MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series MELSENSOR

MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Application)

-R60MH112NA

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the MELSEC iQ-R Module Configuration Manual.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Precautions for Using Laser Products]

⚠WARNING

- The laser products use semiconductor laser light sources. When handling laser products, observe the following because human access to laser radiation may result in injury.
  (1) Do not disassemble the laser products. Doing so may result in exposure to laser radiation.
  (2) Shut off the external power supply (all phases) to stop laser emission before replacing a failed laser product or changing the layout.
- Observe the following handling precautions for the laser products in each class.
  (1) Class 3R laser products
    - Do not aim the laser beam at people.
    - Do not directly look at or come in contact with the laser beam and its reflection from a specular surface (such as a mirror). In addition, never look at the beam and its reflection through optical instruments (such as a microscope and a telescope).
    - Shorten the beam paths as much as possible to prevent diffusion of laser beams. Terminate the laser beams at the end of their paths by diffusely reflecting materials of appropriate reflectivity and thermal properties or by absorbers.
    - Locate the beam path above or below the eye level. Wearing protective eyewear is recommended when handling the laser products.
    - Install the laser products carefully so that the laser beam is not unintentionally reflected from specular surfaces.

  (2) Class 2 laser products
    - Do not aim the laser beam at people.
    - Do not stare into the laser beam and its reflection from specular surfaces.
    - To prevent exposure to laser radiation (specularly or diffusely reflected laser beams), install a protective enclosure with an appropriate reflectance.
    - Locate the beam path above or below the eye level.

  (3) Class 1 laser products
    - Do not stare into the laser beam and its reflection from specular surfaces.

[Design Precautions]

⚠WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
    - Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    - Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.
- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.

[Design Precautions]

⚠WARNING

- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- Provide safety measures such as a dual safety mechanism when the module is used for applications that have the possibility of causing physical injury or serious damage.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or reset the CPU module while the settings are being written. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also may cause malfunction or failure of the module.
- When changing the operating status of the CPU module from external devices (such as the remote RUN/STOP functions), select "Do Not Open by Program" for "Opening Method" of "Module Parameter". If "Open by Program" is selected, an execution of the remote STOP function causes the communication line to close. Consequently, the CPU module cannot reopen the line, and external devices cannot execute the remote RUN function.
- Do not use the laser displacement sensor outside of its specifications (such as ratings or environments). Doing so may result in overheating or smoke.

[Design Precautions]

⚠CAUTION

- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines included with the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s). Incorrect interconnection may cause malfunction, failure, or drop of the module.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause malfunction.
- When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette or a battery-less option cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, battery-less option cassette, or connector. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or cause the module to fail or malfunction.
- After installation and wiring, attach a blank cover module (RG60) to each empty slot and an included extension connector protective cover to the unused extension cable connector before powering on the system for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cables may swing or inadvertently be pulled, resulting in malfunction or damage to modules or cables.
  In addition, the weight of the cables may put stress on modules in an environment of strong vibrations and shocks.
  Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.

[Wiring Precautions]

⚠CAUTION

- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.
- Do not apply the 24VDC power before connecting a sensor head. If the power is applied before wiring, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so will cause the battery to produce heat, explode, ignite, or leak, resulting in injury and fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the connector screws or module fixing screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) more than 25cm away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- After the first use of the product, do not perform each of the following operations more than 50 times (IEC 61131-2/JIS B 3502 compliant).
  Exceeding the limit may cause malfunction.
  - Mounting/removing the module to/from the base unit
  - Inserting/removing the extended SRAM cassette or battery-less option cassette to/from the CPU module
  - Mounting/removing the terminal block to/from the module
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure of the module.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette or a battery-less option cassette. Doing so may cause malfunction or failure of the module.
- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.
- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so can cause malfunction or failure of the module.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above restrictions, Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable controllers.
This manual describes the functions, parameter settings, and troubleshooting of the relevant products listed below.
Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

Relevant product

R60MH112NA

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Application) [SH-082019ENG] (this manual)	Functions, parameter settings, troubleshooting, I/O signals, and buffer memory of the control module	Print book e-Manual PDF
MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup) [SH-082017ENG]	Specifications, procedures before operation, system configuration, wiring, and communication examples of the control module	Print book e-Manual PDF
MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head) [SH-082023ENG]	Precautions for using the sensor head correctly and installation methods/ specifications/maintenance and inspection for the sensor head	Print book e-Manual PDF
Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual [SH-082021ENG]	Operation methods, functions, and error messages of the setting tool. It also describes the use of the buffering function and the received light intensity waveform display function, which are useful for an evaluation analysis of the laser displacement sensor MH11 or for optimum settings.	e-Manual PDF

Point

e-Manual refers to the Mitsubishi Electric FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.
- Sample programs can be copied to an engineering tool.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	Memory in an intelligent function module to store data such as setting values and monitored values.
Control module	An abbreviation for the MELSEC iQ-R laser displacement sensor control module.
CPU module	A generic term for the MELSEC iQ-R series CPU module.
Device	A device (X, Y, M, D, or others) in a CPU module
Diffuse reflection	A method in which a beam of light is transmitted perpendicularly to the measurement surface and the diffuse reflection of the light is received from the target. This enables a wide measurement range.
Engineering tool	Another name for the software package for the MELSEC programmable controllers.
I/O module	A generic term for input module, output module, I/O combined module, and interrupt module.
Intelligent function module	A module that has functions other than input and output, such as an A/D converter module and D/A converter module.
Label	A label that represents a device with a given character string.
Module label	A label that represents a memory area (I/O signal or buffer memory area) specific to each module with a given character string. This label is automatically generated by GX Works3 from the module used and can be used as a global label.
Power supply module	An abbreviation for the MELSEC iQ-R series power supply module.
Sensor head	An abbreviation for the laser displacement sensor MH11 sensor head.
Setting tool	An abbreviation for the laser displacement sensor MH11 SettingTool Version 2.
Specular reflection	A method in which specular reflections of the light are received directly from the object. This method stably measures metal and other such targets with glossy surfaces.

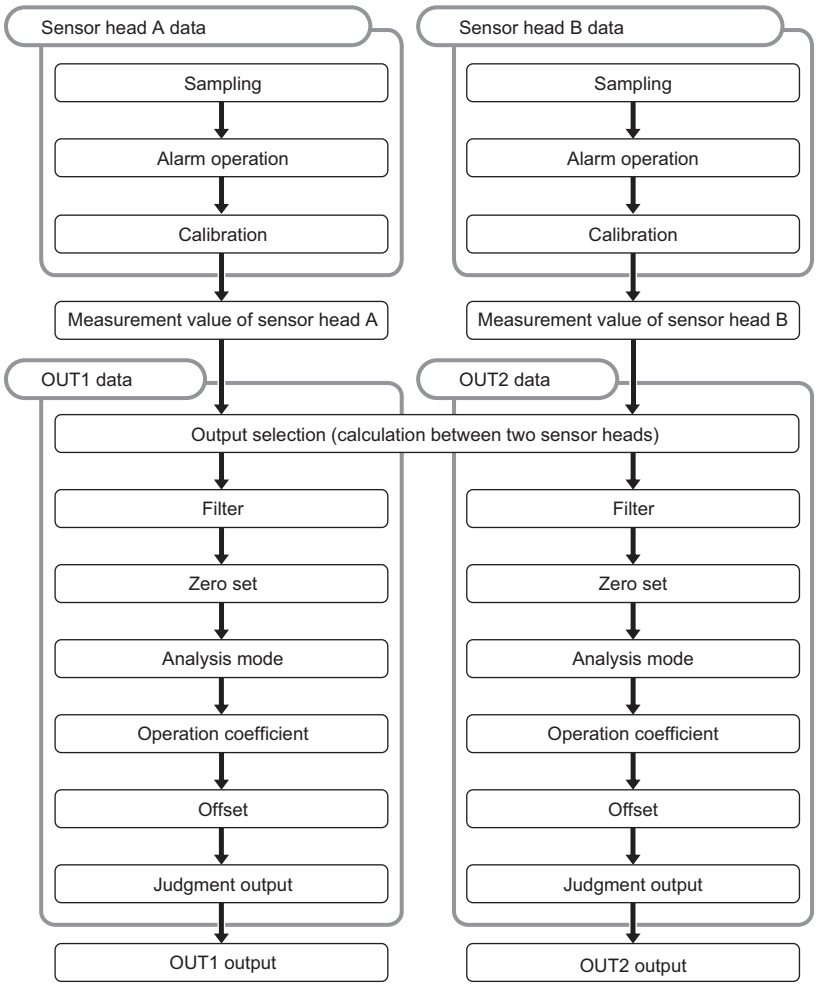
1 FUNCTIONS

1.1 Sensing Function

This function outputs the displacement amount as a measurement result using a laser beam.
This allows for change of the measurement conditions and adjustment and judgment of the measurement result.

Measurement function

Up to two sensor heads can be connected to the control module. Individual measurement by each sensor head and calculation of measurement values for two sensor heads can be performed. The following figure shows the operation flow of each function.

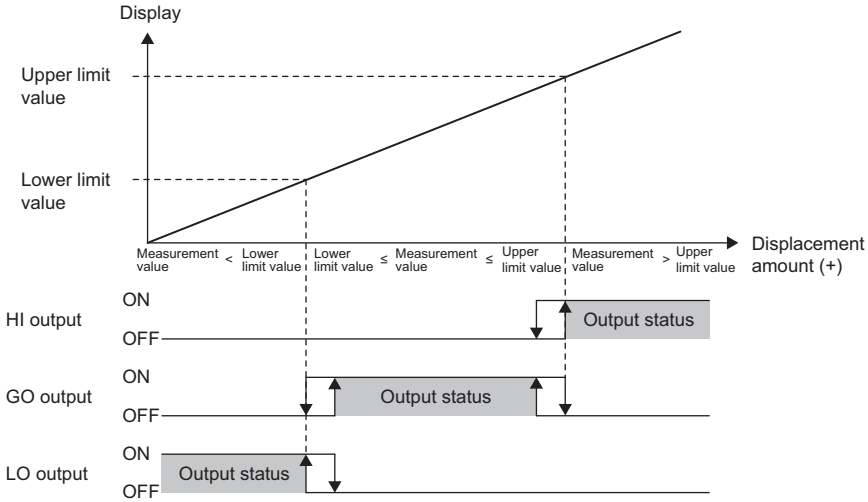


Item	Description	Reference
Sampling	The sampling cycle of 10μs to 2ms can be selected in eight levels.	For details, refer to the sampling cycle in the following manual. 📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Alarm operation	An alarm occurs when the light intensity is saturated, insufficient light intensity is detected, or a measurement object is not in the measurement range.	For details, refer to the alarm delay times in the following manual. 📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Calibration	The gap between the actual distance and the measurement value can be corrected.	📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Measurement value of sensor head A/ sensor head B	The measurement value per sensor head is fixed.	—
Output selection (calculation between two sensor heads)	The measurement value of a given sensor head can be output to OUT1 and OUT2. Calculation between two sensor heads can be performed.	For details, refer to the output selection in the following manual. 📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Filter	The moving average, low pass filter, and high pass filter can be set for the measurement value and calculation value.	For details, refer to the filter processing in the following manual. 📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Zero set	The measurement value when the zero set is turned on can be set to the reference value of measurement (zero). The measurement value set to the reference value of measurement is cleared when the zero set is turned off.	☞ Page 19 Zero set
Analysis mode	The mode can be selected from four types including peak to peak measurement.	📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Operation coefficient	The operation coefficient can be set for the measurement value.	
Offset	A set value can be subtracted or added from/to the measurement value.	
Judgment output	The output type is determined from HI, GO, or LO output according to the last result of data processing.	☞ Page 15 Upper/lower limit value of judgment output

Upper/lower limit value of judgment output

The measurement value can be judged by setting the upper and lower limit values.

The output status changes in three types as follows: Measurement value > Upper limit value: HI output, Lower limit value ≤ Measurement value ≤ Upper limit value: GO output, Measurement value < Lower limit value: LO output.



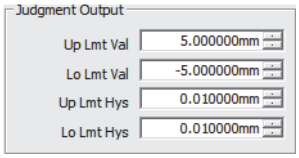
■Supplemental remarks

- The input range of both upper/lower limit values is -950.000000 to 950.000000mm.
- The initial upper limit value is the upper measurement limit (positive number). The initial lower limit value is the lower measurement limit (negative number).

■Setting method

Use the setting tool.

1. Select the "OUT1" or "OUT2" tab in the main window.
2. Set "Up Lmt Val" and "Lo Lmt Val" under "Judgment Output" in the main window.



Precautions

- Set the upper limit value higher than the lower limit value. When the upper limit value is set to be equal to or lower than the lower limit value, a setting error occurs and the parameter setting cannot be performed.
- The output type is determined based on the fixed value when an alarm occurs and the measurement value output at alarm is set to "Fixed Value".

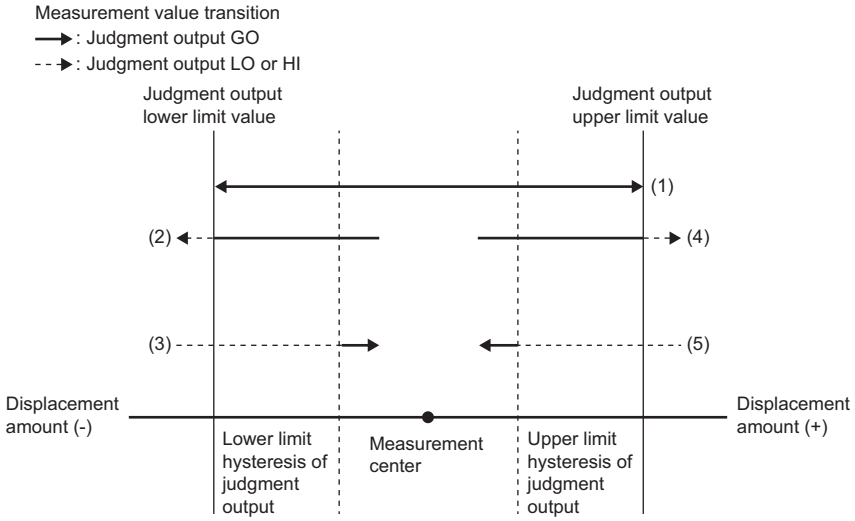
Upper/lower limit hysteresis of judgment output

This function stabilizes the judgment output for chattering of the measurement value.

The relationship between the hysteresis value to set and the output turning on/off is shown below. The function acts on the upper/lower limit values when output is in the ON state.

Ex.

For GO output



Measurement value transition	Description	Judgment output
(1)	Transitions within the range of the upper/lower limit value of judgment output.	GO
(2)	Transitions from within the range of the upper/lower limit value of judgment output to outside the lower limit value of judgment output.	GO→LO
(3)	Transitions from outside the upper/lower limit value of judgment output to within the lower limit threshold value.	LO→GO
(4)	Transitions within the range of the upper/lower limit value of judgment output to outside the upper limit value of judgment output.	GO→HI
(5)	Transitions from outside the upper limit value of judgment output to within the upper limit threshold value.	HI→GO

Point

If the measurement value fluctuates around the upper/lower limit value of judgment output, output repeats the ON/OFF state. This may cause unstable judgment output. In this case, set the upper/lower limit hysteresis of judgment output to prevent such chattering.

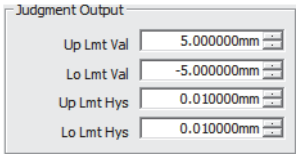
■Supplemental remarks

The input range of both upper/lower limit hysteresis values is 0.000000 to 950.000000mm.
The initial values of both upper/lower limit hysteresis are 0.1% of the measurement range.

■Setting method

Use the setting tool.

1. Select the "OUT1" or "OUT2" tab in the main window.
2. Set "Up Lmt Val" and "Lo Lmt Val" under "Judgment Output" in the main window.



Precautions

- After setting the operating condition and before setting the upper/lower limit hysteresis of judgment output, check rough resolution of the measurement value with peak to peak measurement because resolution (variations in measurement) differs depending on the conditions such as the measurement object and the setting of average times.
- Set the upper/lower limit hysteresis values of judgment output lower than the upper/lower limit values of judgment output. If they are not set, operation cannot be guaranteed.

Head laser control

This function switches the state of the laser between emission and stop.

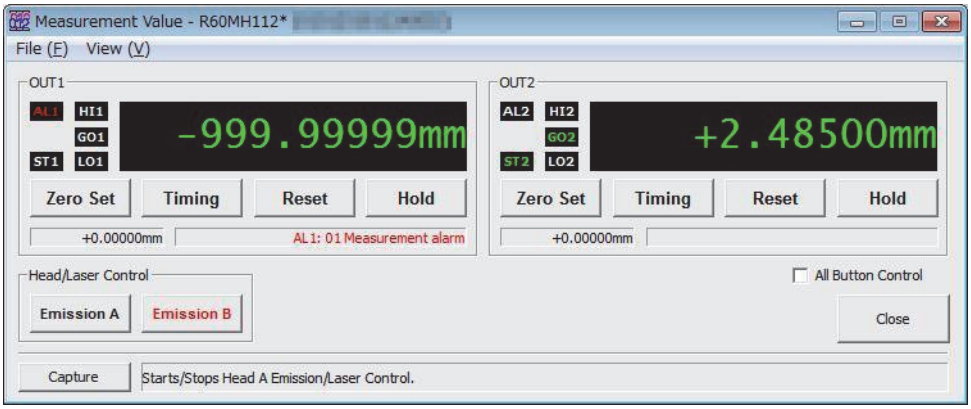
■Setting method

Use the setting tool.

1. Display the "Measurement Value" window.

Main window ⇨ [Window] ⇨ [Measurement Value Display]

2. Click the [Emission A]/[Emission B] button to switch the state of the laser between emission and stop.



Status	Setting details
Off (Text is displayed in black.)	Stops laser emission.
On (Text is displayed in red.)	Starts laser emission.

Precautions

- While the laser control setting is being turned off and on and after the laser control setting is switched from off to on, data becomes unfixed for a while. 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn off the data unfixed state. After the system recovers from the data unfixed state, 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn on and the measurement value display starts. (☞ Page 51 TIMING CHARTS)

Zero set

The measurement value when the zero set is turned on can be set to the reference value of measurement (zero). The measurement value set to the reference value of measurement is cleared when the zero set is turned off.
Use the function to set the measurement value of a reference measurement object to 0 and measure the displacement amount from the set point or execute the judgment output.
The zero set can be turned on even when timing is on.

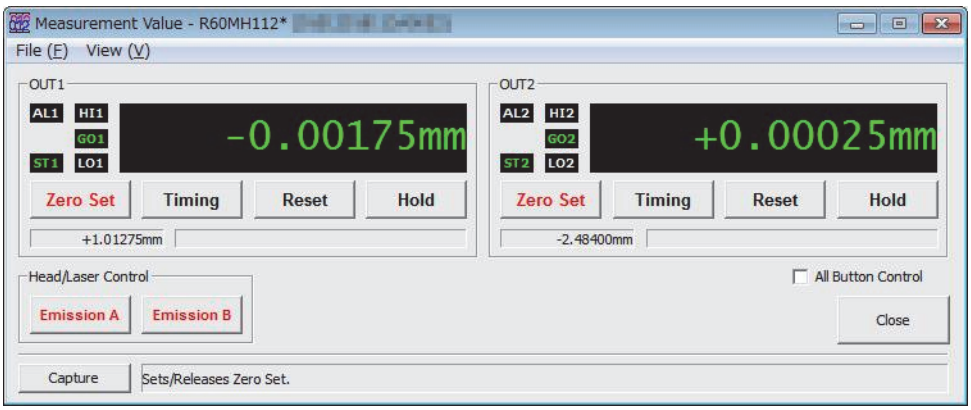
■Setting method

Use the setting tool.

1. Display the "Measurement Value" window.

Main window ⇨ [Window] ⇨ [Measurement Value Display]

2. Check that the zero set is off (the text of the [Zero Set] button is black).
3. Click the [Zero Set] button.
4. The zero set is turned on (the text of the [Zero Set] button turns red), and the measurement values of OUT1 and OUT2 are set to the reference value of measurement.



Status	Setting details
Off (Text is displayed in black.)	Returns the reference value of measurement to its original value. (Clear the zero set.)
On (Text is displayed in red.)	Sets the measurement value when the zero set is turned on to the reference value of measurement. (Execute the zero set.) When the zero set is off, clicking the [Zero Set] button turns on the zero set. The zero set remains on until the [Zero Set] button is clicked again. The measurement values during the zero set ON state indicate the displacement amounts from the point when the [Zero Set] button was clicked.

Precautions

- If the offset is set, the offset value remains in the measurement value after the zero set is canceled.
- During alarm occurrence and during data unfixed state, the zero set cannot be turned on.
- During data unfixed state, the zero set cannot be turned off.
- The zero set status is saved in the memory when the [Save] button in the main window is clicked.
- When the zero set is turned on while the timing is on, the measurement value of when the timing is turned on becomes the reference value of measurement.

Timing

The measurement value and the judgment output can be held at a desired timing.

Judgment output is held by turning on the timing at a desired timing. This enables loading of the judgment result at a later time.

For details, refer to the following.

☞ Page 51 TIMING CHARTS

■Setting method

Use the setting tool.

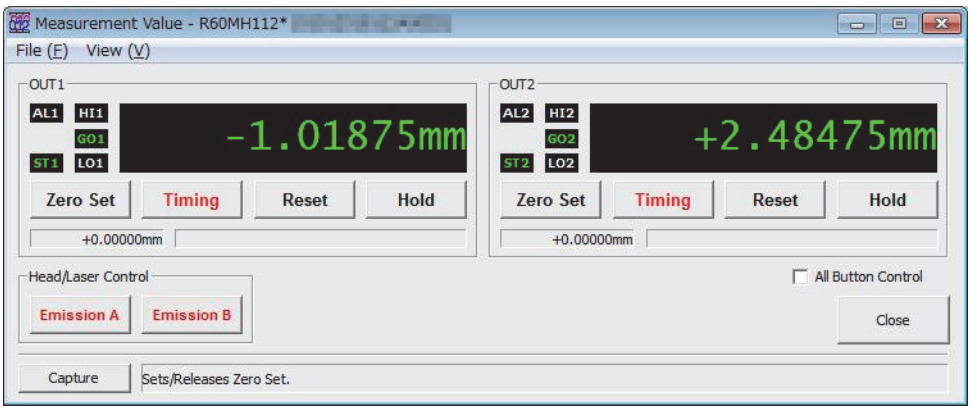
1. Display the "Measurement Value" window.

Main window ⇨ [Window] ⇨ [Measurement Value Display]

2. Check that the timing is off (the text of the [Timing] button is black).

3. Click the [Timing] button.

4. The timing is turned on (the text of the [Timing] button turns red), and the measurement values of OUT1 and OUT2 are set to the reference value of measurement.



Status	Setting details
Off (Text is displayed in black.)	Clears the holding of the measurement value. When the measurement mode is the peak measurement or bottom measurement, clearing the holding of the measurement value resets the measurement value. When the measurement mode is the peak to peak measurement, clearing the holding of the measurement value resets the measurement value to 0.
On (Text is displayed in red.)	Holds the measurement value at the timing of being turned on.

Precautions

The timing input status is not saved in the memory even when the [Save] button in the main window is clicked.

If data becomes unfixed while the timing is on, the measurement value switches to a data unfixed value and retained.

Reset

The measurement value can be reset.

When the [Reset] button is clicked, 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn off. While 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) are off, the system data status becomes unfixed, and the displayed measurement value is fixed to -999.999999mm. In addition, 'Alarm signal OUT1' (X18) and 'Alarm signal OUT2' (X19) are turned off, 'Alarm code' (Un\G1 to Un\G2) becomes 0, all judgment outputs are turned off, and the count (for averaging) is reset.

When moving average is set, the system data status remains unfixed for the length of time until the set conditions are met. For details, refer to the following.

☞ Page 51 TIMING CHARTS

Point

Clicking the [Reset] button turns off all the judgment outputs. The function is useful for judging the measurement value for each measurement object in peak measurement, bottom measurement, and peak to peak measurement.

