Mitutoyo

Laser Scan Micrometer <Sensor>

LSM-02-A
LSM-30-A

User's Manual

- Instructions for use -

Read this document thoroughly before operating the product. After reading, retain it close at hand for future reference.
This English language version of the document contains the original instructions.

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Product names and model numbers covered in this document

Product name	Model number
Laser Scan Micrometer <Sensor>	LSM-02-A LSM-30-A

Notice regarding this document

- Mitutoyo Corporation assumes no responsibilities for any damage to the product, caused by its use not conforming to the procedure described in this document.
- Upon loan or transfer of this product, be sure to attach this document to the product.
- In the event of loss or damage to this document, immediately contact the agent where you purchased the product or a Mitutoyo sales office.
- Read this document thoroughly before operating the product. In particular, be sure to fully understand "Safety Precautions" on page 5 and "Precautions for Use" on page 6.
- The contents of this document are based on information current as of June 2023.
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Contents

About This Document

■ Positioning of this document, document map

This describes the positioning of this document and its relationship with other installments.

● Sensor

LSM-02/30-A
Laser Scan Micrometer <Sensor>
User's Manual (This document)

Describes how to connect the laser scan micrometer sensor to the controller and its specifications.

● Controller

LSM-CU-A
Laser Scan Micrometer <Controller>
User's Manual

Describes how to setup and operate the laser scan micrometer controller using LSMPAK.

● I/F module

Describes how to install the optional IF modules to the laser scan micrometer controller and their specifications.

I/F module for Laser Scan Micrometer controller<EtherNet/IP>
User's Manual

I/F module for Laser Scan Micrometer controller<PROFINET>
User's Manual

I/F module for Laser Scan Micrometer controller<EtherCAT>
User's Manual

I/F module for Laser Scan Micrometer controller<CC Link>
User's Manual

■ Intended readers and purpose of this document

● Intended readers

This document is intended for users and administrators of the Laser Scan Micrometer.

● Purpose

This document is aimed at understanding an overview, specifications, and details for the maintenance of the Laser Scan Micrometer <Sensor> as well as precautions to be observed when detaching the emission and reception units from the mount and attaching them to a dedicated fixture for use.

Conventions Used in This Document

■ Safety reminder conventions warning against potential hazards

DANGER	Indicates a hazard with a high level of risk which, if not avoided, **will result in death or serious injury**.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, **could result in death or serious injury**.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, **could result in minor or moderate injury**.
NOTICE	Indicates a situation which, if not avoided, **may result in property damage**.
	**Electricity** Alerts the user to a specific hazardous situation that means "Caution, risk of electric shock".

■ Conventions indicating prohibited and mandatory actions

	Indicates concrete information about prohibited actions.
	Indicates concrete information about mandatory actions.
	Indicates that grounding needs to be implemented.

■ Conventions indicating referential information or reference location

IMPORTANT	Indicates information that must be known when using the product.
Tips	Indicates further information and details relevant for the operating methods and procedures that are explained in that section.
	Indicates reference location if there is information that should be referred to in this document or an extraneous User's Manual. Example: For details about XX, see "1 Appellations for Each Part" on page A-5 in "Part A Overview".

■ Other conventions

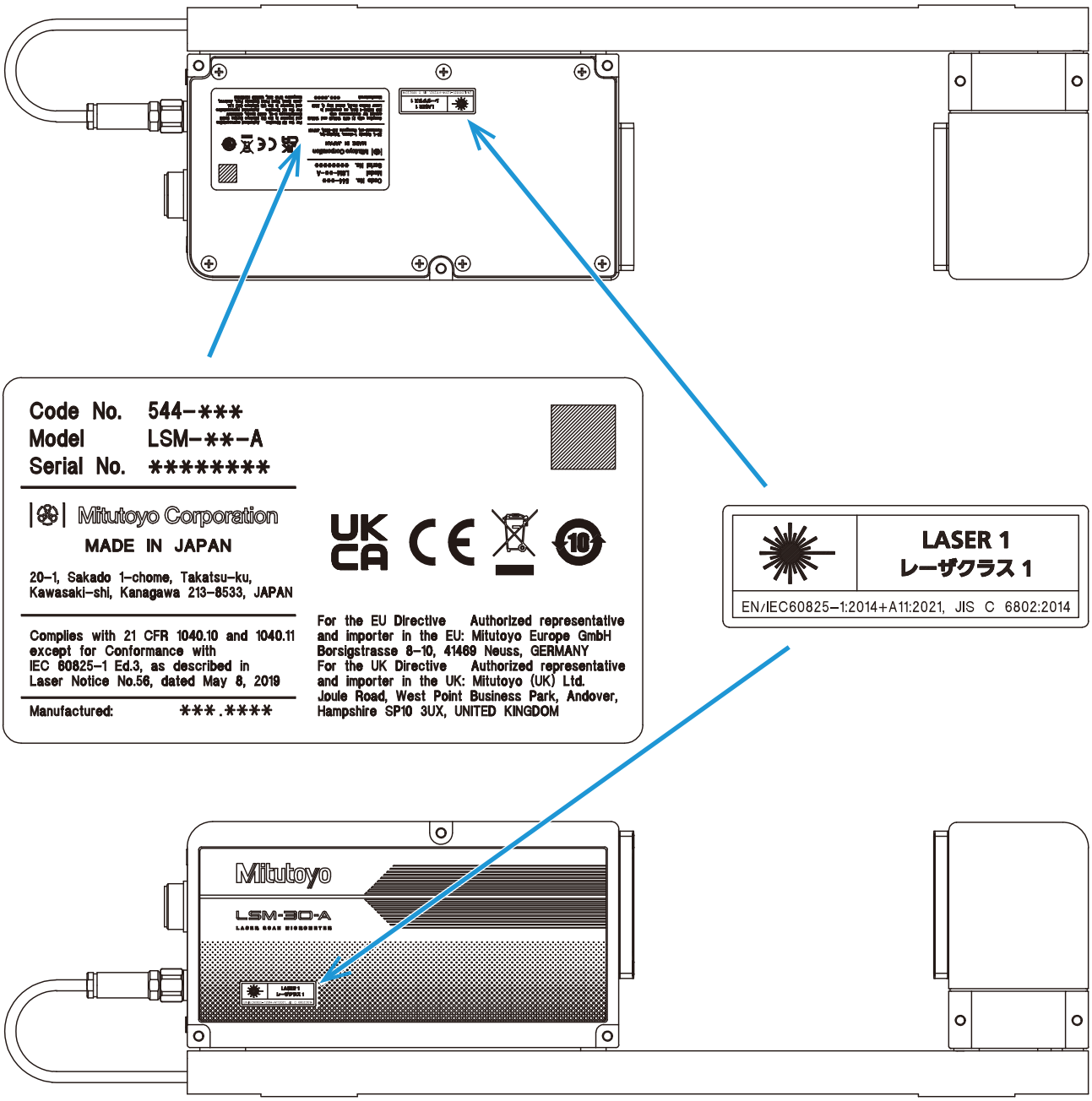
( ): Round brackets	Represent a paraphrase of an immediately preceding phrase or a supplementary explanation.
" ": Double quotation marks	Represent a highlighted phrase. They also indicate an index where information to be referenced is described.
[ ]: Square brackets	Represent a menu name on the screen, screen name, dialog name, button, display item, tab name, or key on the keyboard. They also indicate an item to be purposely entered or selected by the customer.

Labels on Product

Product safety labels

This product has been designed and manufactured with human safety as a priority. In order to use it more safely, product safety labels have been applied to the main body and all peripheral devices. This section explains the meaning and the contents of each safety label on the product.

Before operating this product, be sure to carefully read this section to use this product safely and for a long time.



Safety Precautions

Read these "Safety Precautions" thoroughly before operating the product to use it properly.

