Mitutoyo

# IF Module for LSM Controller <EtherCAT>

## LSM-EC-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.

No. 99MBC165A
Date of publication: June 1, 2023 (1)

## ■ Product names and model numbers covered in this document

| Product name | Model number |
|---|---|
| IF Module for LSM Controller <EtherCAT> | LSM-EC-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" and "Precautions for Use".
- The contents of this document are based on information current as of June 2023.
- No part or whole of this document may be transmitted or reproduced by any means without prior written permission of Mitutoyo Corporation.
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- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

# Conventions and Wording Used in This Document

## ■ Safety reminder conventions and wording 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**<br>Alerts the user to a specific hazardous situation that means "Caution, risk of electric shock". |
|  | **Hot surface**<br>Alerts the user to a specific hazardous situation that means "Caution, risk of burns due to high temperature". |
|  | **Flammable material**<br>Alerts the user to a specific hazardous situation that means "Caution, risk of igniting gas". |
|  | **Sharp element**<br>Alerts the user to a specific hazardous situation that means "Caution, risk of injury". |
|  | **Crushing of hands**<br>Alerts the user to a specific hazardous situation that means "Caution, risk of hand pinching". |
|  | **Optical radiation**<br>Alerts the user to a specific hazardous situation that means "Caution, risk of high-intensity light". |

## ■ 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 and wording indicating referential information or reference location

**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 "1.2 Features of This Product" on page 1 in "1 Introduction".

# 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.

## ■ Precautions for this product

**⚠CAUTION**

To prevent electric shocks, strictly observe the following.
Failure to observe these precautions could result in electric shocks or burns, or in some cases death.

- When mounting external devices or optional accessories, turn off the power to the device.
- Ensure that the product is properly grounded.
- Halt the system in case of a malfunction.

- Do not disassemble this product or remove its cover.
  There is a risk of electric shock or burns, and in some cases, death or serious injury. In addition, there is a risk of accidents due to intrusion of material such as metal powder.
- Do not touch the connection terminals with your hands or objects in order to prevent electric shocks due to connection faults.

**NOTICE**

Securely connect the connectors of the connecting cables for noise isolation.

**Tips**

Even if an error is displayed while measuring, it does not necessarily indicate a malfunction.
See 📖 "6 Troubleshooting" on page 39 to check the cause and solution.

# 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, see "1.3 LSM System Diagram" on page 2.

- This product is for industrial usage.

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

- This 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 ("7 Specifications" on page 41), be aware that the functions and performance cannot be guaranteed.

## ■ Environment for placement

This product is a precision electronic instrument and is designed for indoor use. To obtain the highest accuracy, take into account the following conditions when installing the product. Mitutoyo assumes no responsibility for accidents or failures that result from disregarding the following items.

Use the product in the following places.

- Where there is minimal dust and grit
  Dust or grit in the usage area will adversely affect the mechanical and electronic components inside the product.
- Where there are minimal vibrations
  If the product is going to be used in places where there are lots of vibrations, problems will be generated in the precision components being used, which will cause measuring performance to be impaired.
  If use in a place with vibrations is inevitable, take measures to reduce vibrations, such as laying an anti-vibration rubber mat under the product.
- Where the ambient temperature is from 0 °C through 50 °C
- Where the humidity is from 20 % RH through 85 % RH (without condensation)
- Where the altitude is 2000 m or lower
  If the product is used in places where the altitude exceeds 2000 m, it will cause measuring performance to be impaired.

Do not use or store the product in the following places where the temperature and humidity drastically fluctuate, because the product's functions and measurement results will be adversely affected and it will cause malfunction.

- Where exposed to direct sunlight
  If installing this product in a place exposed to direct sunlight, such as near a window, is inevitable, take measures to shade the product from the sun, such as using a curtain.
- Where extremely hot or cold
- Where there are risks of getting wet

**Tips**

This product does not conform to the International Protection standard (IP standard). Sensors (LSM-02-A and LSM-30-A) are IP67 rated.

## ■ Maintenance

For information on the care of this product, see 📖 "Laser Scan Micrometer <Controller> User's Manual" (separate document).

# 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 Export Trade Control Order or under Category 16 of Appended Table of Foreign Exchange Control Order, based on 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-providing of the technology (including Programs), you shall 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, List-Control Technology (including Programs) under Category 1 - 15 of Appended Table 1 of Export Trade Control Order or under Category 1 - 15 of 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-providing of the technology (including Programs), you shall 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 exported). 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。


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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 Mitutoyo sales representative (📖 "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 product 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 product is properly installed and operated in conformance with the instructions in this document 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 responsibility for all results due to the selection of this product to achieve your intended results.

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If, notwithstanding the foregoing, Mitutoyo is found to be liable to you for any damage or loss which arises out of or is in any way connected with use of this product by you, in no event shall Mitutoyo's and/or its affiliated and related companies' and suppliers' liability to you, whether in contract, tort (including negligence), or otherwise, exceed the price paid by you for the product only.

The foregoing limitations shall apply even if the above-stated warranty fails of its essential purpose. BECAUSE SOME COUNTRIES, STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR THE LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, IN SUCH COUNTRIES, STATES OR JURISDICTIONS, MITUTOYO'S LIABILITY SHALL BE LIMITED TO THE EXTENT PERMITTED BY LAW.

# About This Document

## ■ Positioning of this document, document map

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

| | |
|---|---|
| Laser Scan Micrometer <Controller> User's Manual | Describes use of LSMPAK to set up and operate the controller of the Laser Scan Micrometer. |
| Laser Scan Micrometer <Sensor> User's Manual | Describes the sensor of the Laser Scan Micrometer, including how to connect it to the controller and its specifications. |
| **IF Module for LSM Controller <EtherCAT> User's Manual (This document)** | Describes the IF Module for LSM Controller <EtherCAT> which is attached to the controller of the Laser Scan Micrometer, including its attachment to the controller and specifications. |

## ■ Intended readers and purpose of this document

### ● Intended readers

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

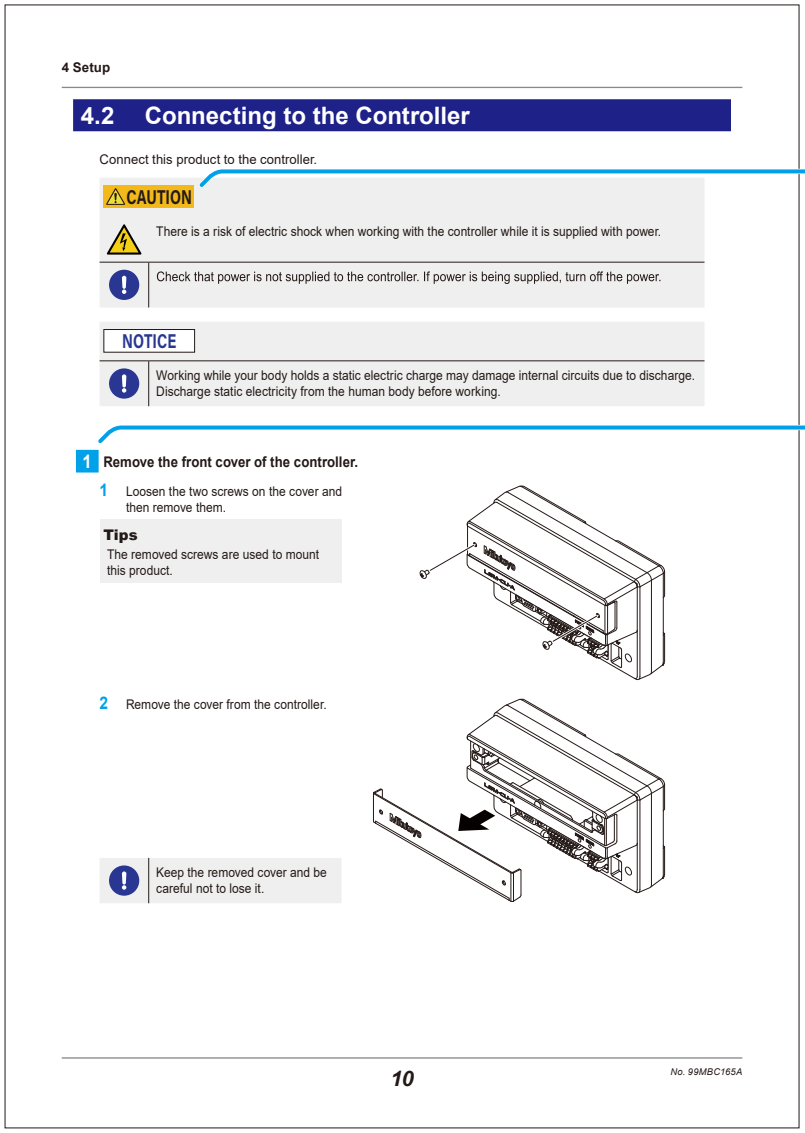
The readers are assumed to have been familiar with basic operations on a PC and Windows.

They are also assumed to be able to understand individual instructions by reading the described drawings.

### ● Purpose

The purpose of this document is to help you to understand the functional overview of the product, the functions of each part, the non-contact type sensor using a laser beam, operation procedures, and maintenance details.

## ■ How to read this document



4 Setup

### 4.2 Connecting to the Controller

Connect this product to the controller.

⚠CAUTION

There is a risk of electric shock when working with the controller while it is supplied with power.

Check that power is not supplied to the controller. If power is being supplied, turn off the power.

NOTICE

Working while your body holds a static electric charge may damage internal circuits due to discharge. Discharge static electricity from the human body before working.

**1 Remove the front cover of the controller.**

1 Loosen the two screws on the cover and then remove them.

**Tips**
The removed screws are used to mount this product.

2 Remove the cover from the controller.

Keep the removed cover and be careful not to lose it.

10

No. 99MBC165A

Indicates safety information.

Indicates an operating procedure to be performed or its outline.

## ■ Brackets, quotation marks and numbers (1, 1)

The meanings of brackets, quotation marks and numbers to be used in this document are as follows.

| | |
|---|---|
| **( ): 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. |
| **1, 2, 3...**<br>1, 2, 3... | Indicates the order and the contents of tasks.<br>(1 : indicates main tasks, 1: indicates detailed tasks) |

# Contents

# 1 Introduction



This product is an IF module that enables data communication using EtherCAT.

## 1.1 About EtherCAT

EtherCAT is an Ethernet-based open industrial network system developed by Beckhoff Automation GmbH, Germany. Use of "on-the-fly" processing enables high-speed and highly efficient communication and supports synchronous control of devices by taking transmission delay time into consideration.

Because it uses standard Ethernet technology as its physical layer, it also allows use of ordinary Ethernet cables.

A device such as a PLC that sends EtherCAT frames, is called an "EtherCAT master", and a device that processes EtherCAT frames on the fly is called an "EtherCAT slave".

## 1.2 Features of This Product

This product connects to the LSM controller and is used together with the LSM controller and sensors connected to the controller to form an LSM system.

This product communicates with an EtherCAT master device (PLC, etc.) as an EtherCAT slave.

With cyclic communication, data such as the control status of the controller and the sensor that is connected to the controller as well as the current position of the workpiece can be output to the EtherCAT master (PLC, etc.).

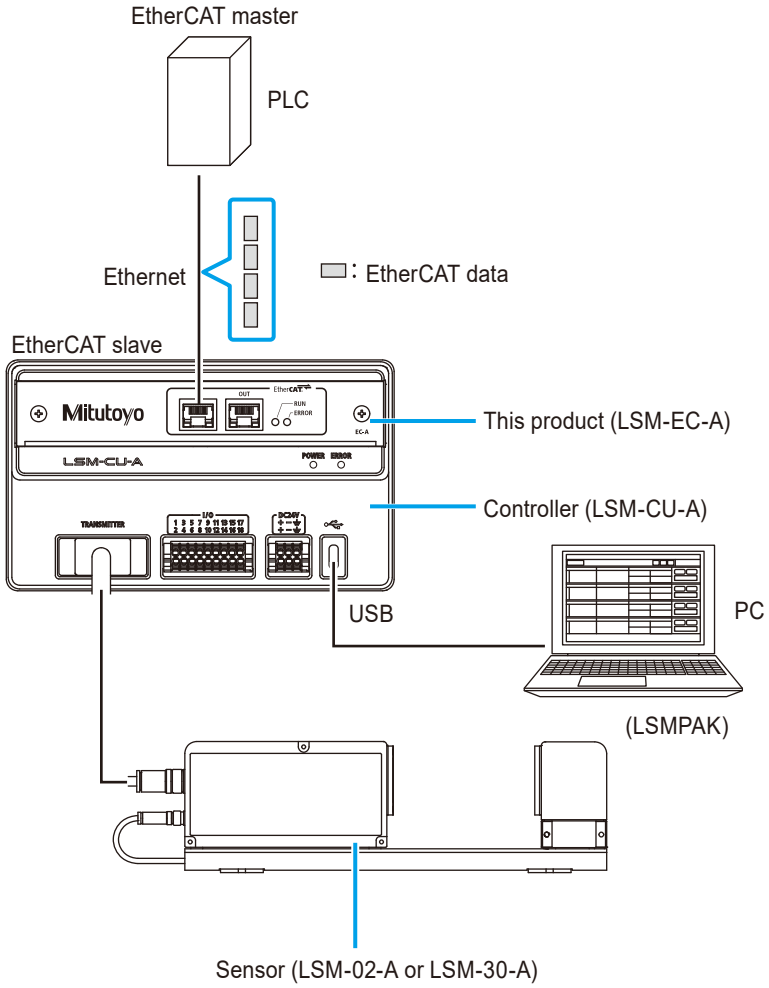
For details on communication, see "5.1.1 EtherCAT Communication" on page 15.

For details about the controller, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).

For details about the sensor, see "Laser Scan Micrometer <Sensor> User's Manual" (separate document).

# 1.3 LSM System Diagram

The following is an example of a system configuration with this product connected with the controller.



Devices required for system configuration

| Device name | Remarks |
|---|---|
| This product | This product is an optional accessory for controller LSM-CU-A. It is used in combination with the controller. This product enables EtherCAT communication.<br>For details, see 📖 "7.3 Measurement Configurations Usable with This Product" on page 42. |
| Controller | The controller LSM-CU-A controls the laser scan micrometer.<br>For details about the controller, see 📖 "Laser Scan Micrometer <Controller> User's Manual" (separate document). |
| Sensor | This is the sensor unit of the laser scan micrometer. LSM-02-A (0.005 mm to 2 mm) or LSM-30-A (0.3 mm to 30 mm) can be used.<br>For details, see 📖 "Laser Scan Micrometer <Sensor> User's Manual" (separate document). |
| LSMPAK (PC) | This is software used for controlling the controller. It is installed for use on a personal computer.<br>The personal computer on which LSMPAK is installed is connected to the controller through a USB connection. |
| EtherCAT master (PLC, PC, etc.) | A device that communicates with this product as a slave device in EtherCAT communication.<br>Typical EtherCAT masters include devices such as PLCs. |

## MEMO

# 2 Unpacking and Checking

After removing the product from its packaging, check that there are no missing parts or damage.

This product has been thoroughly inspected before shipment from the factory, and its normal performance is guaranteed.

First, remove the product from its packaging and check the following.

- No missing parts (including the product and all accessories)
- No damage was sustained during transit

We take all possible measures to ensure the quality of our products, but in the unlikely event that you discover a missing or damaged product, please contact your nearest Mitutoyo sales office.