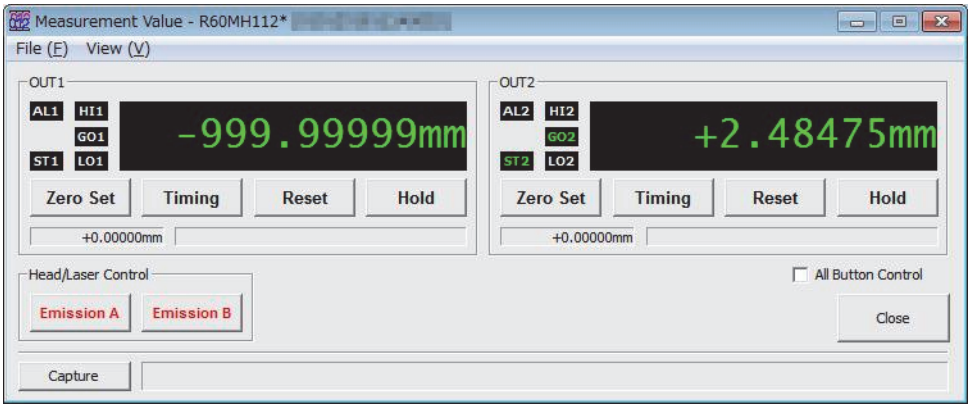
■Setting method

Use the setting tool.

1. Display the "Measurement Value" window.

Main window ⇨ [Window] ⇨ [Measurement Value Display]

2. Click the [Reset] button.
3. The measurement values of OUT1 and OUT2 are reset.



Point

When the timing is turned on, the data unfixed value is retained until the timing is turned off.

When the measurement mode is peak to peak measurement, if the zero set is turned on, the measurement value at that time becomes zero (reference value of measurement). Therefore, when the reset is turned on while the zero set is turned on, the measurement value starts from a negative (-) value.

Emitted light intensity search

The received light intensity of the measurement surface are searched and sets the appropriate emitted light intensity automatically.

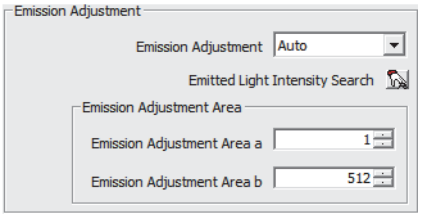
Point

Set this function when measuring the thickness or other items of a transparent object with low received light intensity. Without this function, the emission adjustment function automatically optimizes the emitted light intensity based on another object or surface with high received light intensity. This results in failure to measure any objects with low received light intensity in an optimal condition. The function is useful for optimally measuring the surfaces set in output selection.

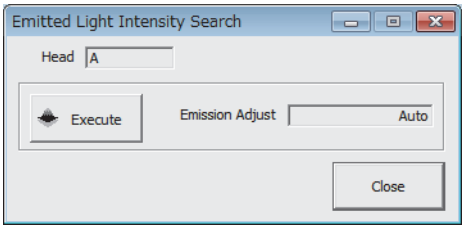
■Setting method

Use the setting tool.

1. Select the "Head A" tab or the "Head B" tab in the main window.
2. Click the [Emitted light intensity search] button.



3. In the "Emitted light intensity search" window that appears, click the [Execute] button to automatically adjust the emitted light intensity.



4. The emitted light intensity of an object is determined from the fixed value of 31 levels and the setting is changed to optimize the received light intensity of the waveform with the least receiving light intensity among all received light surfaces set in output selection. After completion of the emitted light intensity search, the optimum value will be displayed within "0.04% Fixed" to "100% Fixed". If the emitted light intensity search fails to determine the optimum value, emission adjustment is set to "Auto".

Precautions

- When a value other than the initial value needs to be set in output selection, set the value before starting the emitted light intensity search. For details on the output selection, refer to the operating manual. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
- This function searches all areas for the emission intensity regardless of the setting of the emission adjustment area specification.

1.2 Memory Operation Function

This function issues a command for initializing, copying, or saving setting details from the setting tool and the buffer memory to a memory for saving the setting details.

Output setting copy

This function copies the OUT setting between OUT1 and OUT2.

Settings related to memory output that are specified in the memory change function can be copied between OUT1 and OUT2 (OUT1 ⇨ OUT2, OUT2 ⇨ OUT1).

■Setting method

The OUT settings can be copied between memory areas by 'Output setting copy request' (Un\G32258).

For details on the request for output setting copy, refer to the following.

☞ Page 100 Output setting copy request

Precautions

The function cannot be used to copy the status of timing, reset, and hold.

Memory change

The destination memory for saving the setting details can be changed.

■Setting method

Use the setting tool.

1. Set the memory number from M0 to M15 under "Memory Change" in the main window.
2. Click the [Send] button.
3. The destination memory for saving the settings is switched.

Setting value	Setting details
M0 to M15	Memory number to which the setting details are saved

Precautions

- When memory change is executed, data may be unfixed temporarily. 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn off under data unfixed state. After the system recovers from the data unfixed state, 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn on and the measurement value display starts.
- Note that the settings are deleted at the next power-off and on if the memory change setting is not saved.

Memory copy

This function copies the settings saved in a memory area to another memory area.

If the destination memory and source memory are the same, copying the settings fails.

■Setting method

The settings saved in a memory area can be copied to another memory area by 'Memory copy request' (Un\G32260).

For details on the request for memory copy, refer to the following.

☞ Page 101 Memory copy request

Precautions

Note that the copied settings are deleted at the next power-off and on if the copied settings are not saved.

Initialization

This function deletes all the settings in the memory and restores the initial values.

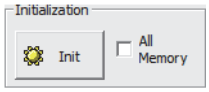
If settings are initialized but not saved, the system operates with the previous settings after the next power-off and on.

Setting	Function
Initialization	The memory settings in current use are initialized.
All memory initialization	All memory settings are initialized.

■Setting method (for initializing the memory settings in current use)

Use the setting tool.

Check that the "All Memory" check box in the main window is not selected, and then click the [Init] button to initialize the memory settings in current use.



■Setting method (for initializing the settings of all the memory areas)

Use the setting tool.

Select the "All Memory" check box in the main window, and then click the [Init] button to initialize the settings of all the memory areas.

Precautions

- Note that initialization does not save the initialized settings. Save the initialized settings to maintain them after the power-off. (☞ Page 25 Save)
- When initialization is executed, the system data status temporarily becomes unfixed. 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn off under data unfixed state. After the system recovers from the data unfixed state, 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn on and the measurement data display starts.

Save

This function saves the settings in all the memory areas.

To use the new settings after the next power-off and on, save the settings before power-off. If the settings are not saved, all the changes are deleted at power-off.

The settings saved last are applied at the next power-off and on. If the settings are not saved, all of them are set to the initial values.

■Setting method

Use the setting tool.

Click the [Save] button in the main window to save the settings common to all the memory areas.

Precautions

This function cannot save the status of timing input and hold.

1.3 Buffering Function

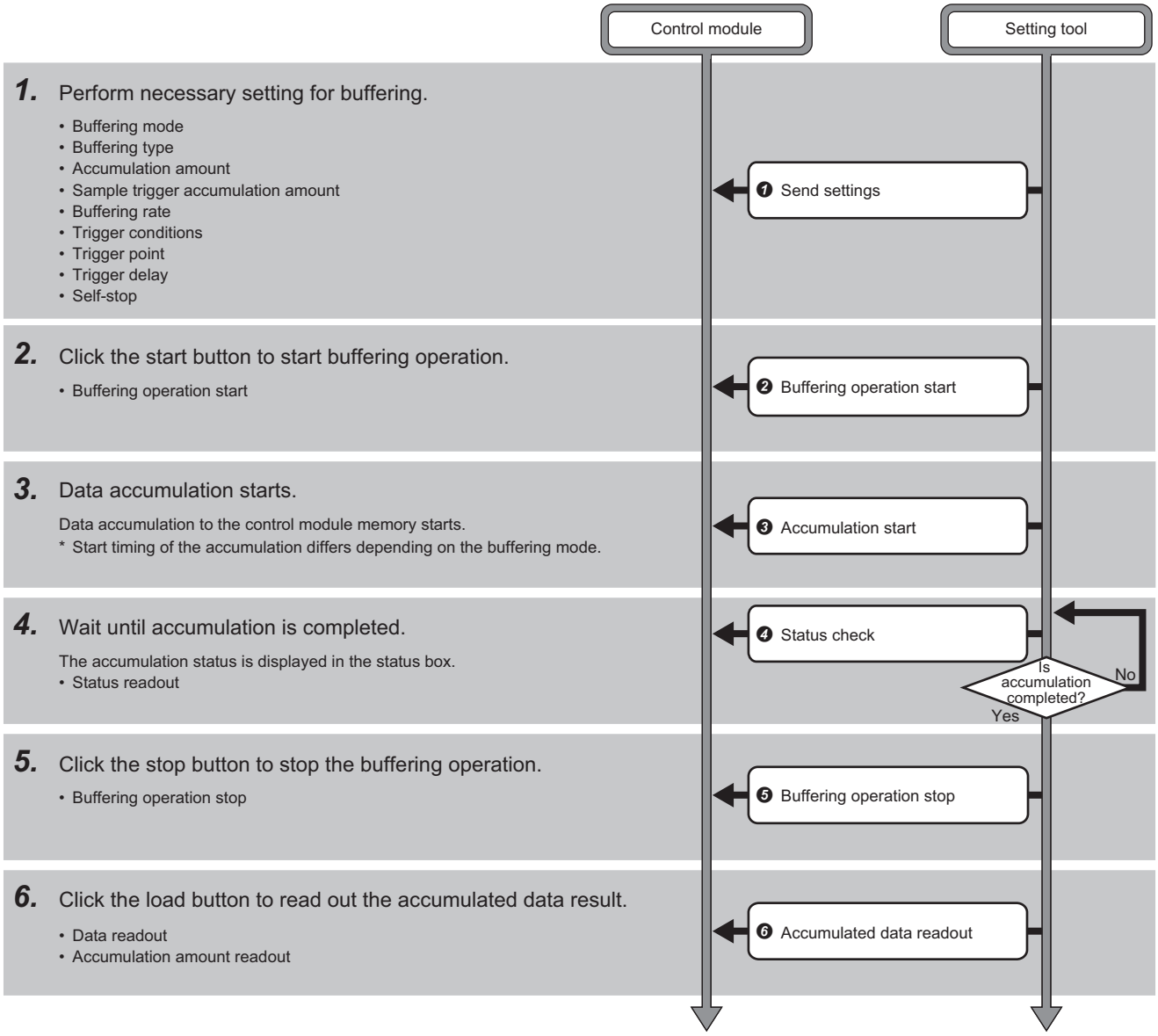
This function accumulates measurement data in the memory of the control module and loads the data to the setting tool. A maximum of 65000 measurement data items can be temporarily accumulated in the memory of the control module to load them to the setting tool. All the accumulated data can be loaded using the setting tool later.

Point

For the buffering function, by using the setting tool, accumulation and loading of measurement data can be executed easily. Data can be saved as CSV data, which can be used for graphic display, saving, and reading of measurement data, and for applications such as spreadsheet software. Thus, it is useful for checking or verifying measurement data.

Buffering procedures

Perform the following operations using the setting tool.



Buffering operation

Data can be accumulated during buffering operation.
Set necessary parameters in advance and start buffering operation.

Precautions

- To start buffering operation, the buffering type and the accumulation amount need to be set within the setting range.
- Just stopping buffering operation does not switch the system to the non-buffering state.
- Do not change the settings of the control module during buffering operation. Otherwise, buffering may fail to operate correctly. To change the settings, stop the buffering operation, and then change the settings.

Self-stop

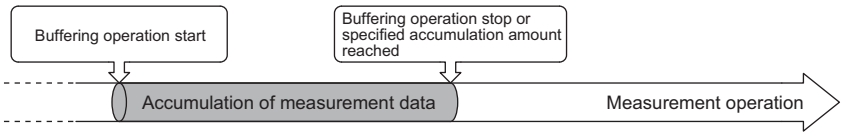
This function stops buffering operation automatically at completion of accumulation.
When the self-stop function is on (buffering operation is automatically stopped), stop input for buffering operation is unnecessary.
This function is enabled when the buffering mode is set to the "Continuous Mode", "Trigger Mode", or "Sample Trigger Mode".
This function is disabled when the "Timing Mode" is selected.
When "OUT1" or "OUT2" is set for the buffering type, the function performs self-stop at completion of accumulation for OUT1 or OUT2. When "OUT1&OUT2" is set for the buffering type, the function performs self-stop at completion of accumulation for both OUT1 and OUT2.

Buffering mode

Select a buffering mode from four types.
The initial value is "Continuous Mode".

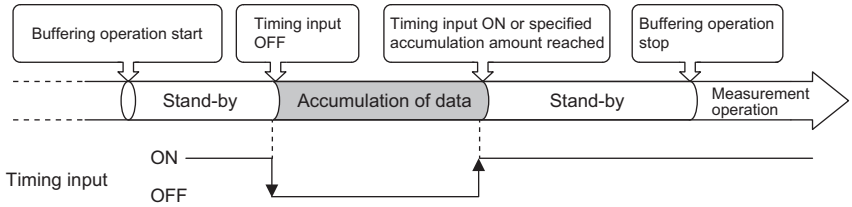
■Continuous mode

- When buffering operation starts, data accumulation to the memory of the control module starts.
- Accumulation stops when the accumulation amount reaches the setting value or buffering operation stops.



■Timing mode

- When buffering operation starts, timing input is turned to a standby state.
- Turning off the timing input during the standby state starts data accumulation in the memory of the control module.
- Accumulation stops when timing input is turned on, when the accumulation amount reaches the setting value, or when buffering operation stops.

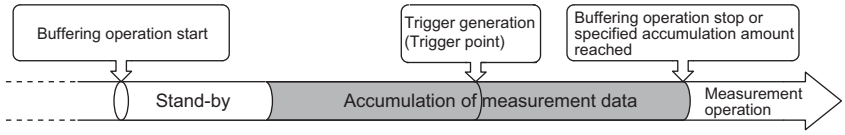


Precautions

Turning off the timing input again deletes the previous data and starts new data accumulation. Stop the buffering operation, and load and save the accumulated measurement data before performing the next accumulation.

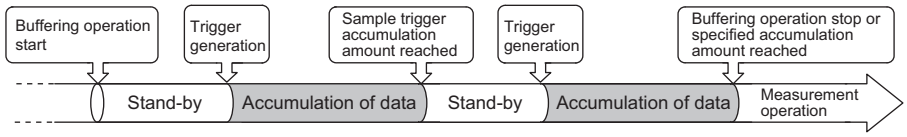
■Trigger mode

- When buffering operation starts, trigger generation is turned to a standby state.
- The measurement data before and after the trigger point where the trigger condition is generated is accumulated in the memory of the control module.
- Accumulation stops when the accumulation amount reaches the setting value or buffering operation stops.



■Sample trigger mode

- When buffering operation starts, trigger generation is turned to a standby state.
- Accumulation of measurement data for the set sample trigger accumulation amount starts after the set trigger condition is generated.
- After completion of sample trigger accumulation, trigger generation is turned to a standby state again.
- Accumulation of measurement data for the set sample trigger accumulation amount re-starts after the set trigger condition is generated again.
- Accumulation stops when the accumulation amount reaches the setting value or buffering operation stops.



Precautions

Set the sample trigger accumulation amount so that (accumulation amount) ÷ (sample trigger accumulation amount) is an integer value.

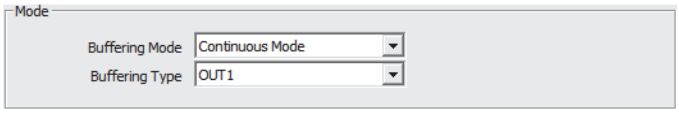
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set "Buffering Mode".



Setting value	Setting details
Continuous Mode	For details on the continuous mode, refer to the following. ☞ Page 27 Continuous mode
Timing Mode	For details on the timing mode, refer to the following. ☞ Page 28 Timing mode
Trigger Mode	For details on the trigger mode, refer to the following. ☞ Page 28 Trigger mode
Sample Trigger Mode	For details on the sample trigger mode, refer to the following. ☞ Page 28 Sample trigger mode

Buffering type

Select individual data accumulation or simultaneous data accumulation on OUT1 and OUT2.

The initial value is "OUT1".

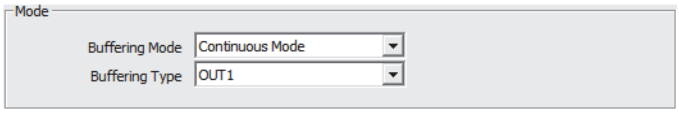
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set the "Buffering Type".



Setting value	Setting details
OUT1	Accumulates only the measurement values of OUT1.
OUT2	Accumulates only the measurement values of OUT2.
OUT1&OUT2	Accumulates the measurement values of OUT1 and OUT2.

Precautions

- The maximum accumulation amount of measurement data differs depending on the buffering type. (☞ Page 31 Accumulation amount)
- The buffering information of the OUT whose buffering type is not selected is not updated.

Buffering rate

Set the buffering rate for accumulating measurement data over long duration by setting an interval to the sampling cycle.
Select from "1 (all measurement data)", "1/2", "1/4", ··· "1/32768".
The initial value is "1 (all measurement data)".
For example, if "1/4" is selected, measurement data is accumulated only once every four sampling cycles.

Point

All measurement data can be accumulated. However, when the measurement data variation amount is small for the sampling cycle, the measurement data can be accumulated with a longer cycle by lowering the buffering rate. This setting is useful for effective use of the memory since the measurement data accumulation amount is limited.

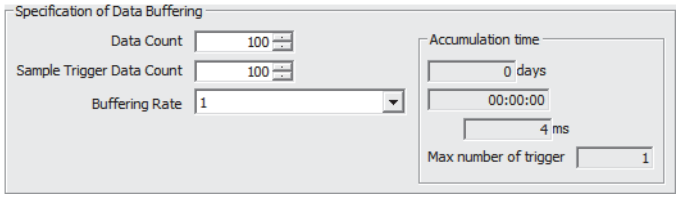
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set the "Buffering Rate".



Setting value	Setting details
1	Accumulates measurement data in synchronization with the sampling cycle.
1/2	Accumulates measurement data only once per 2 sampling cycles.
1/4	Accumulates measurement data once per 4 sampling cycles.
⋮	⋮
1/8192	Accumulates measurement data only once per 8192 sampling cycles.
1/16384	Accumulates measurement data only once per 16384 sampling cycles.
1/32768	Accumulates measurement data only once per 32768 sampling cycles.

Accumulation amount

Set the accumulation amount of measurement data.

Specify the accumulation amount of measurement data in the range of 1 to the maximum accumulation amount.

The maximum accumulation data amount differs depending on the buffering type as follows.

- "OUT1" or "OUT2": Maximum accumulation amount = 65000 pieces of data
- "OUT1&OUT2": Maximum accumulation amount = 32500 pieces of data

The initial value is "20000".

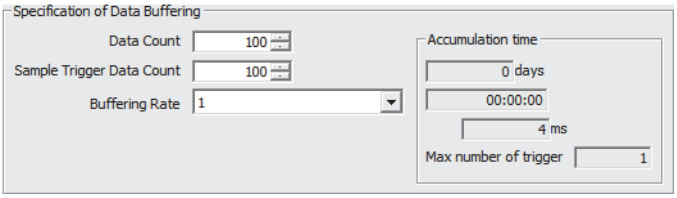
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set "Data Count".



Setting value	Setting details
1 to 65000	Accumulation amount of measurement data

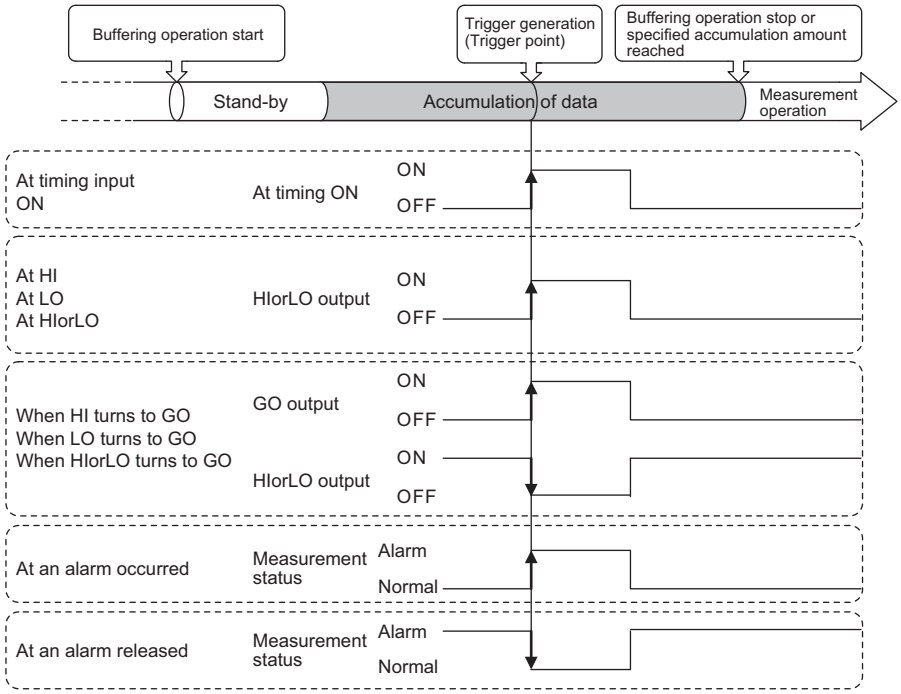
Precautions

Accumulation cannot be started when the setting of the accumulation amount for each buffering type or the settings of the trigger point and sample trigger accumulation amount for the accumulation amount are not correct.

Trigger condition

Set the trigger generation conditions when the buffering mode is the trigger mode or sample trigger mode.
Trigger conditions can be selected from "At timing input on", the result of the judgment output ("At HI", "At LO", "At HI or LO", "When HI turns to GO", "When LO turns to GO", "When HI or LO turns to GO"), "At an alarm occurred", and "At an alarm released".
The initial value is "At timing input on".

Ex.
The following figure shows the operations with each trigger condition when the buffering mode is "Trigger Mode".



Precautions

Normally, the measurement value is held at timing input ON; however, only when the buffering mode is the trigger mode or sample trigger mode and this function is set to "At timing input on", the measurement value is not held at timing input ON during buffering operation.

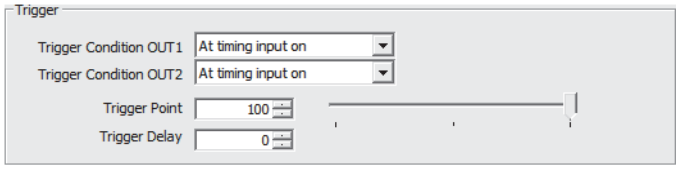
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set "Trigger Condition OUT1" and "Trigger Condition OUT2".



Setting value	Setting details
At HI	A trigger is generated when the signal becomes HI.
At LO	A trigger is generated when the signal becomes LO.
At HI or LO	A trigger is generated when the signal becomes HI or LO.
When HI turns to GO	A trigger is generated when the signal changes from HI to GO.
When LO turns to GO	A trigger is generated when the signal changes from LO to GO.
When HI or LO turns to GO	A trigger is generated when the signal changes from HI or LO to GO.
At an alarm occurred	A trigger is generated when an alarm occurs.
At an alarm released	A trigger is generated when the alarm is cleared.
At timing input on	A trigger is generated when the timing input turns on.

Precautions

- The settings of upper/lower limit value of judgment output and upper/lower hysteresis of judgment output become effective when the result of the judgment output is set as a trigger condition.
- The setting of alarm delay times becomes effective when "At an alarm occurred" is set as a trigger condition.

Trigger point

This setting is used to display the measurement data before trigger generation. Set the number of data items to be displayed before trigger generation as the trigger point.

The trigger point is enabled only when "Buffering Mode" is set to "Trigger Mode".

The setting range is 1 to the set "Data Count".

The initial value is "10000".

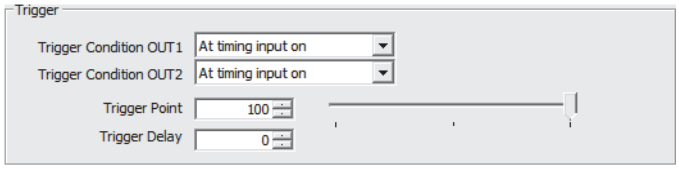
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set the "Trigger Point".



