Panasonic®

CC-Link IE Field Communication Unit
for **HG** series

SC-HG1-CEF

User's Manual

(MEMO)

Introduction

Thank you for purchasing an **SC-HG1-CEF** CC-Link IE Field Communication Unit for the **HG** Series.
Before using this product, read and understand this User's Manual. Use the product correctly and in the optimum manner.
Keep this manual in a safe location for reference whenever necessary.

Types of Manuals

The following user's manuals are available for the **SC-HG1-CEF** series. Refer to the appropriate manual according to your need.
The user's manuals are also available for download from our website (https://industry.panasonic.com/).

Unit name or purpose of use	Manual name	Manual code
Communication Unit for CC-Link IE Field / CC-Link for **HG** series	**SC-HG1-CEF** User's Manual	WUME-SCHG1CEF
Contact-Type Digital Displacement Sensor **HG-S** series	**HG-S** series User's Manual	WUME-HGS
Thru-Beam Type Digital Displacement Sensor **HG-T** series	**HG-T** series User's Manual	WUME-HGT
HG-T Configuration Tool	**HG-T Configuration Tool User's Manual**	WUME-HGTCT

Informetion

1) Unauthorized reproduction of part or all of this manual is prohibited.
2) The contents of this manual are subject to change without notice.
3) This manual has undergone strict quality control procedures; however, in the event that you discover any problems or points of concern, please contact your local dealer.
4) CC-Link IE Field is a registered trademark of Mitsubishi Electric Corporation, and is controlled by the CC-Link Partner Association.
5) Ethernet is a trademark or registered trademark of FUJIFILM Business Innovation Corp.
6) The ownerships of all other trademarks or registered trademarks belong to their respective owners.

Structure of this manual

Chapter 1 Before Using This Product	Cautions for safe use of the product, terminology, contents of the package, and names and functions of the parts of the product.

Chapter 2 System Configuration	Types of controllers that can be connected to the product and restrictions.

Chapter 3 Installation and Settings	Installation, connecting controllers, connecting external devices, and configuring communication settings.

Chapter 4 CC-Link IE Field Network Communication	Communication methods.

Chapter 5 Specifications	Specifications and dimensions.

Chapter 6 Warranty	Warranty information.

Chapter 7 Maintenance	Maintenance and inspection.

Chapter 8 Troubleshooting	Troubleshooting and error codes.

Frequently asked questions

Question	Section	Page
I want to learn about communication commands for **HG-S** series	4-9-1 HG-S series command list	4-15
I want to learn about communication commands for **HG-T** series	4-9-2 HG-T series command list	4-20
I want to set threshold values	4-9-3 Command sending procedure	4-32
I want to acquire controller output	4-5 Judgment output reading	4-11
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Contents

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Chapter 1 Before Using This Product

Before Using This Product

1-1 Safety rules (Always observe)

This section explains important rules that must be observed to prevent human injury and property damage.

■The hazards that may occur if the product is used incorrectly are described and classified by level of harm.

⚠**WARNING**	Risk of death or serious injury.
⚠**CAUTION**	Risk of minor injury or property damage.

■The following symbols are used to indicate safety information that must be observed.

🚫	Indicates an action that is prohibited.
❗	Indicates an action that must be taken.
⚠	Indicates a matter that requires caution.
\<Reference\>	Indicates supplemental information.

1-2 Safety information

> ⚠**WARNING**
>
> ● **Never use this product as a sensing device for personnel protection.**
> ● **When using sensing devices for personnel protection, use products that meet the laws and standards for personnel protection that apply in each region or country, such as OSHA, ANSI and IEC.**

Specifications

● This product has been developed / produced for industrial use only.
● Do not use this product under conditions outside the specified ranges. Risk of an accident and product damage.
  There is also a risk of a significant reduction of service life.

Power supply

● Incorrect wiring will damage the internal circuitry. Check the wiring before turning ON the power.
● Verify that power supply fluctuations are within the rating.
● Risk of damage and burning if a voltage over the rating is applied, or AC power is directly applied.
● If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal is connected to an actual ground.
● Ensure that there is sufficient leeway in the voltage source capacity.
● Do not use during the initial transient time after the power supply is switched ON.
  When the product is ready for use after the transient time, a remote ready flag is set in CC-Link IE Field network communication. Always check the remote ready flag before use.
● Use an isolation transformer in the DC power supply. Risk of short-circuiting and damage to the product or power supply if an auto transformer is used.
● If surges occur in the power supply, connect a surge absorber to the source to absorb the surges.

Wiring

● Make sure that the power is OFF while performing wiring or connection work. Risk of electric shock or product damage.
● Risk of damage and burning if the load is incorrectly wired or short-circuiting occurs.
● When noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment separately to ground.
● To avoid noise, keep the wiring as short as possible.
● Do not wire in parallel with a high-voltage line or power line, or run through the same conduit. Risk of malfunctioning due to induction.
● Use Ethernet cable that complies with CC Link IE Field network specifications.
● Do not apply stress such as excessive bending or pulling to the extracted part of Ethernet cable. Risk of damage and malfunctioning due to connection failure.
● Always ground the shield wire of Ethernet cable on the host device side. This product does not have a ground terminal.
● For detailed grounding specifications, refer to the "CC-Link IE Field Network Cable Installation Manual" published by the CC-Link Partner Association.

Before Using This Product

Usage environment
- This product is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Do not use in locations where there are corrosive or other harmful gases.
- Ensure that the product does not come into contact with organic solvents such as thinner.
- Ensure that the product does not come into contact with strong acid or alkaline.
- Ensure that the product does not come into contact with oil or grease.
- This product cannot be used in an environment that contains flammable or explosive gases.
- Performance may not be satisfactory in a strong electromagnetic field.
- Do not drop or otherwise subject to shock. Risk of product damage.

Other matters
- Never attempt to disassemble, repair, or modify the product.
- When the product becomes unusable or unneeded, dispose of the product appropriately as industrial waste.
- Design the system so that system trouble protection and safety circuits are located externally.
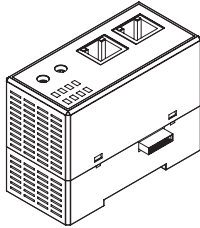
1-3 Glossary

	Term	Meaning
System terms	CC-Link IE Field network	A high-speed, high-capacity open filed network that uses Ethernet (1000Base-T).
	Transient transmission	A function in Data Link for communication with other stations using peripheral devices, including reading or writing data from/to another station by means of a read/write command in the program of the local station.
	Cyclic transmission	A function in Data Link for periodic data communication between stations on the same network.
	Memory map	This assigns functions of a communication unit to a link device. By accessing a link device that supports memory map, the master station can use the functions of a communication unit.
	Network No.	In a multi-network system, this number is assigned to identify each network. The same number cannot be assigned to more than one network.
	Station number	This number is assigned to identify each network unit connected to a network. The same number cannot be assigned to more than one network unit in a network.
	RX[*]	Remote input Information input from a slave station to the master station in units of bits. [*]: Indicates the bit number in hex.
	RY[*]	Remote output Information output from the master station to a slave station in units of bits. [*]: Indicates the bit number in hex.
	RWw[*]	Remote register (output) Information output from the master station to a slave station in units of words (16 bits). [*]: Indicates the word number in hex.
	RWr[*]	Remote register (input) Information input from a slave station to the master station in units of words (16 bits). [*]: Indicates the word number in hex.
Unit name	Master station	This station controls the overall network. The master station can communicate with all stations by cyclic transmission and transient transmission.
	Slave station	A general name for stations other than the master station (local station, remote I/O station, remote device station, intelligent device station).
	Remote I/O station	Exchanges input / output signals in units of bits with the master station by cyclic transmission.
	Remote device station	Sends information in units of bits and information in units of words by cyclic transmission. Returns a response to a transient transmission from another station.
	Intelligent device station	Sends input / output signals in units of bits and input / output data in units of words to the master station by cyclic transmission. Returns a response to a transient transmission (request) from another station.
	Local station	Communicates with the master station and other local stations by cyclic transmission and transient transmission.
	Controller - Master unit	A controller equipped with power supply, external I/O, and analog current output wires, and which can be used on a standalone basis.
	Controller - Slave unit	A controller that is connected to a master unit.
	Ethernet cable	CC-Link Partner Association recommended cable Category 5e or higher Ethernet cable that complies with the 1000Base-T standard. (Double-shielded / STP, straight cable)
	End plates or commercially available fittings	When the product is connected to a controller, the end plates secure the units at both ends to prevent the connector from disconnecting and causing a communication failure.

1-4 Contents of package

The product package contains the following items. Before using the product, make sure that no items are missing.

● **Communication unit: 1 pc.**   ● **Instruction manual**
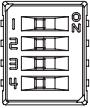
1-5 Description of parts

<Switch cover removed>

	Name	Function
1	St./Net. Number setting switch	Rotary switch for setting a station number or a network number for the CC-Link IE Field network. The functions change depending on the operation mode set with the mode setting switch. • Network number setting mode 　Operates as the network number setting switch 　[Factory default state: Network No. 1] • Normal mode 　Operates as the station number setting switch 　[Factory default state: Station 1]
2	Port2 L ER. indicator (Yellow)	ON:　　Abnormal data received.
3	Port1 L ER. indicator (Yellow)	OFF:　　Normal data received.
4	Port2 LINK indicator (Green)	ON:　　Linking up.
5	Port1 LINK indicator (Green)	OFF:　　Linking down.
6	Port1	RJ45 connector for CC-Link IE Field network connection
7	Port2	Connect an Ethernet cable. There are no restrictions on the order of connection of Port1 and Port2.
8	Male connector	Connect to a master controller or slave controller. Power for the communication unit is supplied from the controller through this connector.
9	STS2 indicator (Red)	• Network number setting mode 　ON:　　Network number setting is outside range. 　OFF:　Network number setting is inside range. • Normal mode 　ON:　Command to controller resulted in an error. 　OFF:　Command to controller processed normally.
10	STS1 indicator (Green)	• Network number setting mode 　Blinking: Network number setting preparation completed. 　ON:　　Network number setting save completed. • Normal mode 　ON:　Communicating with controller. 　OFF:　Not communicating with controller.
11	RD indicator (Green)	Indicates the data reception status. ON:　　Receiving data. OFF:　　Data not received.
12	D LINK indicator (Green)	Indicates the Data Link status of the communication unit. ON:　　Data Link in effect (cyclic transmission in progress). Blinking: Data link in effect (cyclic transmission stopped). OFF:　　Data link not executed (parallel off).
13	Power indicator (Green)	Indicates the power status of the communication unit. ON:　Power is ON. OFF:　Power is OFF.

	Name	Function
14	ERR. indicator (Red)	Indicates the error status of the communication unit. ON: Communication error occurred. Blinking: "Station / Network No. setting switch" was changed after the power was turned ON. (Station number changes made after the power is turned ON are not applied.) OFF: Normal operation.
15	RUN indicator (Green)	Indicates the operation status of the communication unit. ON: Normal operation. OFF: Communication unit error occurred.
16	SD indicator (Green)	Indicates the data transmission status. ON: Sending data. OFF: Data not sent.

	Name	Function				
17	Mode setting switch (with cover)	Set the operation mode. [Factory default state: Normal mode]				
		SW No.	1	2	3	4
		Network number setting mode	ON	Not used (keep set to OFF)		
		Normal mode	OFF	Not used (keep set to OFF)		

Chapter 2 System Configuration

2-1 Communication unit system

This product is a communication unit for the purpose of monitoring controller ON/OFF output and detected quantities using CC-Link IE Field network communication between controllers and a CC-Link IE Field host device.
This product can connect a maximum of 15 controllers (one master controller, 14 slave controllers). The power that drives this product is supplied from a connected controller / master controller.

To power supply

CC-Link Partner Association recommended cable
(Double-shielded / STP, straight cable)
(Please obtain separately)

To CC-Link IE Field
host device

To power supply

Controller - master
(option)

Controllers - slave (option)
(Maximum of 14 units are
connectable)

MS-DIN-E end plate (option)
or commercially available fitting

SC-HG1-CEF

<Reference>
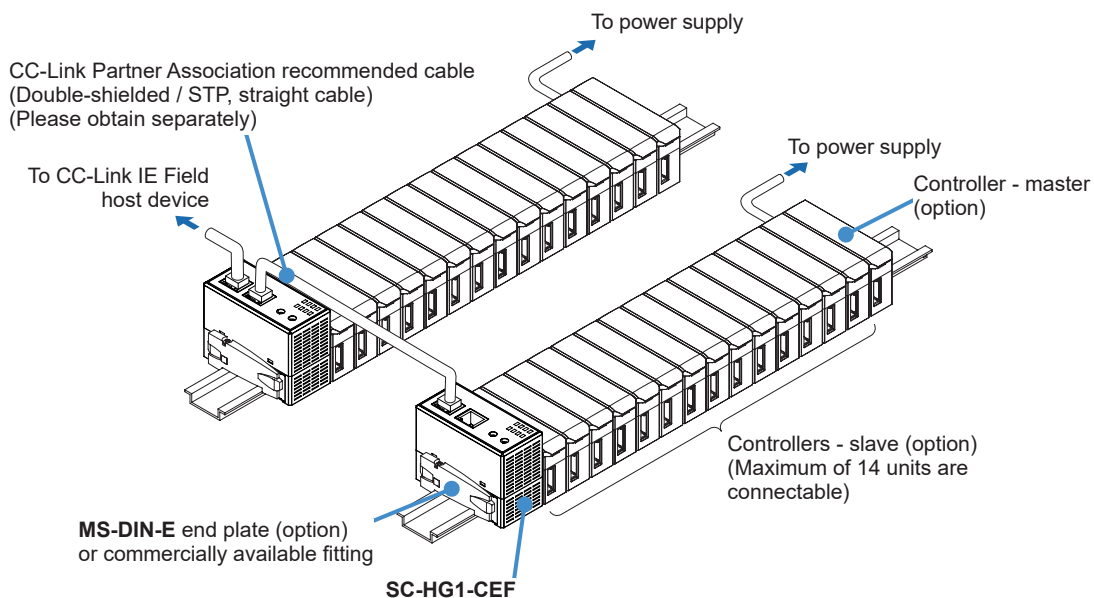
● If **HG-TC** series and **HG-SC** series controllers are used in combination, connect a slave unit of the same series (as the master unit) on the near side of the master unit and a slave unit of a different series (from the master unit) on the far side of the master unit.

Example: When **HG-SC□** is master unit

Controller - Master unit
HG-SC□

Controller - Slave unit
HG-SC□

Controller - Slave unit
HG-TC□

SC-HG1-CEF
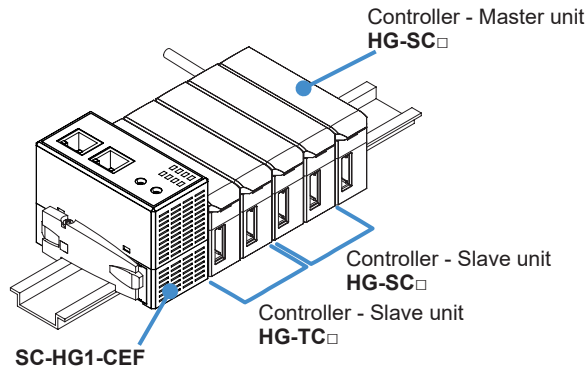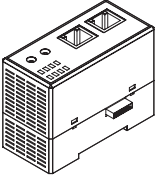
● If **HG-TC** series and **HG-SC** series controllers are used in combination, there are limitations on the functions below.

