retracted.

Specifications

Metric

Order No.	Range (mm)	Graduation (mm)	Stem dia. (mm)	Stem	Spindle end	Spindle pitch (mm)	Graduation features	Maximum permissible error J_{MPE} (μm)
250-301	0 - 25	0.01	10	Plain	Flat (carbide tip)	0.5	—	±2

Inch

Order No.	Range (in)	Graduation (in)	Stem dia. (in)	Stem	Spindle end	Spindle pitch (in)	Graduation features	Maximum permissible error J_{MPE} (in)
250-312	0 - 1	0.0001	0.375	Plain	Flat (carbide tip)	0.025	Vernier scale	±0.0001

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Carbide tip,
Hardness: 90 HRA or more,
Lapped
- Scale finishing: Satin-chrome plated

Special sizes and specifications



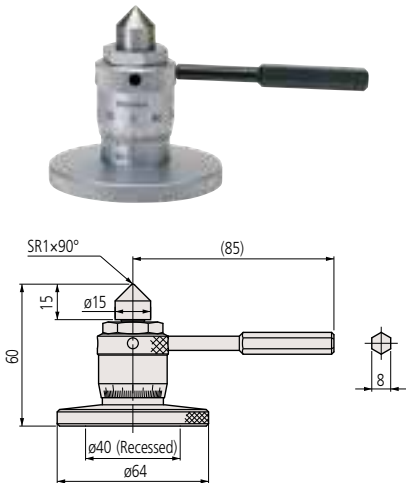
Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Micro Jack
SERIES 7

- Used for accurate leveling of machines, surface plates, and other precision instruments.
- Zero-setting is possible at any position.
- Easy adjustment under heavy load.

Dimensions

Unit: mm



7850

Specifications

Metric				
Order No.	Range (mm)	Graduation (mm)	Remarks (kg)	Handle power at the max. loading (N)
7850	60 - 75	0.01	Max. load: 400	90

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Alloy tool steel,
Hardness: 60 HRC or more,
Lapped
- Scale finishing: Satin-chrome plated

Measurement example



Special sizes and specifications



Products with special sizes and specifications can be made to order.
For details, contact the nearest Mitutoyo sales office.

Accessories for Micrometer Heads

Micrometer Head Mounting Fixtures

Manufacturing brackets to mount micrometer heads for each particular application can be laborious and costly. Mitutoyo offers various types of fixtures for micrometer heads to meet a wide range of applications. These fixtures are made of nickel-plated cast iron.



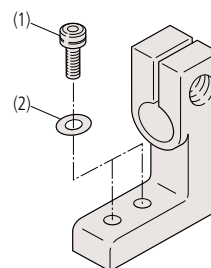
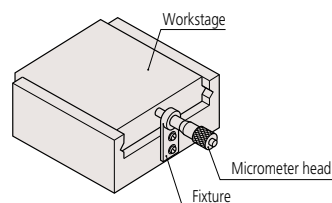
Specifications

Mounting hole size

Micrometer Head	Fixtures (Order No.)	Mounting hole size
148 Series	303560, 303562, 303564, 303566 303559, 303561, 303563, 303565	ø9.5×9.5 long for plain stem or stem locknut type micrometer heads
149 Series	303569, 303571, 303573, 303575 303568, 303570, 303572, 303574	ø9.5×15 long for plain stem or stem locknut type micrometer heads
150 Series	303579, 303581, 303583, 303585 303578, 303580, 303582, 303584	ø10×15 long for plain stem or stem locknut type micrometer heads

Note 1: Supplied with a socket head screw (M3×0.5×12) for fixtures to be used with a micrometer head without stem locknut (plain stem type micrometer head).

Note 2: Refer to page 3-68 for details of the recommended maximum loading limit.



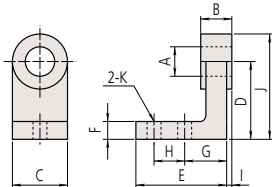
Recommended socket head screws for the fixtures

Fixtures (Order No.)	Socket head screw (1)	Washer (2)
303559, 303560, 303561, 303562, 303563, 303564 303565, 303566	M3×0.5×8 M3×0.5×12	Small, Nominal dia.: 3 Small, Nominal dia.: 3
303568, 303569, 303570, 303571, 303572, 303573 303578, 303579, 303580, 303581, 303582, 303583	M4×0.7×10	Small, Nominal dia.: 4
303574, 303575 303584, 303585	M4×0.7×12	Small, Nominal dia.: 4

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

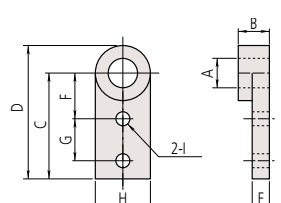
Fixtures for micrometer heads with stem locknut

Unit: mm



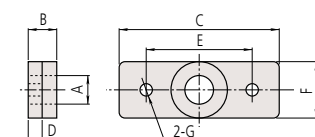
Order No.	303559	303568	303578
A	ø9.5	ø9.5	ø10
B	6	11.5	11.5
C	15	20	20
D	20	30	30
E	24	35	35
F	5	7	7
G	11	16	16
H	8	12	12
I	0.5	1.75	1.75
J	27.5	40	40
K	ø3.4	ø4.5	ø4.5

Unit: mm



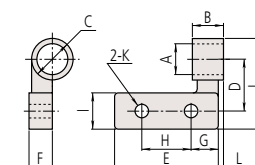
Order No.	303563	303572	303582
A	ø9.5	ø9.5	ø10
B	6	11.5	11.5
C	30	40	40
D	37.5	50	50
E	4.5	6.5	6.5
F	15	18	18
G	10	15	15
H	15	20	20
I	ø3.4	ø4.5	ø4.5

Unit: mm



Order No.	303561	303570	303580
A	ø9.5	ø9.5	ø10
B	6	11.5	11.5
C	40	60	60
D	3.5	5.5	5.5
E	30	40	40
F	15	20	20
G	ø3.4	ø4.5	ø4.5

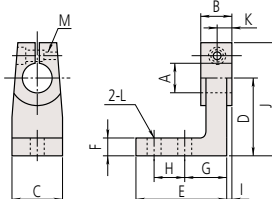
Unit: mm



Order No.	303565	303574	303584
A	ø9.5	ø9.5	ø10
B	6	11.5	11.5
C	ø15	ø15	ø15
D	15	20	20
E	25	40	40
F	8.5	8.5	8.5
G	7.5	10	10
H	10	20	20
I	10	15	15
J	27.5	35	35
K	ø3.4	ø4.5	ø4.5
L	0.75	1.25	1.25

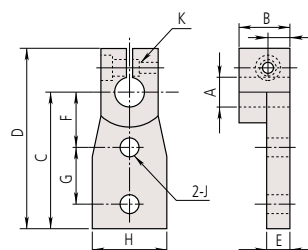
Fixtures for plain stem type micrometer heads

Unit: mm



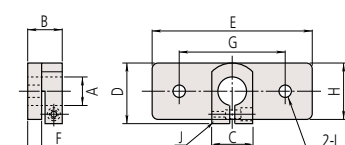
Order No.	303560	303569	303579
A	ø9.5	ø9.5	ø10
B	9	14.5	14.5
C	15	20	20
D	20	30	30
E	23	35	35
F	5	7	7
G	11	16	16
H	8	12	12
I	1.5	3.25	3.25
J	32.5	42.5	42.5
K	4.5	7.25	7.25
L	ø3.4	ø4.5	ø4.5
M	M3×0.5	M3×0.5	M3×0.5

Unit: mm



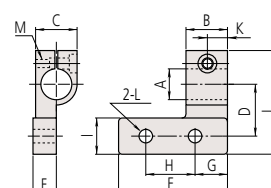
Order No.	303564	303573	303583
A	ø9.5	ø9.5	ø10
B	9	14.5	14.5
C	30	40	40
D	42.5	52.5	52.5
E	4	6	6
F	15	18	18
G	10	15	15
H	15	20	20
I	4.5	7.25	7.25
J	ø3.4	ø4.5	ø4.5
K	M3×0.5	M3×0.5	M3×0.5

Unit: mm



Order No.	303562	303571	303581
A	ø9.5	ø9.5	ø10
B	9	14.5	14.5
C	15	15	15
D	20	22.5	22.5
E	40	60	60
F	3	5	5
G	30	40	40
H	15	20	20
I	ø3.4	ø4.5	ø4.5
J	M3×0.5	M3×0.5	M3×0.5

Unit: mm

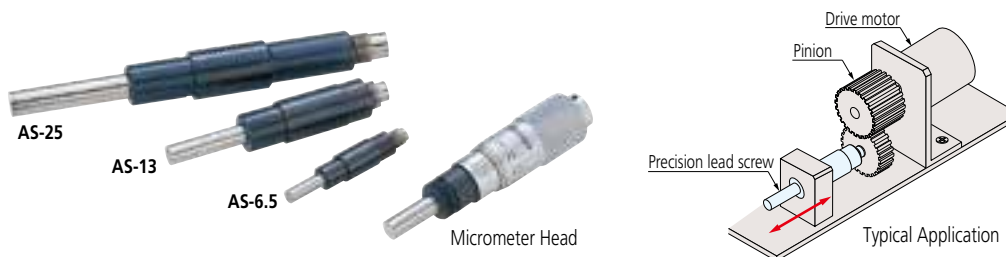


Order No.	303566	303575	303585
A	ø9.5	ø9.5	ø10
B	9	14.5	14.5
C	15	15	15
D	15	20	20
E	25	40	40
F	8.5	8.5	8.5
G	7.5	10	10
H	10	20	20
I	10	15	15
J	32.5	40	40
K	4.5	7.25	7.25
L	ø3.4	ø4.5	ø4.5
M	M3×0.5	M3×0.5	M3×0.5

Accessories for Micrometer Heads

Precision Leadscrews

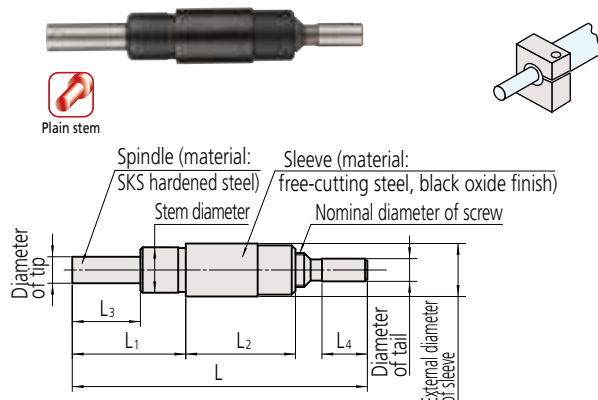
- Mitutoyo manufacture simple and less expensive precision leadscrews for precise positioning mechanisms and fine-feed mechanisms, in addition to standard micrometer heads.
- Mitutoyo also manufacture leadscrews with special specifications, such as 0.25 mm pitch, as well as those with the standard 0.5 mm feed pitch and with dimensions and forms that meet customer requirements.



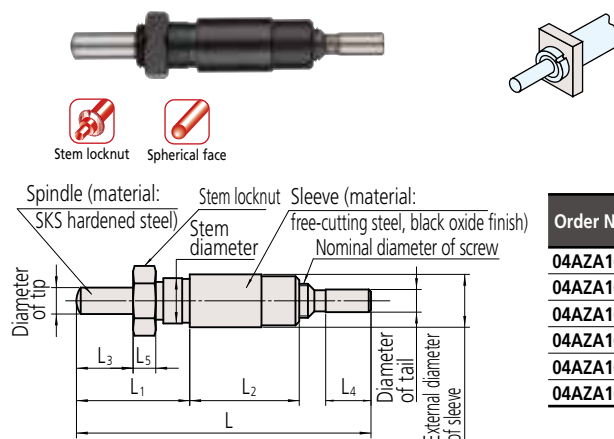
Dimensions

Unit: mm

Type AS: Plain Stem



Type BS: Stem with Locknut



Order No.	L	L ₁	L ₂	L ₃	L ₄	L ₅
04AZA160	39	15	14.5	9	6	—
04AZA161				7.5		3
04AZA162	57.5	25	21.5	15.5	8	—
04AZA163						4
04AZA164	96.5	42	39.5	27	10	—
04AZA165						4

Specifications

Order No.	Model*	Range (mm)	Feed pitch (mm)	Feed accuracy (μm)	Stem diameter (mm)	Tip diameter (mm)	Tail diameter (mm)	Screw nominal diameter	Sleeve diameter (mm)	Measuring face	Mass (g)
04AZA160	AS-6.5	0 - 6.5	0.5	±5	ø6 ⁰ _{-0.008}	ø3.5	ø3 ⁰ _{-0.01}	M4.5×0.5	ø7	Hardened	10
04AZA161	BS-6.5										
04AZA162	AS-13	0 - 13		±2	ø9.5 ⁰ _{-0.009}	ø5	ø5 ⁰ _{-0.012}	M7.35×0.5	ø10.5		27
04AZA163	BS-13										
04AZA164	AS-25	0 - 25			ø10 ⁰ _{-0.009}	ø6.35	ø6 ⁰ _{-0.015}		ø12	Carbide tip	61
04AZA165	BS-25										

* AS type: Flat spindle tip without nut, BS type: Spherical spindle tip with nut

Note: Refer to page 3-68 for details of the recommended maximum loading limit.

Technical data

- Measuring face: Alloy tool steel (AS-25 and BS-25 are Carbide tip),
Hardness: 60 HRC or more (AS-25 and BS-25 are 90 HRA or more),
Lapped
- Durability: 100,000 operations are guaranteed (use condition: 4 kg load; 2 kg for AS-6.5 and BS-6.5)
- Main applications:
 - Precision feed stages
 - Fine adjustment of optical elements (mirrors, prisms)
 - Fiber optic centering devices
 - Various assembly and adjustment jigs

Micrometer Heads



Key Factors in Selection

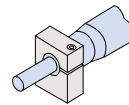
Key factors in selecting a micrometer head are the measuring range, spindle face, stem, graduations, thimble diameter.

With reference to the content of each product, select a micrometer suited to the purpose.

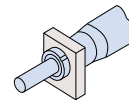
■ Stem

- The stem used to mount a micrometer head is classified as a "plain type" or "clamp nut type" as illustrated above. The stem diameter is manufactured to a nominal Metric or Imperial size with an h6 tolerance.
- The clamp nut stem allows fast and secure clamping of the micrometer head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does require a split-fixture clamping arrangement or adhesive fixing.
- General-purpose mounting fixtures are available as optional accessories.

Plain stem



Stem locknut type



■ Measuring Face

- A flat measuring face is often specified where a micrometer head is used in measurement applications.
- When a micrometer head is used as a feed device, a spherical face can minimize errors due to misalignment (Figure A). Alternatively, a flat face on the spindle can bear against a sphere, such as a carbide ball (Figure B).
- A non-rotating spindle type micrometer head or one fitted with an anti-rotation device on the spindle (Figure C) can be used if a twisting action on the workpiece must be avoided.
- If a micrometer head is used as a stop, then a flat face on both the spindle and the face it contacts provides durability.



Flat face



Spherical face



Anti-rotation device

Figure A

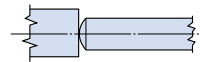


Figure C

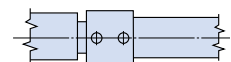
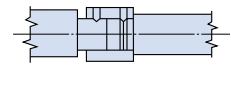
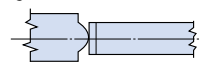


Figure B



■ Non-Rotating Spindle

- A non-rotating spindle type head does not exert a twisting action on a workpiece, which may be an important factor in some applications.

■ Spindle Thread Pitch

- The standard type head has 0.5 mm pitch.
- 1 mm-pitch type: quicker to set than standard type and avoids the possibility of a 0.5 mm reading error. Excellent load-bearing characteristics due to larger screw thread.
- 0.25 mm or 0.1 mm-pitch type
This type is the best for fine-feed or fine-positioning applications.

■ Constant-force Device

- A micrometer head fitted with a constant-force device (ratchet or friction thimble) is recommended for measurement applications.
- If using a micrometer head as a stop, or where saving space is a priority, a head without a ratchet is probably the best choice.



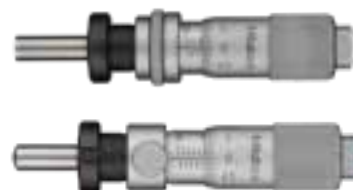
Micrometer head with constant-force device



Micrometer head without constant-force device (no ratchet)

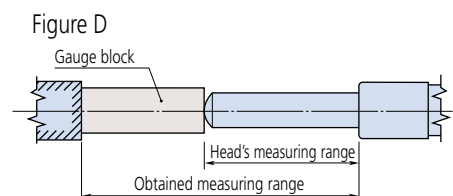
■ Spindle Lock

- If a micrometer head is used as a stop, it is desirable to use a head fitted with a spindle lock so that the setting will not change even under repeated shock loading.



■ Measuring Range

- When choosing a measuring range for a micrometer head, allow an adequate margin in consideration of the expected measuring range. Six measuring ranges, 5 mm to 50 mm, are available for standard micrometer heads.
- Even if the expected measuring range is small, such as 2 mm to 3 mm, it will be cost effective to choose a 25 mm-stroke model as long as there is enough space for installation.
- If a long measuring range of over 50 mm is required, the concurrent use of a gauge block can extend the effective measuring range. (Figure D)
- In this guide, the range (or stroke end) of the thimble is indicated by a dashed line. For stroke ends, consider the thimble as moving to the position indicated by the line when designing the jig.



■ Ultra-fine Feed Applications

- Dedicated micrometer heads are available for manipulator applications, etc., which require ultra-fine feed or adjustment of spindle.

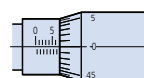
■ Thimble Diameter

- The diameter of a thimble greatly affects its usability and the "finesness" of positioning. A small-diameter thimble allows quick positioning whereas a large-diameter thimble allows fine positioning and easy reading of the graduations. Some models combine the advantages of both features by mounting a coarse-feed thimble (speeder) on the large-diameter thimble.

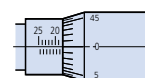


■ Graduation Styles

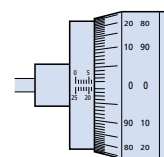
- Care is needed when taking a reading from a mechanical micrometer head, especially if the user is unfamiliar with the model.
- The "normal graduation" style, identical to that of an outside micrometer, is the standard. For this style, the reading increases as the spindle retracts into the body.
- On the contrary, in the "reverse graduation" style, the reading increases as the spindle advances out of the body.
- The "bidirectional graduation" style is intended to facilitate measurement in either direction by using black numerals for normal, and red numerals for reverse operation.
- Micrometer heads with a mechanical or electronic digital display, which allow direct reading of a measurement value, are also available. These types are free from misreading errors. A further advantage is that the electronic digital display type can enable computer-based storage and statistical processing of measurement data.



Normal graduation style



Reverse graduation style



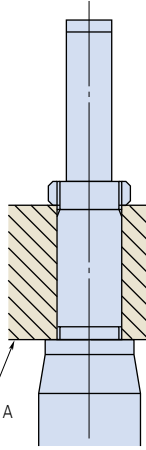
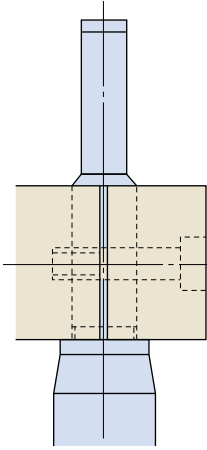
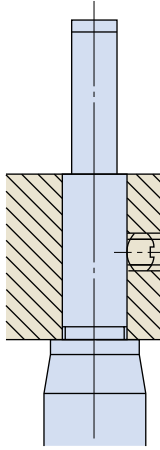
Bidirectional graduation style

Quick Guide to Precision Measuring Instruments

Guidelines for Self-made Fixtures

A micrometer head should be mounted by the stem in an accurately machined hole using a clamping method that does not exert excessive force on the stem. There are three common mounting methods as shown below. Method (3) is not recommended. Adopt methods (1) or (2) wherever possible.

(Unit: mm)

Mounting method	(1) Clamp nut				(2) Split-body clamp				(3) Setscrew clamp			
												
	Points to keep in mind											
	Face A											
Stem diameter	ø9.5	ø10	ø12	ø18	ø9.5	ø10	ø12	ø18	ø9.5	ø10	ø12	ø18
Mounting hole	G7		G7		G7		G7		H5		H5	
Fitting tolerance	+0.005 to +0.020		+0.006 to +0.024		+0.005 to +0.020		+0.006 to +0.024		0 to +0.006		0 to +0.008	
Precautions	Care should be taken to make Face A square to the mounting hole. The stem can be clamped without any problem at squareness within 0.16/6.5.				Remove burrs generated on the wall of the mounting hole by the slitting operation.				M3×0.5 or M4×0.7 is an appropriate size for the setscrew. Limit countersinking into stem to 90°×0.5 and be careful not to damage the stem in the process.			

■ Maximum Loading Capacity of Micrometer Heads

The maximum loading capacity of a micrometer head depends mainly on the method of mounting and whether the loading is static or dynamic (used as a stop, for example). Therefore the maximum loading capacity of each model cannot be definitely specified. The loading limits recommended by Mitutoyo (at less than 100,000 revolutions if used for measuring within the guaranteed accuracy range) and the results of static load tests using a small micrometer head are given below.

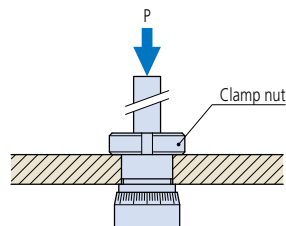
1) Recommended maximum loading limit

		Maximum loading limit
Standard type	Spindle pitch: 0.5 mm	Up to approx. 39.2 N (4 kgf)*
	Spindle pitch: 0.1 mm/0.25 mm	Up to approx. 19.6 N (2 kgf)
High function type	Spindle pitch: 0.5 mm	Up to approx. 39.2 N (4 kgf)
	Spindle pitch: 1.0 mm	Up to approx. 58.8 N (6 kgf)
	Non-rotating spindle	Up to approx. 19.6 N (2 kgf)
	Series 110 micro-fine feed type (with a differential mechanism)	Up to approx. 19.6 N (2 kgf)

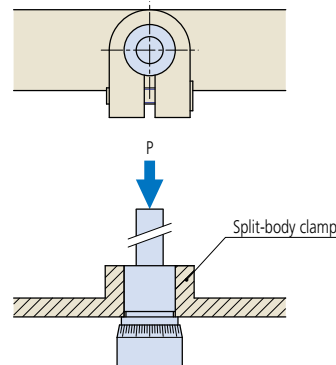
* Up to approx. 19.6 N (2 kgf) only for Ultra small models

2) Static load test for micrometer heads (using 148-104/ 148-103 for this test)

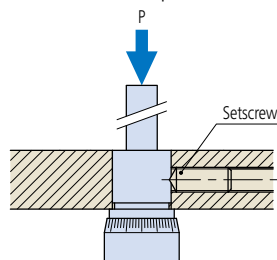
(1) Clamp nut



(2) Split-body clamp



(3) Setscrew clamp



Test method

Micrometer heads were set up as shown and the force at which the head was damaged or pushed out of the fixture when a static load was applied, in direction P, was measured. (In the tests no account was taken of the guaranteed accuracy range.)

Mounting method	Damaging / dislodging load
(1) Clamp nut	Damage to the main unit will occur at 8.63 to 9.8 kN (880 to 1000 kgf).
(2) Split-body clamp	The main unit will be pushed out of the fixture at 0.69 to 0.98 kN (70 to 100 kgf).
(3) Setscrew clamp	Damage to the setscrew will occur at 0.69 to 1.08 kN (70 to 110 kgf).

Note: These load values should only be used as an approximate guide.

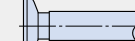
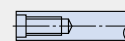
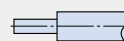
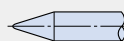
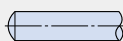
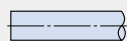
Quick Guide to Precision Measuring Instruments

Custom-built Products (Product Example Introductions)

Micrometer heads have applications in many fields of science and industry and Mitutoyo offers a wide range of standard models to meet customers' needs. However, in those cases where the standard product is not suitable, Mitutoyo can custom build a head incorporating features better suited to your special application. Please feel free to contact Mitutoyo about the possibilities - even if only one custom-manufactured piece is required.

1. Spindle-end types

- Standard
- Spherical
- Pointed
- Spline
- Tapped
- Flanged
- Blade (for non-rotating spindle type only)

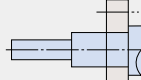
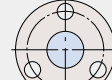
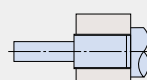
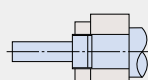
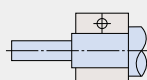


Note: Long spindle type is also available. Please consult Mitutoyo.

2. Stem types

A custom stem can be manufactured to suit the mounting fixture.

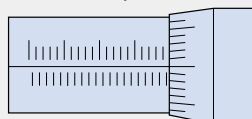
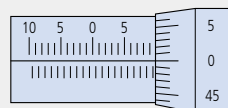
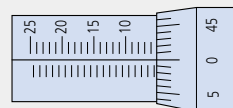
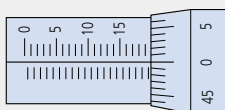
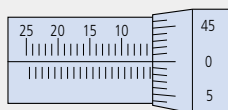
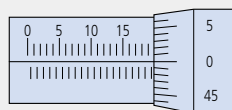
- Plain
- Clamp nut
- Threaded
- Flanged



3. Scale graduation schemes

Various barrel and thimble scale graduation schemes, such as reverse and vertical, are available. Please consult Mitutoyo for ordering a custom scheme not shown here.

- Standard
- Reverse
- Vertical
- Reverse vertical
- Offset zero
- Graduations only



4. Logo engraving

A specific logo can be engraved as required.

5. Motor Coupling

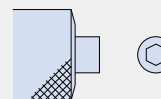
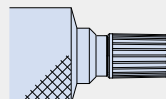
Couplings for providing motor drive to a head can be designed.



6. Thimble mounting

Thimble mounting methods including a ratchet, setscrew, and hex-socket head screw types are available.

- Ratchet
- Setscrew
- Hex-socket head screw



7. Spindle-thread pitch

Pitches of 1 mm for fast-feed applications or 0.25 mm and 0.1 mm for fine-feed can be supplied as alternatives to the standard 0.5 mm. Inch pitches are also supported. Please consult Mitutoyo for details.

9. All-stainless construction

All components of a head can be manufactured in stainless steel.

8. Lubricant for spindle threads

Lubrication arrangements can be specified by the customer.

10. Simple packaging

Large-quantity orders of micrometer heads can be delivered in simple packaging for OEM purposes.

Chapter 4

VL

Litematic

**Ideal for measuring the thickness or height
of a workpiece that can be easily affected
by the measuring force**

VL-50-B/50S-B 4-1

LITEMATIC® VL-50-B/50S-B

- With a measuring force of only 0.01 N, the Litematic is ideal for measuring easily deformed workpieces or high-accuracy components.
- For workpieces for which 0.01 N is insufficient, either the 0.15 N or 1 N model (factory-installed option) is recommended.
- The spindle is motor-driven and stops when the contact point touches the workpiece. From then on, the maximum, minimum, or difference value can be measured using a constant measuring force.

High-accuracy measurement

- High resolution of 0.01 μm , and wide measuring range of 50 mm.
- The measuring table supplied with **VL-50-B** is ceramic, which is corrosion free, for easier maintenance and storage.
- The spindle is made of low thermal expansion material.



Litematic
VL-50-B



Litematic Head
VL-50S-B

Note: The stand (957460) is sold as an option.

Separate type VL-50S-B

Because the measuring unit and the display unit are separate, they can be integrated into the user's measurement system. An optional dedicated stand is also available.

Tips

Constant measuring force principle

An unbalanced, parallel-link structure enables the Litematic to offer a low and constant measuring force.

The Litematic's measuring force is not provided by a spring but comes from a structure resembling a balance scale. We call this a "parallel linkage." A motorized slider carrying the linked spindle moves down its guideway while the linkage is supported on a stop, as shown in Fig. 1. When the spindle contacts the workpiece (Fig. 2) it moves the linkage up off the stop and the motor is halted. At this point the linkage is now supported by the workpiece, and thus a constant measuring force is applied.

Fig. 1. The spindle moves downwards towards the workpiece.

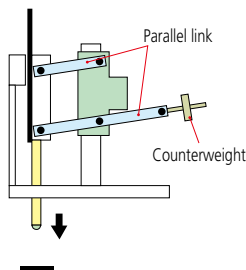
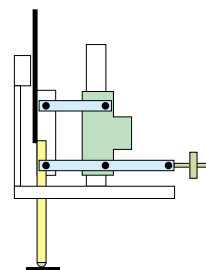


Fig. 2. The spindle lifts the linkage off the stop into the measuring position.



The contact point on the spindle touches the workpiece, lifting the linkage off the stop and halting the motor that was lowering the spindle, thus applying a constant force to the workpiece.

VL-50-B/50S-B

Specifications

Order No.	318-221 ^{*4}	318-222 ^{*4}	318-223 ^{*4}	318-226 ^{*4}	318-227 ^{*4}	318-228 ^{*4}
Model	VL-50-B	VL-50-15-B	VL-50-100-B	VL-50S-B	VL-50S-15-B	VL-50S-100-B
Measuring range ^{*1}	0 to 50 mm (0 to 2 in)					
Resolution	0.01/0.1/1.0 μm (0.0000005 in/0.000005 in/0.00005 in)					
Display unit	8 digits/14 mm (0.6 in) character height (without signs)					
Scale type	Reflection type linear encoder					
Stroke	51.5 mm (2 in) (when using a standard contact point)					
Measuring accuracy (20 °C) ^{*1}	(0.5+L/100) μm L=arbitrary measuring length (mm)					
Accuracy guaranteed temperature ^{*2}	20±1 °C					
Repeatability ^{*1}	σ = 0.05 μm					
Measuring force ^{*1}	0.01 N	0.15 N ^{*3}	1 N ^{*3}	0.01 N	0.15 N ^{*3}	1 N ^{*3}
Feed speed	Measurement	Approx. 2 mm/s (0.08 in/s) or 4 mm/s (0.16 in/s) (changeable by parameter)				
	Fast feed	Approx. 8 mm/s (0.3 in/s)				
Contact point	ø3 mm carbide tipped (fixing screw: M2.5 (P=0.45)×5), standard contact point: 901312					
Measuring table	ø100 (ceramic, grooved, removable)			—		
Input	Foot switch input (when optional foot switch is used), External Control					
Output	Digimatic output/RS-232C output (changeable by parameter)					
Rating	Power supply	85 to 264 V AC (depends on AC adapter)				
	Power consumption	Max. 12 W (12 V, 1 A)				
EU Directive	EMC Directive					
Main unit mass	19 kg (35.2 lbs)			6 kg (11 lbs)		
Standard Accessories	AC adapter: 357651 , Power cable: 02ZAA000 , Grounding wire: 934626 , AC cable (Japan): 02ZAA000 , AC cable (USA): 02ZAA010 , AC cable (EU): 02ZAA020 , AC cable (UK): 02ZAA030 , AC cable (China): 02ZAA040 , AC cable (Korea): 02ZAA050 Hex wrench (2 pcs, for fixing contact point and for removing fixing bracket)					
Optional accessories	Foot switch: 937179T					
	—			Dedicated stand: 957460		
	Output connector (with cover): 02ADB440 (for external control)					
	RS-LINK/Digimatic connecting cable: 936937 (1 m) 965014 (2 m)					
	Recommended interchangeable contact points ^{*5} (Measuring force when each interchangeable contact point is used.) Shell type: 101118 (Approx. 0.02 N) Carbide tipped spherical contact point, ø7: 120059 (Approx. 0.03 N) Carbide tipped spherical contact point, ø10.5: 120060 (Approx. 0.06 N) Carbide tipped needle contact point, ø0.45: 120066 (Approx. 0.01 N)					
	VL weight parts: 02AZE375 Measuring force: Approx 0.01 N to 0.96 N Note: The above VL weights are not applicable to VL-50-100-B , VL-50S-100-B .					

*1 Normal measurement using standard contact point (with smoothing set as "weak").

*2 Under less temperature change, and hot or cold direct air flow should be avoided.

*3 0.15 N and 1 N types are factory-installed option.

*4 To denote your AC power cable add the following suffixes to the order No.: A for UL / CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, and No suffix are required for PSE.

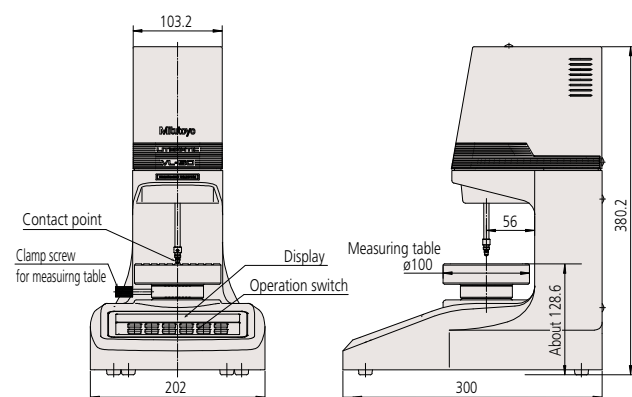
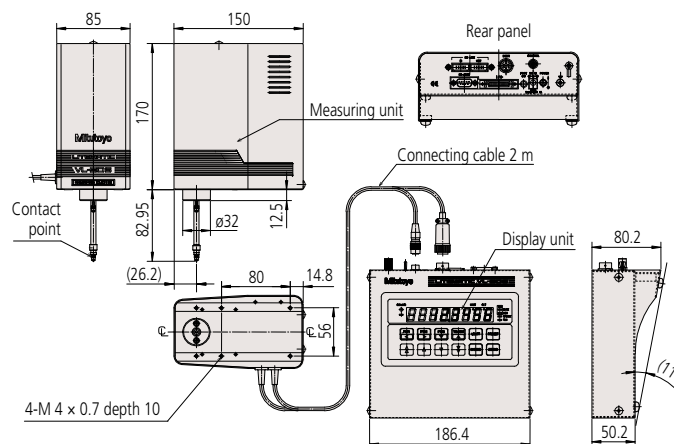
*5 When another contact point that has a flat measuring face is mounted, the contact point requires parallelism adjustment with respect to the table surface.

Mounting this contact point should be custom-ordered from Mitutoyo.

Note: Motor life is approximately 100,000 operations, after which replacement is advisable.

This maintenance factor is particularly important to bear in mind when the machine is used frequently, such as on a production line.

VL-50-B

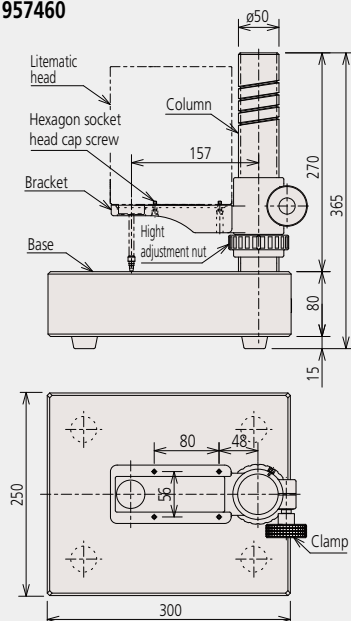
**VL-50S-B**

Note: When a contact point having a flat measuring surface, other than those described above, is installed, the measuring surface must be adjusted for parallelism with the table surface. This requires a special order.

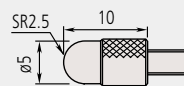
Optional accessories

Optional stand for VL-50S-B

957460

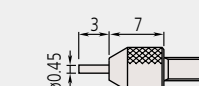


Interchangeable contact points



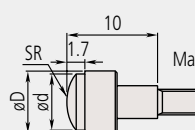
Material: Hardened steel

Order No.	Measuring force
101118	0.02 N



Material: carbide Flatness: 3 μm

Order No.	Measuring force
120066	0.01 N

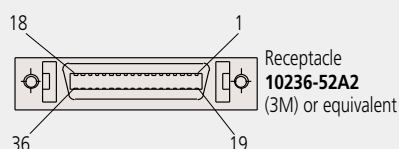


Material: carbide

Order No.	Measuring force	D	d	SR
120059	0.03 N	ø7.5	ø6.5	7
120060	0.06 N	ø10.5	ø9.5	10

Applicable plug

02ADB440 (with cover) Optional accessory



Applicable plug (commercially available)

10136-3000VE (3M: Plug)

10336-52AO-008 (3M: Cover)

DX40M-36P (Hirose: Plug)

DX30M-36-CV (Hirose: Cover)

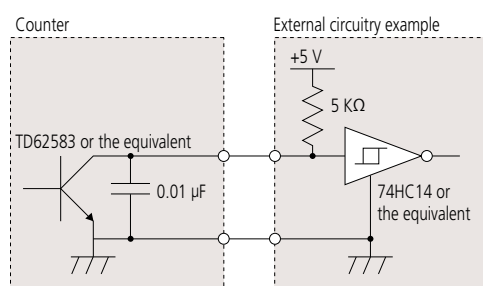
Connector terminal function

1) Pin assignment

Pin No.	Signal name	Input/Output	Description (purpose)															
1	COM	—	Common terminal to input and output circuits (internally connected to GND)															
2	COM	—																
3	L1	OUT	Tolerance judgment output terminal A related judgment terminal only outputs “L” At error occurrence L1, L5 = Outputs “L” L2, L3, L4 = Outputs “H”															
4	L2	OUT																
5	L3	OUT																
6	L4	OUT																
7	L5	OUT																
10	NOM	OUT	Outputs “L” in the count mode.															
21	ULIMIT	OUT	Outputs “L” at the top dead point of the spindle.															
22	WORK	OUT	Outputs “L” upon detection of a workpiece.															
25	SET1	IN	Specifies peak selection/motor speed in combination with SET.															
26	SET2	IN																
28	MODE	IN	Peak selection: In combination with SET <table><tr><th>Peak mode</th><th>SET2</th><th>SET1</th></tr><tr><td>Current value</td><td>H</td><td>H</td></tr><tr><td>MAX</td><td>H</td><td>L</td></tr><tr><td>MIN</td><td>L</td><td>H</td></tr><tr><td>TIR</td><td>L</td><td>L</td></tr></table>	Peak mode	SET2	SET1	Current value	H	H	MAX	H	L	MIN	L	H	TIR	L	L
Peak mode	SET2	SET1																
Current value	H	H																
MAX	H	L																
MIN	L	H																
TIR	L	L																
30	UP	IN	Motor control: Specifies a spindle ascent speed along with SET. <table><tr><th>Speed</th><th>SET2</th><th>SET1</th></tr><tr><td>approx. 8mm/s</td><td>H</td><td>H</td></tr><tr><td>approx. 4mm/s</td><td>H</td><td>L</td></tr><tr><td>approx. 2mm/s</td><td>L</td><td>H</td></tr><tr><td>approx. 1mm/s</td><td>L</td><td>L</td></tr></table> When changing the spindle speed, stops the spindle once and allows 50 ms or more before change.	Speed	SET2	SET1	approx. 8mm/s	H	H	approx. 4mm/s	H	L	approx. 2mm/s	L	H	approx. 1mm/s	L	L
Speed	SET2	SET1																
approx. 8mm/s	H	H																
approx. 4mm/s	H	L																
approx. 2mm/s	L	H																
approx. 1mm/s	L	L																
31	DN	IN	Motor control: Specifies a spindle ascent speed along with SET. <table><tr><th>Speed</th><th>SET2</th><th>SET1</th></tr><tr><td>approx. 8mm/s</td><td>H</td><td>H</td></tr><tr><td>approx. 4mm/s</td><td>H</td><td>L</td></tr><tr><td>approx. 2mm/s</td><td>L</td><td>H</td></tr><tr><td>approx. 1mm/s</td><td>L</td><td>L</td></tr></table> When changing the spindle speed, stops the spindle once and allows 50 ms or more before change.	Speed	SET2	SET1	approx. 8mm/s	H	H	approx. 4mm/s	H	L	approx. 2mm/s	L	H	approx. 1mm/s	L	L
Speed	SET2	SET1																
approx. 8mm/s	H	H																
approx. 4mm/s	H	L																
approx. 2mm/s	L	H																
approx. 1mm/s	L	L																
32	FSW	IN	Motor control: Same function as that of foot switch.															
34	HOLD	IN	The display value is held during input. At error occurrence the error is cleared at the leading edge of this signal.															
35	P.SET	IN	Executes presetting. Peak clear: The peak value is cleared upon input of the signal during the HOLD signal input in the Peak mode.															
	N.C.	—	Unconnected terminals (Do not connect anything) (8, 9, 11-20, 23, 24, 27, 29, 33 and 36 pin terminals)															

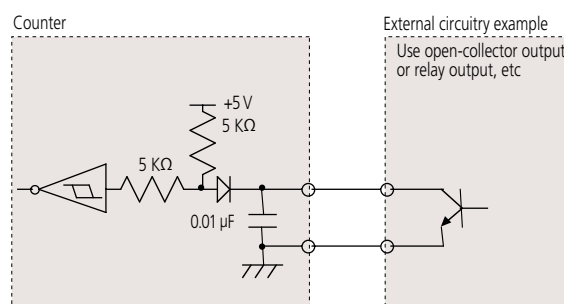
2) Input/output circuit

1. Output circuit: When the signal goes to "Low," the transistor turns on. (Open collector output)



Maximum output voltage: 24 V
Maximum output current: 20 mA
Maximum saturation voltage: 0.7 V

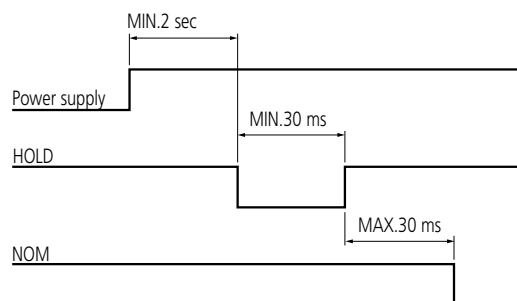
2. Input circuit: When the signal goes to "Low," the input is enabled.



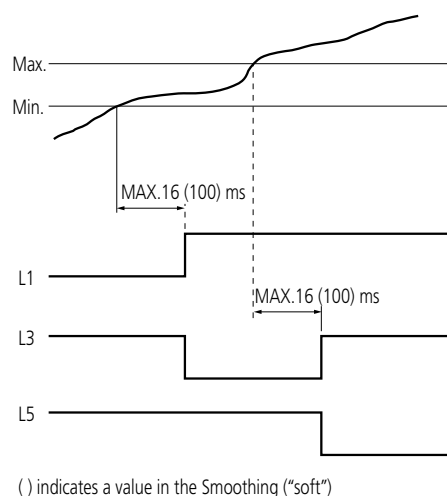
Maximum input current: 1 mA
Input voltage (H): H=4~24 V
Input voltage (L): L=1 V max.

3) Timing Chart

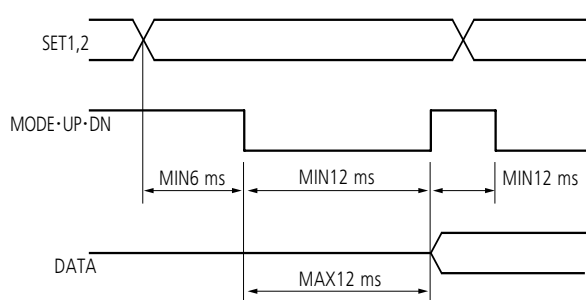
1. Power On characteristics



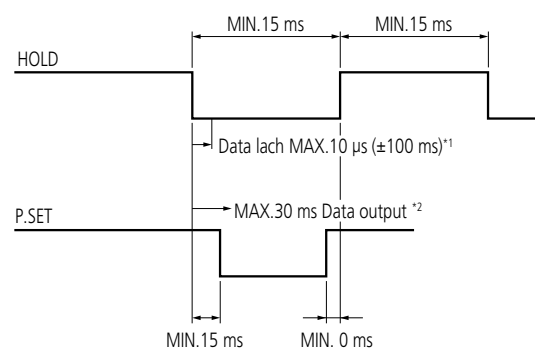
2. Tolerance judgment result output timing



3. Mode/Up/DN timing



4. HOLD, Error clear



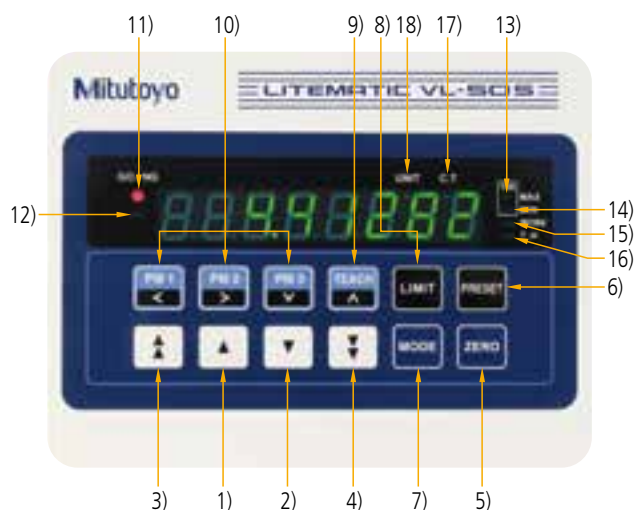
* Peak clear input (following HOLD input, preset input)

*1: The value in () is that at the time of smoothing.

*2: In case of parameter 28 and HOLD selection 1.

Functions

Control panel/Display Unit

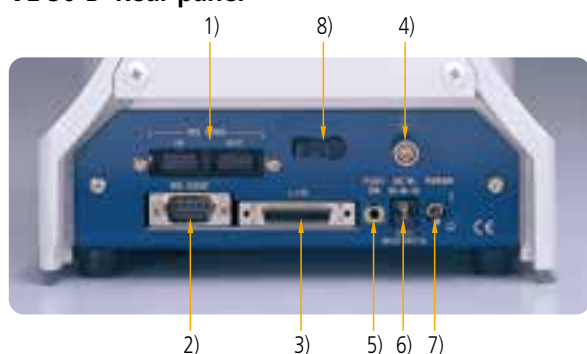


Key function	
Key	Function
1) Up	Moves the spindle up only while the key is pressed.
2) Down	Moves the spindle down only while the key is pressed. Used to touch the contact point on a workpiece to make a measurement.
3) Rapid Up	Moves the spindle up quickly only while the key is pressed.
4) Rapid Down	Moves the spindle down quickly only while the key is pressed.
5) ZERO	Sets the origin at any position of the spindle. Also, it zero-sets all display values for difference measurements. This key can be used to clear an error.
6) PRESET	Allows the currently displayed value to be set from the keyboard, irrespective of spindle position. Often used in conjunction with gauge blocks.
7) MODE	Selects and sets one of various measurement modes such as MAX/MIN measurement.
8) LIMIT	Enters tolerance limits for tolerance judgment.
9) TEACH	Sets up the position memory.
10) PM1 to PM3	Moves the spindle to a previously stored position with a single keystroke.

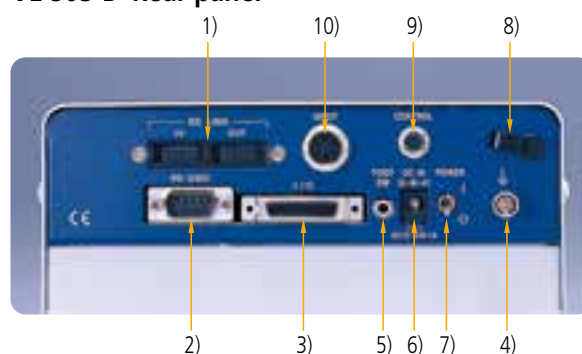
Indicator (LED)	
Indicator	Function
11) GO/NG	Displays the result of a GO/NG judgment.
12) Sign	Lights to display a minus value.
13) MAX	Lights in the maximum value mode.
14) MIN	Lights in the minimum value mode.
	Both light when the measurement is the difference type (MAX - MIN).
15) WORK	Lights while a workpiece is being measured.
16) T.H.	Lights when a measurement value is held after measurement has been completed.
17) C.T.	Lights when the user compensation is set to ON. (Lights while the position memory is active.)
18) UNIT	Lights while the unit of display values is inch. (Lights in the external HOLD mode.)

Rear panel (switches and connectors)

VL-50-B Rear panel



VL-50S-B Rear panel



Part name	Function
1) Measurement data output connector (OUT)	Outputs measurement data to a Digimatic mini-processor, etc.
RS-LINK connector (IN/OUT)	Connects multiple devices and can output measurement data from one RS-232 port.
2) RS-232C connector	For communication with a PC, etc.
3) External control connector	Used to connect this instrument to an external device for remote control.
4) GND terminal	—
5) Foot switch	Foot switch (optional) for controlling measurement operation is connected here.
6) DC IN	Input connector to receive power from the AC mains adapter.
7) Power switch	—
8) AC adapter cord clamp	Prevents AC adapter cord from pulling out.
9) CONTROL connector: for VL-50S-B only	Gage head connector.
10) INPUT connector: for VL-50S-B only	Gage head connector.

Optional accessories

Optional weights for the Litematic
02AZE375

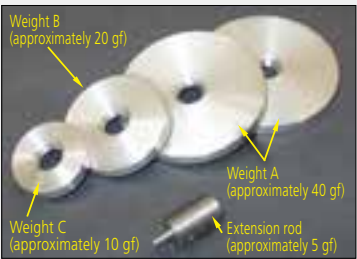
One of the notable characteristics of the Litematic is its small measuring force (0.01 N or 0.15 N models). However, depending on the characteristics of the workpiece, it may not be possible to transmit a sufficient measuring force and the contact point may appear suspended. To solve such a problem, optional weights are available that attach to the spindle to achieve the appropriate measuring force without damaging the workpiece.

Note: Cannot be used with **VL-50-100-B**, or **VL-50S-100-B**

Spindle with an optional weight installed



External appearance of optional weights



Measuring forces generated by weight combinations for 0.01/0.15 N models

Measuring force (N)		Extension rod	A	B	C
0.01	0.15				
0.06	0.21	1			
0.16	0.31	1			1
0.26	0.41	1		1	
0.36	0.51	1		1	1
0.46	0.61	1	1		
0.56	0.71	1	1		1
0.66	0.81	1	1	1	
0.76	0.91	1	1	1	1
0.86	—	1	2		
0.96	—	1	2		1

Contact Sensor

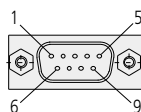
Non-contact Sensor

RS-232C communication function

1) List of commands

Command format	Response output	Operation content
GA * * CRLF	G # * *, + 01234.567CRLF	A display value is output via RS-232C. “* *” indicates gage channel numbers 01 to 99 (all channel number when set to 00). When RS-LINK is not connected, the channel number is “01”. “#” indicates the type of data (N: current value, X: maximum value, M: minimum value, and W: TIR (range)).
CN * * CRLF	CH * * CRLF	The display is switched to the current value.
CX * * CRLF	CH * * CRLF	The display is switched to the maximum value.
CM * * CRLF	CH * * CRLF	The display is switched to the minimum value.
CW * * CRLF	CH * * CRLF	The display is switched to the TIR value.
CR * * CRLF	CH * * CRLF	The display is zero-set.
CL * * CRLF	CH * * CRLF	The peak value is cleared.
CP * *, +01234567CRLF	CH * * CRLF	The preset value is input. Input a preset value and a tolerance limit with a sign and a numeric value of 8 digits without appending a decimal point.
CD * *, +01234567CRLF	CH * * CRLF	Input tolerance limit S1. Perform tolerance setup in the order of CD and CG for 3-step tolerance judgment, and in the order of CD, CE, CF, and CG for 5-step tolerance judgment. An error message is output if there is a difference in tolerance limit order, or in the number of steps between the setting and data to be sent, or if incorrect data exists. If this is the case, repeat setup from the beginning of the CD command.
CE * *, +01234567CRLF	CH * * CRLF	Input tolerance limit S2.
CF * *, +01234567CRLF	CH * * CRLF	Input tolerance limit S3.
CG * *, +01234567CRLF	CH * * CRLF	Input tolerance limit S4.
CS * * CRLF	CH * * CRLF	An error is canceled.
VS * *, + \$ CRLF	CH * * CRLF	Spindle control Sign +: Moves up the spindle., -: Moves down the spindle. \$: Speed specification 0: Stop 1: 2 mm/s 2: 4 mm 3: 8 mm/s approx.
VT * *, + \$ CRLF	CH * *, # CRLF	Status of spindle condition In place of #, 0: Normal 1: Upper dead point limit 2: WORK ON Channel number 00 cannot be used.

2) Pin assignment

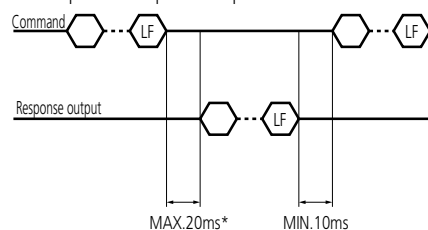


- Receptacle specification: D-sub 9-pin (male), inch thread spec.
- Applicable plug specification: D-sub 9-pin (female), inch thread spec.
- Commercial cable examples:
For DOS/V: KRS-403XF1K (1.5 m), Sanwa Supply Corp.
For PC-98 series: KRS-423XF1K (1.5 m), Sanwa Supply Corp.

Pin No.	Signal name	Input/Output	Definition
2	RXD	IN	Receive data
3	TXD	OUT	Transmit data
4	DTR	OUT	Data terminal ready
5	GND	—	Ground
6	DSR	IN	Data set ready
7	RTS	OUT	Request to send
8	CTS	IN	Clear to send
1, 9	N.C.	—	Unconnected

4) Timing Chart

RS-232C command input and response output



*The RS-232C output is put on hold during key operations.

3) Communication protocol (EIA RS-232C compatible)

Home position	DTE (terminal) and cross cable are to be used.
Communication method	half-duplex, non-procedural
Baud rate	4800, 9600, 19200 bps
Bit configuration	Start bit: 1 Data bits: (7 or 8) ASCII, uppercase Parity bit: None, even or odd Stop bits: 2
Communication condition setup	Set with parameters.

RS-232C data output time

The maximum output time when the all-data-output command (GA00CRLF) is used can be calculated using the following formula:

$$\text{Maximum output time [ms]} = \text{counter connection count} \times 20 + \text{connected channel} \times 17 (8.5) + 6 (3)$$

*At a transfer speed of 9,600 bps; figures inside () indicate values [in ms] when the speed is 19,200 bps. (Calculation example) 1 VL unit = MAX43 (31.5) ms (Note: The processing time by the personal computer is not included.)

Printer and connecting cable

Digimatic mini processor

DP-1VA LOGGER 264-505*

* To denote your AC line voltage add the following suffixes. A for North America, D for Europe, E for UK, K for Korea, DC for China, B for Oceania without AC adapter and no suffix is required for Japan.