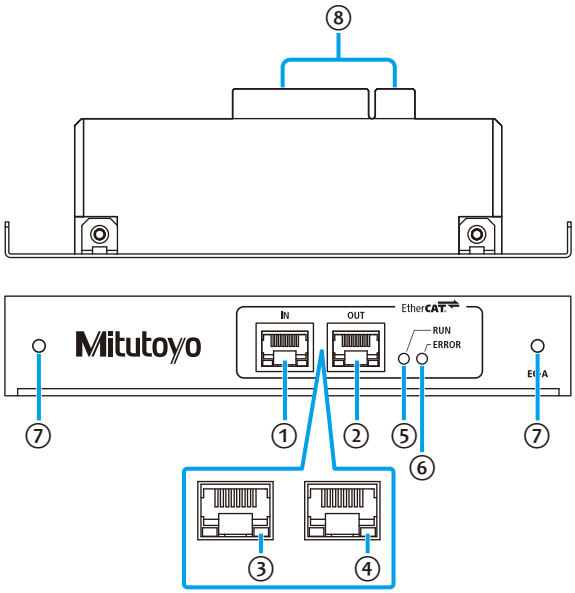
## ■ This product and included accessories

| Part No. | Name | Quantity |
|---|---|---|
| 02AGQ380 | IF Module for LSM Controller <EtherCAT> (this product) | 1 |
| 99MBC166B | Quick Start Manual | 1 |
| 02NGA064 | CD-ROM | 1 |
| 02NGA075 | LSM-EC-A device file | — |
| 99MBC165J/A | User's Manual (PDF) (this document) | — |
| WA140 | General product warranty (large) | 1 |

## MEMO

# 3 Part Names and Functions

This chapter describes the name and function of each part of this product.




| No. | Name | Function | Reference |
|---|---|---|---|
| ① | RJ-45 connector (port IN) | These are Ethernet ports.<br>Connect to them with communication cables (Ethernet cables). | 5.2.1 |
| ② | RJ-45 connector (port OUT) | | |
| ③ | Link/activity LED (port IN) | Indicates the status of communications. | |
| ④ | Link/activity LED (port OUT) | | |
| ⑤ | RUN indicator | Indicates the network status of this product. | |
| ⑥ | ERROR indicator | Indicates the error status of this product. | |
| ⑦ | Mounting hole | Used for mounting the controller. | 4.2 |
| ⑧ | Edge connector | Insert into the socket of the controller. | |

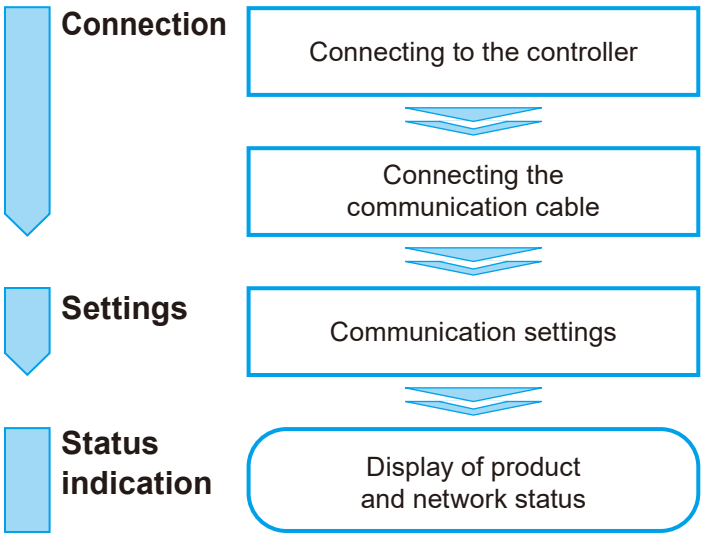
## MEMO

# 4 Setup

Use the following procedure to connect this product and the system devices and configure the settings.

## 4.1 Work Flow

This section describes the work flow.




📖 "4.2 Connecting to the Controller" on page 10

📖 "4.3 Connecting the Communication Cable" on page 12

📖 "■ Configuration of EtherCAT communication from the EtherCAT master device" on page 13

📖 "5.2 Status Indication" on page 36

# 4.2 Connecting to the Controller

Connect this product to the controller.

**⚠CAUTION**

There is a risk of electric shock when working with the controller while it is supplied with power.

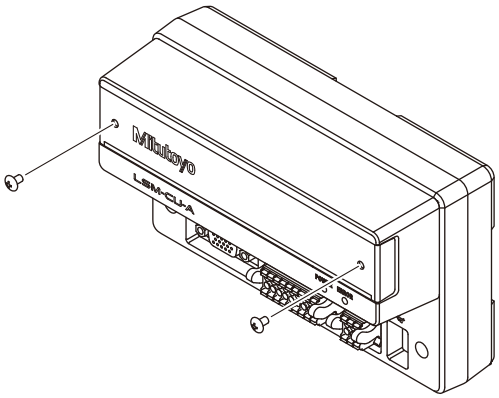
Check that power is not supplied to the controller. If power is being supplied, turn off the power.

**NOTICE**

Working while your body holds a static electric charge may damage internal circuits due to discharge. Discharge static electricity from the human body before working.

## 1 Remove the front cover of the controller.

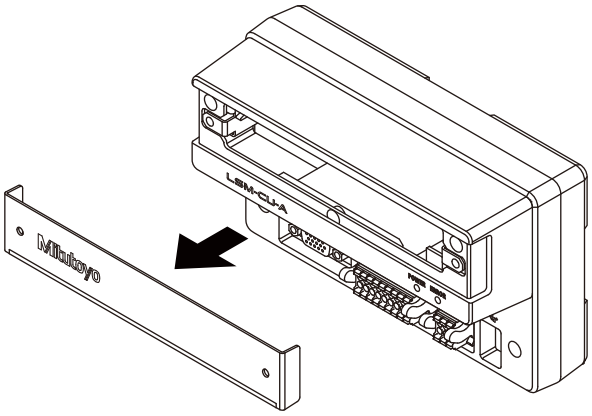
1 Loosen the two screws on the cover and then remove them.




**Tips**

The removed screws are used to mount this product.

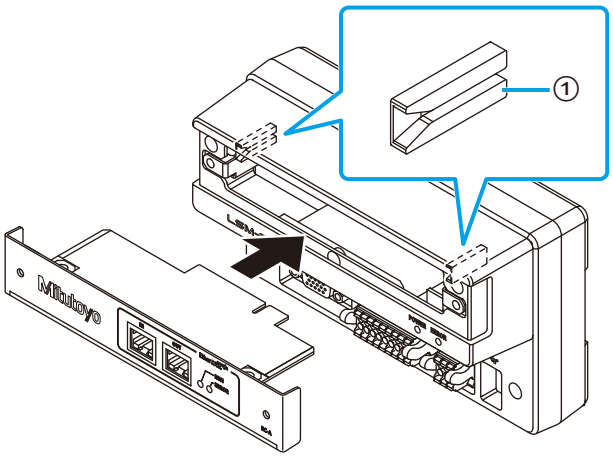
2 Remove the cover from the controller.




Keep the removed cover and be careful not to lose it.

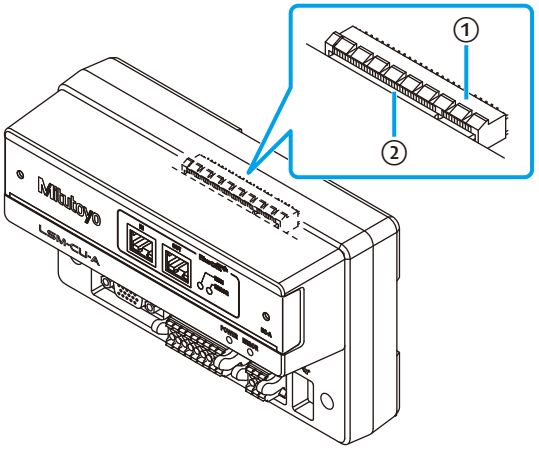
## 2 Mount this product on the controller.

1 Insert this product along the guides on either side of the controller.



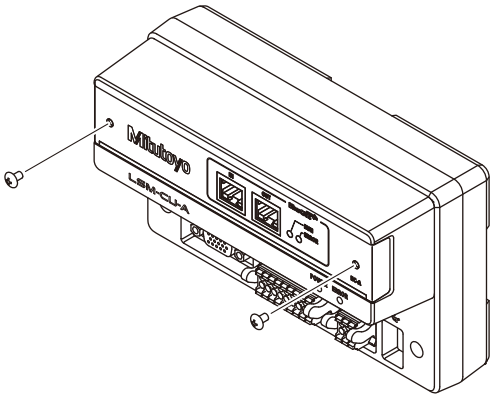

| No. | Name |
|---|---|
| ① | Guide |

2 Insert the edge connector of this product into the socket of the controller.




| No. | Name |
|---|---|
| ① | Socket |
| ② | Edge connector |

3 Fasten with the two screws removed in step 1.



# 4.3 Connecting the Communication Cable

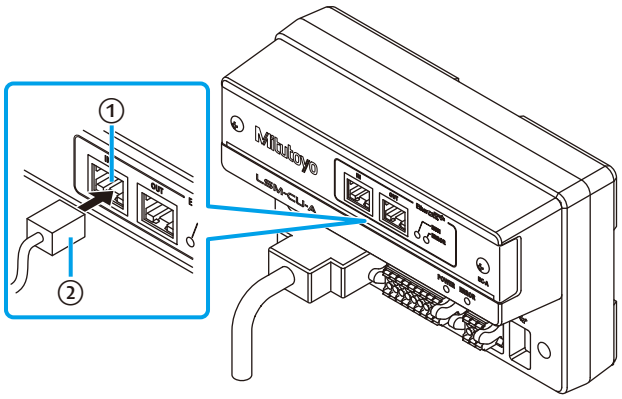
Connect the communication cable to this product.

## 4.3.1 How to Connect the Communication Cable

**Tips**

- Use an STP cable of Cat.5e or higher for the communication cable.
- This product is compatible with Auto MDI-X, which automatically detects whether the cable type is straight or cross for communication.
- This product does not support optical communication or single-pair Ethernet.
- Make sure that communication cable length does not exceed 30 m.

**1 Connect the communication cable to the RJ-45 connector (port IN) of this product.**




| No. | Name |
|---|---|
| ① | RJ-45 connector |
| ② | Communication cable |

**2 Connect the other end of the communication cable to the RJ-45 connector on the network side.**

**Tips**

- Depending on the PLC, the following connection operations may not result in normal EtherCAT communication and may require a reset operation on the PLC side.
  When building your network, refer to your PLC manual.
  - Connection of the PLC to the RJ-45 connector (port OUT) of this product
  - Connection of devices that do not support EtherCAT communication
  - Connection or disconnection of the communication cable while the PLC is in the RUN state
- To add an additional EtherCAT slave, connect a communication cable to the RJ-45 connector (port OUT) of this product.

# 4.4 Device Settings

This section describes the settings for network communication between this product and the EtherCAT master device.

No IP address setting is required for EtherCAT communication.

## ■ Configuration of EtherCAT communication from the EtherCAT master device

The settings required for EtherCAT communication with this product are made using the engineering tool of the EtherCAT master device. For information on how to operate the engineering tool, see the EtherCAT master device manual.

The general setup process to be performed on the EtherCAT master device is as follows.

### ● Registering the device profile

Register the device profile of this product to the EtherCAT master device.

Use this product's ESI (EtherCAT Slave Information) file to register device profiles.
Use the ESI file stored on the included CD-ROM or download it from the Mitutoyo web site.

### ● Setting the connection

Set the connection type (point-to-point/multicast), send and receive data size, transmission interval, etc.

### ● Assigning device input/output data

Assign the data area to be sent/received by this product in the program variables using the engineering tool, etc.

## MEMO

# 5 Communication Function

This chapter describes the device settings and communication function of this product.

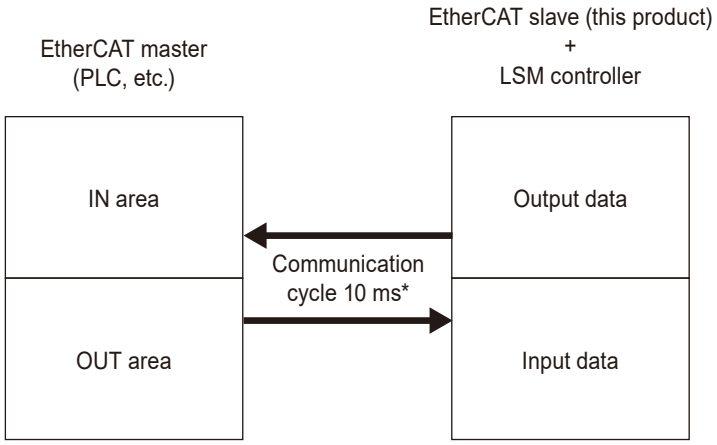
## 5.1 Communication Specification

### 5.1.1 EtherCAT Communication

Communication between the EtherCAT master device and this product is performed via EtherCAT.
This section provides an overview of EtherCAT communication and details of the data used for communication.

#### ■ Overview

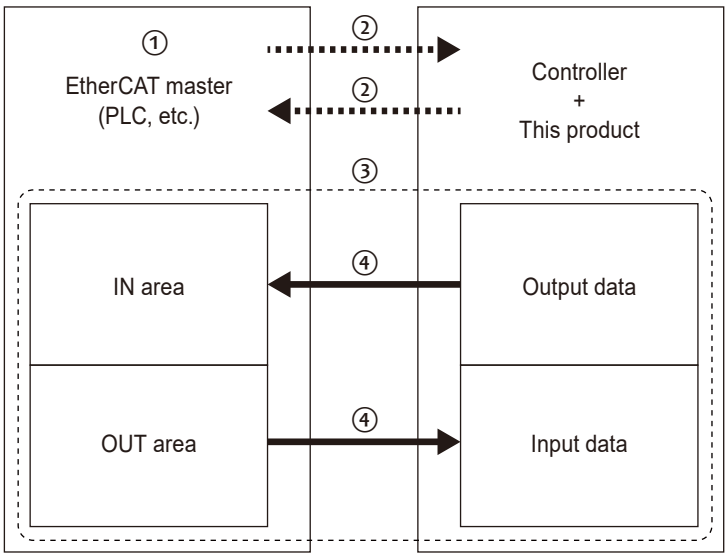
The EtherCAT master device and this product conduct cyclic data communication at a fixed cycle, and input and output data are exchanged according to the communication cycle.
The communication cycle of this product can be set to a value of 2 ms or greater.



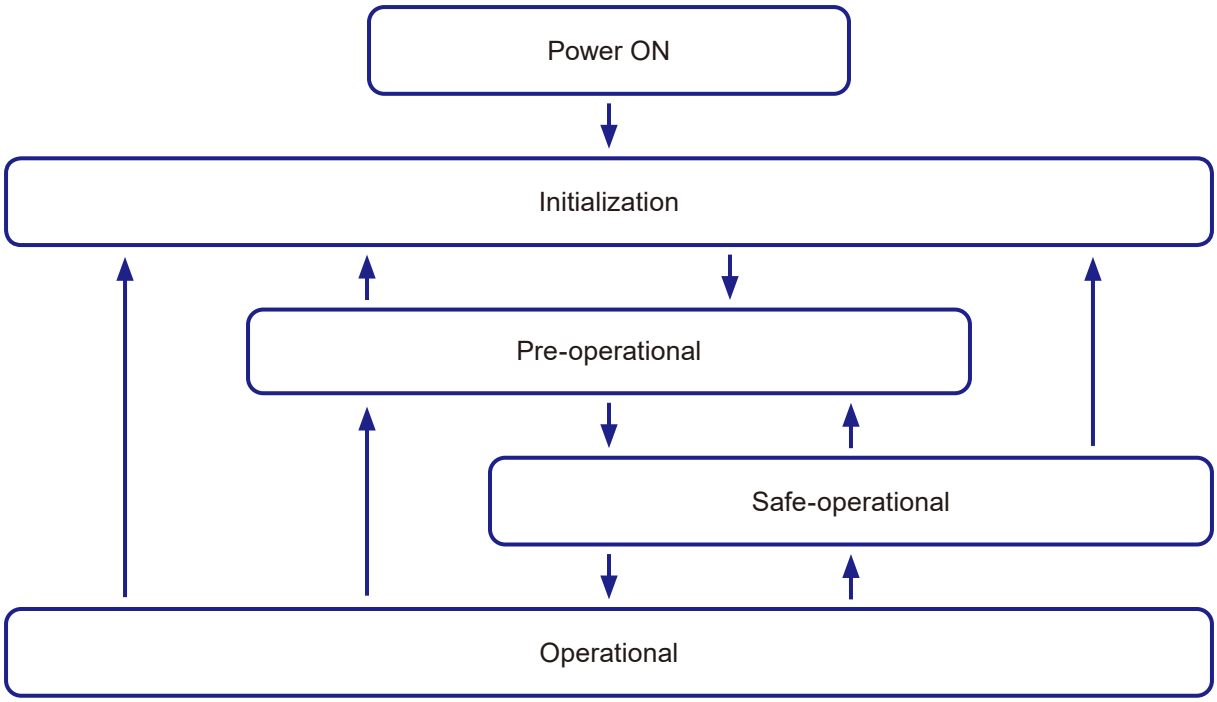

* The communication cycle can be set on an individual basis.