	Item	Description of limitation
1	Calculation function	Calculation is only performed when the slave unit is the same series as the master unit. Calculation is not performed when the slave unit series is different from the master unit series. "CALC" does not appear in the display of a slave unit of a different series.
2	Input all	The master unit only performs input all when the slave unit is the same series. A slave unit of a different series than the master unit is not input even when the external input settings match those of the master unit.
3	Copy function	Copying is only performed when the slave unit is the same series as the master unit. When copying is attempted, "NOW COPY" appears on the displays of the slave unit of a different series than the master unit, but copying is not performed.
4	Interference prevention	This function is only available on the **HG-TC** controller series. The function is not executed on the **HG-SC** controller series.
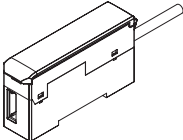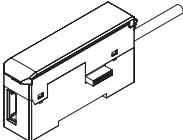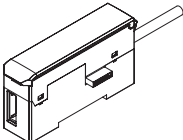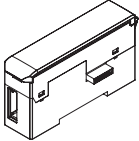
2-2 Unit types

Communication unit

Product name	Appearance	Model
CC-Link IE Field Communication Unit		**SC-HG1-CEF**

Controller
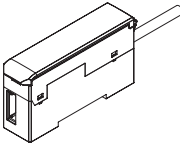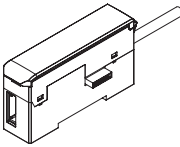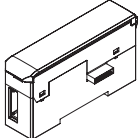
● HG-SC series

Type			Appearance	Model	Output
Contact-type digital displacement sensor	Master unit	High-performance type (Analog current output + Input / output)		**HG-SC101**	NPN open-collector transistor
				HG-SC101-P	PNP open-collector transistor
	Slave unit	High-performance type (Analog current output + Input / output)		**HG-SC111**	NPN open-collector transistor
				HG-SC111-P	PNP open-collector transistor
		Standard type (Input / output)		**HG-SC112**	NPN open-collector transistor
				HG-SC112-P	PNP open-collector transistor
		Wire-saving type		**HG-SC113**	–

> 🚫
> ● When connecting slave units to a master unit, connect only NPN output types, or only PNP output types. Dissimilar output types cannot be connected together.
> ● If an **HG-SC** series controller manufactured in January 2019 or earlier is connected with an **HG-TC** series controller, operation will not take place normally. Connect with an **HG-SC** series controller manufactured in February 2019 or later.

● **HG-TC series**

Type			Appearance	Model	Output
Thru–beam type digital displacement sensor	Master unit	High-performance type Analog current output + Input / output		**HG-TC101**	NPN open-collector transistor
				HG-TC101-P	PNP open-collector transistor
	Slave unit	High-performance type Analog current output + Input / output		**HG-TC111**	NPN open-collector transistor
				HG-TC111-P	PNP open-collector transistor
		Wire-saving type		**HG-TC113**	–

🚫 ● When connecting slave units to a master unit, connect only NPN output types, or only PNP output types. Dissimilar output types cannot be connected together.
● If an **HG-SC** series controller manufactured in January 2019 or earlier is connected with an **HG-TC** series controller, operation will not take place normally. Connect with an **HG-SC** series controller manufactured in February 2019 or later.

Option

Product name	Appearance	Model
End plate		**MS-DIN-E**

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Chapter 3 Installation and Settings

Installation and Settings

3-1 Steps prior to operation

The steps that are required prior to operation are indicated below.

Check column   Page

Unit mounting - 1

Mount the product and controllers on a DIN rail according to the system configuration, and connect. Do not attach end plates.

"Chapter 2 System Configuration"
"3-2-1 Mounting"
"3-2-2 Connection"

Connect power supply

Connect the power supply of the master controller.

Network number setting

Follow the setting procedure to set the network number of the product.

"Network number setting"

Station number setting

Follow the setting procedure to set the station number on the product.

"Station number setting"

Wiring

Connect an Ethernet cable to the product.

"3-2-3 Ethernet cable connection"

Unit mounting - 2

Attach the end plates.
If you will not set a network number and station number, attach the end plates in "Unit mounting -1".

"3-2-2 Connection"

Controller settings

Configure controller settings.
Configure threshold and other settings by programming or direct setting on the controller.
For direct setting on a controller, refer to the manual for the controller.

Programming

Create a program for control of each controller connected to the product from the master station.

"Chapter 4 CC-Link IE Field Network Communication"
"4-9-1 HG-S series command list"
"4-9-2 HG-T series command list"

3-2 Installation

3-2-1 Mounting

■ **Mounting on a DIN rail**

1. Insert the rear of the mounting part into the DIN rail.

2. While pressing down on the rear of the mounting part, insert the front of the mounting part into the DIN rail.
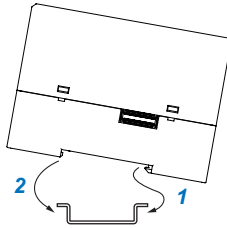
■ **Removing from a DIN Rail**

1. Grasp the product and push forward.

2. Lift the front to remove.
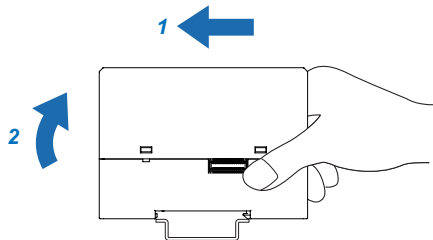
3-2-2 Connection

This product must be connected to a controller.

Up to 15 controllers (one master controller and 14 slave controllers) can be connected to the product.

🚫	● Always shut OFF the power before connecting the product to, or disconnecting the product from, a controller. Risk of damage to the product and controller if connected with the power ON. ● Insert the male connector firmly into the female connector. ● Risk of damage to the product and controller if not connected completely.
❗	To connect the product to a controller, the units must be mounted on a DIN rail. Attach **MS-DIN-E** end plates (optional) to enclose the connected units at the ends.

<Reference>

For detailed information on the digital displacement sensor, refer to the User's Manual of the controller you are using.

■ **Connection procedure**

1. Mount the product on a 35mm width DIN rail.

2. Remove the connector cover from the controller. (Note)

Controllers - slave (option)

Controller - master (option)

SC-HG1-CEF
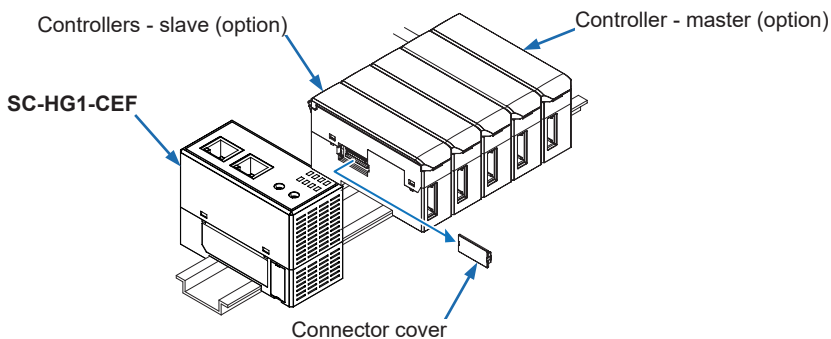
Connector cover

Note: Be sure to keep the connector cover you removed from the controller.

3. Slide the product until it directly contacts the controller.

Slide
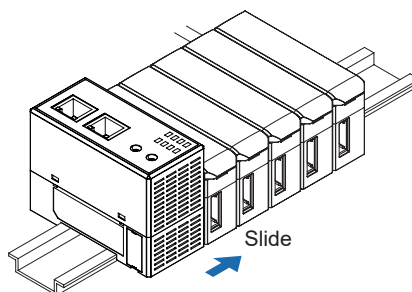
4. Replace the switch cover and configure communication settings.
For details on how to configure settings, refer to **"3-3-3 Communication unit settings"**.
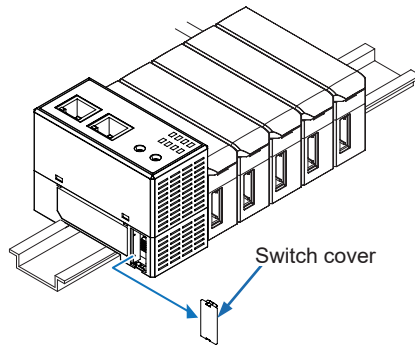
Switch cover

5. When you have completed the communication unit settings, be sure to attach the switch cover.

> ❗ After completing **"3-3-3 Communication unit settings"**, attach **MS-DIN-E** end plates (optional).

6. Attach end plates **MS-DIN-E** (optional) with the flat side facing in so as to enclose the connected units at the ends.

End plate **MS-DIN-E** (option)

End plate **MS-DIN-E** (option)
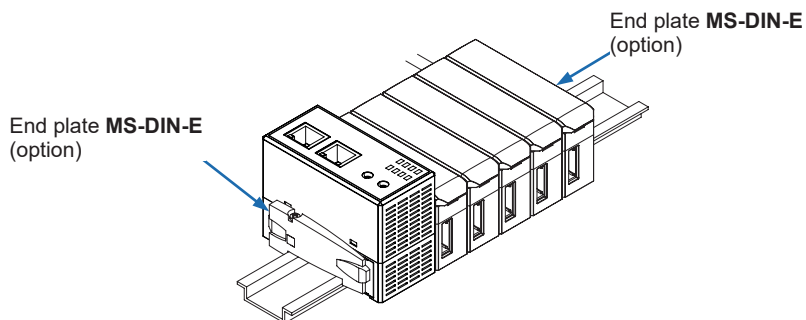
7. Tighten the screws on the **MS-DIN-E** to fasten. Tighten to a torque of 0.3N·m or less.

■ **Removal procedure**

1. Loosen the screws on the **MS-DIN-E** to remove.

2. Slide and remove the product and controllers.

Slide
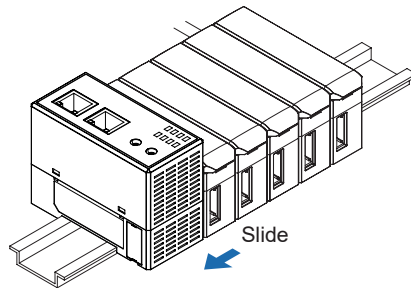
3-2-3 Ethernet cable connection

■ Ethernet cable connection procedure

> ● Make sure that the power supply is OFF while performing wiring work.
> ● For the Ethernet cable, use CC-Link Partner Association recommended cable.
> ● The communication distance must be within the specified range.
> ● Run the Ethernet cable through a conduit or fasten with clamps. Risk of malfunctioning if vibration or shock impairs connector contact.

1. Hold the Ethernet cable by the connector and align the lock release lever on the Ethernet cable with the slot on Port1 or Port2.

2. Insert the connector until you hear a "click" sound.

Ethernet cable
Lock release lever
Groove
SC-HG1-CEF
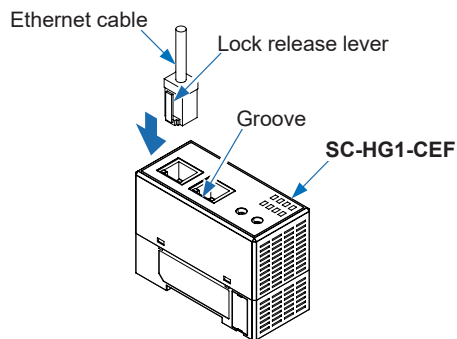
■ Ethernet cable removal procedure

1. Press the lock release lever on the Ethernet cable and pull out to remove.
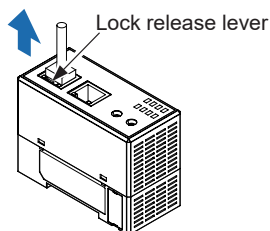
Lock release lever

Note: Attempting to pull the connector without pressing the lock release lever may break the lever. Do not use Ethernet cable with a broken lock release lever. Take care not to pull the cable with excessive force. This may cause wire breakage.

■ CC-Link IE Field network connection configurations

CC-Link IE Field network configurations are "line type", "star type", and "ring type". A mixed "line type" and "star type" network can also be configured.

Line type

| CC-Link IE Field host device | Station No. 1 | Station No. 2 | Station No. 3 | Station No. 4 | Station No. 5 |

Star type

CC-Link IE Field host device

HUB

| Station No. 1 | Station No. 2 | Station No. 3 | Station No. 4 | Station No. 5 |

Ring type

CC-Link IE Field host device

Station No. 5   Station No. 1

Station No. 4   Station No. 2

Station No. 3
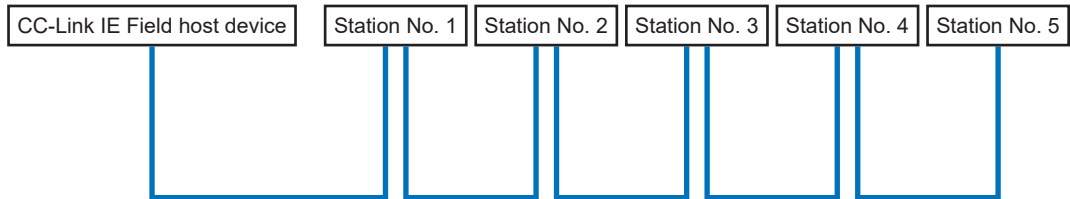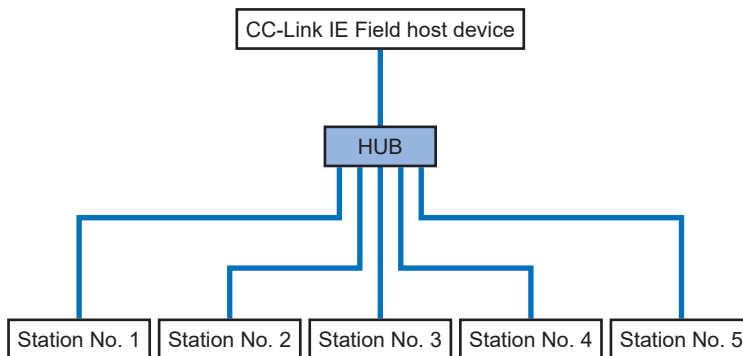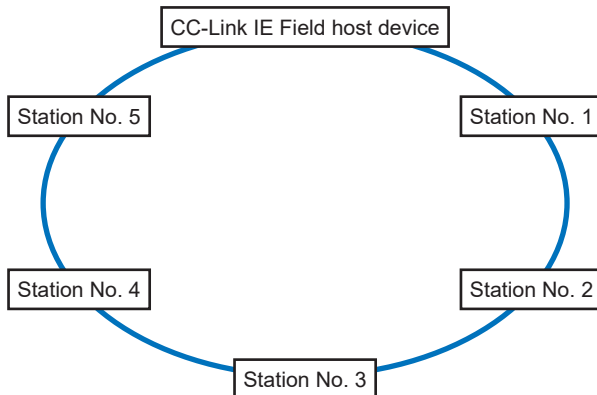
3-3 Settings

3-3-1 CC-Link IE Field network communication settings

When connecting the product to a master station, configure the settings below.