Prints the Digimatic output up to 8 digits from Litematic.

- Connecting cable (1 m) **936937**

Note: The number of significant digits for Digimatic output is six.



Example measurement applications

Rubber and plastic

If the workpiece is soft the risk of indentation may be reduced by replacing the standard contact point with one of larger radius, such as an optional carbide-ball type.



- ▶ Plastic
- ▶ Rubber
- ▶ Keypad



Glass

For this type of workpiece the smallest measuring force available is recommended.



- ▶ Blue plate glass
- ▶ Lenses
- ▶ Contact lenses



Film and sheet

If the workpiece flexes, making accurate measurement impossible, using a type with a larger measuring force or adding a weight to the spindle may be effective.



- ▶ Film
- ▶ Flexible substrates
- ▶ Various types of sheet



Precision components

The Litematic can be used as a high-precision displacement gage.



- ▶ Bearing
- ▶ Shaft



Thin sheet metal

Because the measuring force is small, deformation of the workpiece can be minimized.



- ▶ Chassis
- ▶ Shimming materials
- ▶ Blade springs
- ▶ Beverage can materials



Media discs

For this type of workpiece the smallest measuring force available is recommended.



- ▶ Media tape
- ▶ Hard disks
- ▶ Various types of disks



Medical and pharmaceutical products

If the workpiece is soft the risk of indentation may be reduced by replacing the standard contact point with one of larger radius, such as an optional carbide-ball type.



- ▶ Injection needles
- ▶ Pills
- ▶ Patches and ointments



Semiconductors

If the workpiece flexes, making accurate measurement impossible, using a type with a larger measuring force or adding a weight to the spindle may be effective.



- ▶ Chips
- ▶ Wafers
- ▶ Lead frames

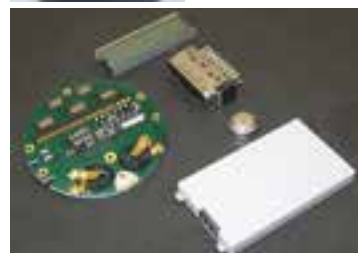


Electronic components

For this type of workpiece the smallest measuring force available is recommended.



- ▶ Printed circuit boards
- ▶ Connectors
- ▶ Battery components



Chapter 5

LSM

Laser Scan Micrometer

High accuracy non-contact measuring system

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Mitutoyo Precision Gage Heads

Innovative Laser Technology

Laser Scan Micrometers



High Precision Full-lineup

Features

Ultra-high scanning rate 3200 scans/sec

[excludes some models]

The incorporation of a sixteen-face polygonal mirror and a high-precision motor now makes scanning at 3200 scans per second possible. This formidable capability is ideal, for example, for taking measurements on high-speed production lines or on vibrating workpieces.

Eliminates measuring errors due to individual operator differences

Since measurement is performed by just placing the target part on the measuring table or jig, operator differences are eliminated.

Repeatability and linearity are improved and positional errors are reduced

Thanks to the optical system optimization and clock pulse speed enhancement, the repeatability and linearity have been dramatically improved and positional errors are decreased, making the LSM very suitable for high accuracy applications.

The industry's first guarantee of narrow range accuracy

The improvements made have enabled specification of a guaranteed narrow range accuracy for the first time ever. Now a higher level of accuracy is obtainable for comparison measurements using master gages or workpieces. (Except for the **LSM-500S** and **LSM-9506**)

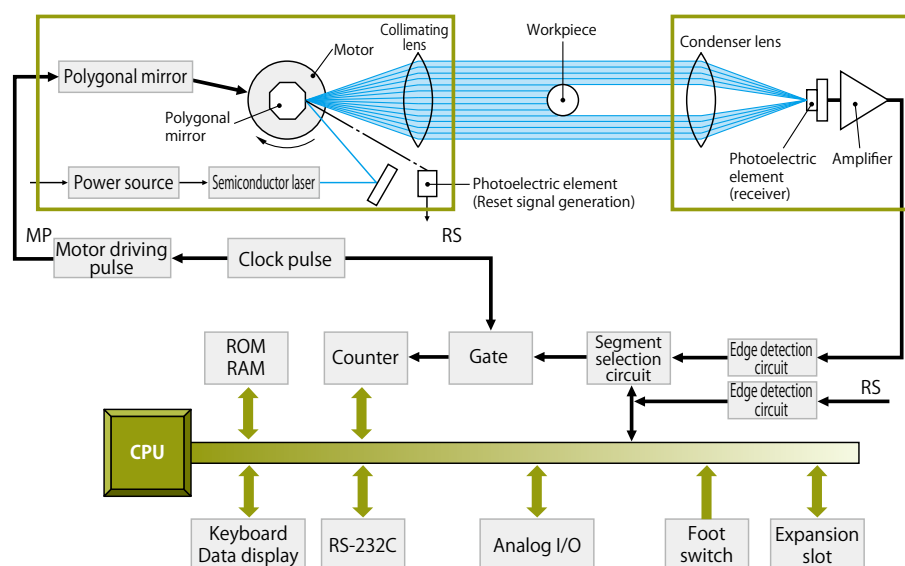
Principle

An ultra-precision scanning motor is adopted to achieve ultra-high accuracy.

<Benefits of scan motors>

- High accuracy is achieved with highly stable and smooth rotation.
- A long service life without requiring maintenance.
- Ultra-high-speed measurement at 3200 scans per second follows any positional change of the workpiece.
- Being affected little by the ambient temperature and humidity changes enables high accuracy.

Principle diagram of laser scan micrometer (scan motor type)



As shown in the block diagram above, the laser beam emitted from the semiconductor laser synchronizes with the clock pulse and is reflected by the polygon mirror rotating at high speed. Then, it is converted to a parallel beam by the collimator lens, scans across the workpiece and finally reaches the photodetector.

The photodetector generates a voltage while it detects laser light during the scan.

According to the presence or absence of detector voltage, the dimension is displayed by counting the pulses generated while the laser beam is blocked by the workpiece.

Therefore, the workpiece size and gaps between workpieces can be measured.

In this laser scanning method, the essential element to achieve high accuracy is the constant scanning speed of the laser beam.

Mitutoyo's laser scan micrometers address this requirement by adopting the ultra-precision scanning motor and ultra-high-precision optical components.

Excellent **linearity** is an essential prerequisite for high accuracy over the entire measuring range, and the LSM is highly linear. Accuracy is guaranteed for **both the entire measuring range and narrow range***, and measurement values are stabilized.

* Excepting the LSM-500S and LSM-9506.

A wide choice of calibration gauges is available (optional)



Laser Scan Micrometer Selection Guide

- Semiconductor laser light source for measurement section: Visible light type (wavelength: 650 nm)

Measuring Units

Measuring range 0.005 - 2 mm
(0.0002 in - 0.08 in)

LSM-500S



Measuring range 0.05 - 10 mm
(0.002 in - 0.4 in)

LSM-501S



Measuring range 0.3 - 30 mm
(0.012 in - 1.18 in)

LSM-503S



Measuring range 1 - 60 mm
(0.04 in - 2.36 in)

LSM-506S



Measuring range 1 - 120 mm
(0.04 in - 4.72 in)

LSM-512S



Measuring range 1 - 160 mm
(0.04 in - 6.30 in)

LSM-516S



Display Units

Multi-function (Power Supply 100 V - 240 V AC)

LSM-6200



Compact (Power Supply +24 V DC) 1.3A

LSM-5200



Measuring Unit (Factory-set package)

Measuring range 0.1 - 25 mm
(0.004 in - 1.0 in)

LSM-6902H



Repeatability: $\pm 0.045 \mu\text{m}$

Measuring Unit with Integrated Display

Measuring range 0.5 - 60 mm
(0.02 in - 2.36 in)

LSM-9506



Bench-top type with integrated display unit

The optimal solution for measuring the outside diameter of pin gages and plug gages.

The use of world-class laser scan micrometer LSM-6902H along with an adjustable workstage allows high-accuracy measurement inspection of the outside diameter of pin gages and plug gages.

This LSM is also capable of data output to an external device such as a personal computer from the display unit.

(Measurement data can be stored easily in cells on EXCEL by using the Mitutoyo input tool.)

■ Major Specifications

Measuring range: $\varnothing 0.1 \text{ mm}$ to $\varnothing 25.0 \text{ mm}$

Resolution: $0.01 \mu\text{m}$

Accuracy: $\pm 0.5 \mu\text{m}$

Repeatability: $\pm 0.045 \mu\text{m}$

LSM-6902H



MEASURING UNIT and DISPLAY

Ultra-High Accuracy Measuring Unit LSM-6902H

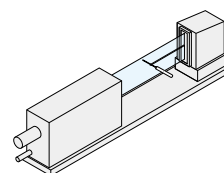
- Demonstrates the outstanding repeatability available in the 25 mm class.
- The ultra-precise scanning motor enables the highest measurement accuracy to be realized.
- Thanks to excellent linearity, an accuracy of $\pm 0.5 \mu\text{m}$ over the entire measuring range and a higher accuracy of $\pm(0.3+0.1 \Delta D) \mu\text{m}$ over a narrow range are guaranteed.
- The optimal solution for measuring the outside diameter of pin gages and plug gages.



LSM-6902H
Signal cable (5 m) No.02AGN770A is supplied.

Tips

Pin and plug gage
measurements



Specifications

Measuring unit

Set Order No.		544-497-1	544-498-1	544-499-1
Type		mm	mm	inch/mm
Applicable standards		JIS	IEC, FDA	
Measuring range		0.1 to 25 mm		
Resolution		0.01 to 10 μm (selectable)		
Repeatability*1	Entire range	±0.045 μm (ø25 mm)		
	Narrow range	±0.03 μm (ø10 mm)		
Accuracy*2 (20 °C)	Entire range	±0.5 μm		
	Narrow range	±(0.3+0.1 ΔD) μm [D: mm]**5		
Positional error*3		±0.5 μm		
Measuring range*4		±1.5 mm × 25 mm		
Scanning rate		3200 scans/s		
Laser wavelength		650 nm (Visible)		
Laser scanning speed		226 m/s		
Operating temperature		0 to 40 °C		
Operating humidity		RH 35 to 85 % (non-condensing)		

*1: At the 2 σ level in the case where $\phi 25 \text{ mm}$ and $\phi 10 \text{ mm}$ diameters are measured using a measurement time of 1.28 seconds (2048 scans on average).

*2: The value at the center of the measuring range.

*3: The additional error (in outside diameter) caused by workpiece movement within the measuring envelope during the measuring cycle.

*4: Length along optical axis \times Scanning length (Measuring range)

*5: ΔD is the difference in outside diameter between the master gage and workpiece.

Note: To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.

Display unit

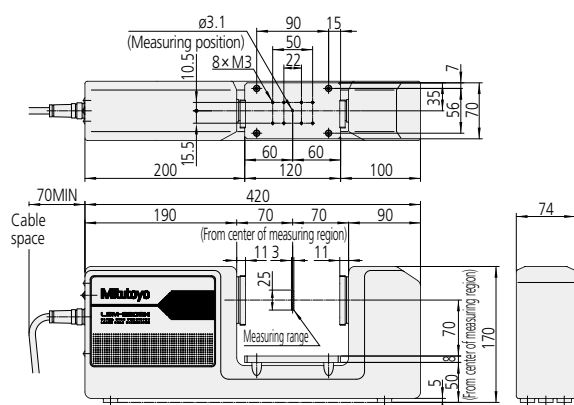
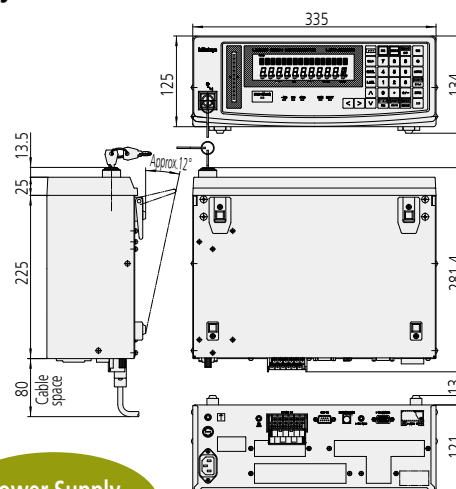
Display	16-digit plus 11-digit fluorescent display, and guide message LED
Segment	1 to 7 (1 to 3, transparent) or 1 to 255 edges
Averaging times	Arithmetic average: 2 to 2048 scans. Moving average: 32 to 2048 scans.
Judgment	Selection from "target value + tolerance", "lower tolerance + upper tolerance", or "7 classes multilimit tolerance zone".
Measurement mode	Standby, Single measurement, Continuous measurement
Statistical analysis	Maximum, Minimum, Average, Dispersion, σ (S.D)
External dimensions	335(W) \times 134(H) \times 250(D) mm
Power supply	100 to 240 VAC $\pm 10 \%$ 50 W 50/60 Hz
Standard I/F	RS-232C, Analog I/O
Optional I/F	Digimatic code output unit (2-ch), 2nd I/O analog I/F, BCD I/F
Operating temperature/humidity	0 to 40 °C, RH 35 to 85 % (non-condensing)
Others	Nominal setting, sample setting, suppression of unnecessary digits, transparent object measurement, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position), zero-set/offset Note: In the case of dual measuring-unit connection, extra-fine line measurement and some of the communication commands are not available

LSM-6902H

Dimensions

Unit: mm (inch)

Measuring unit

**Display unit**

Power Supply
100 V - 240 V AC

Optional accessories

Calibration gage set

(ø1 mm, ø25 mm)
02AGD180



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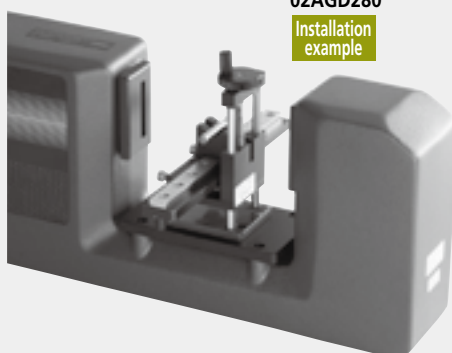
Workstage

02AGD270



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Adjustable Workstage

02AGD280
Installation
example

page 5-23

MEASURING UNIT

Ultra-Fine Wire Measuring Unit LSM-500S

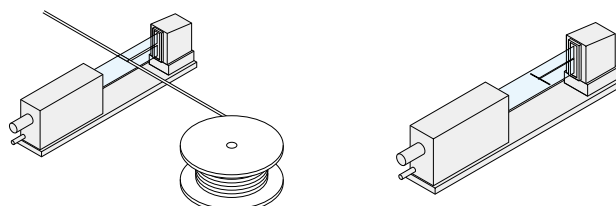
- Permits measurements starting from $\phi 5 \mu\text{m}$
- Provides ultra-high accuracy with a linearity of $\pm 0.3 \mu\text{m}$ over the entire measurement range (5 μm to 2 mm).



Signal cable (5 m) No.02AGN770A is supplied.

Tips

Ultra-fine wire measurement ... Fiber measurement



Note: For ultra-fine wire measurement, following functions are unavailable in combination: Simultaneous (Dual-program) measurement/1 to 255 edges specification/workpiece/automatic workpiece detecting/group judgment/odd-fluted cutting tool measurement

Specifications

Model	LSM-500S		
Order No.	544-531		544-532
Acceptable standard of laser	JIS		IEC, FDA
Measuring range ^{*1}	0.005 - 2 mm		
Resolution (selectable)	0.01 - 10 μm (selectable)		
Repeatability ^{*2}	$\pm 0.03 \mu\text{m}$		
Linearity at 20 °C ^{*3}	$\pm 0.3 \mu\text{m}$		
Positional error ^{*4}	$\pm 0.4 \mu\text{m}$		
Measuring region ^{*5}	1x2 mm		
Scanning rate	3200 scans/s		
Laser wavelength	650 nm, Visible		
Laser scanning speed	76 m/s		
Operating temperature	0 °C - 40 °C		
Operating humidity	35 - 85 % RH (non-condensing)		
Water/Dust protection grade	Conforming to IP64 ^{*6}		
Mass	Measuring unit: 1.0 kg, Signal cable: 0.5 kg		

*1: If a workpiece is transparent, measurement range will be set to between 0.05 mm (0.002 in) to 2 mm (0.08 in). If the workpiece is less than 0.05 mm, contact your Mitutoyo office. If the edge measurement is selected for 1 to 255 edges and each function such as the automatic workpiece detecting function, the group judgment, odd-fluted cutting tool measurement, simultaneous measurement, and the dual-type add-on unit that is an optional accessory for the LSM-6200 display unit are used, ultra-fine wire measurement will be invalid. In this case the measurement range will be set to between 0.1 mm (0.004 in) to 2 mm (0.08 in) as well.

*2: Determined by the value for $\pm 2\sigma$ at the measurement of $\phi 2 \text{ mm}$ workpiece with 0.32 sec. interval (1024-time average).

*3: At the center of the measuring region (According to Mitutoyo's specified acceptance procedure).

*4: An error due to workpiece shift either in the optical axis direction or in the scanning direction.

*5: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction".

*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Tips

Example

LSM-6200 (multi function type display unit)



page 5-27

LSM-5200 (panel mount type display unit)

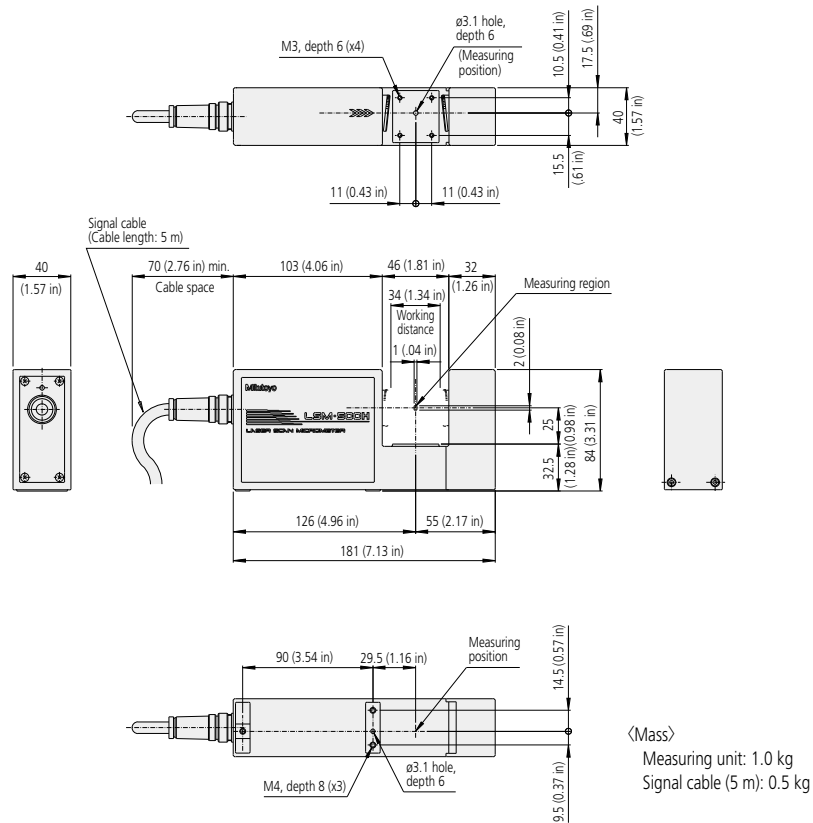


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LSM-500S

Dimensions

Unit: mm (inch)



Optional accessories

Calibration gage set

(ø0.1 mm, ø2.0 mm)
02AGD110



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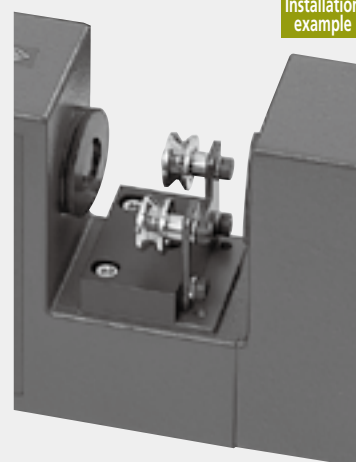
Extension signal cable

Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m

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Wire guiding pulley

02AGD200

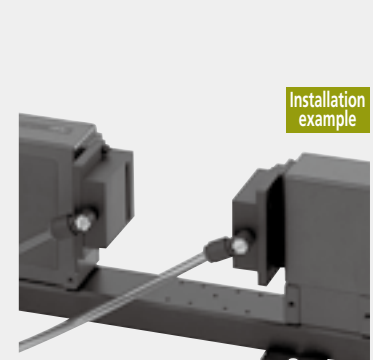


Installation example

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Air shield

02AGD220



Installation example

page 5-22

The photo shows the air shield for LSM-503S.

MEASURING UNIT

Fine Wire Measuring Unit LSM-501S

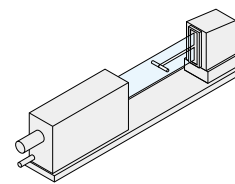
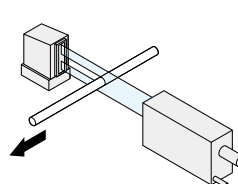
- Provides ultra-high accuracy with a linearity of $\pm 0.5 \mu\text{m}$ over the entire measurement range (0.05 mm to 10 mm) and $\pm(0.3+0.1 \Delta D) \mu\text{m}$ in the narrow range.



Signal cable (5 m) No.02AGN770A is supplied.

Tips

Precision shaft measurement ··· Ferrule measurement ·······



Specifications

Model	LSM-501S	
Order No.	544-533	544-534
Acceptable standard of laser	JIS	IEC, FDA
Measuring range	0.05 - 10 mm	
Resolution (selectable)	0.01 - 10 μm (selectable)	
Repeatability ^{*1}	$\pm 0.04 \mu\text{m}$	
Linearity at 20 °C ^{*2}	Entire range	$\pm 0.5 \mu\text{m}$
	Narrow range	$\pm(0.3+0.1 \Delta D) \mu\text{m}$
Positional error ^{*3}	$\pm 0.5 \mu\text{m}$	
Measuring region ^{*4}	2 x 10 mm at $\phi 0.05 - 0.1 \text{ mm}$ 4 x 10 mm at $\phi 0.1 - 10 \text{ mm}$	
Scanning rate	3200 scans/s	
Laser wavelength	650 nm, Visible ^{*5}	
Laser scanning speed	113 m/s	
Operating temperature	0 °C - 40 °C	
Operating humidity	35 - 85 % RH (non-condensing)	
Water/Dust protection grade	Conforming to IP64 ^{*6}	
Mass	Emission unit: 0.7 kg, Reception unit: 0.4 kg, Base: 0.3 kg (0.6 lbs.), Signal cable: 0.5 kg	

*1: Determined by the value for $\pm 2 \sigma$ at the measurement of $\phi 10 \text{ mm}$ workpiece with 0.32 sec. interval (1024-time average).

*2: At the center of the measuring region (According to Mitutoyo's specified acceptance procedure).

*3: ΔD is the outside diameter difference from the master gage (unit: mm).

*4: An error due to workpiece shift either in the optical axis direction or in the scanning direction.

*5: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction".

*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Tips

Example ·······

LSM-6200 (display unit)

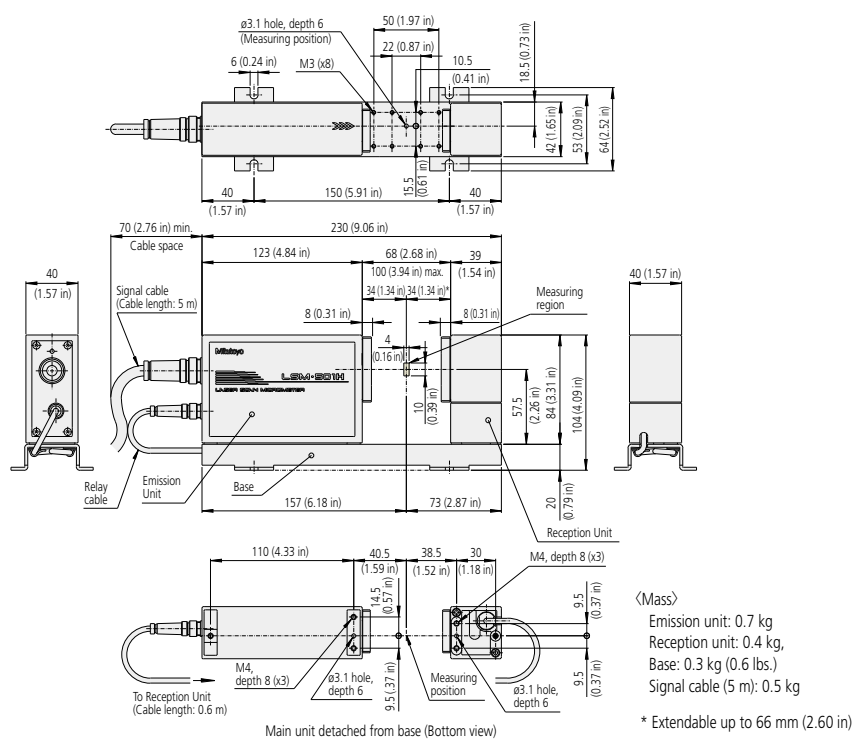


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LSM-5200 (display unit)



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Optional accessories

Calibration gage set

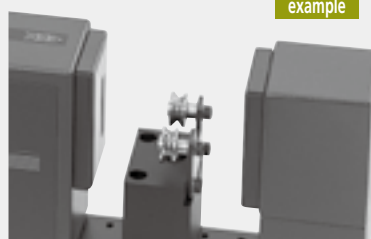
(ø0.1 mm, ø10 mm)
02AGD120



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Wire guiding pulley

02AGD210

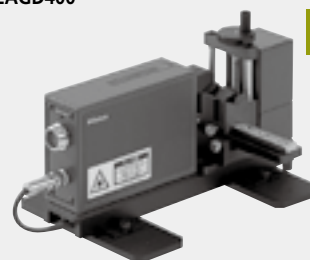


Installation example

page 5-21

Adjustable workstage

02AGD400

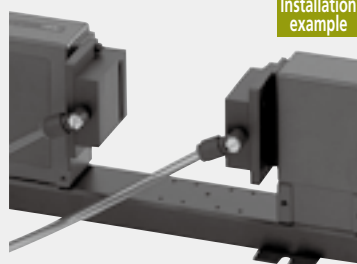


Installation example

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Air shield

02AGD230

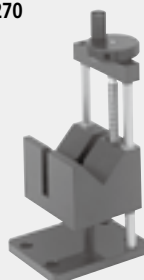


Installation example

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Workstage

02AGD270



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Extension signal cable

Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m

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Extension relay cable

Order No.	Cable length
02AGC150A	1m

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MEASURING UNIT

Standard Measuring Unit LSM-503S

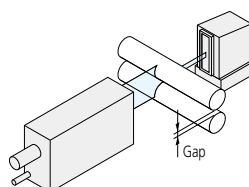
- General-purpose type with a measurement range of 0.3 mm to 30 mm.
- Provides high accuracy with a linearity of $\pm 1.0 \mu\text{m}$ over the entire measurement range and $\pm(0.6+0.1 \Delta D) \mu\text{m}$ in the narrow range.



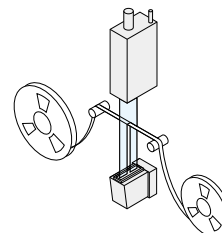
Signal cable (5 m) No.02AGN770A is supplied.

Tips

Measurement of gap between rollers



Tape width measurement



Specifications

Model	LSM-503S	
Order No.	544-535	544-536
Acceptable standard of laser	JIS	IEC, FDA
Measuring range	0.3 - 30 mm	
Resolution (selectable)	0.02 - 100 μm	
Repeatability ^{*1}	$\pm 0.11 \mu\text{m}$	
Linearity at 20 °C ^{*2}	Entire range	$\pm 1.0 \mu\text{m}$
	Narrow range	$\pm(0.6+0.1 \Delta D) \mu\text{m}$
Positional error ^{*3}	$\pm 1.5 \mu\text{m}$	
Measuring region ^{*4}	10 x 30 mm	
Scanning rate	3200 scans/s	
Laser wavelength	650 nm, Visible ^{*5}	
Laser scanning speed	226 m/s (8900 in/s)	
Operating temperature	0 °C - 40 °C	
Operating humidity	35 - 85 % RH (non-condensing)	
Water/Dust protection grade	Conforming to IP64 ^{*6}	
Mass	Emission unit: 1.1 kg, Reception unit: 0.6 kg, Base: 0.5 kg (1.1 lbs.), Signal cable: 0.5 kg	

*1: Determined by the value for $\pm 2\sigma$ at the measurement of $\phi 30$ mm workpiece with 0.32 sec. interval (1024-time average).

*2: At the center of the measuring region (According to Mitutoyo's specified acceptance procedure).

*3: ΔD is the outside diameter difference from the master gage (unit: mm).

*4: An error due to workpiece shift either in the optical axis direction or in the scanning direction.

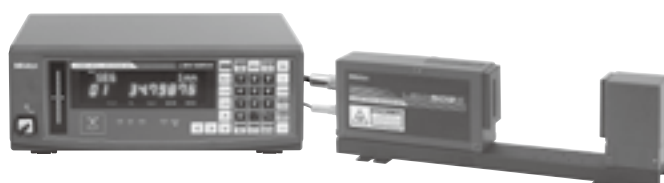
*5: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction".

*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Tips

Example

LSM-6200 (display unit)



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LSM-5200 (display unit)

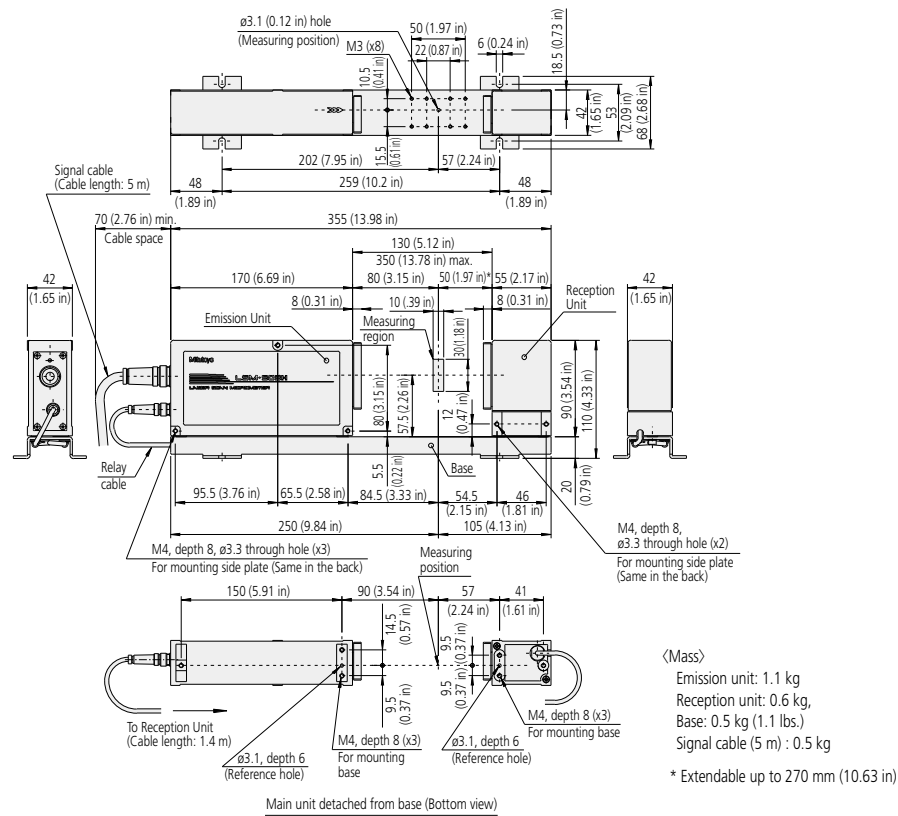


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LSM-503S

Dimensions

Unit: mm (inch)



Optional accessories

Calibration gage set

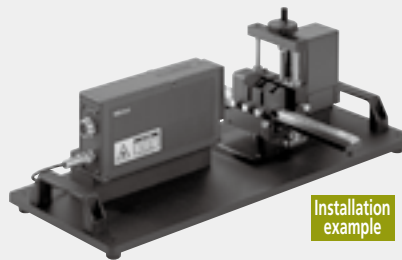
(ø1.0 mm, ø30 mm)
02AGD130



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Adjustable workstage

02AGD490



Installation example

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Workstage

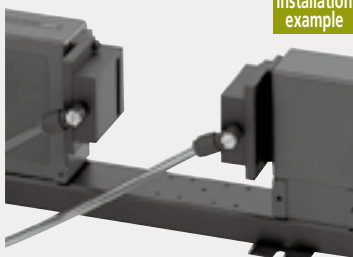
02AGD270



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Air shield

02AGD240



Installation example

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Extension signal cable

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Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m
02AGN780D	20m

Extension relay cable

page 5-22

Order No.	Cable length
02AGC150A	1m
02AGC150B	3m
02AGC150C	5m

MEASURING UNIT

Wide Range Measuring Unit LSM-506S

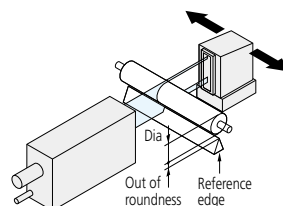
- General-purpose type with a measurement range of 1 mm to 60 mm.
- Provides high accuracy with a linearity of $\pm 3 \mu\text{m}$ over the entire measurement range and $\pm(1.5+0.5 \Delta D) \mu\text{m}$ in the narrow range.



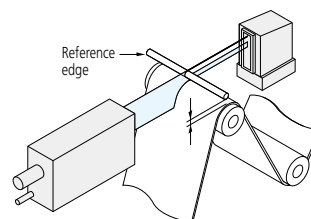
Signal cable (5 m) No.02AGN770A is supplied.

Tips

Measurement of outer diameter and roundness of cylinder.....



Measurement of film sheet thickness.....



Specifications

Model	LSM-506S	
Order No.	544-537	544-538
Acceptable standard of laser	JIS	IEC, FDA
Measuring range	1 - 60 mm	
Resolution (selectable)	0.05 - 100 μm	
Repeatability ^{*1}	$\pm 0.36 \mu\text{m}$	
Linearity at 20 °C ^{*2}	Entire range	$\pm 3 \mu\text{m}$
	Narrow range	$\pm(1.5+0.5 \Delta D) \mu\text{m}$
Positional error ^{*3}	$\pm 4 \mu\text{m}$	
Measuring region ^{*4}	20 x 60 mm	
Scanning rate	3200 scans/s	
Laser wavelength	650 nm, Visible ^{*5}	
Laser scanning speed	452 m/s	
Operating temperature	0 °C - 40 °C	
Operating humidity	35 - 85 % RH (non-condensing)	
Water/Dust protection grade	Conforming to IP64 ^{*6}	
Mass	Emission unit: 1.4 kg, Reception unit: 0.8 kg, Base: 0.8 kg, Signal cable: 0.5 kg	

*1: Determined by the value for $\pm 2 \sigma$ at the measurement of $\phi 60$ mm workpiece with 0.32 sec. interval (1024-time average).

*2: At the center of the measuring region (According to Mitutoyo's specified acceptance procedure).

*3: ΔD is the outside diameter difference from the master gage (unit: mm).

*4: An error due to workpiece shift either in the optical axis direction or in the scanning direction.

*5: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction".

*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Tips

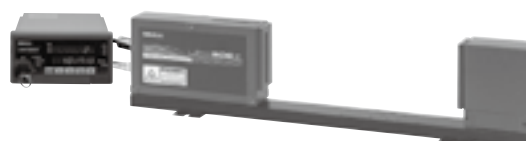
Example

LSM-6200 (display unit)



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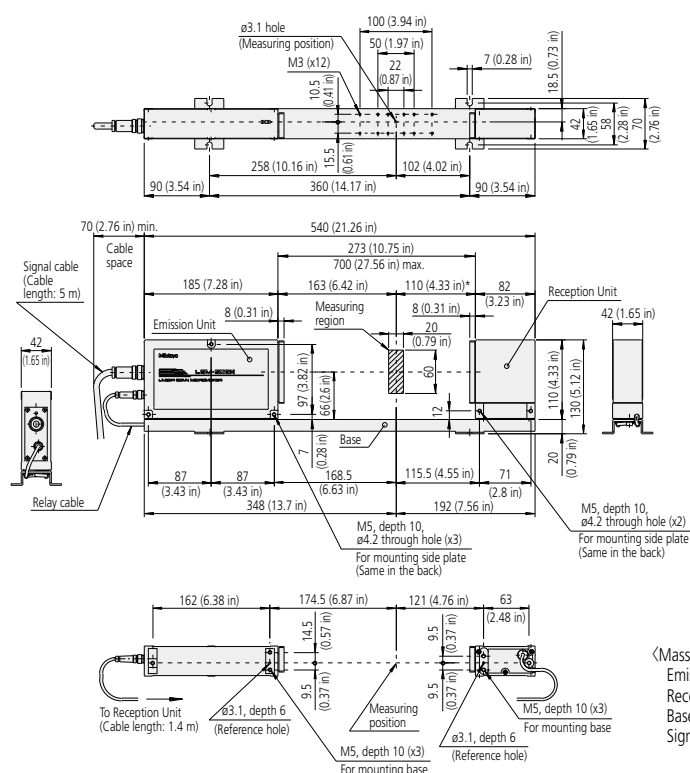
LSM-5200 (display unit)



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Dimensions

Unit: mm (inch)



〈Mass〉
Emission unit: 1.4 kg
Reception unit: 0.8 kg
Base: 0.8 kg
Signal cable (5 m) : 0.5 kg

* Extendable up to 537 mm (21.14 in)

Optional accessories

Calibration gage set

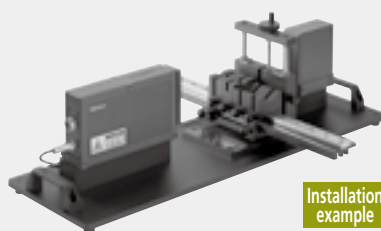
(ø1.0 mm, ø60 mm)
02AGD140



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Adjustable workstage

02AGD520

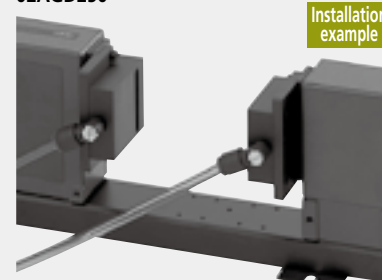


Installation example

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Air shield

02AGD250



Installation example

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Extension signal cable page 5-22

Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m
02AGN780D	20m

Extension relay cable page 5-22

Order No.	Cable length
02AGC150A	1m
02AGC150B	3m
02AGC150C	5m

MEASURING UNIT

Ultra-Wide Range Measuring Unit LSM-512S

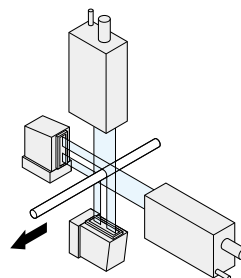
- General-purpose type with a wide measurement range of 1 mm to 120 mm.
- Provides high accuracy with a linearity of $\pm 6 \mu\text{m}$ over the entire measurement range and $\pm(4.0+0.5 \Delta D) \mu\text{m}$ in the narrow range.



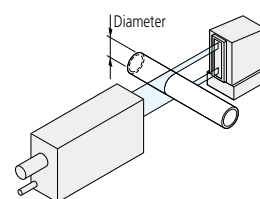
Signal cable (5 m) No.02AGN770A is supplied.

Tips

X and Y axes simultaneous measurement for resin pipe.....



Rubber roll measurement.....



Specifications

Model	LSM-512S	
Order No.	544-539	544-540
Acceptable standard of laser	JIS	IEC, FDA
Measuring range	1 - 120 mm	
Resolution (selectable)	0.1 - 100 μm	
Repeatability ^{*1}	$\pm 0.85 \mu\text{m}$	
Linearity at 20 °C ^{*2}	Entire range	$\pm 6 \mu\text{m}$
	Narrow range	$\pm(4.0+0.5 \Delta D) \mu\text{m}$
Positional error ^{*3}	$\pm 8 \mu\text{m}$	
Measuring region ^{*4}	30 x 120 mm at $\phi 1 - 120 \text{ mm}$	
Scanning rate	3200 scans/s	
Laser wavelength	650 nm, Visible ^{*5}	
Laser scanning speed	904 m/s	
Operating temperature	0 °C - 40 °C	
Operating humidity	35 - 85 % RH (non-condensing)	
Water/Dust protection grade	Conforming to IP64 ^{*6}	
Mass	Emission unit: 3.0 kg, Reception unit: 1.2 kg, Base: 1.8 kg (3.96 lbs.), Signal cable: 0.5 kg	

*1: Determined by the value for $\pm 2 \sigma$ at the measurement of $\phi 120 \text{ mm}$ workpiece with 0.32 sec. interval (1024-time average).

*2: At the center of the measuring region (According to Mitutoyo's specified acceptance procedure).

*3: ΔD is the outside diameter difference from the master gage (unit: mm).

*4: An error due to workpiece shift either in the optical axis direction or in the scanning direction.

*5: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction".

*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Tips

Example

LSM-6200 (display unit)



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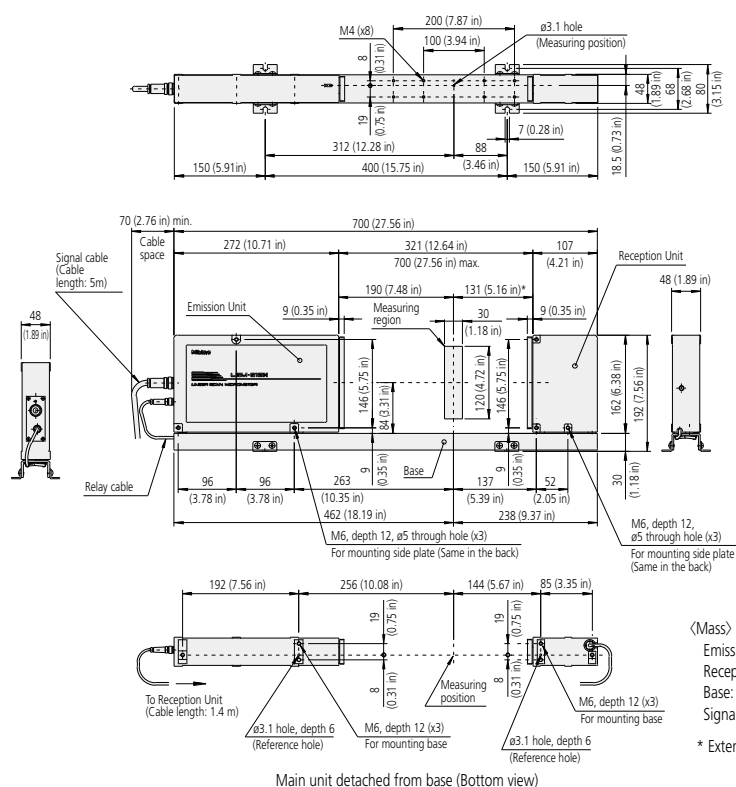
LSM-5200 (display unit)



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Dimensions

Unit: mm (inch)



Optional accessories

Calibration gage set

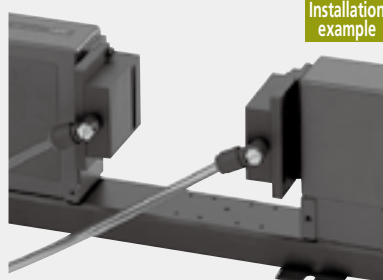
(ø20 mm, ø120 mm)
02AGD150



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Air shield

02AGD260



Installation example

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Extension signal cable

Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m
02AGN780D	20m

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Extension relay cable

Order No.	Cable length
02AGC150A	1m
02AGC150B	3m
02AGC150C	5m

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MEASURING UNIT

Ultra-Wide Range Measuring Unit LSM-516S

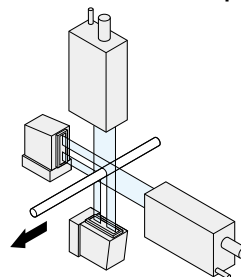
- General-purpose type with a wide measurement range of 1 to 160 mm.
- Provides high accuracy with a linearity of $\pm 7 \mu\text{m}$ over the entire measurement range and $\pm(4.0+2.0 \Delta D) \mu\text{m}$ in the narrow range.



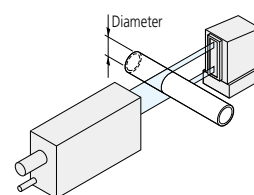
Signal cable (5 m) No.02AGN770A is supplied.

Tips

X and Y axes simultaneous measurement for resin pipe.....



Roll measurement



Specifications

Model	LSM-516S	
Order No.	544-541	544-542
Acceptable standard of laser	JIS	IEC, FDA
Measuring range	1 - 160 mm	
Resolution (selectable)	0.1 - 100 μm	
Repeatability ^{*1}	$\pm 1.4 \mu\text{m}$	
Linearity at 20 °C ^{*2}	Entire range	$\pm 7 \mu\text{m}$
	Narrow range	$\pm(4.0+2.0 \Delta D) \mu\text{m}$
Positional error ^{*3}	$\pm 8 \mu\text{m}$	
Measuring region ^{*4}	40 x 160 mm at $\phi 1 - 160 \text{ mm}$	
Scanning rate	3200 scans/s	
Laser wavelength	650 nm, Visible ^{*5}	
Laser scanning speed	1206 m/s	
Operating temperature	0 °C - 40 °C	
Operating humidity	35 - 85 % RH (non-condensing)	
Water/Dust protection grade	Conforming to IP64 ^{*6}	
Mass	Emission unit: 3.0 kg, Reception unit: 1.2 kg, Base: 1.8 kg, Signal cable: 0.5 kg	

*1: Determined by the value for $\pm 2 \sigma$ at the measurement of $\phi 160 \text{ mm}$ workpiece with 0.32 sec. interval (1024-time average).

*2: At the center of the measuring region (According to Mitutoyo's specified acceptance procedure).

*3: ΔD is the outside diameter difference from the master gage (unit: mm).

*4: An error due to workpiece shift either in the optical axis direction or in the scanning direction.

*5: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction".

*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

Tips

Example

LSM-6200 (display unit)



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LSM-5200 (display unit)

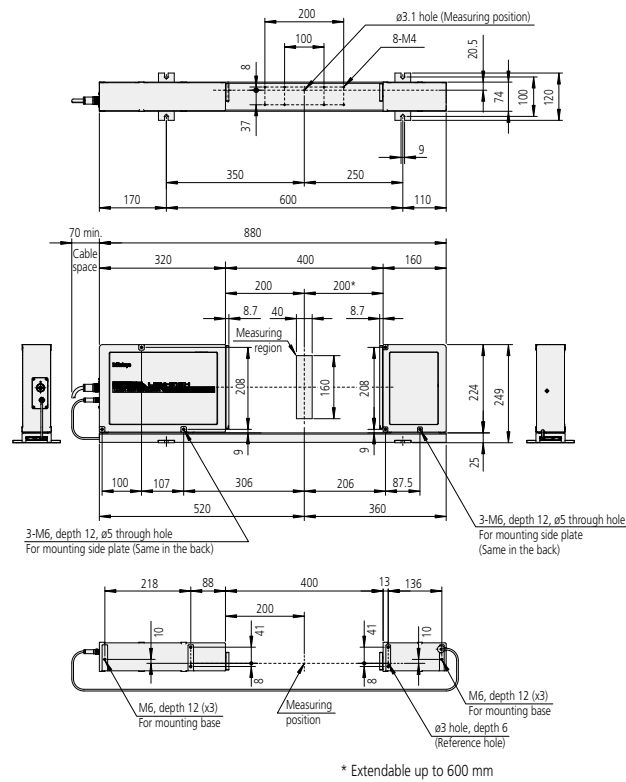


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LSM-516S

Dimensions

Unit: mm (inch)



Optional accessories

Calibration gage set

(ø20 mm, ø160 mm)
02AGM300



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Extension signal cable page 5-22

Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m
02AGN780D	20m

Extension relay cable page 5-22

Order No.	Cable length
02AGC150A	1m
02AGC150B	3m
02AGC150C	5m

MEASURING UNIT

Bench-top Type with Display Unit LSM-9506

- With a design that integrates the display section and measuring section into one unit, this instrument is best suited for making bench-top measurements in an inspection room.
- Optional calibration gage set (ø1.0 mm, ø60 mm)



Specifications

Order No.	544-115*	544-116**
Type	mm	inch/mm
Measuring range	0.5 to 60 mm	0.02 to 2.36 in/0.5 to 60 mm
Resolution	0.05 to 100 μ m (selectable)	0.000002 to 0.005 in/0.00005 to 0.1 mm
Repeatability* ¹	$\pm 0.6 \mu$ m (± 0.00003 in)	
Accuracy* ² (20 °C)	$\pm 2.5 \mu$ m (± 0.0001 in)	
Positional error* ³ (optical axis/scanning direction)	$\pm 2.5 \mu$ m (± 0.0001 in) L: Displacement between workpiece center and optical axis center	
Measuring range* ⁴	$\pm 5 \times 60$ mm ($\pm 0.2 \times 2.36$ in)	
Scanning rate	1600 scans/s	
Laser wavelength	650 nm (Visible)* ⁵	
Laser scanning speed	226 m/s (8900 in/s)	
Standard interface	RS-232C, Digimatic code output unit (1ch)	
Optional interface	No	
Power supply	AC100 V to 240 V ± 10 %, 40 VA, 50/60 Hz	
Operating environment	0 to 40 °C, RH 35 to 85 % (non-condensing)	

*1: Determined at the level of $\pm 2 \sigma$ (: standard deviation) when measuring ø10 mm at the interval of 0.32 sec. (average 512 times).

*2: Applies at the center of the measuring range when measuring outside diameters.

*3: ΔD =Difference in diameter between the master gage and workpiece (Unit: mm)

*4: An error in outside diameter measurement due to variation in workpiece position either in the optical axis direction or in the scanning direction.

*5: FDA Class II (544-116-1A)/IEC Class 2 (All models except 544-116-1A) semiconductor laser for scanning (Maximum power: 1.0 mW)

* To denote your AC power cable add the following suffixes to the order No.: D for CEE, DC for CCC, E for BS, F for SAA, K for KC, C and No suffix are required for PSE.

** To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

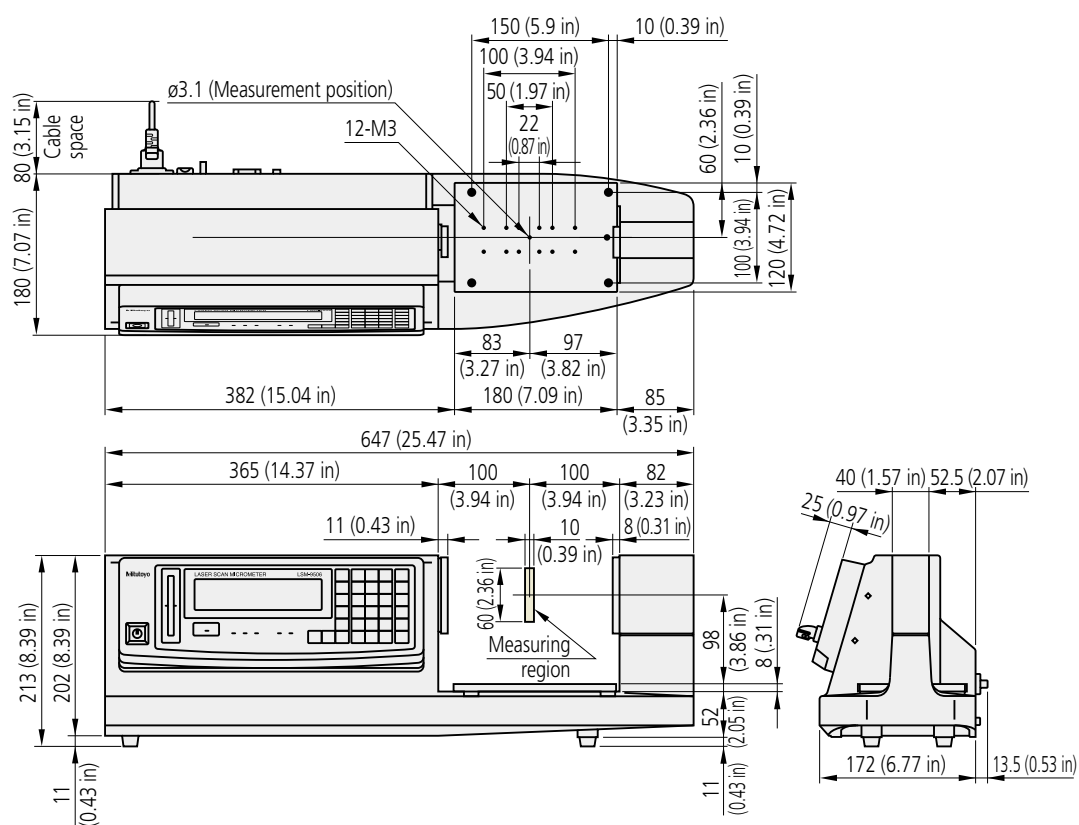
Display unit

Display	16-digit plus 11-digit fluorescent display, and guide message LED
Segment	1 to 7 (1 to 3, transparent) or 1 to 255 edges
Averaging times	Arithmetic average: 1 to 2048 scans. Moving average: 32 to 2048 scans.
Judgment	Selection from "target value + tolerance", "lower tolerance + upper tolerance", or "7 classes multilimit tolerance zone".
Measurement mode	Standby, Single measurement, Continuous measurement
Statistical analysis	Maximum, Minimum, Average, Dispersion, σ (S.D)
Others	Nominal setting, sample setting, suppression of unnecessary digits, transparent object measurement, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position), zero-set/offset Note: In the case of dual measuring-unit connection, extra-fine line measurement and some of the communication commands are not available

LSM-9506

Dimensions

Unit: mm (inch)



Contents

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Measuring Unit

Optional Accessories

Calibration Gage Sets

The calibration gage sets are made up of precision disks, cylinders or wires used for calibrating Laser Scan Micrometers. Each gauge that may be measured in alternate positions is marked at the position where the calibration measurement was made.