These safety precautions include such information as to prevent injury to the operator and other persons, damage to property and product defects. Be sure to observe these precautions carefully.

■ Safety precautions for sensor laser beam

This product uses a visible-light laser. Use of controls, adjustments, or operations other than specified herein may result in hazardous radiation exposure.

⚠CAUTION

- The IEC standard "IEC 60825-1" is used for the safety standard of the laser equipment.
- This is a "Class 1 laser product" in the IEC standard.
- Do not look directly into the laser beam. Never look into the emission window even if it seems that no light is being emitted from there.
- Do not look directly at the laser beam through an optical instrument (magnifying glass or other light-condensing device).
- If the workpiece has a mirror finished surface, avoid looking at the reflection on the surface.
- Never remove laser class identification labels attached to the Sensor.

- Skin irradiation is not a particular problem.

■ Other notes

NOTICE

- Tighten the connector screw of each connecting cable firmly to ensure shielding and waterproof/dustproof. Recommended tightening torque for signal cable: 1.3 N•m Recommended tightening torque for relay cable: 1.0 N•m (LSM-30-A only)
- Never touch the terminal of a connector. Otherwise, contact may be poor.

Unplug the power cord of the controller and then the connection cables when a system failure is encountered.

- Never remove the protective glass. If removed, the protection grade: IP67 is not guaranteed.
- Never disassemble the emission and reception units. If disassembled, the protection grade: IP67 is not guaranteed.
  (The LSM-30-A mount is removable.)

Precautions for Use

■ Use and handling of the product

● Use this product only by connecting to measuring instruments which supports this product.

Do not use this product for measuring instruments which does not support this product.

For measuring instruments supported by this product, contact the agent where you purchased the product or a Mitutoyo sales office.

● This product is for industrial usage.

Do not use this product for purposes other than for industrial usage.

● The product is a precision instrument.

Do not subject the product to drastic shocks such as dropping it, or exert excessive force upon it.

Do not disassemble or modify the product.

If the product is used beyond the conditions indicated in the specifications ("6 Specifications of Sensor" on page 29), be aware that the functions and performance cannot be guaranteed.

■ Environment for placement

This product is a precision optical and electronic instrument intended for indoor use. It must be carefully installed under the following conditions to attain the highest possible accuracy. Mitutoyo assumes no responsibility for accident or failure arising from failure to observe these items.

● Vibration

Install this product in a place where it will not be subject to vibration. If this product is used for an extended period of time in an environment where there is significant vibration, the precision parts in this product may be affected, resulting in the deterioration of measuring accuracy.

If this product has to be used in an environment where vibration is significant, take measures to reduce the effect of vibration such as a vibration damping rubber pad laid under the product.

● Dust・Water

Dust and water at the installation site may adversely affect optical components such as the sensor's protective glass and the accuracy of measurements. Therefore, install the sensor in a place with as little dust and water as possible.

IP 67 does not guarantee use in water. Protection Grade: See IP 67 (For details, see IEC 60529 and JIS C 9020.).

The controller connector of the signal cable and the controller body are not waterproof. Do not use this product if it is exposed to water or oil directly.

● Direct sunlight

Heat from exposure to direct sunlight may deform this product and affect the measuring accuracy.

If this product must be placed by a window where it will be subjected to direct sunlight, protect the product by shading it.

- Air from air-conditioning equipment

  Exposure of the measuring position to warm or cold air from air-conditioning equipment may artificially refract the laser beam due to the unevenness of ambient air concentration, affecting measurement accuracy.

  If this is the case, block the air by curtain or other means.

- Ambient temperature and humidity

  This product must be operated in an environment where the temperature is between 0 and 40 °C and the humidity is between 35 and 85 % RH. Avoid installing this product where there is significant temperature or humidity change, which may reduce measuring accuracy.

■ Cleaning method

For details on the cleaning of this product, see "4 Inspection and Maintenance" on page 25.

■ Warming-up

For stable measurement accuracy, warm up this product for thirty minutes to 1 hour after turning on the power.

Electromagnetic Compatibility (EMC)

This product complies with the EMC Directive and the UK Electromagnetic Compatibility Regulations; however, if this receives electromagnetic interference that exceeds these requirements, it will be out of warranty and require appropriate measures.

This product is an industrial product, and is not intended to be used in residential environment. If this product is used in residential environment, this product may cause electromagnetic interference with other instruments. In such a case, it is required to take appropriate measures for preventing such electromagnetic interference.

Export Control Compliance

This product falls 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.

If you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-provision of the technology (including program), you are obligated to observe the regulations of your country.

Also, if an option is added or modified to add a function to this product, this product may fall under the category of List-Control Goods and/or List-Control Technology (including Programs) under Category 1 - 15 of Appended Table 1 of the Export Trade Control Order or under Category 1 - 15 of the Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Act of Japan. In that case, if you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-provision of the technology (including program), you are obligated to observe the regulations of your country. Please contact Mitutoyo in advance.

Notes on Export to European Countries

When you intend exporting of this product to any of the European countries, it may be required to provide User's Manual(s) in English and Declaration of Conformity in English (in some cases, the official language of the country to be exproted). For detailed information, please contact Mitutoyo in advance.

Disposal of Products outside the European Countries

Please follow the official instruction in each community and country.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Countries with Separate Collection Systems)

This symbol on the product or on its packaging is based on WEEE Directive (Directive on Waste Electrical and Electronic Equipment), and this symbol indicates that this product shall not be treated as household waste.

To reduce the environmental impact and minimize the volume of landfills, please cooperate in reuse and recycle.

For how to dispose of the product, please contact the agent where you purchased the product or a Mitutoyo sales office.

China RoHS Compliance Information

This product meets China RoHS requirements. See the table below.

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
本体	○	○	○	○	○	○
电气设备部分	×	○	○	○	○	○
配件	○	○	○	○	○	○

本表格依据 SJ/T 11364 的规定编制。

○: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

×: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

环保使用期限标识是根据《电器电子产品有害物质限制使用管理办法》以及《电子电气产品有害物质限制使用标识要求(SJ/T11364—2014)》制定的,适用于中国境内销售的电子电气产品的标识。

电器电子产品只要按照安全及使用说明内容在正常使用情况下,从生产日期算起,在此期限内产品中含有的有毒有害物质不致发生外泄或突变,不致对环境造成严重污染或对其人身、财产造成严重损害。

产品使用后,要废弃在环保使用年限内或者刚到年限的产品,请根据国家标准采取适当的方法进行处置。

另外,此期限不同于质量/功能的保证期限。

Warranty

This product has been manufactured under strict quality management, but should it develop problems within one year of the date of purchase in normal use, repair shall be performed free of charge. Please contact the agent where you purchased the product or a Mitutoyo sales office (📖 "SERVICE NETWORK" on page App-1). This warranty, however, shall not affect any provisions of the Mitutoyo Software End User License Agreement.

If this product fails or is damaged for any of the following reasons, it will be subject to a repair charge, even if it is still under warranty.

- Failure or damage owing to fair wear and tear
- Failure or damage owing to inappropriate handling, maintenance or repair, or to unauthorized modification
- Failure or damage owing to transport, dropping, or relocation of the instrument after purchase
- Failure or damage owing to fire, salt, gas, abnormal voltage, lightning surge, or natural disaster
- Failure or damage owing to use in combination with hardware or software other than those designated or permitted by Mitutoyo
- Failure or damage owing to use in ultra-hazardous activities

This warranty is effective only where the instrument is properly installed and operated in conformance with the instructions in this manual within the original country of the installation.

EXCEPT AS SPECIFIED IN THIS WARRANTY, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES OF ANY NATURE WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OR WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW.

You assume all responsibility for all results arising out of its selection of this product to achieve its intended results.