Slave property settings

Register the product as a remote device station in the master station.

You can use CSP+ (CC-Link System Profile) to easily configure communication settings for the CC-Link IE Field network.

CSP+ can be downloaded from the CC-Link Partner Association website.

CC-Link Partner Association website:

https://www.cc-link.org/sch/c012List?userSeqNo=4&menuSeqNo=2

Memory allocation settings

Change the settings in the master station software to enable communication between the product and master station.

3-3-2 Relation between network number and station numbers

> ⚠ ● For the network number of the slave station, set the same number as the network number of the master station.
> ● Do not set duplicate station numbers.

Each network is identified by its network number.
For detailed information, refer to the "CC-Link IE Field Network Cable Installation Manual" published by the CC-Link Partner Association.
Network numbers can be set within the range 1 to 239 (decimal).
Station numbers can be set within the range 1 to 120 (decimal).

Network configuration example
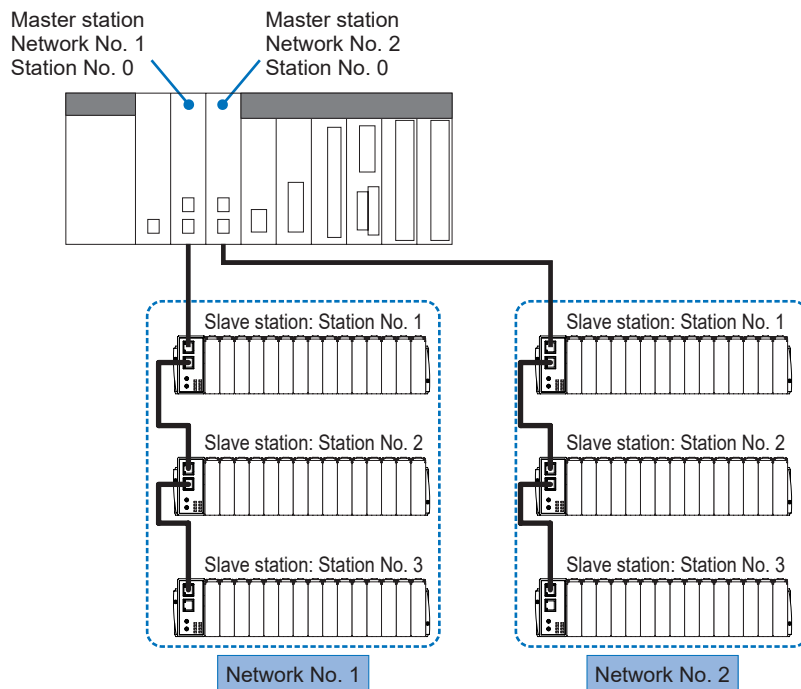
3-3-3 Communication unit settings

Set a network number and station number in order to connect the product to a CC-Link IE Field network.
Always set in the order "Network No." → "Station No.".

⊕ After changing the settings, be sure to turn the power OFF and then ON.

■ **Network number setting**

The factory default setting for the network number is "1". Set the network number to the same number as the master station with which communication will be performed.
Follow the procedure below to configure the setting.

1. With the power OFF, set the mode setting switches to network number setting mode.

• Mode setting switch

SW1	ON
SW2	OFF
SW3	OFF
SW4	OFF
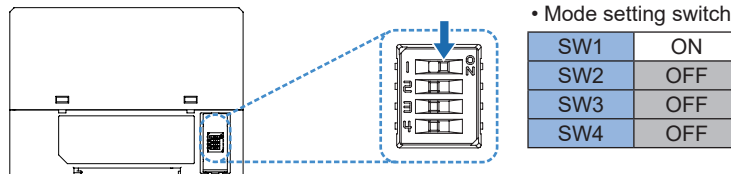
2. Turn ON the power. When the unit starts up, the STS1 indicator (Green) blinks.

STS1 indicator (Green)
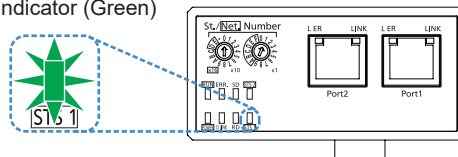
3. Set the same network number as the master station with the St./Net. Number setting switch. The network number setting range is 1 to 239 (decimal). (0 and 240 or higher cannot be set.) Convert the network number to hex and set the hex value.
 ● "x1" sets the first digit of the network number. 0 to F (hex) are valid.
 ● "x16" sets the second digit of the network number. 0 to E (hex) are valid.

Example 1
To set to "10" (decimal), set "0A" (hex).

St./Net. Number setting switch
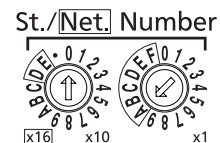
Example 2
To set to "239" (decimal), set "EF" (hex).

St./Net. Number setting switch
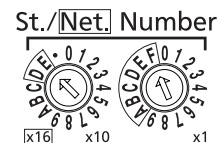
4. Set the mode setting switch to OFF. The network number is saved in the product.

Installation and Settings

When the number is saved, the STS1 indicator (Green) changes from blinking to solidly lit. At this point, the network number is not yet valid.

• Mode setting switch

SW1	OFF
SW2	OFF
SW3	OFF
SW4	OFF

STS1 indicator (Green)
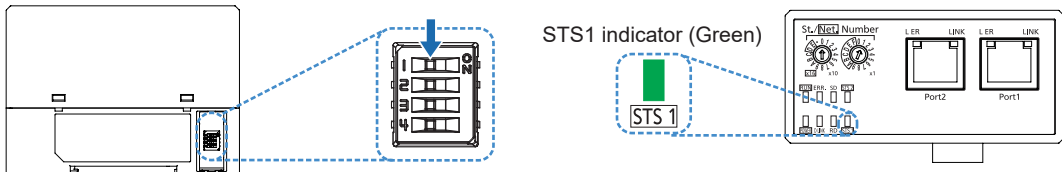
Note: If you set a network number that is outside the setting range, an error will occur, the number will not be saved, and the STS2 indicator (red) will light up. In this event, repeat the procedure from the beginning.

5. Turn OFF the power.

The network number setting is completed and the network number becomes valid.

Once a network number is saved, the product starts up automatically with the saved network number when the power is turned ON. It is not necessary to repeat this setting each time the power is turned ON.

■ Station number setting

Follow the procedure below to configure the setting.

1. With the power OFF, set the mode setting switches to normal mode.

• Mode setting switch

SW1	OFF
SW2	OFF
SW3	OFF
SW4	OFF
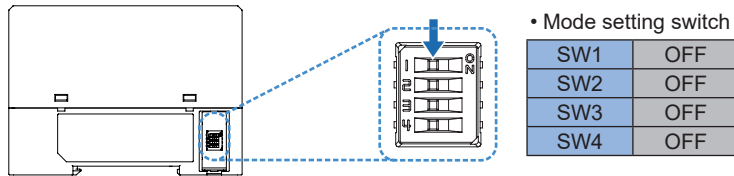
2. Set the station number with the St./Net. Number setting switch. The station number setting range is 1 to 120 (decimal). (0 and 121 or higher cannot be set.)
Unlike the network number, the station number is set in decimal. To set a station number from 100 to 120, use A to C on the 2nd digit switch.
● "x1" sets the first digit of the station number. 0 to 9 are valid.
● "x10" sets the second digit of the station number. 0 to C are valid.
  (A = 10, B = 11, C = 12)

Example 1
To set to "5", set "05".

St./Net. Number setting switch
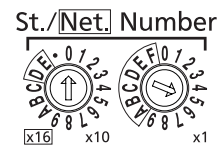
Example 2
To set to "119", set "B9".

St./Net. Number setting switch
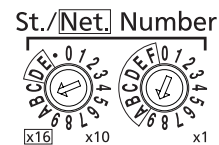
This completes the station number setting.

Note: When the power is turned ON in normal mode, the station number is set to the value of "St./Net. Number setting switch". After setting the station number, do not change the "St./Net. No. setting switch".

3. When the power is turned ON with the mode setting switch set to normal mode, CC-Link IE Field network communication starts with the set "Network No." and "Station No.".

(MEMO)

Chapter 4 CC-Link IE Field Network Communication

CC-Link IE Field Network Communication

4-1 Overview of communication

4-1-1 Communication with master station

Data is exchanged between the communication unit and master station using link devices.
There are four types of link devices: "remote input RX", "remote output RY", "remote register RWr", and "remote register RWw".
The link device values of each are periodically updated by cyclic transmission.
Communication unit functions and link device assignments can be checked using the memory map.
By accessing a link device that supports memory map, the master station can use the functions of a communication unit.
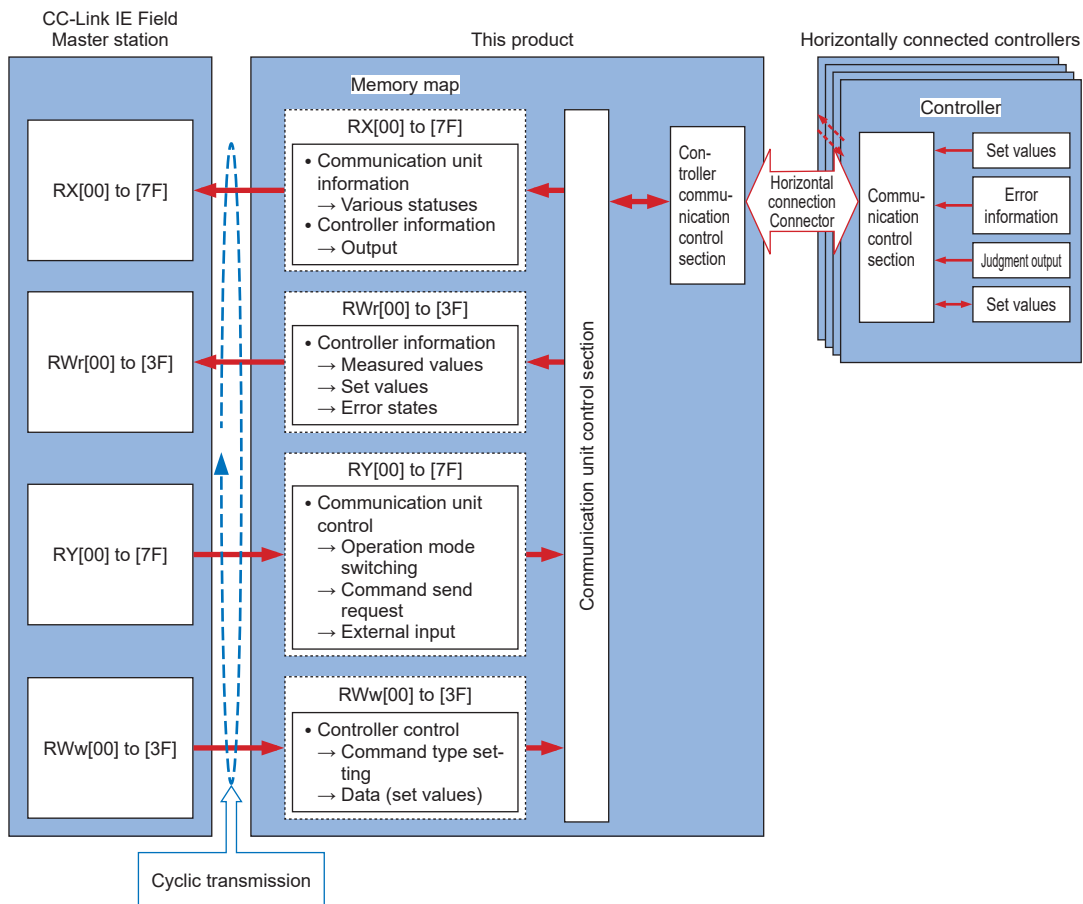
4-1-2 SC-HG1-CEF and controller communication

This product automatically converts CC-Link IE Field network communication data, and performs communication with connected controllers.

CC-Link IE Field network communication can be used to read and write input/output and settings of connected controllers.
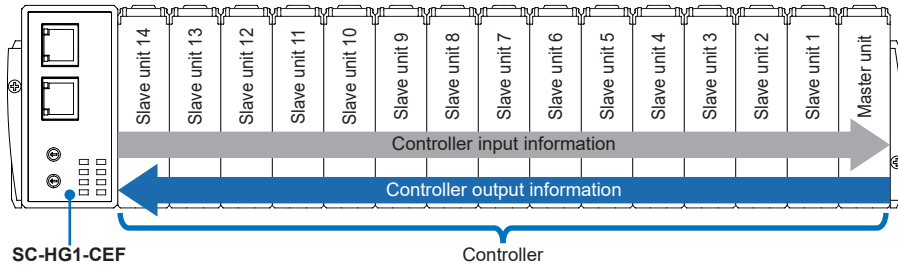
4-2 Memory map

4-2-1 Remote input RX (communication unit to master station)

This is a read-only register for input from the communication unit to the master station in units of bits. Values cannot be written to this register.

Remote input RX

RX	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
+00	Not used	Error code	Not used	Command	Sensor head value	Calcu-lated value	Normal mea-sured value	Judg-ment value	Not used						Error flag	Send done
				Sensor response data switching response											Command response	
+10	Not used															
+20	Not used	Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
						Judgment output 1 (OUT1)										
+30	Not used	Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
						Judgment output 2 (OUT2)										
+40	Not used	Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
						Judgment output 3 (OUT3)										
+50	Not used	Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
						Alarm output										
+60	Commu-nication unit	Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
						Error output										
+70	Not used				Remote ready	Error state	Not used									
					System area											

Setting details

	Name	Device No.	Description
Command response	Send done	RX[00]	RY[00]: Response bit to a send request. This bit is set when transmission of a command to a controller is completed.
	Error flag	RX[01]	This bit is set when the command response from a controller is an error.
Sensor response data switching response(*1)(*2)	Judgment value (*3)	RX[08]	RY[08]: Response bit to a judgment value. This bit is set when judgment value mode is entered.
	Normal mea-sured value(*3)	RX[09]	RY[09]: Response bit to a normal measured value. This bit is set when normal measured value mode is entered.
	Calculated value(*3)	RX[0A]	RY[0A]: Response bit to a calculated value. This bit is set when calculated value mode is entered.
	Sensor head value (*3)	RX[0B]	RY[0B]: Response bit to a sensor head value. This bit is set when sensor head value mode is entered.
	Command	RX[0C]	RY[0C]: Response bit to a command. This bit is set when transmission of commands is allowed.
	Error code	RX[0E]	RY[0E]: Response bit to an error code. This bit is set when error mode is entered.
Judgment output 1 (OUT1)		RX[20 - 2E]	Status of output 1 (OUT1) of a connected controller. This bit is set when the output is ON.