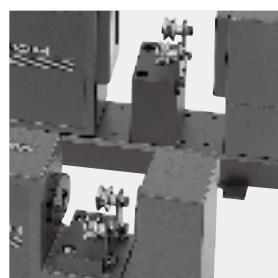
For calibrating models		LSM-6902H	LSM-500S	LSM-501S	LSM-503S	LSM-506S	LSM-512S	LSM-516S	LSM-9506
		544-498, 544-499	544-531, 544-532	544-533, 544-534	544-535, 545-536	544-537, 544-538	544-539, 544-540	544-541, 544-542	544-115, 544-116
Set No.		02AGD180	02AGD110	02AGD120	02AGD130	02AGD140	02AGD150	02AGM300	02AGD170
Stand		02AGD181	02AGD111	02AGD121	02AGD131	02AGD141	02AGD151	02AGM320	02AGD171
Configuration (Order No.)	Gages	ø1: 02AGD920 ø25: 02AGD963	ø0.1: 958200 ø2: 958202	ø0.1: 958200 ø10: 229317	ø1: 02AGD920 ø30: 02AGD961	ø1: 02AGD920 ø60: 02AGD962	ø20: 229730 ø120: 234072	ø20: 229730 ø160: 02AGM303	ø1: 02AGD920 ø60: 02AGD962
	Carrying case	02AGD190	958203	958203	02AGD980	02AGD980	02AGD990	02AGM310	02AGD970

Wire Guiding Pulleys

This jig is for guiding thin filaments, such as fine magnet wire or optical fiber, so that a stable measurement of the outside diameter can be made.

Order No.	Application	Measuring range
02AGD200	LSM-500S	ø5 μm to 1.6 mm
02AGD210	LSM-501S	ø50 μm to 2 mm

Use the calibration gage set (**02AGD110**) for both types of wire guiding pulley.



Workstage

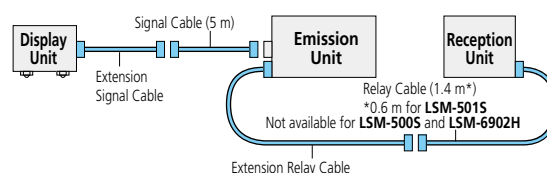
Aids shaft measurement by providing a V-block mounting and an up/down adjustment mechanism.

Model	LSM-501S LSM-503S LSM-6902H
Order No.	02AGD270



Extension Signal Cables / Extension Relay Cables

Extension signal cables are necessary when the measuring unit and display unit are separated in operation. Extension relay cables are necessary when the optical section is separated in operation.



Extension signal cables

Order No.	Cable length
02AGN780A	5m
02AGN780B	10m
02AGN780C	15m
02AGN780D	20m

Extension relay cables

Order No.	Cable length
02AGC150A	1m
02AGC150B	3m
02AGC150C	5m

Note 1: For **LSM-500S/501S** the allowable maximum length for signal cable is 20 m; relay cable is 2 m.

Note 2: For **LSM-503S/506S/512S/516S** the allowable maximum length for signal cable is 30 m; relay cable is 5 m.

Note 3: The maximum extension length of the signal cable and relay cable is 32 m in total.

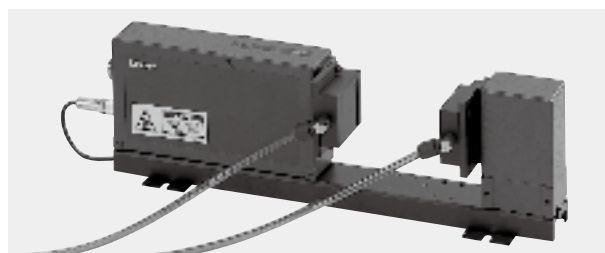
Note 4: Not available for the **LSM-6902H**.

Air Shield System

If using your LSMs in a smoky or dusty environment, an air shield system consisting of two covers per unit and a central air cleaner/regulator can be used to help prevent the emission/reception windows from being soiled.

Order No.	Application	
02AGD220	LSM-500S	6 pcs.
02AGD230	LSM-501S	6 pcs.
02AGD240	LSM-503S	3 pcs.
02AGD250	LSM-506S	1 pc.
02AGD260	LSM-512S	1 pc.

Note: Air tube (length of 5 m and outside diameter of 6 mm) is supplied for the air shield.

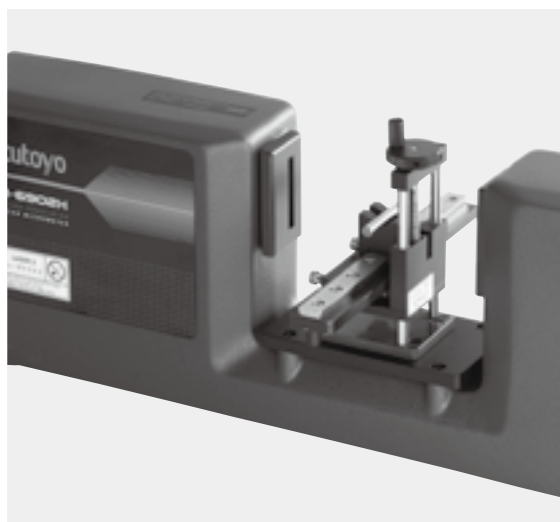


Measuring Unit/Optional Accessories

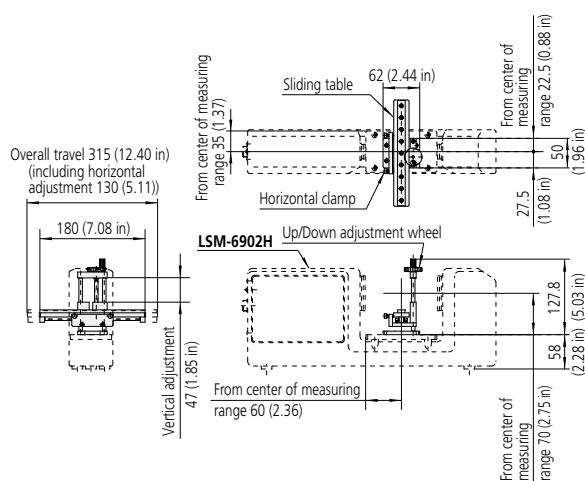
Adjustable Workstages

- Aids in measuring workpiece diameter by means of up/down and right/left slide adjustments.
- Optimum for quality control of precision shafts, rollers, pin gages, etc.

For LSM-6902H



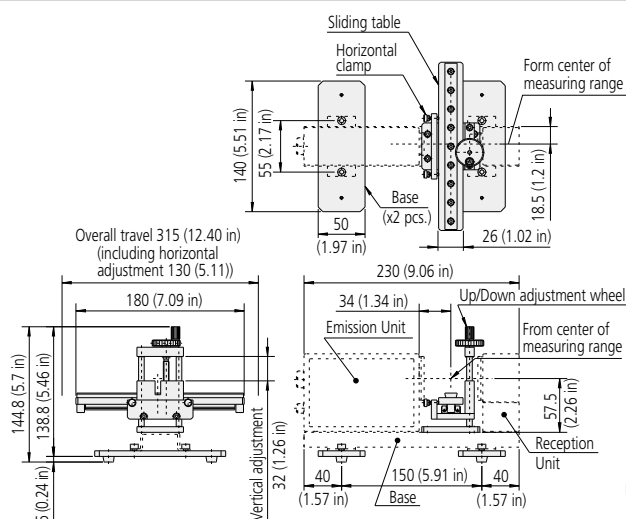
Order No.	02AGD280
Name	Adjustable workstage for LSM-6902H
Application	LSM-6902H
Measuring range	0.1 to 25 mm
Horizontal adjustment	130 mm
Vertical adjustment	47 mm
Maximum table loading	0.5 kg
Mass	0.8 kg
Standard accessories	V-block (02AGD420) x 2 pcs. Workpiece stop (02AGD430)
Optional accessories	Center support (02AGD440) Adjustable V-block (02AGD450)

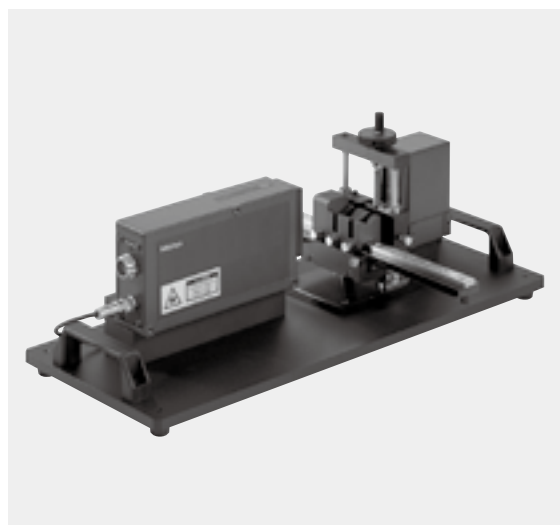


For LSM-501S

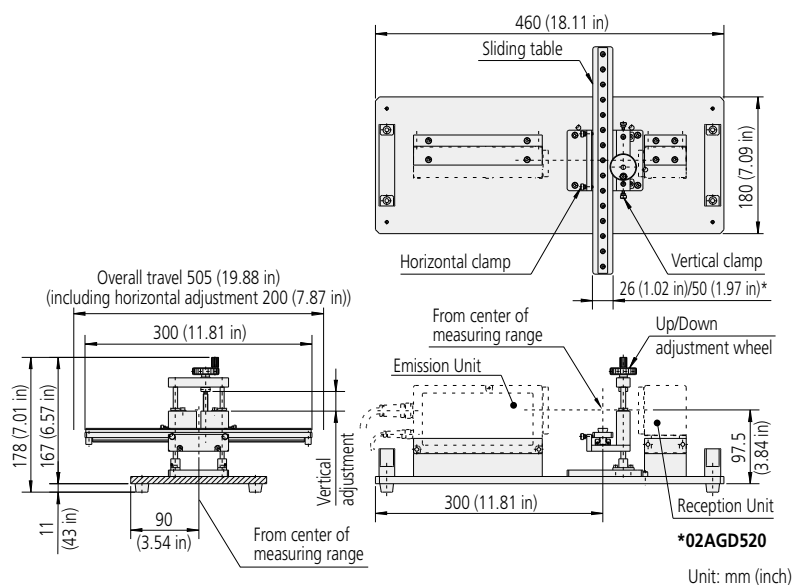


Order No.	02AGD400
Name	Adjustable workstage for LSM-501S
Application	LSM-501S
Measuring range	0.05 to 10 mm
Horizontal adjustment	130 mm
Vertical adjustment	32 mm
Maximum table loading	0.5 kg
Mass	1.0 kg
Standard accessories	V-block (02AGD420) x 2 pcs. Workpiece stop (02AGD430)
Optional accessories	Center support (02AGD440) Adjustable V-block (02AGD450)



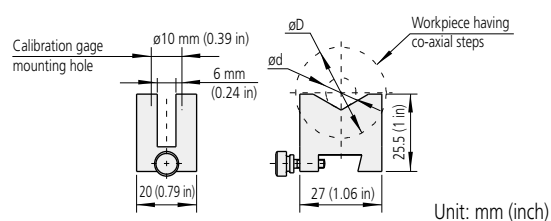


Order No.	02AGD490
Name	Adjustable workstage for LSM-503S
Application	LSM-503S
Measuring range	0.3 to 30 mm
Horizontal adjustment	200 mm
Vertical adjustment	35 mm
Maximum table loading	2.0 kg
Mass	4.9 kg
Standard accessories	V-block (02AGD420) x 2 pcs. Workpiece stop (02AGD430)
Optional accessories	Center support (02AGD440) Adjustable V-block (02AGD450)



Standard Accessories for Adjustable Workstages (Common to LSM-6902H, 501S, 503S)

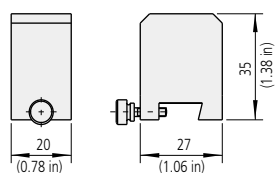
V-blocks



Order No.	02AGD420
Application	LSM-6902H, 501S and 503S
øD max. (workpiece)	30 mm*
ød max. (axis)	30 mm*
(øD-ød) max.	25 mm
Mass	0.03 kg
Applicable calibration gage	ø0.1 (958200) Not applicable for LSM-503S ø1 (02AGD920) ø10 (229317) ø25 (02AGD963) ø30 (02AGD961)

* ø10 (0.39 in) for **LSM-501S**, ø25 (0.98 in) for **LSM-6902H**

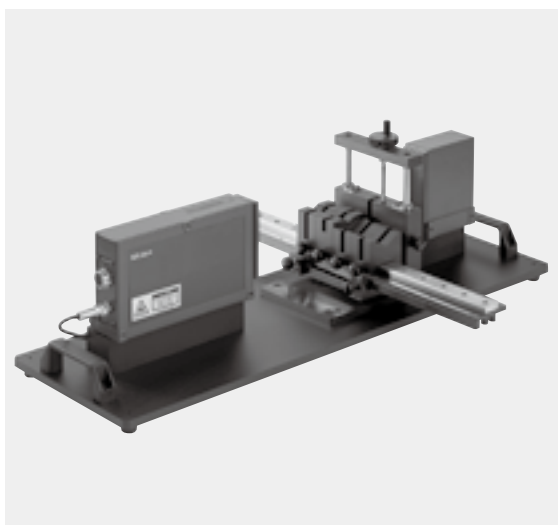
Workpiece stop



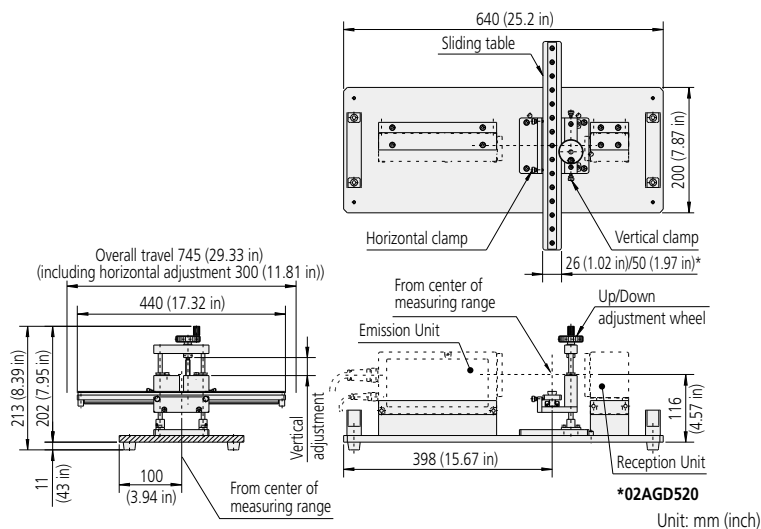
Order No.	02AGD430
Application	LSM-6902H and 503S
Mass	0.05 kg

Measuring Unit/Optional Accessories

For LSM-506S

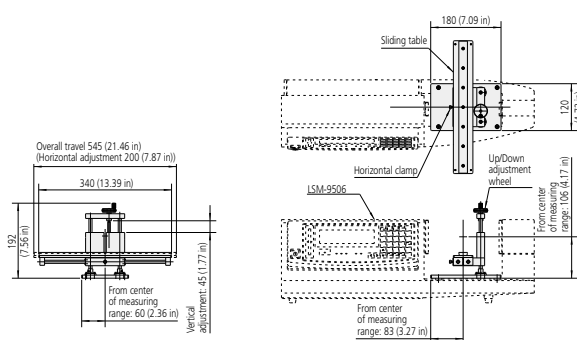


Order No.	02AGD520
Name	Adjustable workstage for LSM-506S
Application	LSM-506S
Measuring range	1 to 60 mm
Horizontal adjustment	300 mm
Vertical adjustment	45 mm
Maximum table loading	5.0 kg
Mass	9.7 kg
Standard accessories	V-block (02AGD550) x 2 pcs. V-block (02AGD560) V-block (02AGD570)
Optional accessories	Center support (02AGD580) Adjustable V-block (02AGD590)

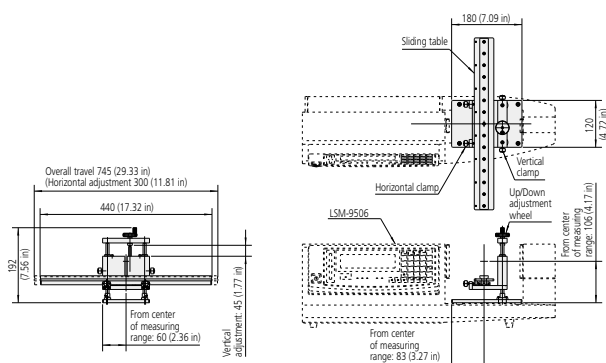


For LSM-9506

Order No.	02AGD370	02AGD680
Name	Adjustable workstage-200 for LSM-9506	Adjustable workstage-300 for LSM-9506
Application	LSM-9506	
Measuring range	0.5 to 60 mm	
Horizontal adjustment	200 mm	300 mm
Vertical adjustment	45 mm	
Maximum table loading	2.0 kg	5.0 kg
Mass	3.8 kg	4.8 kg
Standard accessories	V-block (02AGD550) x 2 pcs. V-block (02AGD560) V-block (02AGD570)	
Optional accessories	Center support (02AGD580) Adjustable V-block (02AGD590)	



02AGD370



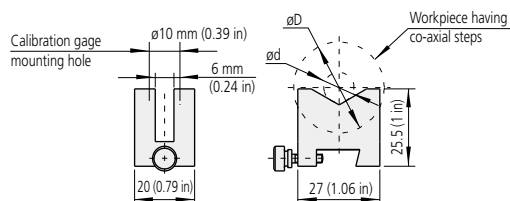
02AGD680

Unit: mm (inch)

Standard Accessories (For LSM-506S and 9506)

V-blocks

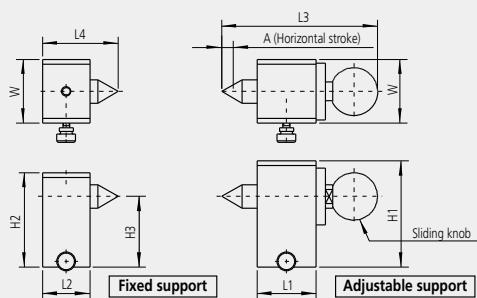
Unit: mm (inch)



Order No.	02AGD550	02AGD560	02AGD570
Name	V block (A)	V block (B)	V block (C)
øD max. (workpiece)	60 (2.36 in)	60 (2.36 in)	60 (2.36 in)
ød max. (axis)	60 (2.36 in)	30 (1.18 in)	30 (1.18 in)
(øD-ød) max.	30 (1.18 in)	50 (1.97 in)	50 (1.97 in)
H	39 (1.54 in)	45 (1.77 in)	45 (1.77 in)
L1	50 (1.97 in)	50 (1.97 in)	50 (1.97 in)
L2	30 (1.18 in)	30 (1.18 in)	30 (1.18 in)
Mass	0.12 kg	0.15 kg	0.15 kg
Applicable calibration gage	• ø10 mm • ø30 mm	• ø10 mm • ø30 mm • ø60 mm	• ø1 mm • ø10 mm • ø30 mm

Optional accessories for adjustable workstages

Center Supports

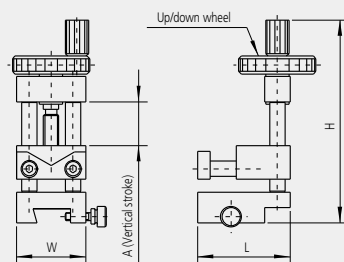


Unit: mm (inch)

Order No.	02AGD440	02AGD580
H1	45 (1.77 in)	65 (2.56 in)
H2	40 (1.57 in)	60 (2.36 in)
H3	30 (1.18 in)	45 (1.77 in)
L1	25 (0.98 in)	50 (1.97 in)
L2	20 (0.79 in)	40 (1.57 in)
L3	66 (2.60 in)	106.5 (4.19 in)
L4	32 (1.26 in)	55 (2.17 in)
W	27 (1.06 in)	50 (1.97 in)

Order No.	02AGD440	02AGD580
Application	For adjustable workstage LSM-501S (02AGD400) , For adjustable workstage LSM-6902H (02AGD280) , For adjustable workstage LSM-503S (02AGD490)	For adjustable workstage LSM-506S (02AGD520) , For adjustable workstage LSM-9506 (02AGD680 and 02AGD370)
Point angle	60°	60°
Maximum workpiece length	110 mm on 02AGD400/02AGD280 230 mm on 02AGD490	315 mm on 02AGD520 on 02AGD680
Mechanism of center	Spring method	
Horizontal adjustment (A)	5 mm or more	10 mm or more
Center point clamping force	Approx. 1 N	Approx. 3 N
Mass	Adjustable support: 0.11 kg Fixed support: 0.07 kg	0.5 kg 0.35 kg

Adjustable V-blocks



Unit: mm (inch)

Order No.	02AGD450	02AGD590
H	78.8 (3.1 in)	105.8 (4.17 in)
L	36 (1.42 in)	40 (1.57 in)
W	27 (1.06 in)	50 (1.97 in)

Order No.	02AGD450	02AGD590
Application	For adjustable workstage LSM-501S (02AGD400) , For adjustable workstage LSM-6902H (02AGD280) , For adjustable workstage LSM-503S (02AGD490)	For adjustable workstage LSM-506S (02AGD520) , For adjustable workstage LSM-9506 (02AGD680 and 02AGD370)
Vertical adjustment (A)	20 mm	35 mm
Maximum workpiece diameter	30 mm	60 mm
Mass	0.1 kg	0.2 kg

DISPLAY UNIT

Multi-function Type Display Unit LSM-6200

- With a dual-display design setup values can be continuously monitored. Also, two measurement value items can be displayed on the sub-display with the simultaneous measurement function.
- A statistical calculation function and abnormal data eliminating function are provided.
- Capable of calculating mean, maximum, minimum, and range (maximum - minimum).
- Either segment measurement (7 segments max.) or edge measurement (1 to 255 edges) can be selected.



Specifications

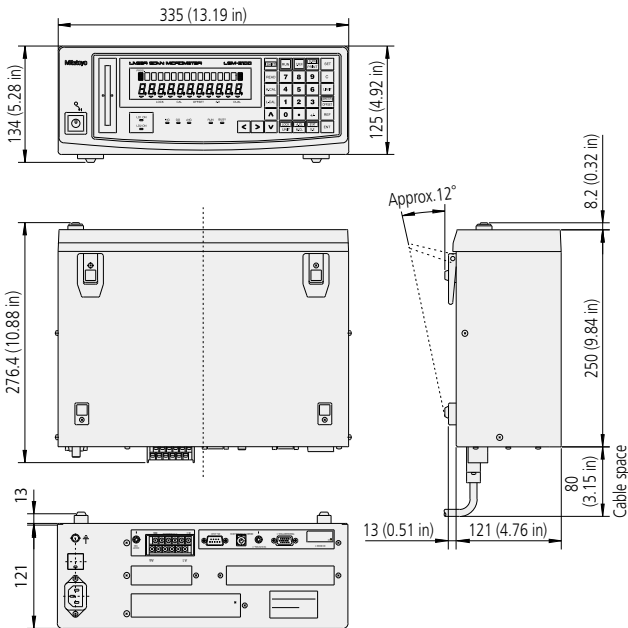
Model	LSM-6200	
Order No.	544-071	544-072
Type	mm	inch/mm
Display	16-digit plus 11-digit fluorescent display, and guide message LED	
Segment	1 to 7 (1 to 3, transparent) or 1 to 255 edges ^{*1}	
Averaging times	Arithmetic average: per 2 to 2048/ Moving average: per 32 to 2048 (Arithmetic average is per 16 to 2048 when using 544-531, 544-532)	
Judgment	Selection from "target value + tolerance", "lower tolerance + upper tolerance", or "7 classes multi-limit tolerance zone".	
Measurement mode	Standby, Single measurement, Continuous measurement	
Statistical analysis	Maximum, Minimum, Average, Dispersion, σ (S.D)	
Size	335(W)×134(H)×250(D) mm	
Power supply	100 to 240 V AC $\pm 10\%$, 40 VA, 50/60 Hz	
Standard I/F	RS-232C, Analog I/O	
Optional I/F	Digimatic code output unit (2-ch), 2nd I/O analog I/F, BCD I/F	
Operating environment	0 to +40 °C, RH 35 to 85 % (non-condensing)	
Other functions	Nominal setting, sample setting, selection of unnecessary digits, transparent object measurement ^{*2} , measurement of odd fluted parts, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position) ^{*1} , zero-set/offset, dual measurement (optional)	

[>] For Australia
^{*1}: If the edge measurement is selected for 1 to 255 edges and each function such as the automatic workpiece detecting function, the group judgment, odd-fluted cutting tool measurement, simultaneous measurement, and the dual-type add-on unit that is an optional accessory for the **LSM-6200** display unit are used in **LSM-500S**, ultra-fine wire measurement will be invalid. In this case the measurement range is between 0.1 mm (0.004 in) to 2 mm (0.08 in).
^{*2}: Measurement range will be set to between 0.05 mm (0.002 in) to 2 mm (0.08 in) when **LSM-500S** is connected.
Note1: Can not be connected to the measuring unit of old models (**LSM-500**, **LSM-500H**, etc.). Note2: Can not be connected to the **LSM-6902H**.

Dimensions

Unit: mm (inch)

Power Supply
100 V - 240 V AC



DISPLAY UNIT

Panel-mount Type Display Unit LSM-5200

- Capable of calculating mean, maximum, minimum, and range (maximum - minimum).
- Either segment measurement (7 segments max.) or edge measurement (1 to 255 edges) can be selected.
- Analog I/O and RS-232C is standard.
- Arithmetical average or moving average can be selected.
- Panel-mount type making system integration easy.
- GO/±NG judgment function
- A function to eliminate abnormal values is standard.



Specifications

Model	LSM-5200
Order No.	544-047
Display	9 digits plus 8 digits LED, guide message LED
Segment	1 to 7 (1 to 3, transparent) or 1 to 255 edges ^{*1}
Averaging method	Arithmetic average: from 4 to 2048; Moving average: from 32 to 2048 (Arithmetic average is from 16 to 2048 when using LSM-500S .)
Judgment	Selecting from "target value ±tolerance value" or "lower limit/upper limit".
Measurement mode	Standby, Single measurement, Continuous measurement
Statistical analysis	Calculation result is output via USB or RS-232C.
External dimensions	144(W)×72(H)×197.1(D) mm
Power supply ^{*3}	24 V DC ±10 %, 1.3 A or more
Standard I/F	USB2.0, RS-232C, I/O analog
Operating environment	0 to 40 °C, RH 35 to 85 % (non-condensing)
Preservation environments	−20 to 70 °C, RH 35 to 85 % (non-condensing)
Other functions	Measurement of odd fluted parts, simultaneous measurement, nominal setting, sample setting, selection of unnecessary digits, transparent object measurement ^{*2} Automatic workpiece detection (dimension/position detected) ^{*1} , abnormal data elimination, mastering, statistical processing (when using USB, RS-232C), output timer, automatic measurement in edge mode, presetting Note that every function is limited in its combination possibilities. See the user manual for details.
Mass	1.4 kg

^{*1}: If the edge measurement is selected for 1 to 255 edges and each function such as the automatic workpiece detecting function, the group judgment, odd-fluted cutting tool measurement, simultaneous measurement are used in **LSM-500S**, ultra-fine wire measurement will be invalid. In this case the measurement range is between 0.05 mm (0.002 in) to 2 mm (0.08 in).

^{*2}: Measurement range will be set to between 0.05 mm (0.002 in) to 2 mm (0.08 in) when **LSM-500S** is connected.

Note1: Can not be connected to the measuring unit of old models (**LSM-500**, **LSM-500H**, etc.).

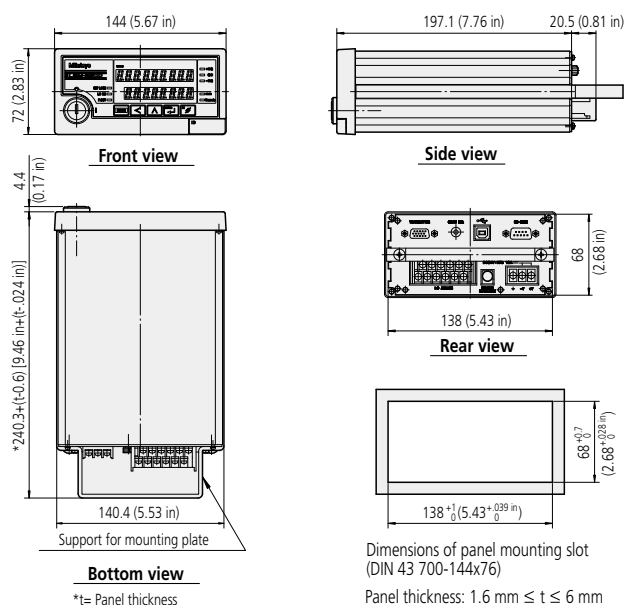
Note2: Can not be connected to the **LSM-6902H**.

Note3: When USB communication is performed with PC, the dedicated device driver is required.

Dimensions

Unit: mm (inch)

Power Supply
24 V DC



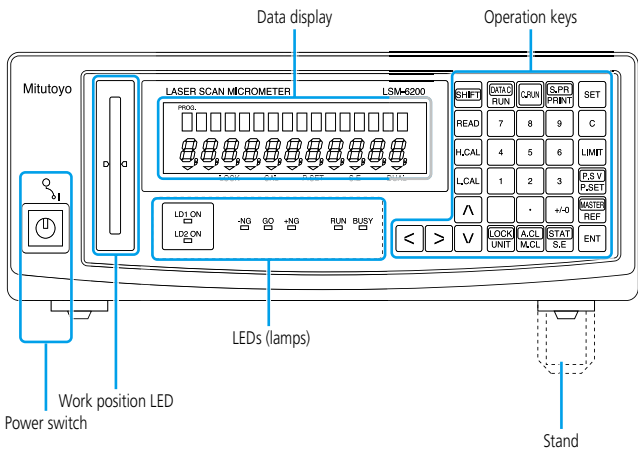



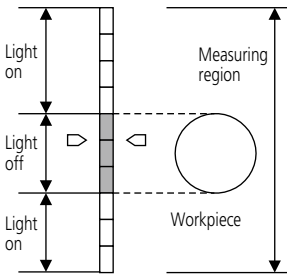
Part Name and Function

This chapter describes the name and function of each part on the front/rear panels of the product (Display Unit) and the Measuring Unit which is a part of the LSM system.

1 Display Unit

■ Front panel
























Name	Function
Data display	<p>Insert the provided power switch key and operate as follows:</p> <ul style="list-style-type: none">• To power on, turn the key clockwise to the "I" position• To power off, turn the key counterclockwise to the "O" position <p> If the short-circuiting pin is not inserted in the REMOTE INTERLOCK connector on the rear panel, the safety mechanism works to disable laser emission even though the power is turned on.</p>
Work position LED	<p>This 10-LED indicator shows the position of the workpiece. When the laser beam is shielded by the workpiece, several LEDs turn off to show the position.</p> <p>Tips Adjust the workpiece to center it in the measuring region.</p> 
LEDs (lamps)	<p>Each LED has the following meaning when lit:</p> <ul style="list-style-type: none">• LD1 ON: The Measuring Unit is emitting laser• LD2 ON: The Measuring Unit connected to the dual-type add-on unit is emitting laser• -NG: The measured value is below the lower limit of the GO/NG judgment criteria• GO: The measured value falls within the range of the GO/NG judgment criteria• +NG: The measured value is above the upper limit of the GO/NG judgment criteria• RUN: Running the single-run or continuous-run measurement• BUSY: Updating the measured result
Stand	<p>Pull the right and left stands toward you to tilt the product's front panel upward.</p>
Operation keys	<p>For details, see "Operation keys" (page 5-30)</p>
Data display	<p>For details, see "Data display" (page 5-33)</p>

• Operation keys

Key	Function		
	• In the ready state • In the display-latched state	• During single-run measurement • During continuous-run measurement	• During setup
	Changes the program number.	—	Enters the setup data. [9] key + Power-on will enter the expanded basic setup mode.
	—	—	Enters a decimal point.
	—	—	Inverts the sign of the setup value.
	Enters the selection mode for the setup item displayed in the upper display section.	—	Move left key.
	—	—	Move right key.
	—	—	Up key to increment the setup data.
	—	—	Down key to increment the setup data.
	Cancels an error that occurred at power-on. Cancels the display-latched state and returns to the ready state.	Aborts the measurement and returns to the ready state.	Cancels the setup value or resets it to the initial value. Cancels the error state. [C] key + Power-on will enter the initialization mode of the Display Unit.
	Enters the function setup mode.	—	Exits the function setup mode and returns to the ready state. Enters the post-power-on state if in the basic setup mode. [SET] key + Power-on will enter the basic setup mode.
	—	—	Accepts the setup data.
	—	—	Reads the measured value of the reference gage as the setup value. The read value can be modified with the [<], [>], [^], and [v] keys.
	Enters the HIGH CAL setup mode.	—	(Input of gage diameter) + [ENT] key executes HIGH CAL and illuminates the measurement state guidance (▼) for CAL. Press the [H.CAL] or [SET] key in the HIGH CAL setup mode to abort the setup operation and return to the ready state.
	Enters the LOW CAL setup mode.	—	(Input of gage diameter) + [ENT] key executes LOW CAL. Press the [L.CAL] or [SET] key in the LOW CAL setup mode to abort the setup operation and return to the ready state.
	Executes single-run measurement (even in the display-latched state).	Disabled during single-run measurement. Quits continuous-run measurement if it is in process.	—
	Starts continuous-run measurement (even in the display-latched state).	Quits continuous-run measurement if it is in process.	—

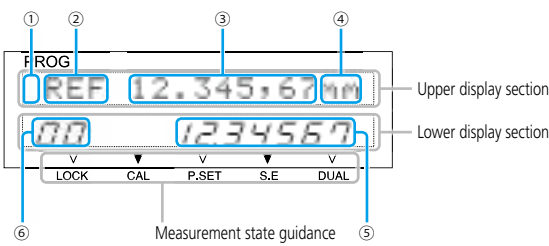
LSM-6200

Key	Function		
	<ul style="list-style-type: none"> • In the ready state • In the display-latched state 	<ul style="list-style-type: none"> • During single-run measurement • During continuous-run measurement 	<ul style="list-style-type: none"> • During setup
	Enables or disables statistical processing. If statistical processing is enabled, the measurement state guidance (▼) for statistical processing turns on.	—	—
	Prints out the previous measurement data. Prints out the currently displayed data in the display-latched state.	Disabled during single-run measurement. Prints out the previous measurement data during continuous measurement.	—
	Directly enters the setup mode for GO/NG judgment.	—	Press the [ENT] key to complete the setup operation and return to the ready state. Press the [LIMIT] or [SET] key to abort the setup operation and return to the ready state.
	Directly performs zero-setting (in the positive direction) if preset is not set up. If preset is already set up, executes preset with the set value.	—	—
	Directly enters the setup operation for the reference value and scale value. If "Copy the target value to the reference value" is specified in the basic setup, only the scale value is set up.	—	Press the [ENT] key to complete the setup operation and return to the ready state. Press the [MASTER/REF] or [SET] key to abort the setup operation and return to the ready state.
	Enters the unit change mode. Press the [ENT] key to execute unit change. Press the [LOCK/UNIT] or [SET] key to abort the unit change operation and return to the ready state.	—	—
	Enters the statistical memory clear mode for the foreground program numbers. Press the [ENT] key to clear. Press the [A.CL/M.CL] or [SET] key to abort clearing and return to the ready state.	—	—
	Shift key. To use the upper function of a double-function key (e.g., [S.PR/PRINT]), press [SHIFT] immediately before the double-function key. The foreground program number will flash for approximately 10 seconds.	—	The [SHIFT] and [READ] key combination (light amount detection setup) is valid only when a function setup item number is flashing in the function setup mode.
	Enters the key lock mode, turns on the measurement state guidance (▼) for key lock, and prohibits key operations. Pressing again during key lock will unlock the keys.	—	—
	Enters the mode to cancel the previous measurement result. While "CANCEL" on the upper display section is flashing, press these keys followed by the [ENT] key to accept the cancellation and return to the ready state.	—	—
	Enters the statistical result display mode and displays N in the statistical memory. Each time the [ENT] key is pressed, S.D, MAX, MIN, AVG, R, and N are sequentially displayed. Press the [STAT/S.E] or [SET] key to return to the ready state.	—	—

Key	Function		
	• In the ready state • In the display-latched state	• During single-run measurement • During continuous-run measurement	• During setup
 → 	If the printer is active, prints out all the statistical processing data and clears all the statistical memory. If the printer is inactive, the operation is invalid.	—	—
 → 	Allows you to set up preset. Press the [C] or [ENT] key to cancel preset and zero-set.	—	—
 → 	Directly enters the setup for mastering.	—	Press the [ENT] key to complete the setup operation and return to the ready state. Press the [MASTER/REF] or [SET] key to abort the setup operation and return to the ready state.
 → 	Enters the statistical memory clear mode for all the program numbers. Press the [ENT] key to clear. Press the [A.CL/M.CL] or [SET] key to abort clearing and return to the ready state.	—	—
 → 	Enters the mode to detect the measuring position (focal position). Press the [READ] or [SET] key to return to the ready state.	—	Enters the light amount detection setup if this key combination is operated while a function setup item number is flashing in the function setup mode invoked by the [SET] key.

LSM-6200

- Data display

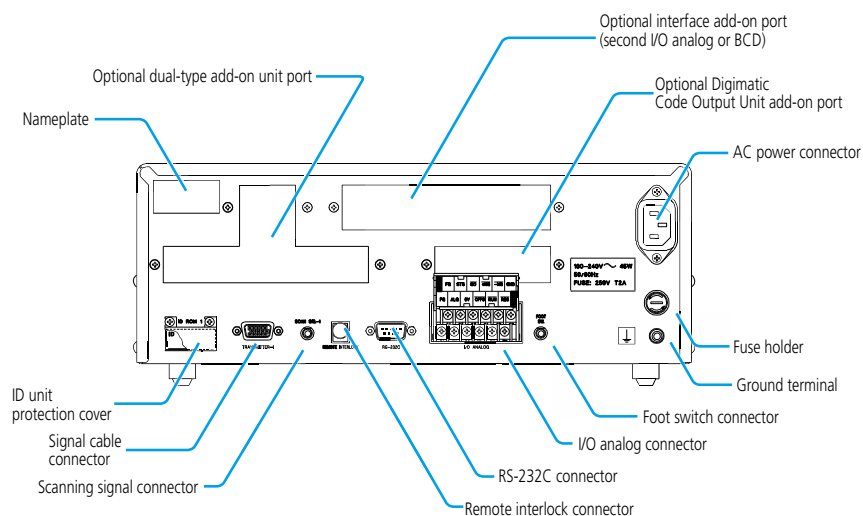






Number	Contents	
	At single measurement	At simultaneous measurement
Upper display section		
①	Light off	Background program number
②	Setup item	
③	Setup value	Background program measured value
④	Unit	
Lower display section		
⑤	Foreground program measured value	
⑥	Foreground program number	

Measurement state guidance

Name	Meaning of light
LOCK	The [SHIFT] and [LOCK/UNIT] keys have been pressed to accept no key operations.
CAL	The calibration (HIGH CAL) has been set up.
P.SET	The preset has been set up.
S.E	The [STAT/S.E] key has been pressed to enable the statistic processing.
DUAL	In the basic setup B2 mode, c "Setting the simultaneous measurement" (guidance: PROG) is set to "DUAL" (Perform simultaneous measurement).

■ Rear panel



Name	Function
Nameplate	Indicates the code NO., model/type, serial number, and rating.
Optional dual-type add-on unit port	The dual-type add-on unit (option) is attached.
Optional interface add-on port (second I/O analog or BCD)	The second I/O analog interface (option) or the BCD interface (option) is attached.
Optional Digimatic Code Output Unit add-on port	The Digimatic Code Output Unit interface (option) is attached.
ID unit protection cover	Remove this cover and attach the ID unit therein.
Signal cable connector	Connects to the Measuring Unit using a special cable.
Scanning signal connector	This terminal is used to observe scanning waveform. The accessory scanning signal monitoring connector can be connected.
Remote interlock connector	A short-circuiting pin is inserted.  If the short-circuiting pin is not inserted in the REMOTE INTERLOCK connector, the safety mechanism works to disable laser emission even though the power is turned on.
RS-232C connector	An RS-232C cable is connected for communicating with an external device via RS-232C (EIA Standards)-compliant serial signals.
I/O analog connector	A terminal block having I/O and analog outputs. A protection cover is provided.  <ul style="list-style-type: none"> • For your convenience in wiring, a terminal name label is provided under the I/O analog connector protection cover. • When wiring the I/O analog connector terminal block, avoid direct contact with the I/O terminals while your body is electrically charged. Otherwise, the internal circuit may be damaged by static discharge. Be sure to touch a metal part of the Display Unit to discharge static electricity before wiring. Unplug the power cable from the outlet before wiring. • After wiring, close the protection cover. • Never touch an I/O terminal on the terminal block during operation. Otherwise, an operation error may result.
Foot switch connector	The foot switch (option) is connected.
AC power connector	The accessory power cord is connected.
Fuse holder	A fuse (2A) is inserted.
Ground terminal	The accessory earth lead is connected to ground.  The ground terminal marked with  keeps the main signal line potentially equal to other devices. It is used to enhance noise tolerance.

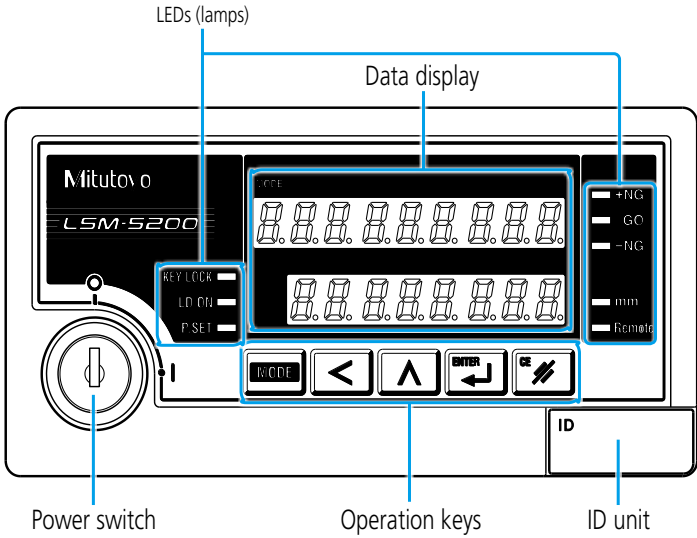


Part Name and Function

This chapter describes the name and function of each part on the front/rear panels of the product (Display Unit) and the Measuring Unit which is a part of the LSM system.

1 Display Unit

■ Front panel








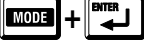



Name	Function
LEDs (lamps)	Each LED has the following meaning when lit: <ul style="list-style-type: none">• KEY LOCK: The key is in a locked state• LD ON: The measuring unit is emitting laser• P.SET: The preset has been set up• +NG: The measured value is above the upper limit of the GO/NG judgment criteria• GO: The measured value falls within the range of the GO/NG judgment criteria• -NG: The measured value is below the lower limit of the GO/NG judgment criteria• mm: The mm measuring unit system is selected• Remote: Not used (used for external control)
Data display	For details, see "Data display" (page 5-37)
ID unit	Important data that guarantees the accuracy of the Measuring Unit is stored.
Operation keys	For details, see "Operation keys" (page 5-36)
Power switch	Insert the provided power switch key and operate as follows: <ul style="list-style-type: none">• To power on, turn the key clockwise to the "I" position• To power off, turn the key counterclockwise to the "O" position <div>Tips If the short-circuiting pin is not inserted in the REMOTE INTERLOCK on the rear panel, the safety mechanism works to disable laser emission even though the power is turned on.</div>

Contact Sensor

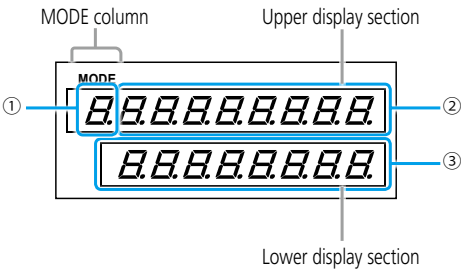
Non-contact Sensor

• Operation keys

Key	Function		
	• In the ready state • In the display-latched state	• During single-run measurement • During continuous-run measurement	• During setup
	Enters the function setup mode from the ready state.	—	Extends functionality by pressing a key while holding this key. Cancels the settings.
	Enters the change mode for the setup item displayed in the upper display section.	—	Moves the column to set to the left.
	—	—	Increases the number on the selected column. Changes the selected setting item.
	Executes the single-run or continuous-run measurement.	Quits continuous-run measurement if it is in process.	Accepts the Setup item or setup value being selected.
	Clears the error which is triggered during the start operation immediately after power-on.	Aborts single-run measurement. Quits continuous-run measurement.	Clears the error during setup. Reverts the setup item to the factory settings.
	Enters the measuring position display mode. Returns to ready state of MODE entry.	—	Moves the column to set to the right.
	Enters the key lock mode. Press the same key again to clear the key lock mode.	—	Decreases the number on the selected column. Changes the selected setting item.
	—	—	Reads the measured value of the reference gage as the setup value.
	Enters the unit system change mode. ENTER: Accept (mm or E) CE: Cancel (without change)	—	—

LSM-5200

- Data display

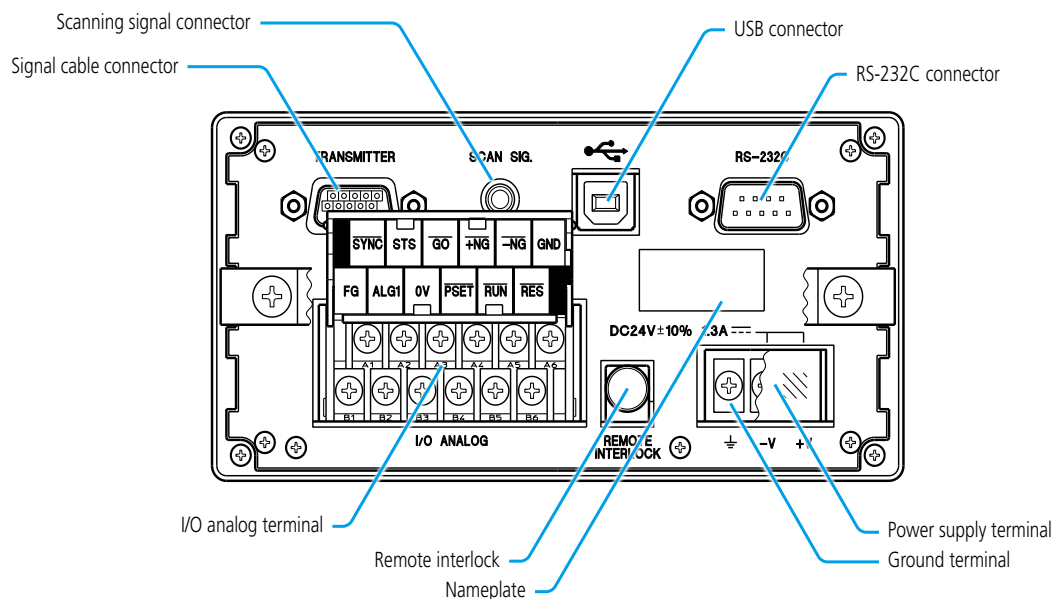






Number	Contents
Upper display section	
①	<ul style="list-style-type: none">• Displays setup items and operation mode• The decimal point of the MODE column is lit during the measurement (single-run or continuous-run)
②	<ul style="list-style-type: none">• Displays setup values• Displays a measured value if the simultaneous measurement is enabled• Displays the version number of the display unit during the start operation immediately after power-on• Displays any error message during the start operation immediately after power-on
Lower display section	
③	<ul style="list-style-type: none">• Displays the measured value• The decimal point of the lowest digit flashes each time the measured value is updated during ready state, single-run measurement, or continuous-run measurement• An error message is shown

Contact Sensor

Non-contact Sensor

■ Rear panel



Name	Function
Signal cable connector	Connects to the Measuring Unit using a special cable.
Scanning signal connector	This terminal is used to observe scanning waveform. The accessory scanning signal monitoring connector can be connected.
USB connector	A USB cable is connected for communicating with a PC. The communication standard is compliant to USB 2.0.
RS-232C connector	A RS-232C cable is connected for communicating with an external device. The communication standard is compliant to EIA Standards.
Power supply terminal	DC24 V power supply terminal is connected.
Ground terminal	The accessory earth lead is connected to ground.  The ground terminal marked with  keeps the main signal line potentially equal to other devices. It is used to enhance noise tolerance.
Nameplate	Indicates the code NO., model/type, serial number, and rating.
Remote interlock	A short-circuiting pin is inserted.  If the short-circuiting pin is not inserted in the REMOTE INTERLOCK, the safety mechanism works to disable laser emission even though the power is turned on.
I/O analog terminal	A terminal block having I/O and analog outputs. A protection cover is provided.  <ul style="list-style-type: none"> For your convenience in wiring, a terminal name label is provided under the I/O analog terminal protection cover. When wiring the I/O analog terminal, avoid direct contact with the I/O terminals while your body is electrically charged. Otherwise, the internal circuit may be damaged by static discharge. Be sure to touch a metal part of the Display Unit to discharge static electricity before wiring. Unplug the power cable from the outlet before wiring. After wiring, close the protection cover. Never touch an I/O terminal on the terminal block during operation. Otherwise, an operation error may result.

Display Unit

LSM-5200/6200/6902H Functions

Measuring Setup Memory

The measuring setup can be registered as a program and saved (**LSM-5200**: 2 programs, **LSM-6200**: 100 programs, **LSM-6902H**: 10 program). These programs can be recalled with a single operation.

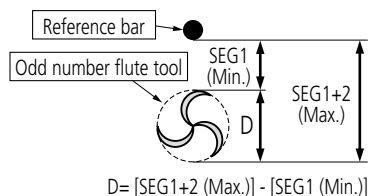
Multiple Calibration Data Memory Function

This function allows storage of 10 types of calibration data. In this function mode, up to 10 sets of 10 programs are available in hand.

- 10 programs (a piece of calibration data) X 10 sets
- * **LSM-6200** can only support this function.

Drill/Endmill (odd number flute) diameter measurement

The diameter of drills or endmills that have an odd number of flutes can be measured by using the max/min value function.



Measurement Mode Setting Function

It is possible to set measurement modes such as normal, maximum, minimum, amplitude, and sample measurement according to different workpieces, and these settings can be saved as a program.

Automatic Workpiece Detection

This function automatically starts measurement when a workpiece advances into the specified measuring area.

Preset/Offset

Sets the currently displayed measurement value to zero or a specified numeric value. This is useful, for example, if a difference in the diameters of a reference gage and a workpiece is to be allowed for in calibration, or if a dimension of a workpiece that exceeds the measurement range of the LSM is to be measured.

Mastering

For continuous processing of high-precision workpieces, fine-adjusting the preset or offset value is called mastering. By specifying a mastering value the total correction will be (zero-set/offset value) + (± mastering value). If a positive mastering value is specified, the displayed value for a workpiece diameter measurement will be greater than the actual value; if a negative value is specified, the displayed value will be smaller than the actual value.

Sample Measurement

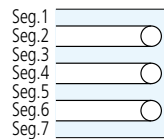
On a sample measurement the number of measurements will be defined (in the range of 2 to 999) in advance. From this sample measurement various calculation results (mean, maximum, minimum, and range) can be derived. These measurements can be used for runout measurements on a revolving workpiece and simplified cylindricity measurements.

Arithmetical Average/Moving Average

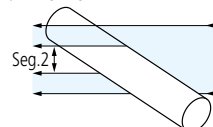
Arithmetical/moving average modes are provided to obtain the average of measurement values. On this type of LSM either of them can be specified before starting measurement. In the arithmetical average mode, the number of scans over which to take an averaging can be set at one of twelve steps between 2 (0.64 ms) and 2048 (0.64 sec). In the moving average mode the number of scans can be set at one of seven steps between 32 (0.01sec) and 2048 (0.64 sec), and the measurement value will be updated every sixteen scans on and after the second measurement, irrespective of the specified number of scans for averaging. The latter mode is suitable for judging the trend in the diameter or width of an endless workpiece such as wire or tape from a measurement that requires a long period.

Measurement using Segment Specification

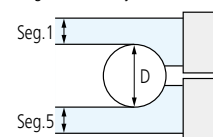
The following conventions are used to set up to the maximum of seven segments. However, if the transparent object measuring mode is set, no more than three segments can be set at one time.



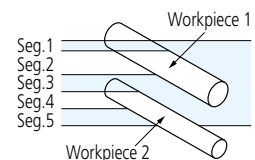
- The outside diameter of a wire or cylindrical workpiece can be measured by using Seg.2.



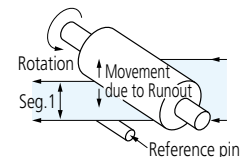
- The outside diameter of a large workpiece can be measured by using Seg.1 and Seg.5 in a dual-unit configuration. (only with **LSM-6200**).



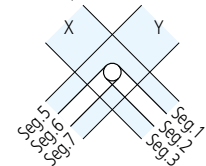
- Measurement of spacing of two parallel pins (pitch measurement)
Pitch = ((Seg.2+Seg.4)/2)+Seg.3



- The Runout of a revolving workpiece can be obtained by observing the variation in Seg.1 which is measured against a stationary reference pin.

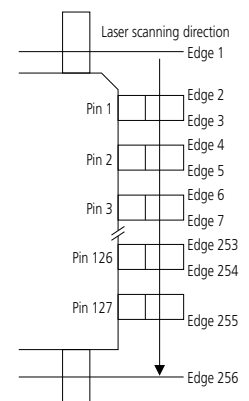


- If dimensions in both X and Y directions (min. distance of X/Y scanning section: 10mm) are measured through dual-unit measurement, use Seg.2 and Seg.6 (only with LSM-6200).



Automatic Measurement using Edges

The edges created by scanning a workpiece can be used to program an LSM. A maximum of 127 workpiece features, and 127 of the spaces between these features, can be used which involves a total of 255 edges. This is most useful for measuring such things as IC chip leads or connector pins that are approximately equally spaced. This method cannot be applied to transparent objects.



Abnormal Data Elimination

If a piece of data significantly exceeds the tolerance limit because the workpiece or measuring unit is contaminated by a water droplet, oil droplet, or dust, the piece of data will be automatically removed by this function.

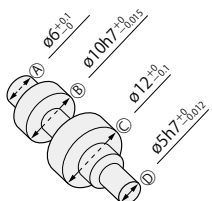
Data Output Interval Setting

By setting an interval (between 1 and 999 seconds) to continuous measurement in advance, data output will take place at each specified period of time.

Statistical Calculation

With this function, multiple measurements are taken from the same kind of workpiece, statistical values are calculated from the measurement results and quality evaluation is executed for each lot.

- Example of measuring a stepped cylinder using the statistical calculation function.



Measuring procedure: Measure the dimensions numbered (A) to (D), perform tolerance judgment, and statistically process the resulting data for every ten samples defined as one lot.