Communication must be established between the EtherCAT master and the EtherCAT slave in order for data communication to take place.
The following shows the sequence for starting data transmission.

① The EtherCAT master sends a connection request.
② Initial communication is conducted to make the connection.
③ Connection is established (data communication becomes possible).
④ Data is sent.




During the initial communication, the state of the EtherCAT slave sequentially changes according to the requests from the EtherCAT master as follows. The state of the EtherCAT slave may also change due to a connection termination request from the EtherCAT master or an error.




| EtherCAT slave status | Mailbox communication (SDO communication) | Cyclic communication (PDO communication) | Description |
|---|---|---|---|
| Initialization | - | - | Communication initializing. |
| Pre-operational | ✓ | - | Mailbox communication is possible. |
| Safe-operational | ✓ | ✓ (IN area only) | In addition to mailbox communication, cyclic communication to the IN area is possible for output data only. |
| Operational | ✓ | ✓ | Normal communication status (a connection is established to the EtherCAT master and data communication is possible). |

## ■ Details of data

### ● This product → Output data to EtherCAT master

This product has two output data structures: Basic (28-byte) and Advanced (180-byte).

The Basic structure allows acquisition of data for one measurement from an EtherCAT master such as a PLC during one cyclic communication cycle while the Advanced structure allows acquisition of data for 20 measurements.

Two PDO mapping objects are defined in the ESI file for this product: Input Data (Index No. = 0x1A00, 28-byte) and Input Additional Data (Index No. = 0x1A01, 152-byte). The Basic and Advanced objects are switched by changing the assignment of the PDO assignment object (Index No. = 0x1C13).

When using the Basic structure, assign only input data to the PDO assignment object.

When using the Advanced structure, assign both input data and input additional data to the PDO assignment object.

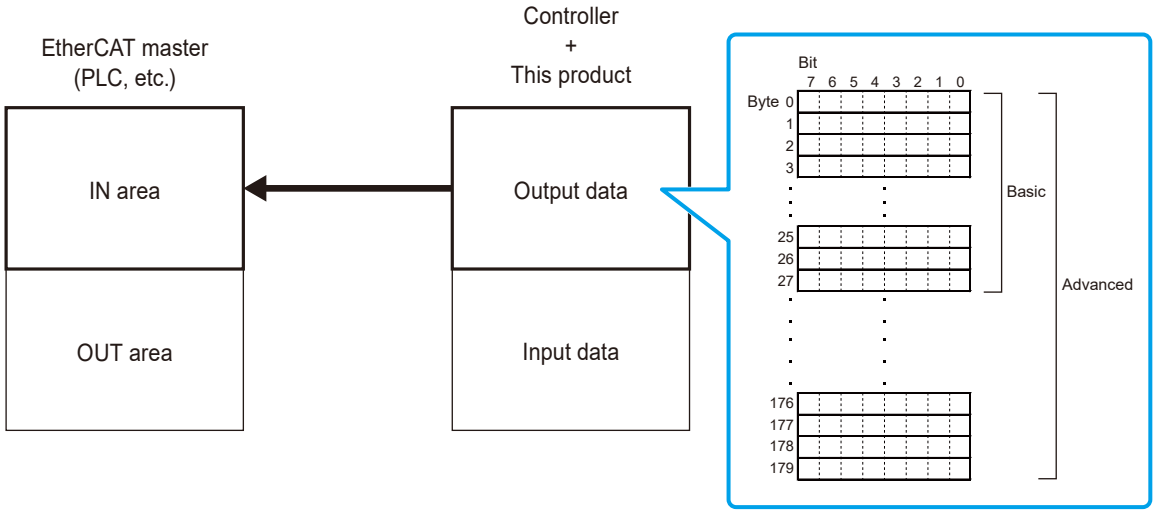
**Tips**

If the communication cycle between this product and the EtherCAT master is longer than the cycle for exchanging measurement data between the LSM controller and the product, measurement data may be lost on the EtherCAT master side.

The cycle of measurement data exchange between the LSM controller and this product depends on the number of averaging setting of the LSM controller.

Select Basic or Advanced and set the communication cycle between this product and the EtherCAT master according to the number of averaging setting of the LSM controller and the EtherCAT master's capability.

You can switch between Basic and Advanced and set the communication cycle between this product and the EtherCAT master using the EtherCAT master's configuration software. For details, see the EtherCAT master device manual.




| Field type | TYPE | Byte | Bit | Description | Name | Current position display execution | Measurement execution |
|---|---|---|---|---|---|---|---|
| Status bit 1*1 | BYTE | 0 | 7 | N/A | N/A | ✓<br>Error record:<br>4 bytes | ✓<br>Error status record:<br>4 bytes |
| | | | 6 | N/A | N/A | | |
| | | | 5 | Automatic workpiece detection | AUTO_DET | | |
| | | | 4 | N/A | N/A | | |
| | | | 3 | N/A | N/A | | |
| | | | 2 | N/A | N/A | | |
| | | | 1 | Two items measurement | SUB | | |
| | | | 0 | Measuring | MEAS | | |
| | | 1 | 7 | N/A | N/A | | |
| | | | 6 | N/A | N/A | | |
| | | | 5 | N/A | N/A | | |
| | | | 4 | N/A | N/A | | |
| | | | 3 | N/A | N/A | | |
| | | | 2 | Calibrating | CAL_OK | | |
| | | | 1 | Offset state | OFST_NOW | | |
| | | | 0 | Preset state | PRST_NOW | | |
| | | 2 | 7:0 | N/A | N/A | | |
| | | 3 | 7:0 | N/A | N/A | | |

| Field type | TYPE | Byte | Bit | Description | Name | Current position display execution | Measurement execution |
|---|---|---|---|---|---|---|---|
| Status bit 2*1 | BYTE | 4 | 7 | N/A | N/A | ✓ Status record: 4 bytes | ✓ Status record: 4 bytes |
| | | | 6 | Calibration error | CAL_ER | | |
| | | | 5 | Statistics buffer overflow | STAT_OVF | | |
| | | | 4 | Overflow data | OVR_DATA | | |
| | | | 3 | Waste removal (overflow) | RMV_DUST_OVR | | |
| | | | 2 | Waste removal | RMV_DUST | | |
| | | | 1 | Outlier elimination□(all) | ABNML_DATA_OUT_ALL | | |
| | | | 0 | Outlier elimination | ABNML_DATA_OUT | | |
| | | 5 | 7 | N/A | N/A | | |
| | | | 6 | N/A | N/A | | |
| | | | 5 | Edge error | EDGER | | |
| | | | 4 | Edge not detected | NOEDG | | |
| | | | 3 | No measurement sampling | NO_SCAN_SIG | | |
| | | | 2 | Measurement interruption from outside | EXT_MEAS_STP | | |
| | | | 1 | Ring buffer overflow | RING_OVF | | |
| | | | 0 | No workpiece | NO_WORK_PCS | | |
| | | 6 | 7 | Dirt detection | DIRT_ER | | |
| | | | 6 | N/A | N/A | | |
| | | | 5 | Watchdog error | WDTO_ER | | |
| | | | 4 | LD overcurrent | LD_OC_ER | | |
| | | | 3 | Amount of light memorize error | LIT_INT_ER | | |
| | | | 2 | FPGA config. error | FPGA_ER | | |
| | | | 1 | Measurement unit EEPROM load error | MEPRM_ER | | |
| | | | 0 | EEPROM load error | EPRM_ER | | |
| | | 7 | 7 | Total error | TOTAL_ER | | |
| | | | 6 | Invalid setting | STCFT | | |
| | | | 5 | N/A | N/A | | |
| | | | 4 | N/A | N/A | | |
| | | | 3 | N/A | N/A | | |
| | | | 2 | N/A | N/A | | |
| | | | 1 | N/A | N/A | | |
| | | | 0 | Power supply error | PWR_ER | | |
| Not used | N/A | 8 | 7:0 | N/A | N/A | N/A | N/A |
| | | 9 | 7:0 | N/A | N/A | N/A | N/A |
| I/O bit | BYTE | 10 | 7 | LSM processing in progress | BUSY | - | ✓ |
| | | | 6 | N/A | N/A | N/A | N/A |
| | | | 5 | N/A | N/A | N/A | N/A |
| | | | 4 | N/A | N/A | N/A | N/A |
| | | | 3 | Next data available | NEXT | - | ✓ |
| | | | 2 | N/A | N/A | N/A | N/A |
| | | | 1 | Valid measurement data available | MDVLD | - | ✓ |
| | | | 0 | Valid display data available | DDVLD | ✓ | - |
| | | 11 | 7 | N/A | N/A | N/A | N/A |
| | | | 6 | GO/NG judgment | LT7 | - | ✓ |
| | | | 5 | | LT6 | - | ✓ |
| | | | 4 | | LT5 | - | ✓ |
| | | | 3 | | LT4 | - | ✓ |
| | | | 2 | | LT3 | - | ✓ |
| | | | 1 | | LT2 | - | ✓ |
| | | | 0 | | LT1 | - | ✓ |

| Field type | TYPE | Byte | Bit | Description | Name | Current position display execution | Measurement execution |
|---|---|---|---|---|---|---|---|
| I/O bit (echo back) | BYTE | 12 | 7 | Reboot request | RBTRQ | | |
| | | | 6 | N/A | N/A | N/A | N/A |
| | | | 5 | N/A | N/A | N/A | N/A |
| | | | 4 | N/A | N/A | N/A | N/A |
| | | | 3 | Stream measurement | STRM | | |
| | | | 2 | Single measurement | SNGL | | |
| | | | 1 | Measurement start | RUN | | |
| | | | 0 | Current value display | DPVAL | | |
| | | 13 | 7 | Endian switching | ENDN | | |
| | | | 6 | N/A | N/A | N/A | N/A |
| | | | 5 | N/A | N/A | N/A | N/A |
| | | | 4 | Parameter setting change request | CHGPRM | | |
| | | | 3 | Error clear request | CLRRQ | | |
| | | | 2 | Preset request | PSTRQ | | |
| | | | 1 | Data reception OK | RCVOK | | |
| | | | 0 | Measured data request | DREQ | | |
| Device control bit (echo back) | BYTE | 14 | 7:0 | Parameter set number | PRM[7:0] | | |
| | | 15 | 7 | N/A | N/A | N/A | N/A |
| | | | 6 | N/A | N/A | N/A | N/A |
| | | | 5 | N/A | N/A | N/A | N/A |
| | | | 4 | N/A | N/A | N/A | N/A |
| | | | 3 | N/A | N/A | N/A | N/A |
| | | | 2 | N/A | N/A | N/A | N/A |
| | | | 1 | N/A | N/A | N/A | N/A |
| | | | 0 | GO/NG judgment ON | TOLON | | |
| Number of valid data bits*2 | INT | 16 | 7:0 | Valid data quantity | NODT[15:0] (Big endian) | ✓ | ✓ |
| | | 17 | 7:0 | | | | |
| Sequential number bits*2 | UINT | 18 | 7:0 | Sequential number | SEQNO[15:0] (Big endian) | | |
| | | 19 | 7:0 | | | | |
| Data bits (data ①)*2 | FLOAT | 20 | 7:0 | Data | DATA01[31:0] (Big endian) | ✓ Internal value ①: 4 bytes | ✓ Measured value ①: 4 bytes |
| | | 21 | 7:0 | | | | |
| | | 22 | 7:0 | | | | |
| | | 23 | 7:0 | | | | |
| Data bits (data ①)*2 | INT | 24 | 7:0 | GO/NG judgment information | TOL01[15:0] (Big endian) | - | ✓ GO/NG judgment result①: 2 bytes |
| | | 25 | 7:0 | | | | |
| Data bits (data ①)*2 | INT | 26 | 7:0 | Status information | STS01[15:0] (Big endian) | - | ✓ Data status①: 2 bytes |
| | | 27 | 7:0 | | | | |
| : | | : | : | : | | : | : |
| : | | : | : | : | | : | : |
| Data bits (data ⑳) *2 | FLOAT | 172 | 7:0 | Data | DATA20[31:0] (Big endian) | ✓ Internal value ⑳: 4 bytes | ✓ Measured value ⑳: 4 bytes |
| | | 173 | 7:0 | | | | |
| | | 174 | 7:0 | | | | |
| | | 175 | 7:0 | | | | |
| Data bits (data ⑳) *2 | INT | 176 | 7:0 | GO/NG judgment information | TOL20[15:0] (Big endian) | - | ✓ GO/NG judgment result⑳: 2 bytes |
| | | 177 | 7:0 | | | | |
| Data bits (data ⑳) *2 | INT | 178 | 7:0 | Status information | STS20[15:0] (Big endian) | - | ✓ Data status⑳: 2 bytes |
| | | 179 | 7:0 | | | | |

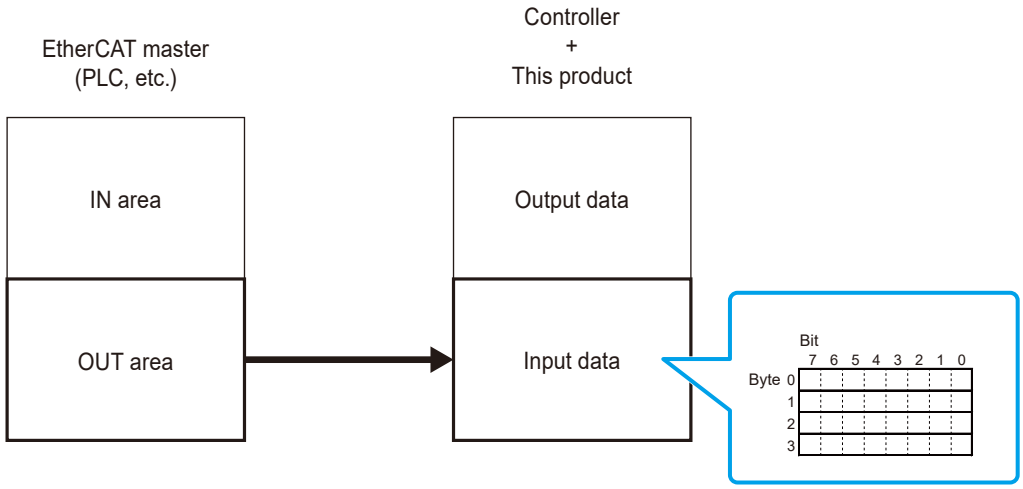
*1 To update the status, perform a measurement (RUN) or display current value (DPVAL) before referring to the status. Status information is not updated unless measurement (RUN) or current value display (DPVAL) is performed.

*2 Endian specification is available.

## ● EtherCAT master → Input data to this product

4-byte data (bytes 0 to 3) is received.