Name		Device No.	Description
Judgment output 2 (OUT2)		RX[30 - 3E]	Status of output 2 (OUT2) of a connected controller. This bit is set when the output is ON.
Judgment output 3 (OUT3)		RX[40 - 4E]	Status of output 3 (OUT3) of a connected controller. This bit is set when the output is ON.
Alarm output (*4)		RX[50 - 5E]	Status of the alarm output of a connected controller. This bit is set when the output is ON.
Error output		RX[60 - 6F]	Status of the error output of a connected controller or the communication unit. When an error occurs, the corresponding bit is set.
System area	Error state	RX[7A]	When an error occurs, the corresponding bit is set. The bit is cleared when the error is cleared.
	Remote ready	RX[7B]	This bit is set when preparation for communication is completed. The bit is cleared when preparation for communication is not completed or an error has occurred.

*1: RY[08] to [0C], RY[0E]: When all sensor response data switch request bits are cleared, RX[08]: judgment value is set.

*2: RY[08] to [0C], RY[0E]: When multiple sensor response data switch request bits are set, a response to the request with the lowest bit number is set.

*3: For information on judgment values, normal measured values, calculated values, and sensor head values, refer to the User's Manual of the controller you are using.

*4: Controller-specific function. For detailed information, refer to the User's Manual of the controller you are using.

*5: Values read in unused areas are not defined.

4-2-2 Remote register RWr (communication unit to master station)

This is a read-only register for input from the communication unit to the master station in units of words (16 bits).
Values cannot be written to this register.

Remote register RWr

RWr	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
+0	Not used	Command response sensor														
		Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
+1	Command response code															
+2	Sensor response data Master unit (32 bits)															
+3																
+4	Sensor response data Slave unit 1 (32 bits)															
+5																
+6	Sensor response data Slave unit 2 (32 bits)															
+7																
+8	Sensor response data Slave unit 3 (32 bits)															
+9																
+A	Sensor response data Slave unit 4 (32 bits)															
+B																
+C	Sensor response data Slave unit 5 (32 bits)															
+D																
+E	Sensor response data Slave unit 6 (32 bits)															
+F																
+10	Sensor response data Slave unit 7 (32 bits)															
+11																
+12	Sensor response data Slave unit 8 (32 bits)															
+13																
+14	Sensor response data Slave unit 9 (32 bits)															
+15																
+16	Sensor response data Slave unit 10 (32 bits)															
+17																
+18	Sensor response data Slave unit 11 (32 bits)															
+19																
+1A	Sensor response data Slave unit 12 (32 bits)															
+1B																
+1C	Sensor response data Slave unit 13 (32 bits)															
+1D																
+1E	Sensor response data Slave unit 14 (32 bits)															
+1F																
+20	Communication unit status (valid when "Error code: RY[0E] is 1", 0 in all other modes)															
+21																
+22 〜 +3F	Not used															

Setting details

Name	Device No.	Description
Command response sensor	RWr[0]	The bit corresponding to the controller which returned a response to a command or mode is set.
Command response code	RWr[1]	The command code sent to the controller is stored.
Sensor response data	RWr[2 - 1F]	The response data from the controller to which a command or mode was sent is stored.
Communication unit status	RWr[20 - 21]	When error mode is set, the communication unit error code is stored. "0x0000" is stored when there is no error in the communication unit or error mode is not in effect.

*1: Values read in unused areas are not defined.

4-2-3 Remote output RY (master station to communication unit)

This is a write-only register for output from the master station to the communication unit in units of bits.

Remote output RY

RY	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
+00	Sensor response data switching request								Not used						Command request	
	Not used	Error code	Not used	Command	Sensor head value	Calculated value	Normal measured value	Judgment value							Write flag	Send request
+10	Not used															
+20	Not used	External input 1 (IN1)														
		Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
+30	Not used	External input (IN2)														
		Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
+40	Not used	External input (IN3)														
		Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
+50	Not used															
+60																
+70																

Setting details

	Name	Device No.	Description
Command request	Send request	RY[00]	Send command to controller request bit. When this bit is set, a command is sent. To send a subsequent command, clear the bit and then set again.
	Write flag	RY[01]	To execute a read command, clear this bit. To execute a write command, set this bit. RY[00]: Set before a send request.
Sensor response data switching request (*1)(*2)	Judgment value (*3)	RY[08]	Change to judgment value mode. When the bit is set, the mode changes to judgment value mode.
	Normal measured value (*3)	RY[09]	Change to normal measured value mode. When the bit is set, the mode changes to normal measured value mode.
	Calculated value (*3)	RY[0A]	Change to calculated value mode. When the bit is set, the mode changes to calculated value mode.
	Sensor head value (*3)	RY[0B]	Change to sensor head value mode. When the bit is set, the mode changes to sensor head value mode.
	Command	RY[0C]	Allow command sending. When this bit is set, command sending is allowed. Set before a command request (RY[00]: send request).
	Error code	RY[0E]	Change to error mode. When this bit is set, the mode changes to error mode.
External input 1 (IN1) (*4)		RY[20 - 2E]	Controls external input 1 on the controller. When this bit is set, external input 1 turns ON.
External input 2 (IN2) (*4)		RY[30 - 3E]	Controls external input 2 on the controller. When this bit is set, external input 2 turns ON.
External input 3 (IN3) (*4)		RY[40 - 4E]	Controls external input 3 on the controller. When this bit is set, external input 3 turns ON.

*1: RY[08] to [0C], RY[0E]: When all sensor response data switch request bits are cleared, the RY[08]: judgment value bit is set and the corresponding operation takes place.

*2: RY[08] to [0C], RY[0E]: When multiple sensor response data switch request bits are set, the request with the lowest bit number is given priority.

*3: For information on judgment values, normal measured values, calculated values, and sensor head values, refer to the User's Manual of the controller you are using.

*4: Operation depends on the controller set value. To use external input, refer to the User's Manual of the controller you are using.

*5: If it is necessary to use the unused area, always set to "0".

4-2-4 Remote register RWw (master station to communication unit)

This is a write-only register for output from the master station to the communication unit in units of words (16 bits).

Remote register RWw

RWw	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
+0	Not used	Command request sensor														
		Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
+1	Command code															
+2	Command data Master unit (32 bits)															
+3																
+4	Command data Slave unit 1 (32 bits)															
+5																
+6	Command data Slave unit 2 (32 bits)															
+7																
+8	Command data Slave unit 3 (32 bits)															
+9																
+A	Command data Slave unit 4 (32 bits)															
+B																
+C	Command data Slave unit 5 (32 bits)															
+D																
+E	Command data Slave unit 6 (32 bits)															
+F																
+10	Command data Slave unit 7 (32 bits)															
+11																
+12	Command data Slave unit 8 (32 bits)															
+13																
+14	Command data Slave unit 9 (32 bits)															
+15																
+16	Command data Slave unit 10 (32 bits)															
+17																
+18	Command data Slave unit 11 (32 bits)															
+19																
+1A	Command data Slave unit 12 (32 bits)															
+1B																
+1C	Command data Slave unit 13 (32 bits)															
+1D																
+1E	Command data Slave unit 14 (32 bits)															
+1F																
+20	Not used															
⁀																
+3F																

Setting details

Name	Device No.	Description
Command request sensor	RWw[0]	Specify the controller for sending a command. The command is sent to the controller whose bit is set.
Command code	RWw[1]	Set the command code to be sent to the controller.
Command data	RWw[2 - 1F]	Set the controller set value according to the command to be sent.

*1: If it is necessary to use the unused area, always set to "0".

4-3 Memory map and controller assignments

- This product can be connected to a maximum of 15 controllers (one master controller, 14 slave controllers).
- To enable data communication with connected controllers (master unit and slave units), the memory map contains a communication register for each controller.
- The controllers are assigned to register positions in the memory map based on the position in which each is connected.

> 🛈 The controllers are automatically assigned in the memory map starting from the master unit and continuing in order from slave unit 1. The order cannot be changed.

SC-HG1-CEF　　　　　　　Controller

RWr	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
+0	Not used	|← Command response sensor →|														
		Slave unit 14	Slave unit 13	Slave unit 12	Slave unit 11	Slave unit 10	Slave unit 9	Slave unit 8	Slave unit 7	Slave unit 6	Slave unit 5	Slave unit 4	Slave unit 3	Slave unit 2	Slave unit 1	Master unit
+1	Command response code															
+2	Sensor response data															
+3	Master unit (32 bits)															
+4	Sensor response data															
+5	Slave unit 1 (32 bits)															
+6	Sensor response data															
+7	Slave unit 2 (32 bits)															
+8	Sensor response data															
+9	Slave unit 3 (32 bits)															
+A	Sensor response data															
+B	Slave unit 4 (32 bits)															
+C	Sensor response data															
+D	Slave unit 5 (32 bits)															
+E	Sensor response data															
+F	Slave unit 6 (32 bits)															
+10	Sensor response data															
+11	Slave unit 7 (32 bits)															
+12	Sensor response data															
+13	Slave unit 8 (32 bits)															
+14	Sensor response data															
+15	Slave unit 9 (32 bits)															
+16	Sensor response data															
+17	Slave unit 10 (32 bits)															
+18	Sensor response data															
+19	Slave unit 11 (32 bits)															
+1A	Sensor response data															
+1B	Slave unit 12 (32 bits)															
+1C	Sensor response data															
+1D	Slave unit 13 (32 bits)															
+1E	Sensor response data															
+1F	Slave unit 14 (32 bits)															
+20	Communication unit status (valid when mode switching is "error: RY[0E] is 1". "0" in all other modes)															
+21																
+22	Not used															
≀																
+3F																

In the case of the Master unit, the unit is assigned to the register indicated by the arrow.

In the case of Slave 14, the unit is assigned to the register indicated by the arrow.

*1: Registers other than RWr remote registers that are assigned in the same way also exist.
For information on the memory map, refer to **"4-2 Memory map"**.

4-4 Initial operation after power is turned ON

After the power is turned ON, the communication unit cannot start communication until it completes initial transient processing such as initialization.
When the unit is ready for communication, the RX[7B]: remote ready flag bit is automatically set.
Check that the RX[7B]: remote ready flag bit is set before executing communication.
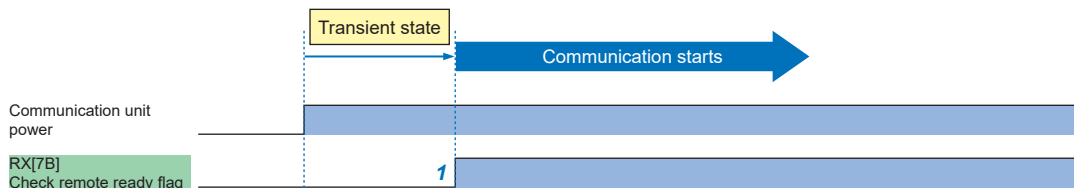
1. When initialization is completed after the power is turned ON, the RX[7B]: remote ready flag is automatically set.

If the RX[7B]: remote ready flag is not set after the power is turned ON, startup may have failed.
Check the communication unit connection and settings, and turn ON the power again.

4-5 Judgment output reading

You can get the external output and alarm output of each controller by reading RX[20] to [2E], RX[30] to [3E], RX[40] to [4E], and RX[50] to [5E] in the memory map.
These values are always kept updated to the most recent state, so operations such as command setting are not needed.
For detailed information on external output and alarm functions, refer to the User's Manual of the controller you are using.

Auto

Remote output RX (**SC-HG1-CEF**→ master)

RX	Sensor / Function	F Communi-cation unit	E Slave unit 14	D Slave unit 13	C Slave unit 12	B Slave unit 11	A Slave unit 10	9 Slave unit 9	8 Slave unit 8	7 Slave unit 7	6 Slave unit 6	5 Slave unit 5	4 Slave unit 4	3 Slave unit 3	2 Slave unit 2	1 Slave unit 1	0 Master unit
+20	OUT1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30	OUT2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+40	OUT3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+50	Alarm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Example: To check the external output signal and alarm function signal of slave unit 2, read RX[22], [32], [42], [52].

Example: To check the external output signal and alarm function signal of the master unit, read RX[20], [30], [40], [50].

4-6 External input

Control of external input from the master unit and external input from this product unit is by OR operation.
External input operation depends on the controller settings. For detailed information, refer to the User's Manual of the controller you are using.

When the external input of either turns ON, controller ON operation is executed.

Controller - Master unit

SC-HG1-CEF
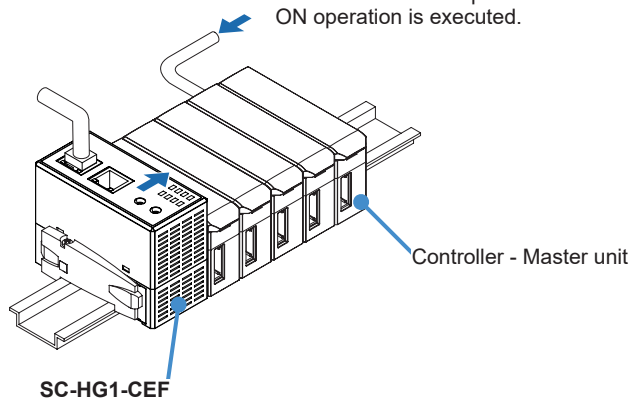
4-7 Continuous reading of measurement data

If you want to continuously read judgment values, normal measured values, calculated values, and sensor head values at once from all connected controllers, you can use a sensor response data switching request to change to each mode and continuously read the values without the need for commands.

Measurement mode	Description
Judgment value	Judgment values are read continuously.
Normal measured value	Normal measured values are read continuously.
Calculated value	Calculated values are read continuously.
Sensor head value	Sensor head values are read continuously.

An example of reading judgment values when a master unit and slave units 1 to 3 are connected is shown below.
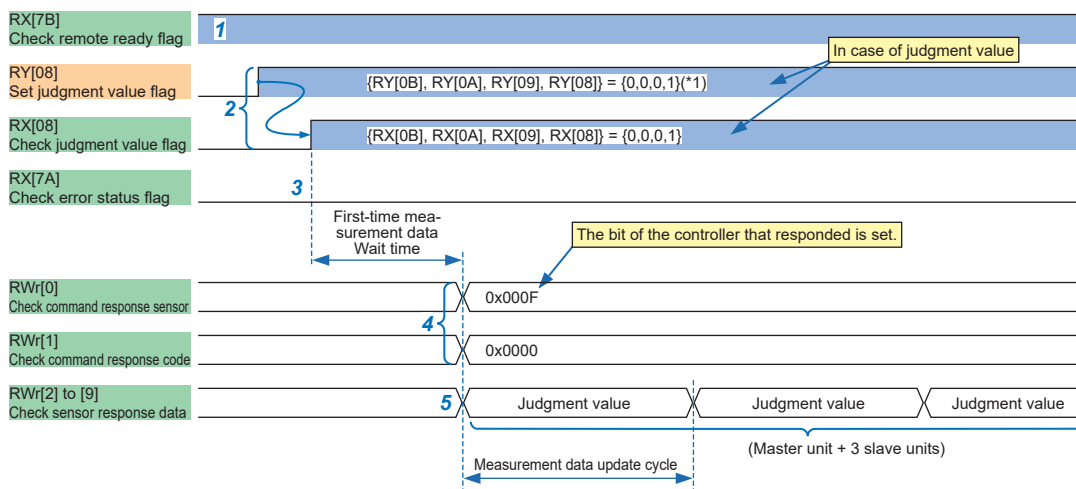
1. Check that the RX[7B]: remote ready flag is set.