Print Example

P: 0 +NG 6.1700	Print only NG data
P: 0 -NG 5.7340	
STAT. DATA	Operation result data
PROGRAM NO. = 0	Program No. 0 (Conditions for measurement of (A))
N 10	Number of samples
Σ 6.0045	Mean value
MAX 6.0155	Max. value
MIN 5.9970	Min. value
R 0.0185	Deviation
S.D 0.00600	Standard deviation
STAT. DATA	Program No. 1 (Statistics of (B) measurement)
PROGRAM NO. = 1	
N 10	
Σ 9.9890	
MAX 9.9950	
MIN 9.9775	
R 0.0175	
S.D 0.00530	
STAT. DATA	Program No. 2 (Statistics of (C) measurement)
PROGRAM NO. = 2	
N 10	
Σ 11.9485	
MAX 11.9835	
MIN 11.9145	
R 0.0690	
S.D 0.01900	
STAT. DATA	Program No. 3 (Statistics of (D) measurement)
PROGRAM NO. = 3	
N 10	
Σ 4.9930	
MAX 5.0160	
MIN 4.9595	
R 0.0565	
S.D 0.01485	

Data Output

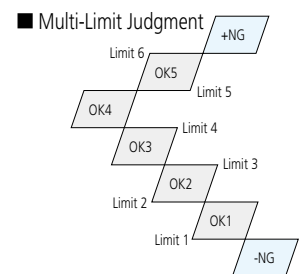
Every model has a standard RS-232C interface unit, allowing data to be output to an external PC or printer. There are additional means of data output, including SPC and BCD(optional).

External trigger signal input (Available only for LSM-6200/6902H)

By supplying a contact signal to the footswitch connector at the rear panel the measurement can be triggered.

Multi-Limit Judgment (Available only for LSM-6200/6902H)

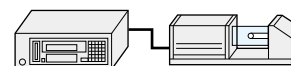
In addition to +NG, GO, and -NG judgment criteria limit values from Limit 1 to Limit 6 can also be set. If an optional 2nd I/O-Analog interface unit (02AGC880) is used, seven-step judgment signals can be output to external devices to support GO/NG judgment.



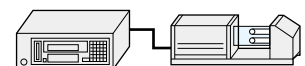
Simultaneous (Dual-program) Measurement (Available only for LSM-6200)

It is possible to measure two items simultaneously with one Laser Scan Micrometer unit, and to output the data. This function can be used to simultaneously measure the outside diameter and runout of a bar that is rotating, or to measure the outside diameters of two cylinders or wires at the same time.

- Simultaneous measurement of one workpiece and one beam passage



- Simultaneous measurement of two workpieces



Restrictions Associated with Particular Combinations of Functions

Combinations of Functions	Edge specification		Transparent object measurement	Ultra-fine wire measurement*	Automatic workpiece detection	Abnormal data elimination	Sample measurement	Odd-fluted cutting tool measurement**	Moving average	Group judgment***
	Manual measurement	Automatic measurement								
Edge Manual measurement	—	—	—	—	●	●	●	—	●	●
Edge Automatic measurement	—	—	—	—	●	—	—	—	—	—
Transparent object measurement	—	—	—	●	●	●	●	●	●	●
Ultra-fine wire measurement*	—	—	●	—	—	●	●	—	●	—
Automatic workpiece detection	●	●	●	●	—	●	●	—	—	●
Abnormal data elimination	●	—	●	●	●	—	●	●	●	●
Sample measurement	●	—	●	●	●	●	●	●	●	●
Odd-fluted cutting tool measurement**	—	—	●	—	—	●	●	—	—	●
Moving average	●	—	●	●	—	●	●	—	—	—
Group judgment***	●	—	●	—	●	●	●	●	—	—

●: Permitted combination, —: Combination that is not permitted

*Function that is not provided for LSM-9506

**Function that is only provided for LSM-6200/5200.

***Function that is only provided for LSM-6200/6900.

Note1: The number of scans will be limited to between 16 and 2048 if the ultra-fine wire measurement function is on.

Note2: The number of scans will be limited to between 32 and 2048 for the moving averages.

Note3: Segment setting will be limited to between 1 and 3 for the transparent object measurement.

Display Unit

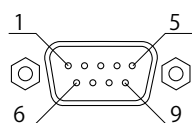
Data I/O Specifications for LSM-5200/6200/6902H

RS-232C Interface

Allows the LSM to communicate with external devices via RS-232C (conforming to the EIA standard) serial signals. Depending on the basic setup this interface can be used as a printer port.

Common specifications

- Matching plug: D-sub 9pin (female) (Manufactured by AMP: Equivalent to HD-20/747951-1, etc.)



The pin configuration of the **LSM-6200/6902H** is shown in the left figure.
It is upside down for the **LSM-5200**.

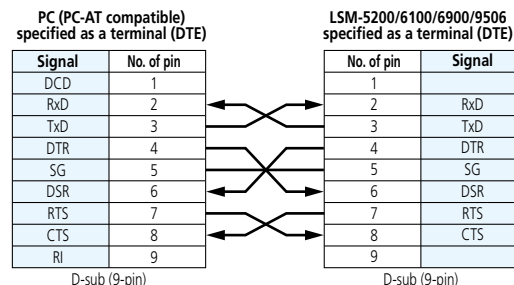
Communication specifications

Definition of device	DTE definition on the side of LSM	
Data transmission method	All-duplex transmission	
Syncronizing method	Start-stop system	
Data transmission speed	6200, 5200	4800, 9600, 19200, 38400bps
	6902H	1200, 2400, 4800, 9600, 19200bps
Data arrangement	Transmission code	ASCII
	Data length	7 or 8 bits
	Start bit	1 bit
	Parity check	Non, odd or even
	Delimiter	CR+LF, CR, LF

Connections

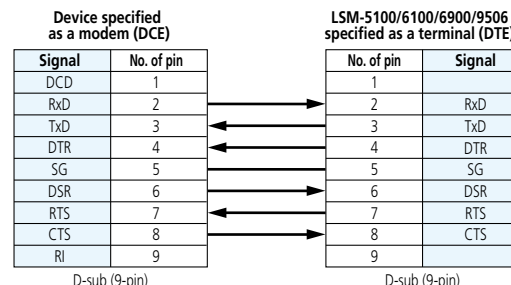
1) Connecting the RS-232C interface to a device specified as a terminal (DTE)

Example 1: Flow control method (handshake method controlled by CTS, DSR, DTR, and RTS signals)

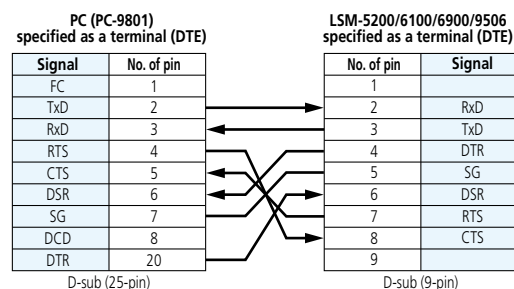


2) Connecting the RS-232C interface to a device specified as a modem (DCE)

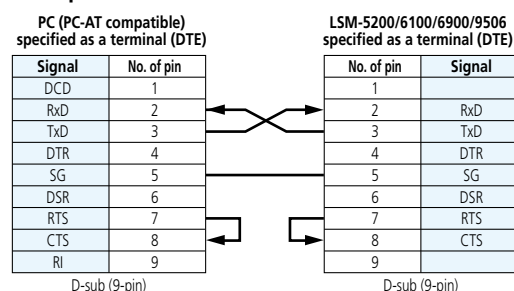
Example 1: Flow control method (handshake method controlled by CTS, DSR, DTR, and RTS signals)



Example 2: Flow control method (handshake method controlled by CTS, DSR, DTR, and RTS signals)



Example 3: 3-Wire method (teletype protocol using TxD, RxD and SG)



I/O-Analog Interface

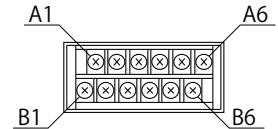
Used to communicate with a PC, programmable controller, or relay circuitry by means of sequential signals. It is also capable of producing an analog voltage output that may be used for feedback control and/or continuous recording of workpiece dimension deviation. If the optional second I/OAnalog Interface is connected, this I/O-Analog Interface becomes invalid.

Pin assignment (LSM-5200)

Terminal	Signal	Function	I/O
A1	SYNC	Synchronizing signal (an operation is selected with "b5 SYNc" in the basic setup.)	IN/OUT
A2	STS	Status signal for error (an operation is selected with "b5 STS" in the basic setup.) Normal status: on / Error status (Err-0, Err-8): off	OUT
A3	GO STB ACK	GO judgment signal ("b5 Go"="Go" in the basic setup) STB signal ("b5 Go"="Stb" in the basic setup) ACK signal ("b5 Go"="AC" in the basic setup)	OUT
A4	+NG	+NG judgment signal	OUT
A5	-NG	-NG judgment signal	OUT
A6	GND	Signal ground	—
B1	FG	Frame ground (connected to the casing)	—
B2	ALG	Analog voltage output	OUT
B3	OV	OV of analog voltage output	OUT
B4	PSET HOLD	Preset/zero-set execution input signal ("b5 PSET"="PSET" in the basic setup) The updating of judgment output is disabled. ("b5 PSET"="HoLd" in the basic setup)	IN
B5	RUN	Input signal to trigger measurement (an operation is selected with "b5 rUn" in the basic setup.)	IN
B6	RES	Input of CLEAR command	IN

External view of the connector

Terminal name label is provided under the I/O analog connector protection cover.

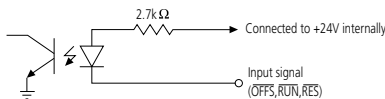


Pin assignment (of LSM-6200/6902)

Terminal	Signal	Function	I/O
A1	FG	Frame ground (Used for connecting the shield conductor of I/O signal cables)	—
A2	STS	Output of measurement condition (Goes high in the event of "Err-0")	OUT
A3	GO	GO/NG judgment result output (GO) (Can be changed to strobe signal (STB) or measurement in-progress signal (ACK) output by the basic setup)	OUT
A4	+NG	GO/NG judgment result output (+NG)	OUT
A5	-NG	GO/NG judgment result output (-NG)	OUT
A6	GND	Digital ground (Common ground terminal of both output (A2 thru A5) and input (B4 thru B6))	—
B1	FG	Frame ground (Used for connecting the shield conductor of I/O signal cables)	—
B2	ALG	Analog voltage output	OUT
B3	OV	OV reference for analog voltage output	OUT
B4	OFFS	Offset input (Can be changed to (HOLD) by the basic setup)	IN
B5	RUN	Input of trigger command for single-run measurement (Can be changed to a trigger for continuous-run measurement (with term specification))	IN
B6	RES	Input of CLEAR command	IN

Input/output equivalent circuit

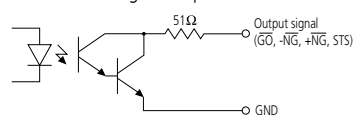
1) Input circuit



- Low-level signal to be between 0 and 1V. Generally drive this circuit with an open collector type transistor.
- Maximum current drawn from the input signal terminal is 12 mA.

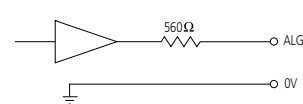
2) Output circuit

1. Control signal output



- Maximum rating of the output transistor is 30 V, 50 mA.

2. Analog signal output



- The output voltage range is ± 5 V.
- The accuracy of the analog voltage output is 0.2 % of full-scale range.
- This analog output should be connected to a device that has an input impedance of 1 M Ω or greater. If the input impedance is lower than this value, the output accuracy will be reduced due to the internal resistance of 560 Ω .

Remote Interlock Connector 214938

The Remote Interlock Connector is provided as a means of turning the laser beam on and off from a remote location. Since the supplied shortcircuit pin is usually inserted in this terminal, the circuit is short-circuited. Insert an optional switched plug to allow external control of the LSM laser.

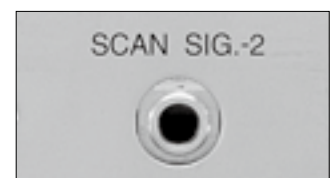


Attached plug: MP-121M (Marushin Electric)

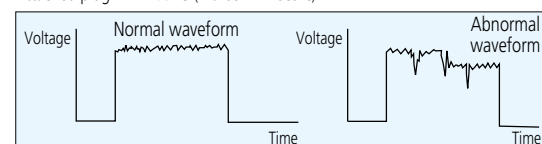
Laser emission ON	Short-circuit pin inserted
Laser emission OFF	Short-circuit pin removed

Scanning Signal Connector 02AGC401

The Scanning Signal Connector is provided for observing the output signal waveform from the reception chip in the measuring unit. Typically, this connector is used to align the emission unit and reception unit after they have been removed from the original base and then mounted on a different base.



Attached plug: MP-105LC (Marushin Electric)

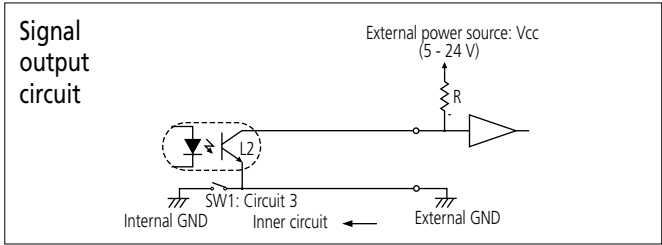
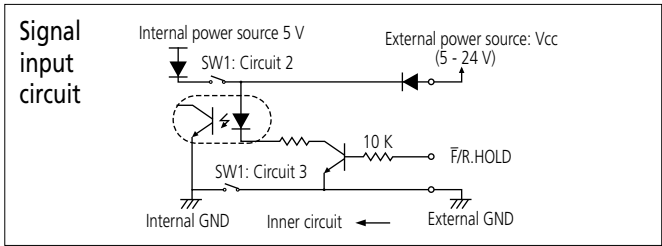
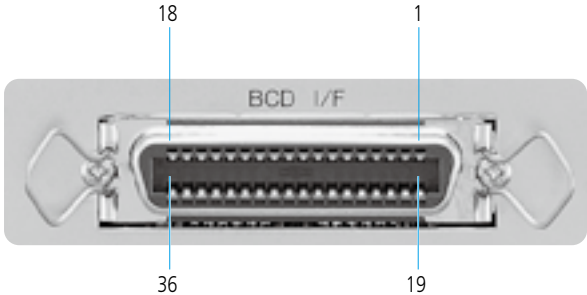
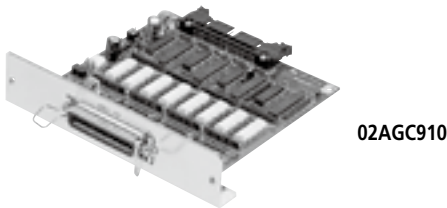


Optional Accessories

Interface unit for LSM-6200/6902H

BCD Interface Unit

- Outputs a 7-digit BCD and a positive or negative sign.
- Switchable data logic.
- The input and output circuits are isolated.
- Available for **LSM-6200** and **6902H**



Pin assignment of BCD interface unit			
57-40360-D			
Pin No.	Signal name	Pin No.	Signal name
1	1	19	1 } $\times 10^4$
2	2	20	2 } $\times 10^4$
3	4	21	1
4	8	22	2
5	1	23	4 } $\times 10^5$
6	2	24	8
7	4	25	1
8	8	26	2
9	1	27	4 } $\times 10^6$
10	2	28	8
11	4	29	Err.0 (Segment error)
12	8	30	HOLD (input)
13	1	31	F/R
14	2	32	STB (Strobe output)
15	4	33	EXT.Vcc (Ext. power)
16	8	34	+POLE (Polarity)
17	1	35	GND (Signal GND)
18	2	36	FG (Frame GND)

Applicable connector: **57-40360-D** (Standard accessory)

Contact Sensor

Non-contact Sensor

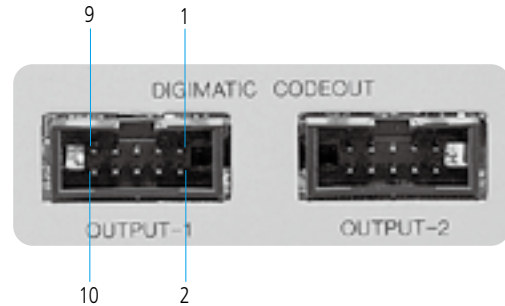
Digimatic Code-out Unit

- Provides two channels of SPC (Digimatic) output.
- Outputs the following during simultaneous measurement:
From OUTPUT1: Measured values by PRG.0 through PRG.4. OUTPUT2:
Measured values by PRG.5 through PRG.9
- 10 pin MIL type connector
- The output cable (**936937**) is optional.
- Available for **LSM-6200** and **6902H**

*Outputs six digits of the measured value with a maximum of 5 digits after the decimal point.

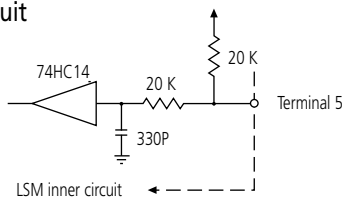


02AGC840

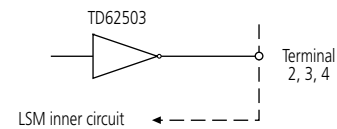


Pin No.	Signal name	I/O	Function
1	GND	—	Signal GND
2	DATA	OUT	Data out
3	CK	OUT	Data transmission clock
4	RD	OUT	Data read request
5	REQ	IN	Data output request
6, 7, 8, 9	I.C	—	Spare
10	F.G	—	Frame GND

Signal input circuit

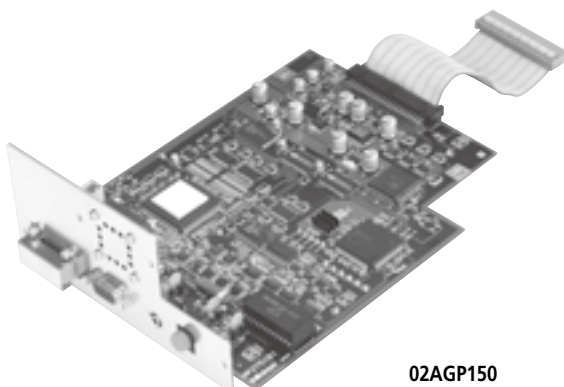


Signal output circuit



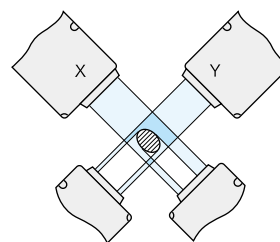
Dual-type Add-on Unit (02AGP150)

- Enables a second measuring unit to be connected to the display unit (this is possible only if the two measuring units are the same model).
- Depending on the layout of the two measuring units, large-diameter measurement, XY measurement, and parallel measurement are possible.
- The sub-display of the **LSM-6200** allows simultaneous measurement and display with two measuring units.
- Not available for **LSM-6902H**



02AGP150

■ XY measurement

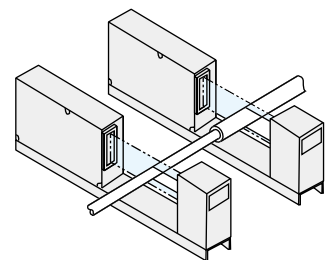


$(X-Y)$ =Deviation

$(X+Y)/2$ =Mean

Note: Min. distance of XY scanning section: 10 mm

■ Parallel measurement



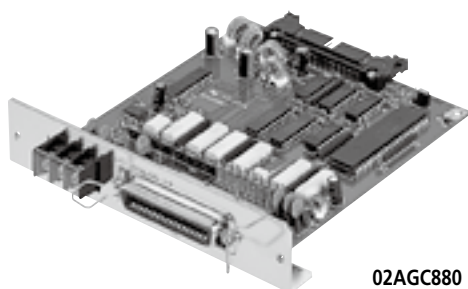
Display Unit

Optional Accessories

2nd I/O-Analog Interface Unit

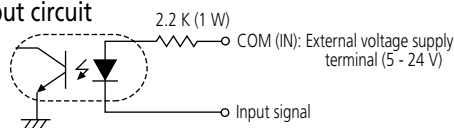
- I/O, analog output.
- Simultaneous measurement is supported by two pairs of go/no-go judgment outputs.
- Available for **LSM-6200/6902H**.

*If the second I/O-Analog Interface is connected, the standard I/O-Analog Interface becomes invalid.

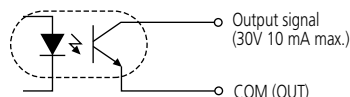


02AGC880

Signal input circuit



Signal output circuit (open collector)

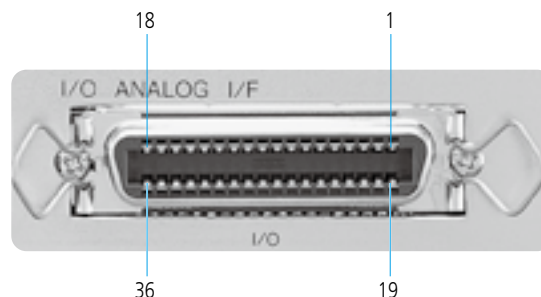


- Analog voltage output and scale value
The analog voltage output is calculated as (Measured value - Reference value) x Scale value (Sensitivity) according to the resolution configured for each measuring unit.
(The upper limit of analog output is within the measurement range.)

Scale value (1)		Display Resolution			
No.		0.01 μm	0.02 μm	0.05 μm	0.1 μm
1	Sensitivity	2.5 mV/0.01 μm	2.5 mV/0.02 μm	2.5 mV/0.05 μm	2.5 mV/0.1 μm
	Maximum Output	±5 V/20 μm	±5 V/40 μm	±5 V/100 μm	±5 V/200 μm
2	Sensitivity	2.5 mV/0.1 μm	2.5 mV/0.2 μm	2.5 mV/0.5 μm	2.5 mV/1 μm
	Maximum Output	±5 V/200 μm	±5 V/400 μm	±5 V/1 mm	±5 V/2 mm
3	Sensitivity	2.5 mV/1 μm	2.5 mV/2 μm	2.5 mV/5 μm	2.5 mV/10 μm
	Maximum Output	±5 V/2 mm	±5 V/4 mm	±5 V/10 mm	±5 V/20 mm

Scale value (1)		Display Resolution			
No.		0.2 μm	0.5 μm	1 μm	2 μm
1	Sensitivity	2.5 mV/0.2 μm	2.5 mV/0.5 μm	2.5 mV/1 μm	2.5 mV/2 μm
	Maximum Output	±5 V/100 μm	±5 V/1 μm	±5 V/2 mm	±5 V/4 mm
2	Sensitivity	2.5 mV/2 μm	2.5 mV/5 μm	2.5 mV/10 μm	2.5 mV/20 μm
	Maximum Output	±5 V/4 mm	±5 V/10 mm	±5 V/20 mm	±5 V/40 mm
3	Sensitivity	2.5 mV/20 μm	2.5 mV/50 μm	2.5 mV/100 μm	2.5 mV/200 μm
	Maximum Output	±5 V/40 mm	±5 V/100 mm	±5 V/200 mm	±5 V/400 mm

Scale value (1)		Display Resolution		
No.		5 μm	10 μm	100 μm
1	Sensitivity	2.5 mV/5 μm	2.5 mV/10 μm	2.5 mV/100 μm
	Maximum Output	±5 V/10 mm	±5 V/20 mm	±5 V/200 mm
2	Sensitivity	2.5 mV/50 μm	2.5 mV/100 μm	2.5 mV/1 mm
	Maximum Output	±5 V/100 mm	±5 V/200 mm	±5 V/2000 mm
3	Sensitivity	2.5 mV/50 μm	2.5 mV/1 mm	2.5 mV/10 mm
	Maximum Output	±5 V/1000 mm	±5 V/2000 mm	±5 V/20000 mm



Pin assignment for GO/NG judgment

Pin No.	Signal name	I/O	Pin No.	Signal name	I/O
1	+5V	(Internal power)	19	GND	(Internal power)
2	COM (IN)	(IN)	20	COM (IN)	(IN)
3	PROG.0/b0	IN	21	PROG.1/b1	IN
4	PROG.2/b2	IN	22	PROG.3/b3	IN
5	PROG.4/PRG	IN	23	IC	(OUT)
6	SHIFT	IN	24	PRINT	IN
7	RUN	IN	25	RESET	IN
8	A•(-NG)	OUT	26	A•(GO)	OUT
9	I.C	(OUT)	27	I.C	(OUT)
10	I.C	(OUT)	28	I.C	(OUT)
11	B•(-NG)	OUT	29	B•(GO)	OUT
12	B•(+NG)	OUT	30	I.C	OUT
13	I.C	(OUT)	31	I.C	(OUT)
14	A•(+NG)	OUT	32	A•(-NG)	OUT
15	A•(GO)	OUT	33	ACK	OUT
16	ERR.0	OUT	34	STB	OUT
17	COM (OUT)	(OUT)	35	COM (OUT)	(OUT)
18	CNT	OUT	36	FG	—

With a combined use of b0, b2, PRG, b1 and b3 maximum 100 patterns of program can be used.

Pin assignment for multi-limit selection (L1-L6)

Pin No.	Signal name	I/O	Pin No.	Signal name	I/O
1	+5V	(Internal power)	19	GND	(Internal power)
2	COM (IN)	(IN)	20	COM (IN)	(IN)
3	PROG.0	IN	21	PROG.1	IN
4	PROG.2	IN	22	PROG.3	IN
5	PROG.4	IN	23	B-L7	(OUT)
6	SHIFT	IN	24	PRINT	IN
7	RUN	IN	25	RESET	IN
8	A-L1	OUT	26	A-L2	OUT
9	A-L3	(OUT)	27	A-L4	(OUT)
10	A-L5	(OUT)	28	A-L6	(OUT)
11	B-L1	OUT	29	B-L2	OUT
12	B-L3	OUT	30	B-L4	OUT
13	B-L5	(OUT)	31	B-L6	(OUT)
14	A-L7	OUT	32	A-L1	OUT
15	A-L2	OUT	33	ACK	OUT
16	ERR.0	OUT	34	STB	OUT
17	COM (OUT)	(OUT)	35	COM (OUT)	(OUT)
18	CNT	OUT	36	FG	—

- Applicable connector
57-30360 (or the equivalent product by DDK or Amphenol, etc.)
This is the standard accessory for this interface.

System Extension Devices

Extension Cable for Concurrent Installation of BCD and Second I/O-Analog Interface

02AGE060

- The use of this cable enables concurrent installation of BCD (02AGC910) and second I/O-Analog interface (02AGC880) in LSM-6200/6900.



*Restrictions

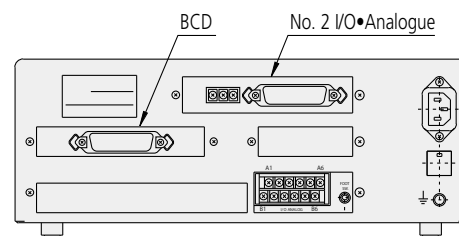
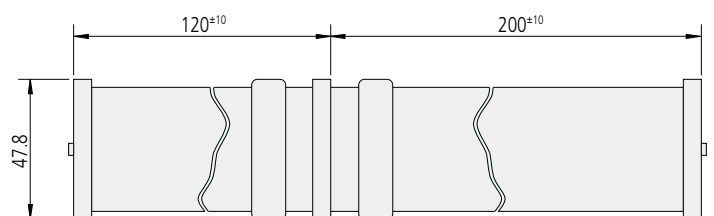
If this cable is used, the dual extension unit (02AGP150) can not be used.

Tips

Example

LSM-6200 is equipped with the BCD and 2nd I/O / analog interface

■ Dimensions



Thermal Printer DPU-S445

- This printer can be connected to panel-mount type or multifunctional display unit.
- Both measurement values and statistical calculation results can be printed (only with **LSM-6200/9506/6902H**).

02AGP850A

P00:	GO	10.00010	DEV	0.00010	
P05:	GO	0.00124			
P06:	GO	10.00025	DEV	0.00025	
P08:	GO	0.00028			
P09:	GO	9.99988	DEV	-0.00012	
P05:	GO	0.00040			
P01:	GO	8.00123	P06:	GO	0.00022
P01:	GO	8.00008	P06:	GO	0.00050
STAT. DATA					
PROGRAM NO. = 00					
N 24					
AVG 10.00014					
MAX 10.00342					
MIN 9.99893					
R 0.00049					
S.D 0.000726					
PROGRAM NO. = 01					
N 24					
AVG 0.00138					
MAX 0.00091					
MIN 0.00016					
R 0.00345					
S.D 0.000618					

Print Example

Order No.	02AGP850A DPU-S445
Model	DPU-S445-00C-E (Standard model)
Printing method	Thermal method
Printing capacity	52 columns*1
Character size (Vertical x Horizontal)	Half-width: 24 dots x 12 dots Full-width: 24 dots x 24 dots
Number of effective dots	832 dots
Dot density	8 dot/mm
Print width/Paper width	104/112 mm
Print speed	Max. 90 millisecond
Operating temperature	0 °C - 50 °C
Relative humidity*2	30 to 80%RH (no condensation)
Power consumption at power off	0.099 W
Dimensions (WxDxH)	145x135x58 mm*3
Mass	approx. 490 g (including battery pack)

*1: Standard size characters, character spacing is 4 dots

*2: Refer to the technical manual for applicable humidity at each temperature.

*3: Excludes protrusions

Footswitch connection port

- A connection port provided on the rear panel of LSM-6200/9506/6902H
Shorting this terminal performs the same function as a press of the Run key.
An optional dedicated footswitch can be connected.

Compatible plug
MP-105LC Mini plug (Marushin Electric)

Measurement ON	Short-circuit pin inserted
Measurement OFF	Short-circuit pin removed



Footswitch (Optional)
937179T



Glossary

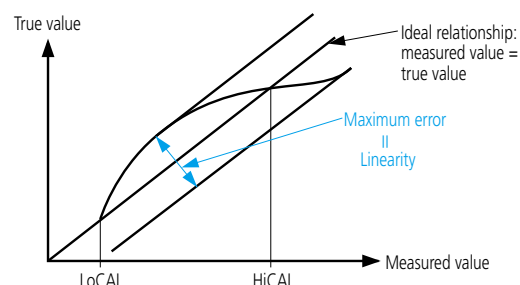
1. Linearity

This is a specified value that defines the maximum error* that may be indicated by the LSM after calibration**, anywhere within its measuring range, when measuring a workpiece in the center of the measuring region.

Note that the linearity specification does not include the calibration error specification of the calibration gages themselves. This error must be added separately.

* The difference between the result of measuring a dimension and the true value of the dimension measured.

** Optional calibration gages are available for each model of LSM to provide appropriate high and low calibration points (HiCAL and LoCAL on the diagram).

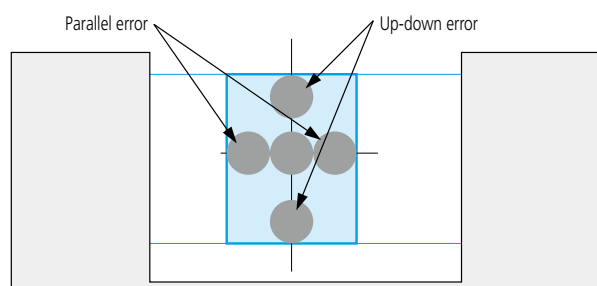


2. Repeatability

Means, in the center of a measuring region, the dispersion ($\pm 2\sigma$) of measurement values as the result of continuous measurement for 2 minutes with the number of scans for averaging set at 512 times (2048 times for **LSM-6902H**) without moving a workpiece of the maximum measurement diameter on each measuring unit.

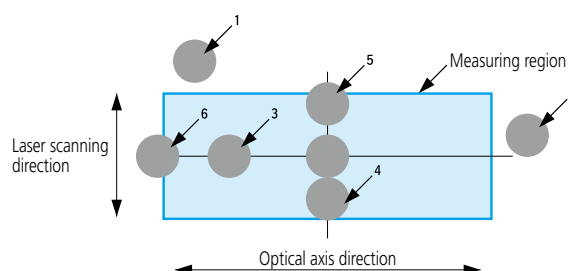
3. Positional error

Means an error with reference to the measurement value at the center of the measuring region if a workpiece is displaced in the measuring region. A position error consists of an up-down error and a parallel error as shown in the following figure. This error separately affects measurement accuracy.

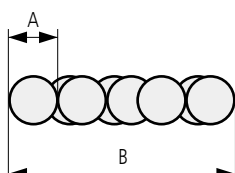


4. Measuring region

The LSM provides numeric values for which the accuracy (linearity + position error) is guaranteed only if a workpiece is located within the prescribed space domain. This domain is called the measuring region. A measuring region is determined by [laser beam scanning direction range] x [optical axis direction range]. To perform measurement with a minimum of error, it is necessary to measure a workpiece at the center of this measuring region. As an example in the figure right, workpieces 1, 2, 5, and 6 cannot be measured because these are outside the measuring region. For workpieces 3 and 4, a position error is added to a linearity error.



5. Beam diameter and width



	LSM-6902H	LSM-500S	LSM-501S	LSM-503S	LSM-506S	LSM-9506	LSM-512S	LSM-516S
Beam diameter A	200 μm	80 μm	120 μm	240 μm	600 μm	600 μm	1200 μm	1200 μm
Beam width B	300 μm	120 μm	170 μm	340 μm	800 μm	800 μm	1600 μm	1600 μm

*Reference value



Precautions

Observe the following precautions

Compatibility

Your Laser Scan Micrometer has been adjusted together with the ID Unit, which is supplied with the measuring unit. The ID Unit, which has the same code number and the same serial number as the measuring unit, must be installed in the display unit. This means that if the ID Unit is replaced the measuring unit can be connected to another corresponding display unit.

The workpiece and measuring conditions

Depending on the workpiece shape, and the surface roughness, measurement errors may result. If this is the case, perform calibration with a master workpiece which has dimensions, shape, and surface roughness similar to the actual workpiece to be measured. If measurement values show a large degree of dispersion due to the measuring conditions, increase the number of scans for averaging to improve the measurement accuracy.

Electrical noise interference

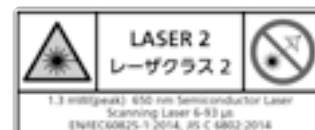
To avoid operational errors, do not route the signal cable and relay cable of the Laser Scan Micrometer alongside a high-voltage line or other cable capable of inducing noise current in nearby conductors. Ground all appropriate units and cable shields.

Connection to a computer

If the Laser Scan Micrometer is to be connected to an external personal computer via the RS-232C interface, ensure that the cable connections conform to the specification.

Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 IEC 60825-1 device. Warning and explanation labels, as shown on the right, are attached to the Laser Scan Micrometers as is appropriate.



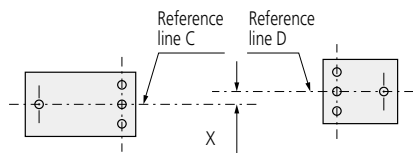
Precautions

Re-assembly after removal from the base

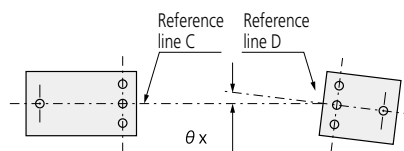
Observe the following limits when re-assembling the emission unit and reception unit to minimize measurement errors due to misalignment of the laser's optical axis with the reception unit.

1) Alignment within the horizontal plane

a. Parallel deviation between reference lines C and D: X (in the transverse direction)

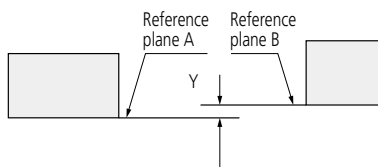


b. Angle between reference lines C and D: θ_x (angle)

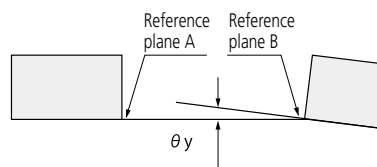


2) Alignment within the vertical plane

c. Parallel deviation between reference planes A and B: Y (in height)



d. Angle between reference planes A and B: θ_y (angle)



3) Allowable limits of optical axis misalignment

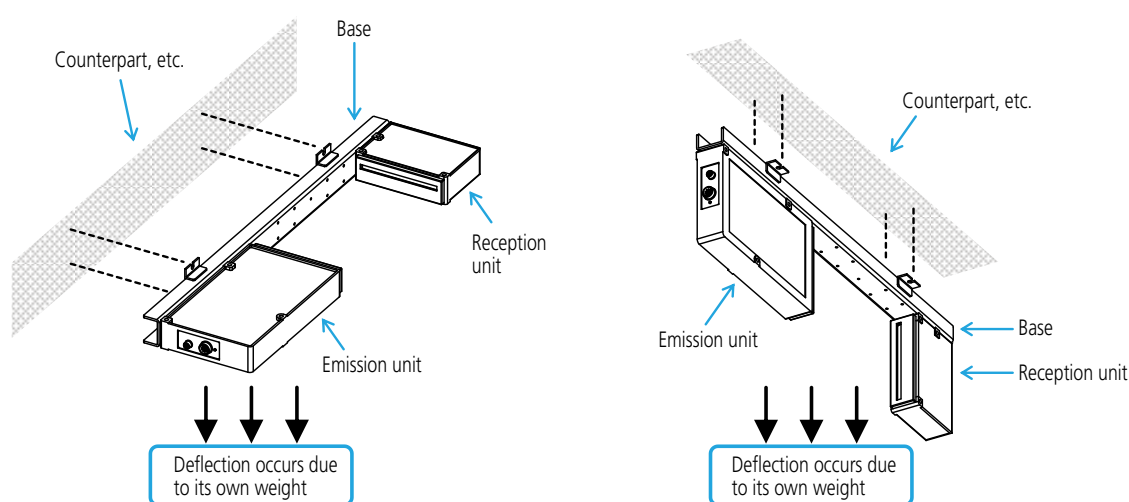
Model	Distance between Emission Unit and Reception Unit	X and Y	θ_x and θ_y
LSM-501S	68 mm (2.68 in) or less	within 0.5 mm (0.02 in)	within 0.4 ° (7 mrad)
	100 mm (3.94 in) or less	within 0.5 mm (0.02 in)	within 0.3 ° (5.2 mrad)
LSM-503S	130 mm (5.12 in) or less	within 1 mm (0.04 in)	within 0.4 ° (7 mrad)
	350 mm (13.78 in) or less	within 1 mm (0.04 in)	within 0.16 ° (2.8 mrad)
LSM-506S	273 mm (10.75 in) or less	within 1 mm (0.04 in)	within 0.2 ° (3.5 mrad)
	700 mm (27.56 in) or less	within 1 mm (0.04 in)	within 0.08 ° (1.4 mrad)
LSM-512S	321 mm (12.64 in) or less	within 1 mm (0.04 in)	within 0.18 ° (3.6 mrad)
	700 mm (27.56 in) or less	within 1 mm (0.04 in)	within 0.08 ° (1.4 mrad)
LSM-516S	800 mm (31.50 in) or less	within 1 mm (0.04 in)	within 0.09 ° (1.6 mrad)

Cautions on the Mounting Posture of LSM-512S and LSM-516S Main Unit

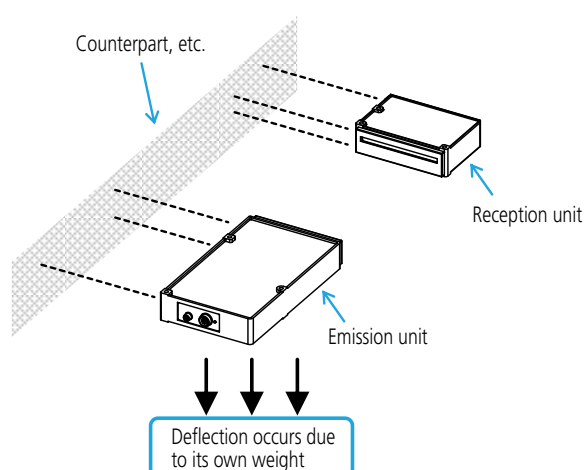
When mounting the main unit sideways or on the under surface by using the base, the optical axis may shift due to deflection of the main unit caused by its own weight. In this case, use the screw holes on the sides, or prepare reinforcement parts, etc. to prevent the deflection from occurring.

Mounting Posture that Induces Deflection

■ Mounting of the integrated type by using the base (standard)



■ Mounting of the separate type by using the screw holes for bottom-face mounting



1

2

3

4

5

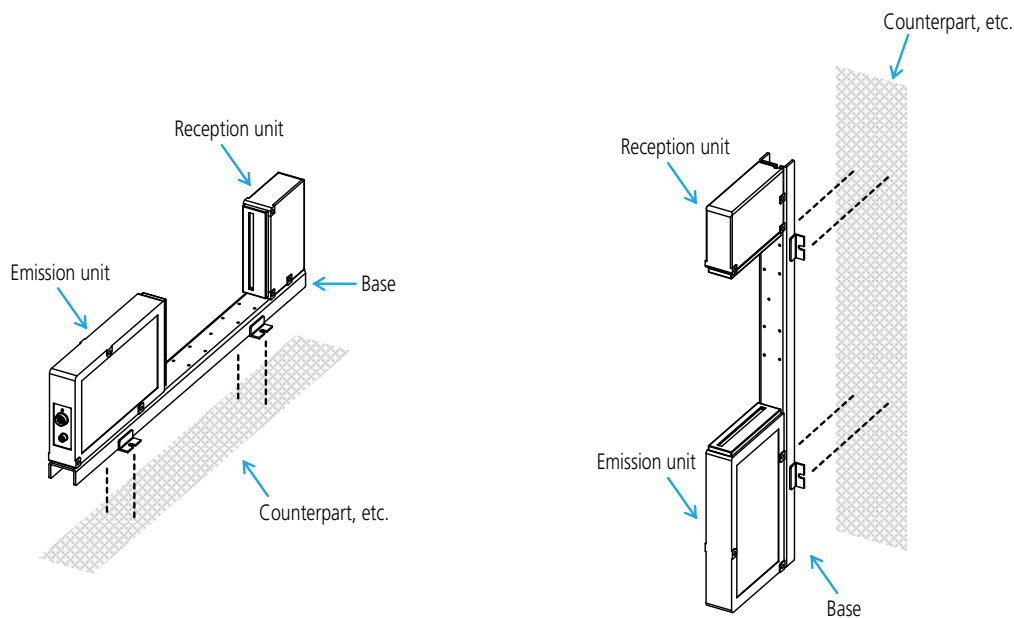
6

7

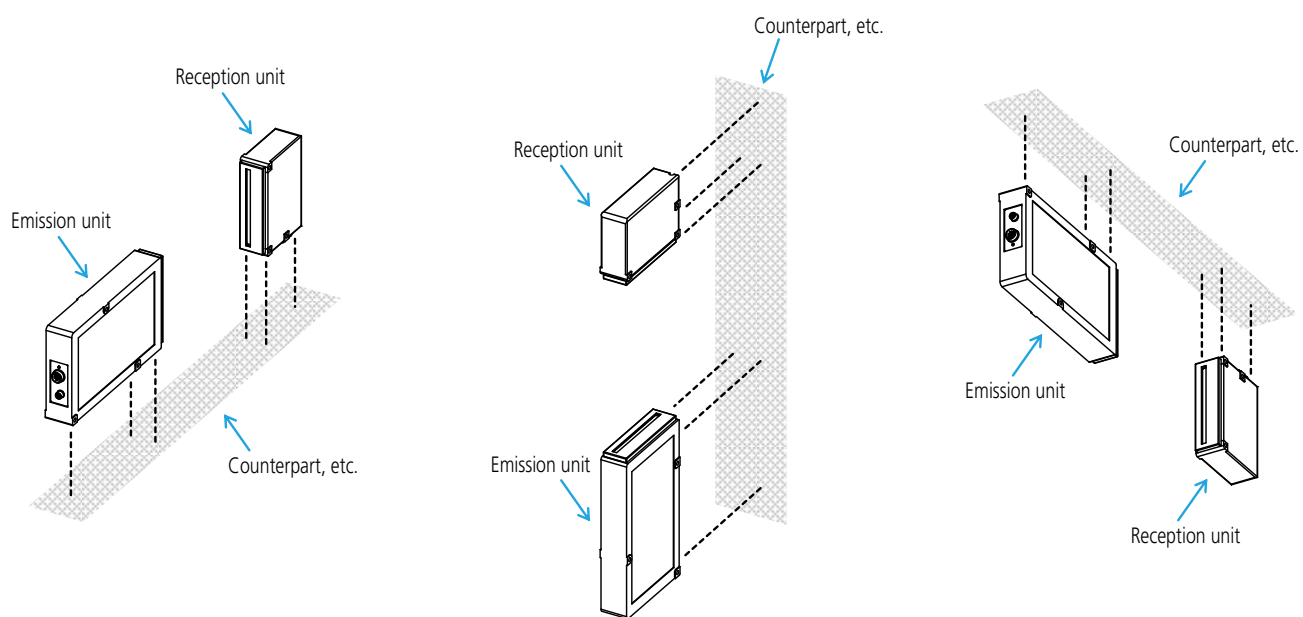
Precautions

Mounting Posture Resistant to Deflection

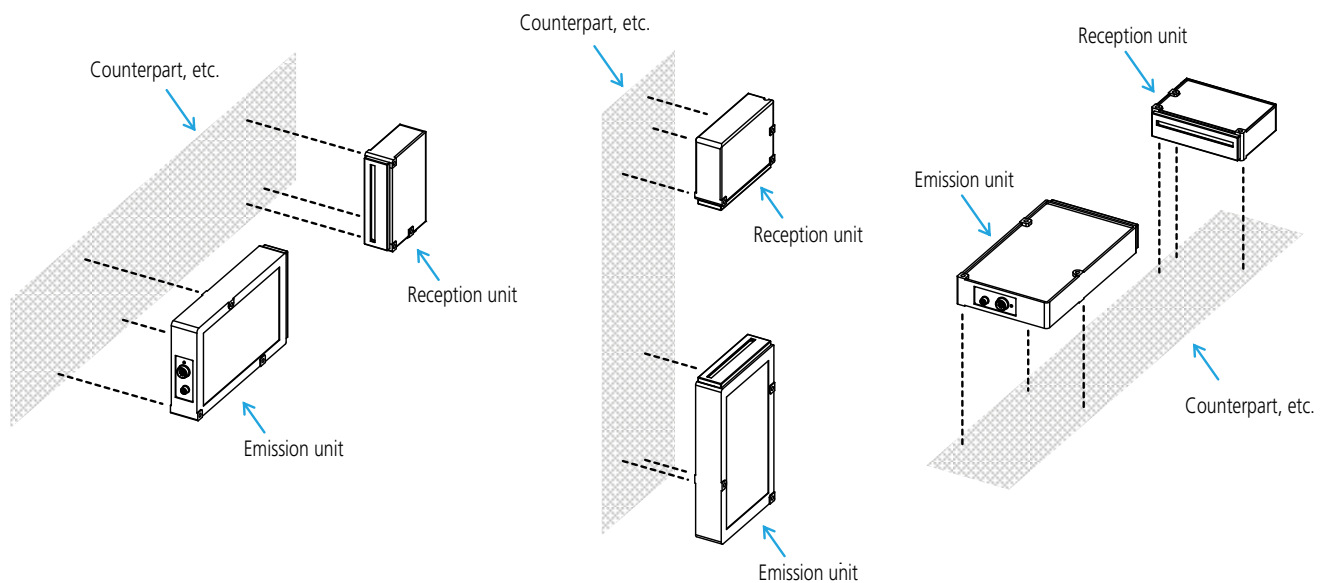
■ Mounting of the integrated type by using the base (standard)



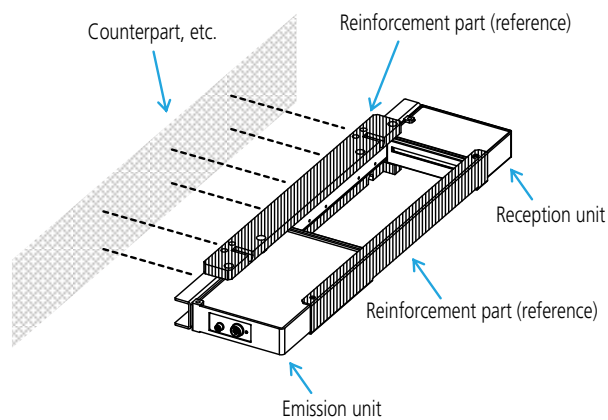
■ Mounting of the separate type by using the screw holes for bottom-face mounting



■ Mounting of the separate type by using the screw holes for side-face mounting



■ A reference example of mounting by using reinforcement parts (prepared by user)



NOTICE The reinforcement parts in the image above are just a reference. Prepare one, taking the mounting area or the counterpart size into consideration.

Export Control Compliance

Laser scan micrometers fall into the Catch-All-Controlled Goods and/or Catch-All-Controlled Technologies (including Programs) under Category 16 of Appended Table 1 of the Export Trade Control Order or under Category 16 of the Appended Table of Foreign Exchange Control Order, based on the Foreign Exchange and Foreign Trade Act of Japan.

Re-export or relocation of any of these products and re-provision of the related technology may require prior approval by an appropriate governing authority. If a purchased product is exported or re-exported, even if it is not considered a regulated item by a governing authority.

In addition, exporting laser products to the United States must meet the Food and Drug Administration (FDA) requirements. Please contact Mitutoyo in advance.

Applications

Automobile Manufacturing Process

The wide measurement range and high resolution expand the scope of use to suit various applications.

Measurement of outside diameter of rubber roll



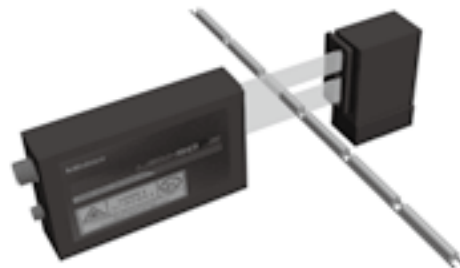
Simultaneous measurement of roller outside diameter and deflection



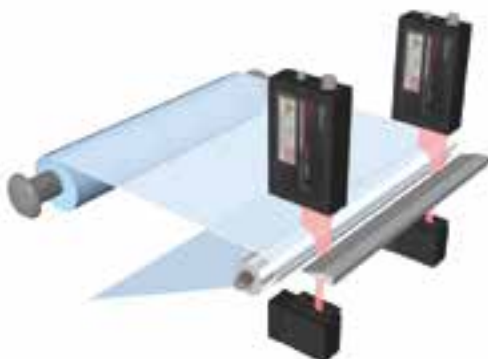
Measurement of gap between rollers



Roll bearing measurement



Measurement of uneven thickness of film or sheet (simultaneous measurement)



Measurement of film sheet thickness



Outside diameter measurement of wires and filament fibers



Dual system for measuring a large outside diameter



1

2

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4

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6

7

Chapter 6

SM

**Non-contact Line-laser Sensor
SurfaceMeasure**

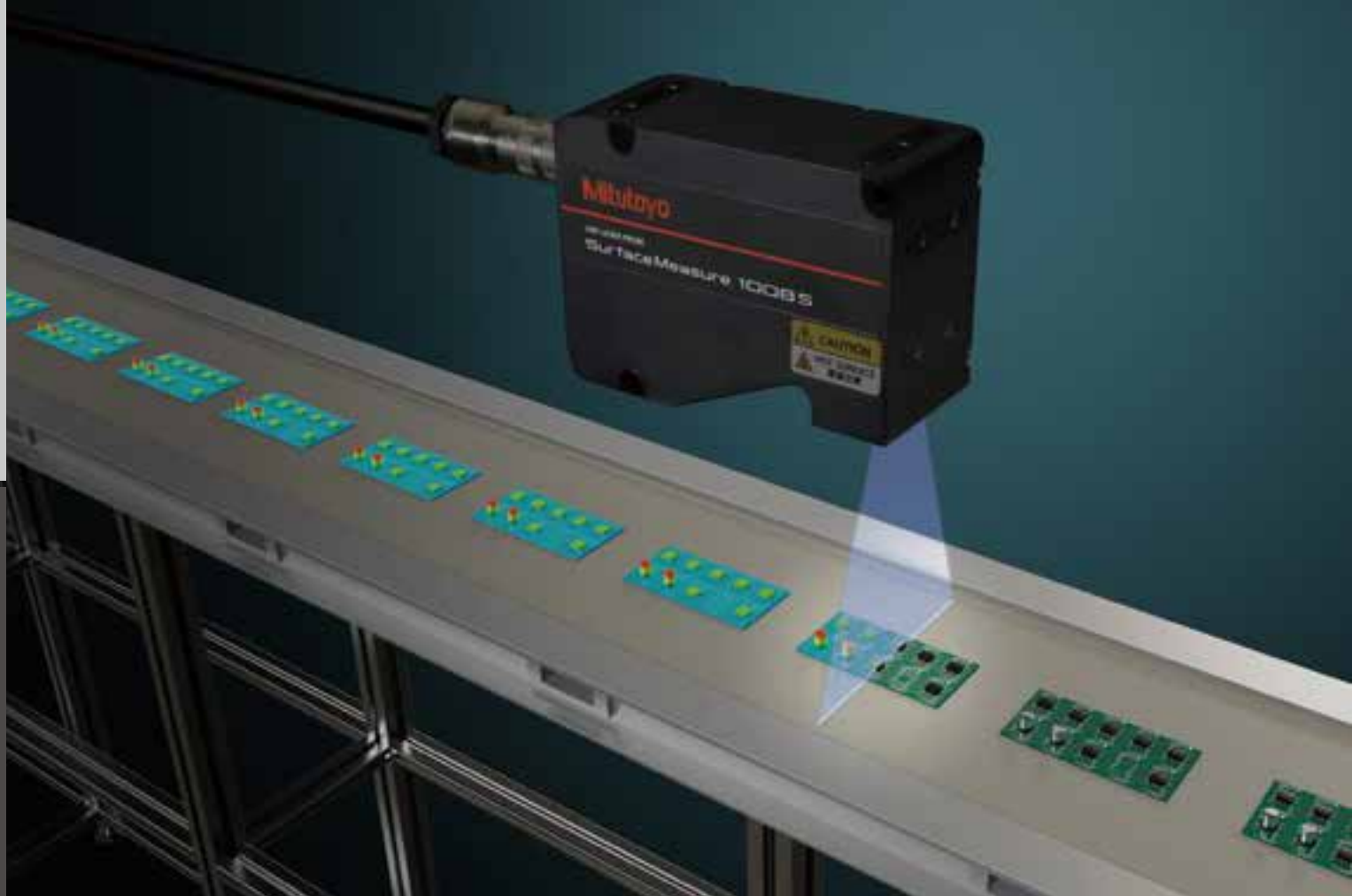
**Line-laser sensor providing stable
measurements with simple operations**

SurfaceMeasure1008S 6-1

Line-laser sensor providing stable measurements with simple operations

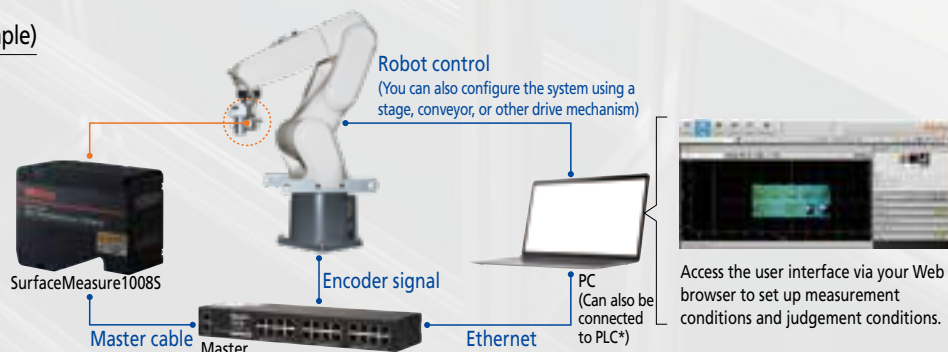
Contact Sensor

Non-contact Sensor



System configuration (example)

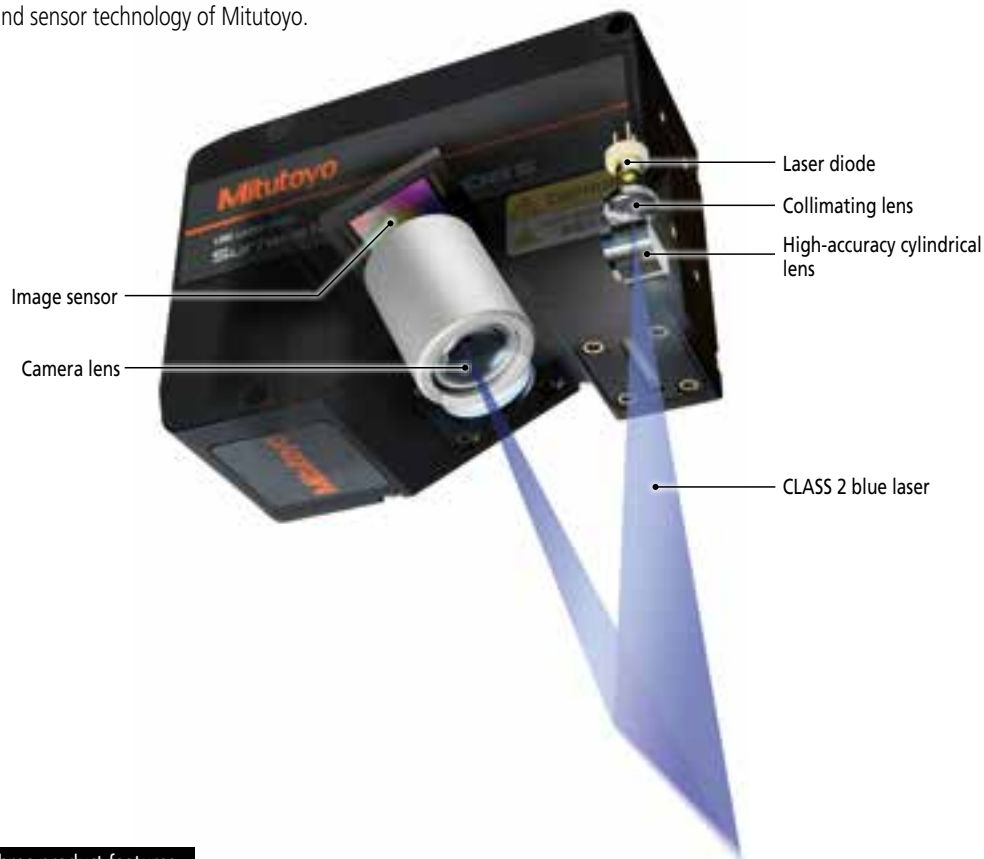
This is an example of the system configuration of SurfaceMeasure1008S. Various other system configurations are also available.