Setting value	Setting details
1 to the set "Data Count"	The number of data items to be displayed before trigger generation

Precautions

- If a value larger than the set "Data Count" is set for "Trigger Point", accumulation cannot be started.
- When the trigger delay function is set, reading the measurement data starts from the delayed trigger point that has been set with this function after the set trigger is generated. (☞ Page 35 Trigger delay)

Trigger delay

This function delays the timing of trigger detection when "Buffering Mode" is set to "Trigger Mode" or "Sample Trigger Mode". Set the number of sampling times for "Trigger Delay". The setting range is 0 to 100000000.
The initial value is "0". The status during the trigger delay is indicated as "Buffering".

■In trigger mode

Reading the measurement data starts from the delayed trigger point that has been set with this function after the set trigger is generated.

■In sample trigger mode

Accumulation of the measurement data starts from the delayed trigger point that has been set with this function after the set trigger is generated. If a new trigger is generated during trigger delay operation, it is ignored.

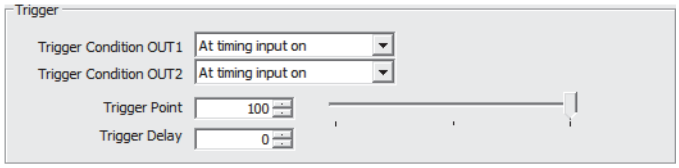
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set the "Trigger Delay".



Setting value	Setting details
0 to 100000000	Timing to detect triggers (set with the number of sampling operations)

Precautions

When "Buffering Rate" is set, the trigger delay is counted with the extended sampling cycle in accordance with the setting.

Sample trigger accumulation amount

This function sets the accumulation amount for every trigger generation when "Buffering Mode" is set to "Sample Trigger Mode".

The setting range is 1 to the set "Data Count". The initial value is "1".

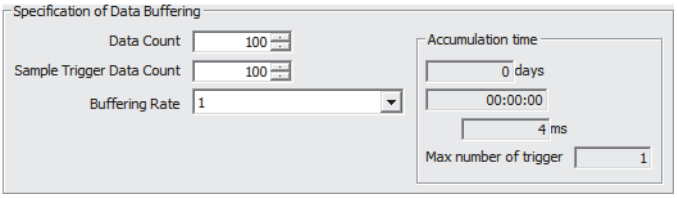
■Setting method

Use the setting tool.

1. Display the "Buffering Setting" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Setting] button

2. Set "Sample Trigger Data Count".



Setting value	Setting details
1 to the set "Data Count"	The accumulation amount of data for each trigger generation

Precautions

Set the sample trigger accumulation amount so that (accumulation amount) ÷ (sample trigger accumulation amount) is an integer value.

Status readout

This function checks the status of measurement data accumulation.

The accumulation status can be checked before reading the accumulated data. The following table shows the status displayed in the "Status" field in the "Buffering" window.

Status	Description
Non-buffering	Buffering operation is not started after power-on or after initialization.
Wait for Trigger	Buffering operation is waiting for a trigger after it has started.
Buffering	Buffering operation started and measurement data accumulation started.
Buffering Completed	The accumulation amount has reached the setting value or buffering operation has stopped.

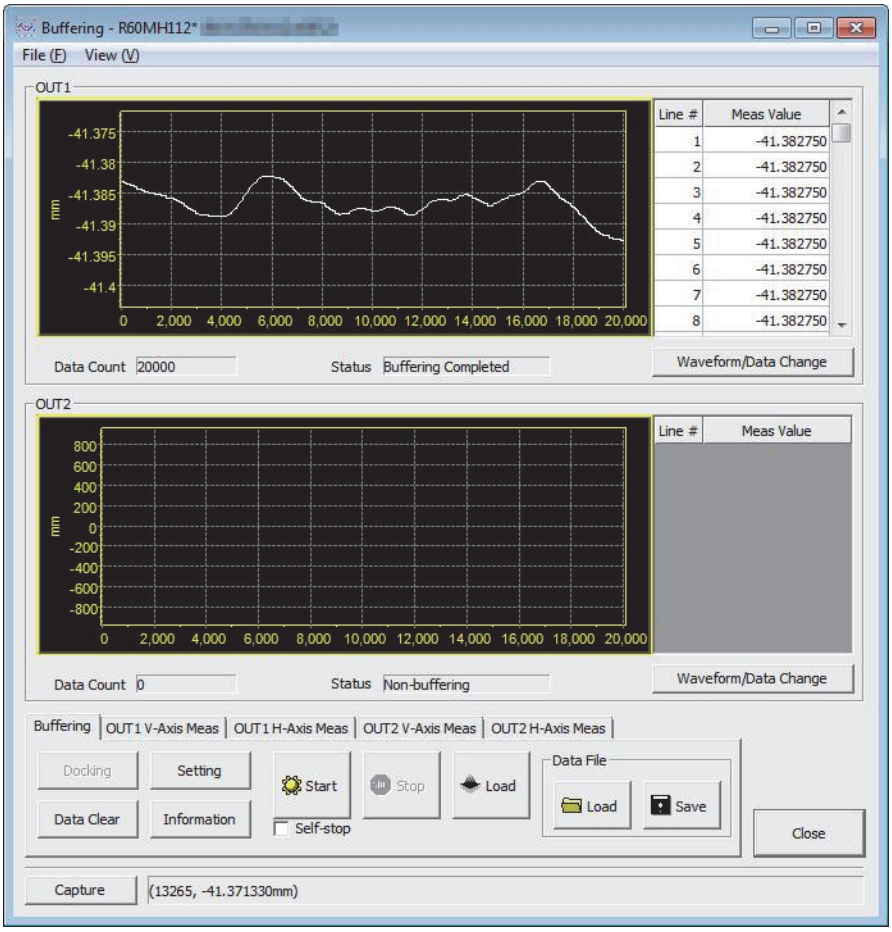
■How to use

Use the setting tool.

1. Display the "Buffering" window.

Main window ⇨ [Window] ⇨ [Buffering Display]

2. Check the status of measurement data accumulation in the "Status" field in the "Buffering" window.



Reading the accumulation amount

This function reads the amount of accumulated data.

"Data Count" that was read is "0" when "Status" is "Non-buffering".

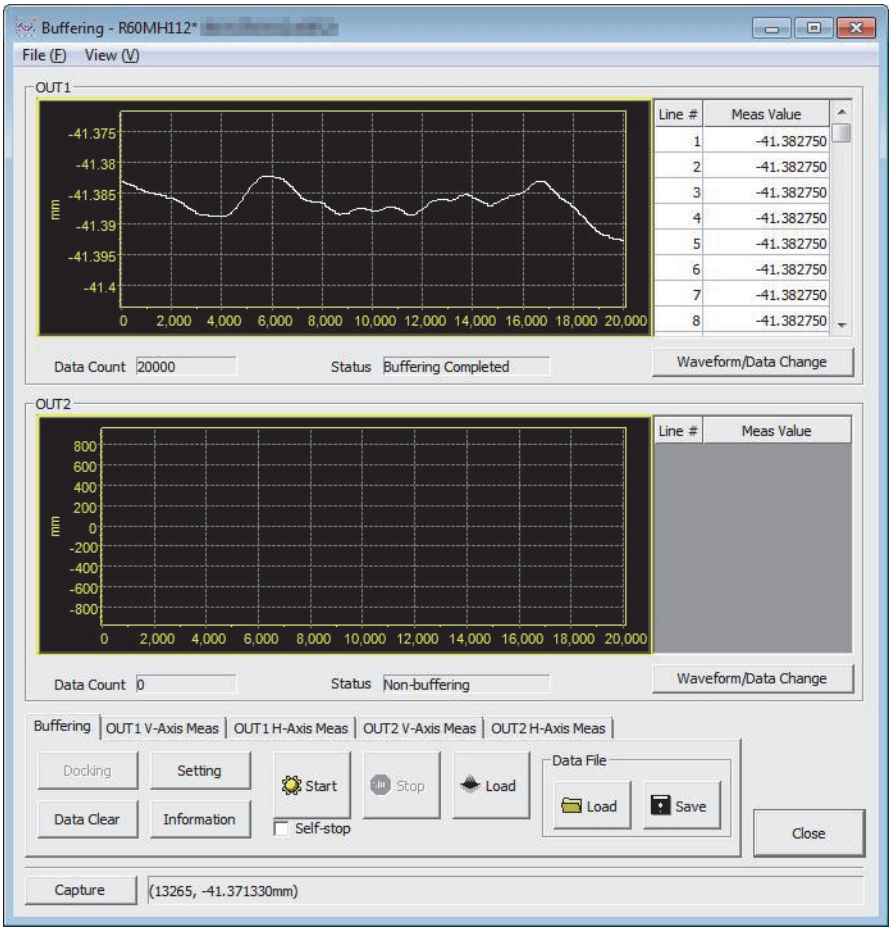
■How to use

Use the setting tool.

1. Display the "Buffering" window.

Main window ⇨ [Window] ⇨ [Buffering Display]

2. The accumulated data amount can be read by using the "Data Count" field in the "Buffering" window.



Trigger counter readout

This function reads the total number of triggers when "Buffering Mode" is set to "Sample Trigger Mode".

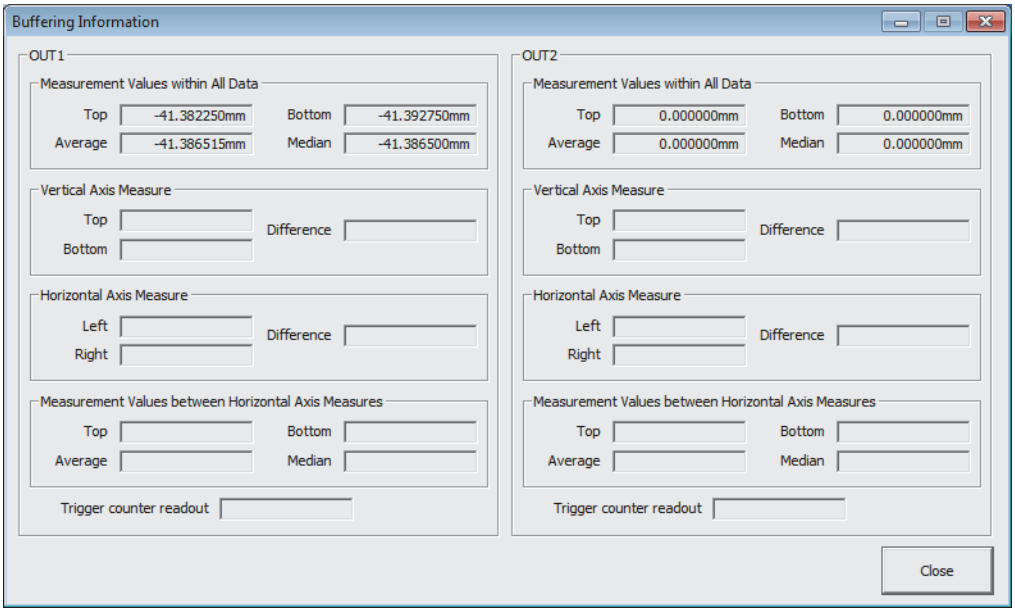
■How to use

Use the setting tool.

1. Display the "Buffering Information" window.

Main window ⇨ [Window] ⇨ [Buffering Display] ⇨ [Information] button

2. The total number of triggers is displayed in the "Trigger counter readout" field in the "Buffering Information" window.



Precautions

When performing trigger counter readout, stop the accumulation operation, and check "Data Count" and "Status" in the "Buffering" window.

When "Data Count" any value other than "0" and "Status" is "Buffering Completed", trigger counter readout can be performed.

1.4 Intelligent Function

External power supply interruption detection function

This function detects interruptions in the supply of power from an external power supply.

■Operation

When no power is being supplied from the external power supply, such situation is judged to be an external power supply interruption state. However, external power supply interruptions are not detected for approximately 5 seconds after the control module starts.

Every time the external power supply is turned on and off, the value for 'External power supply off count' (Un\G29000) is incremented by one.

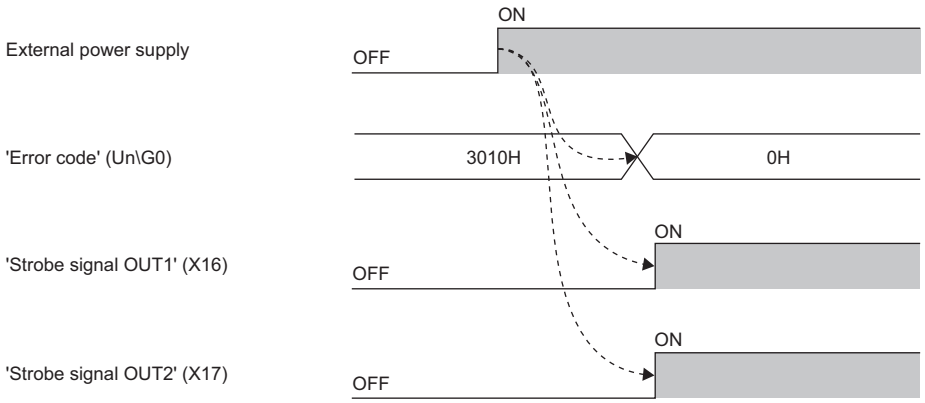
When an external power supply interruption occurs, 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn off.

For details on the recovery methods when an external power supply interruption occurs, refer to the list of error codes (3010H). (☞ Page 64 Error Code List)

An external power supply interruption is automatically cleared approximately 40 to 50 seconds after the external power supply is turned on.

The external power supply interruption clear function operates as follows.

----------▶ Controlled by the control module



Precautions

- When the external power supply is turned off, the measurement value turns to a data-unfixed state (-999.999999mm).
- The external power supply not meeting the performance specification requirements may be judged to be an external power supply interruption state. For details on the performance specifications, refer to the following.

📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup)

- When the external power supply is off, communications with the setting tool fail. A communication error occurs.
- When the external power supply is interrupted, the following errors are cleared at the same time.

Error code	Error name
3005H	Sensor head unconnected
3006H	Connection head mismatch
3008H	Automatic head adjustment error
3011H	Circuit malfunction
3021H	Head system failure
3022H	Head connection check failure

Received light intensity waveform acquisition function

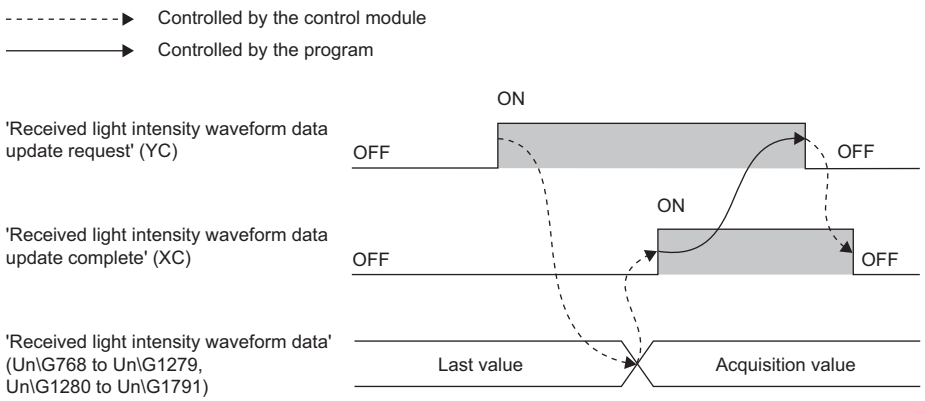
This function stores the received light intensity waveform data in the buffer memory of the control module. This enables to handle the received light intensity waveform data as the data of the CPU module, which can be used to determine the causes of errors and in other such production quality management.

■Buffer memory to be used

Buffer memory address	Buffer memory name		Description	Read, write	Initial value
Un\G768 to Un\G1279	Received light intensity waveform data	Sensor head A	The received light intensity wave data of sensor head A is stored.	Read	—
Un\G1280 to Un\G1791		Sensor head B	The received light intensity wave data of sensor head B is stored.	Read	—

■Setting method

1. Turn on 'Received light intensity waveform data update request' (YC) of the output signal.
2. Check that 'Received light intensity waveform data update complete' (XC) of the input signal has turned on (the storage has completed).



■Operation

The received light intensity waveform data at sensor heads A and B are simultaneously acquired.

Precautions

- The received light intensity waveform data cannot be continuously acquired into the buffer memory according to the sampling cycle.
- If an update request is made to a sensor head that is not connected, the received light intensity waveform data will be all zeros.

1.5 Recipe Selection Function

Default recipe

The setting tool has recipes in which reflectance properties of typical materials of measurement objects as well as measurement method parameters have been registered in advance.
By selecting the recipe depending on the measurement object, the optimal parameters can be set just by fine-tuning items such as the upper/lower limit values of the judgment output and the number of moving average times.
For details, refer to the following manual.
📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual

2 PARAMETER SETTINGS

2.1 Parameter Setting Procedure

1. Add the control module in the engineering tool.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]

2. The only parameter settings that can be configured are the refresh settings.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter]

3. Use the engineering tool to write the settings to the CPU module.

[Online] ⇨ [Write to PLC]

4. The settings are reflected by resetting or powering off and on the CPU module.

2.2 Parameter Settings in the Engineering Tool

This section describes the parameter settings in the engineering tool.

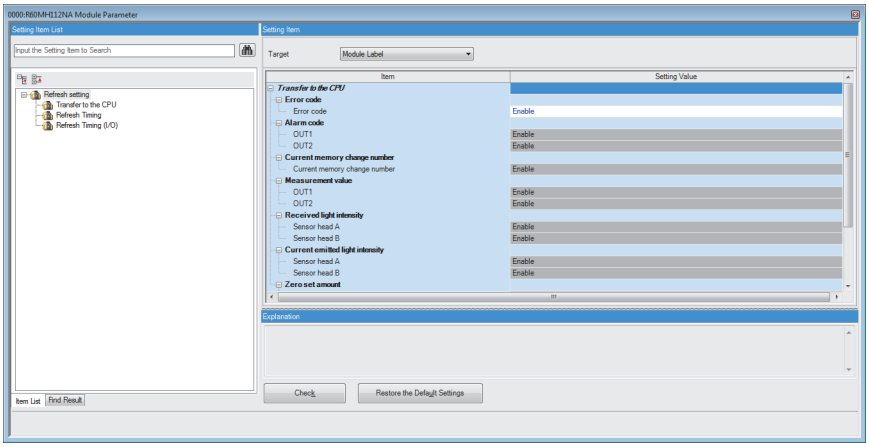
Refresh settings

Set the buffer memory area of the control module to be refreshed.

This refresh setting eliminates the need for reading/writing data by programming.

1. Start the module parameter.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ [Refresh setting]



2. Click "Target" and set the refresh target.

• When "Target" is "Module Label"

Set whether to enable or disable the refresh by setting "Error code" to "Enable" or "Disable".

• When "Target" is "Refresh Data Register (RD)"

The transfer destinations of all items are automatically set by setting the start device to "Start Device Name".

• When "Target" is "Device"

Double-click the item to be set to enter the refresh target device.

3. Click "Refresh Timing" to set the timing of the refresh operation.

Set "Refresh Timing" to "At the Execution Time of END Instruction" or "At the Execution Time of Specified Program".

When "At the Execution Time of Specified Program" is set, double-click "Refresh Group [n](n: 1-64)" and set a value of 1 to 64.

Refresh processing time

The refresh processing time [μs] is an element that configures the scan time of the CPU module. For the scan time, refer to the following.

MELSEC iQ-R CPU Module User's Manual (Application)

The following shows a formula to calculate the refresh processing time [μs] with the refresh settings enabled.

- Refresh processing time [μs] = Refresh read (refresh transfer to the CPU module) time + Refresh write (refresh transfer to an intelligent function module) time

The refresh read time and the refresh write time vary depending on the refresh target setting.

When the refresh target is a module label or refresh data register (RD)

The following table shows the refresh read time and refresh write time when a CPU module is used.

Classification	Refresh processing time
Refresh read time	13.89μs
Refresh write time	0μs*1

*1 The control module does not have a refresh write target.

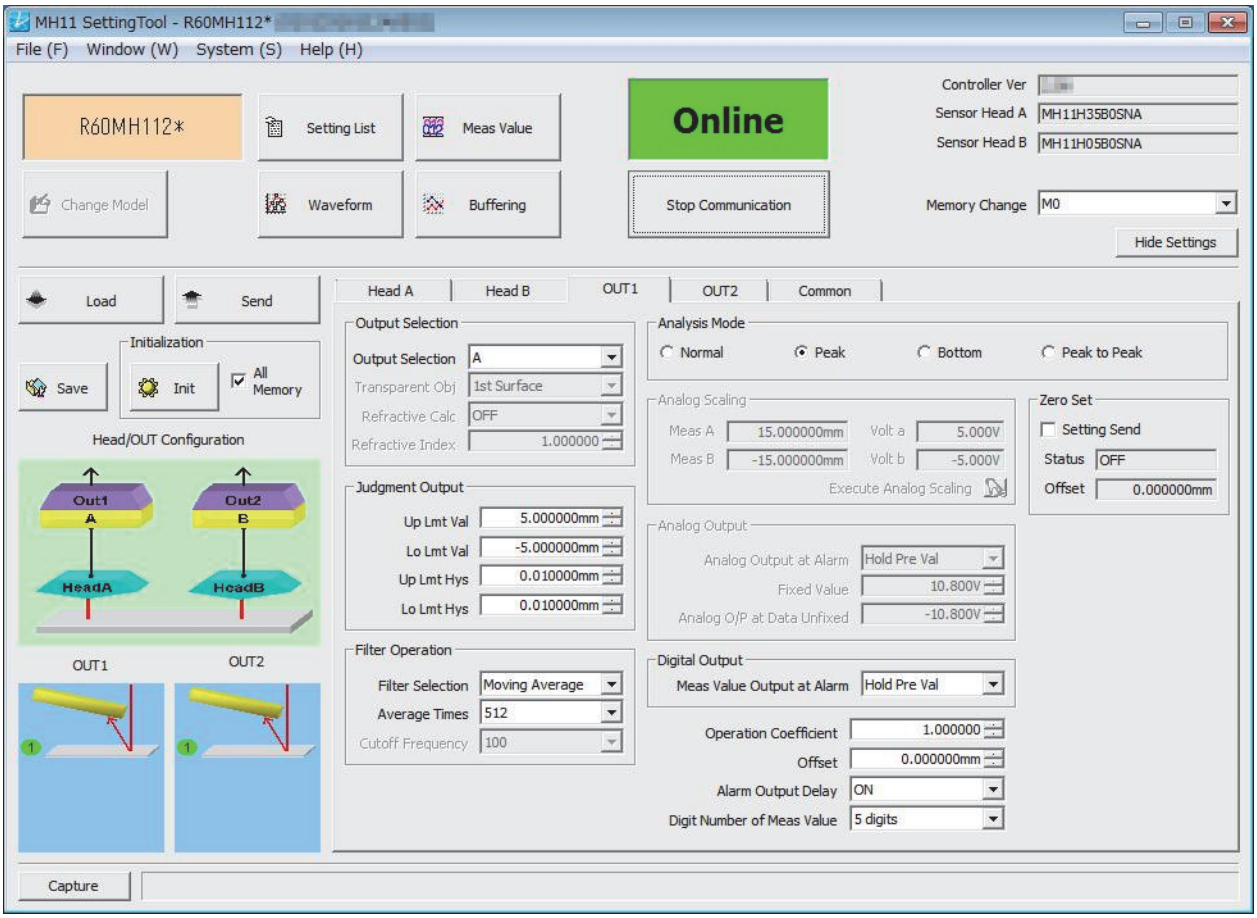
When the refresh target is a specified module

Calculate the refresh read time and refresh write time from the number of items where the refresh settings have been set and the number of transfers (words). For the calculation method, refer to the following.

MELSEC iQ-R CPU Module User's Manual (Application)

2.3 Parameter Settings in the Setting Tool

When the setting tool starts, the following main window is displayed.



For details on parameter settings in the setting tool, refer to the pages on the "Head A" and "Head B" tabs, "OUT1" and "OUT2" tabs, and "Common" tab in the following manual.

📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual

Point

Even if the engineering tool is exited while the setting tool is running, it can operate independently. Setting tool operations can continue.

3 PROGRAMMING

This chapter describes control module programming.

For details on communication between the control module and the sensor heads, refer to the following.

MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup)

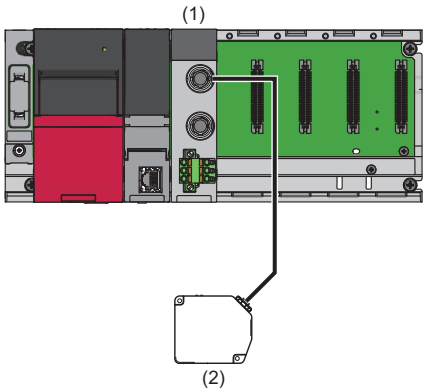
3.1 Control Module Program Example

This chapter describes a control module program example.