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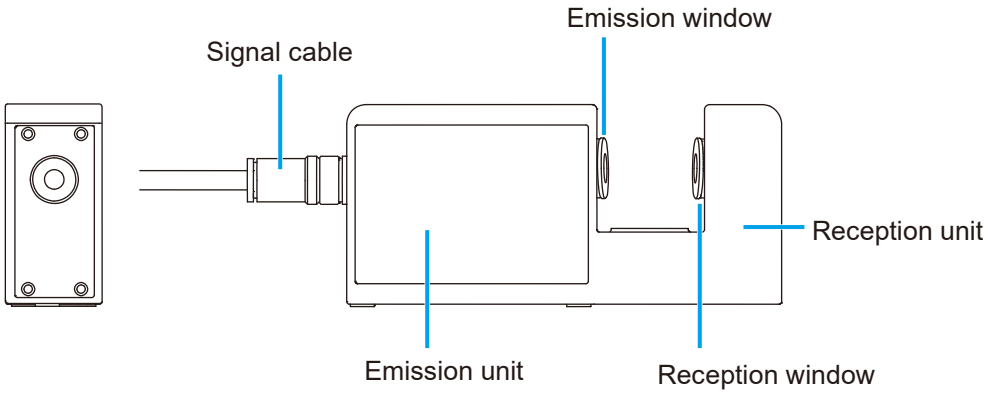
1 Foreword

This product is an accurate, non-contact measurement system capable of measuring dimensions of workpieces by high-speed scanning laser beam. With non-contact measurement capability, this system offers high-precision measurement of workpieces that are difficult for conventional measuring systems to measure, including hot workpieces, brittle or elastic workpieces, workpieces that must be kept free from contamination, and soft workpieces subject to measuring force.

This product comes in two types: the integrated sensor LSM-02-A and the separate sensor LSM-30-A. In addition, this product is connected to the LSM-CU-A controller to be used.

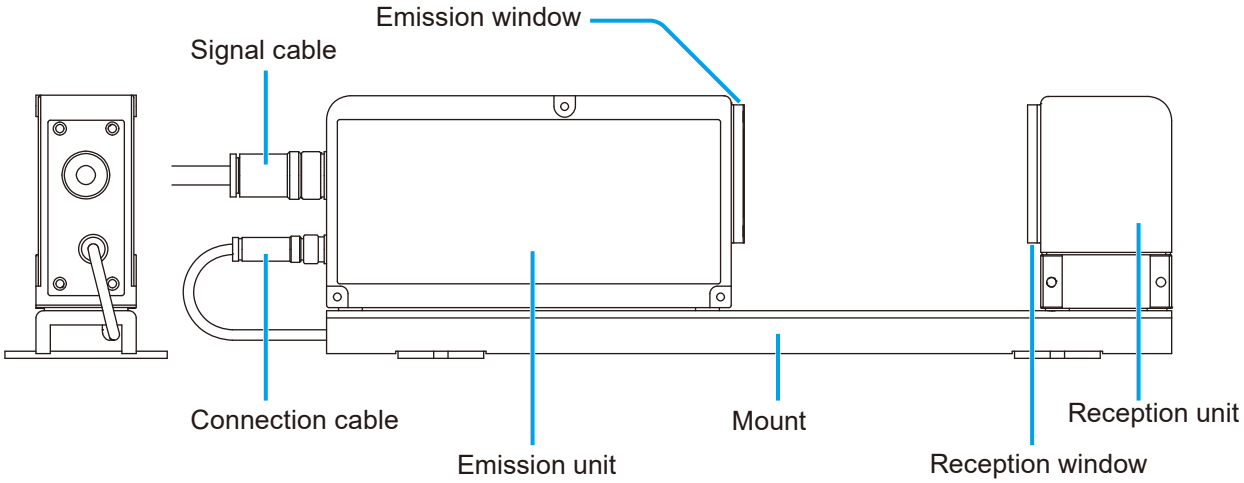
For details on connection with a controller, functions, and measurement procedures, see "Controller User's Manual" of "LSM-CU-A Laser Scan Micrometer"

■ Integrated sensor : LSM-02-A



■ Separable sensor : LSM-30-A

The emission unit and reception unit can be used separately by removing the mount.



MEMO

2 Calibration

Sometimes a measurement error occurs due to the influence of the shape/material/surface state of a workpiece, installation situations, combination of the controller and sensor. To reduce such error to perform measurement with higher accuracy, be sure to perform calibration before measurement. The measurement accuracy of this product has been verified by two-point calibration using two reference gages.

For details on the calibration operation, see 📖 "Controller User's Manual" of "LSM-CU-A Laser Scan Micrometer".

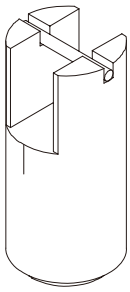
IMPORTANT

- When the customer prepares a gauge or workpiece for calibration, the size ratio of the HIGH CAL gauge to the LOW CAL gauge should be 1.2 times or more. Measurement accuracy may not be guaranteed if calibrated with a gauge or workpiece with a small diameter difference.
- If a material close to the workpiece is selected as the gauge or workpiece for calibration, more accurate measurement can be performed. If the material is different, measurement accuracy may not be guaranteed due to surface roughness or material differences.

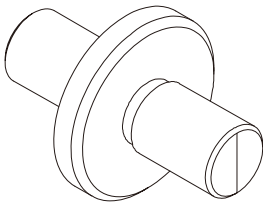
● Types and sizes of the calibration gages (option)

When the calibration gauge set of the standard option is used for calibration, the calibration gauge set to be provided differs depending on the type of sensor used. The size and shape of the calibration gauge set are as follows:

Model		LSM-02-A	LSM-30-A
LOW CAL gage	Size	ø0.1 mm	ø1 mm
	Shape	With-holder type	
HIGH CAL gage	Size	ø2 mm	ø30 mm
	Shape	With-holder type	Stepped type



With-holder type

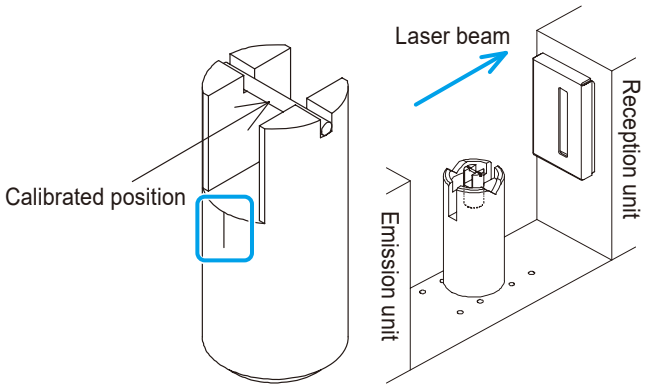


Stepped type

2.1 Calibration Gage (CAL Gage)

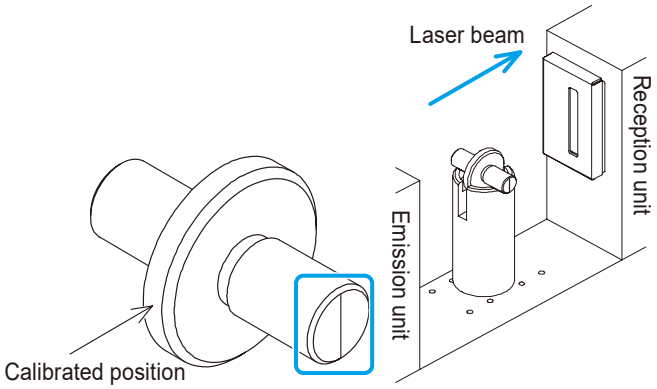
With-holder type

Set the gauge on the gauge stand so that the laser beam hits the "|" mark.



Stepped type

Set the gauge on the gauge stand so that the "|" mark is vertical.