* PLC protocol: Modbus TCP, EtherNet/IP, PROFINET

Product structure

This line-laser sensor combines the optical technology and sensor technology of Mitutoyo.



Three product features

— (1) High-accuracy and environment-resistant sensor

The sensor itself is guaranteed for an accuracy of 20 μm and a Z repeatability of 0.5 μm . It has also achieved the IP67 protection level, providing stable measurements.

— (2) Supporting automated measurement

The **SurfaceMeasure1008S** can obtain the profiles and three-dimensional shapes of measurement workpieces at high speed (a maximum frame rate of 10 kHz) and make an automatic judgement inside the sensor. It is also equipped with a parts matching function that allows the measurement tool to be applied throughout, regardless of the orientations of the parts being measured. Measurements can be taken without performing alignment.

— (3) Simple operability

The software supports intuitive operation and is built into the sensor (software installation is not required), so you can use it immediately after mounting.

Non-contact Line-laser Sensor SurfaceMeasure1008S

- The sensor itself is guaranteed for an accuracy of 20 μm and a Z repeatability of 0.5 μm . It has also achieved the IP67 protection level, providing stable measurements.
- The SurfaceMeasure1008S can obtain the profiles and three-dimensional shapes of measurement workpieces at high speed (a maximum frame rate of 10 kHz) and make an automatic judgement inside the sensor.
- It is equipped with a parts matching function that allows the measurement tool to be applied throughout, regardless of the orientations of the parts being measured. Measurements can be taken without performing alignment.
- The software supports intuitive operation and is built into the sensor (software installation is not required), so you can use it immediately after mounting.



Specifications

Order No.		553-100
Maximum measuring width		100 mm
Measuring range		80 mm
Working distance		80 mm
Scanning error (1 σ) *1		20 μm
Frame rate		Max. 10 kHz
Laser class	EN / IEC	CLASS 2
		IEC 60825-1:2014, EN 60825-1:2014+A11:2021
	JIS	CLASS 2 (JIS C 6802: 2014)
Line laser	Laser medium	Semiconductor laser
	Wavelength	405 nm (visible)
	Max. output	2.2 mW
Mass		650 g
Operating environment	Temperature	0 °C to 40 °C
	Humidity	RH 20 to 80%, non-condensing
Storage environment	Temperature	-30 °C to 70 °C
	Humidity	RH 20 to 95%, non-condensing
IP code		IP 67 *2
Power supply (power consumption)		24 to 48 VDC (15 W)

*1 Accuracy inspection environment: Temperature 20 °C \pm 1 °C, Humidity 50%RH \pm 10%RH
Measurement workpieces: Specified reference ball for inspection (Φ 30 mm)

Inspection method: Determined by Mitutoyo-specified inspection method.

The operating environment and the storage environment are different from the guaranteed accuracy environment.

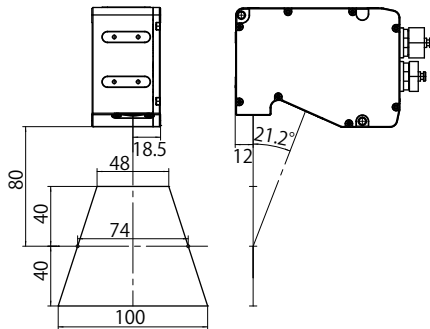
*2 Measuring accuracy may deteriorate if any water droplet or dust particle adheres to the optical path.

SurfaceMeasure1008S

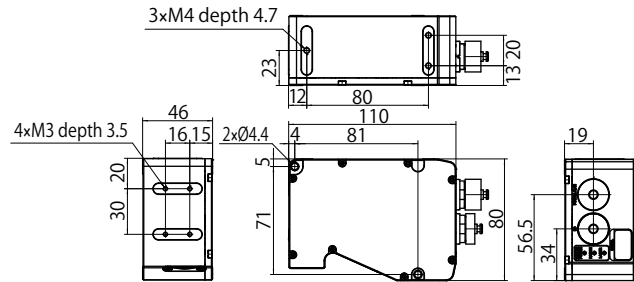
Dimensions

Unit: mm

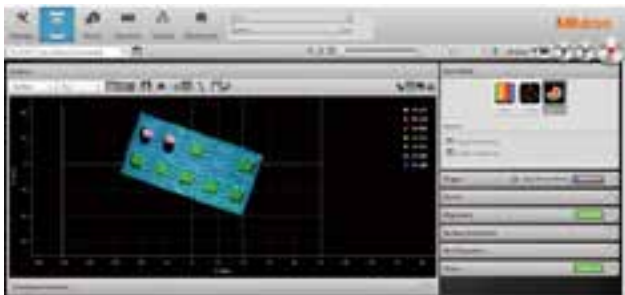
Measuring range



Mounting size



Software



Powerful interface with excellent operability and functionality

- Excellent operability simply by using a mouse
- Simple and intuitive interface
- Web browser-based, no need to install software
- Various built-in measurement tools
- 2D and 3D data can be obtained



Easy-to-configure measuring system

Functions

Measurement tool

- Pattern matching
- Countersink Hole
- OCR (Optical character recognition)
- Gap & Flush
- Groove
- Size

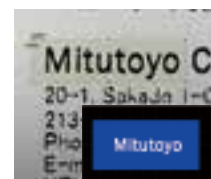
Various measurement tools such as these are available.



Pattern matching



Countersink Hole



OCR



Gap & Flush



Groove



Size

Emulator

Using the emulator makes it possible to consider measurement conditions or make an analysis with obtained data even when offline.

Accessories for SurfaceMeasure1008S

Optional accessories

Sensor networking hub Master

In the multi-sensor system, this device is used for distributing power to sensors and synchronizing the sensors.

Input: Power supply 24 to 48 V, Laser Enable input, Encoder input, External input



Master2410

Order No.	Product Name	Remarks
02AQL401	Master810	Accepting a maximum of 8 sensors
02AQL402	Master2410	Accepting a maximum of 24 sensors

Master cable

Cable for the connection between sensor and Master.



Specifications	Sensor side	M16 connector (Straight or 90° upward-pointing can be selected)
	Power supply side	RJ45 (Connect to Master)
	Communication side	RJ45 (Ethernet connection)

Order No.	Product Name	Remarks
02AQL373	2 m Power and Ethernet Master	2×RJ45 ends
02AQL374	5 m Power and Ethernet Master	2×RJ45 ends
02AQL375	10 m Power and Ethernet Master	2×RJ45 ends
02AQL376	15 m Power and Ethernet Master	2×RJ45 ends
02AQL377	20 m Power and Ethernet Master	2×RJ45 ends
02AQL378	25 m Power and Ethernet Master	2×RJ45 ends
02AQL391	2 m Power and Ethernet Master 90deg	2×RJ45 ends, 90° connector
02AQL392	5 m Power and Ethernet Master 90deg	2×RJ45 ends, 90° connector
02AQL393	10 m Power and Ethernet Master 90deg	2×RJ45 ends, 90° connector
02AQL394	15 m Power and Ethernet Master 90deg	2×RJ45 ends, 90° connector
02AQL395	20 m Power and Ethernet Master 90deg	2×RJ45 ends, 90° connector
02AQL396	25 m Power and Ethernet Master 90deg	2×RJ45 ends, 90° connector

Power and Ethernet cable

Cable to supply and control power without using the Master for the sensor



Specifications	Sensor side	M16 connector (Straight or 90° upward-pointing can be selected)
	Power supply side	Flying lead
	Communication side	RJ45 (Ethernet connection)

Order No.	Product Name	Remarks
02AQL367	2 m Power and Ethernet	1×Open wire end, 1×RJ45 end
02AQL368	5 m Power and Ethernet	1×Open wire end, 1×RJ45 end
02AQL369	10 m Power and Ethernet	1×Open wire end, 1×RJ45 end
02AQL370	15 m Power and Ethernet	1×Open wire end, 1×RJ45 end
02AQL371	20 m Power and Ethernet	1×Open wire end, 1×RJ45 end
02AQL372	25 m Power and Ethernet	1×Open wire end, 1×RJ45 end
02AQL385	2 m Power and Ethernet 90deg	1×Open wire end, 1×RJ45 end, 90° connector
02AQL386	5 m Power and Ethernet 90deg	1×Open wire end, 1×RJ45 end, 90° connector
02AQL387	10 m Power and Ethernet 90deg	1×Open wire end, 1×RJ45 end, 90° connector
02AQL388	15 m Power and Ethernet 90deg	1×Open wire end, 1×RJ45 end, 90° connector
02AQL389	20 m Power and Ethernet 90deg	1×Open wire end, 1×RJ45 end, 90° connector
02AQL390	25 m Power and Ethernet 90deg	1×Open wire end, 1×RJ45 end, 90° connector

Optional accessories

I/O cable

Cable to connect the external I/O device to the sensor



Specifications	Sensor side	M16 connector (Straight or 90° upward-pointing can be selected)
	I/O device side	Flying lead
Communication	Encoder input (2-phase square-wave signals Phase A, Phase B, Phase Z), Trigger input, Digital output, RS-485 output	

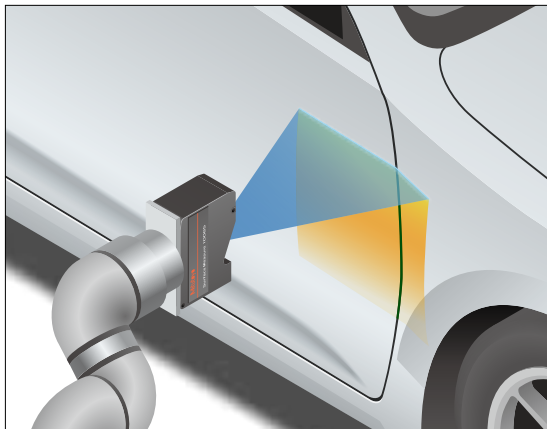
Note: Sensors cannot be synchronized by the signals input to and output from each sensor through this cable.

Order No.	Product Name	Remarks
02AQL361	2 m I/O	Open wire end
02AQL362	5 m I/O	Open wire end
02AQL363	10 m I/O	Open wire end
02AQL364	15 m I/O	Open wire end
02AQL365	20 m I/O	Open wire end
02AQL366	25 m I/O	Open wire end
02AQL379	2 m I/O 90deg	Open wire end, 90° connector
02AQL380	5 m I/O 90deg	Open wire end, 90° connector
02AQL381	10 m I/O 90deg	Open wire end, 90° connector
02AQL382	15 m I/O 90deg	Open wire end, 90° connector
02AQL383	20 m I/O 90deg	Open wire end, 90° connector
02AQL384	25 m I/O 90deg	Open wire end, 90° connector

Applications

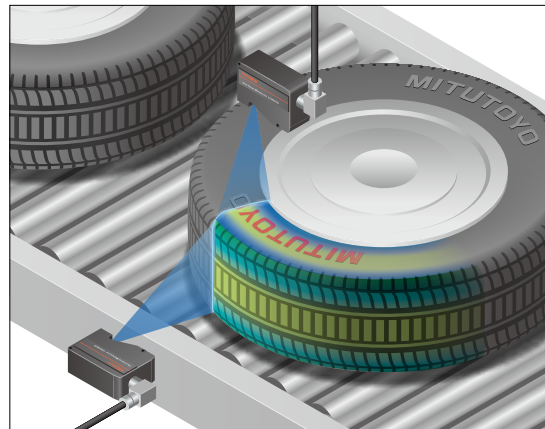
Automobile industry

Panel gap inspection



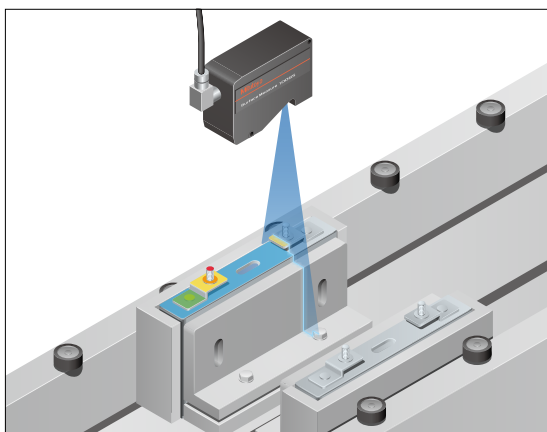
Rubber and tire industries

Tire shape inspection



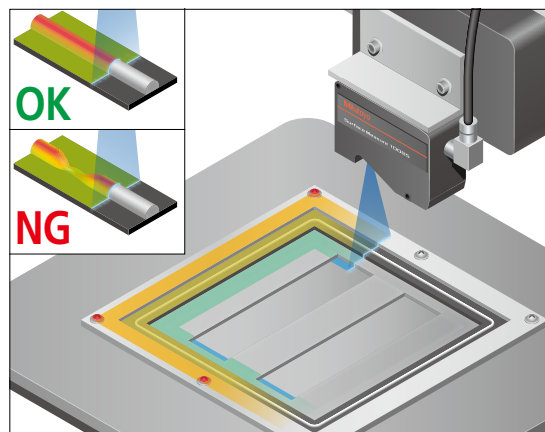
Electric vehicle battery industry

Cell assembly inspection



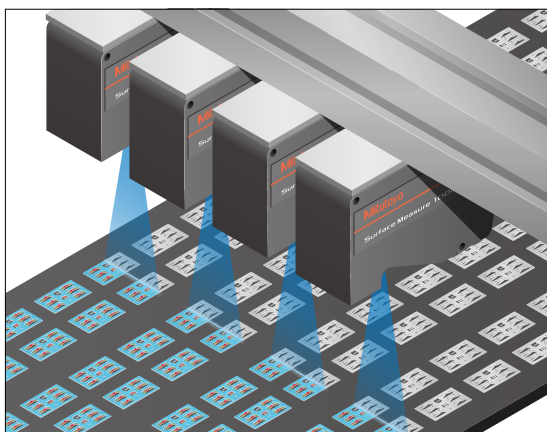
Electrical and electronic industries

Adhesive inspection



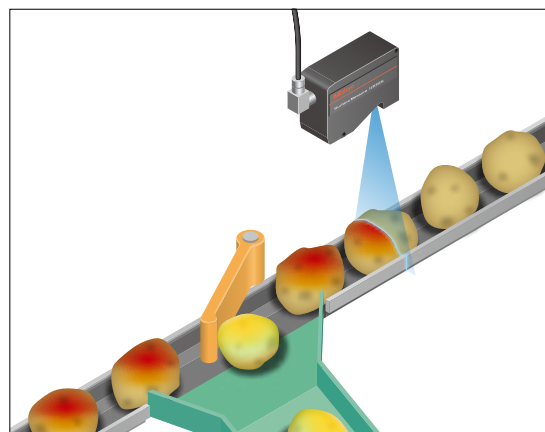
Electrical and electronic industries

Connector pin inspection



Food industry

Standard inspection of food, etc.



Chapter 7

LS

Linear Scale

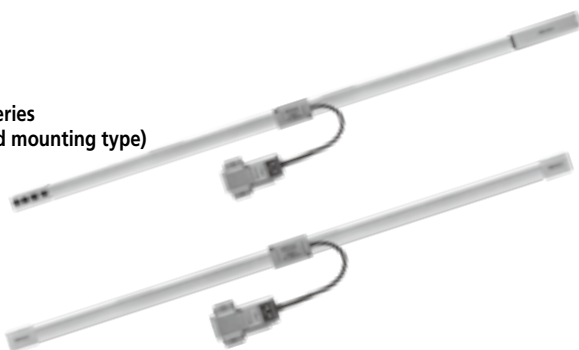
Detecting and quantifying device movement

Absolute Scale Unit	7-1
ABS ST700 Series	7-3
ABS ST1300 Series	7-9
ABS AT1100 Series	7-23
ABS AT1300 Series	7-37
Handling Linear Scales	7-46
Specifications of Air Supply Unit for AT Scale	7-48
Technical Information	7-51
Applications	7-58
Detection Principle	7-59

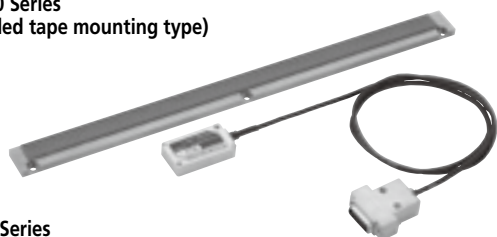
Absolute Scale Unit

Lineup

ABS ST1300 Series
(Double-ended mounting type)



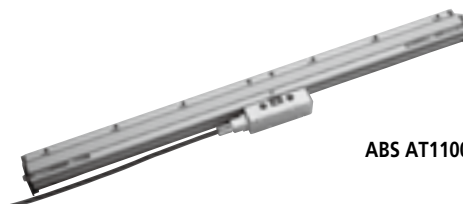
ABS ST1300 Series
(Double-sided tape mounting type)



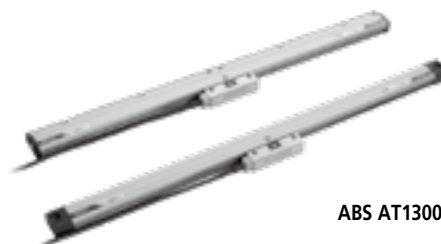
ABS ST700 Series
(scale base type)



ABS AT1100 Series



ABS AT1300 Series



Scale Format

Applicable Systems*			Resolution				
Manufacturer name	SERVO Series	Interface	0.001 μm	0.01 μm	0.05 μm	0.1 μm	
FANUC CORPORATION	FANUC Serial αi Series	α interface	ABS ST1352	ABS ST1351	ABS AT1153	ABS ST758	
		αi interface	ABS AT1357	ABS AT1354	ABS AT1353	—	
Mitsubishi Electric Corporation	MDS-D/MDS-DH Series	Mitsubishi Electric Corporation high-speed serial (4 wire)	ABS AT1347	ABS AT1344	ABS AT1143 ABS AT1343	ABS ST748	
	MR-J3 Series	Mitsubishi Electric Corporation high-speed serial (2 wire)	—	—	—	ABS ST748A	
	MR-J4 Series		ABS ST1342A ABS AT1347A	ABS ST1341A ABS AT1344A	ABS AT1343A		
Yaskawa Electric Corporation	Servopack Σ 7 Series	Yaskawa Electric Corporation serial interface Σ -LINK	ABS ST1382A ABS AT1387A	ABS ST1381A ABS AT1384A	ABS AT1383A	ABS ST788A	
Panasonic Corporation	MINAS A5 Series	Panasonic Corporation I/F	ABS ST1372A	ABS ST1371A	—	ABS ST778A	
Siemens AG	SINAMICS Series SINUMERIK Series	DRIVE-CLiQ interface	—	—	ABS AT1123	—	
CKD Nikki Denso Co., Ltd.	VPH Series	Mitutoyo ENSIS Interface	ABS ST1302A	ABS ST1301A	—	ABS ST708A	
Servoland Corporation	SVF Series		ABS ST1302A ABS AT1307A	ABS ST1301A ABS AT1304A	ABS AT1103A ABS AT1303A		
OMRON Corporation	Power-UMAC, Power-Clipper, Power-Brick Series CK3M						
Other control device manufacturers							

* For details regarding the applicable system, please consult with the individual manufacturer.

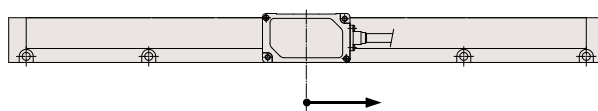
Specifications

Series	Scale Type	Maximum effective range (mm)	Maximum response speed (mm/s)	Accuracy (20 °C)*
ABS ST700 Series	Separate Type	6000	5000	$(5 + 5L_0/1000) \mu\text{m}$
ABS ST1300 Series	Separate Type	12000	8000	$\pm 5 \mu\text{m/m}$
ABS AT1300 Series	S Type	2200	3000	$(3 + 3L_0/1000) \mu\text{m}$
	H Type	1000		$(2 + 2L_0/1000) \mu\text{m}$
ABS AT1100 Series	Assembly Type	3040	3000	$(3 + 5L/1000) \mu\text{m}$ L=140 to 2040 mm $(5 + 5L/1000) \mu\text{m}$ L=2240 to 3040 mm

* L_0 =effective range (mm). This specification corresponds to the accuracy for the scale-base type in **ABS ST700 Series** and that for the type with an effective measuring length of 1.1 m or more in **ABS ST1300 Series**.

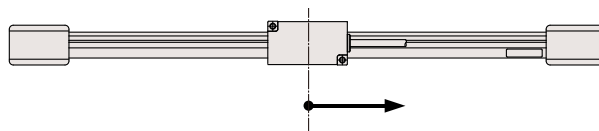
Direction of absolute unit scale data increase

• ABS ST700 Series



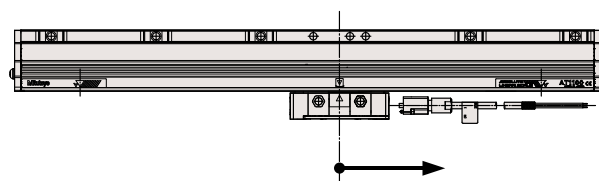
The data will increase when the detector moves in this direction.

• ABS ST1300 Series



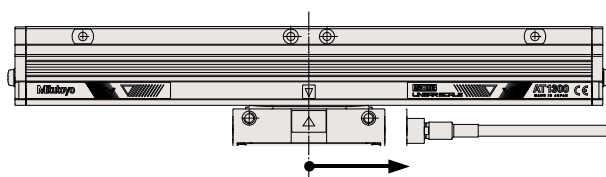
The data will increase when the detector moves in this direction.

• ABS AT1100 Series



The data will increase when the detector moves in this direction.

• ABS AT1300 Series



The data will increase when the detector moves in this direction.

Separate Type ABS ST Series Absolute Scale Unit (Slim Type) ABS ST700 Series

- Electromagnetic induction ABS linear encoder with separate exposed scale.
- Non-contact detection is optimal for high speed and high acceleration of linear motors, etc.
- The detector head is approximately 1/3 the previous model size: 50 mm (W)×28 mm (D)×11 mm (H)
- Cable outlets can be in four directions, with mounting holes on the top and sides.
- Accuracy $(5 + 5L_0/1000) \mu\text{m}$ is realized (previous models: $(8 + 5L_0/1000) \mu\text{m}$).
Note: L_0 : Effective range (mm)
- Compatible with servo amplifiers from a range of companies (high-speed serial interfaces).

ABSOLUTE™

Scale base type



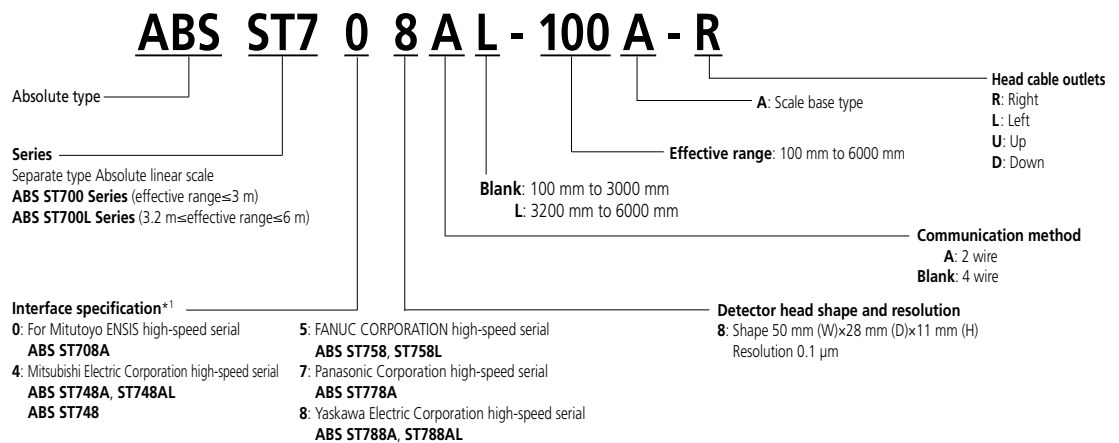
Specifications

Item		Scale Type	Scale base type
Resolution			0.1 μm
Detection method			Electromagnetic induction Absolute position detection method*
Shape			Separate type scale
Effective range (accuracy guarantee range)		100 to 3000 mm	3200 to 6000 mm
Accuracy (20 °C)		$(5 + 5L_0/1000) \mu\text{m}$ L_0 : Effective range (mm)	$(5 + 5L_0/1000) \mu\text{m}$ L_0 : Effective range (mm)
Maximum response speed			5000 mm/s
Thermal expansion coefficient			$\approx 12 \times 10^{-6}/\text{K}$
Operating temperature			0 to 50 °C
Operating humidity		20 to 80%RH (non-condensing)	20 to 70%RH (non-condensing)
Storage temperature		-20 to 70 °C	-20 to 60 °C
Storage humidity		20 to 80%RH (non-condensing)	20 to 70%RH (non-condensing)
Power supply voltage			5 V \pm 10% (at the detector head) (Ripple and spike noise should not exceed 100 mV)
Current consumption			270 mA (Max.)
Vibration resistance			300 m/s ² (55 to 2000 Hz)
Shock resistance			500 m/s ² (1/2 sin, 11 ms)
Head cable	Length/cable diameter		1 m/ ϕ 3.8 mm (high-flex cable)
	Connector		1) D-sub (15-pin pin type) connector (not waterproof) 2) D-sub (9-pin socket type) connector (not waterproof): for ST788A
Maximum signal cable length			Up to 29 m (head cable length included) (Please consult the user's manual)
Detector mounting			1 location each on top and sides
Direction of cable outlet			4 sides (top, bottom, left, right) can be selected
EMC standard			EN/IEC 61326-1

* For details about the signal adjustment method when mounting this series, refer to page 7-8.

ABS ST700 Series

Meaning of Model No.



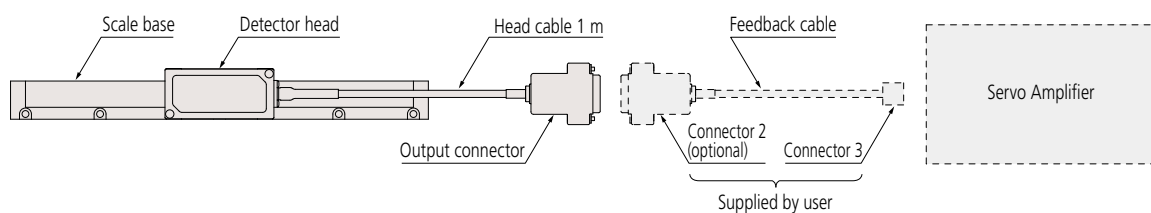
Available Interfaces

Available Interfaces*1	FANUC CORPORATION, Serial αi Series
	Mitsubishi Electric Corporation, MITSUBISHI CNC Drive Unit MDS Series
	Mitsubishi Electric Corporation, MELSERVO Servo Amplifier MR-J4 Series, MR-J3 Series
	YASKAWA Electric Corporation, SERVOPACK Σ7 Series
	Panasonic Corporation, MINAS A5 Series
	Mitutoyo ENSIS*2 CKD Nikki Denso Co., Ltd., VPH Series Servoland Corporation, SVF Series OMRON Corporation, Power-UMAC, Power-Clipper, Power-Brick, CK3M Series

*1 Be sure to contact each manufacturer for details of the applicable systems (availability of connection).

*2 ENSIS is a registered trademark of Mitutoyo Corporation.

System configuration



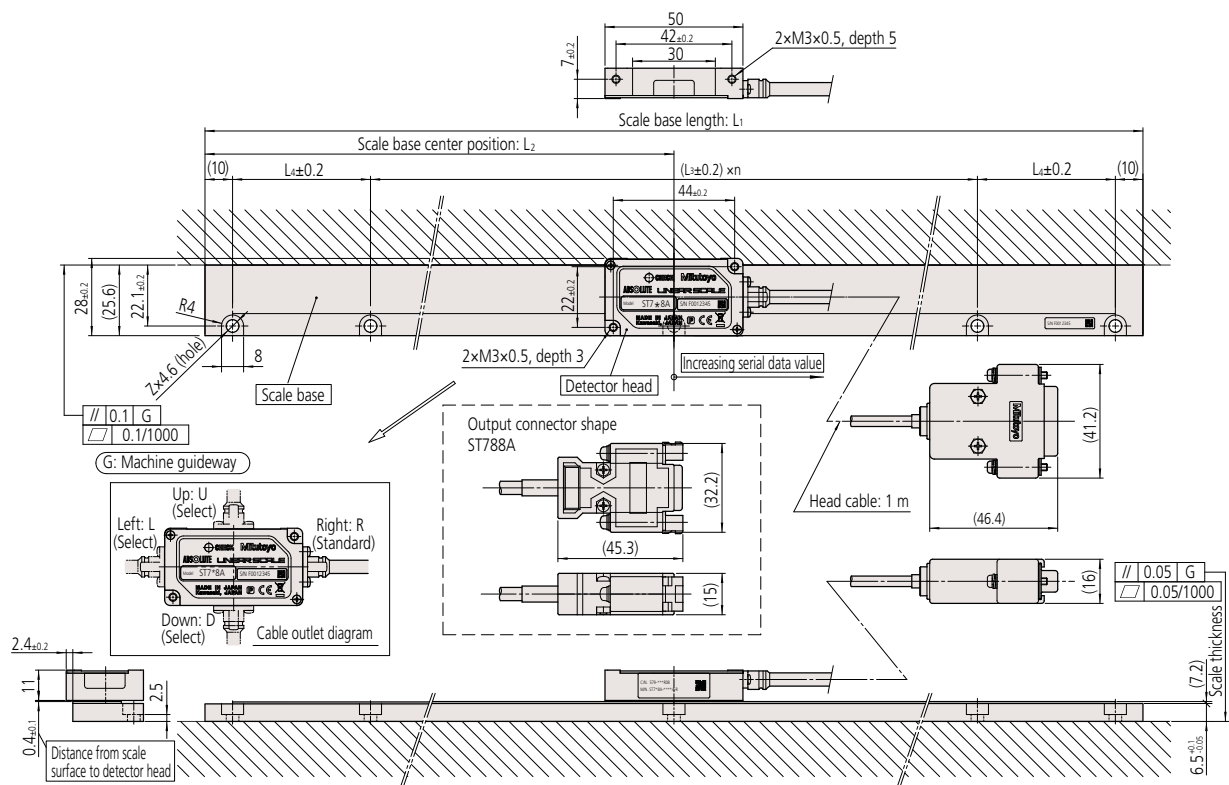
Tips Feedback cable

- Yaskawa Electric Corporation serial cable can be used as the feedback cable for connecting to the Yaskawa Electric Corporation servo amplifier.
Cable type number: JZSP-CLP70-□□-E (03,05,10,15,20)
- For the feedback cable to connect to Mitsubishi Electric Corporation MR-J4/MR-J3 Series, place an order with Mitutoyo with the following order No.
Feedback cable for MR-J4/MR-J3 Series, 5 m: **06ACF117A**
10 m: **06ACF117B**

ABS ST700 Series

Mounting dimensions

Scale base type (100 to 3000 mm)



Dimensions

Order No.	Model	Effective range L ₀ (mm)	Maximum travel length (mm)	L ₁ (mm)	L ₂ (mm)	L ₃ (mm)	n	L ₄ (mm)	No. of mounting holes Z
579-301*□8	ST7◇8(A)-100A-*	100	110	180	90	80	2	—	3
579-302*□8	ST7◇8(A)-200A-*	200	210	280	140	130			
579-303*□8	ST7◇8(A)-300A-*	300	310	380	190	180			
579-304*□8	ST7◇8(A)-400A-*	400	410	480	240	230			
579-305*□8	ST7◇8(A)-500A-*	500	510	580	290				
579-306*□8	ST7◇8(A)-600A-*	600	610	680	340		4	80	5
579-307*□8	ST7◇8(A)-700A-*	700	710	780	390				
579-308*□8	ST7◇8(A)-800A-*	800	810	880	440				
579-309*□8	ST7◇8(A)-900A-*	900	910	980	490				
579-310*□8	ST7◇8(A)-1000A-*	1000	1010	1080	540				
579-311*□8	ST7◇8(A)-1100A-*	1100	1110	1180	590		6	130	7
579-312*□8	ST7◇8(A)-1200A-*	1200	1210	1280	640				
579-313*□8	ST7◇8(A)-1300A-*	1300	1310	1380	690				
579-314*□8	ST7◇8(A)-1400A-*	1400	1410	1480	740				
579-315*□8	ST7◇8(A)-1500A-*	1500	1510	1580	790				
579-316*□8	ST7◇8(A)-1600A-*	1600	1610	1680	840		8	180	9
579-317*□8	ST7◇8(A)-1700A-*	1700	1710	1780	890				
579-318*□8	ST7◇8(A)-1800A-*	1800	1810	1880	940				
579-319*□8	ST7◇8(A)-1900A-*	1900	1910	1980	990				
579-320*□8	ST7◇8(A)-2000A-*	2000	2010	2080	1040				
579-321*□8	ST7◇8(A)-2100A-*	2100	2110	2180	1090		10	230	11
579-322*□8	ST7◇8(A)-2200A-*	2200	2210	2280	1140				
579-323*□8	ST7◇8(A)-2300A-*	2300	2310	2380	1190				
579-324*□8	ST7◇8(A)-2400A-*	2400	2410	2480	1240				
579-325*□8	ST7◇8(A)-2500A-*	2500	2510	2580	1290				
579-326*□8	ST7◇8(A)-2600A-*	2600	2610	2680	1340		12	80	13
579-327*□8	ST7◇8(A)-2700A-*	2700	2710	2780	1390				
579-328*□8	ST7◇8(A)-2800A-*	2800	2810	2880	1440				
579-329*□8	ST7◇8(A)-2900A-*	2900	2910	2980	1490				
579-330*□8	ST7◇8(A)-3000A-*	3000	3010	3080	1540				

The \diamond code indicates the interface specification (0, 4, 5, 7, 8).

The Order No. and the * code indicate the direction of the head cable (R, L, U, D).

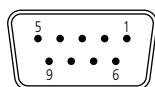
The ☐ in the Order No. is as described below.

ST708A: 0 ST748A: 4 ST748: 3 ST758: 5 ST778A: 7 ST788A: 8

ABS ST700 Series

Output specifications

ST788A(L)

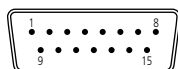


Output connector (socket type)
D-sub 9-pin
Applicable connector
17JE-23090-02 (D2C) (DDK)
Alternately, an equivalent product (D-sub series)
can be used

Pin No.	Signal
1	+5 V (V _{CC})
2	RQ/DT (S)
3	+5 V (V _{CC})
4	N.C
5	0 V (GND)
6	RQ/DT (S)
7	N.C
8	N.C
9	0 V (GND)
Connector shell	F.G

Note: Leave test terminals (Pin No. 7 and 8) disconnected during use.

ST748A(L), ST778A(L), ST708A(L)

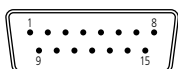


Output connector (pin type)
D-sub 15-pin
Applicable connector
HDAB-15S (Hirose Electric)
Alternately, an equivalent product (D-sub series)
can be used

Pin No.	Signal
1	0 V (GND)
2	0 V (GND)
3	+5 V
4	+5 V
5	N.C
6	N.C
7	RQ/DT
8	RQ/DT
9	N.C
10	N.C
11	+5 V
12	N.C
13	0 V (GND)
14	N.C
15	F.G
Connector shell	F.G

Note: Leave test terminals (Pin No. 9 and 10) disconnected during use.

ST748(L), ST758(L)



Output connector (pin type)
D-sub 15-pin
Applicable connector
HDAB-15S (Hirose Electric)
Alternately, an equivalent product (D-sub series)
can be used

Pin No.	Signal
1	0 V (GND)
2	0 V (GND)
3	+5 V
4	+5 V
5	DT
6	DT
7	RQ
8	RQ
9	N.C
10	N.C
11	+5 V
12	N.C
13	0 V (GND)
14	N.C
15	F.G
Connector shell	F.G

Note: Leave test terminals (Pin No. 9 and 10) disconnected during use.

Signal adjusting method when mounting ABS ST700 series

- In order to perform signal adjustment and confirmation after the unit is mounted, conditioning is necessary using a PC and application software (**ABS ST700** Signal Adjustment Program). (For conditioning, allow a travel distance of at least 60 mm.)

The following settings and confirmation are possible with this software:

- 1) Scale signal automatic adjustment → It is necessary to mount the scale base and detector head detector with specified dimensions.
- 2) Scale signal amplitude (signal strength) confirmation
- 3) Scale origin (absolute position data of zero) setting
- 4) Absolute position data confirmation
- 5) Error history clear
- 6) ABS resultant error checking (effective range 3200 mm to 6000 mm)

Required items

Item	Quantity	Details	Notes
PC*	1	DOS/V (Windows version)	Provided by user
Conversion unit	1	USB-485(422)DS15P (System Sacom Industry Corp.)	Optional (bundle)
Connection cable A	1	USB cable	
Connection cable B	1	RS-485 cable or RS-422 cable	
Application software	1	ABS ST700 Signal Adjustment Program	

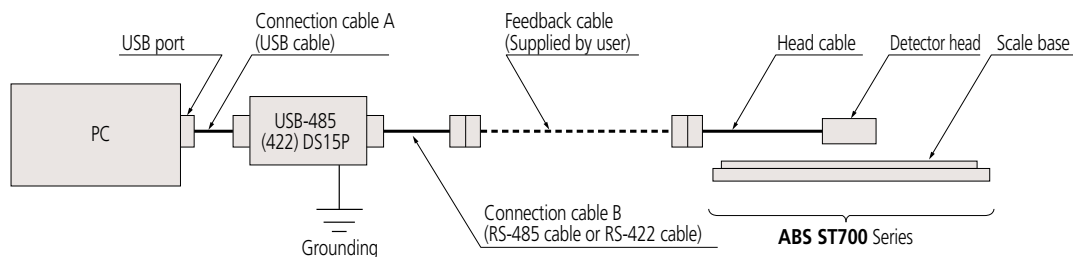
* This program requires a PC with the following operating environment.

CPU : 1 GHz or faster
 Memory : 1 GB min.
 Program size: 10 MB
 OS : Windows 7 or later
 Monitor : 1024×768 or higher is recommended

“Conversion unit, application software” set

Order No.	Applicable model	Conversion unit	Connection cable B
06ADZ751	ST708A	USB-485 DS15P (main unit)	MIT cable
06ADT457	ST748A, ST748AL	USB-485 DS15P (main unit)	MEL cable
06ADP485	ST778A, ST788A, ST788AL	USB-485 DS15P (main unit)	Y/MAT cable
06ADZ752	ST748	USB-422 DS15P (main unit)	MDS cable
06ADR760	ST758, ST758L	USB-422 DS15P (main unit)	FANUC cable

Connection method



Note 1: To prevent the possibility of electric shock the device must be grounded.

Note 2: When using Order No. 06ADZ751, connect the head cable and the connection cable B together.

Note 3: The conversion unit's power source is supplied via connection cable A from the PC USB port.

Compatibility of detector head and main scale

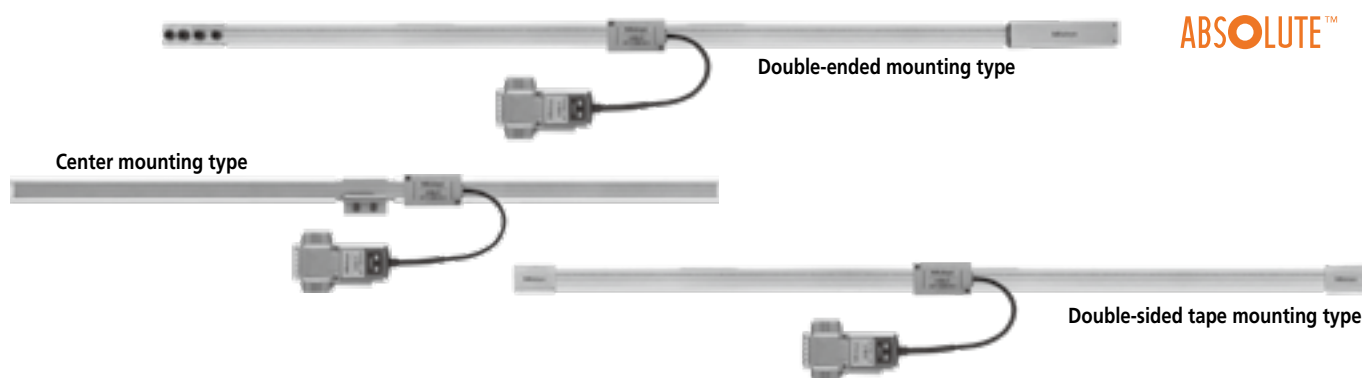
- Note that for the **ST700** Series (compact type) with an effective range 3000 mm or less or 3200 mm or more, the main scale and the detector head are different so they are not compatible.
- The communication standards are different for the ST7 □□ (L) and ST7 □□ A (L), so they are not compatible.

Main scale		Detector head
For effective range of 3200 mm to 6000 mm	Compatible	For effective range of 3200 mm to 6000 mm
	Not compatible	
For effective range of 3000 mm or less	Compatible	For effective range of 3000 mm or less

Separate Type ABS ST Series Absolute Scale Unit (High Environmental Resistance Type) ABS ST1300 Series



- Effective length: 12 m, Maximum response speed: 8 m/s, Resolution: 1 nm
- Various interfaces are supported.
- A new detection method has improved robustness in regards to contamination resistance and gap tolerance (in-house testing result).
- Can be mounted using double-sided tape or screws (on both sides or at the center of the unit).
For center and double sided tape mounted models, tape scale and detector are available as a single components.
- Signal check program enables integrity check and maintenance.



Specifications

Item	Model	ABS ST1300			
Detection method	Optical linear encoder				
Scale type	Metal tape				
	Double-ended mounting	Center mounting	Double-sided tape mounting		
Maximum effective range	12 m	6 m	3 m		
Fixing part material	—	—	Equivalent to iron	Other than equivalent to iron	
Indication accuracy (20 °C)	±5 μm (1 m or less) ±5 μm/m (1.1 m or more)*4	With system parameters ±5 μm (1 m or less) ±5 μm/m (1.1 m or more) Without system parameters ±10 μm (1 m or less) ±10 μm/m (1.1 m or more)	±5 μm (1 m or less) ±5 μm/m (1.1 m or more)		
Resolution	0.001 μm/0.01 μm (Defined within the Scale code)				
Maximum response speed	8000 mm/s				
Applicable Interfaces	Mitsubishi Electric Corporation I/F, Yaskawa Electric Corporation I/F, Panasonic Corporation I/F, FANUC CORPORATION I/F, Mitutoyo ENSIS I/F				
Thermal expansion coefficient	≈10×10 ⁻⁶ /K*5	≈10×10 ⁻⁶ /K	≈10×10 ⁻⁶ /K*2		
GAP allowance	Initial: ±0.1 mm Kinetic: ±0.2 mm				
Cable length	1 m (Highly curved cable)				
Detector size	40 (D)×22 (W)×23 (H) mm				
Operating temperature	0 to 50 °C			0 to 50 °C*1 When mounting: ±10 °C	
Storage temperature	-20 to 70 °C			-20 to 70 °C*3	

*1 Double-sided tape mounting type, careful for the condition of operating temperature range, in case that the sealing surface material is except for Fe equivalent.

*2 Thermal expansion coefficient occasionally change, as the difference between scale material's and sealing surface material's is excessive.

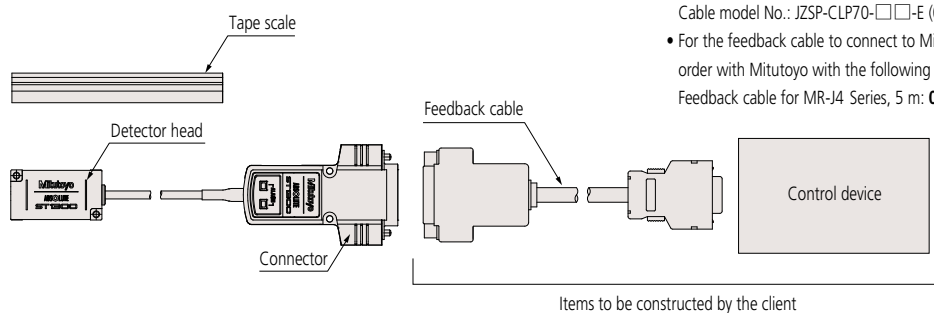
*3 Double-sided tape mounting type, the accuracy compensation occasionally change, in case that the sealing surface material is except for Fe equivalent and stored in environment over operating temperature range. Imaging these conditions, double-ended mounting type is adopted.

*4 Tension fix is adopted to be stable the temperature property. Because scale tension is longer 250 μm/m, the accuracy compensation is needed over the system.

*5 Thermal expansion coefficient after mounted conform to expansion/contraction of mounted surface by changing outer temperature (Double-ended mounting type).

ABS ST1300 Series

System configuration



◇ About the feedback cable

- For the feedback cable to connect to the Yaskawa Electric Corporation's servo amplifier, a serial cable from Yaskawa Electric Corporation is available.
Cable model No.: JZSP-CLP70-□□-E (03,05,10,15, 20)
- For the feedback cable to connect to Mitsubishi Electric Corporation MR-J4 Series, place an order with Mitutoyo with the following order No. specified.
Feedback cable for MR-J4 Series, 5 m: **06ACF117A**, 10 m: **06ACF117B**

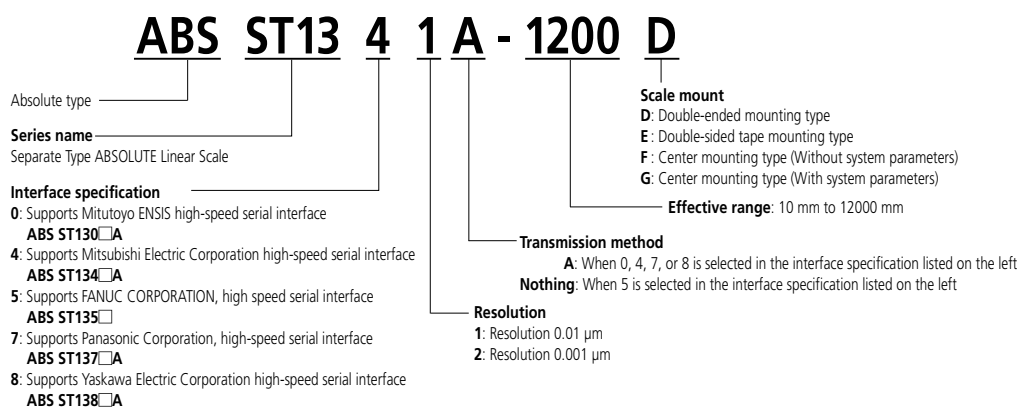
Note: The feedback cable and control device are to be constructed and connected by the client.

If the feedback cable from Yaskawa Electric Corporation is used, the ST1380A connecting cable (optional: 06AFA434A) is needed.

ST1380A Connection cable

Order No.	Cable length (m)
06AFA434A	200
06AFA434B	500
06AFA434C	1000

Meaning of Model No.



Available Interfaces

Applicable interfaces*	Mitutoyo ENSIS
	Mitsubishi Electric Corporation, MELSERVO Servo Amplifier MR-J4 Series
	FANUC CORPORATION, Serial αi Series
	Panasonic Corporation, MINAS A5 Series
	Yaskawa Electric Corporation, SERVOPACK Σ-7 Series

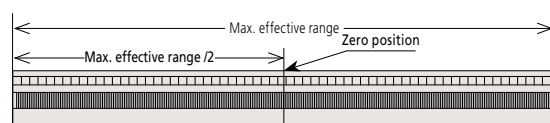
* Be sure to contact each manufacturer for details of the applicable systems (availability of connection).

ABS ST1300 Series

Relation between resolution for each supported interface, maximum effective range, and maximum response speed

	Resolution (nm)	Maximum effective range (mm)			Maximum response speed (m/s)
		Double-ended mounting	Center mounting	Double-sided tape mounting	
Mitsubishi Electric Corporation	10	12000	6000	3000	4
	1	±2100 (* Reference)	±2100 (* Reference)	±1500 (* Reference)	4
FANUC CORPORATION	10	12000	6000	3000	8
	1	±2100 (* Reference)	±2100 (* Reference)	±1500 (* Reference)	8
Panasonic Corporation	10	12000	6000	3000	4
	1	±2100 (* Reference)	±2100 (* Reference)	±1500 (* Reference)	0.4
Yaskawa Electric Corporation	10	12000	6000	3000	8
	1	±1800 (* Reference)	±1800 (* Reference)	±1500 (* Reference)	3.6
Mitutoyo ENSIS	10	12000	6000	3000	8
	1	±2100 (* Reference)	±2100 (* Reference)	±1500 (* Reference)	8

* When the center of the effective range is set zero (ORIGIN) at default setting. When zero-set is executed at the edge of the scale, the maximum effective range will change.



Max. effective range

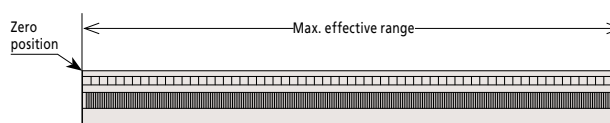
(Double-ended mounting): -2100 mm to +2100 mm

(Mitsubishi Electric Corporation, Panasonic Corporation, Mitutoyo ENSIS)

-1800 mm to +1800 mm

(Yaskawa Electric Corporation)

(Double-sided tape mounting): -1500 mm to +1500 mm



Max. effective range

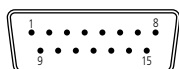
(Double-ended mounting/Center mounting/Double-sided tape mounting): 0 mm to +2100 mm

(Mitsubishi Electric Corporation, Panasonic Corporation, Mitutoyo ENSIS)

0 mm to +1800 mm

(Yaskawa Electric Corporation)

Output specification



Output connector (pin type)
D-sub 15-pin

Applicable connector

HDAB-15S (Hirose Electric)

Alternately, an equivalent product (D-sub series) can be used

Pin assignment for Mitutoyo ENSIS and Mitsubishi Electric Corporation MELSERVO

Pin No.	Signal	Pin No.	Signal
1, 2	0 V (LG)	10	N.C
3, 4	+5 V (P5)	11	+5 V (P5)
5	N.C	12	N.C
6	N.C	13	0 V (LG)
7	MR (RQ/DT)	14	N.C
8	MRR (RQ/DT)	15	F.G
9	N.C	Connector shell	F.G

Pin assignment for FANUC CORPORATION $\alpha / \alpha i$

Pin No.	Signal	Pin No.	Signal
1, 2	GND	10	N.C
3, 4	+5 V	11	+5 V
5	SD or SD/REQ	12	N.C
6	_SD or _SD/_REQ	13	GND
7*	REQ or TEST	14	N.C
8*	_REQ or _TEST	15	F.G
9	N.C	Connector shell	F.G

* TEST/_TEST signal: Used as a communication line when checking signal.