System configuration example

The following system configuration is used for describing an example.

System configuration



(1) Programmable controller system
- Power supply module: R61P
- CPU module: R04CPU
- Control module: R60MH112NA

(2) Sensor head: MH11H05B0SNA

Parameter settings

For details on parameter settings, refer to the parameter settings for the following.

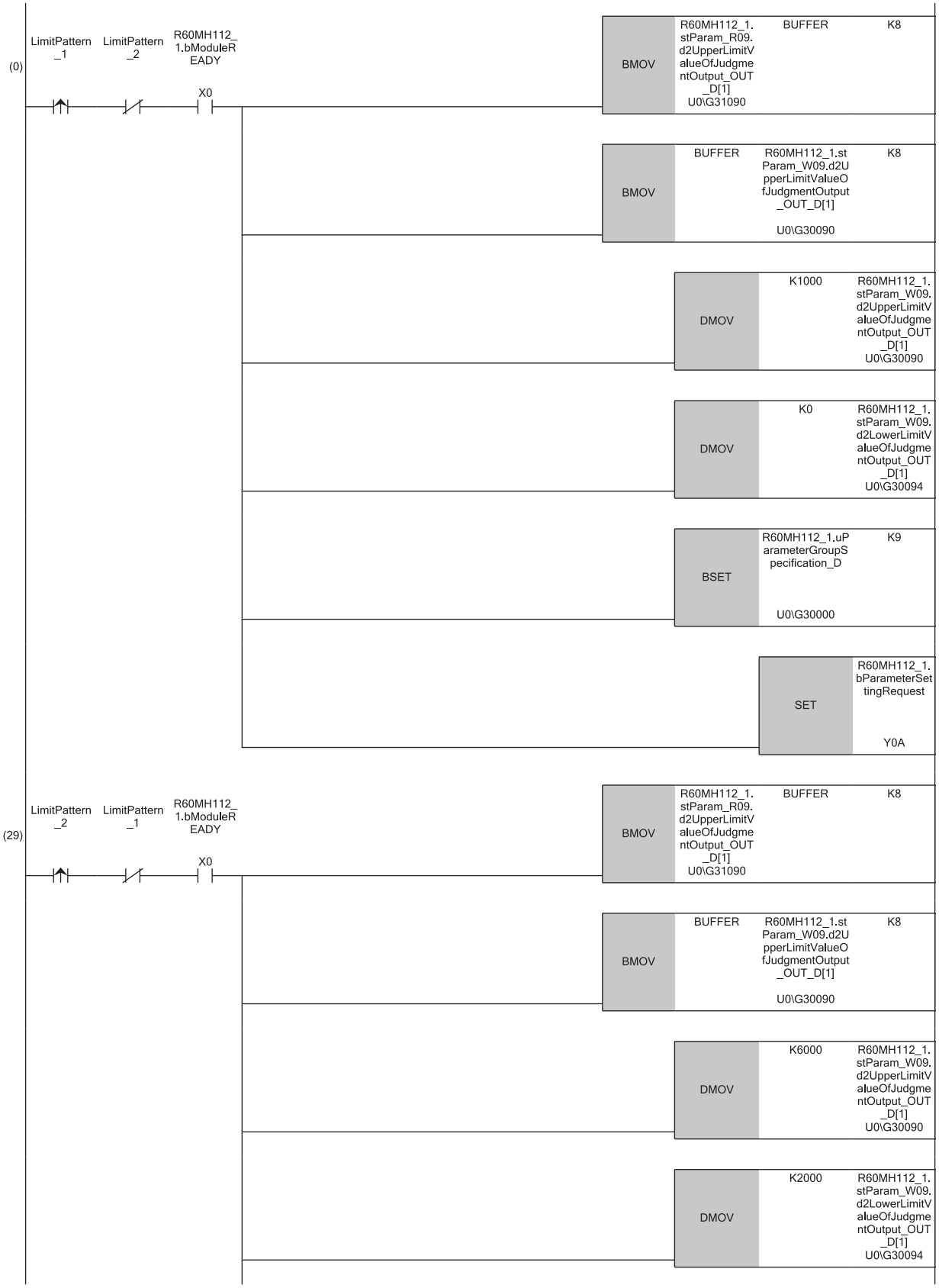
MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup)

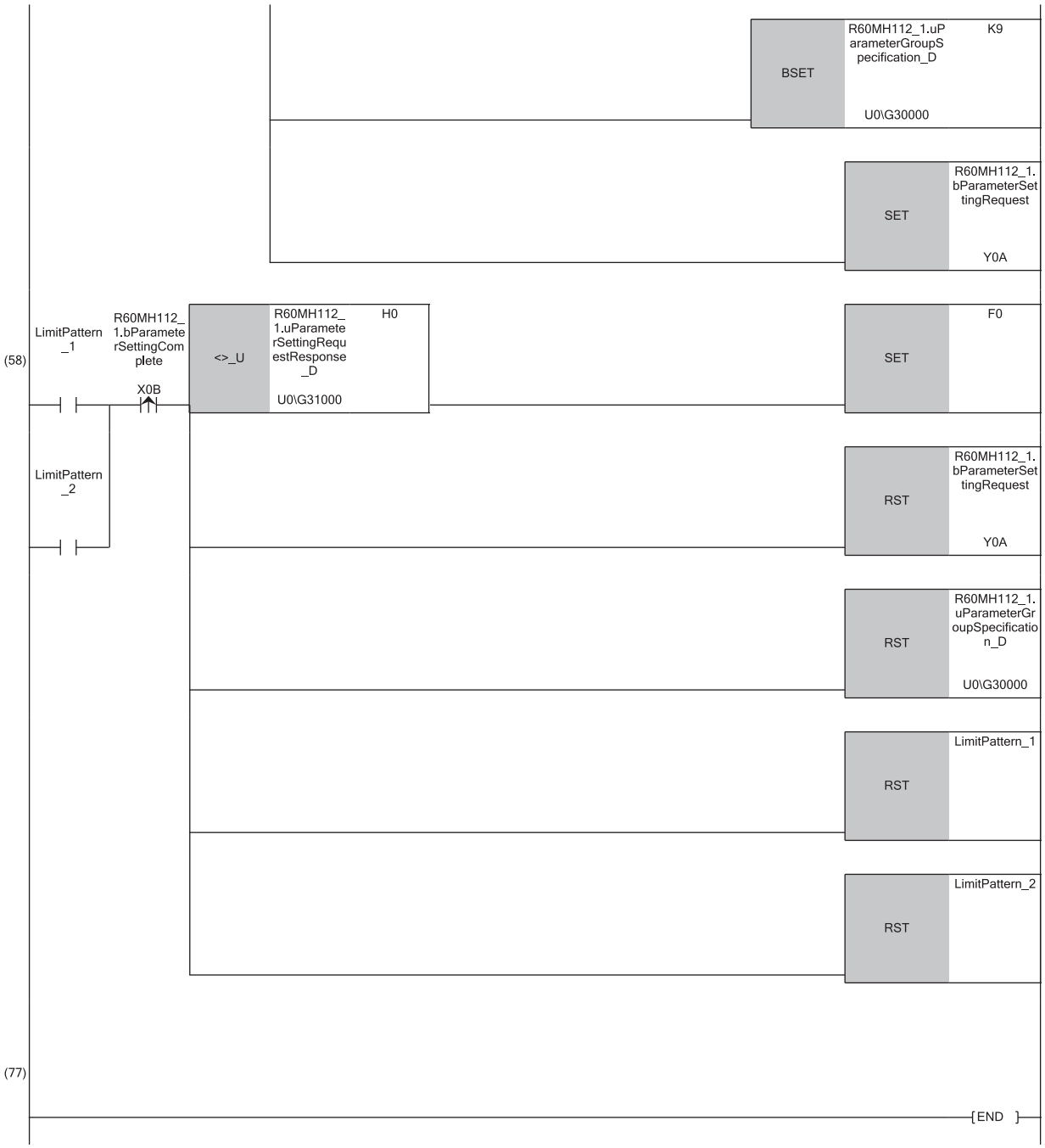
Program example

The following describes a program example of parameter change processing.

Classification	Label name	Description	Device
Module label	R60MH112_1.bModuleREADY	Module READY	X0
	R60MH112_1.stParam_R09.d2UpperLimitValueOfJudgmentOutput_OUT_D[1]	For reading the judgment output upper limit value (OUT1)	U0\G31090
	R60MH112_1.stParam_W09.d2UpperLimitValueOfJudgmentOutput_OUT_D[1]	For writing the judgment output upper limit value (OUT1)	U0\G30090
	R60MH112_1.stParam_W09.d2LowerLimitValueOfJudgmentOutput_OUT_D[1]	For writing the judgment output lower limit value (OUT1)	U0\G30094
	R60MH112_1.uParameterGroupSpecification_D	Parameter group specification	U0\G30000
	R60MH112_1.bParameterSettingRequest	Parameter setting request	YA
	R60MH112_1.uParameterSettingRequestResponse_D	Parameter setting request response	U0\G31000
	R60MH112_1.bParameterSettingComplete	Parameter setting complete	XB
Label to be defined	Define local labels as shown below. Label Name / Data Type / Class LimitPattern_1 / Bit / VAR LimitPattern_2 / Bit / VAR BUFFER / Double Word [Unsigned]/Bit String [32-bit](0.. / VAR		

Program example





(0) Turning off and on of Judgment output setting pattern 1 (LimitPattern_1) sets 1000nm to 'Judgment output upper limit value OUT1' (Un\G30090 to Un\G30091) and 0nm to 'Judgment output lower limit value OUT1' (Un\G30094 to Un\G30095).

(29) Turning off and on of Judgment output setting pattern 2 (LimitPattern_2) sets 6000nm to 'Judgment output upper limit value OUT1' (Un\G30090 to Un\G30091) and 2000nm to 'Judgment output lower limit value OUT1' (Un\G30094 to Un\G30095).

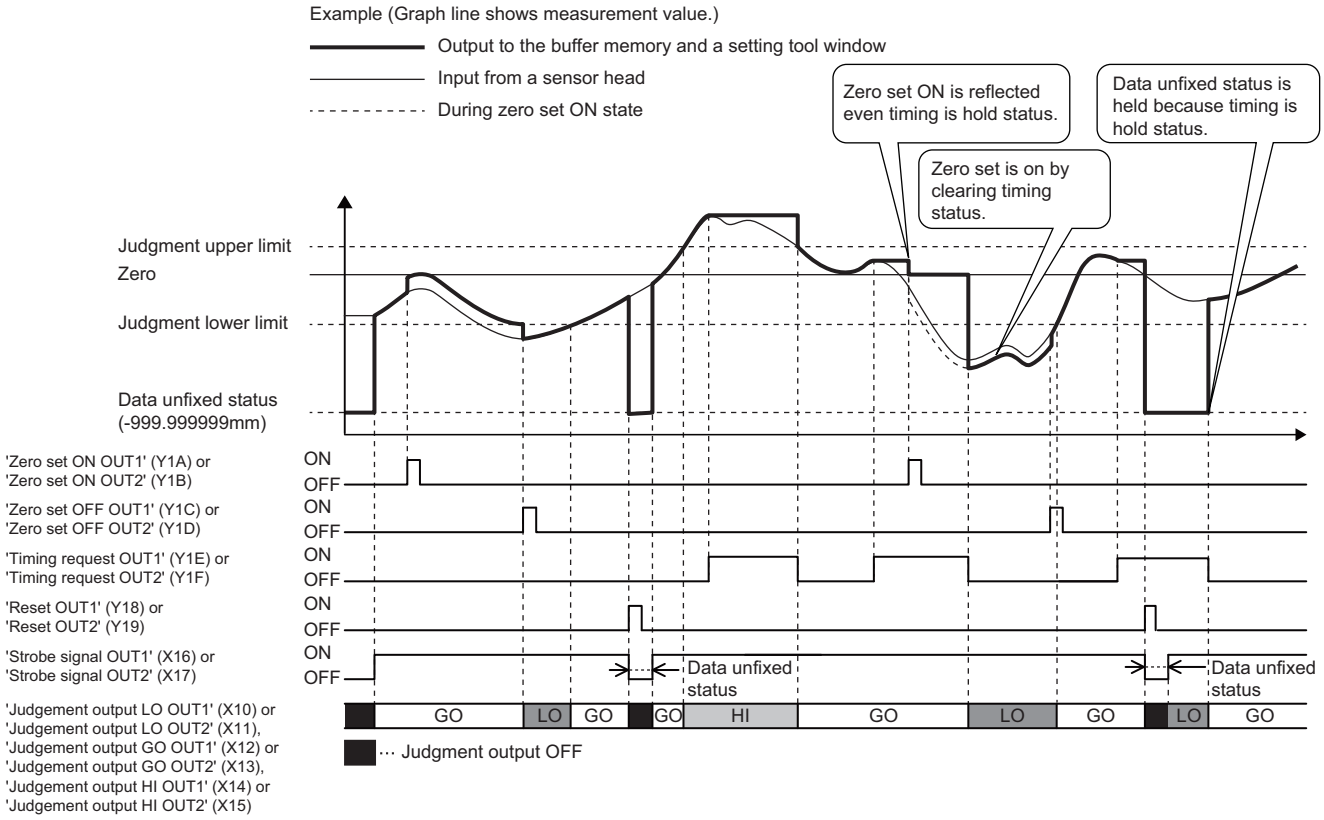
(58) If 'Parameter setting request response' (Un\G31000) is abnormal, F0 is turned on.

4 TIMING CHARTS

This chapter shows the timing charts for normal measurement, peak measurement/bottom measurement, peak to peak measurement, and laser control.

4.1 Normal Measurement

The timing chart for normal measurement is shown below.

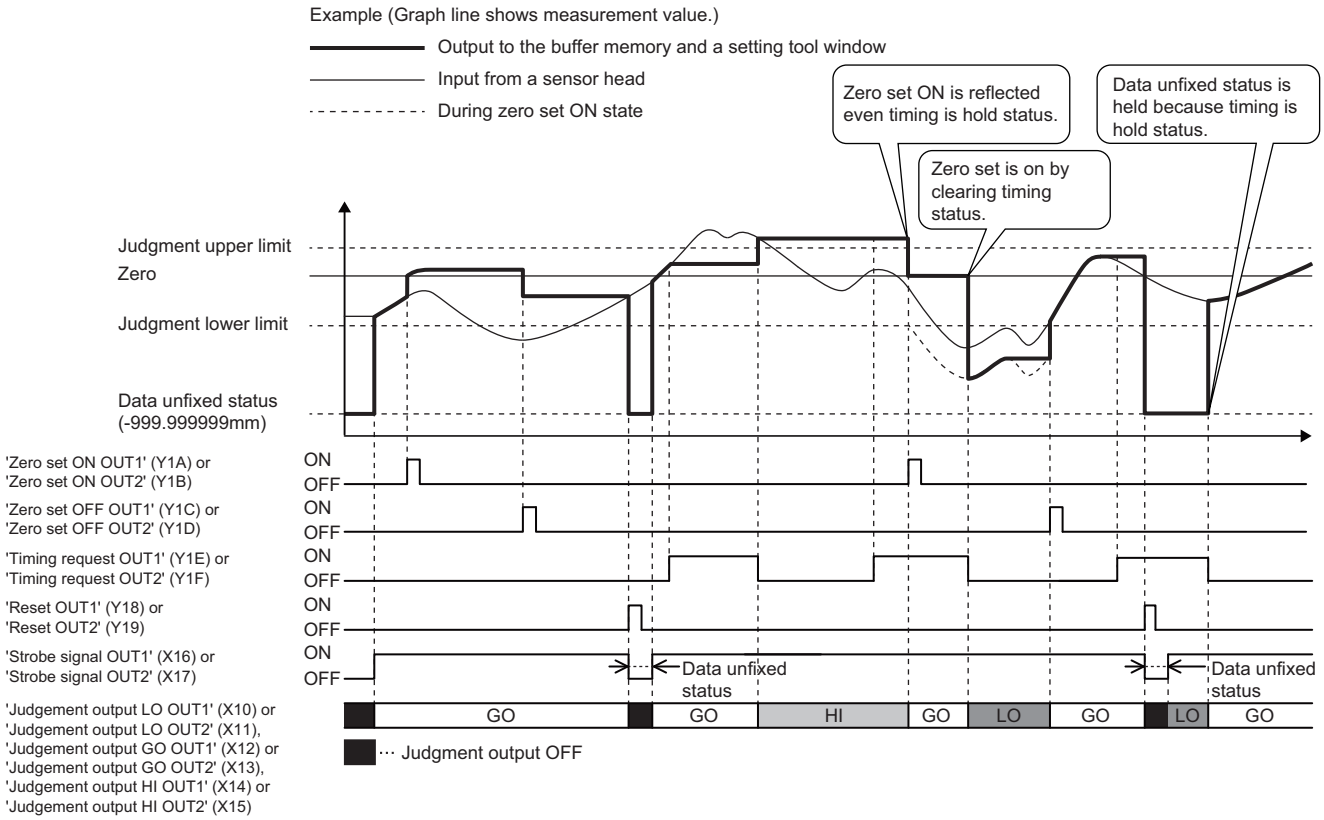


4.2 Peak Measurement/Bottom Measurement

The timing chart for peak measurement/bottom measurement is shown below.

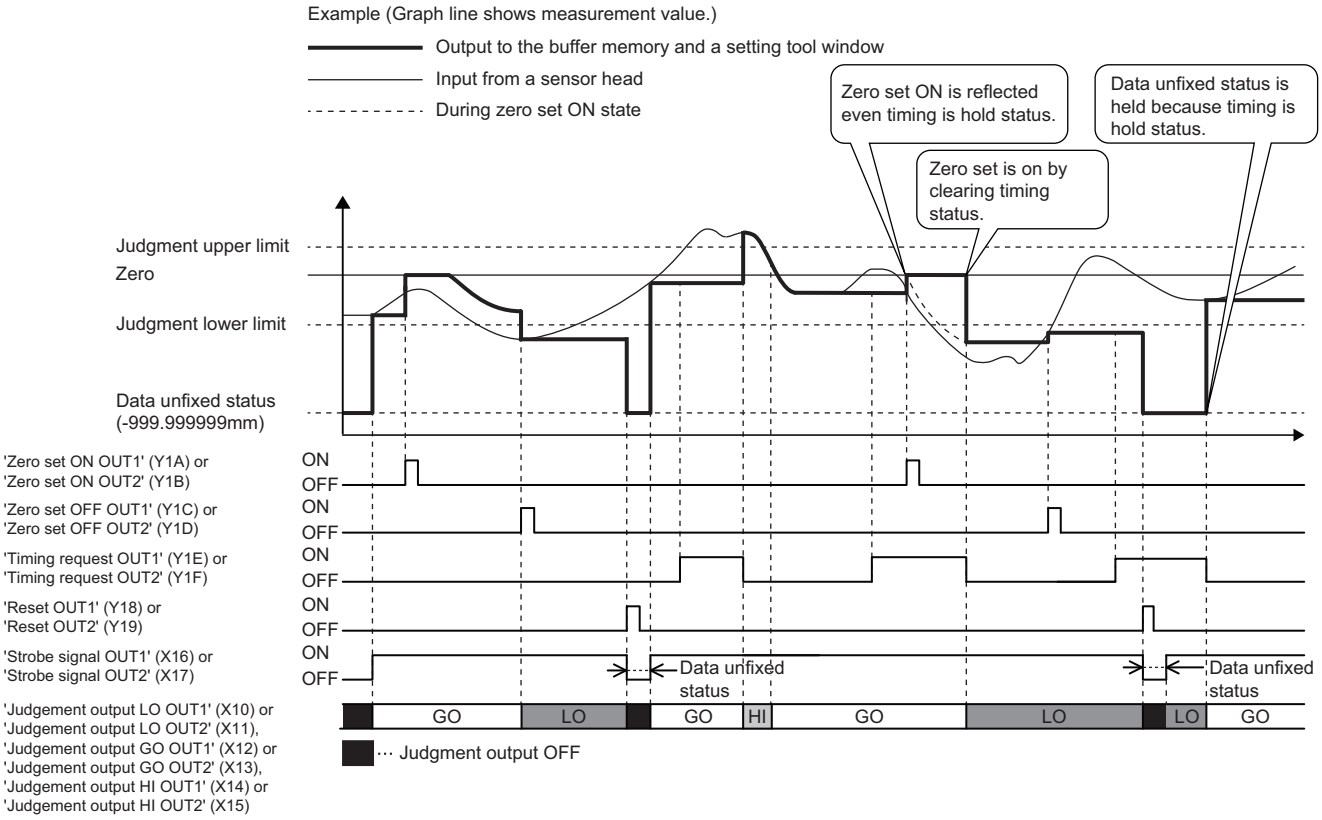
Peak measurement

The timing chart for peak measurement is shown below.



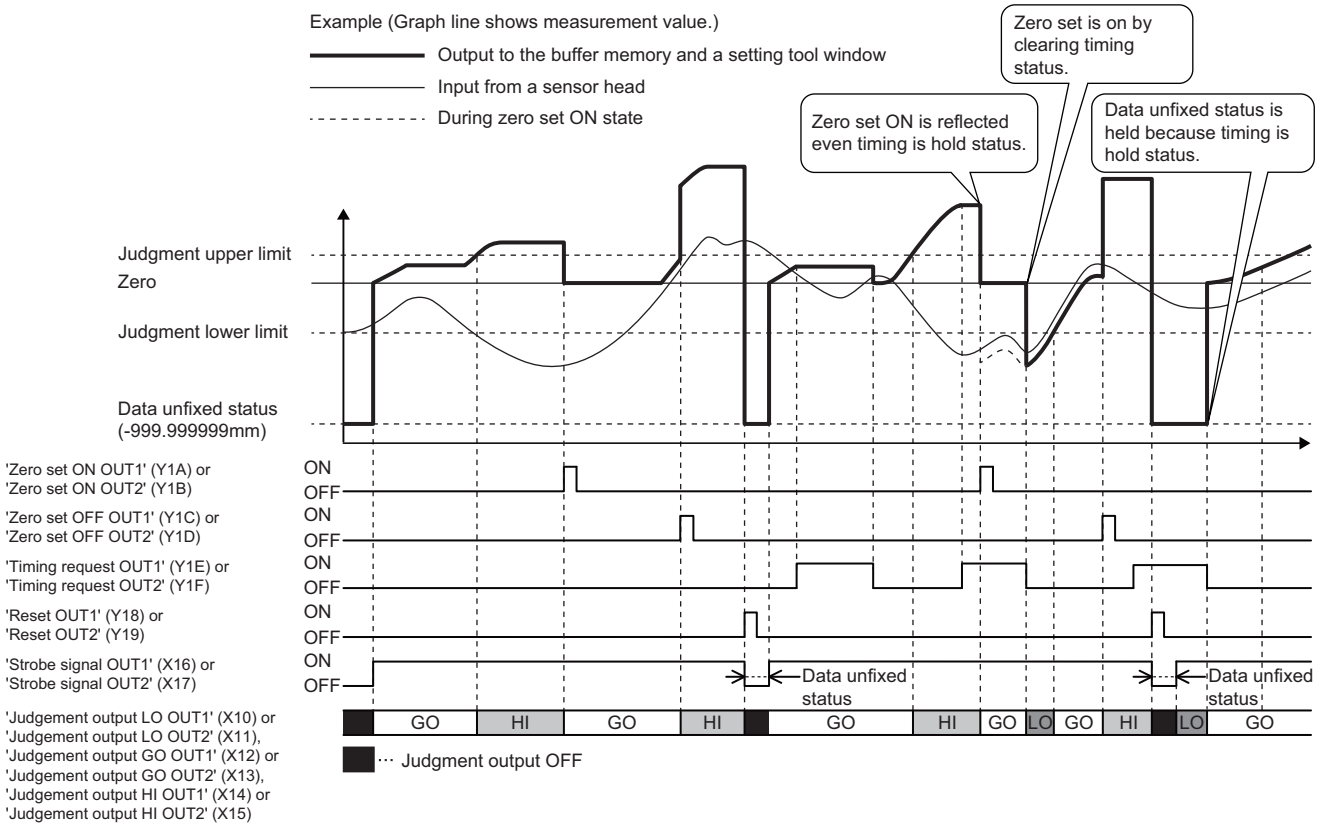
Bottom measurement

The timing chart for bottom measurement is shown below.