3 Fixture Design

This chapter describes precautions to be observed when attaching the emission and reception units, which have been detached from the mount of the sensor, to a specially arranged dedicated fixture.

IMPORTANT

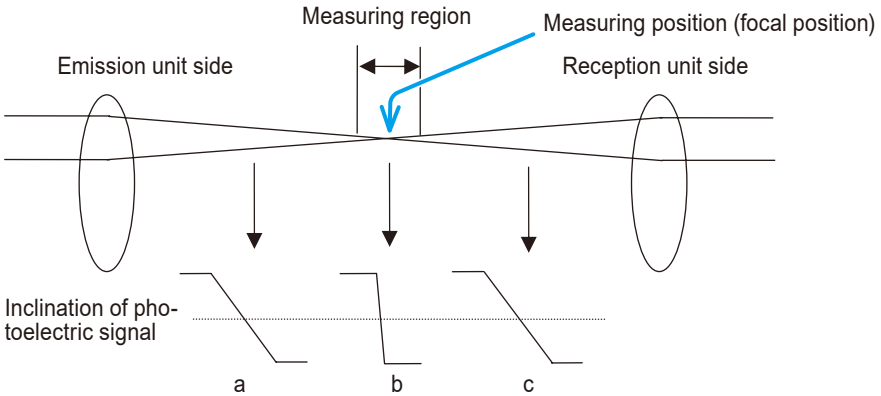
In application, the emission and reception units may have to be detached from the mount of the sensor and attached to a dedicated fixture. If this is the case, the measuring accuracy cannot be ensured unless they are properly aligned on the dedicated fixture. Design a proper fixture according to this section.

3.1 Consideration to Calibration

- When designing a dedicated jig, place the workpiece at the measuring position (focal distance from the light emitting part).
- Be sure to make allowance to install a calibration gauge or workpiece, or a standard calibration gauge set.
  For details on the set of workpieces, see the separate 📖 "Laser Scan Micrometer < Controller > User's Manual".

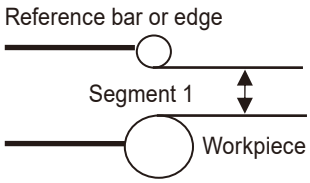
3.1.1 Measuring Position and Resulting Accuracy

- As shown in the figure below, the scanning beam of the sensor is produced by reducing a thick laser beam to a laser beam of the minimum diameter at the measuring position (focal position). Since the inclination of the reception signal is defined as "laser beam diameter/scanning speed", it is the steepest at the measuring position (b) and less steep at points (a) and (c), off from the measuring position.
- The less steep the inclination of the reception signal, the more susceptible the signal is to noise and ambient light, deteriorating the repeat accuracy. Due attention should be paid to ensure that the workpiece is located at the measuring position.



3.1.2 On Measuring Gap

For measuring "segment 1", as in the case of measuring the run-out, be sure to arrange a reference bar or edge at the focal position, as shown on the right.



IMPORTANT

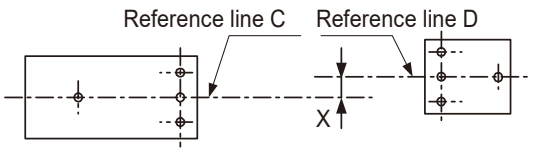
Without a reference bar, the inclination of the reception signal becomes larger, deteriorating repeat accuracy.

For details, see figures (a and c) in "3.1.1 Measuring Position and Resulting Accuracy" on page 15

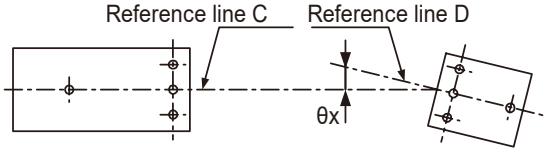
3.2 Optical Axis Alignment

The optical axis of each sensor should be aligned to within the limits shown below.

3.2.1 Optical Axis Alignment in Horizontal Plane

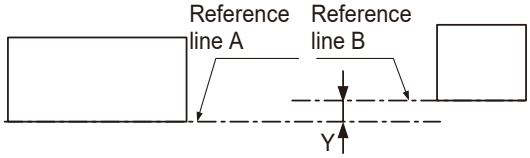


Parallel deviation in reference lines C and D by X in the width direction

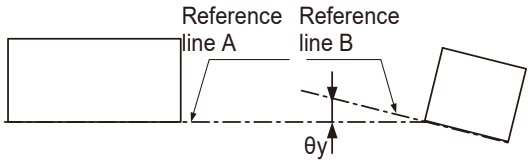


Angular deviation in reference lines C and D by θx in angle

3.2.2 Optical Axis Alignment in Vertical Plane



Parallel deviation in reference planes A and B by Y in height



Angular deviation in reference planes A and B by θy in angle

3.2.3 Permissible Error for Optical Axis Alignment

Model	Distance between emission unit and reception unit	X and Y	θx and θy
LSM-30-A	130 mm or less	1 mm or less	0.4 ° (7 mrad) or less
	350 mm or less	1 mm or less	0.16 ° (2.8 mrad) or less

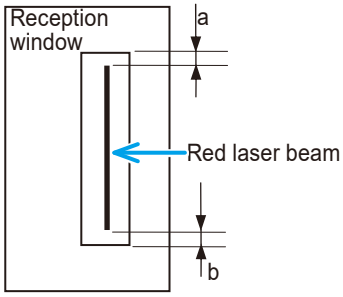
3.3 Confirming the Optical Axis

The optical axis of a sensor can be confirmed by the following methods:

3.3.1 Confirming with the Laser Beam

As shown on the right, the red laser beam is visible on a piece of white paper placed on the reception window. Adjust it so that the incidence of the laser beam is in the center of the reception window.

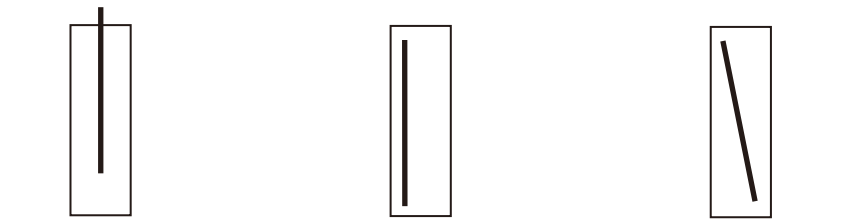
The incidence should be horizontal in the center and at the position where "a" is equal to "b" vertically.



a = b

IMPORTANT

- Make adjustments to reduce the vertical deviation, horizontal deviation, and inclination of the laser beam.



- The laser scanning range is defined by the distance between the emission and reception units mounted on the standard mount. If the distance between them is greater than the standard, a slight machining error will be amplified to an extent that disables the proper reception of the scanning beam. This should be considered when designing a dedicated fixture.

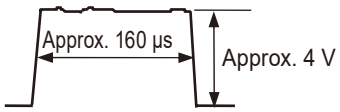
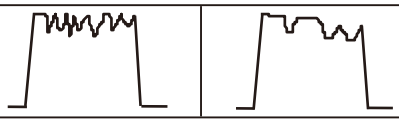
3.3.2 Confirming the Optical Axis with an Oscilloscope

Use the controller I/O interface to check the received signal. Connect pin No. 5 (scan signal output) and pin No. 6 (scan signal output ground) of the I/O terminal block connector to the probe of the oscilloscope to check the received signal.

For details on the I/O interface, see the separate "Laser Scan Micrometer Controller User's Manual."

- Oscilloscope setting
  - Vertical sensitivity: 0.1 V/DIV for a probe of 1/10
  - Horizontal sensitivity: 100 µs/DIV
- Oscilloscope waveform and measure

  If the oscilloscope waveform indicates "Glass contaminated", clean the protective glass.