Pin assignment for Panasonic Corporation MINAS

Pin No.	Signal	Pin No.	Signal
1, 2	GND	10	N.C
3, 4	+5 V	11	+5 V
5	N.C	12	N.C
6	N.C	13	GND
7	+REQ/+SD	14	N.C
8	-REQ/-SD	15	F.G
9	N.C	Connector shell	F.G

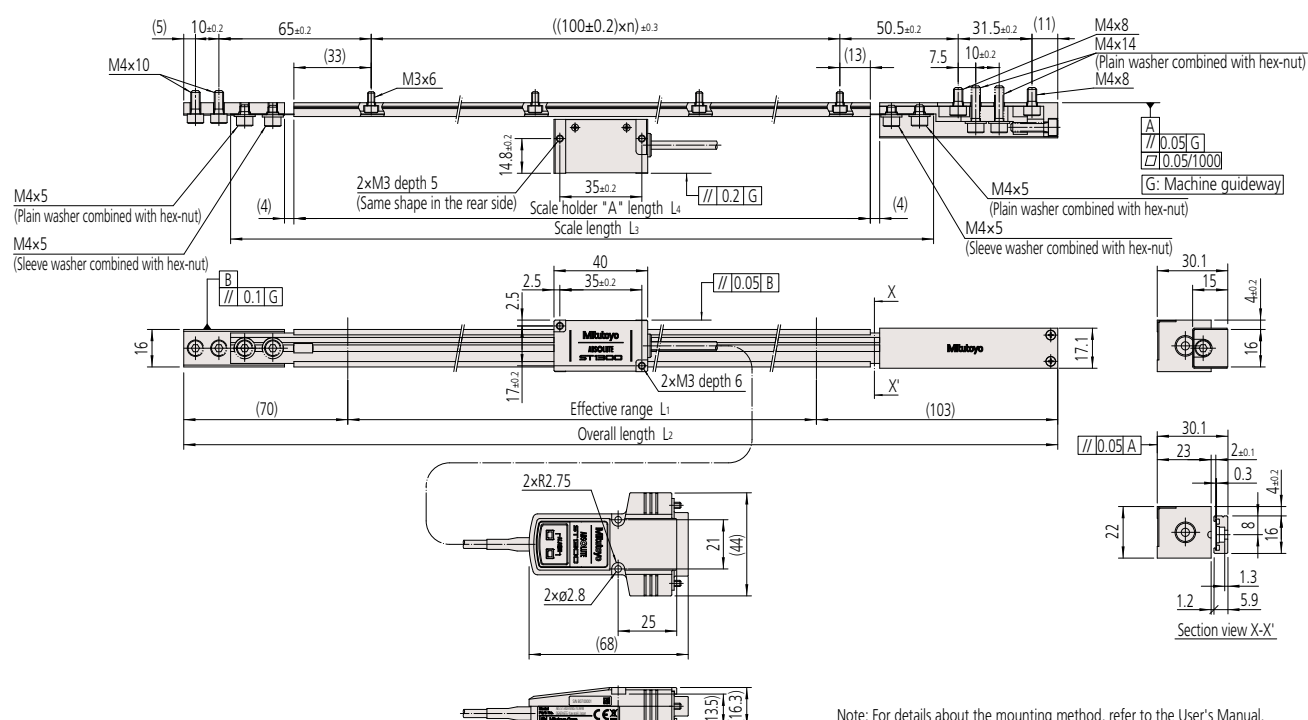
Pin assignment for Yaskawa Electric Corporation Σ Series

Pin No.	Signal	Pin No.	Signal
1, 2	GND	10	N.C
3, 4	VCC	11	VCC
5	N.C	12	N.C
6	N.C	13	GND
7	S	14	N.C
8	/S	15	F.G
9	N.C	Connector shell	F.G

Mounting dimensions

Unit: mm

Double-ended mounting type (Effective range: 500 to 1000 mm)



Dimensions

Resolution: 0.01 μm

Order No.	Model	Effective range L_0 (mm)	Overall length L_2 (mm)	Scale length L_3 (mm)	Scale holder A L_4 (mm)	n
579-434-□1	ST13◇1(A)-00500D	500	673	600	546	5
579-435-□1	ST13◇1(A)-00600D	600	773	700	646	6
579-436-□1	ST13◇1(A)-00700D	700	873	800	746	7
579-437-□1	ST13◇1(A)-00800D	800	973	900	846	8
579-438-□1	ST13◇1(A)-00900D	900	1073	1000	946	9
579-439-□1	ST13◇1(A)-01000D	1000	1173	1100	1046	10

Resolution: 0.001 μm

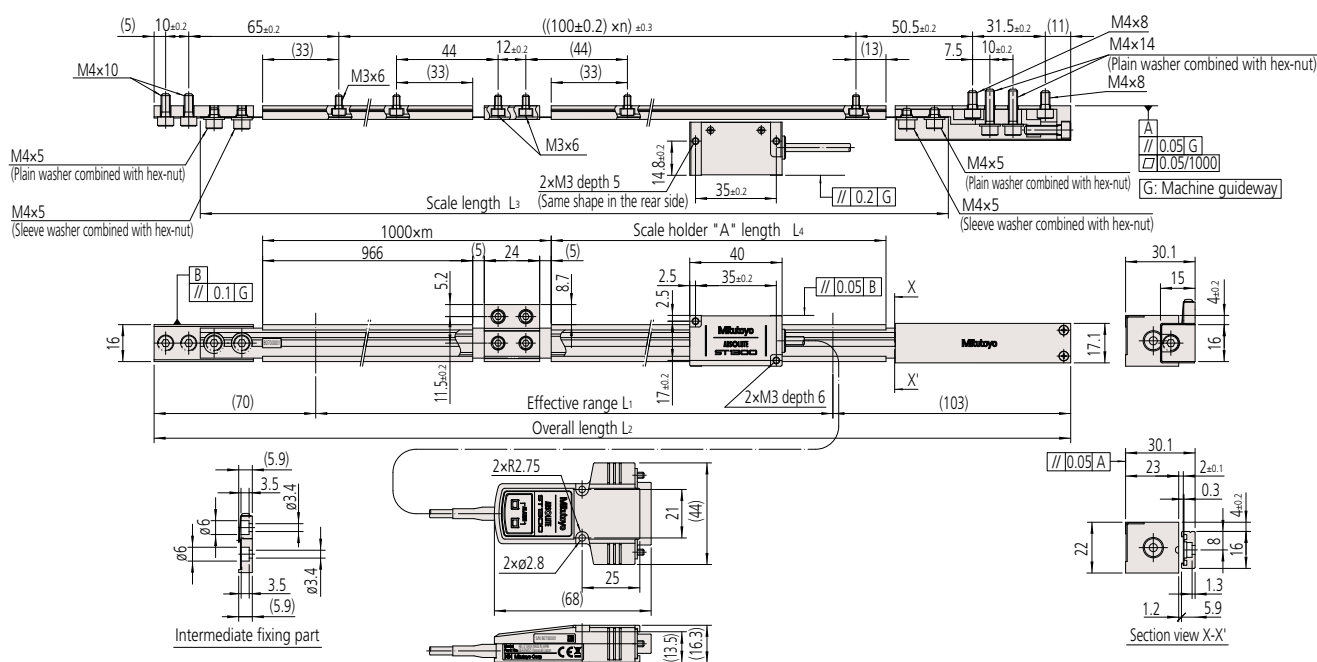
Order No.	Model	Effective range L_0 (mm)	Overall length L_2 (mm)	Scale length L_3 (mm)	Scale holder A L_4 (mm)	n
579-434-□2	ST13◇2(A)-00500D	500	673	600	546	5
579-435-□2	ST13◇2(A)-00600D	600	773	700	646	6
579-436-□2	ST13◇2(A)-00700D	700	873	800	746	7
579-437-□2	ST13◇2(A)-00800D	800	973	900	846	8
579-438-□2	ST13◇2(A)-00900D	900	1073	1000	946	9
579-439-□2	ST13◇2(A)-01000D	1000	1173	1100	1046	10

The □ in the Order No. indicates the interface specification (0, 4, 5, 7, 8).
The ◇ code indicates the interface specification (0, 4, 5, 7, 8).

ABS ST1300 Series

External View

Double-ended mounting type (Effective range: 1100 to 12000 mm)



Note: For details about the mounting method, refer to the User's Manual.

Dimensions

Resolution: 0.01 μm

Order No.	Model	Effective range L ₀ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder A L ₄ (mm)	n
579-440-□1	ST13◇1(A)-01100D	1100	1273	1200	146	11
579-441-□1	ST13◇1(A)-01200D	1200	1373	1300	246	12
579-442-□1	ST13◇1(A)-01300D	1300	1473	1400	346	13
579-443-□1	ST13◇1(A)-01400D	1400	1573	1500	446	14
579-444-□1	ST13◇1(A)-01500D	1500	1673	1600	546	15
579-445-□1	ST13◇1(A)-01600D	1600	1773	1700	646	16
579-446-□1	ST13◇1(A)-01700D	1700	1873	1800	746	17
579-447-□1	ST13◇1(A)-01800D	1800	1973	1900	846	18
579-448-□1	ST13◇1(A)-02000D	2000	2173	2100	1046	20
579-449-□1	ST13◇1(A)-02200D	2200	2373	2300	246	22
579-450-□1	ST13◇1(A)-02400D	2400	2573	2500	446	24
579-451-□1	ST13◇1(A)-02500D	2500	2673	2600	546	25
579-452-□1	ST13◇1(A)-02600D	2600	2773	2700	646	26
579-453-□1	ST13◇1(A)-02800D	2800	2973	2800	846	28
579-454-□1	ST13◇1(A)-03000D	3000	3173	3100	1046	30
579-455-□1	ST13◇1(A)-03200D	3200	3373	3300	246	32
579-456-□1	ST13◇1(A)-03400D	3400	3573	3500	446	34
579-457-□1	ST13◇1(A)-03600D	3600	3773	3700	646	36
579-458-□1	ST13◇1(A)-03800D	3800	3973	3900	846	38
579-459-□1	ST13◇1(A)-04000D	4000	4173	4100	1046	40
579-460-□1	ST13◇1(A)-04200D	4200	4373	4300	246	42
579-461-□1	ST13◇1(A)-04400D	4400	4573	4500	446	44
579-462-□1	ST13◇1(A)-04600D	4600	4773	4700	646	46
579-463-□1	ST13◇1(A)-04800D	4800	4973	4900	846	48
579-464-□1	ST13◇1(A)-05000D	5000	5173	5100	1046	50
579-465-□1	ST13◇1(A)-05200D	5200	5373	5300	246	52
579-466-□1	ST13◇1(A)-05400D	5400	5573	5500	446	54
579-467-□1	ST13◇1(A)-05600D	5600	5773	5700	646	56
579-468-□1	ST13◇1(A)-05800D	5800	5973	5900	846	58
579-469-□1	ST13◇1(A)-06000D	6000	6173	6100	1046	60
579-470-□1	ST13◇1(A)-06200D	6200	6373	6300	246	62
579-471-□1	ST13◇1(A)-06400D	6400	6573	6500	446	64

Order No.	Model	Effective range L ₀ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder A L ₄ (mm)	n
579-472-□1	ST13◇1(A)-06600D	6600	6773	6700	646	66
579-473-□1	ST13◇1(A)-06800D	6800	6973	6900	846	68
579-474-□1	ST13◇1(A)-07000D	7000	7173	7100	1046	70
579-475-□1	ST13◇1(A)-07200D	7200	7373	7300	246	72
579-476-□1	ST13◇1(A)-07400D	7400	7573	7500	446	74
579-477-□1	ST13◇1(A)-07600D	7600	7773	7700	646	76
579-478-□1	ST13◇1(A)-07800D	7800	7973	7900	846	78
579-479-□1	ST13◇1(A)-08000D	8000	8173	8100	1046	80
579-480-□1	ST13◇1(A)-08200D	8200	8373	8300	246	82
579-481-□1	ST13◇1(A)-08400D	8400	8573	8500	446	84
579-482-□1	ST13◇1(A)-08600D	8600	8773	8700	646	86
579-483-□1	ST13◇1(A)-08800D	8800	8973	8900	846	88
579-484-□1	ST13◇1(A)-09000D	9000	9173	9100	1046	90
579-485-□1	ST13◇1(A)-09200D	9200	9373	9300	246	92
579-486-□1	ST13◇1(A)-09400D	9400	9573	9500	446	94
579-487-□1	ST13◇1(A)-09600D	9600	9773	9700	646	96
579-488-□1	ST13◇1(A)-09800D	9800	9973	9900	846	98
579-489-□1	ST13◇1(A)-10000D	10000	10173	10100	1046	100
579-490-□1	ST13◇1(A)-10200D	10200	10373	10300	246	102
579-491-□1	ST13◇1(A)-10400D	10400	10573	10500	446	104
579-492-□1	ST13◇1(A)-10600D	10600	10773	10700	646	106
579-493-□1	ST13◇1(A)-10800D	10800	10973	10900	846	108
579-494-□1	ST13◇1(A)-11000D	11000	11173	11100	1046	110
579-495-□1	ST13◇1(A)-11200D	11200	11373	11300	246	112
579-496-□1	ST13◇1(A)-11400D	11400	11573	11500	446	114
579-497-□1	ST13◇1(A)-11600D	11600	11773	11700	646	116
579-498-□1	ST13◇1(A)-11800D	11800	11973	11900	846	118
579-499-□1	ST13◇1(A)-12000D	12000	12173	12100	1046	120

Resolution: 0.001 μm

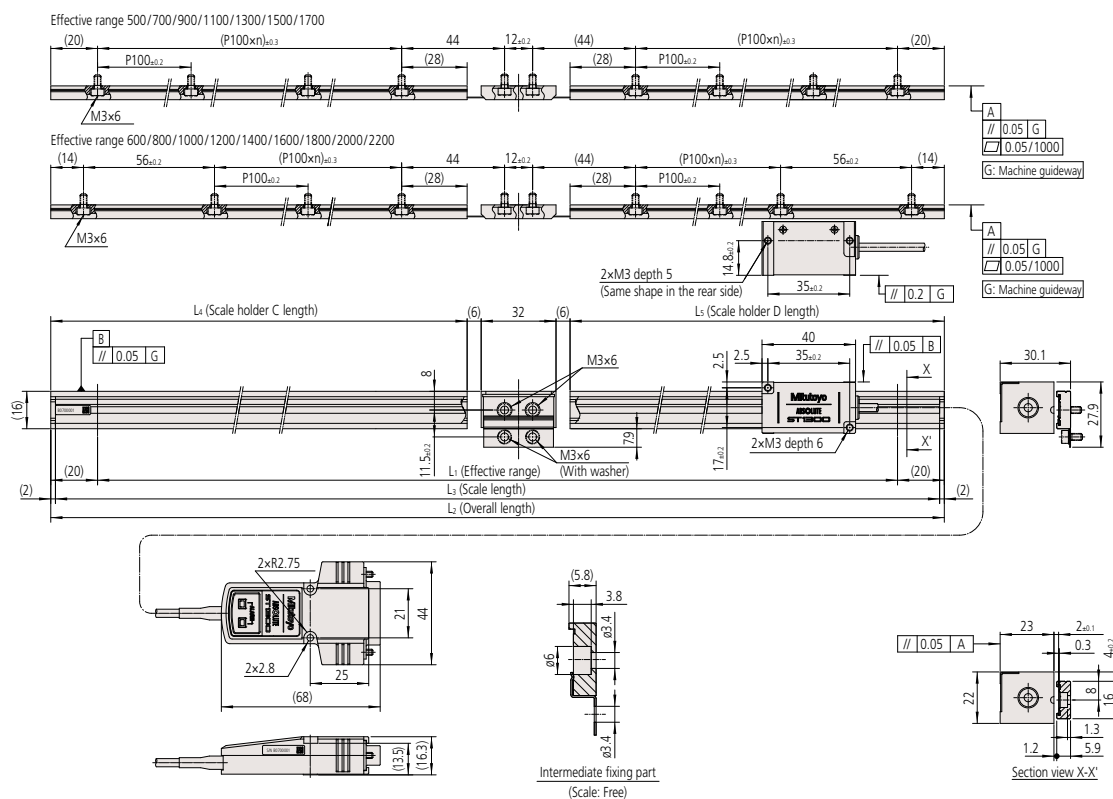
Order No.	Model	Effective range L ₀ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder A L ₄ (mm)	n
579-440-□2	ST13◇2(A)-01100D	1100	1273	1200	146	11
579-441-□2	ST13◇2(A)-01200D	1200	1373	1300	246	12
579-442-□2	ST13◇2(A)-01300D	1300	1473	1400	346	13
579-443-□2	ST13◇2(A)-01400D	1400	1573	1500	446	14
579-444-□2	ST13◇2(A)-01500D	1500	1673	1600	546	15
579-445-□2	ST13◇2(A)-01600D	1600	1773	1700	646	16
579-446-□2	ST13◇2(A)-01700D	1700	1873	1800	746	17
579-447-□2	ST13◇2(A)-01800D	1800	1973	1900	846	18
579-448-□2	ST13◇2(A)-02000D	2000	2173	2100	1046	20
579-449-□2	ST13◇2(A)-02200D	2200	2373	2300	246	22
579-450-□2	ST13◇2(A)-02400D	2400	2573	2500	446	24
579-451-□2	ST13◇2(A)-02500D	2500	2673	2600	546	25
579-452-□2	ST13◇2(A)-02600D	2600	2773	2700	646	26
579-453-□2	ST13◇2(A)-02800D	2800	2973	2900	846	28
579-454-□2	ST13◇2(A)-03000D	3000	3173	3100	1046	30
579-455-□2	ST13◇2(A)-03200D	3200	3373	3300	246	32
579-456-□2	ST13◇2(A)-03400D	3400	3573	3500	446	34
579-457-□2	ST13◇2(A)-03600D	3600	3773	3700	646	36
579-458-□2	ST13◇2(A)-03800D	3800	3973	3900	846	38
579-459-□2	ST13◇2(A)-04000D	4000	4173	4100	1046	40
579-460-□2	ST13◇2(A)-04200D	4200	4373	4300	246	42

The □ in the Order No. indicates the interface specification (0, 4, 5, 7, 8).

The ◇ code indicates the interface specification (0, 4, 5, 7, 8).

Effective range of ST1382A is up to 3600 mm.

Center mounting type Effective range: 500 to 2200 mm



Dimensions

Resolution: 0.01 μm

Order No.	Model	Effective range L ₁ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder C length L ₄ (mm)	Scale holder D length L ₅ (mm)	n1	n2	Total number (n) of scale holder mounting holes
579-434-□◇	ST13□1(A)-500☆	500	540	536	248	248	2	2	6
579-435-□◇	ST13□1(A)-600☆	600	640	636	298	298	2	2	8
579-436-□◇	ST13□1(A)-700☆	700	740	736	348	348	3	3	8
579-437-□◇	ST13□1(A)-800☆	800	840	836	398	398	3	3	10
579-438-□◇	ST13□1(A)-900☆	900	940	936	448	448	4	4	10
579-439-□◇	ST13□1(A)-1000☆	1000	1040	1036	498	498	4	4	12
579-440-□◇	ST13□1(A)-1100☆	1100	1140	1136	548	548	5	5	12
579-441-□◇	ST13□1(A)-1200☆	1200	1240	1236	598	598	5	5	14
579-442-□◇	ST13□1(A)-1300☆	1300	1340	1336	648	648	6	6	14
579-443-□◇	ST13□1(A)-1400☆	1400	1440	1436	698	698	6	6	16
579-444-□◇	ST13□1(A)-1500☆	1500	1540	1536	748	748	7	7	16
579-445-□◇	ST13□1(A)-1600☆	1600	1640	1636	798	798	7	7	18
579-446-□◇	ST13□1(A)-1700☆	1700	1740	1736	848	848	8	8	18
579-447-□◇	ST13□1(A)-1800☆	1800	1840	1836	898	898	8	8	20
579-448-□◇	ST13□1(A)-2000☆	2000	2040	2036	998	998	9	9	22
579-449-□◇	ST13□1(A)-2200☆	2200	2240	2236	1098	1098	10	10	24

Resolution: 0.001 μm

Order No.	Model	Effective range L ₁ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder C length L ₄ (mm)	Scale holder D length L ₅ (mm)	n1	n2	Total number (n) of scale holder mounting holes
579-434-□◇	ST13□2(A)-500☆	500	540	536	248	248	2	2	6
579-435-□◇	ST13□2(A)-600☆	600	640	636	298	298	2	2	8
579-436-□◇	ST13□2(A)-700☆	700	740	736	348	348	3	3	8
579-437-□◇	ST13□2(A)-800☆	800	840	836	398	398	3	3	10
579-438-□◇	ST13□2(A)-900☆	900	940	936	448	448	4	4	10
579-439-□◇	ST13□2(A)-1000☆	1000	1040	1036	498	498	4	4	12
579-440-□◇	ST13□2(A)-1100☆	1100	1140	1136	548	548	5	5	12
579-441-□◇	ST13□2(A)-1200☆	1200	1240	1236	598	598	5	5	14
579-442-□◇	ST13□2(A)-1300☆	1300	1340	1336	648	648	6	6	14
579-443-□◇	ST13□2(A)-1400☆	1400	1440	1436	698	698	6	6	16
579-444-□◇	ST13□2(A)-1500☆	1500	1540	1536	748	748	7	7	16
579-445-□◇	ST13□2(A)-1600☆	1600	1640	1636	798	798	7	7	18
579-446-□◇	ST13□2(A)-1700☆	1700	1740	1736	848	848	8	8	18
579-447-□◇	ST13□2(A)-1800☆	1800	1840	1836	898	898	8	8	20
579-448-□◇	ST13□2(A)-2000☆	2000	2040	2036	998	998	9	9	22
579-449-□◇	ST13□2(A)-2200☆	2200	2240	2236	1098	1098	10	10	24

A numeral for symbol □ in each Order No. and Model No. indicates the following.

- 0: Supports Mitutoyo ENSIS high-speed serial interface
- 4: Supports Mitsubishi Electric Corporation, high-speed serial interface
- 5: Supports FANUC CORPORATION, high-speed serial interface
- 7: Supports Panasonic Corporation, high-speed serial interface
- 8: Supports Yaskawa Electric Corporation, high-speed serial interface

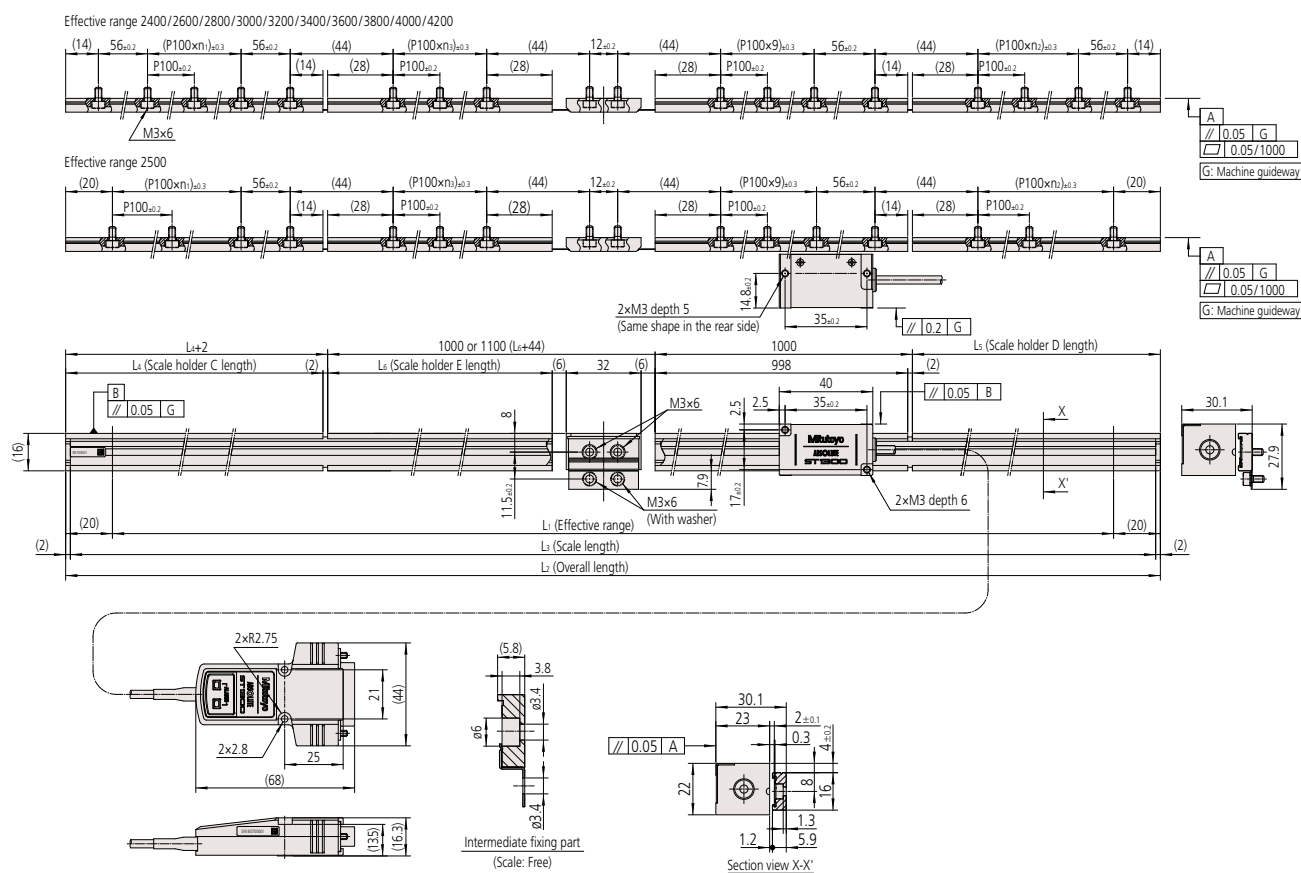
A numeral for symbol ◇ in each Order No. indicates the following.

- 3: 0.01 μm (Without system parameters)
- 4: 0.001 μm (Without system parameters)
- 5: 0.01 μm (With system parameters)
- 6: 0.001 μm (With system parameters)

A numeral for symbol ☆ in each Model No. indicates the following.

- F: Center mounting (Without system parameters)
- G: Center mounting (With system parameters)

Center mounting type Effective range: 2400 to 4200 mm



Dimensions

Resolution: 0.01 μm

Order No.	Model	Effective range L ₁ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder C length L ₄ (mm)	Scale holder D length L ₅ (mm)	Scale holder E length L ₆ (mm)	n1	n2	n3	Total number (n) of scale holder mounting holes
579-450-□◇	ST13□1(A)-2400☆	2400	2440	2436	240	198	956	1	1	9	28
579-451-□◇	ST13□1(A)-2500☆	2500	2540	2536	290	248	956	2	2	9	28
579-452-□◇	ST13□1(A)-2600☆	2600	2640	2636	240	298	1056	1	2	10	30
579-453-□◇	ST13□1(A)-2800☆	2800	2840	2836	440	398	956	3	3	9	32
579-454-□◇	ST13□1(A)-3000☆	3000	3040	3036	440	498	1056	3	4	10	34
579-455-□◇	ST13□1(A)-3200☆	3200	3240	3236	640	598	956	5	5	9	36
579-456-□◇	ST13□1(A)-3400☆	3400	3440	3436	640	698	1056	5	6	10	38
579-457-□◇	ST13□1(A)-3600☆	3600	3640	3636	840	798	956	7	7	9	40
579-458-□◇	ST13□1(A)-3800☆	3800	3840	3836	840	898	1056	7	8	10	42
579-459-□◇	ST13□1(A)-4000☆	4000	4040	4036	1040	998	956	9	9	9	44
579-460-□◇	ST13□1(A)-4200☆	4200	4240	4236	1040	1098	1056	9	10	10	46

Resolution: 0.001 μm

Order No.	Model	Effective range L ₁ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder C length L ₄ (mm)	Scale holder D length L ₅ (mm)	Scale holder E length L ₆ (mm)	n1	n2	n3	Total number (n) of scale holder mounting holes
579-450-□◇	ST13□2(A)-2400☆	2400	2440	2436	240	198	956	1	1	9	28
579-451-□◇	ST13□2(A)-2500☆	2500	2540	2536	290	248	956	2	2	9	28
579-452-□◇	ST13□2(A)-2600☆	2600	2640	2636	240	298	1056	1	2	10	30
579-453-□◇	ST13□2(A)-2800☆	2800	2840	2836	440	398	956	3	3	9	32
579-454-□◇	ST13□2(A)-3000☆	3000	3040	3036	440	498	1056	3	4	10	34
579-455-□◇	ST13□2(A)-3200☆	3200	3240	3236	640	598	956	5	5	9	36
579-456-□◇	ST13□2(A)-3400☆	3400	3440	3436	640	698	1056	5	6	10	38
579-457-□◇	ST13□2(A)-3600☆	3600	3640	3636	840	798	956	7	7	9	40
579-458-□◇	ST13□2(A)-3800☆	3800	3840	3836	840	898	1056	7	8	10	42
579-459-□◇	ST13□2(A)-4000☆	4000	4040	4036	1040	998	956	9	9	9	44
579-460-□◇	ST13□2(A)-4200☆	4200	4240	4236	1040	1098	1056	9	10	10	46

A numeral for symbol □ in each Order No. and Model No. indicates the following.

- 0: Supports Mitutoyo ENSIS high-speed serial interface
- 4: Supports Mitsubishi Electric Corporation, high-speed serial interface
- 5: Supports FANUC CORPORATION, high-speed serial interface
- 7: Supports Panasonic Corporation, high-speed serial interface
- 8: Supports Yaskawa Electric Corporation, high-speed serial interface

Effective range of ST1382A is up to 3600 mm.

A numeral for symbol ◇ in each Order No. indicates the following.

- 3: 0.01 μm (Without system parameters)
- 4: 0.001 μm (Without system parameters)
- 5: 0.01 μm (With system parameters)
- 6: 0.001 μm (With system parameters)

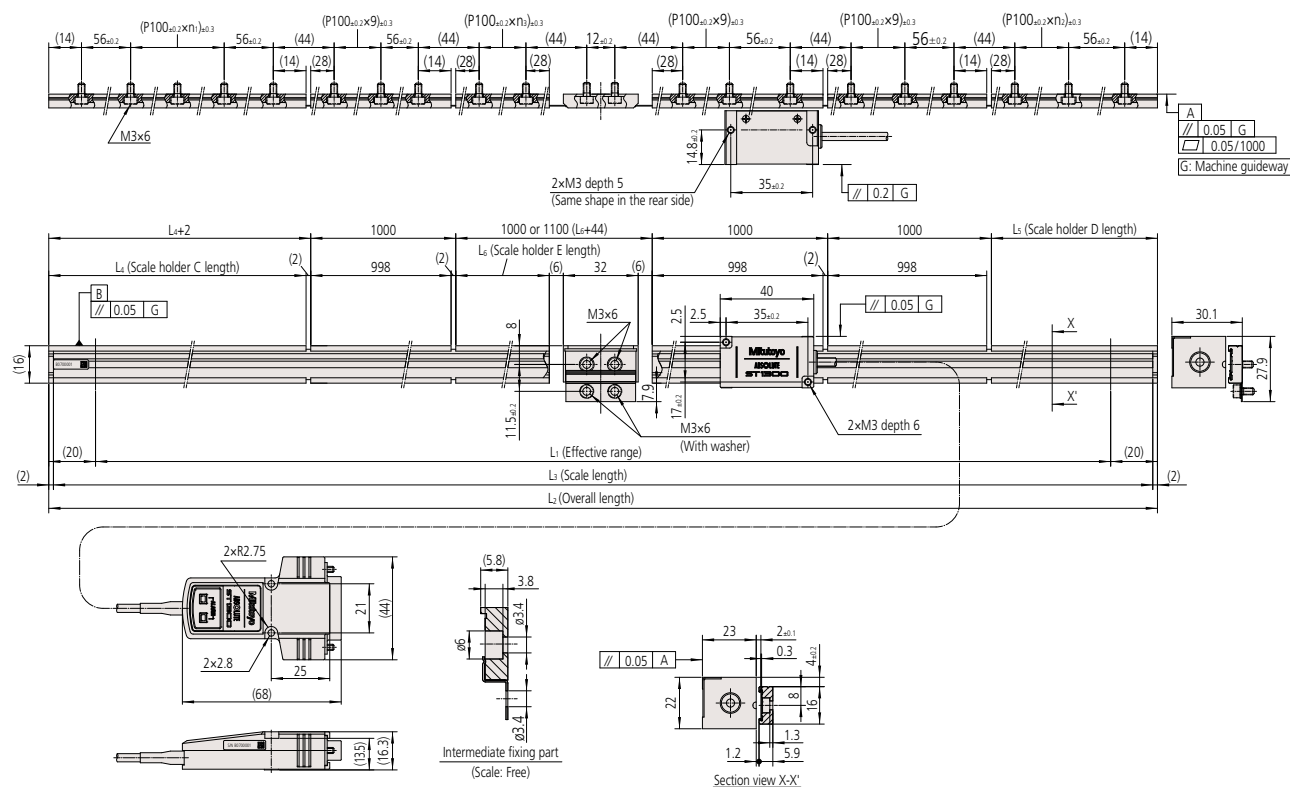
A numeral for symbol ☆ in each Model No. indicates the following.

- F: Center mounting (Without system parameters)
- G: Center mounting (With system parameters)

External View

Unit: mm

Center mounting type Effective range 4400 to 6000 mm



Dimensions

Resolution: 0.01 μm

Order No.	Model	Effective range L ₁ (mm)	Overall length L ₂ (mm)	Scale length L ₃ (mm)	Scale holder C length L ₄ (mm)	Scale holder D length L ₅ (mm)	Scale holder E length L ₆ (mm)	n1	n2	n3	Total number (n) of scale holder mounting holes
579-461-□◇	ST13□1(A)-4400☆	4400	4440	4436	240	198	956	1	1	9	50
579-462-□◇	ST13□1(A)-4600☆	4600	4640	4636	240	298	1056	1	2	10	52
579-463-□◇	ST13□1(A)-4800☆	4800	4840	4836	440	398	956	3	3	9	54
579-464-□◇	ST13□1(A)-5000☆	5000	5040	5036	440	498	1056	3	4	10	56
579-465-□◇	ST13□1(A)-5200☆	5200	5240	5236	640	598	956	5	5	9	58
579-466-□◇	ST13□1(A)-5400☆	5400	5440	5436	640	698	1056	5	6	10	60
579-467-□◇	ST13□1(A)-5600☆	5600	5640	5636	840	798	956	7	7	9	62
579-468-□◇	ST13□1(A)-5800☆	5800	5840	5836	840	898	1056	7	8	10	64
579-469-□◇	ST13□1(A)-6000☆	6000	6040	6036	1040	998	956	9	9	9	66

A numeral for symbol □ in each Order No. and Model No. indicates the following.
 0: Supports Mitutoyo ENSIS high-speed serial interface
 4: Supports Mitsubishi Electric Corporation, high-speed serial interface
 5: Supports FANUC CORPORATION, high-speed serial interface
 7: Supports Panasonic Corporation, high-speed serial interface
 8: Supports Yaskawa Electric Corporation, high-speed serial interface

A numeral for symbol ◇ in each Order No. indicates the following.
 3: 0.01 μm (Without system parameters)
 4: 0.001 μm (Without system parameters)
 5: 0.01 μm (With system parameters)
 6: 0.001 μm (With system parameters)

A numeral for symbol ☆ in each Model No. indicates the following.
 F: Center mounting (Without system parameters)
 G: Center mounting (With system parameters)










The □ in the Order No. indicates the interface specification (0, 4, 5, 7, 8).
The ◇ code indicates the interface specification (0, 4, 5, 7, 8).

ABS ST1300 Series

ABS ST1300 Signal Check Program

- When the ABS ST1300 signal check program has been installed in a PC, the program allows signal check and maintenance work of the scale by connecting the conversion unit and the PC to the ABS ST1300 Series. (The signal check work is indispensable. For details, refer to the User's Manual.)

Description of signal check program

Item	Description	Screen photo
(1) Confirmation of the detector head mounting position	Allows checking and judgment of the mounting status by acquiring data from the tape scale.	
(2) Confirmation of the overall length of the tape scale	Allows checking and judgment of the mounting status by acquiring data on the overall length of the tape scale.	
(3) Scale origin setting	Allows the scale origin (positional data: 0) to be set at an arbitrary point on the scale.	
(4) Confirmation of the absolute position data	Allows verification of the current position data with reference to the scale origin, and the alarm code and alarm information is output attached to the position data.	
(5) Error history clear	Allows records of error detection in the scale to be cleared.	
(6) Writing system parameters	Allows system parameters to be written to the detector head.	
(7) Reading system parameters	Allows system parameters stored in the detector head to be read out and displayed.	
(8) Reading the error history and store it to PC	Allows readout of a detailed internal error code, verification of error code information and saving error codes as an error record file in the PC.	
(9) Signal monitor	Allows a check of the acquired data over the overall length of the tape scale.	

Required items

Item	Quantity	Details	Notes
PC*	1	DOS/V (Windows version)	Provided by user
Conversion unit	1	USB-485 (422) DS15P (System Sacom Industry Corp.)	Optional (bundle)
Connection cable A	1	USB cable	
Connection cable B	1	RS-485 cable or RS-422 cable	
Application software	1	ABS ST1300 Signal Check Program	

* This program requires a PC with the following operating environment.

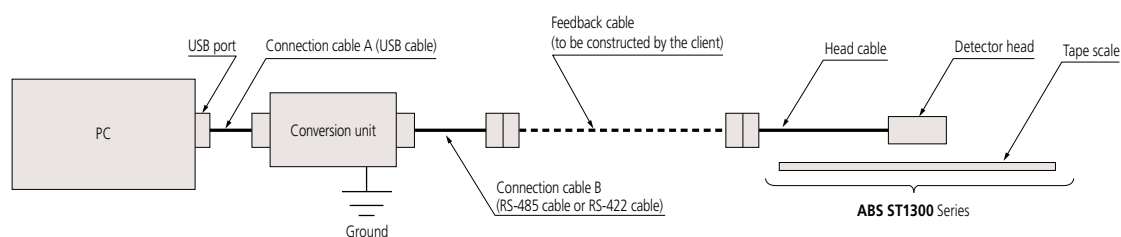
CPU	: 1 GHz or faster
Memory	: 1 GB min.
Program size	: 10 MB
OS	: Windows 7 or later
Monitor	: 1024×768 or higher is recommended

"Conversion unit, application software" set

Order No.	Applicable model	Conversion unit	Connecting cable B
06AFA406	ST1301A ST1302A	USB-485 DS15P	MIT cable
06AEX139	ST1341A ST1342A	USB-485 DS15P	MEL cable
06AFA407	ST1351 ST1352	USB-422 DS15P	FANUC cable
06AEX140	ST1371A, ST1372A ST1381A, ST1382A	USB-485 DS15P	Y/MAT cable

Note: An Order No. is applicable to each company's interface because connecting cable B differs depending on the interface of the **ABS ST1300 Series**.

Connection details



Note 1: To prevent the possibility of electric shock the device must be grounded.

Note 2: When using Order No. **06AFA406**, connect the head cable and the connection cable B together.

Note 3: The conversion unit's power source is supplied via connection cable A from the PC USB port.

Assembly Type ABS AT Series Absolute Scale Unit (Standard Type) ABS AT1100 Series (Resolution 0.05 μm Specification)

Introduction video
available here.



- This series has adopted a new structure not easily subject to infiltration of coolant and a dust-proof rubber highly resistant to coolant attack. It offers a field support type linear scale with higher reliability than before.
- The sensor-to-scale air gap in this series of electromagnetic induction scales is approximately 0.4 mm – around 4 times as wide as that of a conventional optical or electromagnetic sensor. The increased air gap reduces the likelihood of failure due to the accumulation of contaminants and is one of the world's largest to be found in a machine tool scale.
- The de facto standard frame multipoint mounting method has been adopted to provide high resistance to vibration and shock.
- A recently developed small sensor is incorporated in Mitutoyo's proprietary electromagnetic induction detection system.
- The improvement of signal processing technology in the electromagnetic induction type absolute linear encoder has achieved approximately 6 times higher accuracy than that of previous scales.
- This series is compatible with the high-speed serial interface from leading machine-tool companies, allowing direct connection to an NC controller.

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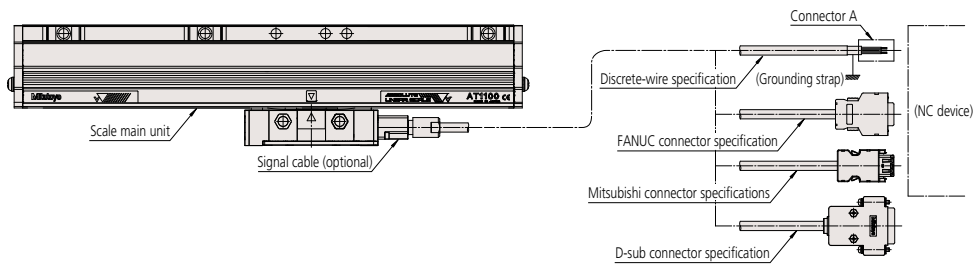
Specifications

Items	Model	ABS AT11□3(A)
Detection method		Electromagnetic induction
Mounting method		Frame multipoint
Reference position for expansion due to temperature variation		Refer to the External View diagram (L5)
Effective range		24 types: 140, 240, 340, 440, 540, 640, 740, 840, 940, 1040, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040, 2240, 2440, 2640, 2840, 3040 mm
Resolution		0.05 μm
Maximum response speed		3000 mm/s
Indication accuracy (20 °C)		Effective range $L_0=140 - 2040 \text{ mm}$: $3 + 5L_0/1000 (\mu\text{m})$ Effective range $L_0=2240 - 3040 \text{ mm}$: $5 + 5L_0/1000 (\mu\text{m})$
Expansion coefficient		$\approx 8 \times 10^{-6}/\text{K}$
Vibration resistance		$\leq 196 \text{ m/s}^2$ (55 - 2000 Hz)
Shock resistance		Effective range $L_0=140 - 2040 \text{ mm}$: $\leq 343 \text{ m/s}^2$ Effective range $L_0=2240 - 3040 \text{ mm}$: $\leq 294 \text{ m/s}^2$ (1/2 sin 11 ms)
Power supply voltage		ABS AT1153/1143/AT1103A : 5 VDC $\pm 10\%$ ABS AT1123 : 24 VDC (Conforming to DRIVE-CLiQ)
Maximum current consumption		AT1153 : 300 mA (Max.) AT1143 : 290 mA (Max.) AT1123 : 140 mA (Max.) AT1103A : 300 mA (Max.)
Operating temperature/humidity		0 to 50 °C 20 - 80%RH (non-condensing)
Storage temperature/humidity		-20 to 70 °C 20 - 80%RH (non-condensing)

ABS AT1100 Series

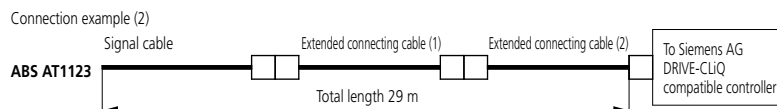
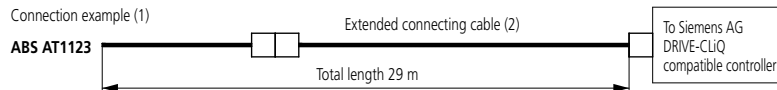
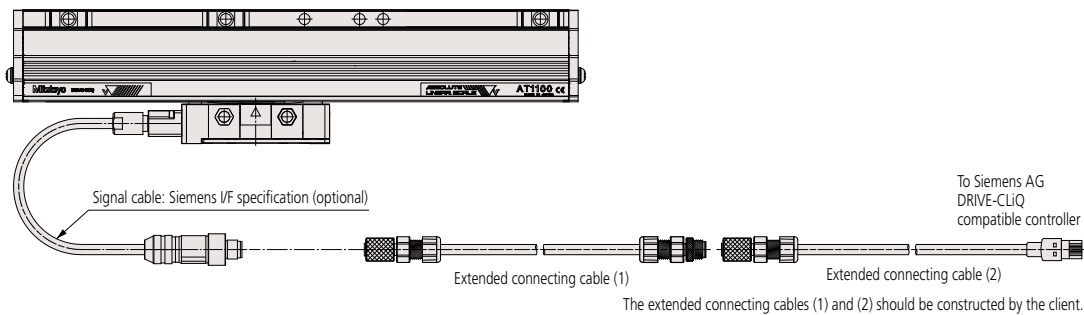
System Configuration (Example)

[Connection example 1] [ABS AT1153/AT1143/AT1103A]



1. The signal cable is an option. The client should construct this according to the situation.
2. The client should configure connector A according to the situation.
3. Installation of connector A and the grounding strap is the responsibility of the client.
4. Each cable length in the above system configuration must be up to 12 m. If any cable length exceeds 12 m, use the cable configuration as shown in [Connection example 2].

[Connection example 2] [ABS AT1123]



Extended connecting cable (1) SIEMENS AG Model No. 6FX8002-2DC34 - ☐ ☐ ☐ ☐
 Extended connecting cable (2) SIEMENS AG Model No. 6FX8002-2DC30 - ☐ ☐ ☐ ☐



1. The extended connecting cables should be constructed by the client.
2. Keep the total length of signal cable and extended connecting cable(s) less than 29 m.
3. For the signal cable specification and how to obtain, contact Siemens AG.

Meaning of Model No.

ABS AT11□3□ - □□□□
 Effective range

Interface specifications

Applicable system	Scale model
FANUC CORPORATION, Serial αi Series	ABS AT1153
Mitsubishi Electric Corporation MDS-D/MDS-DH Series	ABS AT1143
Siemens AG DRIVE-CLiQ	ABS AT1123
Mitutoyo ENSIS	ABS AT1103A

Note 1: For the details of applicable systems, inquiries should be made of each manufacturer.

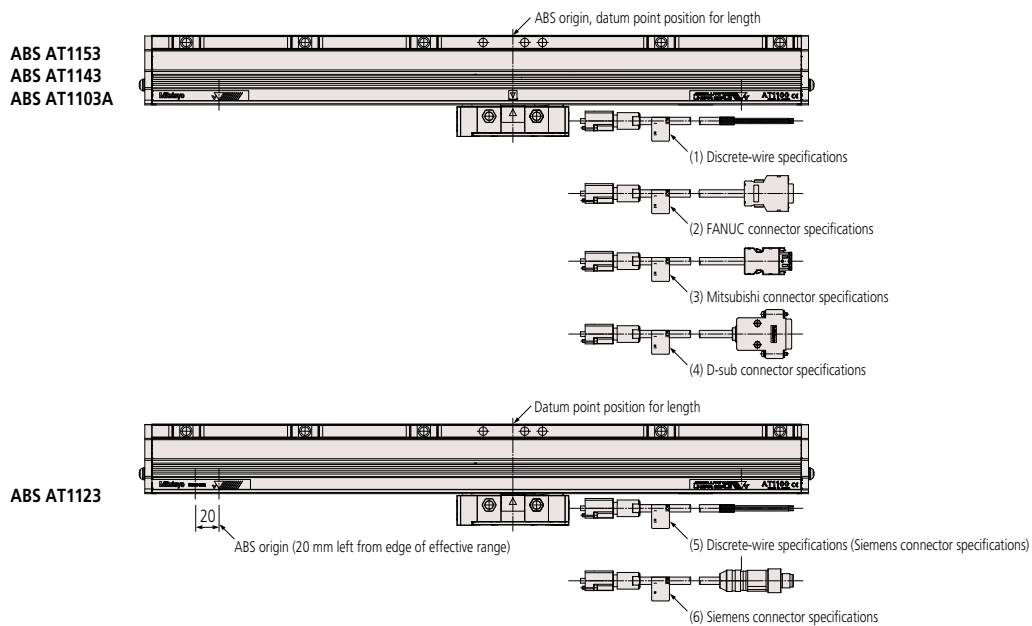
Note 2: **ABS AT11□3□**

Transmission method
 Nothing: Full duplex communication
 A: Half-duplex communication

ABS AT1100 Series

Scale configuration

[ABS AT1100 Series]



Output specifications

ABS AT1153/1143/AT1103A (discrete-wire)

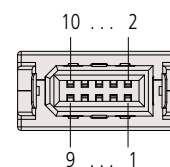
Wire color	Signal
Brown	SD
Red	*SD
Orange	RQ (REQ)
Yellow	*RQ (REQ)
White (2P)	+5 V
Black (2P)	GND
Shield wire	F.G

* Cable to be constructed by the client (A total of 29 m with the signal cable).

ABS AT1143

Mitsubishi connector specifications (MDR)

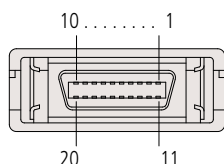
Pin No.	Signal
1	5 V
2	GND
3	RQDT
4	RQDT̄
7	DT
8	DT̄
5, 6, 9, 10	Not used
Connector shell	F.G



ABS AT1153

FANUC connector specifications (FI-20)

Pin No.	Signal
1	SD
2	*SD
5	RQ (REQ)
6	*RQ (REQ)
12, 14	GND
18, 20	+5 V
16	F.G
3, 4, 7 - 11, 13, 15, 17, 19	Not used

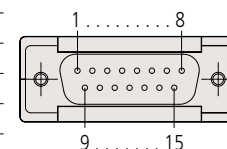


* Cable to be constructed by the client (A total of 29 m with the signal cable).

ABS AT1103A

Mitutoyo connector specifications (D-sub 15-pin)

Pin No.	Signal
1, 2	GND
3, 4	+5 V
5	DT
6	DT̄
7	RQDT
8	RQDT̄
9 - 14	Not used
15	F.G
Connector shell	F.G



ABS AT1123 (discrete-wire)

Siemens connector specifications

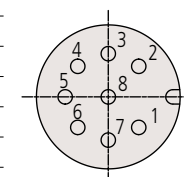
Wire color	Signal
White/Brown	+24 V
Brown	GND
White/Blue	TEST
Blue	TEST̄
White/Orange	TXP
Orange	TXN
White/Green	RXP
Green	RXN
Shield	F.G

Note: Leave test terminals (TEST, TEST̄) disconnected during use.

ABS AT1123

M12 connector specifications

Pin No.	Signal
1	+24 V
2	TEST
3	RXP
4	RXN
5	GND
6	TXN
7	TXP
8	TEST̄
Shield sleeve	F.G



Note: Leave test terminals (TEST, TEST̄) disconnected during use.