2. Set the RY[08]: judgment value flag bit. Judgment value reading is requested and the RX[08]: judgment value flag is set. Clear sensor response data switching request flags other than the judgment value flag in advance.
The values will be as shown in the table below depending on the measurement mode that is read.

Measurement mode	RY[0B]	RY[0A]	RY[09]	RY[08]
Judgment value	0	0	0	1
Normal measured value	0	0	1	0
Calculated value	0	1	0	0
Sensor head value	1	0	0	0

*1: If all sensor response data switching requests are cleared, the mode will default to judgment value read mode. RX[08]: The judgment value flag is set.

3. Verify that a communication error has not occurred with the RX[7A]: error flag cleared. If a communication error has occurred, refer to **"8-2 Communication errors"**.

4. After the first-time measurement data wait time elapses, the bits corresponding to all connected controllers (master unit, slave unit 1, slave unit 2, slave unit 3: 0x000F) are set in RWr[0]: command response sensor. The RWr[1]: command response code is "0".

5. The judgment values are repeatedly stored in an area equivalent to master unit + three slave units of RWr[2] to [9]: sensor response data. The measurement data update cycle is indicated in the table below.

Measurement mode	Update cycle (ms)
Judgment value	1
Normal measured value	15
Calculated value	5
Sensor head value	15

The first time measurement data is saved, a wait time occurs.
Measurement data update cycle ≤ First-time measurement data wait time ≤ (Measurement data update cycle + 2ms)

*2: If the remote ready flag was cleared, the values may not be correctly acquired. Periodically check if the remote ready flag is set.

4-8 Error mode

To read the error code of an error that recently occurred, use error mode.

If multiple errors occurred sequentially, only the error code of the last error is read.

Codes can only be read of errors that occurred since the communication unit power was turned ON. When the communication unit is restarted, the codes of errors that occurred prior to that time are cleared.

For details on errors, refer to **"Table of error codes"** in **"8-1 Command error"**.

An example when a master unit and slave units 1 to 3 are connected is shown below.
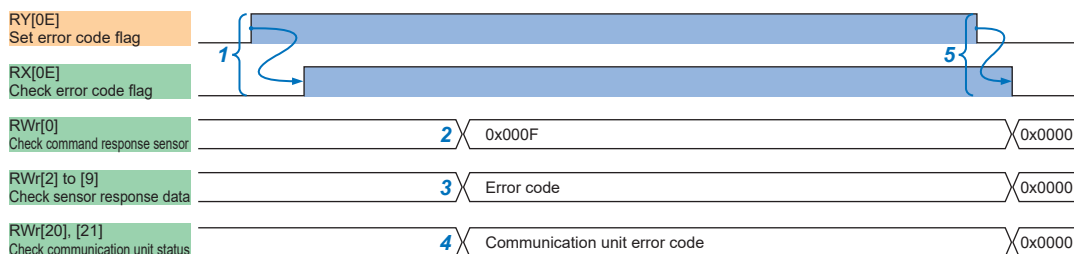
1. Set the RY[0E]: error code flag. Verify that the RX[0E]: error code flag is set and error mode has been entered.
2. The bits corresponding to the controllers from which responses were received (master unit, slave unit 1, slave unit 2, slave unit 3: 0x000F) are set in RWr[0]: command response sensor.
3. The error codes from the controllers are stored in RWr[2] to [9].
4. If there was an error in the communication unit, the error code is stored in RWr[20], [21].
5. Clear the RY[0E]: error code flag. The communication unit exits error mode, and the RX[0E]: error code flag is cleared.

4-9 Commands

4-9-1 HG-S series command list

Reading / writing of controller settings / statuses and parameters used in commands are shown in the table below.
For detailed information on an item, refer to the **"HG-S User's Manual"**

Attributes R: Read, W: Write, R/W: Both Read and Write

	Command	Attribute	Name	Response/Setting parameter
HG-S Series	0x0001	R	Status/Error	When status is normal = 0 When error occurs = Error code
	0x0002 to 0x0004	-	System reserved	Do not use.
	0x0005	W	Controller reset	Reset the controller. (Master unit only)
	0x0006	W	Initialization (RESET)	Return the settings to the factory default state. Do not specify "0".
	0x0007 to 0x000F	-	System reserved	Do not use.
	0x0010	R	Judgment value (JUDGE.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0011	R	Normal measured value (NORM.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0012	R	Calculated value (CALC)	Integer indicating minimum resolution units of controller. If a calculated value is not set, the judgment value is output. -1999999 to 1999999
	0x0013	R	Sensor head measured value (HEAD.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0014	R/W	LOW set value (LO.SET)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0015	R/W	HIGH set value (HI.SET)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0016 to 0x0017	-	System reserved	Do not use.
	0x0018	R/W	Hysteresis (HYSTER)	Integer indicating minimum resolution units of controller. 0 to 1999999
	0x0019	-	System reserved	Do not use.
	0x001A	R/W	Output operation (OUTPUT)	0: N.O. 1: N.C.
	0x001B	-	System reserved	Do not use.
	0x001C	R	Output state	bit0: External output 1 (0 = OFF / 1 = ON) bit1: External output 2 (0 = OFF / 1 = ON) bit2: External output 3 (0 = OFF / 1 = ON) The high bit is "0".
	0x001D	R	Input state	bit0: External input 1 (0 = OFF / 1 = ON) bit1: External input 2 (0 = OFF / 1 = ON) bit2: External input 3 (0 = OFF / 1 = ON) The high bit is "0".
	0x001E	W	Execute bank load (LOAD)	Bank numbers 1 to 3 are loaded
	0x001F	W	Execute bank save (SAVE)	Bank numbers 1 to 3 are saved
	0x0020	R/W	Key lock (LOCK)	0: Key lock OFF 1: Key lock ON
	0x0021	R/W	Eco mode (ECO)	0: Eco mode OFF 1: Eco mode ON
	0x0022	R	Maximum value during P-P measurement	Integer indicating minimum resolution units of controller. If the measurement mode is not P-P or P-P/2, a judgment value is output. -1999999 to 1999999

Command	Attribute	Name	Response/Setting parameter
0x0023	R	Minimum value during P-P measurement	Integer indicating minimum resolution units of controller. If the measurement mode is not P-P or P-P/2, a judgment value is output. -1999999 to 1999999
0x0024 to 0x003F	-	System reserved	Do not use.
0x0040	R/W	Preset (PRESET)	0: OFF 1: ON
0x0041	R/W	Preset value (PR. VAL)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0042	R/W	Preset data selection (PR.OBJ)	0: Normal measured value (NORM.V) 1: Judgment value (JUDGE.V)
0x0043	R/W	Preset save (PR.SAVE)	0: OFF 1: ON
0x0044	R/W	Label 1 (LABEL)	Label [1st to 4th character] Part of character code is usable. (Note 1)
0x0045	R/W	Label 2 (LABEL)	Label [5th to 6th character] Part of character code is usable. (Note 1)
0x0046	R/W	Response time (SPEED)	0: 3ms 1: 5ms 2: 10ms 3: 100ms 4: 500ms 5: 1000ms
0x0047	R/W	Measurement direction (DIRECT)	0: Normal display 1: Reverse display
0x0048	R/W	Alarm delay count (DELAY)	Delay count: 1 to 1000
0x0049	R/W	Teaching type (TEACH)	0: 1-point teaching 1: 2-point teaching 2: 3-point teaching
0x004A	R/W	Input all (ALL IN)	0: Individual input 1: Simultaneous input
0x004B	R/W	External input (EXT.IN)	0: Preset / Reset / Trigger (P/R/T) 1: Bank A / Bank B / Preset (BANK/P) 2: Bank A / Bank B / Reset (BANK/R) 3: Bank A / Bank B / Trigger (BANK/T)
0x004C	R/W	External output (EXT.OUT)	0: 3-value (3VAL) 1: 2-value (2VAL) 2: Logic (LOGIC) 3: Logic 2 (LOGIC2)
0x004D	R/W	Analog scaling (ANALOG)	0: Default 1: Free
0x004E	R/W	Scaling upper limit value (ANA.HI)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x004F	R/W	Scaling lower limit value (ANA.LO)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0050	R/W	Number of digits displayed (DIGIT)	0: 0.0001 1: 0.001 2: 0.01 3: 0.1
0x0051	R/W	Calibration selection (CAL.SEL)	0: Default 1: User setting
0x0052	W	1st point calibration execution (CL.SET1)	Acquire the first point measurement value. Specify "0".
0x0053	R/W	2nd point calibration target value (AJ.VAL2)	Integer indicating minimum resolution units of controller. -1999999 to 1999999

HG-S series

Command	Attribute	Name	Response/Setting parameter
0x0054	W	2nd point calibration execution (CL.SET2)	Acquire the 2nd point measurement value. Specify "0".
0x0055	R/W	1-point teaching tolerance setting (TOL<±>)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0056	W	1st point teaching execution (SET.1)	Execute 1st point of teaching. Specify "0".
0x0057	W	2nd point teaching execution (SET.2)	Execute 2nd point of teaching. Specify "0".
0x0058	W	3rd point teaching execution (SET.3)	Execute 3rd point of teaching. Specify "0".
0x0059 to 0x005D	-	SOther model command area	Do not use.
0x005E to 0x009F	-	System reserved	Do not use.
0x00A0	R	Fault	bit0 : Controller memory function damaged bit1 : Sensor head memory function damaged bit2 : Output section short-circuit error bit3 : Detection circuit damaged bit4 : System error
0x00A1	-	System reserved	Do not use.
0x00A2	R	Notification	bit0 : Sensor head unconnected bit2 : Connected unit count check error bit3 : NPN / PNP output type mixture error bit4 : Calculated unlit count error bit5 : Copy executionerror (Slave unit problem) bit10 : Out-of-specification pressure error bit11 : Catch check bit12 : Pressure check
0x00A3 to 0x00FF	-	System reserved	Do not use.
0x0100	R/W	Leverage ratio (LEVER)	Leverage ratio ×10 1 to 1000
0x0101	R/W	Pressure check (PRS.CHK)	0: OFF 1: ON
0x0102	R/W	Set value for pressure check (PRS.SET)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0103	R/W	Stuckness check (CAT.CHK)	0: OFF 1: ON
0x0104	R/W	Hold setting (HOLD)	Set the sum of the values below according to the states of the measurement mode, trigger mode, self trigger edge direction, and self trigger delay settings. • Measurement mode (MEAS) 0x0000 = Sample hold 0x1000 = Peak hold 0x2000 = Bottom hold 0x3000 = Peak to peak hold 0x4000 = Peak to peak hold P-P/2 0x5000 = NG hold 0x6000 = Self sample hold 0x7000 = Self peak hold 0x8000 = Self bottom hold • Trigger mode (TRIG) 0x000 = One-shot 0x100 = Hold • Self trigger edge direction (SLF.EDG) 0x00 = Rising 0x10 = Falling • Self trigger delay (SLF.DLY) 0x0 = Static width 0x1 = Delay timer

HG-S series

Command	Attribute	Name	Response/Setting parameter
0x0105	R/W	Self trigger level (SLF.LV)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0106	R/W	Static width (DLY.WD)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0107	R/W	Self trigger delay timer (DLY.TIM)	Delay time: 0 to 9999ms
0x0108	R/W	Calculation mode (MODE) / Calculation application selection (APPLI)	0: No calculation 1: Maximum value (MAX) 2: Minimum value (MIN) 3: Flatness (FLAT) 4: Average value (AVERAG) 5: Standard difference (STAND) 6: Torsion (TORSIN) 7: Curvature (CURVEA) 8: Thickness/Width (THICK)
0x0109	R/W	Copy select individual (CPY.SEL)	0: Not target / 1: Target For each target, set 0 or 1 for the bit. bit0 : Response time bit1 : Leverage ratio bit2 : Preset save bit3 : Preset data bit4 : Preset value bit5 : Hysteresis bit6 : LOW set value bit7 : HIGH set value bit8 : Measurement direction bit9 : Teaching type bit10 : Number of digits displayed bit11 : Eco mode bit12 : External output bit13 : External input bit14 : Hold setting bit15 : Output operation bit22 : Alarm setting bit23 : Tolerance <±>
0x010A	W	Copy execution (CPY.EXE)	Execute copying. Specify "0".
0x010B	R/W	Copy lock (LOCK)	0: Copy lock OFF 1: Copy lock ON
0x010C	R/W	Bank save selection (BNK.DAT)	0: All 1: HIGH set value, LOW set value 2: HIGH set value, LOW set value, preset value
0x010D	R/W	Display switching mode	0: Normal measured value 1: Calculated value (during calculation) 2: Label 3: LOW set value 4: HIGH set value 5: Sensor head measured value
0x010E	R	Total stroke operation log (SUM.REC)	Units of 1 m
0x010F	R	Maximum peak value (MAX.VAL)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0110	R	Maximum peak value operation log (MAX.REC)	Units of 1 m
0x0111	R	Overstroke log (OVR.NUM)	Number of times
0x0112	R/W	Connected unit count check (CON.CHK) (Note 2)	0: OFF 1: ON

HG-S series

Notes: 1) Usable ASCII character codes (0x20 is a "space")

		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
									1st digit								
2nd digit	0																
	1																
	2	/		-		+	*										
	3		>		<			9	8	7	6	5	4	3	2	1	0
	4	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A	
	5				\		Z	Y	X	W	V	U	T	S	R	Q	P
	6																
	7																

2) This function can be used on **HG-SC** series controllers manufactured in February 2019 and later.