	Oscilloscope waveform	Measure
Normal		If the light incidence is not normal in relation to the photoelectric element, adjust the mounting position of the emission and reception units to ensure that the light comes to the center of the photoelectric element
Glass contamination		Clean the protective glass to reduce the disorder of the waveform to less than 0.3 V

For details on cleaning the protective glass, see "4.1 Cleaning Optical Parts" on page 25

3.4 Measurement with Two Sensor

This section describes precautions for orthogonal measurement or large diameter measurement with two sensor.

IMPORTANT

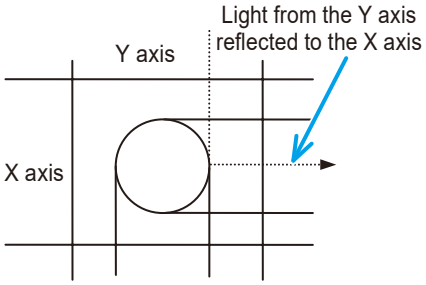
To perform dual measurement with a combination of two sensors, each sensor must have been optically aligned.

For details on optical axis alignment, see "3.2 Optical Axis Alignment" (page 17)

3.4.1 Orthogonal measurement

If a workpiece with a high-reflection coefficient is measured with two sensors being completely crossed (in a orthogonal measurement setup), the scanning beam from one sensor will be reflected into the reception window of the other sensor, reducing the measuring accuracy.

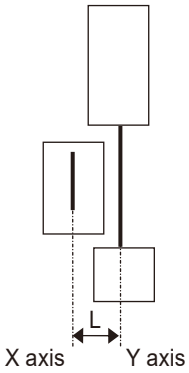
An arrangement is required in such a case so that the light from one sensor will not be reflected from the workpiece into the reception window of the counterpart sensor.



- Arrangement to provide a step

As shown on the right, arrange a step of L between the X and Y axes.

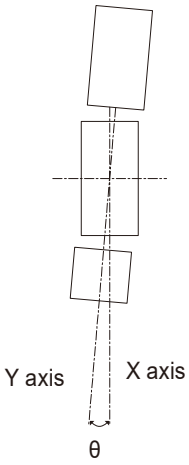
The step L should not be smaller than 10 mm.



- Arrangement to provide an angle

As shown on the right, arrange an angle θ between the X and Y axes.

The angle θ should not be smaller than 15 ° (0.25 rad).



● Checking for reflecting light

This is how to check for reflected light when LSMPAK is used.

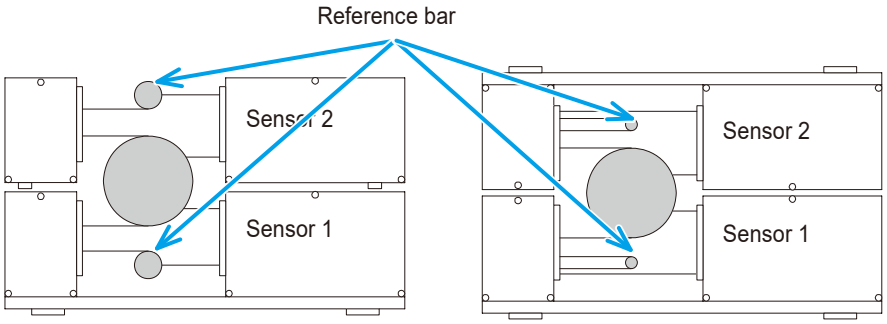
- Set to "Gap (segment 1)" to close the X-axis light emitting section. If there is no reflected light, "E0005 _ Edge Undetected Error" is displayed. Checking the display takes about 5 to 10 minutes because the X-axis and Y-axis scanning lights are not synchronized. Similarly, the Y-axis also checks for reflected light.
  This is how to check for reflected light when LSMPAK is not used.
- Use the controller's I/O interface. Connect pins No. 5 (scan signal output) and No. 6 (scan signal output ground) of the I/O terminal block connector to the oscilloscope probe, and check for reflected light by checking the received signal.
- As a simple measure, you can check for reflected light by applying white paper, such as copy paper or business cards, to the receiver.

3.4.2 Large diameter measurement

In a DF-type setup shown below, a workpiece of a larger diameter can be measured by measuring the gap between the two sensors 1 and 2 and referring to the predetermined offset value of the reference gage.

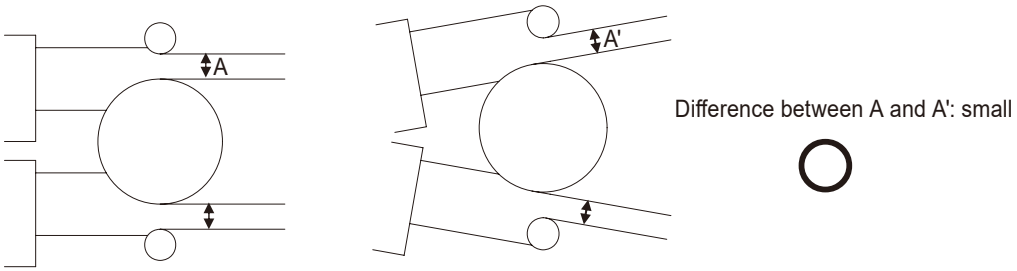
■ Improvement of measurement accuracy

- To ensure better measuring accuracy of the gap measurement, use reference bars or edges located at the focal position.



Example of stacking setup: segment (1 + 5)　　Example of facing setup: segment (1 + 5)

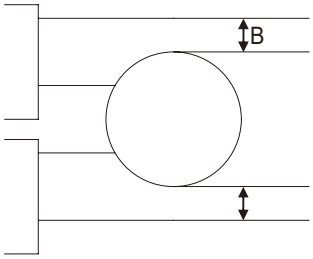
- The reference bar will help reduce the effect of possible fluctuation of the emission unit being subject to a force.



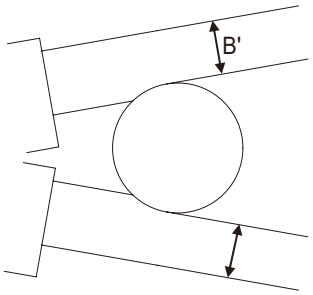
With reference bar
: initial state

With reference bar
: emission unit fluctuated

- In a setup without reference bars, the fluctuation of the emission unit due to external force will produce a significant difference between measurements B and B', as shown below.



Without reference bar
: initial state



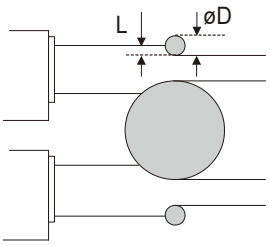
Without reference bar
: emission unit fluctuated

Difference between B and B': large

×

● Size of reference bars

- The diameter of the reference bars should be large enough (approx. 10 mm) to block the laser beam from passing through by more than 2 mm.
- The setup must be fairly robust so that the gap between the reference bars will not change while in service.



■ Parallelism adjustment

Set up two sensors integrating the emission and reception units so that the parallelism of the two sensors can be adjusted.

- First align the optical axis of each sensor, then adjust the parallelism between the two sensors.
- If the parallelism adjustment is inadequate, errors will occur when the workpiece is shifted in the optical axis direction.

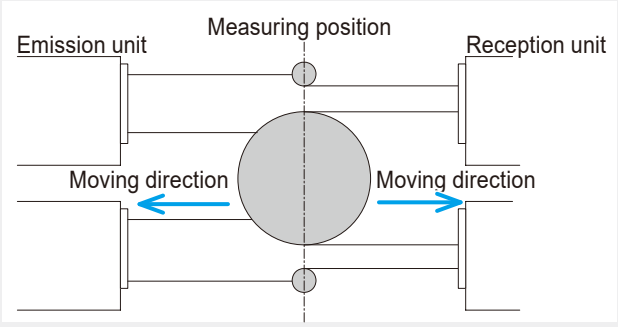
Tips

The proper degree of accuracy depends on user requirements. For reference, three example accuracy ranges are given below.