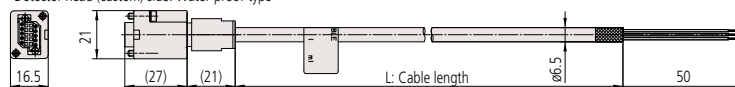
ABS AT1100 Series

Cable Dimensions FANUC connector specifications (AT1153 Series)

Unit: mm

Discrete-wire specification

Detector head (custom) side: Water-proof type



PVC sheath

Order No.	Model	Cable length (m)
06AFG596-1	AT1100F/M discrete-wire cable 1 m	1
06AFG596-3	AT1100F/M discrete-wire cable 3 m	3
06AFG596-6	AT1100F/M discrete-wire cable 6 m	6
06AFG596-9	AT1100F/M discrete-wire cable 9 m	9
06AFG596-12	AT1100F/M discrete-wire cable 12 m	12

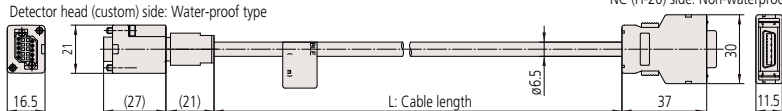
PUR sheath

Order No.	Model	Cable length (m)
06AFX744-1	AT1100PUR discrete-wire cable 1 m	1
06AFX744-3	AT1100PUR discrete-wire cable 3 m	3
06AFX744-6	AT1100PUR discrete-wire cable 6 m	6
06AFX744-9	AT1100PUR discrete-wire cable 9 m	9
06AFX744-12	AT1100PUR discrete-wire cable 12 m	12

FANUC connector specifications

Detector head (custom) side: Water-proof type

NC (FI-20) side: Non-waterproof



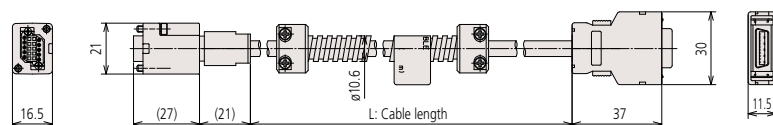
PVC sheath

Order No.	Model	Cable length (m)
06AFF921-1	AT1100F Cable FUNUC 1 m	1
06AFF921-3	AT1100F Cable FUNUC 3 m	3
06AFF921-6	AT1100F Cable FUNUC 6 m	6
06AFF921-9	AT1100F Cable FUNUC 9 m	9
06AFF921-12	AT1100F Cable FUNUC 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AGB149-1	AT1150PUR Cable F 1 m	1
06AGB149-3	AT1150PUR Cable F 3 m	3
06AGB149-6	AT1150PUR Cable F 6 m	6
06AGB149-9	AT1150PUR Cable F 9 m	9
06AGB149-12	AT1150PUR Cable F 12 m	12

FANUC connector specifications Conduit



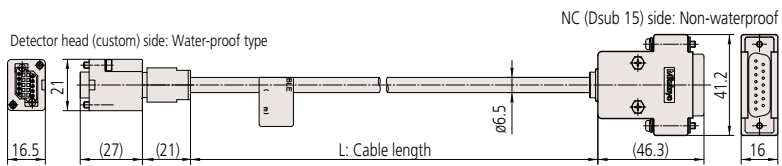
PVC sheath

Order No.	Model	Cable length (m)
06AFX739-1	AT1100F C Cable F 1 m	1
06AFX739-3	AT1100F C Cable F 3 m	3
06AFX739-6	AT1100F C Cable F 6 m	6
06AFX739-9	AT1100F C Cable F 9 m	9
06AFX739-12	AT1100F C Cable F 12 m	12

Cable Dimensions FANUC connector specifications (AT1153 Series)

Unit: mm

D-sub 15-pin connector



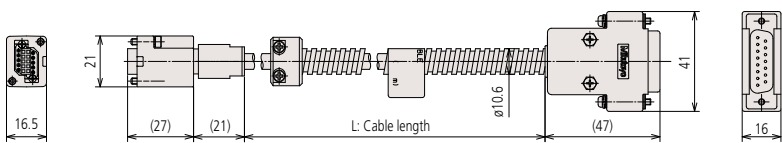
PVC sheath

Order No.	Model	Cable length (m)
06AFY915-1	AT1100E Cable D15 1 m	1
06AFY915-3	AT1100E Cable D15 3 m	3
06AFY915-6	AT1100E Cable D15 6 m	6
06AFY915-9	AT1100E Cable D15 9 m	9
06AFY915-12	AT1100E Cable D15 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AFX743-1	AT1100PUR C Cable D15 1 m	1
06AFX743-3	AT1100PUR C Cable D15 3 m	3
06AFX743-6	AT1100PUR C Cable D15 6 m	6
06AFX743-9	AT1100PUR C Cable D15 9 m	9
06AFX743-12	AT1100PUR C Cable D15 12 m	12

D-sub 15-pin connector Conduit



PVC sheath

Order No.	Model	Cable length (m)
06AFY916-1	AT1100E C Cable D15 1 m	1
06AFY916-3	AT1100E C Cable D15 3 m	3
06AFY916-6	AT1100E C Cable D15 6 m	6
06AFY916-9	AT1100E C Cable D15 9 m	9
06AFY916-12	AT1100E C Cable D15 12 m	12

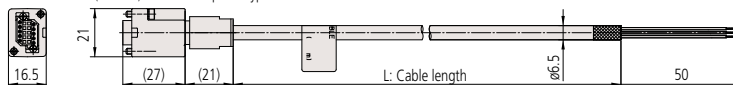
ABS AT1100 Series

Cable Dimensions Mitsubishi connector specifications (AT1143 Series) $\phi 10.6$

Unit: mm

Discrete-wire specification

Detector head (custom) side: Water-proof type



PVC sheath

Order No.	Model	Cable length (m)
06AFG596-1	AT1100F/M discrete-wire cable 1 m	1
06AFG596-3	AT1100F/M discrete-wire cable 3 m	3
06AFG596-6	AT1100F/M discrete-wire cable 6 m	6
06AFG596-9	AT1100F/M discrete-wire cable 9 m	9
06AFG596-12	AT1100F/M discrete-wire cable 12 m	12

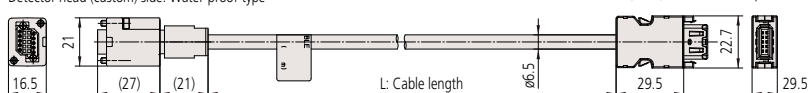
PUR sheath

Order No.	Model	Cable length (m)
06AFX744-1	AT1100PUR discrete-wire cable 1 m	1
06AFX744-3	AT1100PUR discrete-wire cable 3 m	3
06AFX744-6	AT1100PUR discrete-wire cable 6 m	6
06AFX744-9	AT1100PUR discrete-wire cable 9 m	9
06AFX744-12	AT1100PUR discrete-wire cable 12 m	12

Mitsubishi connector specifications

Detector head (custom) side: Water-proof type

NC (MDR) side: Non-waterproof



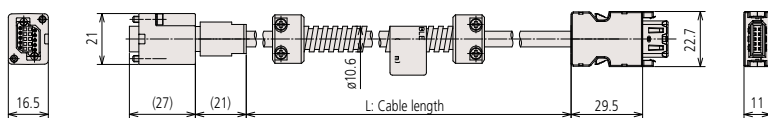
PVC sheath

Order No.	Model	Cable length (m)
06AFF957-1	AT1100M Cable MDS-D 1 m	1
06AFF957-3	AT1100M Cable MDS-D 3 m	3
06AFF957-6	AT1100M Cable MDS-D 6 m	6
06AFF957-9	AT1100M Cable MDS-D 9 m	9
06AFF957-12	AT1100M Cable MDS-D 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AFX746-1	AT1140PUR Cable M 1 m	1
06AFX746-3	AT1140PUR Cable M 3 m	3
06AFX746-6	AT1140PUR Cable M 6 m	6
06AFX746-9	AT1140PUR Cable M 9 m	9
06AFX746-12	AT1140PUR Cable M 12 m	12

Mitsubishi connector specifications Conduit



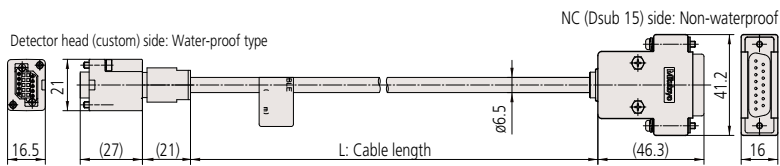
PVC sheath

Order No.	Model	Cable length (m)
06AFX740-1	AT1100M C Cable M 1 m	1
06AFX740-3	AT1100M C Cable M 3 m	3
06AFX740-6	AT1100M C Cable M 6 m	6
06AFX740-9	AT1100M C Cable M 9 m	9
06AFX740-12	AT1100M C Cable M 12 m	12

Cable Dimensions Mitsubishi connector specifications (AT1143 Series)

Unit: mm

D-sub 15-pin connector



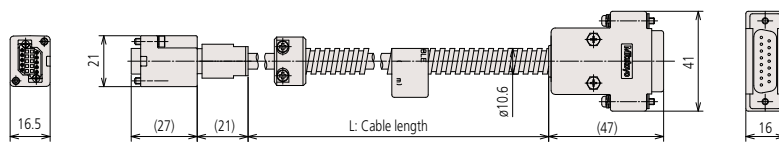
PVC sheath

Order No.	Model	Cable length (m)
06AFY915-1	AT1100E Cable D15 1 m	1
06AFY915-3	AT1100E Cable D15 3 m	3
06AFY915-6	AT1100E Cable D15 6 m	6
06AFY915-9	AT1100E Cable D15 9 m	9
06AFY915-12	AT1100E Cable D15 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AFX743-1	AT1100PUR Cable D15 1 m	1
06AFX743-3	AT1100PUR Cable D15 3 m	3
06AFX743-6	AT1100PUR Cable D15 6 m	6
06AFX743-9	AT1100PUR Cable D15 9 m	9
06AFX743-12	AT1100PUR Cable D15 12 m	12

D-sub 15-pin connector Conduit



PVC sheath

Order No.	Model	Cable length (m)
06AFY916-1	AT1100E C Cable D15 1m	1
06AFY916-3	AT1100E C Cable D15 3 m	3
06AFY916-6	AT1100E C Cable D15 6 m	6
06AFY916-9	AT1100E C Cable D15 9 m	9
06AFY916-12	AT1100E C Cable D15 12 m	12

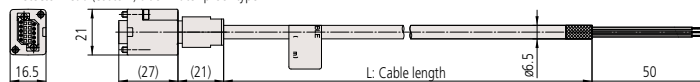
ABS AT1100 Series

Cable dimensions Siemens connector specifications (AT1123 Series)

Unit: mm

Discrete-wire specification

Detector head (custom) side: Water-proof type



PVC sheath

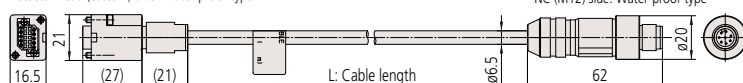
Order No.	Model	Cable length (m)
06AFM103-1	AT1100S discrete-wire cable 1 m	1
06AFM103-3	AT1100S discrete-wire cable 3 m	3
06AFM103-6	AT1100S discrete-wire cable 6 m	6
06AFM103-9	AT1100S discrete-wire cable 9 m	9
06AFM103-12	AT1100S discrete-wire cable 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AFX747-1	AT1120PUR discrete-wire cable 1 m	1
06AFX747-3	AT1120PUR discrete-wire cable 3 m	3
06AFX747-6	AT1120PUR discrete-wire cable 6 m	6
06AFX747-9	AT1120PUR discrete-wire cable 9 m	9
06AFX747-12	AT1120PUR discrete-wire cable 12 m	12

M12 connector

Detector head (custom) side: Water-proof type



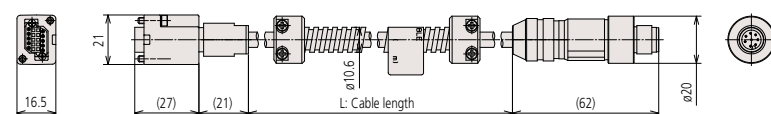
PVC sheath

Order No.	Model	Cable length (m)
06AFL121-1	AT1100S Cable M12 1 m	1
06AFL121-3	AT1100S Cable M12 3 m	3
06AFL121-6	AT1100S Cable M12 6 m	6
06AFL121-9	AT1100S Cable M12 9 m	9
06AFL121-12	AT1100S Cable M12 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AFX748-1	AT1120PUR Cable M12 1 m	1
06AFX748-3	AT1120PUR Cable M12 3 m	3
06AFX748-6	AT1120PUR Cable M12 6 m	6
06AFX748-9	AT1120PUR Cable M12 9 m	9
06AFX748-12	AT1120PUR Cable M12 12 m	12

M12 connector Conduit



PVC sheath

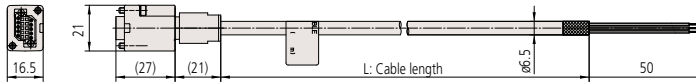
Order No.	Model	Cable length (m)
06AFX741-1	AT1100S C Cable M12 1 m	1
06AFX741-3	AT1100S C Cable M12 3 m	3
06AFX741-6	AT1100S C Cable M12 6 m	6
06AFX741-9	AT1100S C Cable M12 9 m	9
06AFX741-12	AT1100S C Cable M12 12 m	12

Cable Dimensions ENSIS connector specifications (AT1103A Series)

Unit: mm

Discrete-wire specification

Detector head (custom) side: Water-proof type



PVC sheath

Order No.	Model	Cable length (m)
06AFG596-1	AT1100F/M discrete-wire cable 1 m	1
06AFG596-3	AT1100F/M discrete-wire cable 3 m	3
06AFG596-6	AT1100F/M discrete-wire cable 6 m	6
06AFG596-9	AT1100F/M discrete-wire cable 9 m	9
06AFG596-12	AT1100F/M discrete-wire cable 12 m	12

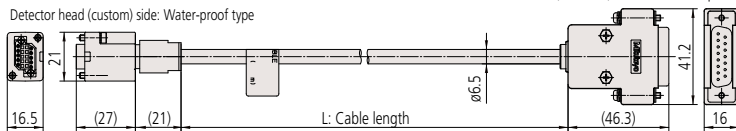
PUR sheath

Order No.	Model	Cable length (m)
06AFX744-1	AT1100PUR discrete-wire cable 1 m	1
06AFX744-3	AT1100PUR discrete-wire cable 3 m	3
06AFX744-6	AT1100PUR discrete-wire cable 6 m	6
06AFX744-9	AT1100PUR discrete-wire cable 9 m	9
06AFX744-12	AT1100PUR discrete-wire cable 12 m	12

D-sub 15-pin connector

Detector head (custom) side: Water-proof type

NC (Dsub 15) side: Non-waterproof



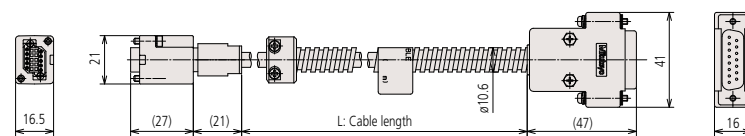
PVC sheath

Order No.	Model	Cable length (m)
06AFY915-1	AT1100E Cable D15 1 m	1
06AFY915-3	AT1100E Cable D15 3 m	3
06AFY915-6	AT1100E Cable D15 6 m	6
06AFY915-9	AT1100E Cable D15 9 m	9
06AFY915-12	AT1100E Cable D15 12 m	12

PUR sheath

Order No.	Model	Cable length (m)
06AFX743-1	AT1100PUR Cable D15 1 m	1
06AFX743-3	AT1100PUR Cable D15 3 m	3
06AFX743-6	AT1100PUR Cable D15 6 m	6
06AFX743-9	AT1100PUR Cable D15 9 m	9
06AFX743-12	AT1100PUR Cable D15 12 m	12

D-sub 15-pin connector Conduit



PVC sheath

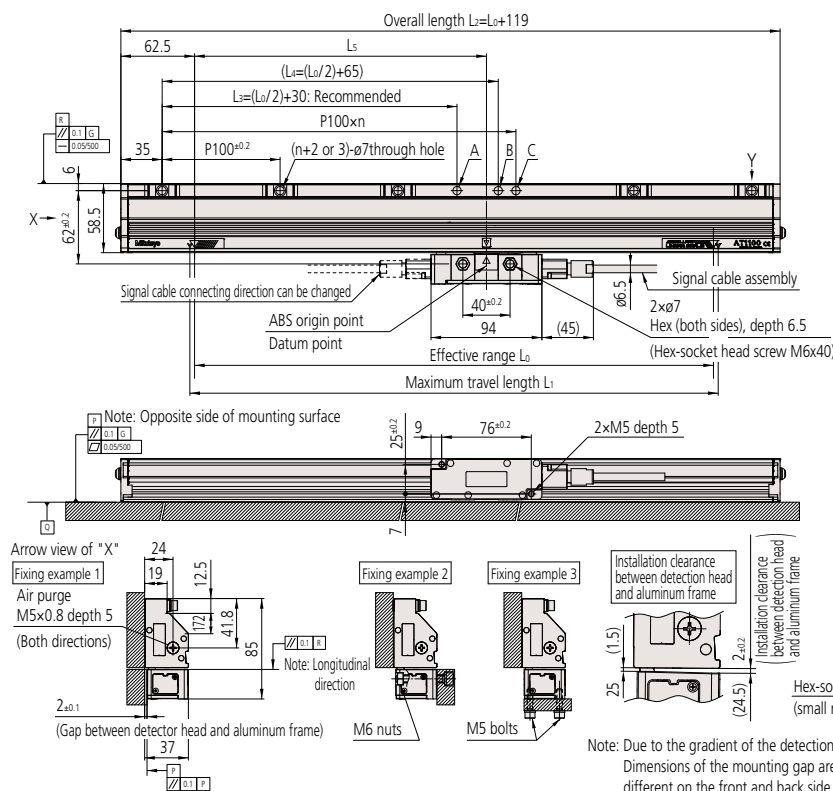
Order No.	Model	Cable length (m)
06AFY916-1	AT1100E C Cable D15 1 m	1
06AFY916-3	AT1100E C Cable D15 3 m	3
06AFY916-6	AT1100E C Cable D15 6 m	6
06AFY916-9	AT1100E C Cable D15 9 m	9
06AFY916-12	AT1100E C Cable D15 12 m	12

ABS AT1100 Series

External View

Unit: mm

ABS AT1153/AT1143/AT1103A



Note:

1. G represents the machine guide.
2. P represents the opposite side of the aluminum frame mounting surface.
- Also, S represents the opposite side of the detector head mounting surface.
3. Q and R represent the linear scale's reference surfaces for mounting.
4. For descriptions of L_0 to L_5 in the figure, refer to the table below.
5. Check the mounting dimensions using the head clamping tool.
6. For the center $\phi 7$, it is recommended that it be fastened at two points, A and C.
7. A- $\phi 7$ is identical to position C due to its effective range.
- At this time, the center $\phi 7$ will be 2 points.
8. The number of holes at complete fixing positions differs depending on the overall scale length. For details, refer to the following description.

For 2 holes: 2-point fixing at both hole positions

For 3 holes: 2-point fixing at the 2-hole positions of A and C (recommended)

A B C

Aluminum frame

SUS bushings

Special plate spring

Hex-socket head screw M6x30 (small round plain washers)

Arrow of "Y"

Dimensions

Order No.	Model	Effective range	Maximum travel length	Overall length	Mounting pitch			n
		L_0 (mm)	L_1 (mm)	L_2 (mm)	L_3 (mm)	L_4 (mm)	L_5 (mm)	
559-100-□3	AT11□3(A)-140	140	148	259	100	135	90	2
559-101-□3	AT11□3(A)-240	240	248	359	150	185	147.5	3
559-102-□3	AT11□3(A)-340	340	348	459	200	235	190	4
559-103-□3	AT11□3(A)-440	440	448	559	250	285	247.5	5
559-104-□3	AT11□3(A)-540	540	548	659	300	335	290	6
559-105-□3	AT11□3(A)-640	640	648	759	350	385	347.5	7
559-106-□3	AT11□3(A)-740	740	748	859	400	435	390	8
559-107-□3	AT11□3(A)-840	840	848	959	450	485	447.5	9
559-108-□3	AT11□3(A)-940	940	948	1059	500	535	490	10
559-109-□3	AT11□3(A)-1040	1040	1048	1159	550	585	547.5	11
559-110-□3	AT11□3(A)-1140	1140	1148	1259	600	635	590	12
559-111-□3	AT11□3(A)-1240	1240	1248	1359	650	685	647.5	13
559-112-□3	AT11□3(A)-1340	1340	1348	1459	700	735	690	14
559-113-□3	AT11□3(A)-1440	1440	1448	1559	750	785	747.5	15
559-114-□3	AT11□3(A)-1540	1540	1548	1659	800	835	790	16
559-115-□3	AT11□3(A)-1640	1640	1648	1759	850	885	847.5	17
559-116-□3	AT11□3(A)-1740	1740	1748	1859	900	935	890	18
559-117-□3	AT11□3(A)-1840	1840	1848	1959	950	985	947.5	19
559-118-□3	AT11□3(A)-2040	2040	2048	2159	1050	1085	1047.5	21
559-119-□3	AT11□3(A)-2240	2240	2248	2359	1150	1185	1147.5	23
559-120-□3	AT11□3(A)-2440	2440	2448	2559	1250	1285	1247.5	25
559-121-□3	AT11□3(A)-2640	2640	2648	2759	1350	1385	1347.5	27
559-122-□3	AT11□3(A)-2840	2840	2848	2959	1450	1485	1447.5	29
559-123-□3	AT11□3(A)-3040	3040	3048	3159	1550	1585	1547.5	31

Note: □ in Order No. and Model indicates the interface specification as follows:

AT1143: 4

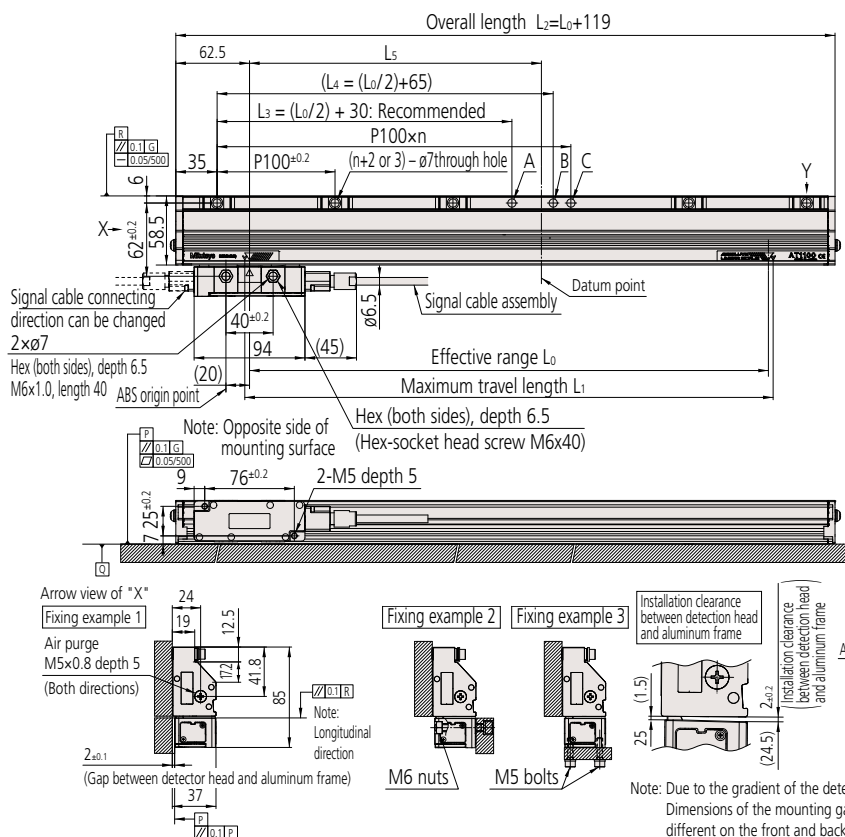
AT1153: 5

AT1103A: 0

External View

Unit: mm

ABS AT1123



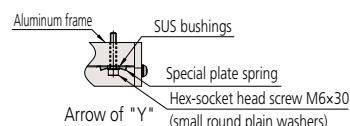
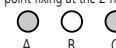
Notes:

1. G represents the machine guide.
2. P represents the opposite side of the aluminum frame mounting surface. Also, S represents the opposite side of the detector head mounting surface.
3. Q and R represent the linear scale's reference surfaces for mounting.
4. For descriptions of L_0 to L_5 in the figure, refer to the table below.
5. Check the mounting dimensions using the head clamping tool.
6. For the center $\phi 7$, it is recommended that it be fastened at two points, A and C.
7. A- $\phi 7$ is identical to position C due to its effective range. At this time, the center $\phi 7$ will be 2 points.
8. The number of holes at complete fixing positions differs depending on the overall scale length. For details, refer to the following description.

For 2 holes: 2-point fixing at both hole positions



For 3 holes: 2-point fixing at the 2-hole positions of A and C (recommended)



Note: Due to the gradient of the detection head, Dimensions of the mounting gap are different on the front and back side.

Dimensions

Order No.	Model	Effective range	Maximum travel length	Overall length	Mounting pitch			n
		L ₀ (mm)	L ₁ (mm)	L ₂ (mm)	L ₃ (mm)	L ₄ (mm)	L ₅ (mm)	
559-100-23	AT1123-140	140	148	259	100	135	90	2
559-101-23	AT1123-240	240	248	359	150	185	147.5	3
559-102-23	AT1123-340	340	348	459	200	235	190	4
559-103-23	AT1123-440	440	448	559	250	285	247.5	5
559-104-23	AT1123-540	540	548	659	300	335	290	6
559-105-23	AT1123-640	640	648	759	350	385	347.5	7
559-106-23	AT1123-740	740	748	859	400	435	390	8
559-107-23	AT1123-840	840	848	959	450	485	447.5	9
559-108-23	AT1123-940	940	948	1059	500	535	490	10
559-109-23	AT1123-1040	1040	1048	1159	550	585	547.5	11
559-110-23	AT1123-1140	1140	1148	1259	600	635	590	12
559-111-23	AT1123-1240	1240	1248	1359	650	685	647.5	13
559-112-23	AT1123-1340	1340	1348	1459	700	735	690	14
559-113-23	AT1123-1440	1440	1448	1559	750	785	747.5	15
559-114-23	AT1123-1540	1540	1548	1659	800	835	790	16
559-115-23	AT1123-1640	1640	1648	1759	850	885	847.5	17
559-116-23	AT1123-1740	1740	1748	1859	900	935	890	18
559-117-23	AT1123-1840	1840	1848	1959	950	985	947.5	19
559-118-23	AT1123-2040	2040	2048	2159	1050	1085	1047.5	21
559-119-23	AT1123-2240	2240	2248	2359	1150	1185	1147.5	23
559-120-23	AT1123-2440	2440	2448	2559	1250	1285	1247.5	25
559-121-23	AT1123-2640	2640	2648	2759	1350	1385	1347.5	27
559-122-23	AT1123-2840	2840	2848	2959	1450	1485	1447.5	29
559-123-23	AT1123-3040	3040	3048	3159	1550	1585	1547.5	31

ABS AT1100 Series

ABS AT1100 Signal Check Program

- The ABS AT1100 signal check program can diagnose the scale signal by connecting the ABS AT1100 Series to the conversion unit connected to a PC with the "ABS AT1100 signal check program" installed.

The AT1100 signal check program allows the PC to execute the following.

- 1) Confirm the signal display with "Signal Monitor"
- 2) Confirm the track status with "Track Error Monitor"
- 3) Confirmation of position data with "Position Monitor"
- 4) Check error history by "Error History Check"

Required items

Item	Quantity	Details	Notes
PC*	1	DOS/V (Windows version)	Provided by user
Conversion unit	1	USB-485 (422) DS15P (System Sacom Industry Corp.)	Optional (bundle)
Connection cable A	1	USB cable	
Connection cable B	1	RS-485 cable or RS-422 cable	
Application software	1	ABS AT1100 Signal Check Program	

* This program requires a PC with the following operating environment.

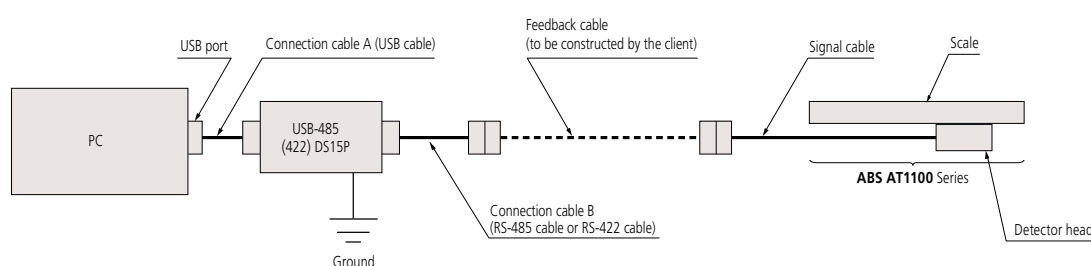
CPU	: 1 GHz or faster
Memory	: 1 GB min.
Program size	: 10 MB
OS	: Windows 7 or later
Monitor	: 1024×768 or higher is recommended

"Conversion unit, application software" set

Order No.	Applicable model	Conversion unit	Connecting cable B
06AGD689	AT1103A	USB-485 DS15P	MIT cable (Mitutoyo ENSIS)
06AGD690	AT1143	USB-422 DS15P	MDS cable (Mitsubishi Electric Corporation)
06AGD691	AT1153	USB-422 DS15P	FANUC cable

Note: Each manufacture I/F has different Order No., since connection cable B and Conversion unit are different for each I/F.

Connection details



Note 1: To prevent the possibility of electric shock the device must be grounded.

Note 2: The conversion unit's power source is supplied via connection cable A from the PC USB port.

Assembly Type ABS AT Series Absolute Scale Unit (Slim Type) ABS AT1300 Series

(Resolution 0.001/0.01/0.05 μm)



- Outstanding resistance to contamination compared to conventional optical types by using a new detection principle (in-house testing result).
- Features a new coolant-proof design incorporating a high-performance rubber seal to provide higher reliability in the harsh factory environment.
- Delivers high accuracy and the outstanding resolution of 0.001 μm , the best-in-class in absolute scales.
- Allows space-saving design thanks to a slim form. (**AT500-S** and **AT500-H** are compatible with each other in installation.)
- Supports the interfaces of various manufacturers allowing a variety of system configurations.



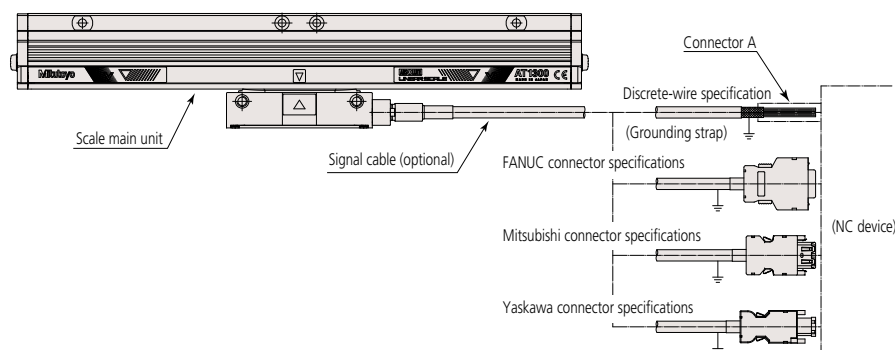
ABSOLUTE™

Specifications

Items	Model	High rigidity type ABS AT13□□(A)-S	High accuracy type ABS AT13□□(A)-H
		Optical linear encoder	
Detection method		Optical linear encoder	
Mounting method		Multi-point elastic fixing	3 or 5-point elastic fixing
Reference position for expansion due to temperature variation		Center of the effective measuring length	
Effective range		19 types: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1800, 2000, 2200 mm	15 types: 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 750, 800, 900, 1000 mm
Resolution		0.001/0.01/0.05 μm	
Maximum response speed		3,000 mm/s	
Indication accuracy (20° C)		3 + 3L α /1000 (μm)	2 + 2L α /1000 (μm)
Expansion coefficient		$\approx 8 \times 10^{-6}/\text{K}$	
Vibration resistance		$\leq 196 \text{ m/s}^2$ (55 - 2000 Hz)	$\leq 147 \text{ m/s}^2$ (55 - 2000 Hz)
Shock resistance		$\leq 343 \text{ m/s}^2$ (1/2 sin 11 ms)	$\leq 196 \text{ m/s}^2$ (1/2 sin 11 ms)
Power supply voltage		5 VDC $\pm 10\%$	
Maximum current consumption		270 mA (Max)	
Operating temperature/humidity		0 to 50 °C 20 to 80%RH (non-condensing)	
Storage temperature/humidity		-20 to 70 °C 20 to 80%RH (non-condensing)	

System Configuration (Example)

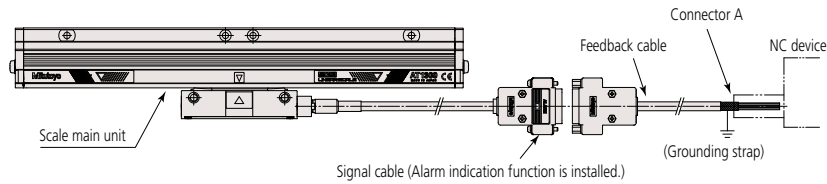
[Connection example 1]



1. The signal cable is an option. The client should construct this according to the situation.
2. The client should configure connector A according to the situation.
3. Installation of connector A and the grounding strap is the responsibility of the client.
4. Each cable length in the above system configuration must be up to 12 m.
If any cable length exceeds 12 m, use the cable configuration as shown in [Connection example 2].

ABS AT1300 Series

[Connection example 2]



1. If you use other than the recommended cable above-described, be sure to use a shielded cable in which the total impedance of power lines (+5 V and 0 V) is 0.65Ω or less for the entire length.
2. Route the feedback cable so that it will not be repeatedly bent.

- Connector A on the NC unit side needs to be prepared by the client.
- Connecting work of connector A and the earth bar should be performed by the client. Follow the manual of the NC unit to be used for the detailed description of this connection.
- When using a client prepared feedback cable, refer to the following.
Maximum cable length (signal cable + feedback cable)...29 m*
Recommended cable material: A66L-0001-0286 (supplied by Hitachi Cable, Ltd. or Oki Electric Cable Co., Ltd.)
* If the total length of cables is 13 to 29 m, then the maximum signal cable length should be 6 m.

Meaning of Model No.

ABS AT13 - -

Interface specifications

Applicable system	Model
FANUC CORPORATION Serial α i Series	ABS AT135 <input type="text"/>
Mitsubishi Electric Corporation MDS-D/MDS-DH Series	ABS AT134 <input type="text"/>
Mitsubishi Electric Corporation MELSERVO servo amplifier MR-J4 Series	ABS AT134 <input type="text"/> A
Yaskawa Electric Corporation Servopack Σ 7 Series	ABS AT138 <input type="text"/> A
Mitutoyo ENSIS	ABS AT130 <input type="text"/> A

Note 1: Be sure to contact each manufacturer for details of the applicable systems.

Note 2: **ABS AT13**

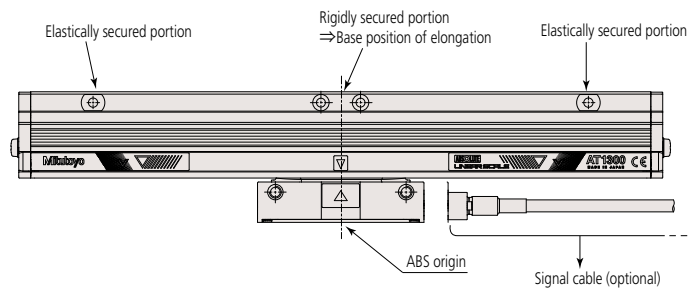
Resolution
7: $0.001 \mu\text{m}$
4: $0.01 \mu\text{m}$
3: $0.05 \mu\text{m}$

Transmission method
 Nothing: Full duplex communication
A: Half-duplex communication

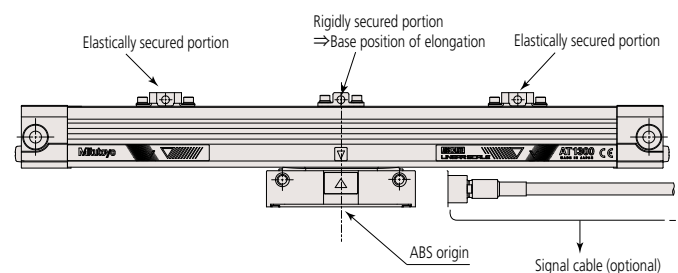
Type of the scale unit
S: High rigidity type
H: High accuracy type

Scale configuration

[ABS AT1300-S Series]



[ABS AT1300-H Series]



Note: Signal cable is optional.
 For Output specifications and Lineup of Cables, refer to page 7-39 and 7-40.

ABS AT1300 Series

Output specifications

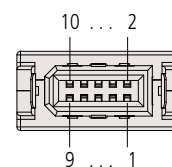
Flying lead specifications

Wire color	Signal
Brown	SD
Red	*SD
Orange	RQ (REQ)
Yellow	*RQ (REQ)
White (2P)	+5 V
Black (2P)	GND
Shield wire	F.G

* Cable to be constructed by the client (A total of 29 m with the signal cable).

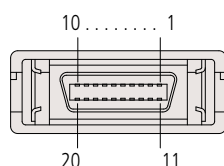
Mitsubishi connector specifications

Pin No.	Signal
1	5 V
2	GND
3	RQDT
4	RQDT̄
7	DT
8	DT̄
5, 6, 9, 10	Not used
Connector shell	F.G



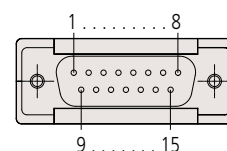
FANUC connector specifications

Pin No.	Signal
1	SD
2	*SD
5	RQ (REQ)
6	*RQ (REQ)
12, 14	GND
18, 20	+5 V
16	F.G
3, 4, 7 - 11, 13, 15, 17, 19	Not used



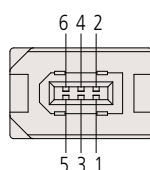
Signal cable (Alarm indication function is installed) (D-sub connector: Pin contact, 15-pin)

Pin No.	Signal
1, 2, 13	GND
3, 4, 11	+5 V
5	DT
6	DT̄
7	RQDT
8	RQDT̄
9, 10, 12, 14	Not used
15	F.G
Connector shell	F.G



Yaskawa connector specifications

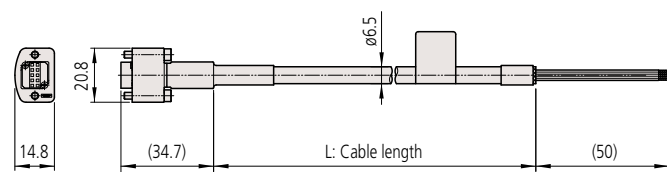
Pin No.	Signal
1	5 V
2	GND
5	S
6	/S
3, 4	Not used
Connector shell	F.G



Cable Dimensions

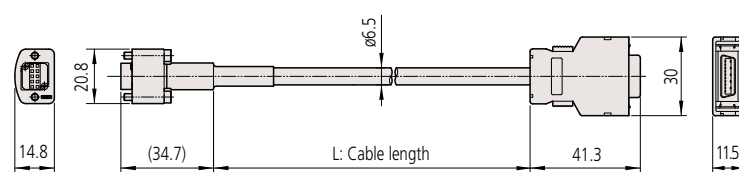
Unit: mm

Flying lead specifications



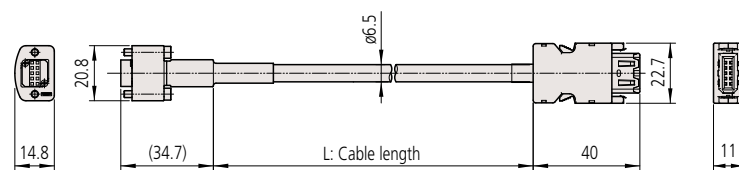
Order No.	Model	Cable length (m)
06AFS310-1	AT1300 discrete-wire cable 1 m	1
06AFS310-2	AT1300 discrete-wire cable 2 m	2
06AFS310-3	AT1300 discrete-wire cable 3 m	3
06AFS310-4	AT1300 discrete-wire cable 4 m	4
06AFS310-5	AT1300 discrete-wire cable 5 m	5
06AFS310-6	AT1300 discrete-wire cable 6 m	6
06AFS310-7	AT1300 discrete-wire cable 7 m	7
06AFS310-8	AT1300 discrete-wire cable 8 m	8
06AFS310-9	AT1300 discrete-wire cable 9 m	9
06AFS310-12	AT1300 discrete-wire cable 12 m	12

FANUC connector specifications



Order No.	Model	Cable length (m)
06AFS312-1	AT1300 Cable FUNUC 1 m	1
06AFS312-2	AT1300 Cable FUNUC 2 m	2
06AFS312-3	AT1300 Cable FUNUC 3 m	3
06AFS312-4	AT1300 Cable FUNUC 4 m	4
06AFS312-5	AT1300 Cable FUNUC 5 m	5
06AFS312-6	AT1300 Cable FUNUC 6 m	6
06AFS312-7	AT1300 Cable FUNUC 7 m	7
06AFS312-8	AT1300 Cable FUNUC 8 m	8
06AFS312-9	AT1300 Cable FUNUC 9 m	9
06AFS312-12	AT1300 Cable FUNUC 12 m	12

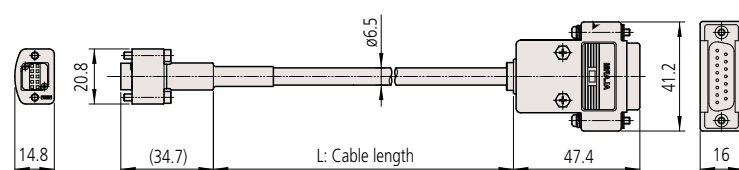
Mitsubishi connector specifications



Order No.	Model	Cable length (m)
06AFS311-1	AT1300 Cable MDS-D 1 m	1
06AFS311-2	AT1300 Cable MDS-D 2 m	2
06AFS311-3	AT1300 Cable MDS-D 3 m	3
06AFS311-4	AT1300 Cable MDS-D 4 m	4
06AFS311-5	AT1300 Cable MDS-D 5 m	5
06AFS311-6	AT1300 Cable MDS-D 6 m	6
06AFS311-7	AT1300 Cable MDS-D 7 m	7
06AFS311-8	AT1300 Cable MDS-D 8 m	8
06AFS311-9	AT1300 Cable MDS-D 9 m	9
06AFS311-12	AT1300 Cable MDS-D 12 m	12

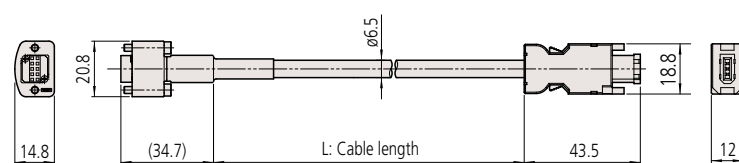
Signal cable

(Alarm indication function is installed) (D-sub connector: Pin contact, 15-pin)



Order No.	Model	Cable length (m)
06AFS313-1	AT1300 Cable D15 1m	1
06AFS313-2	AT1300 Cable D15 2m	2
06AFS313-3	AT1300 Cable D15 3m	3
06AFS313-4	AT1300 Cable D15 4m	4
06AFS313-5	AT1300 Cable D15 5m	5
06AFS313-6	AT1300 Cable D15 6m	6
06AFS313-7	AT1300 Cable D15 7m	7
06AFS313-8	AT1300 Cable D15 8m	8
06AFS313-9	AT1300 Cable D15 9m	9
06AFS313-12	AT1300 Cable D15 12m	12

Yaskawa connector specifications



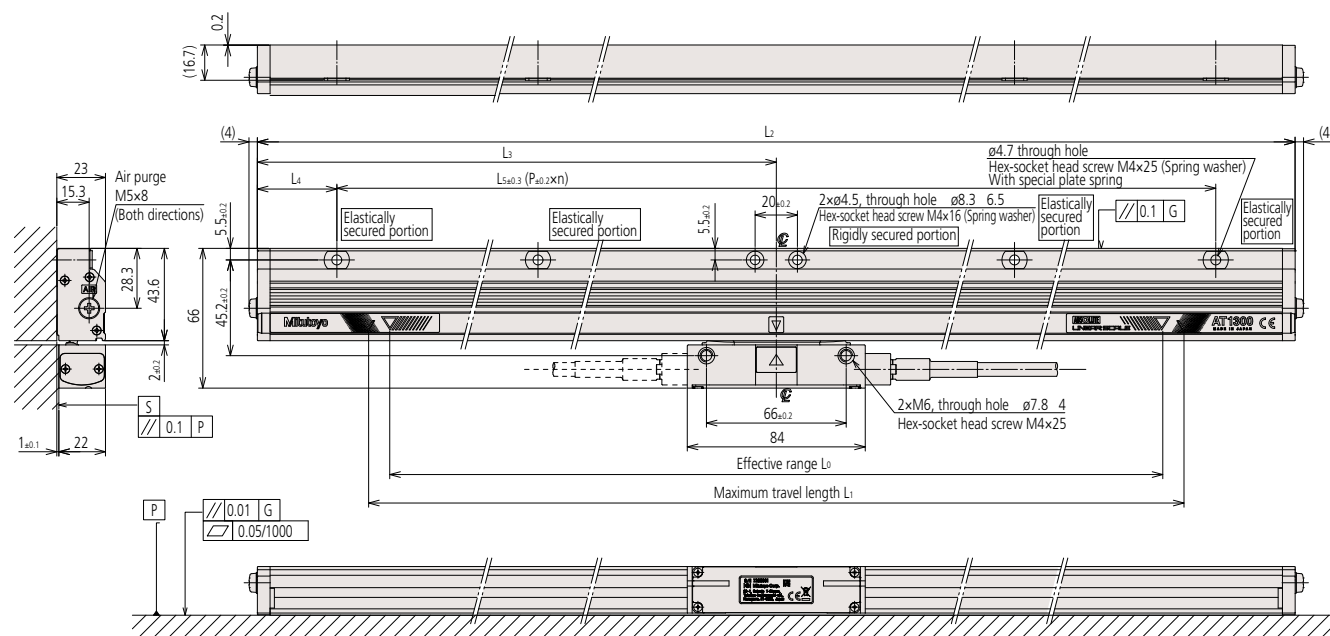
Order No.	Model	Cable length (m)
06AGN986-1	AT1300 Cable YASKAWA 1 m	1
06AGN986-2	AT1300 Cable YASKAWA 2 m	2
06AGN986-3	AT1300 Cable YASKAWA 3 m	3
06AGN986-4	AT1300 Cable YASKAWA 4 m	4
06AGN986-5	AT1300 Cable YASKAWA 5 m	5
06AGN986-6	AT1300 Cable YASKAWA 6 m	6
06AGN986-7	AT1300 Cable YASKAWA 7 m	7
06AGN986-8	AT1300 Cable YASKAWA 8 m	8
06AGN986-9	AT1300 Cable YASKAWA 9 m	9
06AGN986-12	AT1300 Cable YASKAWA 12 m	12

ABS AT1300 Series

Mounting dimensions

Unit: mm

ABS AT1300-S Series



1. G represents the machine guide.
2. P indicates the mating surface for mounting the aluminum frame.
S indicates the mating surface for mounting the detector head.
3. For the dimensions L0 to L5, P and in the figure, refer to the Dimensions list.

Dimensions

Resolution: 0.05 μ m

Order No.	Model	Effective range L ₀ (mm)	Maximum travel length L ₁ (mm)	Overall length L ₂ (mm)	Distance to the center point L ₃ (mm)	Mounting pitch L ₄ (mm)	Mounting pitch L ₅ (mm)	Mounting pitch P (mm)	n
559-500-□3	ABS AT13□3(A)-100-S	100	120	225	112.5	37.5	150	75	2
559-502-□3	ABS AT13□3(A)-200-S	200	220	325	162.5	37.5	250	125	2
559-504-□3	ABS AT13□3(A)-300-S	300	320	425	212.5	37.5	350	175	2
559-506-□3	ABS AT13□3(A)-400-S	400	420	525	262.5	62.5	400	200	2
559-508-□3	ABS AT13□3(A)-500-S	500	520	625	312.5	62.5	500	125	4
559-509-□3	ABS AT13□3(A)-600-S	600	620	725	362.5	62.5	600	150	4
559-510-□3	ABS AT13□3(A)-700-S	700	720	825	412.5	62.5	700	175	4
559-512-□3	ABS AT13□3(A)-800-S	800	820	925	462.5	62.5	800	200	4
559-513-□3	ABS AT13□3(A)-900-S	900	920	1025	512.5	62.5	900	150	6
559-514-□3	ABS AT13□3(A)-1000-S	1000	1020	1125	562.5	37.5	1050	175	6
559-515-□3	ABS AT13□3(A)-1100-S	1100	1120	1225	612.5	87.5	1050	175	6
559-516-□3	ABS AT13□3(A)-1200-S	1200	1220	1325	616.5	62.5	1200	200	6
559-517-□3	ABS AT13□3(A)-1300-S	1300	1320	1425	712.5	112.5	1200	150	8
559-518-□3	ABS AT13□3(A)-1400-S	1400	1420	1525	762.5	62.5	1400	175	8
559-519-□3	ABS AT13□3(A)-1500-S	1500	1520	1625	812.5	112.5	1400	175	8
559-520-□3	ABS AT13□3(A)-1600-S	1600	1620	1725	862.5	62.5	1600	200	8
559-521-□3	ABS AT13□3(A)-1800-S	1800	1820	1925	962.5	87.5	1750	175	10
559-522-□3	ABS AT13□3(A)-2000-S	2000	2020	2125	1062.5	62.5	2000	200	10
559-523-□3	ABS AT13□3(A)-2200-S	2200	2220	2325	1162.5	112.5	2100	175	12

A numeral for symbol □ in each Order No. and Model No. indicates the following.

- 0: Supports Mitutoyo ENSIS high-speed serial interface
- 3: Supports Mitsubishi Electric Corporation (MDS-D/MDS-DH Series), high-speed serial interface
- 4: Supports Mitsubishi Electric Corporation (MELSERVO MR-J4 Series), high-speed serial interface
- 5: Supports FANUC CORPORATION, high-speed serial interface
- 8: Supports Yaskawa Electric Corporation, high-speed serial interface

Resolution: 0.01 μm

Order No.	Model	Effective range L_0 (mm)	Maximum travel length L_1 (mm)	Overall length L_2 (mm)	Distance to the center point L_3 (mm)	Mounting pitch L_4 (mm)	Mounting pitch L_5 (mm)	Mounting pitch P (mm)	n
559-500-□4	ABS AT13□4(A)-100-S	100	120	225	112.5	37.5	150	75	2
559-502-□4	ABS AT13□4(A)-200-S	200	220	325	162.5	37.5	250	125	2
559-504-□4	ABS AT13□4(A)-300-S	300	320	425	212.5	37.5	350	175	2
559-506-□4	ABS AT13□4(A)-400-S	400	420	525	262.5	62.5	400	200	2
559-508-□4	ABS AT13□4(A)-500-S	500	520	625	312.5	62.5	500	125	4
559-509-□4	ABS AT13□4(A)-600-S	600	620	725	362.5	62.5	600	150	4
559-510-□4	ABS AT13□4(A)-700-S	700	720	825	412.5	62.5	700	175	4
559-512-□4	ABS AT13□4(A)-800-S	800	820	925	462.5	62.5	800	200	4
559-513-□4	ABS AT13□4(A)-900-S	900	920	1025	512.5	62.5	900	150	6
559-514-□4	ABS AT13□4(A)-1000-S	1000	1020	1125	562.5	37.5	1050	175	6
559-515-□4	ABS AT13□4(A)-1100-S	1100	1120	1225	612.5	87.5	1050	175	6
559-516-□4	ABS AT13□4(A)-1200-S	1200	1220	1325	616.5	62.5	1200	200	6
559-517-□4	ABS AT13□4(A)-1300-S	1300	1320	1425	712.5	112.5	1200	150	8
559-518-□4	ABS AT13□4(A)-1400-S	1400	1420	1525	762.5	62.5	1400	175	8
559-519-□4	ABS AT13□4(A)-1500-S	1500	1520	1625	812.5	112.5	1400	175	8
559-520-□4	ABS AT13□4(A)-1600-S	1600	1620	1725	862.5	62.5	1600	200	8
559-521-□4	ABS AT13□4(A)-1800-S	1800	1820	1925	962.5	87.5	1750	175	10
559-522-□4	ABS AT13□4(A)-2000-S	2000	2020	2125	1062.5	62.5	2000	200	10
559-523-□4	ABS AT13□4(A)-2200-S	2200	2220	2325	1162.5	112.5	2100	175	12

Resolution: 0.001 μm

Order No.	Model	Effective range L_0 (mm)	Maximum travel length L_1 (mm)	Overall length L_2 (mm)	Distance to the center point L_3 (mm)	Mounting pitch L_4 (mm)	Mounting pitch L_5 (mm)	Mounting pitch P (mm)	n
559-500-□7	ABS AT13□7(A)-100-S	100	120	225	112.5	37.5	150	75	2
559-502-□7	ABS AT13□7(A)-200-S	200	220	325	162.5	37.5	250	125	2
559-504-□7	ABS AT13□7(A)-300-S	300	320	425	212.5	37.5	350	175	2
559-506-□7	ABS AT13□7(A)-400-S	400	420	525	262.5	62.5	400	200	2
559-508-□7	ABS AT13□7(A)-500-S	500	520	625	312.5	62.5	500	125	4
559-509-□7	ABS AT13□7(A)-600-S	600	620	725	362.5	62.5	600	150	4
559-510-□7	ABS AT13□7(A)-700-S	700	720	825	412.5	62.5	700	175	4
559-512-□7	ABS AT13□7(A)-800-S	800	820	925	462.5	62.5	800	200	4
559-513-□7	ABS AT13□7(A)-900-S	900	920	1025	512.5	62.5	900	150	6
559-514-□7	ABS AT13□7(A)-1000-S	1000	1020	1125	562.5	37.5	1050	175	6
559-515-□7	ABS AT13□7(A)-1100-S	1100	1120	1225	612.5	87.5	1050	175	6
559-516-□7	ABS AT13□7(A)-1200-S	1200	1220	1325	616.5	62.5	1200	200	6
559-517-□7	ABS AT13□7(A)-1300-S	1300	1320	1425	712.5	112.5	1200	150	8
559-518-□7	ABS AT13□7(A)-1400-S	1400	1420	1525	762.5	62.5	1400	175	8
559-519-□7	ABS AT13□7(A)-1500-S	1500	1520	1625	812.5	112.5	1400	175	8
559-520-□7	ABS AT13□7(A)-1600-S	1600	1620	1725	862.5	62.5	1600	200	8
559-521-□7	ABS AT13□7(A)-1800-S	1800	1820	1925	962.5	87.5	1750	175	10
559-522-□7	ABS AT13□7(A)-2000-S	2000	2020	2125	1062.5	62.5	2000	200	10
559-523-□7	ABS AT13□7(A)-2200-S	2200	2220	2325	1162.5	112.5	2100	175	12

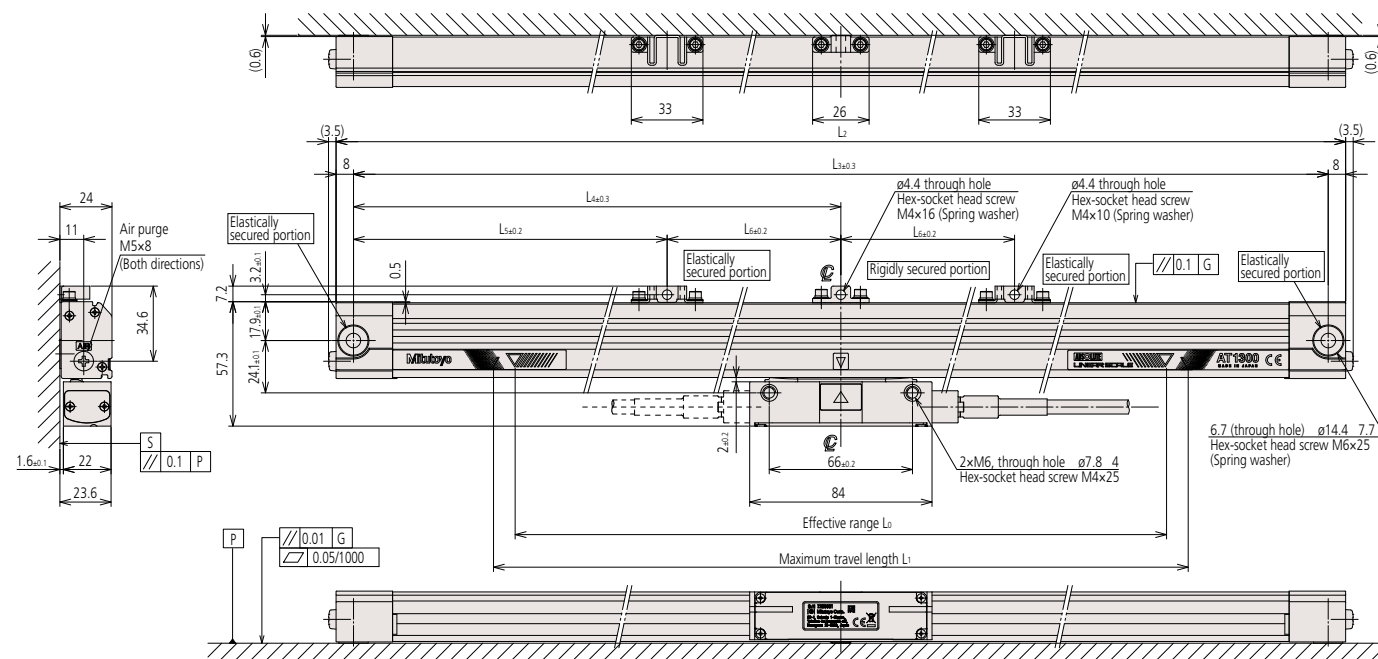
A numeral for symbol □ in each Order No. and Model No. indicates the following.

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- 3: Supports Mitsubishi Electric Corporation (MDS-D/MDS-DH Series), high-speed serial interface
- 4: Supports Mitsubishi Electric Corporation (MELSERVO MR-J4 Series), high-speed serial interface
- 5: Supports FANUC CORPORATION, high-speed serial interface
- 8: Supports Yaskawa Electric Corporation, high-speed serial interface

ABS AT1300 Series

Mounting dimensions

ABS AT1300-H Series



1. G represents the machine guide.
2. P indicates the mating surface for mounting the aluminum frame.
S indicates the mating surface for mounting the detector head.
3. For the dimensions L_0 to L_6 , P and in the figure, refer to the Dimensions list.