The Index No. of the PDO assignment object defined in the ESI file for this product is 0x1C12, and the Index No. of the PDO mapping object is 0x1600.




| Field type | TYPE | Byte | Bit | Description | Name | Current position display execution | Measurement execution |
|---|---|---|---|---|---|---|---|
| I/O bit | BYTE | 0 | 7 | Reboot request | RBTRQ | ✓ | ✓ |
| | | | 6 | N/A | N/A | N/A | N/A |
| | | | 5 | N/A | N/A | N/A | N/A |
| | | | 4 | N/A | N/A | N/A | N/A |
| | | | 3 | Stream measurement | STRM | | |
| | | | 2 | Single measurement | SNGL | - | ✓ |
| | | | 1 | Measurement start | RUN | - | ✓ |
| | | | 0 | Current value display | DPVAL | ✓ | - |
| I/O bit | BYTE | 1 | 7 | Endian switching | EDEN | N/A | N/A |
| | | | 6 | N/A | N/A | N/A | N/A |
| | | | 5 | N/A | N/A | N/A | N/A |
| | | | 4 | Parameter setting change request | CHGPRM | | |
| | | | 3 | Error clear request | CLRRQ | ✓ | ✓ |
| | | | 2 | Preset request | PSTRQ | ✓ | ✓ |
| | | | 1 | Data reception OK | RCVOK | ✓ | ✓ |
| | | | 0 | Measured data request | DREQ | ✓ | ✓ |
| Device control bit | BYTE | 2 | 7:0 | Parameter number | PRM[7:0] | | |
| Device control bit | BYTE | 3 | 7:1 | N/A | N/A | N/A | N/A |
| | | | 0 | GO/NG judgment ON | TOLON | ✓ | ✓ |

## ● Functions of definition bits

**This product → EtherCAT master**

| Field name | Size | Description |
|---|---|---|
| AUTO_DET | 1 bit | Auto Detect<br>Automatic workpiece detection<br>1: ON<br>0: OFF |
| BUSY | 1 bit | Busy<br>Access under way between IF module and LSM controller<br>1: Access in progress<br>0: No access |
| CAL_ER | 1 bit | Calibration Error<br>Calibration error<br>1: Error occurred<br>0: Normal |
| CAL_OK | 1 bit | Calibration<br>Calibration status display<br>1: Calibration OK<br>0: Not calibrated |
| DAT01 | 4 bytes | Data storage area<br>Measured value ① to ⑳ or indicated value ① to ⑳. |
| DAT02 | 4 bytes | |
| DAT03 | 4 bytes | |
| DAT04 | 4 bytes | |
| DAT05 | 4 bytes | |
| DAT06 | 4 bytes | |
| DAT07 | 4 bytes | |
| DAT08 | 4 bytes | |
| DAT09 | 4 bytes | |
| DAT10 | 4 bytes | |
| DAT11 | 4 bytes | |
| DAT12 | 4 bytes | |
| DAT13 | 4 bytes | |
| DAT14 | 4 bytes | |
| DAT15 | 4 bytes | |
| DAT16 | 4 bytes | |
| DAT17 | 4 bytes | |
| DAT18 | 4 bytes | |
| DAT19 | 4 bytes | |
| DAT20 | 4 bytes | |
| DDVLD | 1 bit | Valid Display Value<br>Display data availability indication<br>1: Display data available<br>0: Display data not available |
| DIRT_ER | 1 bit | Dirt Error<br>Sensor unit protective glass stain error |

| Field name | Size | Description |
|---|---|---|
| EDGER | 1 bit | Edge Error<br>Edge error (Occurs when, for example, an odd number of boundaries is detected on the measurement target.)<br>1: Error occurred<br>0: Normal |
| EPRM_ER | 1 bit | EEPROM Error<br>EEPROM load error<br>1: Error occurred<br>0: Normal |
| FPGA_ER | 1 bit | FPGA Error<br>FPGA configuration error<br>1: Error occurred<br>0: Normal |
| LDOC | 1 bit | LD Overcurrent Error<br>Measurement unit laser diode overcurrent error<br>1: Overcurrent detected<br>0: Normal |
| LIT_INT_ER | 1 bit | Light Intensity Error<br>Measurement unit laser diode brightness reduction error |
| LT1 | 1 bit | Limit1 to Limit7<br>GO/NG judgment LT1 to LT7<br>* Corresponds to R1 to R7 of the Multi-Limit Selection function. |
| LT2 | 1 bit | |
| LT3 | 1 bit | |
| LT4 | 1 bit | |
| LT5 | 1 bit | |
| LT6 | 1 bit | |
| LT7 | 1 bit | |
| MDVLD | 1 bit | Valid Measurement Data<br>Measurement data availability indication<br>1: Measurement data available<br>0: Measurement data not available |
| MEAS | 1 bit | Measuring<br>Measuring<br>1: Measuring<br>0: Idle |
| MEPRM_ER | 1 bit | Sensor EEPROM Error<br>Measurement unit EEPROM load error<br>1: Error occurred<br>0: Normal |
| NEXT | 1 bit | Next Data<br>Next data availability indication<br>1: Next data available<br>0: Next data not available |
| NODT | 2 bytes | Number of Valid Data<br>Measurement data quantity indication |

| Field name | Size | Description |
|---|---|---|
| NOEDG | 1 bit | No Edge<br>Edge not detected error (Unable to properly detect boundary on the measurement target.)<br>1: Error occurred<br>0: Normal |
| OFT_NOW | 1 bit | Offset<br>Offset state indication<br>1: Offset set<br>0: No offset |
| PRM[0:7] | 8 bit | Parameter Number Echo<br>Measurement parameter set number display (0x0 to 0xff)<br>* Up to 20 parameter sets can be stored. |
| PST_NOW | 1 bit | Preset<br>Preset state indication<br>1: Preset set<br>0: No preset |
| SEQNO | 2 bytes | Sequence Number<br>Sequence number assigned to the measurement data.<br>* This is a sequential number from 0 through 65535 that is incremented each time the IF module acquires data from the LSM controller. Numbering returns to 0 upon reaching 65535. |
| STCFT | 1 bit | State Conflict Error<br>Setting mismatch<br>1: Mismatch error<br>0: Normal<br>* Raised upon incorrect bit operation. |
| STS01 | 2 bytes | STATUS ① to ⑳<br>0x0001: Outlier elimination<br>0x0002: Outlier elimination<br>0x0004: Dirt removal process applied<br>0x0008: Dirt removal process applied<br>0x0010: Overflow data<br>0x0020: Statistics buffer overflow<br>0x0040: Calibration error<br>0x0080: Outlier elimination CNT warning<br>0x0100: ERR-0 No workpiece<br>0x0200: Measurement ring buffer overflow<br>0x0800: ERR-8 No measurement sampling<br>0x1000: Edge not detected error (upon scan interrupt) |
| STS02 | 2 bytes | |
| STS03 | 2 bytes | |
| STS04 | 2 bytes | |
| STS05 | 2 bytes | |
| STS06 | 2 bytes | |
| STS07 | 2 bytes | |
| STS08 | 2 bytes | |
| STS09 | 2 bytes | |
| STS10 | 2 bytes | |
| STS11 | 2 bytes | |
| STS12 | 2 bytes | |
| STS13 | 2 bytes | |
| STS14 | 2 bytes | |
| STS15 | 2 bytes | |
| STS16 | 2 bytes | |
| STS17 | 2 bytes | |
| STS18 | 2 bytes | |
| STS19 | 2 bytes | |
| STS20 | 2 bytes | |

| Field name | Size | Description |
|---|---|---|
| TOL01 | 2 bytes | GO/NG judgment ① to ⑳<br>1: Lower threshold exceeded (-NG)<br>2: Within limits (GO)<br>4: Upper threshold exceeded (+NG)<br>* Threshold values are set from the LSM controller.<br>For details about the controller, see 📖 "Laser Scan Micrometer <Controller> User's Manual" (separate document). |
| TOL02 | 2 bytes | |
| TOL03 | 2 bytes | |
| TOL04 | 2 bytes | |
| TOL05 | 2 bytes | |
| TOL06 | 2 bytes | |
| TOL07 | 2 bytes | |
| TOL08 | 2 bytes | |
| TOL09 | 2 bytes | |
| TOL10 | 2 bytes | |
| TOL11 | 2 bytes | |
| TOL12 | 2 bytes | |
| TOL13 | 2 bytes | |
| TOL14 | 2 bytes | |
| TOL15 | 2 bytes | |
| TOL16 | 2 bytes | |
| TOL17 | 2 bytes | |
| TOL18 | 2 bytes | |
| TOL19 | 2 bytes | |
| TOL20 | 2 bytes | |
| TOTAL_ER | 1 bit | Total Error<br>Error status indication (determined from R-IN)<br>1: Error occurred<br>0: No error<br>* All error causes are ORed for display. |
| WDTO | 1 bit | Watchdog Error<br>Watchdog timeout error<br>1: WDT timeout occurred<br>0: Error did not occur |

**EtherCAT master → this product**

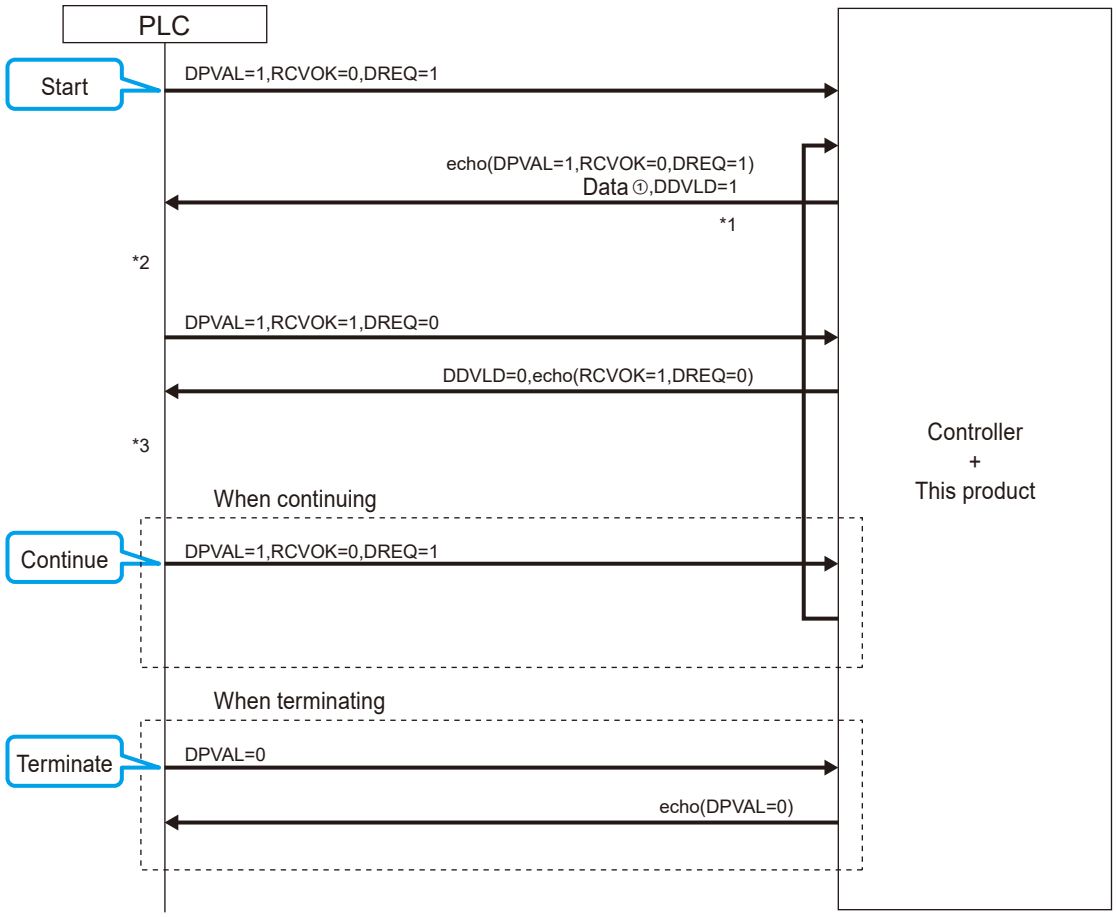
| Field name | Size | Description |
|---|---|---|
| CHGPRM | 1 bit | Change Parameter<br>Parameter setting change<br>1: Change request<br>0: No change request<br>* Changed on transition from 0 → 1. |
| CLRRQ | 1 bit | Clear Request<br>Error status clear request<br>1: Clear request<br>0: No clear request<br>* Cleared on transition from 0 → 1. |
| DPVAL | 1 bit | Display Value<br>Display value acquisition start<br>1: Start display value acquisition<br>0: Stop display value acquisition |

| Field name | Size | Description |
|---|---|---|
| DREQ | 1 bit | Data Request<br>Measured/displayed value data request<br>1: Data request<br>0: No data request |
| ENDN | 1 bit | Endian Swap<br>Endian selection<br>1: Big endian<br>0: Little endian |
| PRM[0:7] | 8 bit | Parameter Number<br>Specify parameter set numbers 0 to 19 (0x00 to 0xff) |
| PSTRQ | 1 bit | Preset Request<br>Preset request<br>1: Preset request<br>0: No preset request<br>* Set on transition from 0 → 1. |
| RBTRQ | 1 bit | Reboot Request<br>Device reset request<br>1: Reset request<br>0: No reset request<br>* Reset on transition from 0 → 1. |
| RCVOK | 1 bit | Receive OK<br>Measurement data reception complete |
| RUN | 1 bit | Run<br>Measurement start/stop<br>1: Measurement start<br>0: Measurement stop |
| SNGL | 1 bit | Single Measurement<br>Single measurement specification<br>1: Single measurement<br>0: Continuous-run measurement |
| STRM | 1 bit | Stream Measurement<br>Measurement data streaming acquisition<br>1: Streaming acquisition<br>0: Normal acquisition |
| TOLON | 1 bit | Torelance On<br>GO/NG judgment ON/OFF<br>1: GO/NG judgment ON<br>0: GO/NG judgment OFF |

## ■ Communication method

This section describes the procedure for communication from an EtherCAT master (PLC, etc.) to the EtherCAT slave (this product).

### ● Idle value display

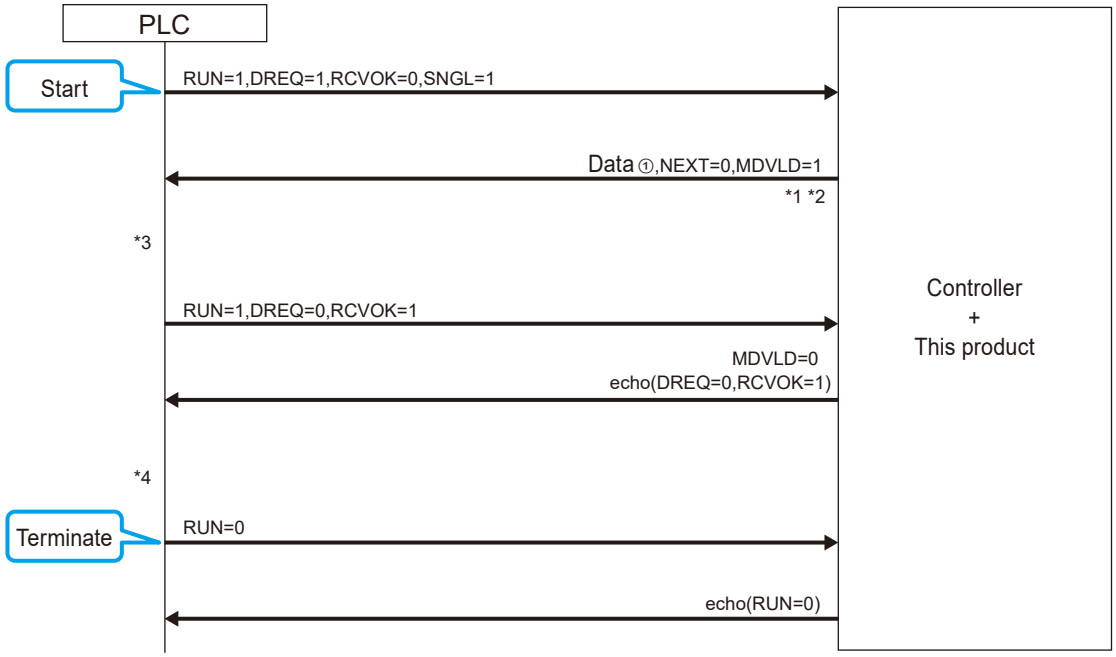



*1 Response (output data to IN area of the EtherCAT master (PLC, etc.))
- Idle value ①: Bytes 20 to 23 data ①
- Status record: Bytes 4 to 7
- Error record: Bytes 0 to 3
- Valid data quantity: Bytes 16 to 17 (valid data quantity=1)

*2 Processing on PLC side
- Checks that DDVLD=1 was set.
- Reads the valid data quantity to check the data count.
- Reads in the number of pieces of data from data areas ① through ⑳ as written in the valid data quantity.
- Sets the data reception OK flag.
  RCVOK=1
  DREQ=0

*3 Processing on PLC side
After confirming DDVLD=0, sets RCVOK=0.