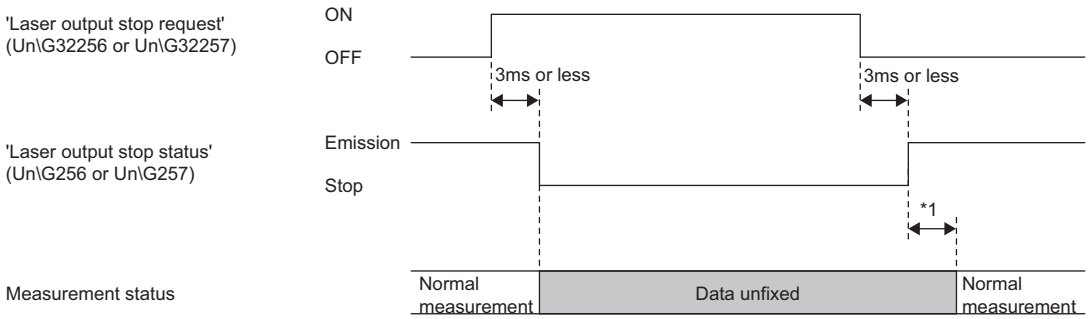
4.3 Peak to Peak Measurement

The timing chart for peak to peak measurement is shown below.



4.4 Laser Control

The timing chart for laser control is shown below.



*1 Sampling cycle (Ts) × Average times + Laser stabilization time

5 TROUBLESHOOTING

This chapter describes troubleshooting of the control module and sensor heads.

5.1 Checking with LEDs

This section describes troubleshooting using the LEDs.

Control module

The error status can be determined by the status of the RUN LED and ERR LED.

RUN LED	ERR LED	Error status	Description
Off	Flashing	Major error	— (no major error)
On	Flashing	Moderate error	An error that prevents measurement from continuing such as a hardware failure.
On	On	Minor error	An error that occurs when the number of writes to flash memory exceeds the prescribed value but allows measurement to continue.

When the RUN LED turns off

Check item	Action
Check whether the control module is installed correctly.	Correctly mount the control module on the base unit.
Check whether the capacity of the power supply module is enough.	Calculate the current consumption of mounted modules, such as the CPU module, I/O modules, and intelligent function modules, to check that the power capacity is enough.
Check whether the control module is operating abnormally due to being affected by noise.	• Review the wiring so that the shielded cable is grounded with a single-point ground. • If the grounding is shared with another device, ensure that the devices are grounded separately.

When the ERR LED turns on or is flashing

Check item	Action
Check whether any error has occurred.	Check the error code in the "Module Diagnostics" window and take actions described in the error code list. ☞ Page 64 Error Code List
Check whether the control module is operating abnormally due to being affected by noise.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

When the ALM1 LED or ALM2 LED turns on

Check item	Action
Check whether any measurement alarm has occurred.	• If the ERR LED is flashing: Check the error code in the "Module Diagnostics" window and take actions described in the error code list. • If the ERR LED is off: Check the installation condition, connection status, and settings so that the light intensity is sufficient.
Check whether the control module is operating abnormally due to being affected by noise.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

Sensor head

LASER ON does not turn on.

Check item	Action
Check whether the connection cable is connected correctly.	Check the connection status between the control module and the connection cable. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether the connection cable is disconnected.	Check the wiring status between the connection cable and the connector. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether the power is supplied to the sensor head.	Check the connection status between the external power supply and the control module. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether the control module has stopped.	Power-off and on the programmable controller again. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

RANGE does not turn on/flash.

Check item	Action
Check whether the sensor head is installed correctly.	The installation for the specular reflection is different from that for the diffuse reflection. Install the device correctly. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the installation mode set correctly.	Set the installation mode to "Spec Refl" or "Diff Refl" and install the sensor head in the correct procedures. Set the installation mode correctly. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the output selection is set correctly.	The measurement range indicator of the sensor head not selected with the output selection turns off. Check the output selection setting. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the measuring range specification is set correctly.	Set the measuring range specification correctly. For details, refer to the measuring range in the following manual. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether measures to reduce noise have been taken.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

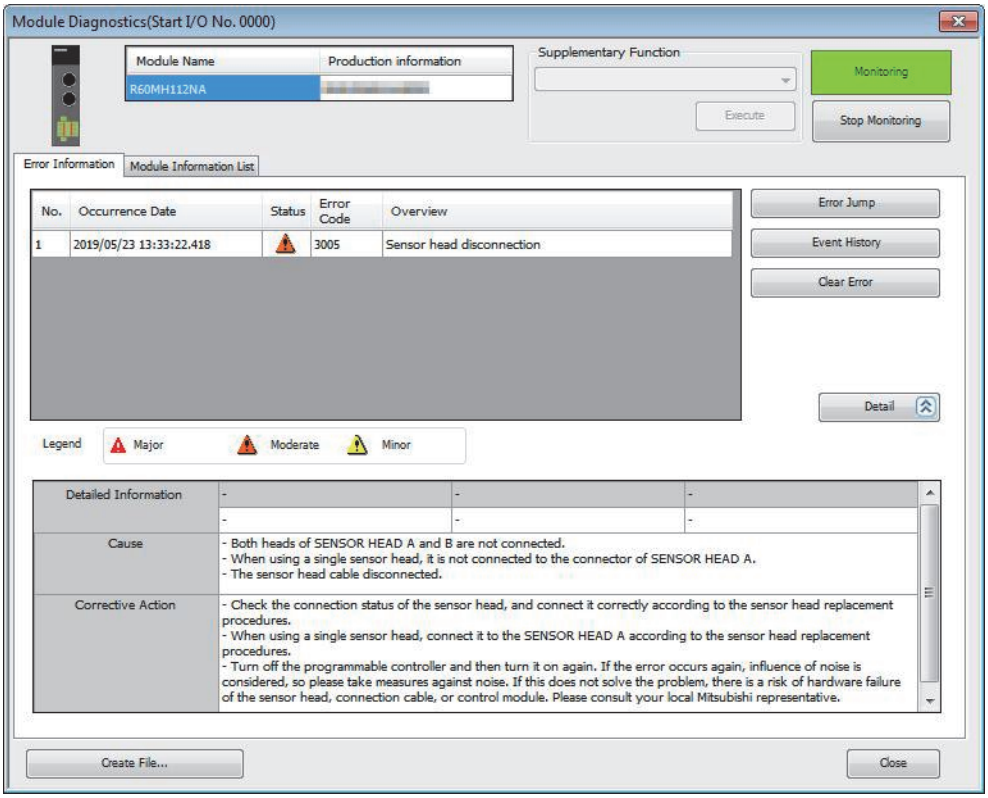
5.2 Checking the Module Status

The following items can be checked in the "Module Diagnostics" window of the control module.

Function	Application
Error Information	The details of the errors currently occurring is displayed.
Module Information List	Various status information of the control module is displayed.

Error information

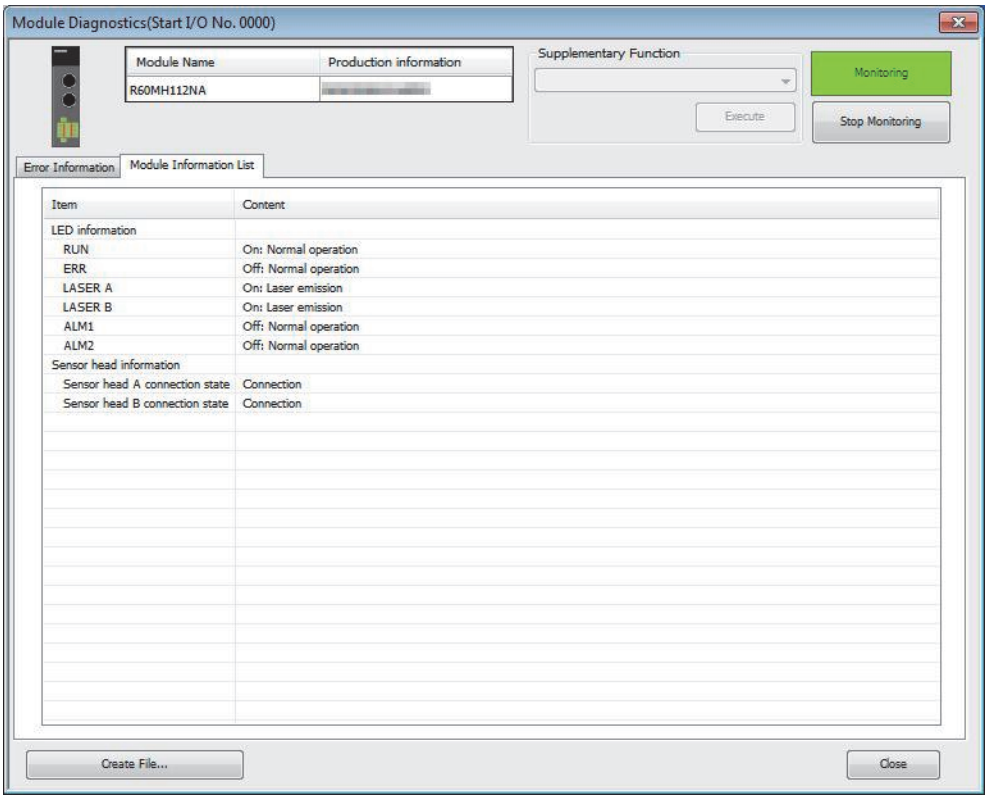
Check the details and actions for the errors that have occurred.



Item	Description
Status	Major: — (no major error)
	Moderate: An error that prevents measurement from continuing such as a hardware failure
	Minor: An error that occurs when the number of writes to flash memory exceeds the prescribed value but allows measurement to continue
Error code	Displays the error code of the control module. (☞ Page 64 Error Code List)
[Error Jump] button	The control module does not support the error jump function.
[Event History] button	When this button is clicked, event codes are displayed, and errors detected and operations executed in each module can be checked. (☞ Page 67 Event List)
[Clear Error] button	The control module does not support the error clear function.
Detailed Information	Displays up to three items of detailed information on each error.
Cause	Displays detailed factors that could lead to each error.
Corrective Action	Displays actions to clear each error.

Module information list

Select the [Module Information List] tab to check various status information of the control module.



Item		Content
LED information	RUN	• On: Normal operation • Off: Module power supply interruption
	ERR	• On: Minor error • Flashing: Moderate error • Off: Normal operation
	LASER A	• On: Laser emission • Off: Laser stop
	LASER B	
	ALM1	• On: Alarm • Flashing: Replacing sensor head • Off: Normal operation
	ALM2	
Sensor head information	Sensor head A connection state	Displays the connection status of the sensor head. • Connection • Disconnection • Not recognizable
	Sensor head B connection state	

5.3 Troubleshooting by Symptom

This section describes troubleshooting by symptom. If an error has occurred in the control module, identify the error cause using the engineering tool. (☞ Page 58 Checking the Module Status)

The measurement object and the measurement value differ from the actual distance.

The following table lists the actions to be taken if there is a difference between the actual distance to the measurement object and the measurement value.

Check item	Action
Check whether the calibration has been set correctly.	Set the calibration correctly. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the measurement object is fluctuating or vibrating.	Stop the fluctuation or vibration of the measurement object. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the measurement object is tilted.	Set the measurement object as vertically as possible. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the received light intensity is saturated or low.	Adjust the received light intensity by using the emission adjustment function. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the refractive index set correctly.	Correct the refractive index by using the refractive index calculation function. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)

Not all measurement values in the measurement range are output.

The following table lists the actions to be taken if not all measurement values in the measurement range are output.

Check item	Action
Check whether the sensor head is installed correctly.	The installation for the specular reflection is different from that for the diffuse reflection. Install the device correctly. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the installation mode is set correctly.	The installation mode needs to be set to "Spec Refl" or "Diff Refl". Set the installation mode correctly. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the measuring range specification is set correctly.	Set the measuring range specification correctly. For details, refer to the measuring range in the following. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)

The correct measurement value is not displayed.

The following table lists the actions to be taken if the correct measurement value is not displayed.

Check item	Action
Check whether the measurement object is within the measurement range.	Check the measurement range of the sensor head used. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether the operation coefficient and offset is set correctly.	Set the operation coefficient and offset correctly. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the light emitting part and light receiving part are dirty.	Clean the light emitting part and light receiving part of the sensor head. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether measures to reduce noise have been taken.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether waveforms are in disorder.	Set the peak recognition sensitivity so that a measurement value expected to be detected originally can be obtained when a detection failure is caused by disorderly waveforms or for a transparent object. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)

The measurement value is not stabilized.

The following table lists the actions to be taken if the measurement value is not stabilized.

Check item	Action
Check whether the set number of moving average times is small.	Increasing the moving average times may stabilize the measurement value. For details, refer to the filter processing in the following manual. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the measurement mode is set correctly.	Changing the measurement mode depending on the measurement object may stabilize the measurement value. Select an optimum measurement mode. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the light emitting part and light receiving part are dirty.	Clean the light emitting part and light receiving part of the sensor head. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the sensor head mounting direction is correct.	Check the mounting direction of the sensor head. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the sensor head or the measurement object is tilted.	Check the installation of the sensor head and the position of the measurement object. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether measures to reduce noise have been taken.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

An alarm indicator is on and measurement cannot be performed.

The following table lists the actions to be taken if an alarm indicator is on and measurement cannot be performed.
Check the alarm code as well. (☞ Page 66 Alarm Code List)

Check item	Action
Check whether the sensor head is detached.	When the sensor head is not connected, the alarm indicator turns on. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether the emission spot is out of the measurement range.	Move the measurement object so that the RANGE indicator of the sensor head turns on or flashes. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether an object is blocking the reflected light from the emission spot before the light reaches the light receiving part.	Change the emission spot position or mounting direction of the sensor head to prevent the reflected light from being blocked. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the emission spot is on the R part (curve) of the measurement object.	Measure the object with a large beam radius by applying the light to the top of the R part or moving the measurement object within the measurement range. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the reflected beam have directionality because the surface of the object is hairline-finished.	Check the mounting direction of the sensor head. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether the received light intensity is insufficient due to a short sampling cycle.	Lengthen the sampling cycle. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether the received light intensity is saturated in specular reflection measurement due to a long sampling cycle.	Shorten the sampling cycle. Alternatively, install the ND filter. • (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual) • (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether diffuse reflection is used to measure a specular-surface or transparent object.	Use the sensor head installed for specular reflection. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether measures to reduce noise have been taken.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

An alarm indicator is on and measurement cannot be performed. The range is narrow.

An alarm indicator is on and measurement cannot be performed. If the measurable range is narrow, check the following items.

Check item	Action
Check whether the received light intensity exceed the adjustment range because the sampling cycle is too long and the received light intensity is too high.	Shorten the sampling cycle and reduce the light intensity of the laser with the emission adjustment. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)
Check whether a specular reflection component is received in diffuse reflection measurement.	Change the mounting direction of the sensor head or adjust the tilt of the measurement object to protect the light receiving part from specular reflection components. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))
Check whether measures to reduce noise have been taken.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
Check whether an alarm code is displayed with an alarm code value other than 0.	Check the alarm code list and eliminate the error cause. (☞ Page 66 Alarm Code List)

The measurement value indicates that the system data status is unfixed

The following table lists the actions to be taken if the measurement value is "-999.999999mm", which indicates that the system data status is unfixed.

Check item	Action
Check whether the time until the measurement value is fixed long.	• Wait some time. • Shorten the time until the measurement value is fixed by changing the number of averages for the moving average of the sampling cycle or filter processing. (☞ Page 106 Conditions for unfixed output data)
Check whether measures to reduce noise have been taken.	Take measures to reduce noise. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

The laser is not emitted.

The following table lists the actions to be taken if the laser is not emitted.

Check item	Action
Check whether the laser control setting has been saved with "Stop"?	If the laser control setting is saved in the memory with "Stop", the system will be started up with laser emission stopped. Set "Emission" in the laser control setting. (☞ Page 18 Head laser control)

Precautions

- When a problem occurs in the processing of measurement data, refer to the following.

☞ Page 13 Measurement function

- If trouble occurs in the alarm, refer to the sampling, alarm processing, calibration, output selection, filter, zero set, measurement mode, operation coefficient, and offset in the following manual.

📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual

- For details on the condition for unfixed output data, refer to the following.

☞ Page 106 Conditions for unfixed output data

- When trouble occurs in the memory saving, refer to the following.

☞ Page 25 Save

5.4 Error Code List

The control module stores an error code in 'Error code' (Un\G0) when an error occurs during operation.
At this time, 'Error flag' (XE) turns on, and 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17) turn off.
When a moderate error occurs, the operation of some input signals cannot be guaranteed. For details, refer to the list of I/O signals. (☞ Page 69 List of I/O signals)
Error codes are classified into major error, moderate error, and minor error, and can be checked in the [Error Information] tab of the "Module Diagnostics" window of the control module. (☞ Page 58 Error information)
The following table lists the error codes that are stored.

Error code	Error name	Error definition and cause	Action	Detailed information
1080H	Life detected	The number of writes to flash memory has exceeded the prescribed value.	Replace the control module.	—
3003H	Flash memory failure	The loading of saved settings failed during startup.	• Initialize all the memory areas and execute save processing. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the control module. Please consult your local Mitsubishi representative.	—
3004H		The saving of settings failed.	• Power off and on the programmable controller. • Execute saving again. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the control module. Please consult your local Mitsubishi representative.	—
3005H	Sensor head unconnected	• Both sensor heads (A and B) are not connected. • If using a single sensor head, it is not connected with SENSOR HEAD A. • The sensor head cable is disconnected.	• Check the connection status of the sensor head, and mount the sensor head correctly according to the sensor head replacement procedure. • When using a single sensor head, according to the sensor head replacement procedure, connect the sensor head to the SENSOR HEAD A side of the control module. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, a possible cause is noise. Take measures to reduce noise. If the measures above fail to fix the error, another possible cause is a hardware failure of the sensor head, extension cable for sensor head, or control module. Please consult your local Mitsubishi representative.	—
3006H	Connection head mismatch	Sensor heads not subject to export regulations are not connected to a control module not subject to export regulations.	• According to the sensor head replacement procedure, replace the sensor heads with ones not subject to export regulations. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the control module. Please consult your local Mitsubishi representative.	Sensor head[*1]
3008H	Automatic head adjustment error	The darkness level of the received light intensity waveform could not be recognized correctly due to ambient light or noise.	• Review the usage environment for items such as ambient light. • Take measures to reduce noise. • According to the sensor head replacement procedure, connect the sensor head again. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the control module. Please consult your local Mitsubishi representative.	Sensor head[*1]

Error code	Error name	Error definition and cause	Action	Detailed information
3010H	External power supply interruption	External power is not being supplied.	• Turn on the external power supply and wait for approximately 40 to 50 seconds. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the control module. Please consult your local Mitsubishi representative.	—
3011H	Circuit malfunction	Malfunction occurred because of the reconnection of the sensor head.	• Check the connection status of the sensor head, and mount the sensor head correctly according to the sensor head replacement procedure. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the sensor head, extension cable for sensor head, or control module. Please consult your local Mitsubishi representative.	—
3200H	Hardware failure	A hardware failure has been detected.	• Take measures to reduce noise. • Check the mounting status of the control module. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the control module. Please consult your local Mitsubishi representative.	—
3201H				
3202H				
3203H				
3210H				
3211H				
3221H	Head system failure	The sensor head system did not operate normally.	• Check the connection status of the sensor head, and mount the sensor head correctly according to the sensor head replacement procedure. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the sensor head, extension cable for sensor head, or control module. Please consult your local Mitsubishi representative.	Sensor head*1
3222H	Head connection check failure	The control module could not recognize the sensor head correctly.	• Take measures to reduce noise. • Check the connection status of the sensor head, and mount the sensor head correctly according to the sensor head replacement procedure. • Power off and on the programmable controller. If the error occurs again even after the above action is taken, the possible cause is a hardware failure of the sensor head, extension cable for sensor head, or control module. Please consult your local Mitsubishi representative.	Sensor head*1

*1 When one sensor head causes the error, the sensor head information is stored in 'Error code details 1' (Un\G36104). When two sensor heads cause the error, the sensor head information is stored in 'Error code details 1' (Un\G36104) and 'Error code details 2' (Un\G36105).

5.5 Alarm Code List

The control module stores an alarm code for OUT1 or OUT2 in 'Alarm code' (Un\G1 to Un\G2) when an alarm occurs during operation.

The following table lists the alarm codes that are stored.

Alarm code (decimal)	Alarm name	Alarm definition	Action
1	Measurement alarm	This alarm occurs when the settings and the status do not match such as when the measurement object is not within the measurement range, when measurement is not possible due to insufficient light intensity, when an attempt is made to display the measurement value of a non-connected sensor head B, and when the specified measurement surface cannot be obtained with the transparent object settings.	Check the installation condition, connection status, and setting so that the light intensity is sufficient.
5	Sensor head unconnected	The sensor head is not connected.	When the sensor head is detached, connect the sensor head again correctly according to the sensor head replacement procedure. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))
10	Error detected alarm	An alarm occurred because an error other than a minor error was detected.	Check the error code and take proper actions. (☞ Page 64 Error Code List)
11	Replacing sensor head	A sensor head replacement request is received.	Replace the sensor head according to the sensor head replacement procedure. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Startup))

5.6 Event List

This section lists the events that occur in the control module.

Operation

Event code	Overview	Cause
24000H	Parameter change request	A parameter was sent from the tool.
24001H	Parameter save request	A parameter was saved.
24002H	Parameter initialization request	The memory was initialized.

APPENDICES

Appendix 1 Module Label

Module labels can be used to set the I/O signals and buffer memory of the control module.

Module label structure

Module label names are defined with the following structure.

"instance name"_"module number"."label name"

"instance name"_"module number"."label name"_D

Ex.

R60MH112_1.bModuleREADY

■Instance name

Control module instance names are as shown below.

Module model name	Instance name
R60MH112NA	R60MH112

■Module number

Module numbers start from one and identify modules that have the same instance name.

■Label name

The label identifier unique to a module is given.

■_D

This code indicates that the module label is for direct access. If this code is not given, the label is for refreshing. Refreshing and direct access differ as shown below.

Type	Description	Access timing
Refresh	Values read/written from/to the module label are reflected on the module collectively during refreshing. The program execution time is shortened.	Refreshing
Direct access	Values read/written from/to the module label are reflected on the module instantly. The program execution time is longer than the refresh method, but the responsiveness increases.	Reading/writing from/to module labels

Appendix 2 I/O Signals

This section describes the I/O signals for the CPU module of the control module. The I/O signal assignment is shown using an example where the start I/O number of the control module is "0".

List of I/O signals

The following tables list I/O signals. Device X is an input signal from the control module to the CPU module. Device Y is an output signal from the CPU module to the control module.

Input signals

Device No.	Signal name
X0	Module READY
X1	Sensor head replace request receiving status
X2	Sensor head A READY
X3	Sensor head B READY
X4	Sensor head configuration complete
X5 to X7	Use prohibited
X8	Command execution request receiving status*1
X9	Command execution complete*1
XA	Parameter setting request receiving status*1
XB	Parameter setting complete*1
XC	Received light intensity waveform data update complete*1
XD	Use prohibited
XE	Error flag
XF	Use prohibited
X10	Judgment output LO OUT1*1
X11	Judgment output LO OUT2*1
X12	Judgment output GO OUT1*1
X13	Judgment output GO OUT2*1
X14	Judgment output HI OUT1*1
X15	Judgment output HI OUT2*1
X16	Strobe signal OUT1
X17	Strobe signal OUT2
X18	Alarm signal OUT1
X19	Alarm signal OUT2
X1A	Zero set status OUT1*1
X1B	Zero set status OUT2*1
X1C to X1D	Use prohibited
X1E	Timing status OUT1*1
X1F	Timing status OUT2*1

*1 When a moderate error occurs, operation cannot be guaranteed.

A

Output signals

Device No.	Signal name
Y0	Use prohibited
Y1	Sensor head replace request
Y2 to Y7	Use prohibited
Y8	Command execution request
Y9	Use prohibited
YA	Parameter setting request
YB	Use prohibited
YC	Received light intensity waveform data update request
YD to Y17	Use prohibited
Y18	Reset OUT1
Y19	Reset OUT2
Y1A	Zero set ON OUT1
Y1B	Zero set ON OUT2
Y1C	Zero set OFF OUT1
Y1D	Zero set OFF OUT2
Y1E	Timing request OUT1
Y1F	Timing request OUT2

Point

Do not turn on any "use prohibited" signals among I/O signals for the CPU module. Doing so may cause malfunction of the programmable controller system.