4-9-2 HG-T series command list

Reading / writing of controller settings / statuses and parameters used in commands are shown in the table below.
For detailed information on an item, refer to the **"HG-T User's Manual"**

Attributes R: Read, W: Write, R/W: Both Read and Write

	Command	Attribute	Name	Response/Setting parameter
HG-T series	0x0001	R	Status/Error	When status is normal = 0 When error occurs = Error code
	0x0002 to 0x0004	-	System reserved	Do not use.
	0x0005	W	Controller reset	Reset the controller. (Master unit only)
	0x0006	W	Initialization (RESET)	Return the settings to the factory default state. Do not specify "0".
	0x0007 to 0x000F	-	System reserved	Do not use.
	0x0010	R	Judgment value (JUDGE.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0011	R	Normal measured value (NORM.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0012	R	Calculated value (CALC)	Integer indicating minimum resolution units of controller. If a calculated value is not set, the judgment value is output. -1999999 to 1999999
	0x0013	R	Sensor head measured value (HEAD.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0014	R/W	LOW set value (LO.SET)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0015	R/W	HIGH set value (HI.SET)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
	0x0016 to 0x0017	-	System reserved	Do not use.
	0x0018	R/W	Hysteresis (HYSTER)	Integer indicating minimum resolution units of controller. 0 to 1999999
	0x0019	-	System reserved	Do not use.
	0x001A	R/W	Output operation (OUTPUT)	0: N.O. 1: N.C.
	0x001B	-	System reserved	Do not use.
	0x001C	R	Output state	bit0: External output 1 (0 = OFF / 1 = ON) bit1: External output 2 (0 = OFF / 1 = ON) bit2: External output 3 (0 = OFF / 1 = ON) The high bit is "0".
	0x001D	R	Input state	bit0: External input 1 (0 = OFF / 1 = ON) bit1: External input 2 (0 = OFF / 1 = ON) bit2: External input 3 (0 = OFF / 1 = ON) The high bit is "0".
	0x001E	W	Execute bank load (LOAD)	Bank numbers 1 to 3 are loaded
	0x001F	W	Execute bank save (SAVE)	Bank numbers 1 to 3 are saved
	0x0020	R/W	Key lock (LOCK)	0: Key lock OFF 1: Key lock ON
	0x0021	R/W	Eco mode (ECO)	0: Eco mode OFF 1: Eco mode ON

Command	Attribute	Name	Response/Setting parameter
0x0022	R	Maximum value during P-P measurement	Integer indicating minimum resolution units of controller. If the measurement mode is not P-P, a judgment value is output. -1999999 to 1999999
0x0023	R	Minimum value during P-P measurement	Integer indicating minimum resolution units of controller. If the measurement mode is not P-P, a judgment value is output. -1999999 to 1999999
0x0024 to 0x003F	-	System reserved	Do not use.
0x0040	R/W	Preset (PRESET)	0: OFF 1: ON
0x0041	R/W	Preset value (PR. VAL)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0042	R/W	Preset data selection (PR.OBJ)	0: Normal measured value (NORM.V) 1: Judgment value (JUDGE.V)
0x0043	R/W	Preset save (PR.SAVE)	0: OFF 1: ON
0x0044	R/W	Label 1 (LABEL)	Label [1st to 4th character] Part of character code is usable. (Note 1)
0x0045	R/W	Label 2 (LABEL)	Label [5th to 6th character] Part of character code is usable. (Note 1)
0x0046	R/W	Average count (SPEED)	0: 1 time 1: 2 times 2: 4 times 3: 8 times 4: 16 times 5: 32 times 6: 64 times 7: 128 times 8: 256 times 9: 512 times 10: 1024 times
0x0047	R/W	Measurement direction (DIRECT)	0: TOP 1: BOTTOM
0x0048	R/W	Alarm delay count (DELAY)	Delay count: 1 to 1000
0x0049	R/W	Teaching type (TEACH)	0: 1-point teaching 1: 2-point teaching 2: 3-point teaching
0x004A	R/W	Input all (ALL IN)	0: Individual input 1: Simultaneous input
0x004B	R/W	External input (EXT.IN)	0: Preset / Reset / Trigger (P/R/T) 1: Bank A / Bank B / Preset (BANK/P) 2: Bank A / Bank B / Reset (BANK/R) 3: Bank A / Bank B / Trigger (BANK/T) 4: Preset / Trigger / Laser emission stop (P/T/L)
0x004C	R/W	External output (EXT.OUT)	0: 3-value (3VAL) 1: 2-value (2VAL) 2: Logic (LOGIC) 3: Logic 2 (LOGIC2) 4: Hold (HOLD)
0x004D	R/W	Analog scaling (ANALOG)	0: Default 1: Free
0x004E	R/W	Scaling upper limit value (ANA.HI)	Integer indicating minimum resolution units of controller. -1999999 to 1999999

HG-T series

Command	Attribute	Name	Response/Setting parameter
0x004F	R/W	Scaling lower limit value (ANA.LO)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0050	R/W	Number of digits displayed (DIGIT)	1: 0.001 2: 0.01 3: 0.1
0x0051	R/W	Calibration selection (CAL.SEL)	0: Default 1: User setting 2: Calibration start
0x0052	W	1st point calibration execution (CL.SET1)	Acquire the first point measurement value. Specify "0".
0x0053	R/W	2nd point calibration target value (AJ.VAL2)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0054	W	2nd point calibration execution (CL.SET2)	Acquire the 2nd point measurement value. Specify "0".
0x0055	R/W	1-point teaching tolerance setting (TOL<±>)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x0056	W	1st point teaching execution (SET.1)	Execute 1st point of teaching. Specify "0".
0x0057	W	2nd point teaching execution (SET.2)	Execute 2nd point of teaching. Specify "0".
0x0058	W	3rd point teaching execution (SET.3)	Execute 3rd point of teaching. Specify "0".
0x0059	R/W	Sampling cycle (SAMPLI)	0: Standard sampling (NORMAL) 1: High-speed sampling (HI-SPD)
0x005A	R/W	Analog output selection (A/O.SEL)	0: Voltage output 1: Current output
0x005B	R/W	External output delay timer selection (OUT.DLY)	0: OFF 1: On delay 2: Off delay 3: Single shot delay
0x005C	R/W	External output delay timer time (OD.TIME)	1 to 9999ms
0x005D	R/W	1st point calibration target value (AJ.VAL1)	Integer indicating minimum resolution units of controller -1999999 to 1999999
0x005E to 0x009F	–	System reserved	Do not use.
0x00A0	R	Fault	bit0 : Controller memory function damaged bit1 : Sensor head memory function damaged bit2 : Output section short-circuit error bit3 : Detection circuit damaged bit4 : System error
0x00A1	R	Caution	bit0 : Controller cumulative run time limit exceeded bit1 : Sensor head cumulative run time limit exceeded bit2 : Controller memory saving count limit exceeded bit3 : Sensor head memory saving count limit exceeded
0x00A2	R	Notification	bit0 : Sensor head unconnected bit1 : Connected sensor head incompatible bit2 : Connected unit count check error bit3 : NPN / PNP output type mixture error bit4 : Calculated unlit count error bit5 : Copy executionerror (Slave unit problem) bit16 : Detection capability limit(obtained edge information) bit17 : Ambient light bit18 : Stain check bit20 : Reverse insertion check
0x00A3 to 0x00FF	–	System reserved	Do not use.

HG-T Series

Command	Attribute	Name	Response/Setting parameter
0x0100 to 0x0112	–	Other model command area	Do not use.
0x0113 to 0x02FF	–	System reserved	Do not use.
0x0300	R/W	Operation mode (OP.MODE)	0: Auto edge detection mode 1: Edge detection mode 2: External form/width detection mode 3: Inside diameter/gap detection mode 5: Center position detection mode 8: User assigned edge detection mode
0x0301	-	System reserved	Do not use.
0x0302	R/W	edge1 (EDGE1)	0: TOP 1~10: 1st to 10th counting from TOP 255: BOTTOM
0x0303	R/W	edgw2 (EDGE2)	0: TOP 1~10: 1st to 10th counting from TOP 255: BOTTOM
0x0304	R/W	Sensitivity setting (SEN.ADJ)	0: DEFAULT 1: USER
0x0305	R/W	Judgment level (JDG.LVL)	10 to 90
0x0306	R/W	Judgment filter (JDG.FIL)	3 to 50
0x0307	R/W	Reference waveform save (BW.SAVE)	0: OFF 1: ON
0x0308	R/W	Interference prevention function (INTF.PR)	0: OFF 1: ON
0x0309	R/W	Alarm state selection (ALM.CND)	0: HOLD (hold previous value) 1: ALARM (alarm output)
0x030A to 0x030B	-	System reserved	Do not use.
0x030C	R/W	Stain check (STA.CHK)	0: Stain check OFF (OFF) 1: Low sensitivity setting ON (LOW) 2: High sensitivity setting ON (HIGH) 3: User setting ON (USER)
0x030D	R/W	Stain threshold (STA.THR)	50 to 95
0x030E	R/W	Hold setting (HOLD)	Set the sum of the values below according to the states of the measurement mode and trigger mode settings. • Measurement mode (MEAS) 0x0000 = Sample hold 0x1000 = Peak hold 0x2000 = Bottom hold 0x3000 = Peak to peak hold 0x4000 = Peak to peak hold P-P/2 0x5000 = NG hold 0x0900 = Tab Cancellation • Trigger mode (TRIG) 0x000 = One-shot 0x100 = Hold
0x030F to 0x0311	-	System reserved	Do not use.
0x0312	R/W	Tab threshold (TB.THRS)	1000~200000
0x0313	R/W	Tab counts (TB.CNT)	5~23
0x0314 to 0x0315	-	System reserved	Do not use.
0x0316	R/W	Calculation mode (MODE) / Calculation application selection (APPLI)	0: No calculation 1: Maximum value (MAX) 2: Minimum value (MIN) 4: Average value (AVERAG) 5: Standard difference (STAND) 8: Thickness/Width (THICK)

HG-T Series

	Command	Attribute	Name	Response/Setting parameter
HG-T Series	0x0317	R/W	Copy select individual (CPY.SEL)	0 = Not target / 1 = Target For each target, set the bit to 0 or 1. Bit 0: Operation mode selection Bit 1: Measurement direction Bit 2: HIGH set value Bit 3: LOW set value Bit 4: Hysteresis Bit 5: Teaching type Bit 6: Tolerance setting Bit 7: Preset value Bit 8: Preset data selection Bit 9: Preset save Bit 10: Reference waveform save Bit 11: Average count Bit 12: Output pattern Bit 13: Analog output selection Bit 14: Hold setting Bit 15: External input Bit 16: External output Bit 17: External output delay timer selection Bit 18: Number of digits displayed Bit 19: Eco mode Bit 20: Alarm Bit 21: Key lock setting selection Bit 22: Reverse of measured value
	0x0318	-	System reserved	Do not use.
	0x0319	W	Copy execution (CPY.EXE)	Execute copying. Specify "0".
	0x031A	R/W	Copy lock (LOCK)	0: Copy lock OFF 1: Copy lock ON
	0x031B	R/W	Bank save selection (BNK.DAT)	0: All 1: HIGH set value, LOW set value 2: HIGH set value, LOW set value, preset value
	0x031C	R/W	Display switching mode	0: Normal measured value 1: Calculated value (during calculation) 2: Label 3: LOW set value 4: HIGH set value 5: Sensor head measured value 6: Work insertion direction (Note 2)
	0x031D	R	Controller cumulative run time (RUN.TIM)	Units of 1 hour
	0x031E	R	Sensor head cumulative run time (HD.TIME)	Units of 1 hour
	0x031F to 0x0322	-	System reserved	Do not use.
	0x0323	R/W	Connected unit count check (CON.CHK)	0: OFF 1: ON
	0x0324	R/W	Key lock (KEYLOC)	0: MANUAL 1: AUTO
	0x0325	R/W	Reverse insertion check (DIR.CHK)	0: OFF 1: ON

	Command	Attribute	Name	Response/Setting parameter
HG-T Series	0x0326	R	Work insertion direction state (Note 2)	• Auto edge detection mode 0: TOP 1: BOTTOM 2: Indeterminate • Edge detection mode, center position detection mode 0: TOP 1: BOTTOM 2: Indeterminate • External form / width detection mode, inside diameter / gap detection mode, User assigned edge detection mode 2: Indeterminate
	0x0327 to 0x035F	-	System reserved	Do not use.
	0x0360	W	Beam axis adjustment mode start	Start beam axis adjustment. Specify "0". Always send during measurement.
	0x0361	R	Beam axis adjustment status	(see table below)
	0x0362	W	Reference waveform registration execution	Execute reference waveform registration. Specify "0". Always send with beam axis in aligned state
	0x0363	R	Reference waveform registration status	0: Registration completed 1: Registration failed 2: Registering
	0x0364	W	Beam axis adjustment end	End beam axis adjustment. Specify "0".
	0x0365 to 0x036F	-	System reserved	Do not use.

Response/Setting parameter for 0x0361:

bit0 to bit12: Reserved

bit15	bit14	bit13	Beam axis state
0	0	0	Immediately after beam axis adjustment starts
0	0	1	Beam axis aligned state
0	1	0	Receiver has shifted toward TOP side (emitter has shifted toward BOTTOM side)
0	1	1	Receiver has shifted toward BOTTOM side (emitter has shifted toward TOP side)
1	0	0	Beam axis is completely out of position (fully blocked state)
1	0	1	The light intensity is too much
1	1	0	The light intensity is too little
1	1	1	Objects intercepting light or stains (adhering substances) exist inside measurement area

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Command	Attribute	Name	Response/Setting parameter
0x0370	R	Waveform read setting (Note 3)	bit0 to bit7 : Select a waveform type. 　0x00 : Reference waveform 　0x10 : Waveform during beam axis adjustment 　0x11 : Measured waveform bit8　　　　: Reserved bit9　　　　: Status 　0: Waveform information has not been saved 　(For example, immediately after the unit starts up, operation mode is changed, or measured values are reset) 　1: Waveform information has been saved bit10 to bit15: Reserved
	W		bit0 to bit7 : Select a waveform type. 　0x00 : Reference waveform 　0x10 : Received light waveform during beam axis adjustment 　0x11 : Measured waveform bit8 to bit15 : Reserved 　Always set "0x01".
0x0371	R	Waveform read data 1	Obtains four bytes of received light waveform data ("Received light intensity 0" to "Received light intensity 3")
0x0372	R	Waveform read data 2	Obtains four bytes of received light waveform data ("Received light intensity 4" to "Received light intensity 7")
0x0373	R	Waveform read data 3	Obtains four bytes of received light waveform data ("Received light intensity 8" to "Received light intensity 11")
0x0374	R	Waveform read data 4	Obtains four bytes of received light waveform data ("Received light intensity 12" to "Received light intensity 15")
0x0375	R	Waveform read data 5	Obtains four bytes of received light waveform data ("Received light intensity 16" to "Received light intensity 19")
0x0376	R	Waveform read data 6	Obtains four bytes of received light waveform data ("Received light intensity 20" to "Received light intensity 23")
0x0377	R	Waveform read data 7	Obtains four bytes of received light waveform data ("Received light intensity 24" to "Received light intensity 27")
0x0378	R	Waveform read data 8	Obtains four bytes of received light waveform data ("Received light intensity 28" to "Received light intensity 31")
0x0379	R	Waveform read data 9	Obtains four bytes of received light waveform data ("Received light intensity 32" to "Received light intensity 35")
0x037A	R	Waveform read data 10	Obtains four bytes of received light waveform data ("Received light intensity 36" to "Received light intensity 39")
0x037B	R	Waveform read data 11	Obtains four bytes of received light waveform data ("Received light intensity 40" to "Received light intensity 43")