## ● Single measurement execution




*1 For single measurement: NEXT=0

*2 Response (output data to IN area of the EtherCAT master (PLC, etc.))
- Status record: Bytes 4 to 7
- Error record: Bytes 0 to 3
- Valid data quantity: Bytes 16 to 17
- Measured value ①: Bytes 20 to 23
- GO/NG judgment result of measured value ①: Bytes 24 to 25
- Data status of measured value ①: Bytes 26 to 27
  (When two items measurement is performed, the acquired two items of data are stored in the data ① and ⑪ areas, respectively.)

  For details about two items measurement, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).

*3 Processing on PLC side
- Checks that MDVLD=1 was set.
- Reads the valid data quantity to check the data count.
- Reads in the number of pieces of data from data areas ① through ⑳ as written in the valid data quantity.
  (When two items measurement is performed, the acquired two items of data are stored in the data ① to ⑩ and ⑪ to ⑳ areas, respectively.)

  For details about two items measurement, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).
- Sets the data reception OK flag.
  RCVOK=1
  DREQ=0

*4 Processing on PLC side
After confirming MDVLD=0, sets RCVOK=0.

## ● Continuous measurement execution

Data can be acquired either by normal acquisition or streaming acquisition.

Streaming acquisition allows measurement data acquisition at shorter intervals than normal acquisition.

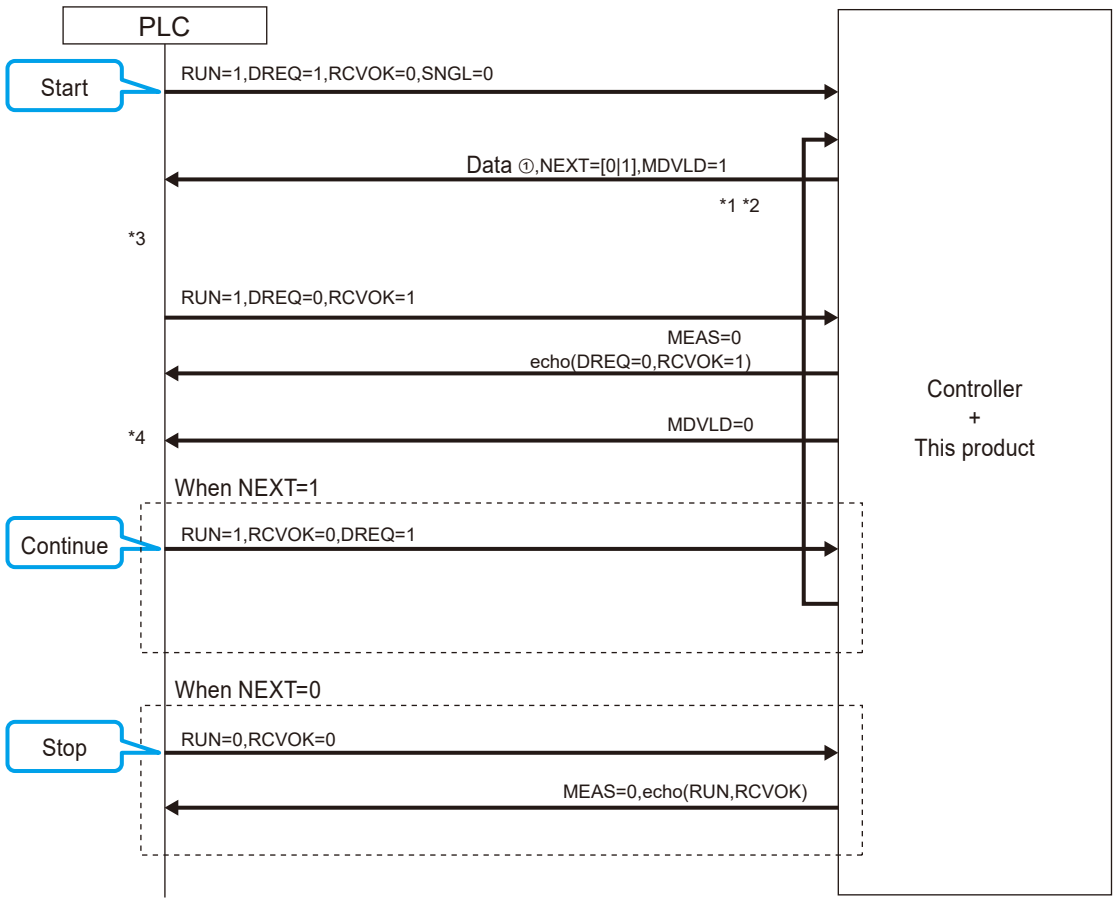
Use of streaming acquisition is recommended if the number of averaging is set to less than 4 times by the LSM controller.

For details about the number of averaging, see 📖 "Laser Scan Micrometer <Controller> User's Manual" (separate document).

### IMPORTANT

Communication handshaking between the PLC and LSM is omitted during streaming acquisition, so data is not assured. If you want to detect missing data, create a PLC program to check using sequence numbers.

#### With normal acquisition




*1 If the valid data quantity is not -1: NEXT=1

*2 Response (output data to IN area of the EtherCAT master (PLC, etc.))
- Status record: Bytes 4 to 7
- Error record: Bytes 0 to 3
- Valid data quantity: Bytes 16 to 17
- Measured value ①: Bytes 20 to 23
- GO/NG judgment result of measured value ①: Bytes 24 to 25
- Data status of measured value ①: Bytes 26 to 27
  (When two items measurement is performed, the acquired two items of data are stored in the data ① and ⑪ areas, respectively.)

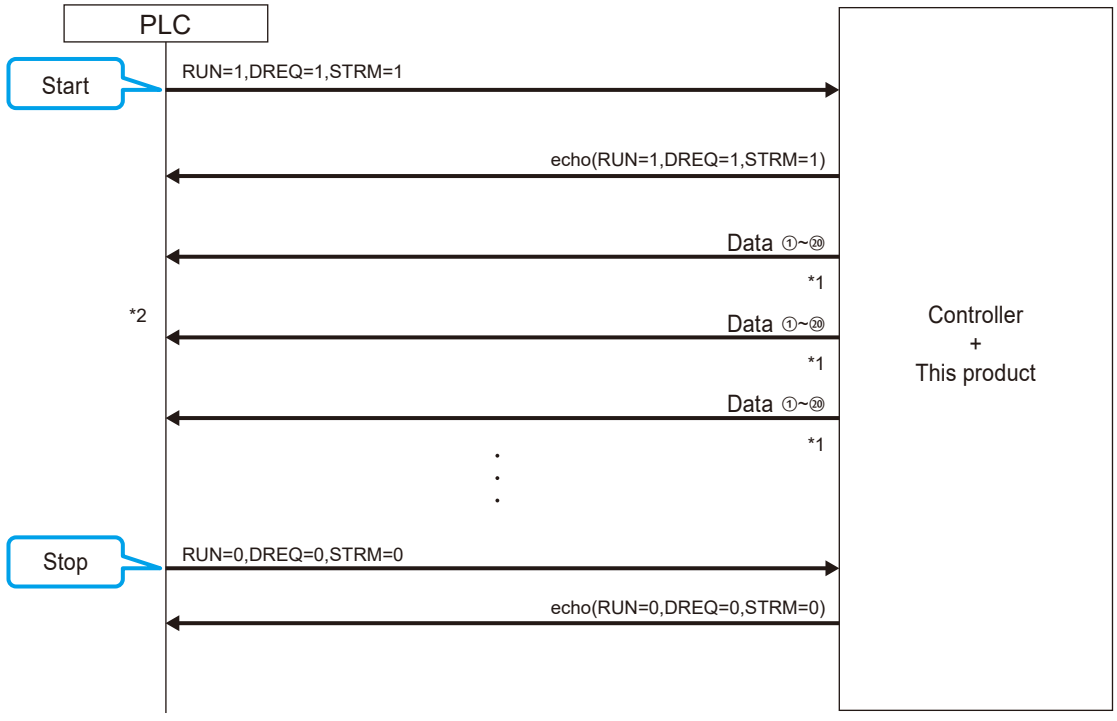
  For details about two items measurement, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).

*3 Processing on PLC side
- Checks that MDVLD=1 was set.
- Reads the valid data quantity to check the data count.
- Reads in the number of pieces of data from data areas ① through ⑳ as written in the valid data quantity.
  (When two items measurement is performed, the acquired two items of data are stored in the data ① to ⑩ and ⑪ to ⑳ areas, respectively.)

  For details about two items measurement, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).
- Sets the data reception OK flag.
  RCVOK=1
  DREQ=0

*4 Processing on PLC side
After confirming MDVLD=0, sets RCVOK=0.

With streaming acquisition



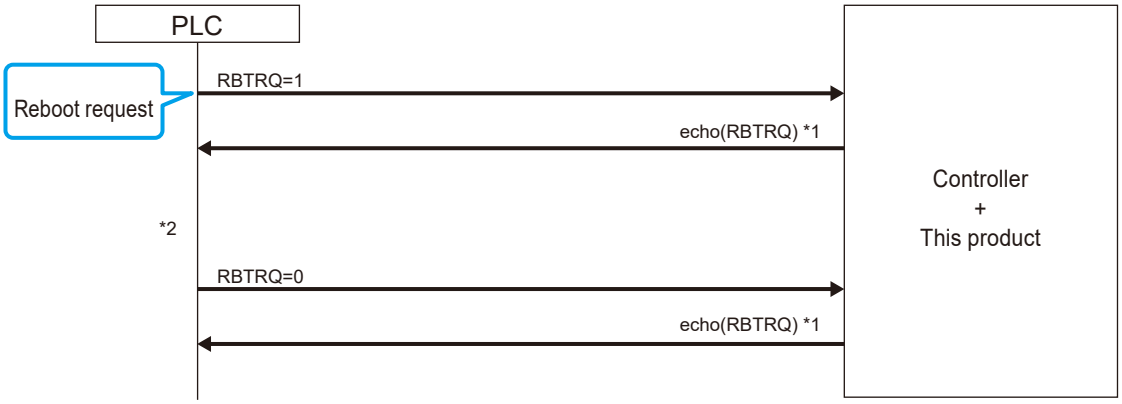
*1 Response (output data to IN area of the EtherCAT master (PLC, etc.))
- Status record: Bytes 4 to 7
- Error record: Bytes 0 to 3
- Valid data quantity: Bytes 16 to 17
- Measured value ①: Bytes 20 to 23
- GO/NG judgment result of measured value ①: Bytes 24 to 25
- Data status of measured value ①: Bytes 26 to 27
  (When two items measurement is performed, the acquired two items of data are stored in the data ① and ⑪ areas, respectively.)

  For details about two items measurement, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).

*2 Processing on PLC side
Data is acquired by repeating the following steps.
Data is updated at the specified communication cycle, and SEQNO is incremented at each update.
- Check the sequence number (SEQNO) of the data.
- Reads the valid data quantity to check the data count.
- Reads in the number of pieces of data from data areas ① through ⑳ as written in the valid data quantity.
  (When two items measurement is performed, the acquired two items of data are stored in the data ① to ⑩ and ⑪ to ⑳ areas, respectively.)

  For details about two items measurement, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).

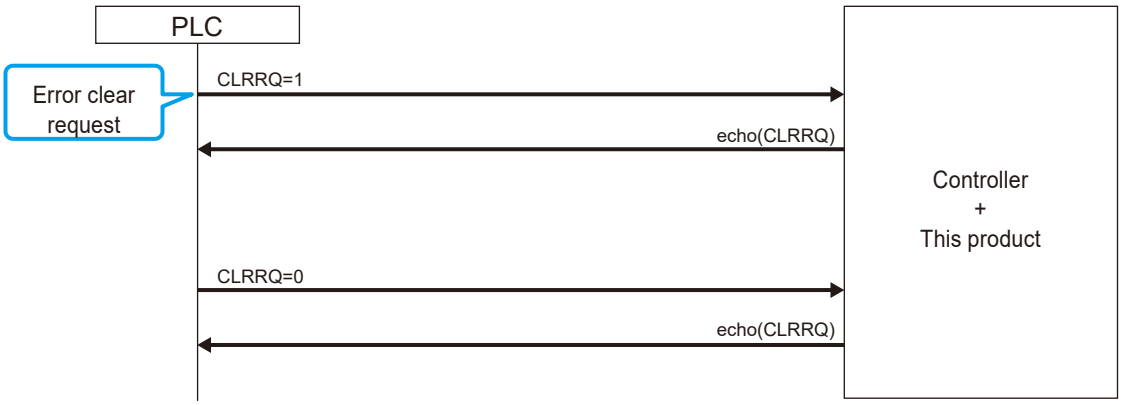
## ● Reboot request




*1 Depending on the timing, this response may not be received by PLC. This is because when RBTRQ is issued, the device enters reboot operation and echo(RBTRQ) becomes 0.

*2 The RBTRQ bit should be held for at least one cycle of cyclic communication.