Details of I/O signals

This section describes information such as the on/off timing and conditions of the input and output signals.

Module READY (X0)

This signal turns off and on to indicate the start of the module operation at the time of power-on or reset of the CPU module.

Sensor head replace request receiving status (X1)

The sensor head replacement request receiving status is stored.

- Off: Normal operation
- On: Sensor head replacement

Sensor head A READY (X2)

The sensor head A recognition status is stored.

When the external power supply is turned off, this signal is turned off.

- Off: Sensor head A recognition, recognition failure, or unconnected
- On: Sensor head A recognition success

Sensor head B READY (X3)

The sensor head B recognition status is stored.

When the external power supply is turned off, this signal is turned off.

- Off: Sensor head B recognition, recognition failure, or unconnected
- On: Sensor head B recognition success

Sensor head configuration complete (X4)

The sensor head configuration completion status is stored.

When the external power supply is turned off, this signal is turned off.

- Off: Sensor head configuration not complete
- On: Sensor head configuration complete

Command execution request receiving status (X8)

The receiving status of 'Command execution request' (Y8) is stored.

- Off: No command execution requested
- On: Receiving command request complete

Command execution complete (X9)

The completion status of 'Command execution request' (Y8) is stored.

- Off: Command not complete or not requested
- On: Command execution complete

Parameter setting request receiving status (XA)

The receiving status of 'Parameter setting request' (YA) is stored.

- Off: No parameter setting requested
- On: Receiving parameter setting request complete

Parameter setting complete (XB)

The completion status of the parameter setting is stored.

- Off: Parameter setting not complete or not requested
- On: Parameter setting complete

Received light intensity waveform data update complete (XC)

The storage completion status of the received light intensity waveform data for sensor head A/B is stored.

- Off: Not stored
- On: Storage complete

Error flag (XE)

This signal turns on when an error occurs.

Judgment output LO OUT1 (X10)

The judgment output LO status of OUT1 is stored.

- Off: Judgment output LO is off.
- On: Judgment output LO is on.

Judgment output LO OUT2 (X11)

The judgment output LO status of OUT2 is stored.

- Off: Judgment output LO is off.
- On: Judgment output LO is on.

Judgment output GO OUT1 (X12)

The judgment output GO status of OUT1 is stored.

- Off: Judgment output GO is off.
- On: Judgment output GO is on.

Judgment output GO OUT2 (X13)

The judgment output GO status of OUT2 is stored.

- Off: Judgment output GO is off.
- On: Judgment output GO is on.

Judgment output HI OUT1 (X14)

The judgment output HI status of OUT1 is stored.

- Off: Judgment output HI is off.
- On: Judgment output HI is on.

Judgment output HI OUT2 (X15)

The judgment output HI status of OUT2 is stored.

- Off: Judgment output HI is off.
- On: Judgment output HI is on.

Strobe signal OUT1 (X16)

The strobe signal status of OUT1 is stored.

- Off: Measurement value unfixed
- On: Measurement value fixed

Only when 'Strobe signal OUT1' (X16) is on, the signal can be used as an interlock signal for referencing measurement values and judgment values.

Strobe signal OUT2 (X17)

The strobe signal status of OUT2 is stored.

- Off: Measurement value unfixed
- On: Measurement value fixed

Only when 'Strobe signal OUT2' (X17) is on, the signal can be used as an interlock signal for referencing measurement values and judgment values.

Alarm signal OUT1 (X18)

The alarm signal status of OUT1 is stored.

- Off: No alarm occurring
- On: Alarm occurring

Alarm signal OUT2 (X19)

The alarm signal status of OUT2 is stored.

- Off: No alarm occurring
- On: Alarm occurring

Zero set status OUT1 (X1A)

The zero set status of OUT1 is stored.

'Zero set status OUT1' (X1A) is turned on by turning off and on 'Zero set ON OUT1' (Y1A).

'Zero set status OUT1' (X1A) is turned off by turning off and on 'Zero set OFF OUT1' (Y1C).

- Off: Zero set is off.
- On: Zero set is on.

Zero set status OUT2 (X1B)

The zero set status of OUT2 is stored.

'Zero set status OUT2' (X1B) is turned on by turning off and on 'Zero set ON OUT2' (Y1B).

'Zero set status OUT2' (X1B) is turned off by turning off and on 'Zero set OFF OUT2' (Y1D).

- Off: Zero set is off.
- On: Zero set is on.

Timing status OUT1 (X1E)

The timing status of OUT1 (update stop status of the measurement value) is stored.

- Off: Timing is off (measurement value update in progress).
- On: Timing is on (measurement value update stopped).

Timing status OUT2 (X1F)

The timing status of OUT2 (update stop status of the measurement value) is stored.

- Off: Timing is off (measurement value update in progress).
- On: Timing is on (measurement value update stopped).

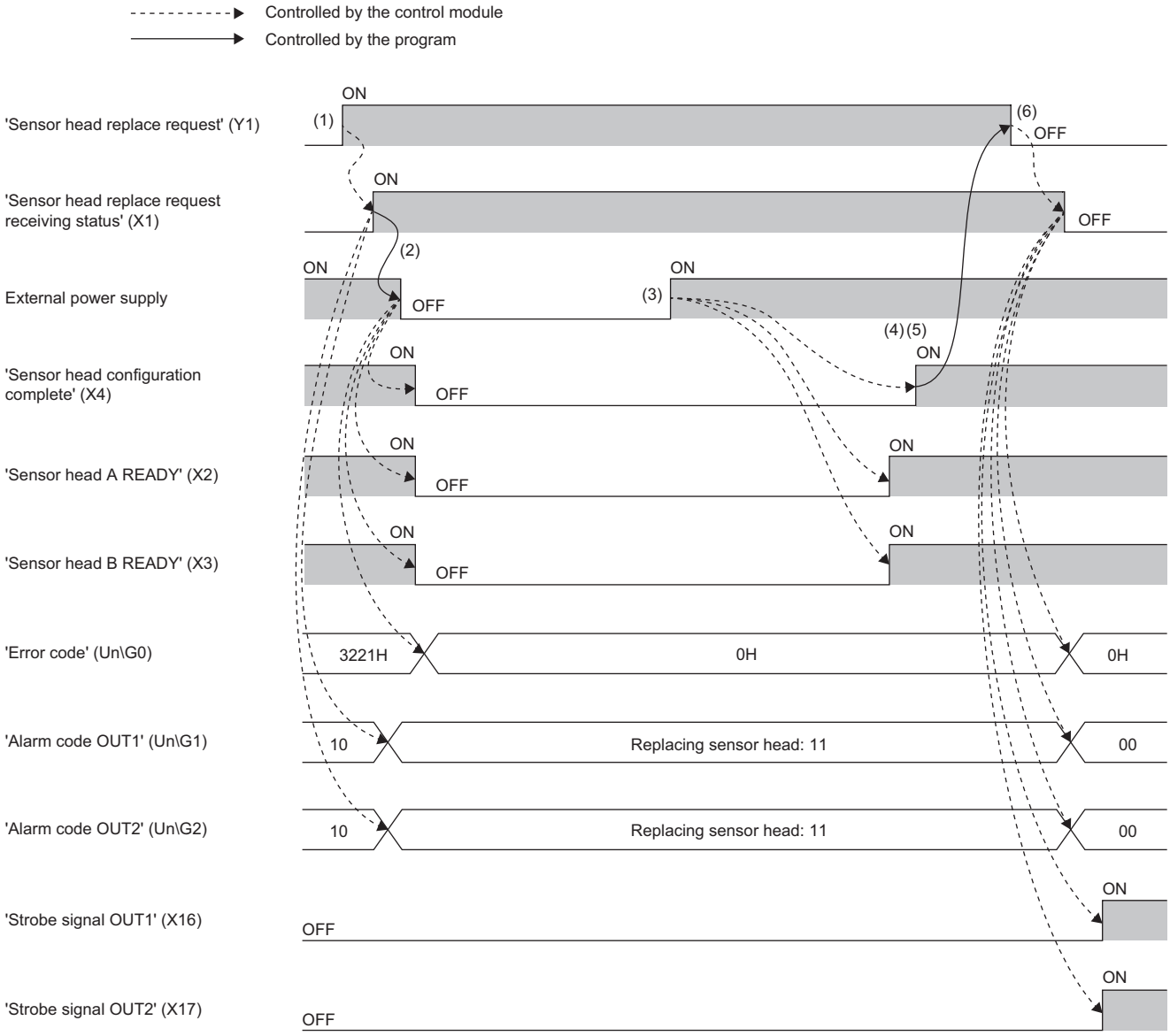
Sensor head replace request (Y1)

When this signal is turned off and on, a sensor head replacement request is issued.

And, when it is turned on and off, sensor head replacement is completed and normal operation starts.

- Off: No sensor head replacement request
- On: Sensor head replacement request

Sensor head replacement by 'Sensor head replace request' (Y1) operates as follows.



(1) Turn off and on 'Sensor head replace request' (Y1).

(2) After checking that 'Sensor head replace request receiving status' (X1) is turned on, turn off the external power supply and replace the sensor head.

(3) When the external power supply is turned on, sensor head recognition processing starts. When the recognition processing is completed, 'Sensor head configuration complete' (X4) turns on.

(4) After 'Sensor head configuration complete' (X4) is turned on, check that 'Sensor head A READY' (X2) or 'Sensor head B READY' (X3) is turned on. When only one sensor head is used, check 'Sensor head A READY' (X2). When using two sensor heads, check 'Sensor head A READY' (X2) and 'Sensor head B READY' (X3).

(5) If 'Sensor head A READY' (X2) and 'Sensor head B READY' (X3) are off, sensor head recognition is failed. Power off the external power supply and check the connection status of the sensor head. Then, power on the external power supply.

(6) When sensor head recognition is completed successfully, turn on and off 'Sensor head replace request' (Y1). 'Sensor head replace request receiving status' (X1) turns off, and normal operation starts.

- None of the errors shown below occurs while a sensor head replacement alarm is occurring.

Error code	Error name
3005H	Sensor head unconnected
3006H	Connection head mismatch
3008H	Automatic head adjustment error
3010H	External power supply interruption
3021H	Head system failure
3022H	Head connection check failure

- While 'Sensor head replace request receiving status' (X1)' is on, if the external power supply is turned off, the errors shown below are cleared. However, if the cause of some error was not resolved, after 'Sensor head replace request receiving status' (X1)' turns off, the error occurs again.

Error code	Error name
3005H	Sensor head unconnected
3006H	Connection head mismatch
3008H	Automatic head adjustment error
3010H	External power supply interruption
3011H	Circuit malfunction
3021H	Head system failure
3022H	Head connection check failure

- When the external power supply is turned off, 'Sensor head A READY' (X2), 'Sensor head B READY' (X3), and 'Sensor head configuration complete' (X4) turn off.

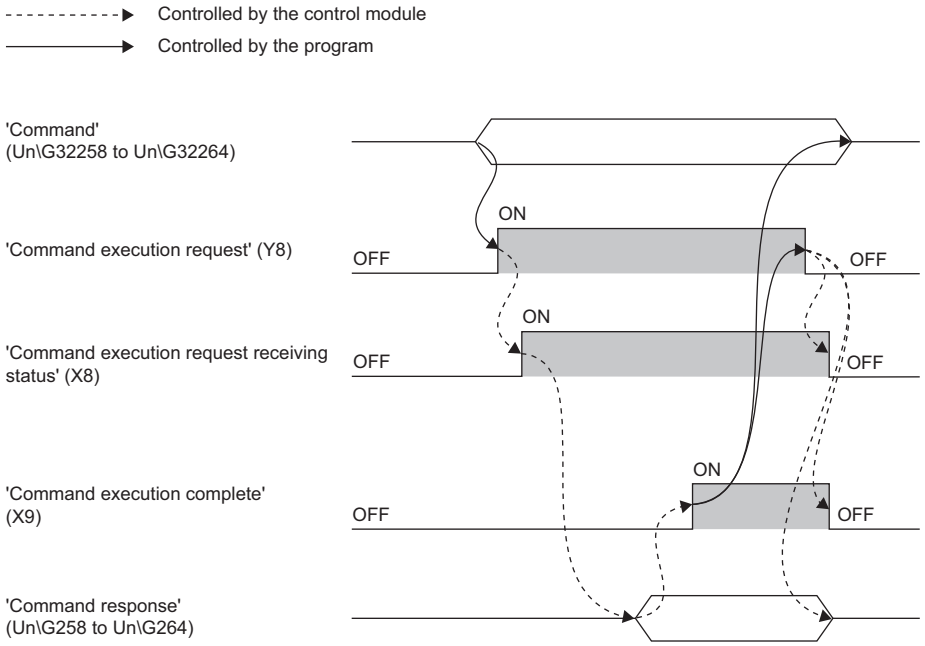
Precautions

- While 'Sensor head replace request receiving status' (X1)' is on, a sensor head replacement alarm occurs in OUT1 and OUT2.
- Do not execute another request while 'Sensor head replace request receiving status' (X1)' is on. Doing so may cause malfunction of the programmable controller system.
- Check that 'Sensor head replace request receiving status' (X1) is on, and turn off the external power supply. If the external power supply is not turned on and off while 'Sensor head replace request receiving status' (X1)' is on, the errors are not cleared.
- After the external power supply turns on, it takes approximately 40 to 50 seconds until 'Sensor head configuration complete' (X4) turns on. Do not turn off 'Sensor head replace request' (Y1) before 'Sensor head configuration complete' (X4) turns on.
- For sensor head replacement, recognition processing is performed on sensor head A and sensor head B. Therefore, when sensor head A is not connected, a sensor head unconnected error occurs.
- When the external power supply is turned off and on, operation starts with the saved parameter settings. To operate with the current parameter settings, save them before turning on 'Sensor head replace request' (Y1).

Command execution request (Y8)

Turning off and on this signal issues the command stored in buffer memory.

Command execution with 'Command execution request' (Y8) operates as shown below.



When using a program to execute commands, set values in the devices corresponding to the commands shown below.

Buffer memory address of command	Command	Buffer memory address of command response
Un\G32258	Output setting copy request	Un\G258
Un\G32259	Memory change request	Un\G259
Un\G32260	Memory copy request	Un\G260
Un\G32261	Initialization request	Un\G261
Un\G32262	Save request	Un\G262
Un\G32263	Emitted light intensity search sensor head A	Un\G263
Un\G32264	Emitted light intensity search sensor head B	Un\G264

Precautions

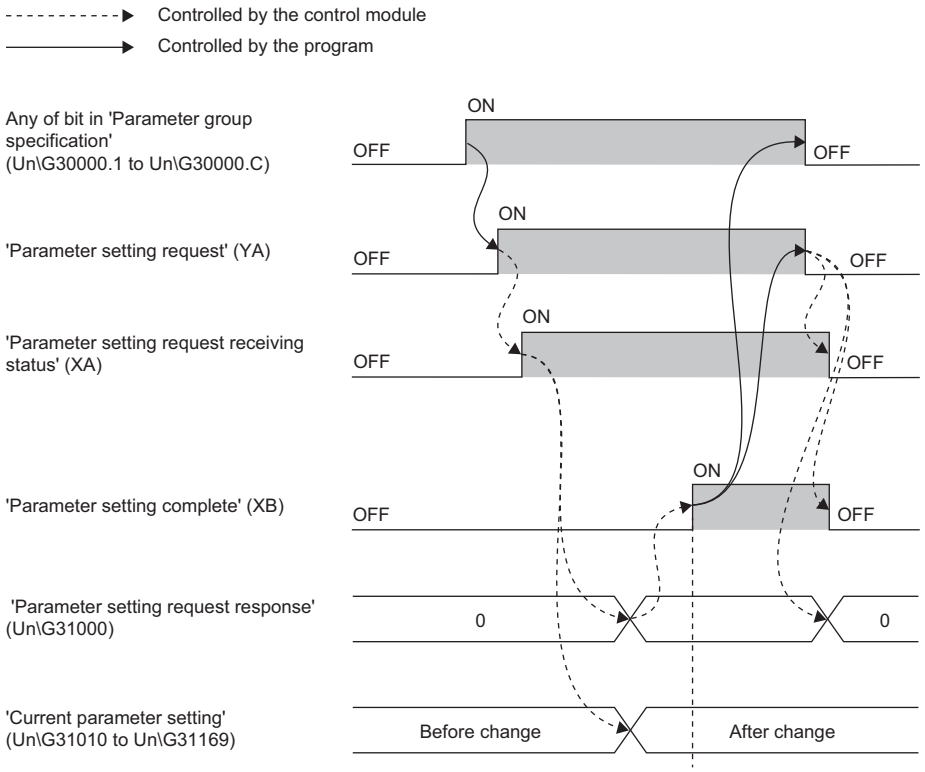
- Turning off and on of 'Command execution request' (Y8) applies to all the commands in Un\G32258 to Un\G32264. Set items excluded from the execution request to 0 in advance.
- Execute commands with one request at a time. Executing multiple commands at the same time will result in a failure response. However, 'Emitted light intensity search sensor head A' (Un\G32263) and 'Emitted light intensity search sensor head B' (Un\G32264) can be executed at the same time.
- When 'Command' (Un\G32258 to Un\G32264) are all set to 0, do not turn on 'Command execution request' (Y8). If it is turned on, 'Command execution complete' (X9) does not turn on.
- When executing a command repeatedly, wait 1ms or longer after turning off 'Command execution request receiving status' (X8). Then, turn on 'Command execution request' (Y8). When the signal is turned on without the lapse of 1ms or longer, 'Command execution request receiving status (X8)' may not turn on.
- Do not turn off 'Command execution request' (Y8) before 'Command execution complete' (X9) turns on. If it is turned off, the value for 'Command response' (Un\G258 to Un\G264) and the off and on state of 'Command execution complete' (X9) cannot be obtained by the program, and unintended operation may result.

Parameter setting request (YA)

Turning off and on this signal issues a request to set the parameter stored in the buffer memory.

- Off: No parameter setting requested
- On: Parameter setting requested

Parameter setting with 'Parameter setting request' (YA) operates as shown below.



When using a program to execute parameter setting, configure the settings for each parameter belonging to the parameter group.

Use 'Parameter group specification' (Un\G30000) to turn off and on the bit corresponding to the parameter group specification to be changed, and then turn off and on 'Parameter setting request' (YA).

A parameter group value can be obtained by dividing the last three digits of a buffer memory address (decimal) by 10 (numbers after the decimal point discarded).

For details on the specification of parameter groups to which parameters belong, refer to the following.

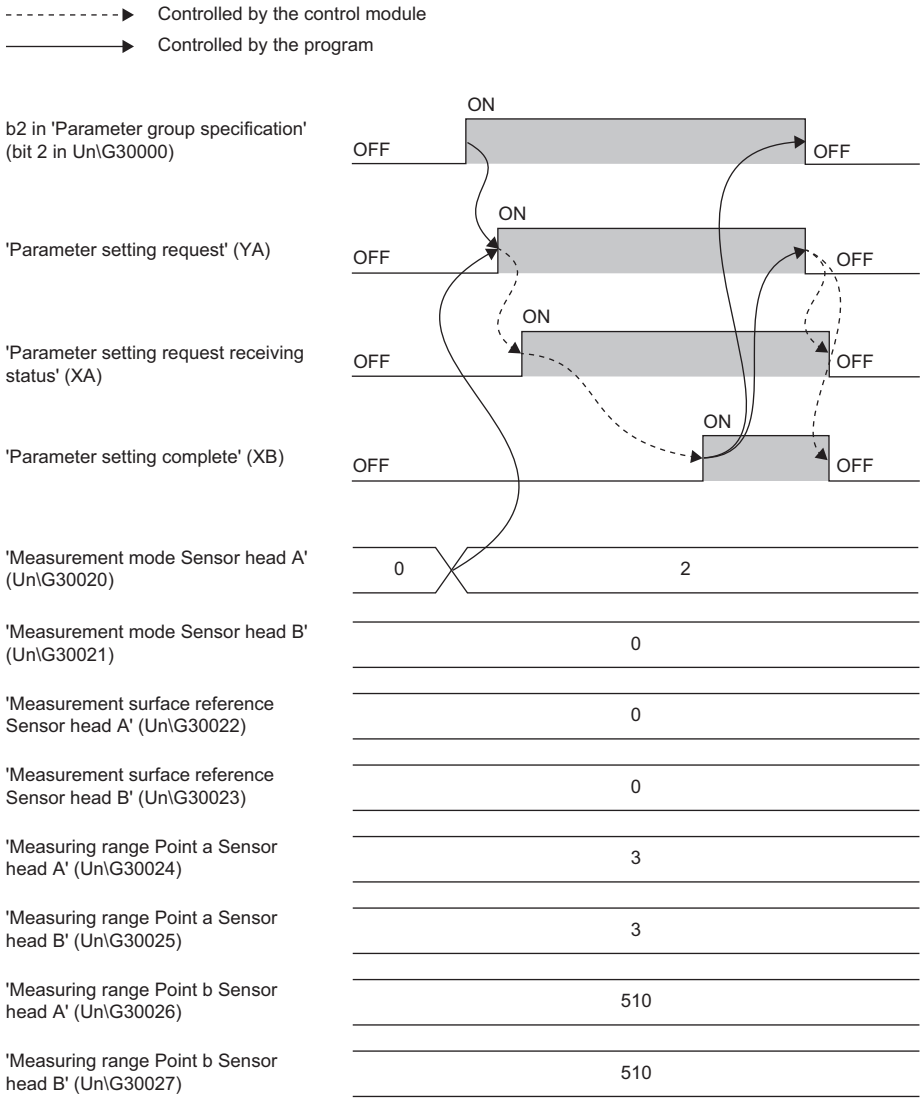
☞ Page 87 Parameter group specification

Precautions

- If 'Parameter setting request' (YA) is turned off and on without first turning off and on the bit corresponding to the parameter group specification, the control module will not receive the parameter change request.
- Because settings are configured for each parameter belonging to the parameter group, all the parameters belonging to the specified parameter group need to be set to a setting value before the parameter setting is executed.
- When an error is detected in the parameter settings, the parameter number of the parameter where the setting error was detected is stored in 'Parameter setting request response' (Un\G31000). All the parameter settings requested are not reflected at this time.
- A parameter number is the last three digits of a buffer memory address (decimal).

Ex.

Parameter setting when 'Measurement mode sensor head A' (Un\G30020) is changed from 0 (diffuse reflection_standard) to 2 (metal 1) operates as shown below.



Point

'Parameter group 2' (Un\G30020 to Un\G30027) must be set in advance.

For details on 'Parameter group 2' (Un\G30020 to Un\G30027), refer to the following.

☞ Page 80 Buffer Memory

Received light intensity waveform data update request (YC)

Turning off and on this signal stores the received light intensity waveform data of sensor head A/B in buffer memory.

Reset OUT1 (Y18)

Turning off and on this signal resets the measurement value of OUT1.

Reset OUT2 (Y19)

Turning off and on this signal resets the measurement value of OUT2.

Zero set ON OUT1 (Y1A)

Turning off and on this signal turns on the zero set of OUT1.

Zero set ON OUT2 (Y1B)

Turning off and on this signal turns on the zero set of OUT2.

Zero set OFF OUT1 (Y1C)

Turning off and on this signal turns off the zero set of OUT1.

Zero set OFF OUT2 (Y1D)

Turning off and on this signal turns off the zero set of OUT2.

Timing request OUT1 (Y1E)

This signal sets the timing of OUT1 (for stopping the update of the measurement value).

- Off: The measurement value is updated.
- On: The update of the measurement value is stopped.

Timing request OUT2 (Y1F)

This signal sets the timing of OUT2 (for stopping the update of the measurement value).

- Off: The measurement value is updated.
- On: The update of the measurement value is stopped.

Appendix 3 Buffer Memory

This section describes the buffer memory of the control module.

List of buffer memory addresses

The following table lists the buffer memory addresses of the control module.