- Should be ±20 µm–50 µm with the gage shifted within ±50 mm from the measuring position
- Should be ±5 µm–10 µm with the gage shifted within ±10 mm from the measuring position
- Should be ±5 µm–10 µm with the gage shifted within ±5 mm from the measuring position

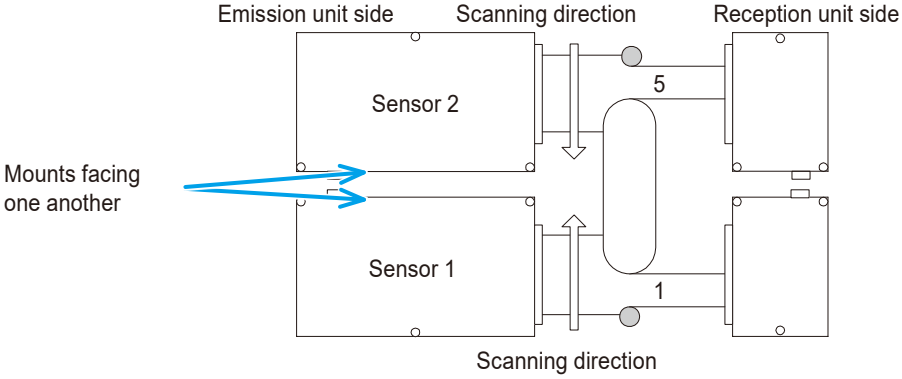
Generally, the larger the amount of shift of the gage, the easier the adjustment will be.

The most appropriate size of the gage is the median value of the measuring range.

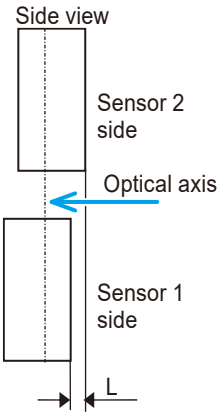


■ Transparent object measurement

- To measure a larger outer diameter transparent glass rod, the external diameter of a plastic object, or the width of a transparent sheet, arrange the sensors with the mounts facing so the scanning laser beams are opposing one another, and set the segment to (1 + 5). Otherwise, measurement may fail.



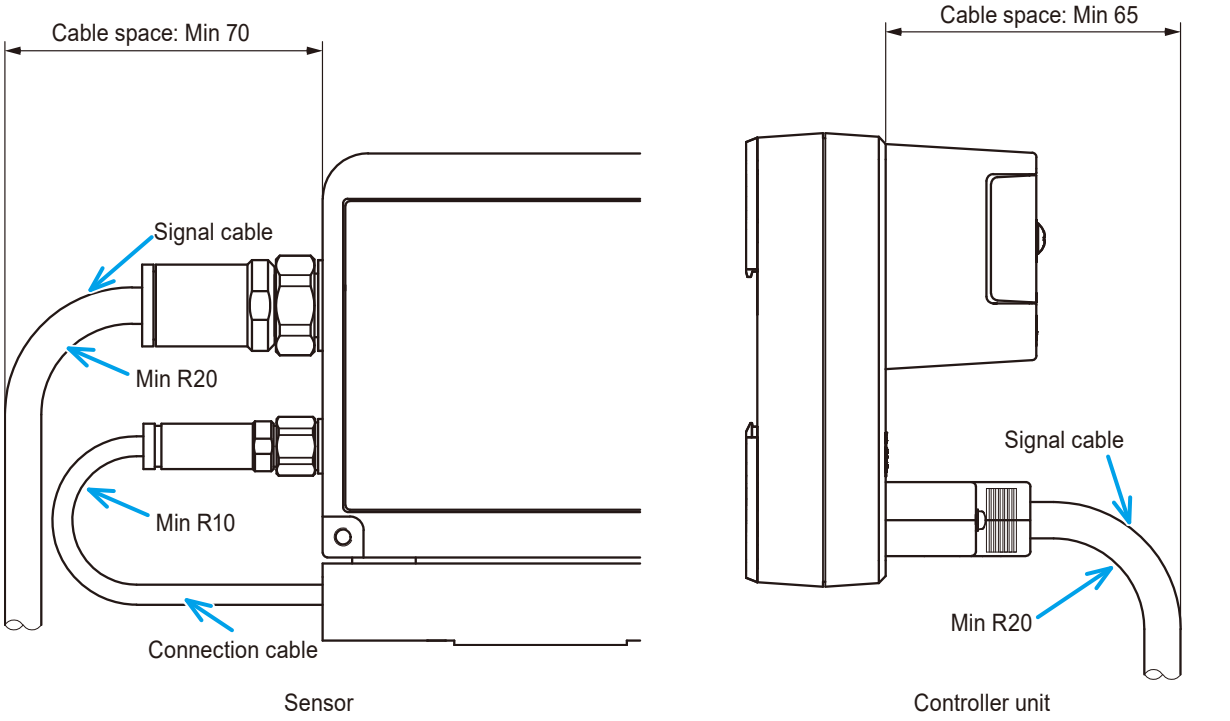
- If two sensors are set up with the mounts facing one another, step L will be produced between the two units, as shown at the right. The step values according to the model are listed below.



Model	Step: L
LSM-02-A	10 mm
LSM-30-A	10 mm

3.5 Radius of Cable Bend

The signal and connection cables will break if bent to an excessively small radius. Allow sufficient space for bending cables according to the figures below.



Unit: mm

IMPORTANT

The supplied cables are not robot cables, which have superior flexibility. Special cables with high flexibility are available at extra cost. Contact a Mitutoyo sales office.

4 Inspection and Maintenance

This section describes the inspection and maintenance procedures for the sensor.

4.1 Cleaning Optical Parts

- Before cleaning the optical parts, turn off the power switch and disconnect the signal cable for safety.
- Always keep the protective glass of the emission and reception units clean.

Never remove the protective glass. If removed, the protection grade: IP67 is not guaranteed.

NOTICE

When cleaning, use a blower brush or gauze containing a small amount of solvent to clean optical components, and wipe gently without applying any force.

Do not use strong organic solvents such as benzene or thinner as they may stain the optical components or the main unit.

IMPORTANT

A soiled protective glass will result in reduced measurement accuracy, and possibly produce erroneous measured values due to dust and foreign particles being treated as part of the workpiece.

● Checking the contamination of the protective glass using an oscilloscope

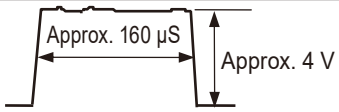
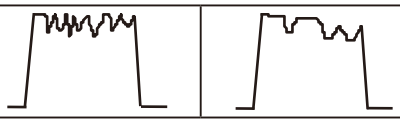
Use the controller I/O interface to check the received signal. Connect pin No. 5 (scan signal output) and pin No. 6 (scan signal output ground) of the I/O terminal block connector to the probe of the oscilloscope to check the received signal.

For details on the I/O interface, see the separate "Laser Scan Micrometer <Controller> User's Manual."

- Oscilloscope setting
  - Vertical sensitivity: 0.1 V/DIV for a probe of 1/10
  - Horizontal sensitivity: 100 µs/DIV

- Oscilloscope waveform and measure

  If the oscilloscope waveform indicates "Glass contaminated", clean the protective glass.

	Oscilloscope waveform	Measure
Normal		-
Glass contamination		Clean the protective glass to reduce the disorder of the waveform to less than 0.3 V

NOTICE

The protective glass of the windows is a precision optical part. Handle with care so as not to scratch the glass.

5 Troubleshooting

This chapter describes issues that may occur with this product and how to solve them.