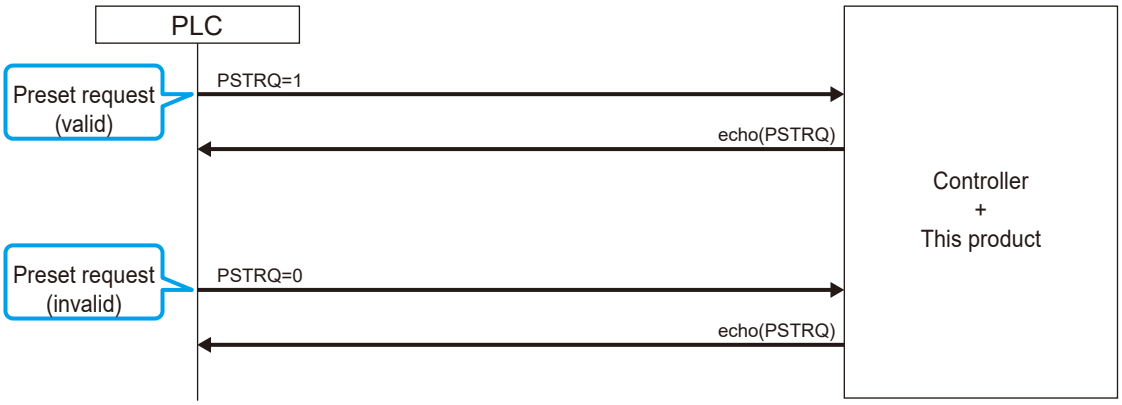
## ● Error clear request



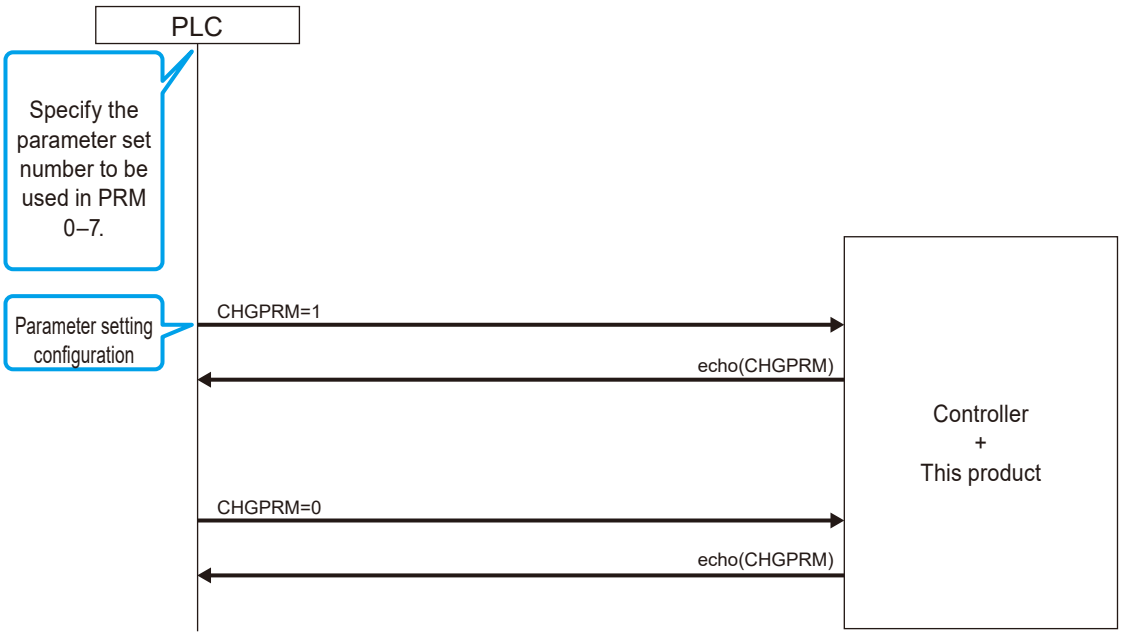
**Tips**

To update the error status after assertion of CLRRQ, set DPVAL ON and update the current value display.

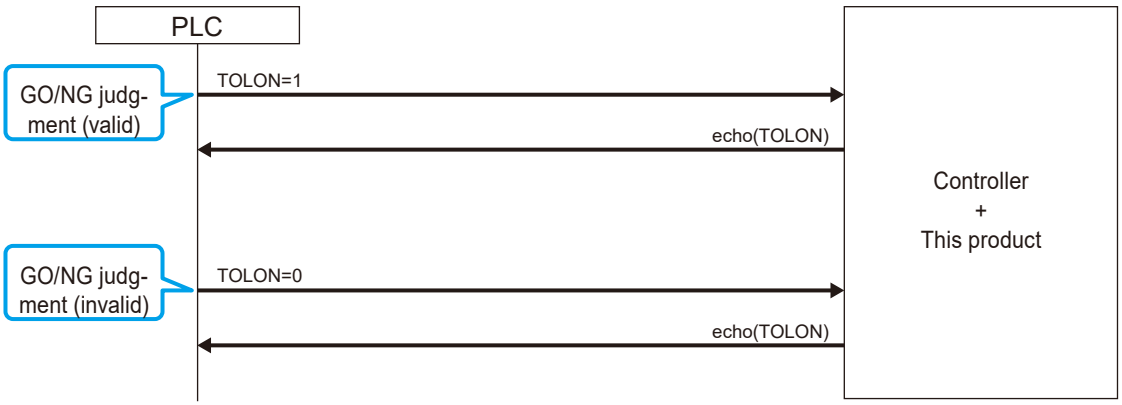
## ● Preset request




## ● Parameter setting configuration

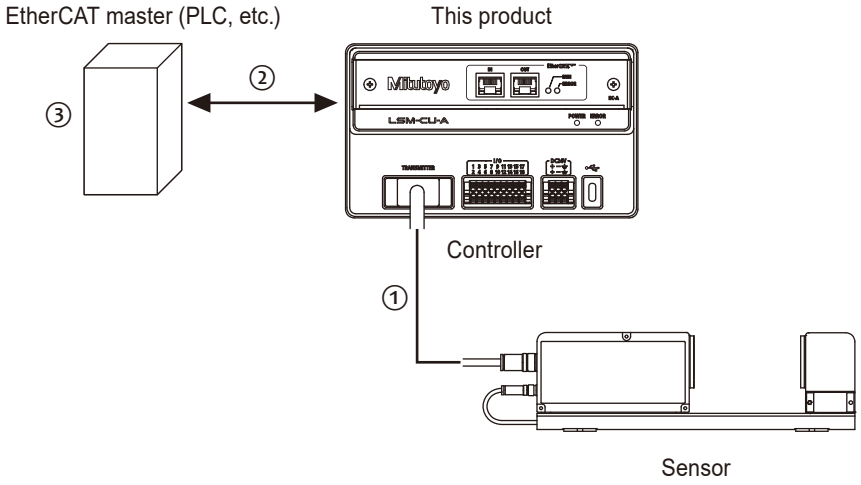


## ● GO/NG judgment setting



## 5.1.2 Duration of Data Processing

Time required from measurement execution to data processing by the EtherCAT master (PLC, etc.) is shown below.




Maximum data processing time = ① + ② + ③

① Response time of the controller

② Transmission interval

③ Scanning time of the EtherCAT master (PLC, etc.)

① For details about response time of the controller, see 📖 "Laser Scan Micrometer <Controller> User's Manual" (separate document).

② The communication cycle is set by the configuration software on the EtherCAT master side. The minimum value that can be set is 2 ms.

③ Program scan times of the EtherCAT master vary according to device processing capacity and program size. Check specifications of the device used and program execution time.

### Tips

If the EtherCAT master's scan time is shorter than the communication cycle, data may not be acquired correctly.

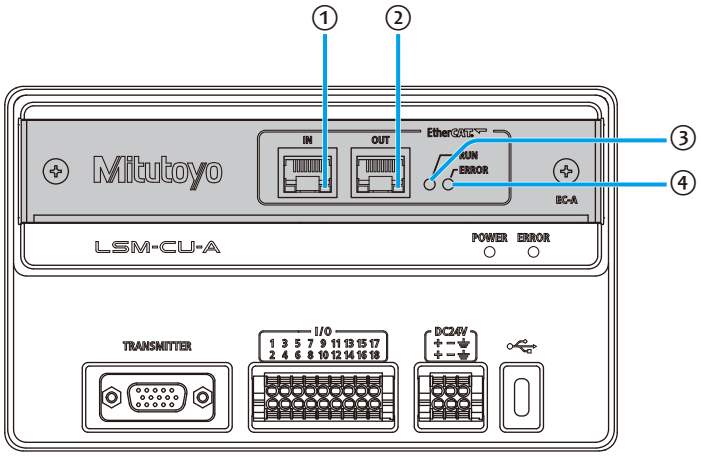
# 5.2 Status Indication

The status of the controller and network can be checked with the LEDs on this product or with LSMPAK.

For details about LSMPAK, see 📖 "Laser Scan Micrometer <Controller> User's Manual" (separate document).

## 5.2.1 LED Indicators on This Product

The LED indications of this product change according to the status of the controller and network.

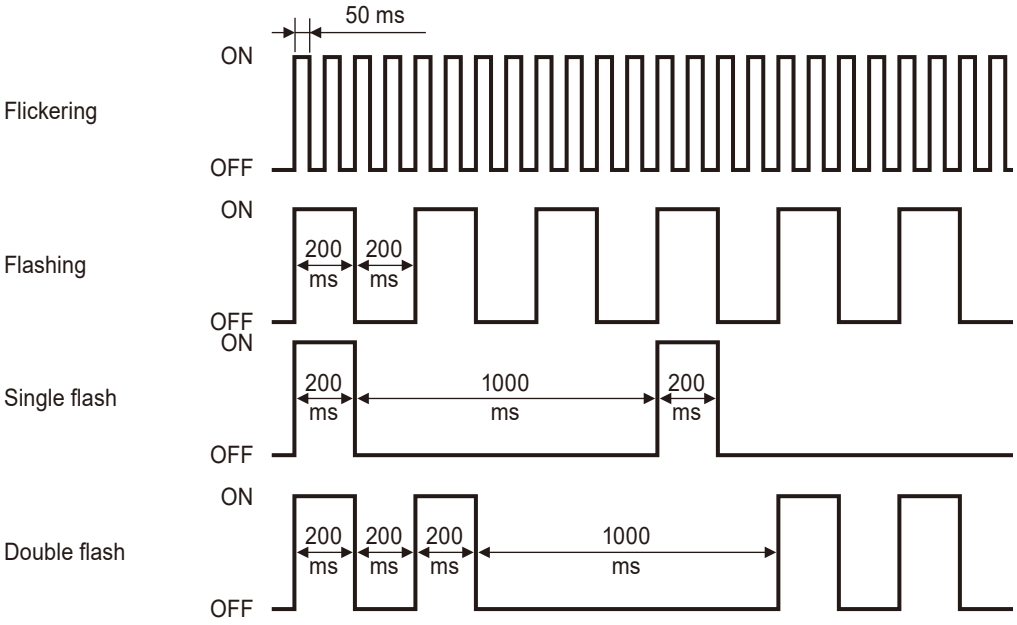



| No. | Name | Applica-tion | Indicator color | | Description |
|---|---|---|---|---|---|
| ① | Link/activity LED (port IN) | Ethernet | Off | | No data is being sent or received. |
| | | | Flashing green | | Data is being sent/received. |
| ② | Link/activity LED (port OUT) | Ethernet | Off | | No data is being sent or received. |
| | | | Flashing green | | Data is being sent/received. |
| ③ | RUN indicator* | EtherCAT | Off | | Power is not being supplied to this product or EtherCAT communication is undergoing initialization. |
| | | | Flashing green | | This product is in the pre-operational state. |
| | | | Single green flash | | This product is in the safe-operational state. |
| | | | Steady green | | This product is in the operational state (connection is established with the EtherCAT master). |

| No. | Name | Application | Indicator color | | Description |
|---|---|---|---|---|---|
| ④ | ERROR indicator | EtherCAT | Off | | Power is not being supplied to the product or there is nothing wrong with the product. |
| | | | Flashing red | | Incorrect communication settings were received from EtherCAT master.<br>Check the settings on the EtherCAT master side. |
| | | | Flickering red | | An SII EEPROM access error occurred.<br>Replacement of this product may be required. |
| | | | Single red flash | | A synchronization error or communication data error occurred. Check the settings on the EtherCAT master side.<br>Example: The EtherCAT master does not supply a synchronization signal with the DC synchronization configuration. |
| | | | Double red flash | | EtherCAT communication timed out.<br>Example: The Ethernet cable was disconnected during EtherCAT communication. |
| | | | Steady red | | Unrecoverable error occurred in this product. Replacement of this product may be required. |

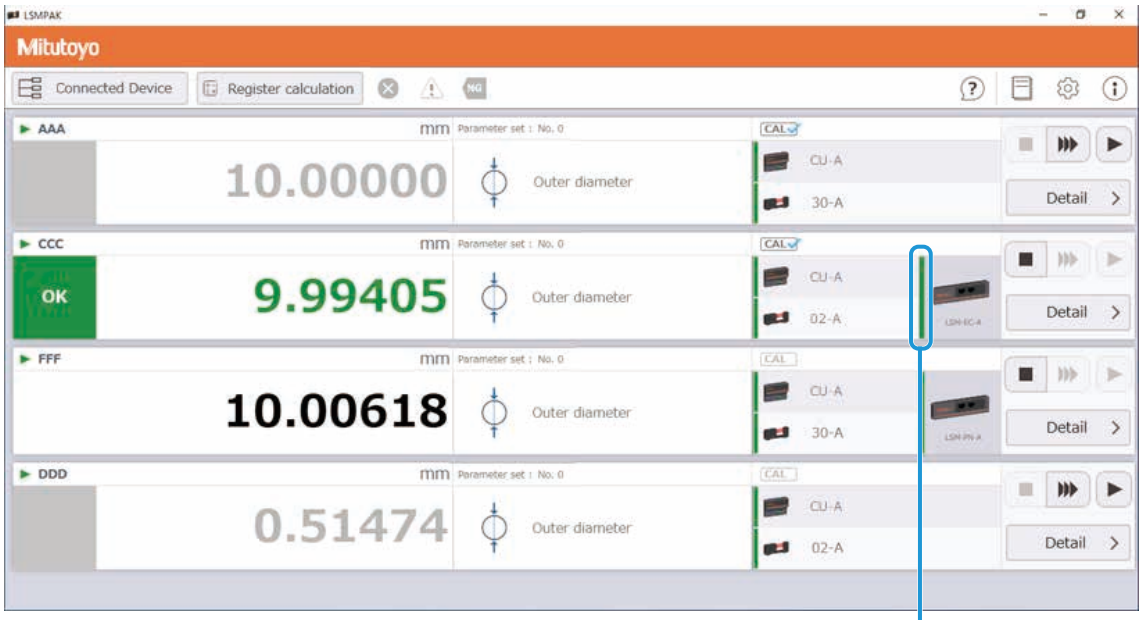
* For details on communication states of this product, see "■ Overview" on page 15.

* The timings at which the RUN and ERROR indicators flash are as indicated below.



## 5.2.2 LSMPAK Screen

When this product is operating normally, the status LED lights green. (Red: Error occurred, Gray: Not working)



# 6 Troubleshooting

If you cannot access the network, check the LED indicators.

For details about the LED indicators, see "5.2.1 LED Indicators on This Product" on page 36
For details about LSMPAK error messages, see "Laser Scan Micrometer <Controller> User's Manual" (separate document).

| Problem | Cause | Solution |
|---|---|---|
| Power does not go on. | This product is not properly inserted into the socket of LSM-CU-A. | Insert this product correctly into the LSM-CU-A.<br>"4.2 Connecting to the Controller" on page 10 |
| Communication not working. | The cable is not properly connected. | Check cable connections and verify that the link/activity LED is lit. |
| | The connected device is not turned on. | Make sure the connected device is turned on and that the link/activity LED is lit. |
| | Incorrect communication settings on current device or connected device. | Check the LED indicators on the device and make communication settings required to obtain a normal lighting pattern.<br>For details on LED lighting patterns, see "5.2.1 LED Indicators on This Product" on page 36.<br>For communication settings for the connected device, see the manual or other document related to that device. |
| Operation of this product is unstable.<br>• Correct measurement values cannot be obtained.<br>• Communication errors occur.<br>• 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.<br>This product resumes normal operation after the electromagnetic interference is eliminated. |
| Operation of other devices is unstable.<br>This product is causing loss of specified functionality of other devices. | This product is being used in other than the intended operating environment.<br>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

# 7 Specifications

This chapter describes the specifications of this product.