Buffer memory address		Name			Initial value	Read/write
Decimal	Hexadecimal					
0	0H	Error code			—	Read
1	1H	Alarm code		OUT1	—	Read
2	2H			OUT2		
3	3H	Current memory change number			—	Read
4 to 15	4H to FH	Use prohibited			—	—
16 to 17	10H to 11H	Measurement value		OUT1	—	Read
18 to 19	12H to 13H			OUT2		
20	14H	Received light intensity		Sensor head A	—	Read
21	15H			Sensor head B		
22	16H	Current emitted light intensity		Sensor head A	—	Read
23	17H			Sensor head B		
24 to 25	18H to 19H	Zero set amount[*1]		OUT1	—	Read
26 to 27	1AH to 1BH			OUT2		
28 to 255	1CH to FFH	Use prohibited			—	—
256	100H	Laser output stop status		Sensor head A	—	Read
257	101H			Sensor head B		
258	102H	Output setting copy response	Command response		—	Read
259	103H	Memory change response	Command response		—	Read
260	104H	Memory copy response	Command response		—	Read
261	105H	Initialization response	Command response		—	Read
262	106H	Save response	Command response		—	Read
263	107H	Emitted light intensity search response	Command response	Sensor head A	—	Read
264	108H			Sensor head B		
265 to 767	109H to 2FFH	Use prohibited			—	—
768 to 1279	300H to 4FFH	Received light intensity waveform data		Sensor head A	—	Read
1280 to 1791	500H to 6FFH			Sensor head B		
1792 to 28671	700H to 6FFFH	Use prohibited			—	—
28672 to 28679	7000H to 7007H	Sensor head module name		Sensor head A	—	Read
28680 to 28687	7008H to 700FH			Sensor head B		
28688 to 28999	7010H to 7147H	Use prohibited			—	—
29000	7148H	External power supply off count			0	Read
29001 to 29999	7149H to 752FH	Use prohibited			—	—
30000	7530H	Parameter group specification			0	Write
30001 to 30009	7531H to 7539H	Use prohibited			—	—
30010	753AH	Installation mode	Parameter group 1	Sensor head A	0	Write
30011	753BH			Sensor head B		
30012	753CH	Emission adjustment	Parameter group 1	Sensor head A	0	Write
30013	753DH			Sensor head B		
30014	753EH	Emission adjustment area specification a	Parameter group 1	Sensor head A	0	Write
30015	753FH			Sensor head B		
30016	7540H	Emission adjustment area specification b	Parameter group 1	Sensor head A	0	Write
30017	7541H			Sensor head B		

Buffer memory address		Name			Initial value	Read/write
Decimal	Hexadecimal					
30018	7542H	Alarm delay times	Parameter group 1	Sensor head A	0	Write
30019	7543H			Sensor head B		
30020	7544H	Measurement mode	Parameter group 2	Sensor head A	0	Write
30021	7545H			Sensor head B		
30022	7546H	Measurement surface reference	Parameter group 2	Sensor head A	0	Write
30023	7547H			Sensor head B		
30024	7548H	Measuring range point a	Parameter group 2	Sensor head A	0	Write
30025	7549H			Sensor head B		
30026	754AH	Measuring range point b	Parameter group 2	Sensor head A	0	Write
30027	754BH			Sensor head B		
30028 to 30029	754CH to 754DH	Use prohibited			—	—
30030 to 30031	754EH to 754FH	Calibration measurement value A*1	Parameter group 3	Sensor head A	0	Write
30032 to 30033	7550H to 7551H			Sensor head B		
30034 to 30035	7552H to 7553H	Calibration measurement value B*1	Parameter group 3	Sensor head A	0	Write
30036 to 30037	7554H to 7555H			Sensor head B		
30038 to 30039	7556H to 7557H	Use prohibited			—	—
30040 to 30041	7558H to 7559H	Calibration correction value a*1	Parameter group 4	Sensor head A	0	Write
30042 to 30043	755AH to 755BH			Sensor head B		
30044 to 30045	755CH to 755DH	Calibration correction value b*1	Parameter group 4	Sensor head A	0	Write
30046 to 30047	755EH to 755FH			Sensor head B		
30048 to 30051	7560H to 7563H	Use prohibited			—	—
30052	7564H	Peak recognition sensitivity	Parameter group 5	Sensor head A	0	Write
30053	7565H			Sensor head B		
30054 to 30059	7566H to 756BH	Use prohibited			—	—
30060	756CH	Output selection	Parameter group 6	OUT1	0	Write
30061	756DH			OUT2		
30062	756EH	Transparent object	Parameter group 6	OUT1	0	Write
30063	756FH			OUT2		
30064	7570H	Refractive index calculation	Parameter group 6	OUT1	0	Write
30065	7571H			OUT2		
30066 to 30067	7572H to 7573H	Refractive index	Parameter group 6	OUT1	0	Write
30068 to 30069	7574H to 7575H			OUT2		
30070	7576H	Analysis mode	Parameter group 7	OUT1	0	Write
30071	7577H			OUT2		
30072	7578H	Filter selection	Parameter group 7	OUT1	0	Write
30073	7579H			OUT2		
30074	757AH	Average times	Parameter group 7	OUT1	0	Write
30075	757BH			OUT2		
30076	757CH	Cutoff frequency	Parameter group 7	OUT1	0	Write
30077	757DH			OUT2		
30078 to 30079	757EH to 757FH	Use prohibited			—	—
30080 to 30081	7580H to 7581H	Operation coefficient	Parameter group 8	OUT1	0	Write
30082 to 30083	7582H to 7583H			OUT2		
30084 to 30085	7584H to 7585H	Offset*1	Parameter group 8	OUT1	0	Write
30086 to 30087	7586H to 7587H			OUT2		
30088 to 30089	7588H to 7589H	Use prohibited			—	—
30090 to 30091	758AH to 758BH	Judgment output upper limit value*1	Parameter group 9	OUT1	0	Write
30092 to 30093	758CH to 758DH			OUT2		
30094 to 30095	758EH to 758FH	Judgment output lower limit value*1	Parameter group 9	OUT1	0	Write
30096 to 30097	7590H to 7591H			OUT2		
30098 to 30099	7592H to 7593H	Use prohibited			—	—

Buffer memory address		Name			Initial value	Read/write
Decimal	Hexadecimal					
30100 to 30101	7594H to 7595H	Upper limit hysteresis of judgment output*1	Parameter group 10	OUT1	0	Write
30102 to 30103	7596H to 7597H			OUT2		
30104 to 30105	7598H to 7599H	Lower limit hysteresis of judgment output*1	Parameter group 10	OUT1	0	Write
30106 to 30107	759AH to 759BH			OUT2		
30108 to 30109	759CH to 759DH	Use prohibited			—	—
30110	759EH	Measurement value output at alarm	Parameter group 11	OUT1	0	Write
30111	759FH			OUT2		
30112	75A0H	Alarm output delay	Parameter group 11	OUT1	0	Write
30113	75A1H			OUT2		
30114 to 30119	75A2H to 75A7H	Use prohibited			—	—
30120	75A8H	Sampling cycle	Parameter group 12		0	Write
30121	75A9H	Judgment output OFF delay	Parameter group 12		0	Write
30122	75AAH	Interference prevention	Parameter group 12		0	Write
30123 to 30999	75ABH to 7917H	Use prohibited			—	—
31000	7918H	Parameter setting request response			—	Read
31001 to 31009	7919H to 7921H	Use prohibited			—	—
31010 to 31169	7922H to 79C1H	Current setting			—	Read
31170 to 32255	79C2H to 7DFFH	Use prohibited			—	—
32256	7E00H	Laser output stop request		Sensor head A	0	Write
32257	7E01H			Sensor head B		
32258	7E02H	Output setting copy request	Command		0	Write
32259	7E03H	Memory change request	Command		0	Write
32260	7E04H	Memory copy request	Command		0	Write
32261	7E05H	Initialization request	Command		0	Write
32262	7E06H	Save request	Command		0	Write
32263	7E07H	Emitted light intensity search	Command	Sensor head A	0	Write
32264	7E08H			Sensor head B		
32265 to 36095	7E09H to 8CFFH	Use prohibited			—	—
36096	8D00H	Error code			—	Read
36097	8D01H	Occurrence date and time (year)			—	Read
36098	8D02H	Occurrence date and time (month)			—	Read
36099	8D03H	Occurrence date and time (day)			—	Read
36100	8D04H	Occurrence date and time (hour)			—	Read
36101	8D05H	Occurrence date and time (minute)			—	Read
36102	8D06H	Occurrence date and time (second)			—	Read
36103	8D07H	Occurrence date and time (day of the week)			—	Read
36104	8D08H	Error code details 1			—	Read
36105	8D09H	Error code details 2			—	Read
36106 to 65535	8D0AH to FFFFH	Use prohibited			—	—

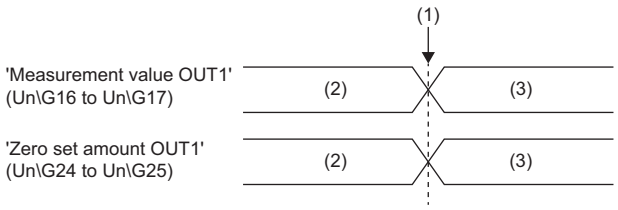
*1 Data can be input in units of 0.001μm, but for the internal processing, data is treated in units of 0.25μm, with a positive value being discarded and a negative value being rounded up.

Point

Do not write any data into use prohibited areas or read/write areas in the buffer memory. Writing data to these areas may cause malfunction.

Precautions

Depending on the refresh or program read timing, old and new data of the related data may be obtained together.
For example, when the zero set is used, new data are acquired in 'Measurement value OUT1' (Un\G16 to Un\G17) and 'Zero set amount OUT1' (Un\G24 to Un\G25) at the same time as shown below. However, old data may be acquired in 'Measurement value OUT1' (Un\G16 to Un\G17) and new data may be acquired in 'Zero set amount OUT1' (Un\G24 to Un\G25) depending on the refresh or program read timing.



(1) Zero set is on.
(2) Old data
(3) New data

A

Details of buffer memory addresses

This section describes the details of buffer memory addresses of the control module.

Error code

■Error code (Un\G0)

The code of the error currently occurring is stored.

Alarm code

■Alarm code (Un\G1 to Un\G2)

The OUT1 and OUT2 alarm codes are stored.

Address	Description
Un\G1	The OUT1 alarm code is stored.
Un\G2	The OUT2 alarm code is stored.

Current memory change number

■Current memory change number (Un\G3)

The current memory change number is stored.

Measurement value

■Measurement value (Un\G16 to Un\G19)

The measurement values of OUT1 and OUT2 are stored as integral values (double word (signed)) in units of nm.

Address	Description
Un\G16 to Un\G17	The measurement value of OUT1 is stored as an integral value (double word (signed)) in units of nm.
Un\G18 to Un\G19	The measurement value of OUT2 is stored as an integral value (double word (signed)) in units of nm.

Received light intensity

■Received light intensity (Un\G20 to Un\G21)

The received light intensities of sensor head A and sensor head B are stored.

Address	Description
Un\G20	The received light intensity of sensor head A is stored.
Un\G21	The received light intensity of sensor head B is stored.

Current emitted light intensity

■Current emitted light intensity (Un\G22 to Un\G23)

The current emitted light intensity adjustment values of sensor head A and sensor head B are stored in units of 0.01%.

Address	Description
Un\G22	The current emitted light intensity adjustment value of sensor head A is stored in units of 0.01%.
Un\G23	The current emitted light intensity adjustment value of sensor head B is stored in units of 0.01%.

Zero set amount

■Zero set amount (Un\G24 to Un\G27)

The OUT1 and OUT2 displacement amounts at the time of zero set input are stored.

Address	Description
Un\G24 to Un\G25	The OUT1 displacement amount at the time of zero set input is stored.
Un\G26 to Un\G27	The OUT2 displacement amount at the time of zero set input is stored.

Laser output stop status

■Laser output stop status (Un\G256 to Un\G257)

The laser output stop statuses of sensor head A and sensor head B are stored.

- 0: Emitting
- 1: Stopped

Address	Description
Un\G256	The laser output stop status of sensor head A is stored.
Un\G257	The laser output stop status of sensor head B is stored.

Output setting copy response

■Output setting copy response (Un\G258)

The response to the copying of setting details related to the OUT setting is stored.

- 0H: No instruction
- 1H: Copying from OUT1 to OUT2 completed
- 2H: Copying from OUT2 to OUT1 completed
- 0FFFFH: Copy failed

Memory change response

■Memory change response (Un\G259)

The response to the memory change request is stored.

- 0H: No instruction
- 8000H: Change to memory area 0 completed
- 8001H: Change to memory area 1 completed
- 8002H: Change to memory area 2 completed
- 8003H: Change to memory area 3 completed
- 8004H: Change to memory area 4 completed
- 8005H: Change to memory area 5 completed
- 8006H: Change to memory area 6 completed
- 8007H: Change to memory area 7 completed
- 8008H: Change to memory area 8 completed
- 8009H: Change to memory area 9 completed
- 800AH: Change to memory area 10 completed
- 800BH: Change to memory area 11 completed
- 800CH: Change to memory area 12 completed
- 800DH: Change to memory area 13 completed
- 800EH: Change to memory area 14 completed
- 800FH: Change to memory area 15 completed
- 0FFFFH: Memory change failed

Memory copy response

■Memory copy response (Un\G260)

The response to the memory copy request is stored.

- 0H: No instruction
- 0FFFFH: Copy failed
- 10H digit = Copy source memory area, 1H digit = Copy destination memory area (completed successfully)

Ex.

01H: The setting details of memory area 0 are copied into memory area 1 (completed successfully).

17H: The setting details of memory area 1 are copied into memory area 7 (completed successfully).

Initialization response

■Initialization response (Un\G261)

The response to the initialization request is stored.

- 0H: No request
- 1H: Initialization of the current memory area completed successfully
- 2H: Initialization of all memory areas completed successfully
- 0FFFFH: Initialization failed

Save response

■Save response (Un\G262)

The response to the save request is stored.

- 0H: No instruction
- 1H: Save completed successfully
- 0FFFFH: Save failed

Emitted light intensity search response

■Emitted light intensity search response (Un\G263 to Un\G264)

The responses to the received light intensity searches on sensor head A and sensor head B are stored.

- 0H: No command
- 1H: Completed successfully
- 0FFFFH: Failed

Address	Description
Un\G263	The response to the emitted light intensity search on sensor head A is stored.
Un\G264	The response to the emitted light intensity search on sensor head B is stored.

Received light intensity waveform data

■Received light intensity waveform data (Un\G768 to Un\G1791)

The received light intensity wave data of sensor head A and sensor head B are stored.

Address	Description
Un\G768 to Un\G1279	The received light intensity wave data of sensor head A is stored.
Un\G1280 to Un\G1791	The received light intensity wave data of sensor head B is stored.

Sensor head module name

■Sensor head module name (Un\G28672 to Un\G28687)

The model names of connected sensor head A and sensor head B are stored.

Address	Description
Un\G28672 to Un\G28679	The model name of connected sensor head A is stored.
Un\G28680 to Un\G28687	The model name of connected sensor head B is stored.

External power supply off count

■External power supply off count (Un\G29000)

The number of external power supply interruption occurrences is stored.

Address	Description
Un\G29000	• The number of external power supply interruption occurrences is stored. • After the count reaches 65535, it will count from 0 again. • When the programmable controller is powered off and on, or when the CPU is reset, the area is cleared to 0.

Parameter group specification

■Parameter group specification (Un\G30000)

Specify a parameter to be changed in units of groups. If a value that is out of range is set, the parameter group specification is ignored.

bit15 to bit13	bit12	bit11	...	bit2	bit1	bit0
—	Parameter group 12 specified	Parameter group 11 specified	...	Parameter group 2 specified	Parameter group 1 specified	—

A parameter group value can be obtained by dividing the last three digits of a buffer memory address (decimal) by 10 (numbers after the decimal point discarded).

0: No parameter group specified (no parameter changed)

The following shows the buffer memory addresses (decimals) corresponding to each parameter group.

- Parameter group 1: Un\G30010 to Un\G30019
- Parameter group 2: Un\G30020 to Un\G30027
- Parameter group 3: Un\G30030 to Un\G30037
- Parameter group 4: Un\G30040 to Un\G30047
- Parameter group 5: Un\G30050 to Un\G30053
- Parameter group 6: Un\G30060 to Un\G30069
- Parameter group 7: Un\G30070 to Un\G30077
- Parameter group 8: Un\G30080 to Un\G30087
- Parameter group 9: Un\G30090 to Un\G30097
- Parameter group 10: Un\G30100 to Un\G30107
- Parameter group 11: Un\G30110 to Un\G30113
- Parameter group 12: Un\G30120 to Un\G30122

Installation mode

■Installation mode (Un\G30010 to Un\G30011)

Select the diffuse reflection mode or the specular reflection mode depending on the measurement object.

- 0H: Diffuse reflection (setting used to measure an object other than a specular-surface and transparent object)
- 1H: Specular reflection (setting used to measure a specular-surface or transparent object)

Address	Description
Un\G30010	Select the diffuse reflection mode or the specular reflection mode for sensor head A.
Un\G30011	Select the diffuse reflection mode or the specular reflection mode for sensor head B.

Emission adjustment

■Emission adjustment (Un\G30012 to Un\G30013)

Set the appropriate emitted light intensity for the measurement area.

- 0: Automatic
- 1: 0.04% Fixed
- 2: 0.05% Fixed
- 3: 0.06% Fixed
- 4: 0.08% Fixed
- 5: 0.11% Fixed
- 6: 0.14% Fixed
- 7: 0.18% Fixed
- 8: 0.24% Fixed
- 9: 0.31% Fixed
- 10: 0.40% Fixed
- 11: 0.53% Fixed
- 12: 0.68% Fixed
- 13: 0.89% Fixed
- 14: 1.16% Fixed
- 15: 1.50% Fixed
- 16: 1.95% Fixed
- 17: 2.54% Fixed
- 18: 3.30% Fixed
- 19: 4.29% Fixed
- 20: 5.58% Fixed
- 21: 7.25% Fixed
- 22: 9.43% Fixed
- 23: 12.3% Fixed
- 24: 15.9% Fixed
- 25: 20.7% Fixed
- 26: 26.9% Fixed
- 27: 35.0% Fixed
- 28: 45.5% Fixed
- 29: 59.2% Fixed
- 30: 76.9% Fixed
- 31: 100% Fixed

Address	Description
Un\G30012	Set the appropriate emitted light intensity for the part to be measured of sensor head A.
Un\G30013	Set the appropriate emitted light intensity for the part to be measured of sensor head B.

Emission adjustment area specification a

■Emission adjustment area specification a (Un\G30014 to Un\G30015)

By setting two light receiving cells, namely emission adjustment area specification point a and emission adjustment area specification point b, between these two points, the light intensity is automatically optimized according to the light reflection intensity of the measurement object.

The value for emission adjustment area specification point a must be different from the value for emission adjustment area specification point b.

Setting range: 1 to 512[*1]

*1 When the sampling cycle is set to 10μs, set a value in the range of 1 to 112.
When the sampling cycle is set to 20μs, set a value in the range of 1 to 256.

Address	Description
Un\G30014	Emission adjustment area specification point a for sensor head A can be specified.
Un\G30015	Emission adjustment area specification point a for sensor head B can be specified.

Emission adjustment area specification b

■Emission adjustment area specification b (Un\G30016 to Un\G30017)

By setting two light receiving cells, namely emission adjustment area specification point a and emission adjustment area specification point b, between these two points, the light intensity is automatically optimized according to the light reflection intensity of the measurement object.

The value for emission adjustment area specification point a must be different from the value for emission adjustment area specification point b.

Setting range: 1 to 512[*1]

*1 When the sampling cycle is set to 10μs, set a value in the range of 1 to 112.
When the sampling cycle is set to 20μs, set a value in the range of 1 to 256.

Address	Description
Un\G30016	Emission adjustment area specification point b for sensor head A can be specified.
Un\G30017	Emission adjustment area specification point b for sensor head B can be specified.

Alarm delay times

■Alarm delay times (Un\G30018 to Un\G30019)

Specify the number of times to hold the last normal value when an alarm occurs.

- Setting range: 0 to 65535
- The last normal value is held while the alarm exists regardless of the number of delay times: 65535

Address	Description
Un\G30018	Specify the number of times to hold the last normal value when an alarm occurs for sensor head A.
Un\G30019	Specify the number of times to hold the last normal value when an alarm occurs for sensor head B.

Measurement mode

■Measurement mode (Un\G30020 to Un\G30021)

Select the measurement value processing method depending on the measurement object.

- 0: Diffuse reflection_standard (standard setting that can be used in a wide range of applications)
- 1: Specular reflection_standard (standard setting for measurement at a specular reflection installation)
- 2: Metal 1 (reduces variation in the measurement value caused by metal surface finishing)
- 3: Metal 2 (enhances the effect in "Metal 1" mode)
- 4: Penetration (reduces penetration of laser beam to the surface of the measurement object)
- 5: Glass (measures thinner clearance than the standard)
- 6: Glass pattern (reduces variation in the measurement value due to the pattern of glass with a different refractive index)

Address	Description
Un\G30020	Set a measurement value processing method of sensor head A depending on the measurement object.
Un\G30021	Set a measurement value processing method of sensor head B depending on the measurement object.

Measurement surface reference

■Measurement surface reference (Un\G30022 to Un\G30023)

Select the method to count the surfaces set by the output selection when measuring a transparent object.

- 0: Near (Measurement surfaces are counted in order as surface 1, surface 2, surface 3, ··· from the nearest surface to the farthest surface in relation to the sensor head.)
- 1: Far (Measurement surfaces are counted from the farthest surface in relation to the sensor head.)

Address	Description
Un\G30022	Select the method to count the surfaces set by the output selection for sensor head A.
Un\G30023	Select the method to count the surfaces set by the output selection for sensor head B.

Measuring range point a

■Measuring range point a (Un\G30024 to Un\G30025)

By setting two light receiving cells, namely measuring range specification point a and measuring range specification point b, the range of these two points is set as the measurement area.

The value for measuring range specification point a must be different from the value for measuring range specification point b.

Setting range: 3 to 510[*1]

*1 When the sampling cycle is set to 10μs, set a value in the range of 3 to 112.
When the sampling cycle is set to 20μs, set a value in the range of 3 to 256.

Address	Description
Un\G30024	Set measuring range specification point a for sensor head A.
Un\G30025	Set measuring range specification point a for sensor head B.

Measuring range point b

■Measuring range point b (Un\G30026 to Un\G30027)

By setting two light receiving cells, namely measuring range specification point a and measuring range specification point b, the range of these two points is set as the measurement area.

The value for measuring range specification point a must be different from the value for measuring range specification point b.

Setting range: 3 to 510[*1]

*1 When the sampling cycle is set to 10μs, set a value in the range of 3 to 112.
When the sampling cycle is set to 20μs, set a value in the range of 3 to 256.

Address	Description
Un\G30026	Set measuring range specification point b for sensor head A.
Un\G30027	Set measuring range specification point b for sensor head B.

Calibration measurement value A

■Calibration measurement value A (Un\G30030 to Un\G30033)

Set the first measurement data value used for 2-point teaching.

The value for calibration measurement value A must be different from the value for calibration measurement value B.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30030 to Un\G30031	For sensor head A, set the first measurement data value used for 2-point teaching.
Un\G30032 to Un\G30033	For sensor head B, set the first measurement data value used for 2-point teaching.

Calibration measurement value B

■Calibration measurement value B (Un\G30034 to Un\G30037)

Set the second measurement data value used for 2-point teaching.

The value for calibration measurement value A must be different from the value for calibration measurement value B.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30034 to Un\G30035	For sensor head A, set the second measurement data value used for 2-point teaching.
Un\G30036 to Un\G30037	For sensor head B, set the second measurement data value used for 2-point teaching.

Calibration correction value a

■Calibration correction value a (Un\G30040 to Un\G30043)

Specify the value originally intended to be output for calibration measurement value A.

The value for calibration correction value a must be different from the value for calibration correction value b.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30040 to Un\G30041	For sensor head A, specify the value originally intended to be output for calibration measurement value A.
Un\G30042 to Un\G30043	For sensor head B, specify the value originally intended to be output for calibration measurement value A.

Calibration correction value b

■Calibration correction value b (Un\G30044 to Un\G30047)

Specify the value originally intended to be output for calibration measurement value B.

The value for calibration correction value a must be different from the value for calibration correction value b.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30044 to Un\G30045	For sensor head A, specify the value originally intended to be output for calibration measurement value B.
Un\G30046 to Un\G30047	For sensor head B, specify the value originally intended to be output for calibration measurement value B.

Peak recognition sensitivity

■Peak recognition sensitivity (Un\G30052 to Un\G30053)

Set the level that is recognized as the peak of the received light intensity waveform.