Issue	Possible cause	Solution
Operation of this product is unstable. • Correct measurement values cannot be obtained. • This product restarts.	This product is receiving electromagnetic interference that exceeds the requirements of the EMC Directive and the UK Electromagnetic Compatibility Regulations.	Eliminate the electromagnetic interference. This product resumes normal operation after the electromagnetic interference is eliminated.
Operation of other devices is unstable. This product is causing loss of specified functionality of other devices.	This product is being used in other than the intended operating environment. This product generates electromagnetic emissions in an industrial environment. This product is not intended for use outside of an industrial environment, and its use in residential areas or other environments may cause electromagnetic interference with other devices.	Implement countermeasures to prevent electromagnetic interference with other devices.

MEMO

6 Specifications of Sensor

This chapter describes the specifications of the following models:

Model	Measuring range	Code No.
LSM-02-A	ø0.005 mm – ø2 mm	544-123
LSM-30-A	ø0.3 mm – ø30 mm	544-124

6.1 LSM-02-A

■ Specifications

Model		LSM-02-A
Code No.		544-123
Applicable controller		LSM-CU-A
Measuring range	mm	0.005–2 0.05–2*1
Minimum readout	µm	0.01
Repeat accuracy (2σ)*2 **Full range(φ2mm)** **Middle range(φ1mm)**	µm	±0.03 *3 ±0.015 *3
Linearity *2	µm	±0.3*4
Positional error *2 *5	µm	±0.4
Measuring region	mm	1 x 2 (Optical axis direction x Scanning direction)
Number of scans for averaging	scans	16–2048*6
Laser classification		Class 1 (maximum power: 1.0 mW, wavelength: 650 nm)
Number of laser scans	scans/s	3200
Laser scanning rate	m/s	76
Protection level		IP67*7
Operating environment	Temperature	0 °C–40 °C
	Humidity	35 %–85 % (relative humidity, no condensation)
	Altitude	2000 m or lower
Storage environment	Temperature	-10 °C–50 °C
	Humidity	35 %–85 % (relative humidity, no condensation)
CE marking/ UKCA marking		EMC Directive/Electromagnetic Compatibility Regulations: EN IEC 61326-1 Immunity test requirement: Clause 6.2 Table2 Emission limit: ClassA RoHS Directive/The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations: EN IEC 63000

*1 Measuring range available when set to "Do not perform ultra-fine wire measurement" or "Edge specification" in the basic setup

*2 Various accuracy tests are performed on glass boards with chromium vapor deposition patterns. Accuracy inspection environment/temperature: 20 °C ±1 °C, humidity: 50% ±10 °C

*3 The value of ±2 σ when a 2 mm-diameter gage has been measured for 2 minutes with a measurement interval of 0.32 seconds, where σ is the standard deviation

*4 The value in the center of the measuring region

*5 Error caused by moving the workpiece in the optical axis direction or scanning direction from the center of the measuring area

*6 The number of scans for averaging between 1 and 8 times is available if "Do not perform ultra-fine wire measurement" is specified in the basic setup. The measuring range, however, is limited to 0.05 mm to 2 mm in this case

*7 IP 67 is not guaranteed to be used while immersed in water.
Protection Grade: See IP 67. (For details, see IEC 60529, JIS C 0920.)
IP6X = Foreign matter protection: no foreign matter inside
IPX7 = Protection against water: no intrusion of water causing harmful effects when temporarily immersed in water at specified pressure and time

■ Standard accessories

Part No.	Item name	Quantity
02AGQ190	Signal cable (5 m)	1
99MBC153B	Quick Start Manual	1
02AGQ039	CD (containing the following files) • User's Manual (PDF) (this document)	1

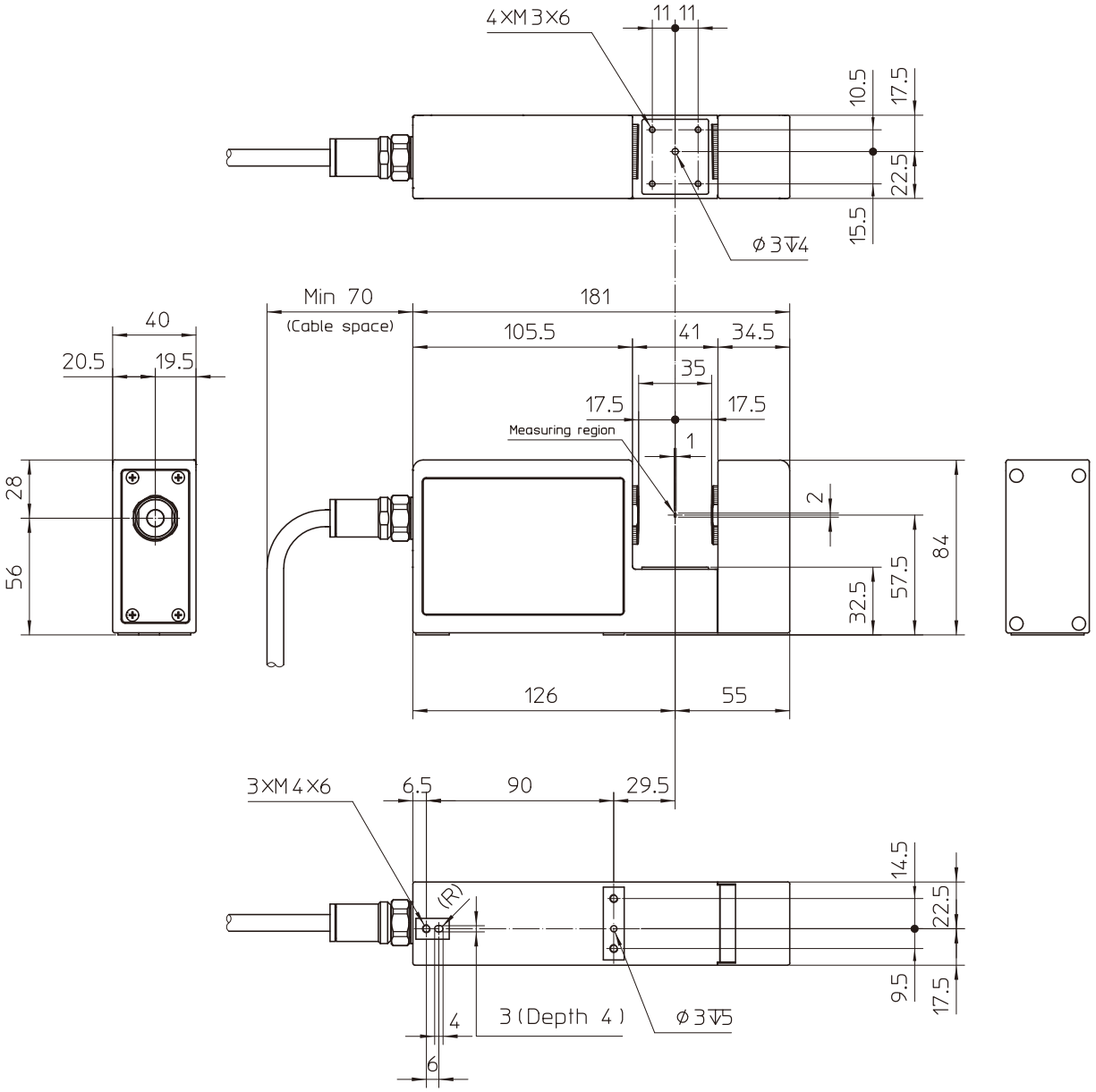
■ Optional accessories

Part No.	Item name
02AGD110	Calibration gage (A)
02AGD200	Guide pulley unit (A)
02AGN780A/B	Extension signal cables (5 m/10 m)*1 *2

*1 The signal cable can be extended up to 20 m.

*2 Changing the length of the signal cable can affect measurement accuracy. If you change the cable length, be sure to perform calibration.