## 7.1 Basic Specifications

| Item | Specification | | |
|---|---|---|---|
| Code No. | 02AGQ370 | | |
| Model number | LSM-EC-A | | |
| Interface | LED | RUN indicator | Single Color LED1 (green) |
| | | ERROR indicator | Single Color LED2 (red) |
| | RJ45 connector | 2 channels | |
| Operating environment | 0 °C to 50 °C, 20 % RH to 85 % RH (non-condensing) | | |
| Storage environment | -10 °C to 60 °C, 20 % RH to 85 % RH (non-condensing) | | |
| CE marking/ UKCA marking | EMC Directive/Electromagnetic Compatibility Regulations: EN IEC 61326-1<br>Immunity test requirement: Clause 6.2 Table 2<br>Emission limit: Class A<br>RoHS Directive/The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations<br>: EN IEC 63000 | | |

## 7.2 Ethernet Communication Specifications

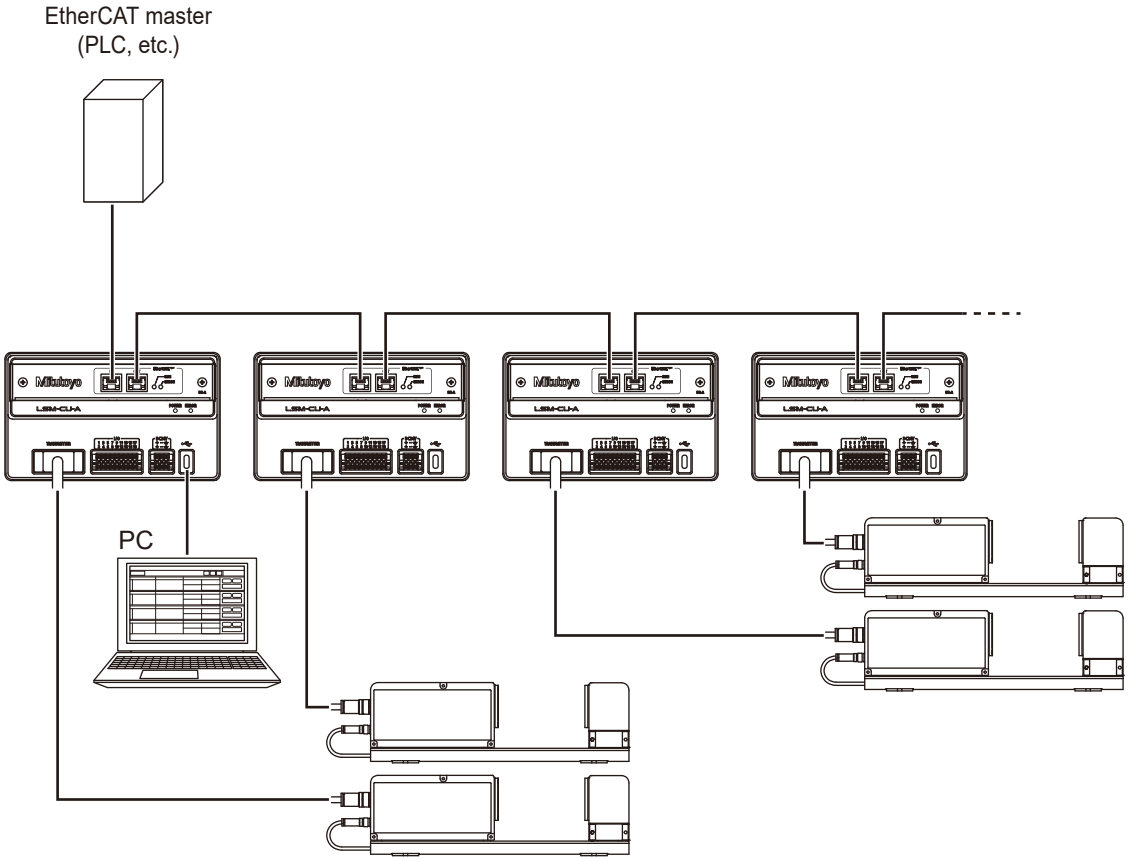
| Item | Specification |
|---|---|
| Communication port | RJ45×2 |
| Transmission speed | 100 Mbps, full duplex |
| Cable used | STP communication cables of type Cat.5e or higher |

# 7.3 Measurement Configurations Usable with This Product

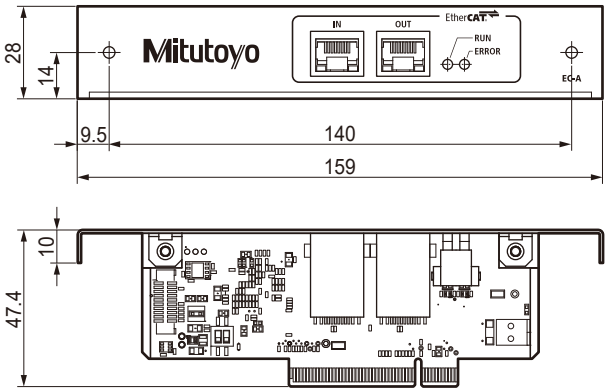
Using this device, multiple LSM controllers can be connected to a network.
Typical connection of multiple LSM controllers is shown below.
Networked LSM controllers can be managed from a PC using LSMPAK.
The maximum number of LSM controllers that can be managed using LSMPAK is eight.

**Tips**

Use port IN for connection from upstream (the PLC side) and port OUT for connection to the downstream LSM.



# 7.4 External Dimensions Drawing




Unit: mm

# SERVICE NETWORK

*As of June 2023

**Europe**

**Mitutoyo Europe GmbH**
Borsigstrasse 8-10, 41469 Neuss, GERMANY
TEL: 49 (0)2137 102-0 FAX: 49 (0)2137 102-351

**Mitutoyo CTL Germany GmbH**
Von-Gunzert-Strasse 17, 78727 Oberndorf, GERMANY
TEL: 49 (0)7423 8776-0 FAX: 49 (0)7423 8776-99

**KOMEG Industrielle Messtechnik GmbH**
Zum Wasserwerk 3, 66333 Völklingen, GERMANY
TEL: 49 (0)6898 91110 FAX: 49 (0)6898 9111100

**Germany**

**Mitutoyo Deutschland GmbH**
Borsigstrasse 8-10, 41469 Neuss, GERMANY
TEL: 49 (0)2137 102-0 FAX: 49 (0)2137 86 85

**M³ Solution Center Hamburg**
Tempowerkring 9·im HIT-Technologiepark 21079 Hamburg, GERMANY
TEL: 49 (0)40 791894-0 FAX: 49 (0)40 791894-50

**M³ Solution Center Berlin**
Ernst-Lau-Straße 6, 12489 Berlin, GERMANY
TEL:49(0)30 2611 267 FAX: 49 30 67988729

**M³ Solution Center Eisenach**
Neue Wiese 4, 99817 Eisenach,GERMANY
TEL: 49 (0)3691 88909-0 FAX: 49 (0)3691 88909-9

**M³ Solution Center Ingolstadt**
Marie-Curie-Strasse 1A, 85055 Ingolstadt, GERMANY
TEL: 49 (0)841 954920 FAX: 49 (0)841 9549250

**M³ Solution Center Leonberg**
Am Längenbühl 3, 71229 Leonberg, GERMANY
TEL: 49 (0)7152 6080-0 FAX: 49 (0)7152 608060

**Mitutoyo Deutschland GmbH - Small Tool Sales Division**
Heidenheimer Strasse 14, 71229 Leonberg, GERMANY
TEL: 49 (0)7152 9237-0 FAX: 49 (0)7152 9237-29

**U.K.**

**Mitutoyo (UK) Ltd. HQ**
Joule Road, West Point Business Park,
Andover, Hampshire SP10 3UX, UNITED KINGDOM
TEL: 44 (0)1264 353123 FAX: 44 (0)1264 354883

**Coventry M³ Solution Centre**
Unit6, Banner Park, Wickmans Drive, Coventry,
West Midlands CV4 9XA, UNITED KINGDOM
TEL: 44 (0)2476 426300

**Halifax M³ Solution Centre**
Lowfields Business Park, Navigation Close, Elland,
West Yorkshire HX5 9HB, UNITED KINGDOM
TEL: 44 (0)1422 375566

**East Kilbride M³ Solution Centre**
The Bairds Building, Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride G75 0QF, UNITED KINGDOM
TEL: 44 (0)1355 581170

**France**

**Mitutoyo France**
Paris Nord 2-123 rue de la Belle Etoile, BP 59267 ROISSY EN FRANCE 95957 ROISSY CDG CEDEX, FRANCE
TEL: 33 (0)149 38 35 00

**M³ Solution Center LYON**
Parc Mail 523, cours du 3ème millénaire, 69791 Saint-Priest, FRANCE
TEL: 33 (0)149 38 35 70

**M³ Solution Center STRASBOURG**
Parc de la porte Sud, Rue du pont du péage, 67118 Geispolsheim, FRANCE
TEL: 33 (0)149 38 35 80

**M³ Solution Center CLUSES**
290 Avenue des Lacs, 74950 Scionzier, FRANCE
TEL: 33 (0)1 49 38 35 90

**M³ Solution Center TOULOUSE**
Aeroparc Saint Martin Cellule B08 ZAC de Saint Martin du Touch 12 rue de Caulet 31300 Toulouse, FRANCE
TEL: 33 (0)1 49 38 42 90

**M³ Solution Center RENNES**
2, rue Claude Chappe, PA le Vallon - ZAC Mivoie, 35230 Noyal-Châtillon-sur-Seiche, FRANCE
TEL: 33 (0)1 49 38 42 10

**Italy**

**Mitutoyo Italiana S.r.l.**
Corso Europa, 7 - 20045 Lainate (MI), ITALY
TEL: 39 02 935781 FAX: 39 02 93578255

**M³ Solution Center BOLOGNA**
Via dei Carpini1/A - 40011 Anzola Emilia (BO), ITALY
TEL: 39 02 93578215 FAX: 39 02 93578255

**M³ Solution Center CHIETI**
Contrada Santa Calcagna - 66020 Rocca S. Giovanni (CH), ITALY
TEL: 39 02 93578280 FAX: 39 02 93578255

**M³ Solution Center PADOVA**
Via G. Galilei 21/F - 35035 Mestrino (PD), ITALY
TEL: 39 02 93578268 FAX: 39 02 93578255

**Netherlands**

**Mitutoyo Nederland B.V.**
Storkstraat 30, 3905 KX Veenendaal,
THE NETHERLANDS
TEL: 31(0)318-534911

**Mitutoyo Nederland B.V. / M³ Solution Center Enschede**
Institutenweg 50, 7521 PK Enschede,
THE NETHERLANDS
TEL: 31(0)318-534911

**Mitutoyo Nederland B.V. / M³ Solution Center Eindhoven**
De Run 1115, 5503 LB Veldhoven,
THE NETHERLANDS
TEL: 31(0)318-534911

**Mitutoyo Research Center Europe B.V.**
De Rijn 18, 5684 PJ Best, THE NETHERLANDS
TEL:31(0)499-320200 FAX:31(0)499-320299

**Belgium**

**Mitutoyo Belgium N.V. / M³ Solution Center Melsele**
Schaarbeekstraat 20, B-9120 Melsele, BELGIUM
TEL: 32 (0)3-2540444

**Sweden**

**Mitutoyo Scandinavia AB**
Släntvägen 6, 194 61 Upplands Väsby, SWEDEN
TEL: 46 (0)8 594 109 50

**Mitutoyo Scandinavia AB / M³ Solution Center Alingsås**
Ängsvaktaregatan 3A, 441 38 Alingsås, SWEDEN
TEL: 46 (0)8 594 109 50

**Mitutoyo Scandinavia AB / M³ Solution Center Värnamo**
Kalkstensvägen 7, 331 44 Värnamo, SWEDEN
TEL: 46 (0)8 594 109 50

**Switzerland**

**Mitutoyo (Schweiz) AG**
Steinackerstrasse 35, 8902 Urdorf, SWITZERLAND
TEL: 41 (0)447361150

**Mitutoyo (Suisse) SA**
Rue Galilée 4, 1400 Yverdon-les Bains, SWITZERLAND
TEL: 41 (0)244259422

**Poland**

**Mitutoyo Polska Sp.z o.o.**
Ul.Graniczna 8A, 54-610 Wroclaw, POLAND
TEL: 48 (0)71354 83 50 FAX: 48 (0)71354 83 55

**Czech Republic**

**Mitutoyo Česko s.r.o.**
Dubská 1626, 415 01 Teplice, CZECH REPUBLIC
TEL: 420 417-514-011 Email: info@mitutoyo.cz

**Mitutoyo Česko s.r.o. M³ Solution Center Ivančice**
Ke Karlovu 62/10, 664 91 Ivančice, CZECH REPUBLIC
TEL: 420 417-514-011 Email: info@mitutoyo.cz

**Mitutoyo Česko s.r.o. M³ Solution Center Ostrava Mošnov**
Mošnov 314, 742 51 Mošnov, CZECH REPUBLIC
TEL: 420 417-514-050 Email: info@mitutoyo.cz

**Mitutoyo Česko s.r.o. Slovakia Branch**
Hviezdoslavova 124, 017 01 Považská Bystrica, SLOVAKIA
TEL: 421 948-595-590 Email: info@mitutoyo.sk

**Hungary**

**Mitutoyo Hungária Kft.**
Galamb József utca 9, 2000 Szentendre, HUNGARY
TEL: 36 (30) 6410210

**Romania**

**Mitutoyo Romania SRL**
1A Drumul Garii Odai Street, showroom, Ground Floor, 075100 OTOPENI-ILFOV, ROMANIA
TEL: 40 (0)311012088 FAX: +40 (0)311012089

**Showroom in Brasov**
Strada Ionescu Crum Nr.1, Brasov Business Park Turnul 1, Mezanin, 500446
Brasov-Judetul Brasov, ROMANIA
TEL/FAX: 40 (0)371020017

**Finland**

**Mitutoyo Scandinavia AB Finnish Branch**

Viherkiitäjä 2A, 33960, Pirkkala, FINLAND

TEL: 358 (0)40 355 8498

**Austria**

**Mitutoyo Austria GmbH**

Salzburger Straße 260 / 3 A-4600 Wels, AUSTRIA

TEL: 43 (0)7242 219 998

**Mitutoyo Austria GmbH Goetzis Regional showroom**

Lastenstrasse 48a, 6840 Götzis, AUSTRIA

**Singapore**

**Mitutoyo Asia Pacific Pte. Ltd.**

**Head office / M³ Solution Center**

24 Kallang Avenue, Mitutoyo Building, SINGAPORE 339415

TEL:(65)62942211 FAX:(65)62996666

**Malaysia**

**Mitutoyo (Malaysia) Sdn. Bhd.**

**Kuala Lumpur Head Office / M³ Solution Center**

Mah Sing Integrated Industrial Park, 4, Jalan Utarid U5/14, Section U5, 40150 Shah Alam, Selangor, MALAYSIA

TEL:(60)3-78459318 FAX:(60)3-78459346

**Penang Branch office / M³ Solution Center**

30, Persiaran Mahsuri 1/2, Sunway Tunas, 11900 Bayan Lepas, Penang, MALAYSIA

TEL:(60)4-6411998 FAX:(60)4-6412998

**Johor Branch office / M³ Solution Center**

70 (Ground Floor), Jalan Molek 1/28, Taman Molek, 81100 Johor Bahru, Johor, MALAYSIA

TEL:(60)7-3521626 FAX:(60)7-3521628

**Thailand**

**Mitutoyo (Thailand) Co., Ltd.**

**Bangkok Head Office / M³ Solution Center**

76/3-5, Chaengwattana Road, Kwaeng Anusaowaree, Khet Bangkaen, Bangkok 10220, THAILAND

TEL:(66)2080 3500 FAX:(66)2521 6136

**Chonburi Branch / M³ Solution Center**

7/1, Moo 3, Tambon Bowin, Amphur Sriracha, Chonburi 20230, THAILAND

TEL:(66)2080 3563 FAX:(66)3834 5788

**ACC Branch / M³ Solution Center**

122/8, 122/9, Moo 6, Tambon Donhuaroh, Amphur Muangchonburi, Chonburi 20000, THAILAND

TEL:(66)2080 3565

**Indonesia**

**PT. Mitutoyo Indonesia**

**Head Office / M³ Solution Center**

Jalan Sriwijaya No.26 Desa cibatu Kec. Cikarang Selatan Kab. Bekasi 17530, INDONESIA

TEL: (62)21-2962 8600 FAX: (62)21-2962 8604

**Batam Branch Office**

Business Center Adhya Building 3rd Floor Kompleks Permata Niaga Blok A No. 1, Jalan jendral Sudirman Kelurahan Sukajadi, Kecamatan Batam Kota, Kepulauan Riau 29444, INDONESIA

TEL: (62)-778-4888000

**Vietnam**

**Mitutoyo Vietnam Co., Ltd**

**Hanoi Head Office / M³ Solution Center**

1st & 2nd floor, MHDI Building, No. 60 Hoang Quoc Viet Road, Nghia Do Ward, Cau Giay District, Hanoi, VIETNAM