Setting range: 100 to 400

Address	Description
Un\G30052	Set the level that is recognized as the peak of the received light intensity waveform for sensor head A.
Un\G30053	Set the level that is recognized as the peak of the received light intensity waveform for sensor head B.

Output selection

■Output selection (Un\G30060 to Un\G30061)

Set whether measurement is individually performed by each sensor head or performed by two sensor heads with various calculations.

- 0: Sensor head_A
- 1: Sensor head_B
- 2: Sensor head_-A
- 3: Sensor head_-B
- 4: Sensor head_A + B
- 5: Sensor head_-(A + B)
- 6: Sensor head_A - B
- 7: Sensor head_B - A
- 8: Sensor head_A [transparent object]
- 9: Sensor head_B [transparent object]
- 10: Sensor head_-A [transparent object]
- 11: Sensor head_-B [transparent object]
- 12: Sensor head_A1 + B1 [transparent object]
- 13: Sensor head_-(A1 + B1) [transparent object]
- 14: Sensor head_A1 - B1 [transparent object]
- 15: Sensor head_B1 - A1 [transparent object]

Address	Description
Un\G30060	Set whether measurement is individually performed by each sensor head or performed by two sensor heads with various calculations for OUT1.
Un\G30061	Set whether measurement is individually performed by each sensor head or performed by two sensor heads with various calculations for OUT2.

Transparent object

■Transparent object (Un\G30062 to Un\G30063)

Set which surface to measure among the multiple surfaces that exist on the transparent object when transparent object is selected as the measurement target.

- 0: Surface 1
- 1: Surface 2
- 2: Surface 3
- 3: Surface 4
- 4: Upper limit surface
- 5: Surface 1 to surface 2
- 6: Surface 1 to surface 3
- 7: Surface 1 to surface 4
- 8: Surface 1 to upper limit surface
- 9: Surface 2 to surface 3
- 10: Surface 2 to surface 4
- 11: Surface 2 to upper limit surface
- 12: Surface 3 to surface 4
- 13: Surface 3 to upper limit surface
- 14: Surface 4 to upper limit surface

Address	Description
Un\G30062	Set which surface to measure among the multiple surfaces that exist on the transparent object when transparent object is selected as the measurement target for OUT1.
Un\G30063	Set which surface to measure among the multiple surfaces that exist on the transparent object when transparent object is selected as the measurement target for OUT2.

Refractive index calculation

■Refractive index calculation (Un\G30064 to Un\G30065)

The refractive index set by Refractive index to the measurement result is reflected when transparent object is selected as the measurement target.

- 0: OFF
- 1: ON

Address	Description
Un\G30064	The refractive index set by Refractive index to the measurement result is reflected when transparent object is selected as the measurement target for OUT1.
Un\G30065	The refractive index set by Refractive index to the measurement result is reflected when transparent object is selected as the measurement target for OUT2.

Refractive index

■Refractive index (Un\G30066 to Un\G30069)

Set the refractive index of the transparent object to be measured.

Setting range: 500000 (0.500000) to 2000000 (2.000000)

Address	Description
Un\G30066 to Un\G30067	Set the refractive index of the transparent object to be measured for OUT1.
Un\G30068 to Un\G30069	Set the refractive index of the transparent object to be measured for OUT2.

Analysis mode

■Analysis mode (Un\G30070 to Un\G30071)

Set the analysis mode.

- 0: Normal measurement
- 1: Peak measurement
- 2: Bottom measurement
- 3: Peak to peak measurement

Address	Description
Un\G30070	Set the analysis mode for OUT1.
Un\G30071	Set the analysis mode for OUT2.

Filter selection

■Filter selection (Un\G30072 to Un\G30073)

Set the filter for stabilizing the measurement value and facilitating detection of specific parts.

- 0: Moving average (calculated on the measurement result for the number of set average times.)
- 1: Low pass filter (used to pick out only the signal with low frequency component from the measurement data.)
- 2: High pass filter (used to pick out only the signal with high frequency component from the measurement data.)

Address	Description
Un\G30072	Set the filter for stabilizing the measurement value and facilitating detection of specific parts for OUT1.
Un\G30073	Set the filter for stabilizing the measurement value and facilitating detection of specific parts for OUT2.

Average times

■Average times (Un\G30074 to Un\G30075)

Set the number of times to perform in the moving average when the moving average is selected by filter selection.

- 0: Average 1 time
- 1: Average 2 times
- 2: Average 4 times
- 3: Average 8 times
- 4: Average 16 times
- 5: Average 32 times
- 6: Average 64 times
- 7: Average 128 times
- 8: Average 256 times
- 9: Average 512 times
- 10: Average 1024 times
- 11: Average 2048 times
- 12: Average 4096 times
- 13: Average 8192 times
- 14: Average 16384 times
- 15: Average 32768 times
- 16: Average 65536 times

Address	Description
Un\G30074	Set the number of times to perform averaging in the moving average when moving average is selected by filter selection for OUT1.
Un\G30075	Set the number of times to perform averaging in the moving average when moving average is selected by filter selection for OUT2.

Cutoff frequency

■Cutoff frequency (Un\G30076 to Un\G30077)

Set the cutoff frequency when low pass filter or high pass filter is selected by filter selection.

- 0: Cutoff frequency: 1Hz
- 1: Cutoff frequency: 2Hz
- 2: Cutoff frequency: 4Hz
- 3: Cutoff frequency: 10Hz
- 4: Cutoff frequency: 20Hz
- 5: Cutoff frequency: 40Hz
- 6: Cutoff frequency: 100Hz
- 7: Cutoff frequency: 200Hz
- 8: Cutoff frequency: 400Hz
- 9: Cutoff frequency: 1000Hz
- 10: Cutoff frequency: 2000Hz

Address	Description
Un\G30076	Set the cutoff frequency when low pass filter or high pass filter is selected by filter selection for OUT1.
Un\G30077	Set the cutoff frequency when low pass filter or high pass filter is selected by filter selection for OUT2.

Operation coefficient

■Operation coefficient (Un\G30080 to Un\G30083)

Set the coefficient to integrate into the measurement value.

Setting range: 100000 (0.100000) to 9999999 (9.999999)

Address	Description
Un\G30080 to Un\G30081	Set the coefficient to integrate into the measurement value for OUT1.
Un\G30082 to Un\G30083	Set the coefficient to integrate into the measurement value for OUT2.

Offset

■Offset (Un\G30084 to Un\G30087)

Set the value to add to or subtract from the measurement value.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30084 to Un\G30085	Set the value to be added to or subtracted from the measurement value for OUT1.
Un\G30086 to Un\G30087	Set the value to be added to or subtracted from the measurement value for OUT2.

Judgment output upper limit value

■Judgment output upper limit value (Un\G30090 to Un\G30093)

Set the upper limit value for judging the measurement value.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30090 to Un\G30091	Set the upper limit value for judging the measurement value for OUT1.
Un\G30092 to Un\G30093	Set the upper limit value for judging the measurement value for OUT2.

Judgment output lower limit value

■Judgment output lower limit value (Un\G30094 to Un\G30097)

Set the lower limit value for judging the measurement value.

Setting range: -950000000 to 950000000 (unit: nm)

Address	Description
Un\G30094 to Un\G30095	Set the lower limit value for judging the measurement value for OUT1.
Un\G30096 to Un\G30097	Set the lower limit value for judging the measurement value for OUT2.

Upper limit hysteresis of judgment output

■Upper limit hysteresis of judgment output (Un\G30100 to Un\G30103)

Set the hysteresis value corresponding to the judgment output upper limit value that is used to stabilize the judgment output.

Setting range: 0 to 950000000 (unit: nm)

Address	Description
Un\G30100 to Un\G30101	Set the hysteresis value corresponding to the judgment output upper limit value that is used to stabilize the judgment output for OUT1.
Un\G30102 to Un\G30103	Set the hysteresis value corresponding to the judgment output upper limit value that is used to stabilize the judgment output for OUT2.

Lower limit hysteresis of judgment output

■Lower limit hysteresis of judgment output (Un\G30104 to Un\G30107)

Set the hysteresis value corresponding to the judgment output lower limit value that is used to stabilize the judgment output.

Setting range: 0 to 950000000 (unit: nm)

Address	Description
Un\G30104 to Un\G30105	Set the hysteresis value corresponding to the judgment output lower limit value that is used to stabilize the judgment output for OUT1.
Un\G30106 to Un\G30107	Set the hysteresis value corresponding to the judgment output lower limit value that is used to stabilize the judgment output for OUT2.

Measurement value output at alarm

■Measurement value output at alarm (Un\G30110 to Un\G30111)

Set the measurement value output status when an alarm occurs.

- 0: Hold last value
- 1: Fixed value (999.999999)

Address	Description
Un\G30110	Set the measurement value output status when an alarm occurs for OUT1.
Un\G30111	Set the measurement value output status when an alarm occurs for OUT2.

Alarm output delay

■Alarm output delay (Un\G30112 to Un\G30113)

Set whether to output the alarm in real time or hold the last normal value up to the set number of times when an alarm occurs (due to light intensity saturation, insufficient light intensity, or when a measurement object is not in the measurement range).

- 0: Off (output in real time)
- 1: On (holds the last normal value up to the set number of delay times)

Address	Description
Un\G30112	Set whether to output the alarm in real time or hold the last normal value up to the set number of times when an alarm occurs (due to light intensity saturation, insufficient light intensity, or when a measurement object is not in the measurement range) for OUT1.
Un\G30113	Set whether to output the alarm in real time or hold the last normal value up to the set number of times when an alarm occurs (due to light intensity saturation, insufficient light intensity, or when a measurement object is not in the measurement range) for OUT2.

Sampling cycle

■Sampling cycle (Un\G30120)

Set the measurement sampling cycle.

- 0: Sampling cycle_10μs
- 1: Sampling cycle_20μs
- 2: Sampling cycle_40μs
- 3: Sampling cycle_100μs
- 4: Sampling cycle_200μs
- 5: Sampling cycle_400μs
- 6: Sampling cycle_1000μs
- 7: Sampling cycle_2000μs

Judgment output OFF delay

■Judgment output OFF delay (Un\G30121)

Set the timing at which the judgment output switches from on to off.

- 0: Delay_Off
- 1: Delay_2ms
- 2: Delay_10ms
- 3: Delay_100ms
- 4: Hold

Interference prevention

■Interference prevention (Un\G30122)

Set whether to prevent interference by offsetting the measurement timing of sensor head A and sensor head B.

- 0: Off (interference prevention not used)
- 1: On (interference prevention used)

Parameter setting request response

■Parameter setting request response (Un\G31000)

The response to the parameter setting request is stored.

- 0: Completed successfully
- 10 to 123: Last three digits of the buffer memory address (decimal) where a setting error was detected in the head setting, OUT setting, or common setting

Current setting

■Current setting (Un\G31010 to Un\G31169)

The current parameter settings are stored.

The settings stored are the same as the parameter settings from Un\G30010 to Un\G30169.

The parameter settings from Un\G30010 to Un\G30169 or the settings configured with the setting tool are reflected.

For the usage of this buffer memory area, refer to the following.

☞ Page 47 PROGRAMMING

Laser output stop request

■Laser output stop request (Un\G32256 to Un\G32257)

Set the laser output stop request for sensor head A and sensor head B.

- 0: Emitting
- 1: Stopped

Address	Description
Un\G32256	Set the laser output stop request for sensor head A.
Un\G32257	Set the laser output stop request for sensor head B.

Output setting copy request

■Output setting copy request (Un\G32258)

The setting details related to the OUT setting can be copied between memory areas.

- 0: No instruction
- 1: Copy from OUT1 to OUT2
- 2: Copy from OUT2 to OUT1

Memory change request

■Memory change request (Un\G32259)

Change the destination memory for saving the settings. Set the memory change numbers shown below.

- 0H: No instruction
- 8000H: Change to memory area 0
- 8001H: Change to memory area 1
- 8002H: Change to memory area 2
- 8003H: Change to memory area 3
- 8004H: Change to memory area 4
- 8005H: Change to memory area 5
- 8006H: Change to memory area 6
- 8007H: Change to memory area 7
- 8008H: Change to memory area 8
- 8009H: Change to memory area 9
- 800AH: Change to memory area 10
- 800BH: Change to memory area 11
- 800CH: Change to memory area 12
- 800DH: Change to memory area 13
- 800EH: Change to memory area 14
- 800FH: Change to memory area 15

Memory copy request

■Memory copy request (Un\G32260)

The setting details of a memory area are copied to another memory area.

- 0H: No instruction
- 10H digit = Copy source memory area, 1H digit = Copy destination memory area

Ex.

01H: Copies the setting details of memory area 0 into memory area 1.

17H: Copies the setting details of memory area 1 into memory area 7.

Initialization request

■Initialization request (Un\G32261)

Initialize the memory settings.

- 0: No initialization request
- 1: Initialization request for the memory area in current use
- 2: Initialization request for all memory areas

Save request

■Save request (Un\G32262)

Save the settings in all the memory areas.

- 0: No save request
- 1: Save request

Emitted light intensity search

■Emitted light intensity search (Un\G32263 to Un\G32264)

Search the received light intensity of all measurement surfaces and set the appropriate emitted light intensity automatically.

- 0: No command issued
- 1: Command issued

Address	Description
Un\G32263	Search the received light intensity of all measurement surfaces and set the appropriate emitted light intensity automatically for sensor head A.
Un\G32264	Search the received light intensity of all measurement surfaces and set the appropriate emitted light intensity automatically for sensor head B.

Error code

■Error code (Un\G36096)

This area indicates the type of error that has occurred.

Occurrence date and time (year)

■Occurrence date and time (year; Un\G36097)

The year of the date and time when the error occurred is stored as BCD code.

Occurrence date and time (month)

■Occurrence date and time (month; Un\G36098)

The month of the date and time when the error occurred is stored as BCD code.

Occurrence date and time (day)

■Occurrence date and time (day; Un\G36099)

The day of the date and time when the error occurred is stored as BCD code.

Occurrence date and time (hour)

■Occurrence date and time (hour; Un\G36100)

The hour of the date and time when the error occurred is stored as BCD code.

Occurrence date and time (minute)

■Occurrence date and time (minute; Un\G36101)

The minute of the date and time when the error occurred is stored as BCD code.

The lower byte is not used (it is fixed to zero).

Occurrence date and time (second)

■Occurrence date and time (second; Un\G36102)

The second of the date and time when the error occurred is stored as BCD code.

The lower byte is not used (it is fixed to zero).

Occurrence date and time (day of the week)

■Occurrence date and time (day of the week; Un\G36103)

The day of the week of the date and time when the error occurred is stored as BCD code.

The lower byte is not used (it is fixed to zero).

- 0: Sunday
- 1: Monday
- 2: Tuesday
- 3: Wednesday
- 4: Thursday
- 5: Friday
- 6: Saturday

Error code details 1

■Error code details 1 (Un\G36104)

The information of the sensor head where an error occurred is stored.

- 0: No information
- 1: Occurrence of an error in sensor head A
- 2: Occurrence of an error in sensor head B

Error code details 2

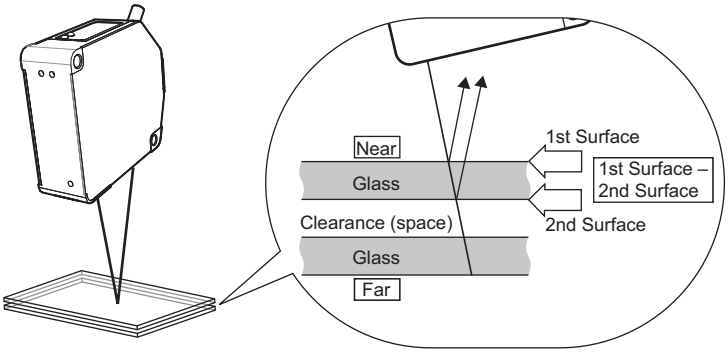
■Error code details 2 (Un\G36105)

The information of the sensor head where an error occurred is stored.

- 0: No information
- 1: Occurrence of an error in sensor head A
- 2: Occurrence of an error in sensor head B

Appendix 4 Measurement Method by Measurement Object

Glass thickness measurement procedure



1. Configuring basic settings with the default recipe

Use the recipe selection function to set the thickness measurement. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)

2. Attaching the ND filter

The ND filter may be required to measure an object with high reflectance. Check that the received light intensity is not saturated. (📖 MELSEC iQ-R Laser Displacement Sensor Control Module User's Manual (Sensor Head))

Received light intensity is adjusted on the display of received light intensity waveform and received light intensity at peak. (📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual)

Point

- The thickness of multiple surfaces or clearance can be measured.
- Measurements that reflect refractive index can be performed. (The refractive index of glass is generally around 1.55.)
- The difference in the measurement value due to the surface condition of the measurement object can be adjusted by setting the calibration function.
- Thin objects or objects with thin clearance can be measured when the measurement mode is set to "Glass".

For details on the refractive index, calibration, and measurement mode, refer to the following.

📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual

For details on the measurement of the thickness or clearance of multiple surfaces, refer to the transparent object in the following manual.

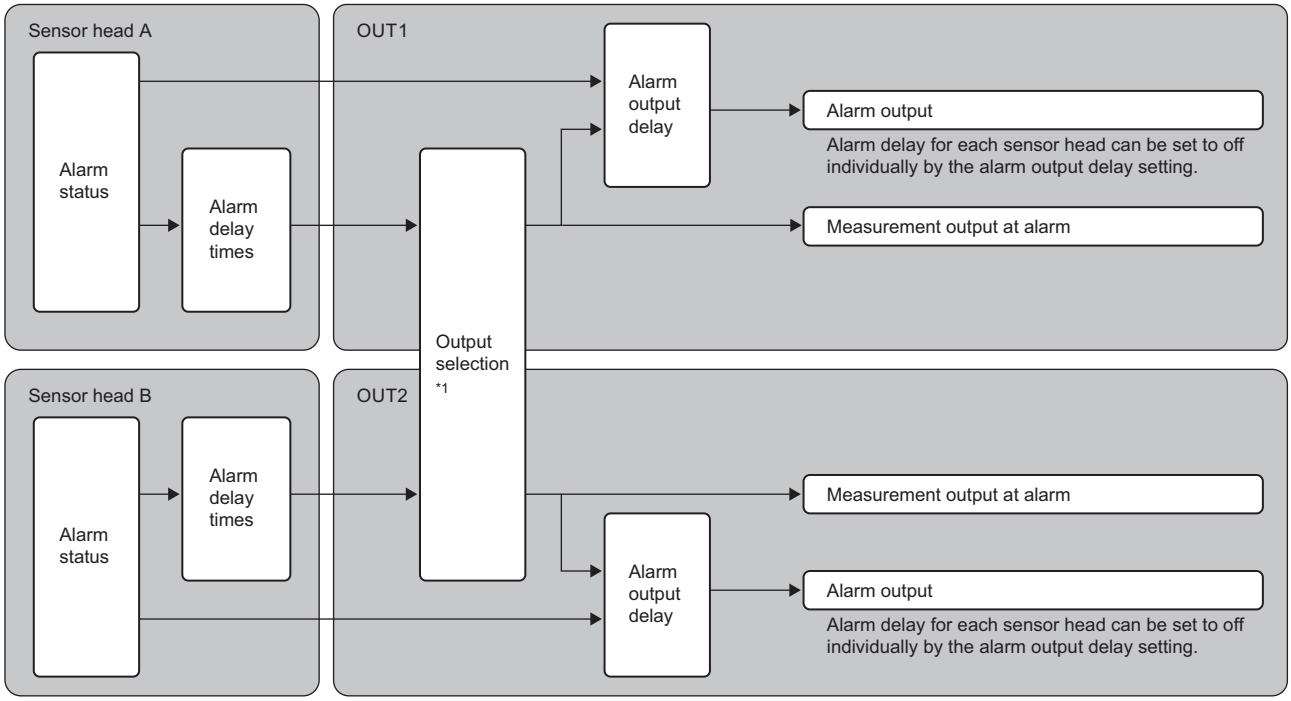
📖 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual

Appendix 5 Supplemental Remarks for Functions

This section describes supplemental explanations to further deepen understanding of the functions.

Alarm setting and outputs

Alarm status means measurement disabled state due to insufficient light intensity or out of measurement range.



*1 When "A+B" is selected in output selection, an alarm is output when either of sensor head A or B goes into the alarm status.

Item	Description	Reference
Alarm delay times	Holds the last normal value up to the set number of times when the sensor head goes into the alarm status.	🕮 Laser Displacement Sensor MH11 SettingTool Version 2 Operating Manual
Measurement value output at alarm	Sets the measurement value display for when the alarm status continues for more than the set number of delay times.	
Alarm output delay	Enables the alarm output in real time regardless of the number of alarm delays.	

A

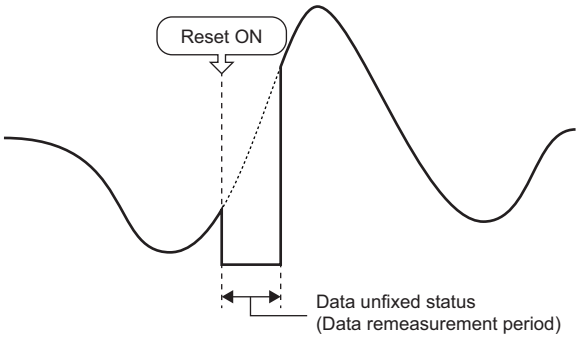
Conditions for unfixed output data

Immediately after the head setting or OUT setting is changed or when reset or laser emission stop is input, the operation status is determined to be data unfixed status (data is not determined), which is different from the alarm status.
Data unfixed status starts at measurement restart after settings are changed or a reset is executed, and then stops when the average times of data is reached.
Under data unfixed status, judgment output, 'Strobe signal OUT1' (X16), and 'Strobe signal OUT2' (X17) are off.

Point

- Under data unfixed status, turning on of the zero set is ignored.
- For how to clear data unfixed status, refer to the troubleshooting. (☞ Page 51 TIMING CHARTS)

For example, the measurement value display for normal measurement when the reset is on is as follows.



The following table shows the measurement value display and output under data unfixed status and alarm status.

Item	Data unfixed status	Alarm status
Status	Measurement data is unfixed. (The average buffer has not reached the set number of times.)	Measurement disabled state due to insufficient light intensity or out of measurement range
Data sent from the programmable controller (The data type is floating point type.)	-999.999999mm*1	The last value is held. (Initial value)
Judgment output (LO, GO, HI)	OFF	Interlocks with measurement value output.
Alarm output	Interlocks with alarm status.	ON
'Strobe signal OUT1' (X16), 'Strobe signal OUT2' (X17)	OFF	ON

*1 To judge data unfixed status, check with 'Strobe signal OUT1' (X16) and 'Strobe signal OUT2' (X17).

Conditions for data unfixed status

The following table shows the conditions that cause data unfixed status and the measurement status.

Conditions for data unfixed status	Measurement status
After power-on	Both OUT1 and OUT2 become data unfixed status.
Change in the sampling cycle setting	
Initialization	
Laser emission stop input	OUT1 and/or OUT2 become data unfixed status depending on the sensor head that is set in output selection for each OUT. For instance, when A+B is set for OUT1, -B is set for OUT2, and the setting of sensor head A is changed, OUT1 becomes data unfixed status, and OUT2 continues measurement.
Change in the installation mode setting	
Change in the measurement mode setting*1	
Change in the measurement surface reference setting	
When the "Execute Calibration" window of the setting tool is displayed	
When the [Cancel] button is clicked on the "Execute Calibration" window of the setting tool	
Execution of calibration	
Execution of an emitted light intensity search	
Change in the output selection setting	When the OUT1 setting is changed, OUT1 becomes data unfixed status, and OUT2 continues measurement. In the same manner, when the OUT2 setting is changed, OUT2 becomes data unfixed status, and OUT1 continues measurement.
Change in the transparent object, refractive index calculation, and refractive index settings	
Change in the analysis mode setting	
Change in filter selection, average times, and cutoff frequency	
Reset	

*1 There are cases where data unfixed status is not caused, depending on the setting conditions.

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REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Revision
June 2019	SH(NA)-082019ENG-A	First edition

Japanese manual number: SH-082018-A

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

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The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.
In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

SH(NA)-082019ENG-A(1906)MEE
MODEL: R60MH112-U-OU-E
MODEL CODE: 13JX92

MITSUBISHI ELECTRIC CORPORATION

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