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Command	Attribute	Name	Response/Setting parameter
0x037C	R	Waveform read data 12	Obtains four bytes of received light waveform data ("Received light intensity 44" to "Received light intensity 47")
0x037D	R	Waveform read data 13	Obtains four bytes of received light waveform data ("Received light intensity 48" to "Received light intensity 51")
0x037E	R	Waveform read data 14	Obtains four bytes of received light waveform data ("Received light intensity 52" to "Received light intensity 55")
0x037F	R	Waveform read data 15	Obtains four bytes of received light waveform data ("Received light intensity 56" to "Received light intensity 59")
0x0380	R	Waveform read data 16	Obtains four bytes of received light waveform data ("Received light intensity 60" to "Received light intensity 63")
0x0381	R	Waveform read data 17	Obtains four bytes of received light waveform data ("Received light intensity 64" to "Received light intensity 67")
0x0382	R	Waveform read data 18	Obtains four bytes of received light waveform data ("Received light intensity 68" to "Received light intensity 71")
0x0383	R	Waveform read data 19	Obtains four bytes of received light waveform data ("Received light intensity 72" to "Received light intensity 75")
0x0384	R	Waveform read data 20	Obtains four bytes of received light waveform data ("Received light intensity 76" to "Received light intensity 79")
0x0385	R	Waveform read data 21	Obtains four bytes of received light waveform data ("Received light intensity 80" to "Received light intensity 83")
0x0386	R	Waveform read data 22	Obtains four bytes of received light waveform data ("Received light intensity 84" to "Received light intensity 87")
0x0387	R	Waveform read data 23	Obtains four bytes of received light waveform data ("Received light intensity 88" to "Received light intensity 91")
0x0388	R	Waveform read data 24	Obtains four bytes of received light waveform data ("Received light intensity 92" to "Received light intensity 95")
0x0389	R	Waveform read data 25	Obtains four bytes of received light waveform data ("Received light intensity 96" to "Received light intensity 99")
0x038A	R	Waveform read data 26	Obtains four bytes of received light waveform data ("Received light intensity 100" to "Received light intensity 103")
0x038B	R	Waveform read data 27	Obtains four bytes of received light waveform data ("Received light intensity 104" to "Received light intensity 107")
0x038C	R	Waveform read data 28	Obtains four bytes of received light waveform data ("Received light intensity 108" to "Received light intensity 111")
0x038D	R	Waveform read data 29	Obtains four bytes of received light waveform data ("Received light intensity 112" to "Received light intensity 115")
0x038E	R	Waveform read data 30	Obtains four bytes of received light waveform data ("Received light intensity 116" to "Received light intensity 119")

Note: The leftmost column spans all rows with the vertical label "HG-T Series".

Command	Attribute	Name	Response/Setting parameter
0x038F	R	Waveform read data 31	Obtains four bytes of received light waveform data ("Received light intensity 120" to "Received light intensity 123")
0x0390	R	Waveform read data 32	Obtains four bytes of received light waveform data ("Received light intensity 124" to "Received light intensity 127")
0x0391	R	Waveform read data 33	Obtains four bytes of received light waveform data ("Received light intensity 128" to "Received light intensity 131")
0x0392	R	Waveform read data 34	Obtains four bytes of received light waveform data ("Received light intensity 132" to "Received light intensity 135")
0x0393	R	Waveform read data 35	Obtains four bytes of received light waveform data ("Received light intensity 136" to "Received light intensity 139")
0x0394	R	Waveform read data 36	Obtains four bytes of received light waveform data ("Received light intensity 140" to "Received light intensity 143")
0x0395	R	Waveform read data 37	Obtains four bytes of received light waveform data ("Received light intensity 144" to "Received light intensity 147")
0x0396	R	Waveform read data 38	Obtains four bytes of received light waveform data ("Received light intensity 148" to "Received light intensity 151")
0x0397	R	Waveform read data 39	Obtains four bytes of received light waveform data ("Received light intensity 152" to "Received light intensity 155")
0x0398	R	Waveform read data 40	Obtains four bytes of received light waveform data ("Received light intensity 156" to "Received light intensity 159")
0x0399	R	Waveform read data 41	Obtains four bytes of received light waveform data ("Received light intensity 160" to "Received light intensity 163")
0x039A	R	Waveform read data 42	Obtains four bytes of received light waveform data ("Received light intensity 164" to "Received light intensity 167")
0x039B	R	Waveform read data 43	Obtains four bytes of received light waveform data ("Received light intensity 168" to "Received light intensity 171")
0x039C	R	Waveform read data 44	Obtains four bytes of received light waveform data ("Received light intensity 172" to "Received light intensity 175")
0x039D	R	Waveform read data 45	Obtains four bytes of received light waveform data ("Received light intensity 176" to "Received light intensity 179")
0x039E	R	Waveform read data 46	Obtains four bytes of received light waveform data ("Received light intensity 180" to "Received light intensity 183")
0x039F	R	Waveform read data 47	Obtains four bytes of received light waveform data ("Received light intensity 184" to "Received light intensity 187")
0x03A0	R	Waveform read data 48	Obtains four bytes of received light waveform data ("Received light intensity 188" to "Received light intensity 191")
0x03A1	R	Waveform read data 49	Obtains four bytes of received light waveform data ("Received light intensity 192" to "Received light intensity 195")

The left side of the table is labeled vertically: **HG-T** Series

Command	Attribute	Name	Response/Setting parameter
0x03A2	R	Waveform read data 50	Obtains four bytes of received light waveform data ("Received light intensity 196" to "Received light intensity 199")
0x03A3	R	Waveform read data 51	Obtains four bytes of received light waveform data ("Received light intensity 200" to "Received light intensity 203")
0x03A4	R	Waveform read data 52	Obtains four bytes of received light waveform data ("Received light intensity 204" to "Received light intensity 207")
0x03A5	R	Waveform read data 53	Obtains four bytes of received light waveform data ("Received light intensity 208" to "Received light intensity 211")
0x03A6	R	Waveform read data 54	Obtains four bytes of received light waveform data ("Received light intensity 212" to "Received light intensity 215")
0x03A7	R	Waveform read data 55	Obtains four bytes of received light waveform data ("Received light intensity 216" to "Received light intensity 219")
0x03A8	R	Waveform read data 56	Obtains four bytes of received light waveform data ("Received light intensity 220" to "Received light intensity 223")
0x03A9	R	Waveform read data 57	Obtains four bytes of received light waveform data ("Received light intensity 224" to "Received light intensity 227")
0x03AA	R	Waveform read data 58	Obtains four bytes of received light waveform data ("Received light intensity 228" to "Received light intensity 231")
0x03AB	R	Waveform read data 59	Obtains four bytes of received light waveform data ("Received light intensity 232" to "Received light intensity 235")
0x03AC	R	Waveform read data 60	Obtains four bytes of received light waveform data ("Received light intensity 236" to "Received light intensity 239")
0x03AD	R	Waveform read data 61	Obtains four bytes of received light waveform data ("Received light intensity 240" to "Received light intensity 243")
0x03AE	R	Waveform read data 62	Obtains four bytes of received light waveform data ("Received light intensity 244" to "Received light intensity 247")
0x03AF	R	Waveform read data 63	Obtains four bytes of received light waveform data ("Received light intensity 248" to "Received light intensity 251")
0x03B0	R	Waveform read data 64	Obtains four bytes of received light waveform data ("Received light intensity 252" to "Received light intensity 255")
0x03B1	R	Edge information at the time of waveform reading	The information to be read differs according to the waveform type selected in "Waveform read setting". See below. • When "Reference waveform" (0x00) is selected →**"4-10-3 Reading reference waveforms"** • When "Waveform during beam axis adjustment" (0x10) is selected →**"4-11 Registering the reference waveform (For the HG-T only)"** • When "Measured waveform" (0x11) is selected →**"4-10-2 Reading measured waveforms"**
0x03B2	R	Measured value at the time of waveform reading (HEAD.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999

The leftmost column is labeled **HG-T** Series (vertical text).

Command	Attribute	Name	Response/Setting parameter
0x03B3	R	Edge position at the time of waveform reading	• Edge position 0 bit8 to bit15: 0x00 to 0xFF • Edge position 1 bit0 to bit7: 0x00 to 0xFF
0x03B4 to 0x03BB	-	System reserved	Do not use.

0x03BC	R	Edge data read setting	bit0 to bit8 : Reserved
			bit9 : Status
			       0: Edge data has not been read
			       (For example, immediately after
			       the unit starts up, operation
			       mode is changed, or measured
			       values are reset)
			       1: Edge data has been read
			bit10 to bit15: Reserved

0x03BC	W	Edge data read setting	bit0 to bit7 : Reserved Always write "0x00". bit8 to : Reserved bit15 Always write "0x01".
0x03BD	R	Edge information at the time of edge data reading	bit0 to bit12: Reserved bits 13 and 14: Edge information 2 (see table below) bit 15: Edge information 1 (see table below)
0x03BE	R	Measured value at the time of edge data reading (HEAD.V)	Integer indicating minimum resolution units of controller. -1999999 to 1999999
0x03BF	R	Edge position at the time of edge data reading	• Edge position 0 bit8 to bit15: 0x00 to 0xFF • Edge position 1 bit0 to bit7: 0x00 to 0xFF
0x03EF	R/W	Reverse of measured value (REVERS)	Enabled/Disabled the reverse of measured value function. 0 : Reverse of measured value disabled 1 : Reverse of measured value enabled

Left vertical label: HG-T Series

Edge information 2 (for 0x03BD):

bit14	bit13	Description
0	0	Both edges disabled (When the beam axis state is "indeterminate", "fully blocked state", or "measurement alarm 1")
0	1	Only one edge enabled
1	0	Both edges enabled

Edge information 1 (for 0x03BD):

bit15	Description
0	Falling edge
1	Rising edge

Notes: 1) Usable ASCII character codes (0x20 is a "space")

2nd digit \ 1st digit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0																
1																
2	/			-		+	*									
3		>		<			9	8	7	6	5	4	3	2	1	0
4	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A	
5				\		Z	Y	X	W	V	U	T	S	R	Q	P
6																
7																

2) In auto edge detection mode, the work insertion direction state is output.
In edge detection mode or center position detection mode, the measurement direction setting is output.

3) For details on how to read waveforms, refer to **"4 -10 Reading received light waveforms (For the HG-T only)"**.

4-9-3 Command sending procedure

Use this procedure to select a destination controller and send a command once only to that controller. There is a slight difference in the operation of read commands and write commands.

Read command sending procedure

This section explains the procedure for using the command transmission function to read controller information.
The example of sending the get judgment value command "0x0010" (Read) to a master unit and slave units 1 to 3 is used.
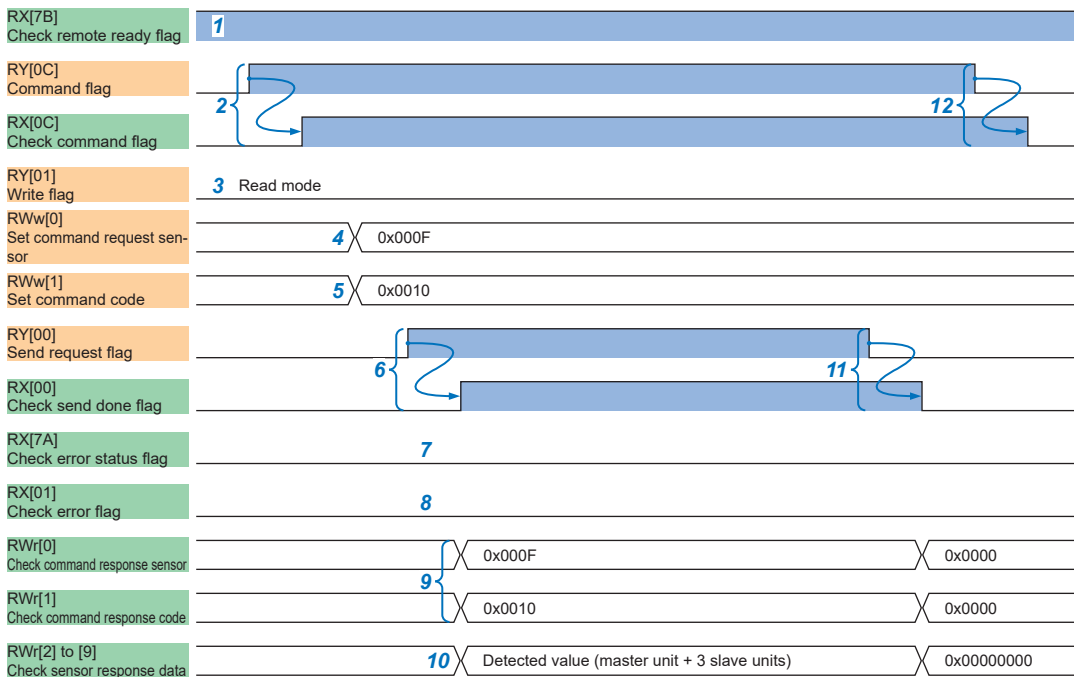
Signal		Value
RX[7B] Check remote ready flag	**1**	
RY[0C] Command flag	**2**	
RX[0C] Check command flag		**12**
RY[01] Write flag	**3** Read mode	
RWw[0] Set command request sensor	**4** 0x000F	
RWw[1] Set command code	**5** 0x0010	
RY[00] Send request flag	**6**	**11**
RX[00] Check send done flag		
RX[7A] Check error status flag	**7**	
RX[01] Check error flag	**8**	
RWr[0] Check command response sensor	**9** 0x000F	0x0000
RWr[1] Check command response code	0x0010	0x0000
RWr[2] to [9] Check sensor response data	**10** Detected value (master unit + 3 slave units)	0x00000000

1. Check that the RX[7B]: remote ready flag is set.
2. Set the RY[0C]: command flag. This puts the communication unit in command mode, and the RX[0C]: command flag is set. Clear sensor response data switching request flags other than the command flag in advance.
3. Clear the RY[01]: write flag and activate Read mode.
4. Specify the controller to which the command will be sent with RWw[0]: command request sensor.
5. Set the command code to be sent to RWw[1].
6. Set RY[00]: send request flag and send the command. When command transmission is completed, RX[00]: send done flag is set. Verify that RX[00]: send done flag is set, and then proceed with the steps below.
7. Verify that a communication error has not occurred with the RX[7A]: error flag cleared. If a communication error has occurred, refer to **"8-2 Communication errors"**.
8. Verify that a command error has not occurred with the RX[01]: error flag cleared. If a command error has occurred, refer to **"8-1 Command error"**.
9. The value specified in step 4 (master unit, slave unit 1, slave unit 2, slave unit 3: 0x000F) is set in RWr[0]: command response sensor. The command code sent to RWr[1] is stored.
10. The Read command response data are stored in an area equivalent to master unit + three slave units of RWr[2] to [9]: sensor response data.
11. Clear the RY[00]: send request flag. The communication unit ends command transmission, and the RX[00]: send done flag is cleared.
12. Clear the RY[0C]: command flag. The communication unit exits command mode, and the RX[0C]: command flag is cleared.

Write command sending procedure

This section explains the procedure for using the command transmission function to write setting information to a controller.