TEL:(84)24-3768-8963 FAX:(84)24-3768-8960

**Ho Chi Minh City Branch Office / M³ Solution Center**

Unit No. B-00.07, Ground Floor, C1 Building, No. 6, Street D9, An Loi Dong Ward, Thu Duc City, Ho Chi Minh City, VIETNAM

TEL:(84)28-3840-3489 FAX:(84)28-3840-3498

**Hai Phong City Branch Office**

Room 511, 5th Floor, Thanh Dat 3 Building, No. 4 Le Thanh Tong Street, May To Ward, Ngo Quyen District, Hai Phong City, VIETNAM

TEL:(84)22-5398-9909

**Philippines**

**Mitutoyo Philippines, Inc.**

**Head Office / M³ Solution Center**

Unit 1B & 2B LTI, Administration Building 1, Annex 1, North Main Avenue, Laguna Technopark, Binan Laguna 4024, PHILIPPINES

TEL/FAX:(63) 49 544 0272

**India**

**Mitutoyo South Asia Pvt. Ltd. Head Office**

C-122, Okhla Industrial Area, Phase-I, New Delhi-110 020, INDIA

TEL: (91) 11-40578485/86

**MSA Technical Center**

Plot no. 65, Ground Floor, Udyog Vihar, Phase-4 Gurgaon, Haryana - 122016, INDIA

TEL : (91) 124–2340286/287

**Mumbai Region Head office**

303, Sentinel Hiranandani Business Park Powai, Mumbai-400 076, INDIA

TEL: (91) 22-25700684/685/837/839

**Pune Office / M³ Solution Center**

G4/G5, Pride Kumar Senate, Off. Senapati Bapat Road, Pune-411 016, INDIA

TEL:(91) 20-25660043/44/45

**Ahmedabad Office / M³ Solution Center**

A-104 & A-105, First Floor, Solitaire Corporate Park, Near Divya Bhaskar Press, S.G. Road, Ahmedabad - 380 015, INDIA

TEL: (91) 079 - 29704902/903

**Bengaluru Region Head office / M³ Solution Center**

116/117-2, Ground Floor, Sy. No. 93 & 94, 3rd Phase, Peenya Industrial Area, Bengaluru-560 058, INDIA

TEL: (91) 80-25630946/47/48/49

**Coimbatore Office**

Regus, Srivari Srimath, 3rd Floor, Door No:1045, Avinashi Road, Coimbatore - 641 018,INDIA

TEL: (91) 9345005663

**Chennai Office / M³ Solution Center**

No. 624, Anna Salai Teynampet, Chennai-600 018, INDIA

TEL: (91) 44-24328823/24/25

**Kolkata Office**

Unit No. 1208,Om Tower, 32,J.L.Nehru Road, Kolkata-700 071, INDIA

TEL: (91) 33-22267088/40060635/22266817

## Taiwan

**Mitutoyo Taiwan Co., Ltd. / M³ Solution Center Taipei**

4F., No.71, Zhouzi St., Neihu Dist.,Taipei City 114, TAIWAN

TEL:886(2)5573-5900 FAX:886(2)8752-3267

**Taichung Branch / M³ Solution Center Taichung**

1F., No. 299, Gaotie 1st Rd., Wuri Dist., Taichung City 414, TAIWAN

TEL:886(4)2338-6822 FAX:886(4)2338-6722

**Kaohsiung Branch / M³ Solution Center Kaohsiung**

1F., No.31-1, Haibian Rd., Lingya Dist., Kaohsiung City 802, TAIWAN

TEL:886(7)334-6168 FAX:886(7)334-6160

## South Korea

**Mitutoyo Korea Corporation**

**Head Office / M³ Solution Center**

(Sanbon-Dong, Geumjeong High View Build.), 6F, 153-8, Ls-Ro, Gunpo-Si, Gyeonggi-Do, 15808 KOREA

TEL:82(31)361-4200 FAX:82(31)361-4201

**Busan Office / M³ Solution Center**

(3150-3, Daejeo 2-dong) 8,Yutongdanji 1-ro 49beon-gil, Gangseo-gu, Busan, 46721 KOREA

TEL:82(51)324-0103 FAX:82(51)324-0104

**Daegu Office / M³ Solution Center**

(Galsan-dong, Daegu Business Center), 301-Ho, 217, Seongseogongdan-ro, Dalseo-gu, Daegu 42704 KOREA

TEL:82(53)593-5602 FAX:82(53)593-5603

## China

**Mitutoyo Measuring Instruments (Shanghai) Co., Ltd.**

8th Floor, Tower 1 Lujiazui Jinkong Square No.1788/1800 Century Ave., Pudong New District, Shanghai 200122, CHINA

TEL:86(21)5836-0718 FAX:86(21)5836-0717

**Suzhou Office / M³ Solution Center China (Suzhou)**

1/2 Floor, Building 4, No.175 Songbei Road, Suzhou Free Trade Zone, Suzhou City, Jiangsu 215000, CHINA

TEL:86(512)6522-1790 FAX:86(512)6251-3420

**Wuhan Office / M³ Solution Corner**

Room 1701, Wuhan Wanda Center, No. 96, Linjiang Road, Wuchang District, Wuhan Hubei 430060, CHINA

TEL:86(27)8544-8631 FAX:86(27)8544-6227

**Chengdu Office**

Room 1-102, 1st Floor, Unit 1, Building 1, No. 24, Wannian Road (Wanniancang Cool), Chenghua District, Chengdu City, Sichuan 610056, CHINA

TEL:86(28)8671-8936 FAX:86(28)8671-9086

**Hangzhou Office**

Room 804, Eastern International Business Center Building 1, No.600 Jinsha Road of

Hangzhou Economic and Technological Development Zone, 310018, CHINA

TEL: 86(571)8288-0319 FAX: 86(571)8288-0320

**Tianjin Office / M³ Solution Center China (Tianjin)**

Room D 12/F, TEDA Building, No.256 Jie-fang Nan Road Hexi District,Tianjin 300042, CHINA

TEL:86(22)5888-1700 FAX:86(22)5888-1701

**Changchun Office**

Room 815, 8F, Building A1, Upper East International No.3000 Dongsheng Street, Erdao District, Changchun, Jilin, 130031, CHINA

TEL:86(431)8192-6998 FAX:86(431)8192-6998

**Chongqing Office**

Room 1312, Building 3, Zhongyu Plaza, No.86, Hongjin Avenue,Longxi Street, Yubei District, Chongqing, 400000, CHINA

TEL:86(23)6595-9950 FAX:86(23)6595-9950

**Qingdao Office**

Room 638, 6F, No.192 Zhengyang Road, Chengyang District, Qingdao, Shandong, 266109, CHINA

TEL:86(532)8096-1936 FAX:86(532)8096-1937

**Xi'an Office**

Room 805, Xi'an International Trade Center, No. 196 Xiaozhai East Road, Xi'an, 710061, CHINA

TEL:86(29)8538-1380 FAX:86(29)8538-1381

**Dalian Office / M³ Solution Center China (Dalian)**

Room A-106 Shuijing SOHO, No.16 Harbin Road,Economic Development Zone,Dalian, 116600 CHINA

TEL:86(411)8718 1212 FAX:86(411)8754-7587

**Zhengzhou Office**

Room1801,18/F,Unit1,Building No.23, Shangwu Inner Ring Road, Zhengdong New District,Zhengzhou City, Henan 450018, CHINA

TEL:86(371)6097-6436 FAX:86(371)6097-6981

**Dongguan Office / M³ Solution Center China (Dongguan)**

Room 801, No 65, Chang'an Section Guanchang Road, Chang'an Town, Dongguan City, Guangdong 523841, CHINA

TEL:86(769)8541 7715 FAX:86(769)-8541 7745

**Fuzhou Office**

Unit 03, 7th floor of East Tower, Sansheng International Center, No.118 Wusi Road, Gulou Distrit, Fuzhou City, Fujian 350001, CHINA

TEL: 86 (591) 8761 8095
FAX: 86 (591) 8761 8096

**Changsha Office**

Room 2207, Building 1, Shiner International Plaza, No. 88, Kaiyuan Middle Road, Changsha City, Hunan 410100, CHINA

TEL: 86 (731) 8401 9276
FAX: 86 (731) 8401 9376

**Changzhou Office**

Room 1502, Joint Financial Tower, No.255, Tongjiang North Road, Tianning District, Changzhou City, Jiangsu 2130002, CHINA

TEL:86(519)8815 8319 FAX:86(519)8815 8319

**Wenzhou Office**

Room 512, Building 4, Xinjingdujiayuan, Sanyang Street, Ouhai District, Wenzhou City, Zhejiang 325014, CHINA

TEL:86(577)8641 5280

**Shunde Office**

Room 1603, Buliding 26, Vanke Golden Riverside Plaza Phase II, No.13 Mid DeSheng Road, ShunDe District, Foshan City, Guangdong 528300, CHINA

TEL/FAX: 86(757)2228 8621

**Mitutoyo Measuring Technology (Suzhou) Co., Ltd.**

1/2 Floor, Building 4, No.175 Songbei Road, Suzhou Free Trade Zone, Suzhou City, Jiangsu 215000, CHINA

TEL:86(512)6252-2660 FAX:86(512)6252-2580

**USA**

**Mitutoyo America Corporation**

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

TEL:1-(630)820-9666 Toll Free No. 1-888-648-8869

FAX:1-(630)978-3501

**Headquarters (Aurora) / M³ Solution Center**

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

**Seattle (Renton) Office / M³ Solution Center**

1000 SW 34th St. Suite G, Renton, WA 98057 U.S.A.

TEL:1-(888)-648-8869

**Houston Office / M³ Solution Center**

4560 Kendrick Plaza Drive Suite 120 Houston, TX 77032, U.S.A.

TEL:1-(888)-648-8869 FAX:1-(281)227-0937

**Cincinnati (Mason) Office / M³ Solution Center**

6220 Hi-Tek Ct., Mason, OH 45040, U.S.A.

TEL:1-(888)-648-8869 FAX:1-(513)754-0718

**Detroit (Novi) Office / M³ Solution Center**

46850 Magellan Drive, Suite 100 Novi, MI 48377, U.S.A.

TEL:1-(888)-648-8869 FAX: 1-(248)-926-0928

**Los Angeles (City of Industry) Office / M³ Solution Center**

16925 E. Gale Ave., City of Industry, CA 91745, U.S.A.

TEL:1-(888)-648-8869 FAX:1-(626)369-3352

**Charlotte (Huntersville) Office / M³ Solution Center**

11515 Vanstory Dr., Suite 140, Huntersville, NC 28078, U.S.A.

TEL:1-(888)-648-8869 FAX:1-(704)875-9273

**Boston (Marlborough) Office / M³ Solution Center**

753 Forest Street, Suite 110, Marlborough, MA 01752, U.S.A.

TEL:1-(888)648-8869 FAX:1-(508)485-0782

**Mitutoyo America Corporation Calibration Lab**

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

TEL:1-(888)-648-8869 FAX:1-(630)978-6477

**Mituotyo America Corporation CT-Lab Chicago**

965 Corporate Blvd., Aurora, IL 60502, U.S.A.

TEL: 1-(888)-648-8869 FAX: 1-(630)-820-3418

**Mitutoyo Research & Development America, Inc.**

11533 NE 118th St., Kirkland,
WA 98034-7111, U.S.A.

TEL:1-(425)821-3906 FAX:1-(425)821-32280

**Mitutoyo Research & Development America, Inc. - California Office**

16925 Gale Ave. City of Industry,
CA 91745-1806 U.S.A.

TEL: 1-(425)821-3906 FAX: 1-(425)821-3228

**Canada**

**Mitutoyo Canada Inc.**

2121 Meadowvale Blvd., Mississauga,
Ont. L5N 5N1., CANADA

TEL:1-(905)821-1261 FAX:1-(905)821-4968

**Montreal Office**

7075 Place Robert-Joncas Suite 129, Montreal,
Quebec H4M 2Z2, CANADA

TEL:1-(514)337-5994 FAX:1-(514)337-4498

**Brazil**

**Mitutoyo Sul Americana Ltda.**

**Head office / M³ Solution Center**

Avenida Mimes nº 25 – Loteamento Multivias II,
Jardim Ermida I, CEP 13212-216 Jundiaí - SP,
BRASIL

TEL: 55 (11) 5643-0004/0041

**Filial Curitiba / M³ Solution Center**

Rua Sergipe, nº 101, Sala A, Bairro Boneca
do Iguaçu, São José dos Pinhais – Paraná –
BRASIL CEP 83040120

TEL: 55 (41) 3534-1728

**Argentina**

**Mitutoyo Sul Americana Ltda.**

**Argentina Branch / M³ Solution Center**

Av. B. Mitre 891/899 – C.P. (B1603CQI)
Vicente López –Pcia. Buenos Aires – ARGENTINA

TEL:54 (11) 4730-1433 FAX:54 (11) 4730-1411

**Sucursal Cordoba / M³ Solution Center**

Av. Ricchieri 2872 L.4 – Bº Jardin – CP X5014O-
PJ Cordoba, ARGENTINA

TEL:54 (351) 464-4125

**Mexico**

**Mitutoyo Mexicana, S.A. de C.V.**

Industria Elēctrica No.15, Parque Industrial, Naucalpan de Juārez, Estado de Mēxico C.P.53370, MÉXICO

TEL: 52 (01-55) 5312-5612
FAX: 52 (01-55) 5312-3380

**Monterrey Office / M³ Solution Center**

Blv. Interamericana No. 103, Parque Industrial FINSA, C.P. 66636 Apodaca, N.L., MÉXICO

TEL: 52(01-81) 8398-8227/8228/8242/8244

FAX: 52(01-81) 8398-8226

**Tijuana Office / M³ Solution Center**

Calle José María Velazco 10501-C, Col. Cd. Industrial Nueva Tijuana, C.P. 22500 Tijuana, B.C., MÉXICO

TEL: 52 (01-664) 647-5024

**Querétaro Office / M³ Solution Center**

Av. Cerro Blanco No.500-1, Colonia Centro Sur, Querétaro, Querétaro, C.P. 76090, MÉXICO

TEL: 52 (01-442) 340-8018, 340-8019 and 340-8020
FAX: 52 (01-442) 340-8017

**Mitutoyo Mexicana, S.A. de C.V. Querétaro Calibration Laboratory**

Av. Cerro Blanco 500 30 Centro Sur,
Querétaro, Querétaro, C.P. 76090, MÉXICO

TEL: 52 (01-442) 340-8018, 340-8019 and 340-8020
FAX: 52 (01-442) 340-8017

**Aguascalientes Office / M³ Solution Center**

Av. Aguascalientes No. 622, Local 15 Centro Comercial El Cilindro Fracc. Pulgas Pandas Norte, C.P. 20138, Aguascalientes, Ags. MÉXICO

TEL: 52 (01-449) 174-4140 and 174-4143

**Irapuato Office / M³ Solution Center**

Boulevard a Villas de Irapuato No. 1460 L.1 Col. Ejido

Irapuato C.P. 36643

Irapuato, Gto., MÉXICO

TEL: 52 (01-462) 144-1200 and 144-1400

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# Mitutoyo Corporation

20-1, Sakado 1-Chome, Takatsu-ku, Kawasaki-shi, Kanagawa 213-8533, Japan
Tel: +81 (0)44 813-8230  Fax: +81 (0)44 813-8231
Home page: https://www.mitutoyo.co.jp/global.html

For the EU Directive, Authorized representative and importer in the EU:
Mitutoyo Europe GmbH
Borsigstrasse 8-10, 41469 Neuss, Germany

For the UK Regulation, Authorized representative and importer in the UK:
Mitutoyo (UK) Ltd.
Joule Road, West Point Business Park, Andover, Hampshire SP10 3UX, UNITED KINGDOM



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