■ Outline dimensional drawing



Unit: mm

Mass

Sensor: 1.0 kg

Signal cable: 0.5 kg

6.2 LSM-30-A

■ Specifications

Model			LSM-30-A
Code No.			544-124
Applicable controller			LSM-CU-A
Measuring range		mm	0.3–30
Minimum readout		µm	0.01
Repeat accuracy (2σ)[*1] **Full range(φ30mm)** **Middle range(φ10mm)**		µm	±0.09[*2] ±0.06[*2]
Linearity [*1]	**Whole range**	µm	±1.0[*3]
	Narrow range	µm	±(0.6+0.1Δ*D*)[*3] [*4]
Positional error [*1] [*5]	**Whole range (10 x 30)**	µm	±1.8
	Central range (5 x 20)	µm	±1.0
Measuring region		mm	10 x 30 (Optical axis direction x Scanning direction)
Number of scans for averaging		scans	1–2048
Laser classification			Class 1 (maximum power: 1.0 mW, wavelength: 650 nm)
Number of laser scans		scans/s	3200
Laser scanning rate		m/s	226
Protection level			IP67[*6]
Distance between Emission unit and Reception unit		mm	Standard: 130, Max.: 350[*7]
Operating environment		Temperature	0 °C–40 °C
		Humidity	35 %–85 % (relative humidity, no condensation)
		Altitude	2000 m or lower
Storage environment		Temperature	-10 °C–50 °C
		Humidity	35 %–85 % (relative humidity, no condensation)
CE marking/ UKCA marking			EMC Directive/Electromagnetic Compatibility Regulations: EN IEC 61326-1 Immunity test requirement: Clause 6.2 Table2 Emission limit: ClassA RoHS Directive/The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations: EN IEC 63000

*1 Various accuracy tests are performed on glass boards with chromium vapor deposition patterns. Accuracy inspection environment/temperature: 20 °C ±1 °C, humidity: 50% ±10 °C

*2 The value of ±2 σ when a ø30 mm/ø10mm -diameter gage has been measured for 2 minutes with a measurement interval of 0.32 seconds, where σ is the standard deviation

*3 The value in the center of the measuring region

*4 ΔD is the difference in outer diameter from the master gage (Unit:mm)

*5 Error caused by moving the workpiece in the optical axis direction or scanning direction from the center of the measuring area

*6 IP 67 is not guaranteed to be used while immersed in water.
Protection Grade: See IP 67. (For details, see IEC 60529, JIS C 0920.)
IP6X = Foreign matter protection: no foreign matter inside
IPX7 = Protection against water: no intrusion of water causing harmful effects when temporarily immersed in water at specified pressure and time.

*7 When the distance between the light emitting and light receiving sections is extended beyond the standard distance (130 mm), a relay extension cable (special accessory) is required. Also, be sure to perform calibration because it may affect accuracy.

■ Standard accessories

Part No.	Item name	Quantity
02AGQ190	Signal cable (5 m)	1
99MBC153B	Quick Start Manual	
02AGQ039	CD (containing the following files) • User's Manual (PDF) (this document)	

■ Optional accessories

Part No.	Item name
02AGD130	Calibration gage set (B)
02AGQ450	Air-blow unit for LSM-30-A
02AGQ452	Laser stabilization cover
02AGD270	Workstage (B)
02AGD490	Adjustable workstage
02AGN780A/B/D	Extension signal cables (5 m/10 m/20 m)*1 *2 *3
02AGQ464A/B	Extension connection cables (1 m/3 m)*2 *3 *4

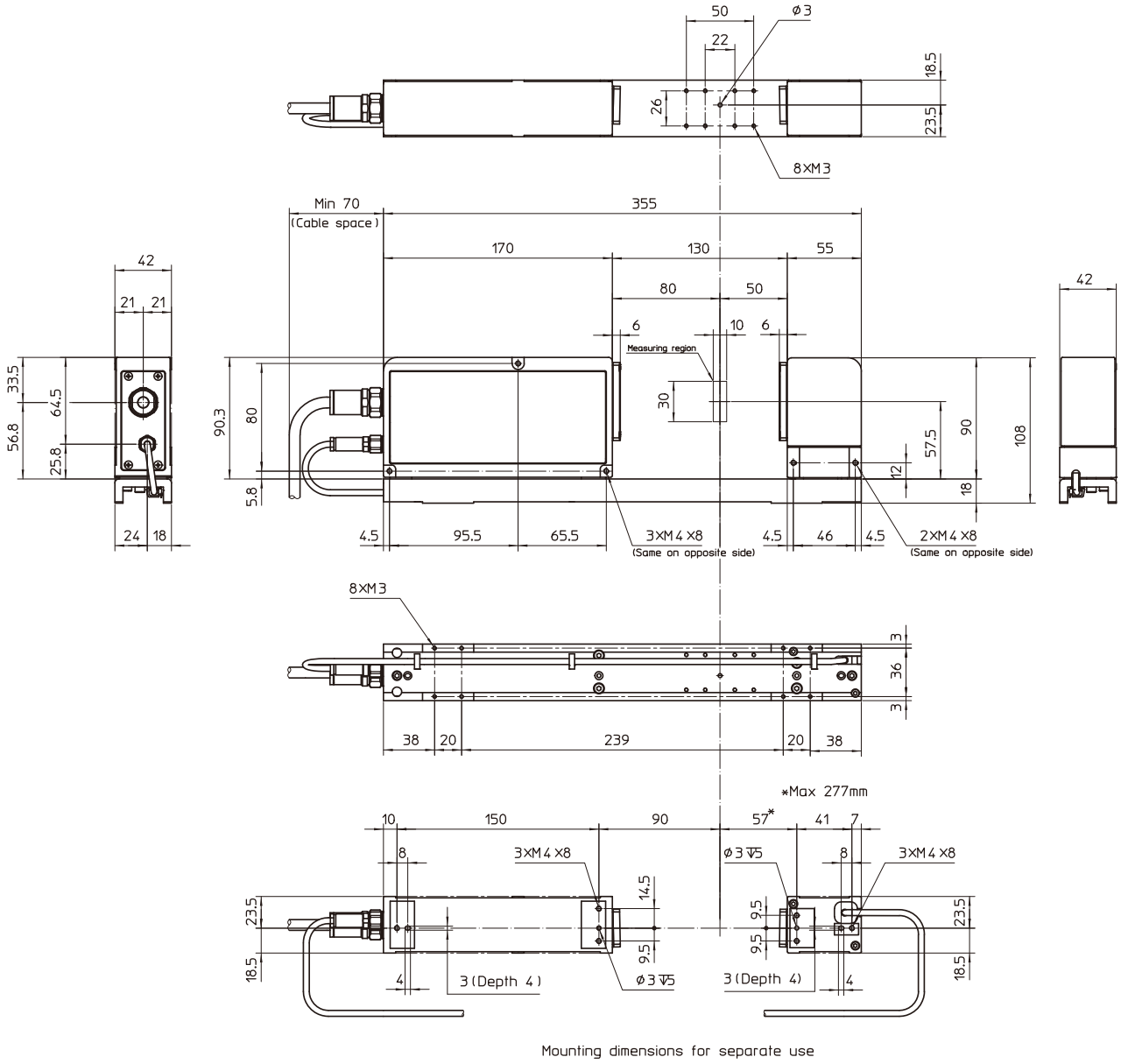
*1 The signal cable can be extended up to 29 m.

*2 The total length of the signal and connection cables can be extended up to 29 m.

*3 Changing the length of the signal cable can affect measurement accuracy. If you change the cable length, be sure to perform calibration.

*4 The connection cable can be extended up to 5 m.

■ Outline dimensional drawing



Mounting dimensions for separate use

Unit: mm

Mass

Emission unit: 1.1 kg

Reception unit: 0.6 kg

Base : 0.5 kg

Signal cable: 0.5 kg

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*As of June 2023

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