Dimensions

Resolution: 0.05 μm

Order No.	Model	Effective range L ₀ (mm)	Maximum travel length L ₁ (mm)	Overall length L ₂ (mm)	Distance to the center point L ₄ (mm)	Mounting pitch L ₃ (mm)	Mounting pitch L ₅ (mm)	Mounting pitch L ₆ (mm)
559-524-□3	ABS AT13□3(A)-100-H	100	120	265	124.5	249	—	—
559-525-□3	ABS AT13□3(A)-150-H	150	170	315	149.5	299	—	—
559-526-□3	ABS AT13□3(A)-200-H	200	220	365	174.5	349	—	—
559-527-□3	ABS AT13□3(A)-250-H	250	270	415	199.5	399	—	—
559-528-□3	ABS AT13□3(A)-300-H	300	320	465	224.5	449	—	—
559-529-□3	ABS AT13□3(A)-350-H	350	370	515	249.5	499	—	—
559-530-□3	ABS AT13□3(A)-400-H	400	420	565	274.5	549	—	—
559-531-□3	ABS AT13□3(A)-450-H	450	470	615	299.5	599	—	—
559-532-□3	ABS AT13□3(A)-500-H	500	520	665	324.5	649	—	—
559-533-□3	ABS AT13□3(A)-600-H	600	620	765	(374.5)	749	204.5	170
559-534-□3	ABS AT13□3(A)-700-H	700	720	865	(424.5)	849	224.5	200
559-535-□3	ABS AT13□3(A)-750-H	750	770	915	(449.5)	899	224.5	225
559-536-□3	ABS AT13□3(A)-800-H	800	820	965	(474.5)	949	224.5	230
559-537-□3	ABS AT13□3(A)-900-H	900	920	1065	(524.5)	1049	264.5	260
559-538-□3	ABS AT13□3(A)-1000-H	1000	1020	1165	(574.5)	1149	284.5	290

A numeral for symbol □ in each Order No. and Model No. indicates the following.

- 0: Supports Mitutoyo ENSIS high-speed serial interface
- 3: Supports Mitsubishi Electric Corporation (MDS-D/MDS-DH Series), high-speed serial interface
- 4: Supports Mitsubishi Electric Corporation (MELSERVO MR-J4 Series), high-speed serial interface
- 5: Supports FANUC CORPORATION, high-speed serial interface
- 8: Supports Yaskawa Electric Corporation, high-speed serial interface

Resolution: 0.01 μm

Order No.	Model	Effective range L_0 (mm)	Maximum travel length L_1 (mm)	Overall length L_2 (mm)	Distance to the center point L_4 (mm)	Mounting pitch L_3 (mm)	Mounting pitch L_5 (mm)	Mounting pitch L_6 (mm)
559-524-□4	ABS AT13□4(A)-100-H	100	120	265	124.5	249	—	—
559-525-□4	ABS AT13□4(A)-150-H	150	170	315	149.5	299	—	—
559-526-□4	ABS AT13□4(A)-200-H	200	220	365	174.5	349	—	—
559-527-□4	ABS AT13□4(A)-250-H	250	270	415	199.5	399	—	—
559-528-□4	ABS AT13□4(A)-300-H	300	320	465	224.5	449	—	—
559-529-□4	ABS AT13□4(A)-350-H	350	370	515	249.5	499	—	—
559-530-□4	ABS AT13□4(A)-400-H	400	420	565	274.5	549	—	—
559-531-□4	ABS AT13□4(A)-450-H	450	470	615	299.5	599	—	—
559-532-□4	ABS AT13□4(A)-500-H	500	520	665	324.5	649	—	—
559-533-□4	ABS AT13□4(A)-600-H	600	620	765	(374.5)	749	204.5	170
559-534-□4	ABS AT13□4(A)-700-H	700	720	865	(424.5)	849	224.5	200
559-535-□4	ABS AT13□4(A)-750-H	750	770	915	(449.5)	899	224.5	225
559-536-□4	ABS AT13□4(A)-800-H	800	820	965	(474.5)	949	224.5	230
559-537-□4	ABS AT13□4(A)-900-H	900	920	1065	(524.5)	1049	264.5	260
559-538-□4	ABS AT13□4(A)-1000-H	1000	1020	1165	(574.5)	1149	284.5	290

Resolution: 0.001 μm

Order No.	Model	Effective range L_0 (mm)	Maximum travel length L_1 (mm)	Overall length L_2 (mm)	Distance to the center point L_4 (mm)	Mounting pitch L_3 (mm)	Mounting pitch L_5 (mm)	Mounting pitch L_6 (mm)
559-524-□7	ABS AT13□7(A)-100-H	100	120	265	124.5	249	—	—
559-525-□7	ABS AT13□7(A)-150-H	150	170	315	149.5	299	—	—
559-526-□7	ABS AT13□7(A)-200-H	200	220	365	174.5	349	—	—
559-527-□7	ABS AT13□7(A)-250-H	250	270	415	199.5	399	—	—
559-528-□7	ABS AT13□7(A)-300-H	300	320	465	224.5	449	—	—
559-529-□7	ABS AT13□7(A)-350-H	350	370	515	249.5	499	—	—
559-530-□7	ABS AT13□7(A)-400-H	400	420	565	274.5	549	—	—
559-531-□7	ABS AT13□7(A)-450-H	450	470	615	299.5	599	—	—
559-532-□7	ABS AT13□7(A)-500-H	500	520	665	324.5	649	—	—
559-533-□7	ABS AT13□7(A)-600-H	600	620	765	(374.5)	749	204.5	170
559-534-□7	ABS AT13□7(A)-700-H	700	720	865	(424.5)	849	224.5	200
559-535-□7	ABS AT13□7(A)-750-H	750	770	915	(449.5)	899	224.5	225
559-536-□7	ABS AT13□7(A)-800-H	800	820	965	(474.5)	949	224.5	230
559-537-□7	ABS AT13□7(A)-900-H	900	920	1065	(524.5)	1049	264.5	260
559-538-□7	ABS AT13□7(A)-1000-H	1000	1020	1165	(574.5)	1149	284.5	290

A numeral for symbol □ in each Order No. and Model No. indicates the following.

- 0: Supports Mitutoyo ENSIS high-speed serial interface
- 3: Supports Mitsubishi Electric Corporation (MDS-D/MDS-DH Series), high-speed serial interface
- 4: Supports Mitsubishi Electric Corporation (MELSERVO MR-J4 Series), high-speed serial interface
- 5: Supports FANUC CORPORATION, high-speed serial interface
- 8: Supports Yaskawa Electric Corporation, high-speed serial interface

ABS AT1300 Series

ABS AT1300 Signal Check Program

- The ABS AT1300 signal check program can diagnose the scale signal by connecting the ABS AT1300 Series to the conversion unit connected to a PC with the "ABS AT1300 signal check program" installed.

The ABS AT1300 signal check program allows the PC to execute the following.

- 1) Confirm and save the scale signal by "Signal Confirmation".
- 2) Confirm the scale error position by "Position Measurement".
- 3) Check error history by "Error History Check".

Required items

Item	Quantity	Details	Notes
PC*	1	DOS/V (Windows version)	Provided by user
Conversion unit	1	USB-485 (422) DS15P (System Sacom Industry Corp.)	Optional (bundle)
Connection cable A	1	USB cable	
Connection cable B	1	RS-485 cable or RS-422 cable	
Application software	1	ABS AT1300 Signal Check Program	

* This program requires a PC with the following operating environment.

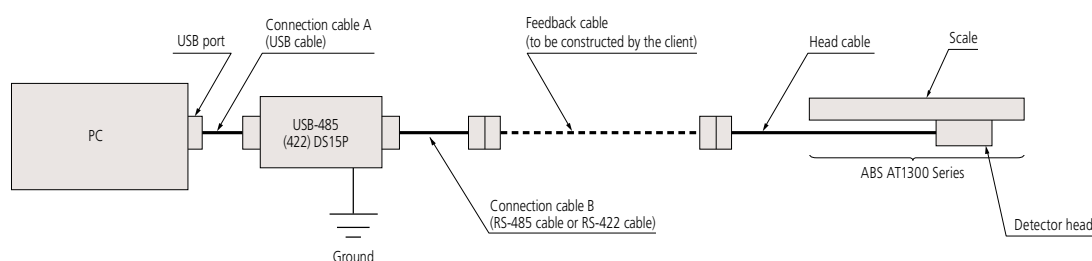
CPU	: 1 GHz or faster
Memory	: 1 GB min.
Program size	: 10 MB
OS	: Windows 7 or later
Monitor	: 1024×768 or higher is recommended

"Conversion unit, application software" set

Order No.	Applicable model	Conversion unit	Connecting cable B
06AGE490	AT1303A AT1304A AT1307A	USB-485 DS15P	MIT cable (Mitutoyo ENSIS)
06AFY987	AT1343A AT1344A AT1347A	USB-485 DS15P	MEL cable (Mitsubishi Electric Corporation)
06AFY988	AT1343 AT1344 AT1347	USB-422 DS15P	MDS cable (Mitsubishi Electric Corporation)
06AFY989	AT1353 AT1354 AT1357	USB-422 DS15P	FANUC cable
06AGQ287	AT1383A AT1384A AT1387A	USB-485 D15P	Y/MAT cable (Yasukawa Electric Corporation)

Note: Each manufacture I/F has different Part No., since connection cable B and Conversion unit are different for each I/F.

Connection details



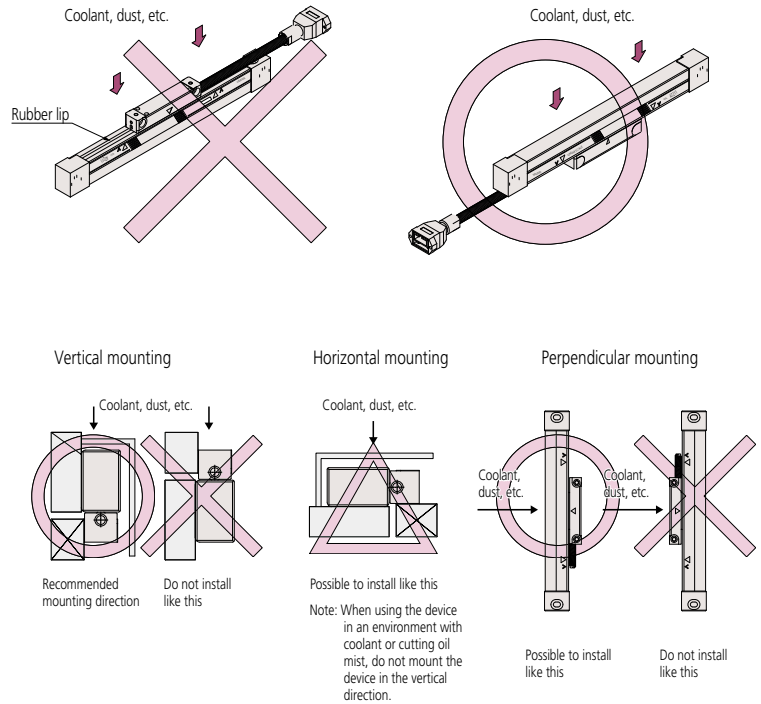
Note: To prevent the possibility of electric shock the device must be grounded.

Handling Linear Scales

Mounting scales

1. AT scale mounting position

The scale unit is designed so that it is difficult for contamination to enter the unit, but determine the mounting position after considering the arrival directions of coolant and dust so that these substances do not come into direct contact with the aperture. Also, be sure to prepare a scale cover.

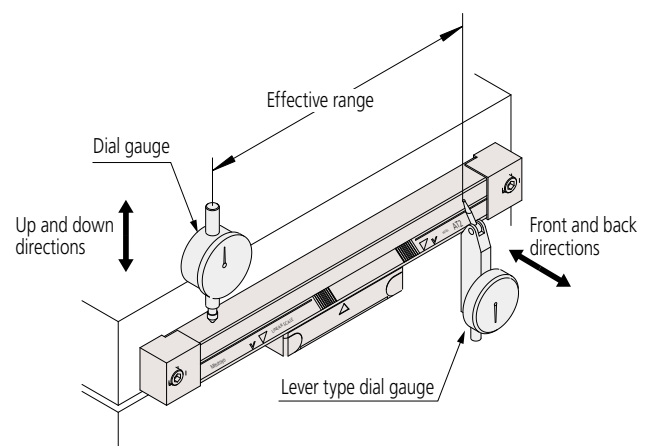


2. Mounting the AT scale unit

As shown in the following figure, use dial gages or similar devices close to the two effective range marks to check and adjust their parallelism with the machine guideway.

To adjust the parallelism: (1) move the mechanically movable parts such as the slide table to adjust the parallelism of the scale unit or (2) measure the position from the mechanism's guide rail or from a corresponding reference.

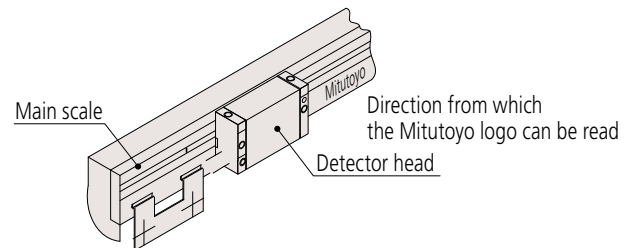
- Permissible parallelism value: Less than 0.1 mm or less than 0.2 mm (This varies depending on the scale model.)



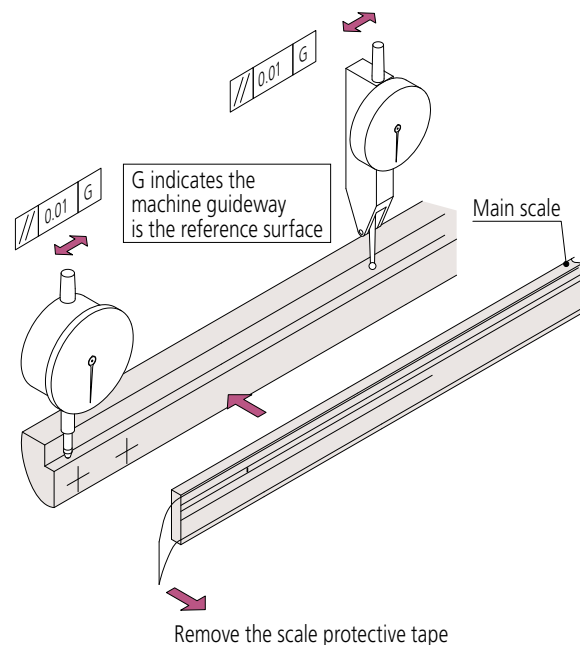
Handling Linear Scales

3. Cautions regarding mounting the ST scale (excluding the ABS ST700)

- Mount the main scale so that the detector head is facing the scale front surface (the surface on which rainbow colors are visible when light strikes the surface at an angle).
(Models that have the Mitutoyo logo on the main scale are mounted correctly when the logo can be read from the detector head side.)
- Ambient light entering from the back of the main scale will cause incorrect operation, so the scale mounting design must ensure that ambient light does not enter.



- Use a tool such as a lever type indicator or dial gage to move the head bracket and the scale mounting relatively in order to check whether the scale mounting surface has been prepared as shown in the mounting diagram.
- Use flexible adhesive with adhesive type scales.
We recommend that you use KE441T manufactured by Shin-Etsu Chemical Co, Ltd.
- Remove the protective tape attached to the glass scale and detector head when you install the device.



Specifications of Air Supply Unit for AT Scale

Supplying clean compressed air to the scale unit is important as a means of improving the environmental resistance (resistance to coolant and dust ingress) of assembly-type linear scales. Provide piping to either of the two M5 screw holes situated on both sides of the scale unit to enable compressed air delivery.

Note 1: **AT211** (multipoint fixed), **ABS AT1300** and **ABS AT1100** Series are standard equipped with the air supply connector.



This air supply method is an auxiliary measure. The orientation of air supply piping is a matter of importance. Observe the piping orientation described in the manual to implement piping. After the air supply has been started, the air filter must be replaced periodically depending on the degree of contamination of the air source to be used. If a contaminated filter continues to be used this will allow contamination of the scale unit, resulting in failure.

1. Air quality specifications

ISO 8573-1 Class 1.4.1 or equivalent

Maximum particle diameter (μm)	0.1
Minimum-pressure dew point ($^{\circ}\text{C}$)	+3
Oil concentration (mg/m^3)	0.01

2. Air flow rate 10 to 20 L/min (per axis)



This flow rate should be maintained to the degree that air leaks out slightly past the dustproof rubber.

2.1 Using the Mitutoyo-spec fixed reducer (fixed reducer diameter: $\varnothing 0.9$)

Adjust air pressure so that the air flow rate becomes 10 to 20 L/min (per axis).

(TIP) When air pressure is 0.1 MPa for one axis, the airflow rate will be approx. 12.7 L/min.

When air pressure is 0.2 MPa, the airflow rate will be approx. 19 L/min.

2.2 Using any other fixed reducer

Adjust air pressure so that the air flow rate becomes 10 to 20 L/min (per axis).

For the relation between flow rate and air pressure, refer to the flow rate characteristics (relation between flow rate depending on fixed reducer diameter and pressure) published by pneumatic device makers.

2.3 Using a flow regulating valve

Adjust air pressure so that the air flow rate becomes 10 to 20 L/min (per axis).

However, be careful not to supply a large flow of air before adjustment.

Otherwise damage may occur, resulting in a failure.

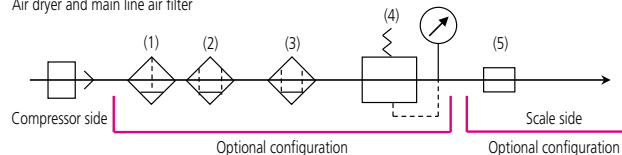
3. Air Supply Unit

[For a typical linear scale]

Be sure to use dry compressed air through an air dryer and a main line air filter without directly supplying air from the compressor. Replace each filter element every year. Mount the fixed reducer on the scale side.

CKD Corporation air supply unit

Air dryer and main line air filter



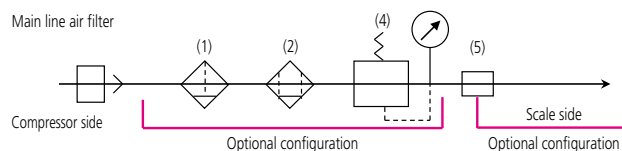
[For ABS AT1100 Series]

The **ABS AT1100** Series does not need an air dryer and a high-performance oil mist filter.

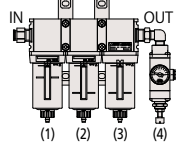
Be sure to use dry compressed air through a main line air filter without directly supplying air from the compressor.

CKD Corporation air supply unit

Main line air filter

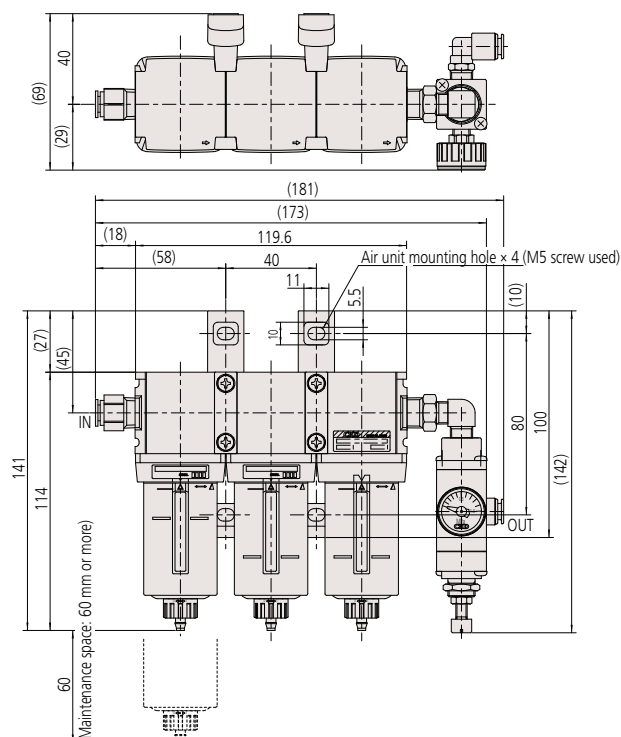


Specifications of Air Supply Unit for AT Scale

No	Configuration element	Specifications	Part No.	
			Order No. (Mitutoyo)	Maker's model No. (Maker name)
(1)	Air filter	<ul style="list-style-type: none"> Used fluid: Compressed air Maximum allowable working pressure: 1.0 MPa Guaranteed safe pressure: 1.5 MPa Maximum particle diameter (filterability): 5 μm Secondary oil concentration: — 	—	F1000-8-W (CKD)
(2)	Oil mist filter	<ul style="list-style-type: none"> Used fluid: Compressed air Maximum allowable working pressure: 1.0 MPa Guaranteed withstanding pressure: 1.5 MPa Maximum particle diameter (filterability): 0.3 μm Secondary oil concentration: 0.01 mg/m³ or less Element replacement: Every year (6000 hours) or upon pressure drop of 0.1 MPa 	—	M1000-8-W (CKD)
(3)	High-performance oil mist filter	<ul style="list-style-type: none"> Used fluid: Compressed air Maximum allowable working pressure: 1.0 MPa Guaranteed safe pressure: 1.5 MPa Maximum particle diameter (filterability): 0.01 μm Secondary oil concentration: 0.001 mg/m³ or less Element replacement: Every year (6000 hours) or upon pressure drop of 0.1 MPa 	—	MX1000-8-W (CKD)
(4)	Regulator	<ul style="list-style-type: none"> Used fluid: Compressed air Maximum allowable working pressure: 1.0 MPa Guaranteed withstanding pressure: 1.5 MPa Settable pressure range: 0.1 to 0.7 MPa Banned-oil processing type 	—	RA-050-L (CKD)
(5)	Fixed reducer	<ul style="list-style-type: none"> Used fluid: Air Usable pressure range: 0.1 to 0.9 MPa Screw clamping torque: 1.0 to 1.5 N·m Flow rate at pressure of 0.1 MPa: Approx. 12.7 L/min Flow rate at pressure of 0.2 MPa: Approx. 19 L/min (per axis) 	06ACJ155	PC6-M5M-0.9 (Pisco custommade part)
(1) to (4)	Air unit ((1) Air filter + (2) Oil mist filter + (3) High-performance oil mist filter + (4) Regulator)	<ul style="list-style-type: none"> ISO -8573-1 Class 1.4.1 or equivalent Maximum particle diameter (filterability): 0.01 μm Minimum pressure dew point: — Oil concentration (oil mist concentration): 0.001 mg/m³ or less Pressure: Flow rate at pressure of 0.1 MPa: 12.7 L/min (per axis) Maximum air flow rate: 75 L/min Replacement cycle of each filter element: Yearly 	06ACJ154	—

Air Unit Dimensions

Unit: mm



4. Connection Method

Be sure to use dry compressed air through an air dryer and a main line air filter without directly supplying air from the compressor.

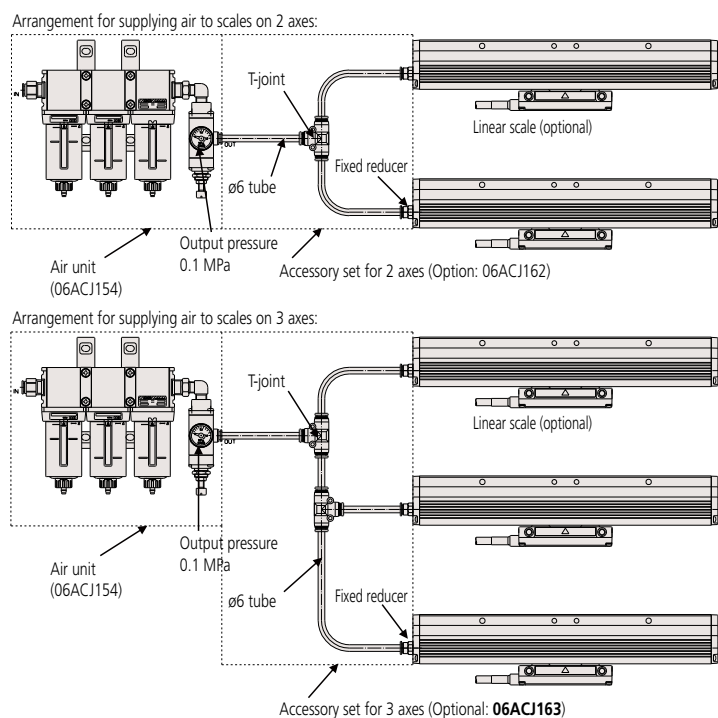
Also, mount the fixed reducer on the scale side.



One air supply unit allows connection of scales on up to 5 axes.

Accessory sets for 2 axes and 3 axes are available. The combination of these 2 sets allows a maximum 4 or 5 axes to be connected. $\phi 6$ air tubes 20 m in length are supplied with each accessory set.

Supply air to each linear scale for approx. 30 minutes prior to use. It is also recommended to supply air to each scale for approx. 30 minutes after use to provide further protection to the scale.



5. Air Supply Unit Configuration and Maintenance Parts

Order No.	Name/Packaged items	Remarks
06ACJ154	Air unit (Appendix (1) to (4))	Optional accessory (extra-cost)
06ACJ162	Accessory set for 2 axes/Fixed reducer: 2 pcs., $\phi 6$ urethane tube: 20 m, T-joint (2 pcs., one is a spare)	
06ACJ163	Accessory set for 3 axes/Fixed reducer: 3 pcs., $\phi 6$ urethane tube: 20 m, T-joint (3 pcs., one is a spare)	
06ACJ155	Fixed reducer/PC6-M5M-0.9 or equivalent (Appendix (5))	Maintenance parts (extra-cost)
06ACJ159*	Air filter element (CKD)/F1000-ELEMENT-ASSY (for the first step)	
06ACJ160*	Mist separator element (CKD)/M1000-MANTLE-ASSY (for the second step)	
06ACJ161*	Micro-mist separator element (CKD)/MX1000-MANTLE-ASSY (for the third step)	

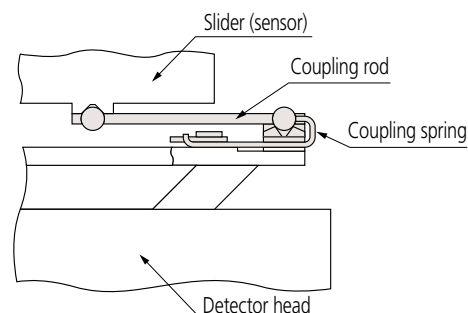
* Replace the elements of 06ACJ159, 06ACJ160 and 06ACJ161 every year.
The replacement cycle differs depending on the usage and circumstances.

Note: For the maintenance method, confirm with the User's Manual supplied with the scale unit.

Structure and features of the assembly type linear scale (AT)

1. AT series detector joint mechanism (Adoption of simple joint structure offering high rigidity)

The detector head and slider (sensor) of the scale unit are connected by the joint shown in the following figure. Because of this structure, if values are less than or equal to the scale mounting standard values, detector head mounting errors and parallelism differences between the scale unit and the machine guideway are absorbed, and normal operation is assured. Also, the simple and highly rigid structure provides superior durability.



2. Advantage of special waterproof connectors

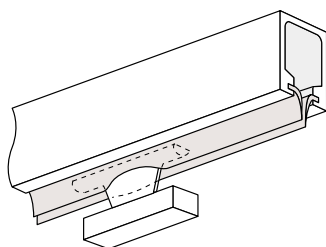
Adopting waterproof and oilproof connectors makes it possible to separate the signal cable. In turn, this makes installation and maintenance easy.

3. Signal cable conduit

Signal cables that are enclosed in a stainless-steel, spiral cover (conduit), for protection, are also available. The conduit will not rust or corrode, so these signal cables can be used over an extended period.

4. Adoption of rubber lip thrust method (Mitutoyo's proprietary technology)

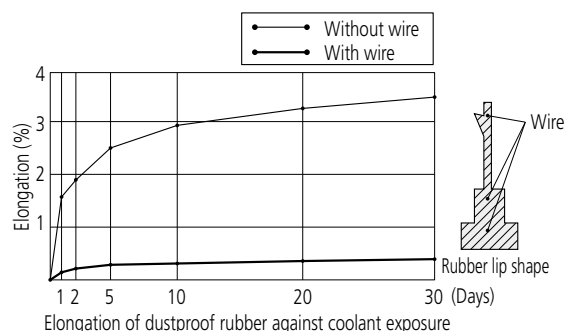
The thrust part (see the following figure) pushes aside the rubber seal like a ship's keel pushes aside water.



5. Adoption of specially formed urethane rubber lip with reinforcing wire

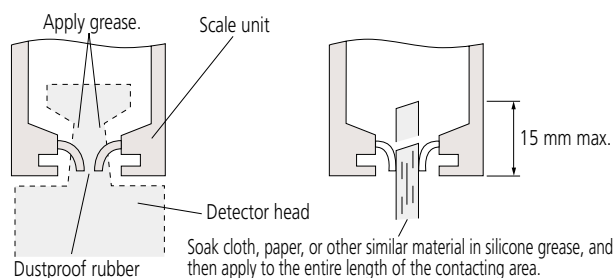
Resistance to oil and dust has been improved.

Note: Can be specially ordered for the AT113 and AT211.



6. Maintenance of the dustproof rubber

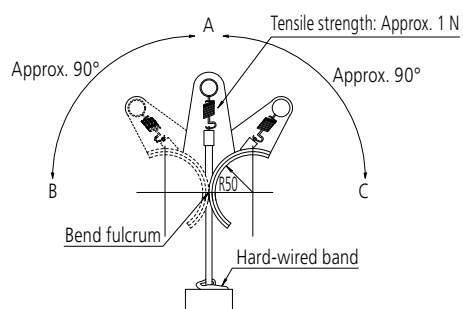
To maintain the dustproof property of the rubber seal and extend its life, apply a small amount of good-quality silicone grease (such as G-30L made by Shin-Etsu Chemical Co, Ltd.) to the contacting area of the rubber and detector head once a year. (The maintenance interval will vary slightly according to the operating conditions of the scale.)



Durability of cables used with the linear scale

The life expectancy of the linear scale cables has been tested using the methods shown below.

Test method A



Test conditions

Bend angle: $\pm 90^\circ$

Test speed: 30 times per minute

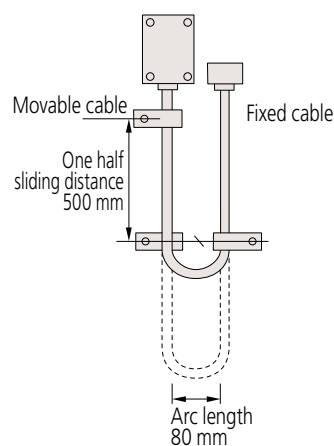
(For the number of bends, A, B, A, C, and then A represents one bend.)

Bend radius: $R = 50 \text{ mm}$

Evaluation standard value: 3000000 times

(No breaks in the signal wires or shield)

Test method B



Test conditions

Bend radius: $R = 40 \text{ mm}$

Speed: 2 m/s

Travel distance: 1000 mm

Scales	Test method	Signal cable* ¹ test result
AT100 Series	A	3 million times
AT211	A	
ST36	B	40 million times or more
ST700 Series	B	
ST1300 Series	B	
AT1100 Series	B	30 million times or more* ²
AT1300 Series	B	

*1 Also including the head cable

*2 Testing still ongoing as of July 2020

Note 1: The test data stated above does not represent guaranteed values.

Depending on the bend conditions, the number of times that the cables can bend without failure may be less than indicated.

Note 2: When bending cables, the recommended bend radius is 100 mm or more.

Alarm functions

1. Detection of detector disconnection and short-circuit errors

Disconnection of and short circuits to 0 V of the phase A and phase B signal lines from the linear scale as well as other similar errors are detected.

2. Detection of excess response speed of detector feed (over-speed)

The feed speed of the linear scale (detector) exceeding the maximum feed speed as well as other similar errors are detected.

3. Detection of input signal errors

The amplitude voltage, DC voltage, or phase difference of the phase A and phase B signals from the linear scale being outside of the corresponding allowable range as well as other similar errors are detected.

4. Drop in line voltage

The line voltage supplied to the linear scale, PSU, and other devices (particularly devices that use a DC power supply) dropping below the allowable range is detected as an error.

5. Detection of momentary power failures

A momentary power failure or voltage drop greater than the allowable range occurring in the power supply that is being supplied to the PSU, counter, or other device (devices that use an AC power supply) is detected as an error.

6. Detection of scale errors

Errors that occur inside the linear scale are detected.

7. Detection of detector circuit errors

Errors caused by the incremental count or absolute count in absolute linear scales are detected.

8. Detection of CPU errors (detection of internal errors)

For linear scales, counters, and other devices that use CPUs, the CPU stopping operating normally is detected as an error.



The alarm functions vary according to the product. For details, see the alarm functions available with each product. Also note that the allowable ranges used to detect alarms vary according to the product.

Alarm detection functions available with each product

(1) Alarm functions on the AT scales (sinusoidal signal output type) + PSU-200

Scale code	Alarm function				
	Detected inside the scale		Detected inside the PSU		
	Scale error	Over-speed	Input signal error	Detection of scale errors	Disconnection or short circuit in signal cable
AT113	Yes				
PSU-200		Yes	Yes	Yes	Yes
PSU-250 Series		Yes	Yes	Yes	Yes

(2) Alarm functions on the AT scales (square wave signal output type)

Scale code	Alarm function	
	Detected inside the detector head (inside the I/F on the AT212)	
	Over-speed	Input signal error
AT211	Yes	Yes

(3) Alarm functions on the ST scales (sinusoidal signal output type) + PSU-200

Scale code	Alarm function				
	Detected inside the scale		Detected inside the PSU		
	Scale error	Over-speed	Input signal error	Detection of scale errors	Disconnection or short circuit in signal cable
ST36A	Yes				
PSU-200		Yes	Yes	Yes	Yes
PSU-250 Series		Yes	Yes	Yes	Yes

(4) Alarm functions on the ST scales (square wave signal output type)

Scale code	Alarm function		
	Detected inside the I/F		
	Over-speed	Input signal error	Disconnection or short circuit in signal cable
ST36	Yes	Yes	Yes
ST46-EZA	Yes	Yes	Yes

(5) Alarm functions on the absolute scales

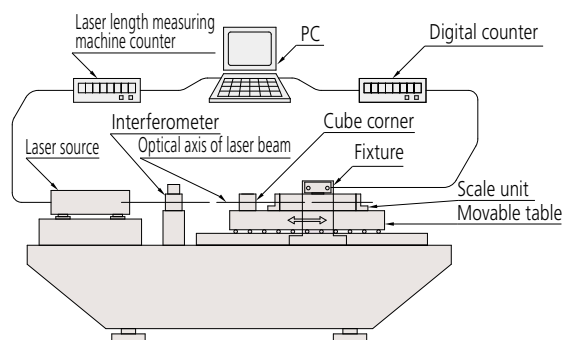
Scale code	Alarm function				
	Detected inside the I/F				
	Scale error	Over-speed	Input signal error	Detector circuit error	CPU error
ABS ST700 Series	Yes	Yes	Yes	Yes	Yes
ABS ST1300 Series	Yes	Yes	Yes	Yes	Yes
ABS AT1300 Series	Yes	Yes	Yes	Yes	Yes
ABS AT1100 Series	Yes	Yes	Yes	Yes	Yes

Explanation of terms

Linear scale accuracy

1) Linear scale indication accuracy

As shown in Figure 1, the accuracy of a linear scale is determined by comparing the positional value indicated by the linear scale with the reference value from a laser length measuring machine at regular intervals using the accuracy inspection system. The inspection environment temperature is 20 °C, so the accuracy is at this temperature. The inspections are performed with other inspection conditions and standard values that comply with Mitutoyo's internal standards.



[Figure 1] Linear scale accuracy inspection device, overview

The accuracy (error) at each measured point is determined according to the following formula.

Error = reference value indicated by the laser length measuring machine – Corresponding value indicated by the linear scale

Here, the words "accuracy" and "error" have the same meaning.

We refer to the plot on a graph of the error at each measured point in the effective range as an accuracy chart.

Based on this accuracy chart, the accuracy of the linear scale is noted as the range between the maximum error and minimum error. There are the following two notation methods.

(1) Note the size of the range between the maximum error and minimum error as 'a'. The value 'a' shown in Figure 2-1 indicates the accuracy.

This standard value is indicated using the conversion formula $(\alpha + \beta L) \mu\text{m}$. Here, L is the effective range (in mm) and α and β are coefficients that are set on each model.

For example, for a linear scale with an accuracy standard value of $(3 + 3L/1000) \mu\text{m}$ and an effective range L of 1000 mm, 'a' is 6 μm .

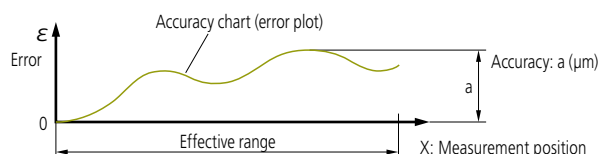
(2) Note the size of the range between the maximum error and minimum error as ' $\pm a/2$ '. The center value between the maximum error and minimum error is 0, the maximum value is noted as '+a/2', the minimum value is noted as '-a/2', and the size of the error range is noted as ' $\pm a/2$ '. This notation is mainly applied to ST scales.

In notations (1) and (2), 'a' in (1) and ' $\pm a/2$ ' in (2) are the same accuracy standard value.

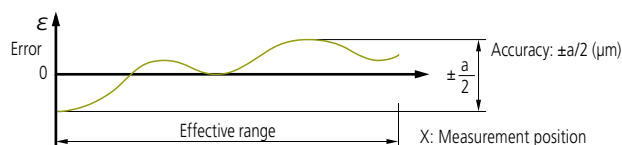
Linear scales use a straight-line scale that has fixed-pitch graduations as the reference to detect the amount of movement and the amount of change in position. By detecting graduations, a linear scale obtains 2-phase sinusoidal signals that have the same pitch as the graduations. The linear scale is designed so that it can perform readings with greater detail than the straight-line scale by interpolating this sine wave signal with an electronic circuit. Interpolation means that these 2-phase sinusoidal signals are interpolated, and the result is divided into pulse signals corresponding to the resolution. For example, if the graduation pitch is 20 μm , readings can be performed with a resolution of 1 μm .

Here, error within the graduation pitch range will occur according to the accuracy of this interpolation processing. This is called interpolation accuracy.

The accuracy standard value of a linear scale includes the aforementioned errors inspected at fixed intervals and interpolation accuracy.



[Figure 2-1] Accuracy notation method (1)



[Figure 2-1] Accuracy notation method (2)

Serial interface

This refers to a communication channel in which digital data is transmitted sequentially 1 bit at a time. While it has inferior real-time characteristics, the advantages are that it requires less wiring and has high reliability. (This is the main communication method for feedback encoders.)

Line-driver output

This refers to signals that are output as square waves. A signal that has the inverted polarity of the output signal is generated, and the difference between these signals is set as the signal (differential signal output). This complies with EIA standards RS-422 and RS-485.

RS-422

This was standardized by the Electronic Industries Alliance (EIA) of the U.S. It is one of the balanced type serial communications standards, and it has excellent noise reducing characteristics. The maximum transmission speed is 10 Mbps, but limitations on the transmission speed arise as the cable length increases.

RS-485

This was standardized by the Electronics Industries Alliance (EIA) of the U.S. It is one of the balanced type serial communications standards, and it ranks higher than RS-422. RS-422 is upwardly compatible with this standard. While RS-422 is a communication standard that supports point-to-point, multi-drop connections, this standard supports bus type multi-point connections and bidirectional communications.

Minimum edge interval

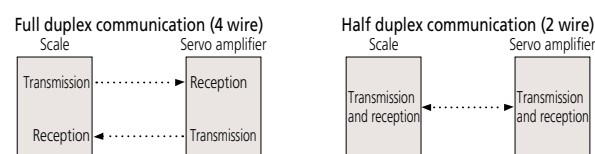
This refers to the minimum time between a rising edge or falling edge of a square wave being output (or input) and the next edge being output (or input). For square wave output type linear scales, even with the same resolution, the shorter the minimum edge interval, the faster the response speed.

Thermal expansion coefficient

This refers to the thermal expansion of an object in response to a change in temperature, which is measured as elongation per unit length for each 1 °C increase in temperature of the material.

Full duplex communication (4 wire) and half duplex communication (2 wire)

Full duplex communication refers to a system in which devices (for example, a scale and a servo amplifier) each have two communication lines and can communicate with each other at the same time. On the other hand, half duplex communication refers to a system in which devices have a single communication line, so devices cannot communicate with each other at the same time, and communications can only be sent from a single device at any one time.

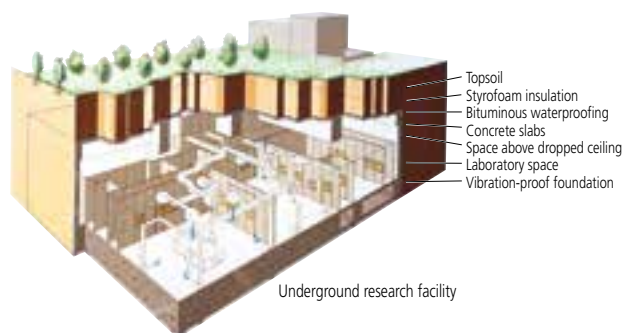


High-Quality Linear Encoder Through Integrated Production

The Utsunomiya Operations Kiyohara Plant presents a complete manufacturing environment where linear encoders for Mitutoyo measuring equipment as well as linear scales for the general market are produced. The whole production process including the manufacturing of glass scales for linear encoders, assembly of electronic components and products, and inspection is performed here. Conditions are continuously being optimized for further enhanced scale accuracy and even higher quality. The underground research laboratory at the Kiyohara Plant has been specially designed and constructed to provide the environment required for the high-level scale graduation process as well as for high-accuracy measurements. Located on a solid bedrock foundation nine meters underground, the facility maintains a stable and tightly controlled environment all year round. Temperature and humidity fluctuations as well as external vibrations are kept to an absolute minimum. In this laboratory, we produce master scales, perform accuracy evaluation, and pursue various kinds of research that provide the underpinning for the accuracy and quality of our linear scales.



Sputtering equipment



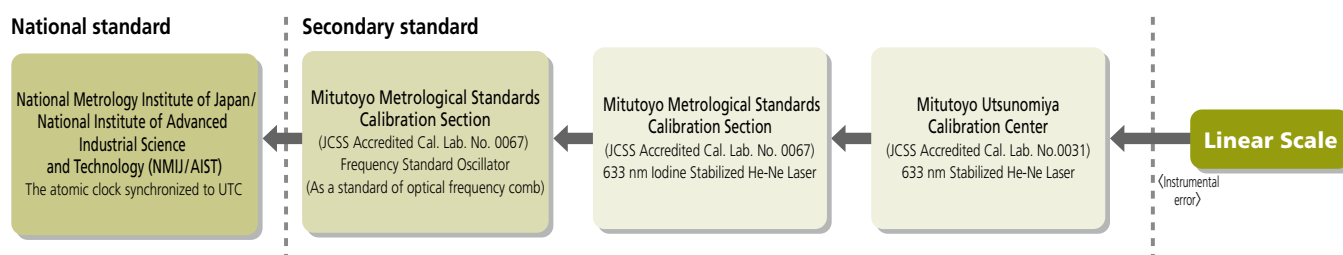
Linear Encoder Accuracy Calibration Technology

To assure high accuracy in linear encoders, a highly reliable calibration system is indispensable. The ultra-precision length measuring machine developed by Mitutoyo and installed in the underground research facility at the Kiyohara Plant benefits from the highly stable underground environment. In addition, the light path of the laser interferometer used to measure lengths is placed in a vacuum to further eliminate any causes of uncertainty. The result is a linear encoder calibration system of world-leading precision, internationally recognized by mutual interlaboratory comparisons. In recognition of the high technological standard realized by this system, it received the Best Paper Award of the Japan Society of Precision Engineering in 2004 and the FA Paper Award of the General Incorporated Foundation in 2005.



Linear Scale Traceability System Chart

Linear Scales from Mitutoyo are traceable to national standards



Linear Scale is a registered trademark of Mitutoyo Corporation for its linear encoder products.

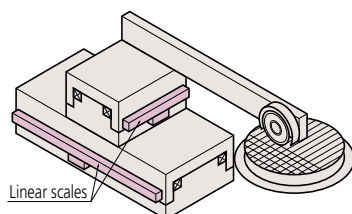
Applications

Linear Scales

AT Series - Reference

Semiconductor fabrication equipment

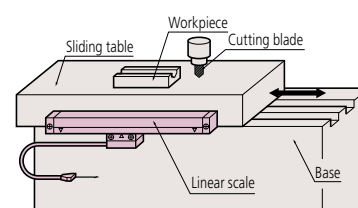
Dicing saw positioning



AT Series - Reference

Various NC machine tools

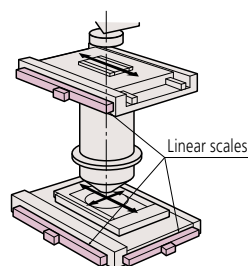
High-precision fully closed loop control



ST Series - Reference

Lithography equipment

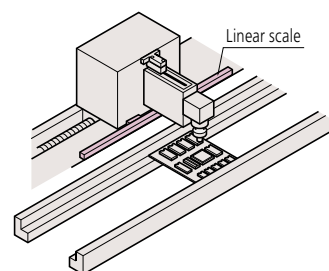
Scanning stage positioning



ST Series - Reference

Electronic component mounting equipment

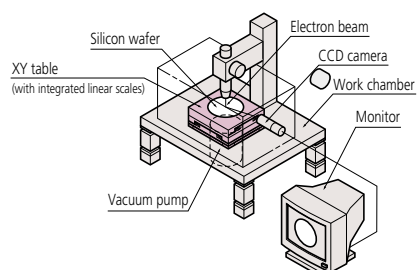
High-speed, high-precision mounting of electronic components



ST Series - Reference

Electron microscope

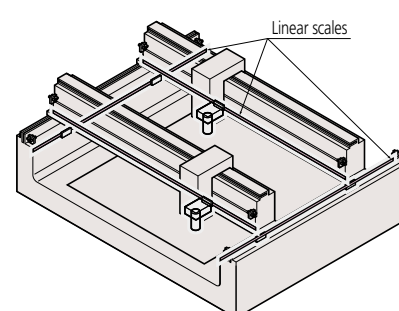
Mask observation, circuit pattern measurement, defect inspection, etc.



ST Series - Reference

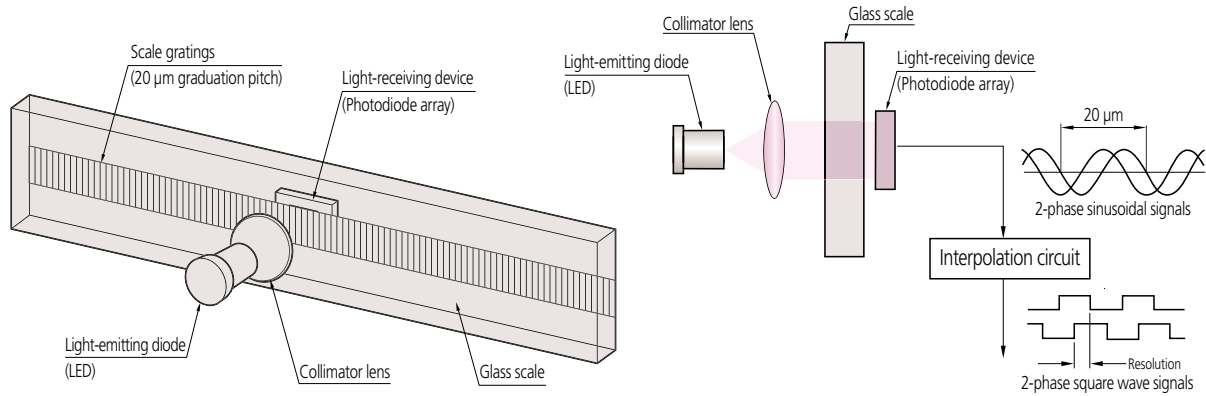
FPD inspection equipment

Defect inspection and repair position determination



Detection Principle

Detection principle of the transmission optical scale(Assembly Type Linear Scale)

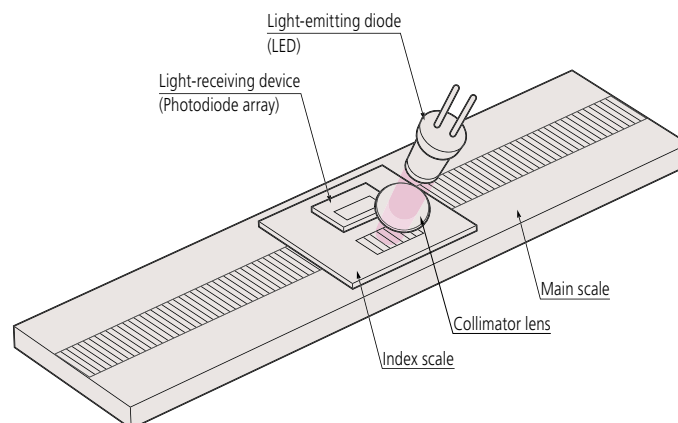


The assembly type linear scale uses a graduated glass scale as measuring length reference. A light-emitting diode (LED) and light-receiving device mounted on opposite sides of the scale serve to detect and detect changes in light intensity and output a value representing the displacement magnitude. Because the change in transmitted light intensity of the glass scale is converted into an electrical signal, the setup is called a transmission optical system.

A parallel light beam generated by the LED and collimator lens is directed through the scale gratings. A light-receiving device consisting of a photodiode array on the other side of the scale receives the parallel light beam and produces interference fringes with a cycle that corresponds to the scale grating pitch. When the glass scale is displaced in the measuring direction, the interference fringes shift, and a 2-phase sinusoidal signal with a cycle that corresponds to the 20 μm pitch of the scale gratings is output by the light-receiving device.

An interpolation circuit electrically divides the output sinusoidal signal, resulting in a square wave (pulse) signal representing the limiting resolution.

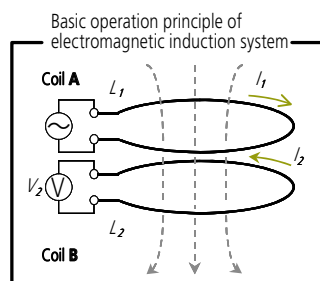
Detection principle of the reflective optical scale (ST36, etc.)



The separate type optical linear scale also uses a graduated glass scale as measuring length reference. An LED and light-receiving device together with gratings on an index scale produce and detect changes in light intensity and output a value representing the displacement magnitude. Because the change in reflected light intensity of the glass scale is converted into an electrical signal, the setup is called a reflective type optical system.

A parallel light beam generated by the LED and collimator lens is directed onto the index scale gratings and the glass scale gratings. The light reflected from the scale gratings produces interference fringes on the photodiode array of the light-receiving device. When the glass scale is displaced in the measuring direction, the interference fringes shift, and a sinusoidal signal with a cycle that is the same as, or one-half of, the scale grating pitch is output by the light-receiving device.

Detection principle of electromagnetic induction scale (ABS ST700, ABS AT1100)

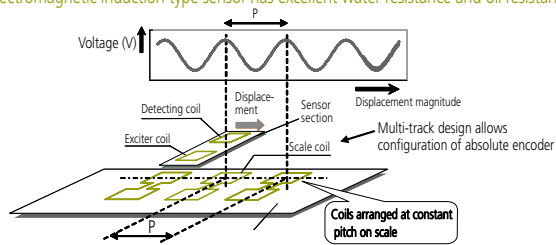


[Figure 1] Electromagnetic induction system encoder principle

When a current (I_1) that changes over time is passed through coil A, a magnetic flux is created in the vicinity of coil A. This causes an inductive current (I_2) to flow in coil B, in a direction that cancels out the magnetic field.

Magnetic permeability between coils is largely identical in air, water, or oil.

Electromagnetic induction type sensor has excellent water resistance and oil resistance.



[Figure 2] Detection principle of electromagnetic induction scale

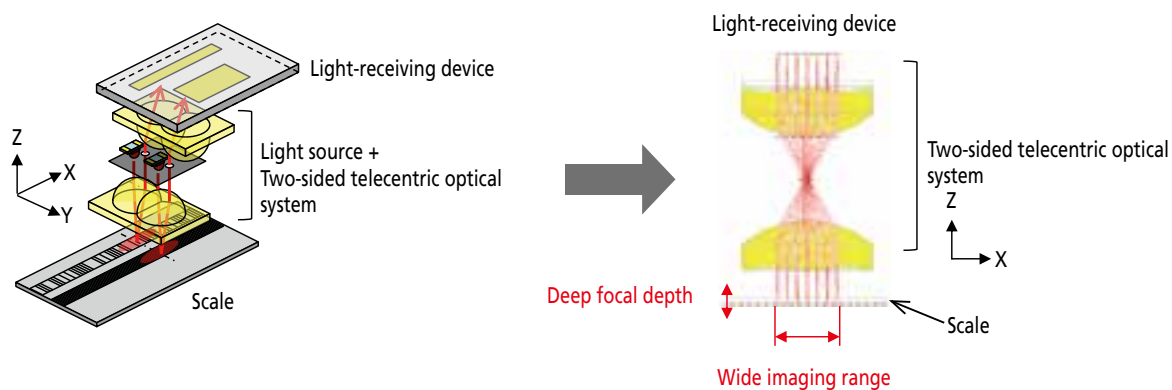
Electromagnetic induction is a phenomenon that occurs, for example, when two coils are arranged facing each other, as shown in Figure 1, and a time-varying current (I_1) is passed through coil A. This will cause an induced current (I_2) to flow in coil B, in a direction that cancels out the magnetic field. The electromagnetic induction type linear scale uses this phenomenon to convert a displacement magnitude into an electrical signal. The operational principle of the sensor section is shown in Figure 2. A number of scale coils are arranged with precise spacing on the main scale. The moveable sensor section that detects displacement carries an exciter coil and a corresponding detector coil. A current is sent through the exciter coil, thereby creating a magnetic flux that induces a current in the facing scale coil. The magnetic flux created in turn by that current induces a current in the facing detector coil. The degree of inductive coupling between the coils changes according to the displacement magnitude of the sensor section, allowing a sinusoidal signal with a cycle that corresponds to the pitch of the scale coils to be obtained.

By using an electrical circuit that performs interpolation (division) of this sinusoidal signal, displacement can be measured with fine resolution.

Detection Principle

Two-sided Telecentric Optical System Principle (ABS ST1300, ABS AT1300)

Linear encoder equipped with two-sided telecentric optical system imaging



Detection Principle

- The scale grating is captured as an image with the two-sided telecentric optical system and its displacement is detected with a light-receiving device.

Features

- Adoption of a two-sided telecentric imaging optical system \Rightarrow Improves the robustness of the encoder.
 - The deep focal depth \Rightarrow Extends allowance for GAP variation (scale waviness and stage orientation variation, detector mounting variation, etc.).
 - The wide imaging range \Rightarrow Extends allowance for contamination, slight damage, etc. on the scale.

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