The example of sending the LOW set value command "0x0014" (Write) to a master unit and slave units 1 to 3 is used.

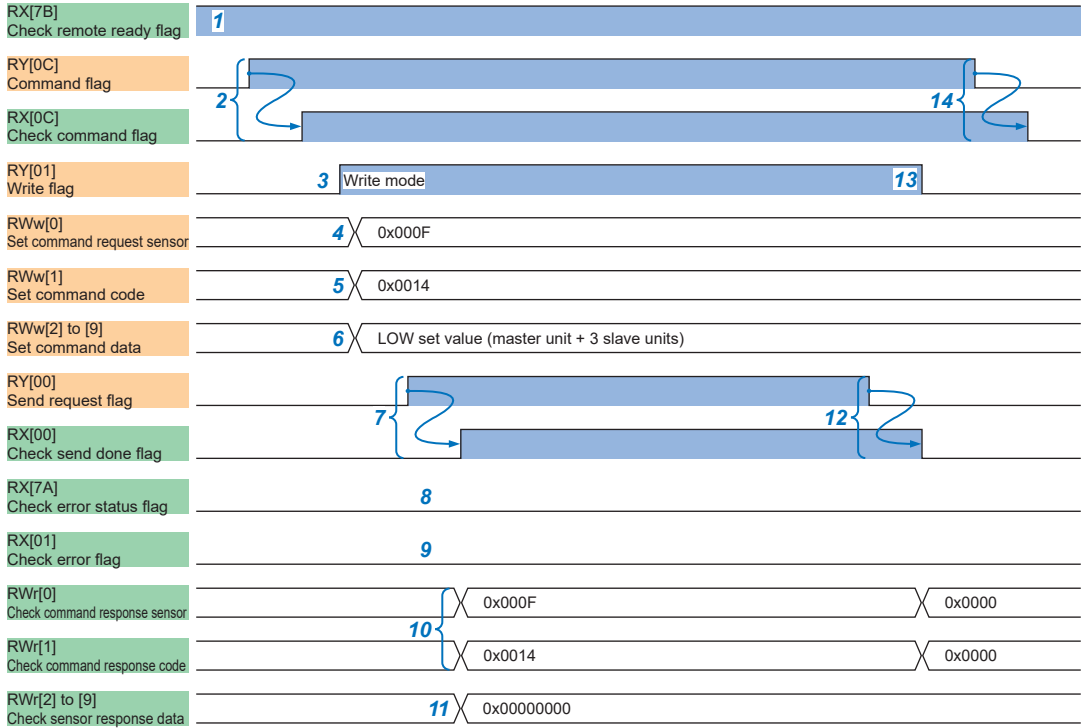| Signal	Description
RX[7B] Check remote ready flag	1
RY[0C] Command flag	2
RX[0C] Check command flag	
RY[01] Write flag	3 Write mode / 13
RWw[0] Set command request sensor	4 0x000F
RWw[1] Set command code	5 0x0014
RWw[2] to [9] Set command data	6 LOW set value (master unit + 3 slave units)
RY[00] Send request flag	7
RX[00] Check send done flag	12
RX[7A] Check error status flag	8
RX[01] Check error flag	9
RWr[0] Check command response sensor	10 0x000F / 0x0000
RWr[1] Check command response code	0x0014 / 0x0000
RWr[2] to [9] Check sensor response data	11 0x00000000

1. Check that the RX[7B]: remote ready flag is set.
2. Set the RY[0C]: command flag. This puts the communication unit in command mode, and the RX[0C]: command flag is set. Clear sensor response data switching request flags other than the command flag in advance.
3. Set the RY[01]: write flag and activate Write mode.
4. Specify the controller to which the command will be sent with RWw[0]: command request sensor.
5. Set the command code to be sent to RWw[1].
6. Set the command data to be sent to RWw[2] to [9].
7. Set RY[00]: send request flag and send the command. When command transmission is completed, RX[00]: send done flag is set. Verify that RX[00]: send done flag is set, and then proceed with the steps below.
8. Verify that a communication error has not occurred with the RX[7A]: error flag cleared. If a communication error has occurred, refer to **"8-2 Communication errors"**.
9. Verify that a command error has not occurred with the RX[01]: error flag cleared. If a command error has occurred, refer to **"8-1 Command error"**.
10. The value specified in step 4 (master unit, slave unit 1, slave unit 2, slave unit 3: 0x000F) is set in RWr[0]: command response sensor. The command code sent to RWr[1] is stored.
11. The RWr sensor response data is "0".
12. Clear the RY[00]: send request flag. The communication unit ends command transmission, and the RX[00]: send done flag is cleared.
13. Clear the RY[01]: write flag.
14. Clear the RY[0C]: command flag. The communication unit exits command mode, and the RX[0C]: command flag is cleared.

4 -10 Reading received light waveforms (For the HG-T only)

When reading received light waveforms, select measured waveforms, reference waveforms, or waveforms during beam axis adjustment (Note 1), so that you can read waveform data and other information.

Note: For details on waveforms during beam axis adjustment, refer to **"4-11 Registering the reference waveform (For the HG-T only)"**.

4-10-1 Format of received light waveform

Reading received light waveforms makes it possible to obtain simplified received light waveforms that represent the maximum received light width (CMOS cell) of the receiver by 256 areas (0 to 255) and the received light intensity by 256 gradations (0 to 255).

● **Measurement start point and measurement end point**

Measurement start points and measurement end points can be obtained only in reference waveform acquisition mode. Obtaining the measurement start point and measurement end point makes it possible to know the range that is used for measurement within the simplified received light waveform.
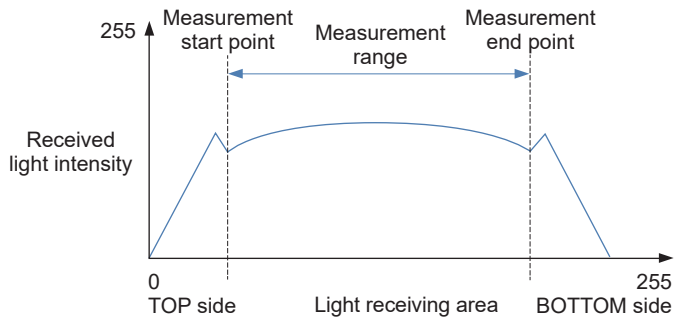
● **Edge information and edge position**

Edge information can be obtained as information indicating a rising edge or falling edge at each edge position (edge information 1) and effective edge mode information (edge information 2). Edge positions are points on the borderline between light interception and light entry within the received light intensity waveform when a measured object is inserted. The edge position on the top side is 0.
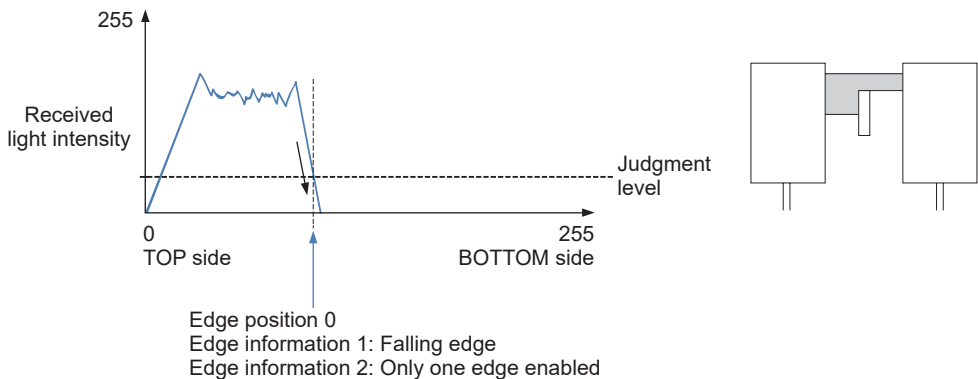
Edge position 0
Edge information 1: Rising edge
Edge information 2: Only one edge enabled

Edge position 0
Edge information 1: Falling
edge
Edge information 2: Both edges
enabled

Edge position 1
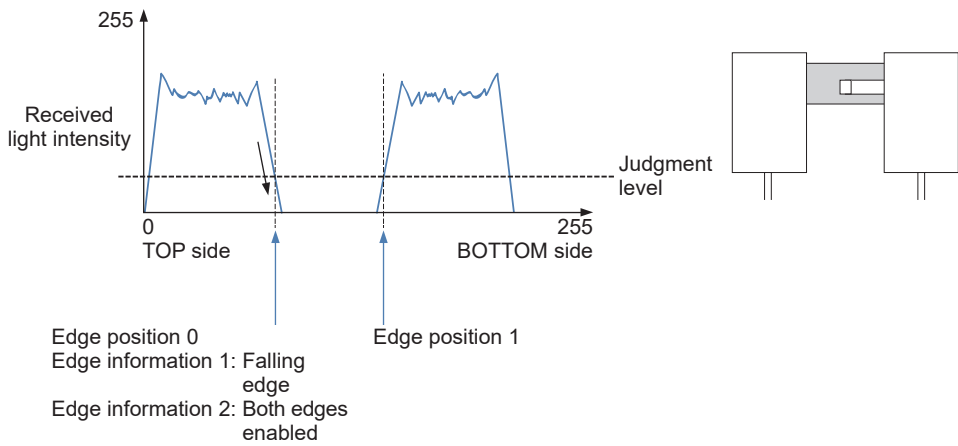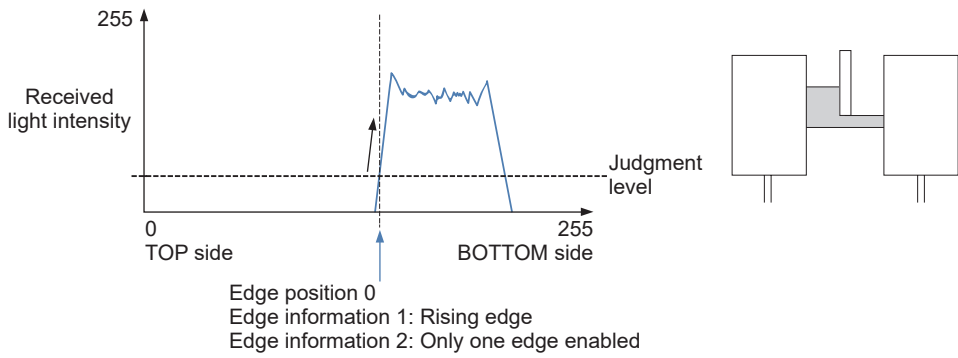
4-10-2 Reading measured waveforms

The following procedure is used to read waveforms.

■ Flowchart of measured waveform reading

1. "Waveform read setting" (WRITE)

The command selects a waveform type (measured waveform).

2. "Waveform read setting" (READ)

The command saves the current waveform information into the controller.

3. "Waveform read data" (READ)

The command reads waveform data.

4. "Measured value at the time of waveform reading [HEAD.V]" (READ)

The command reads the measured value that is associated with the waveform when the waveform is saved.

5. "Edge information at the time of waveform reading" (READ)

The command reads the edge information that is associated with the waveform when the waveform is saved.

6. "Edge position at the time of waveform reading"(READ)

The command reads the edge position associated with the waveform that is saved.

■ Examples of sent commands

1. Send the "Waveform read setting" command (WRITE) to set the waveform type. (Command code: 0x0370)

Send this command only for the first time after starting the communication unit or when switching the type of the waveform to be read.

Write data															
High							Low								
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved (Always write 0x01.)							Waveform type								

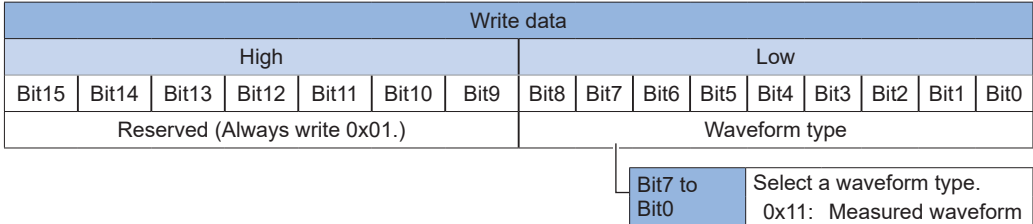| Bit7 to Bit0	Select a waveform type. 0x11: Measured waveform

2. Send the "Waveform read setting" command (READ). (Command code: 0x0370)

If the response is normal, the following response data will be returned.

Read data															
High							Low								
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved						Status	Reserved	Waveform type (0x11: Measured waveform)							

Bit9	Status 1: Waveform information has been saved 0: Waveform information has not been saved (For example, immediately after the unit starts up, operation mode is changed, or measured values are reset)

The waveform information that is obtained when this command is sent will be saved in the controller.

3. Send the "Waveform read data" command (READ). (Command code: 0x0371 to 0x03B0)

The "Waveform read data" command can obtain four bytes of received light data by using a single address. Measured waveform data can be obtained by sending command codes from 0x0371 through to 0x03B0 in this order and then concatenating the data obtained. If the response is normal, the following response data will be returned.

<Example: When the command code is 0x0371>

Read data			
Received light intensity [0] 0x00 to 0xFF	Received light intensity [1] 0x00 to 0xFF	Received light intensity [2] 0x00 to 0xFF	Received light intensity [3] 0x00 to 0xFF

● Reading waveforms continuously
When continuously reading waveforms with the same waveform ID, repeatedly send the commands described in **2.** and subsequent steps. The update interval of compressed waveform information is 64 ms. Leave an interval of at least 1 ms when sending each command.

4. To read the measured value associated with the saved waveform, send the "Measured value at the time of waveform reading [HEAD.V]" command (READ). (Command code: 0x03B2)

If the response is normal, the following response data will be returned.

Read data			
Measured value: Bit 7 to Bit 0	Measured value: Bit 15 to Bit 8	Measured value: Bit 23 to Bit 16	Measured value: Bit 31 to Bit 24
-1999999 to 1999999			

Note: If it is unnecessary to obtain the measured value associated with the waveform, there is no need to send the command.

5. To read the edge information associated with the saved waveform, send the "Edge information at the time of waveform reading" command (READ). (Command code: 0x03B1)

If the response is normal, the following response data will be returned.

Read data															
High								Low							
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Edge information 1	Edge information 2		Reserved					Reserved							

Item	Bit15		Description
Edge information 1	0	Falling edge	Information about whether edge position 0 is a rising edge or falling edge when viewed from the TOP side
	1	Rising edge	

Item	Bit14	Bit13	Set value	Description
Edge information 2	0	0	Both edges disabled ("Indeterminate", "fully blocked state", or "measurement alarm 1")	Information about whether edge positions are disabled or enabled. If edge positions are enabled, this item also identifies whether information for only edge position 0 is enabled or information for both edge position 0 and edge position 1 is enabled.
	0	1	Only one edge enabled	
	1	0	Both edges enabled	

Note: If it is unnecessary to obtain the edge information associated with the waveform, there is no need to send the command.

6. To read the edge position associated with the saved waveform, send the "Edge position at the time of waveform reading" command (READ). (Command code: 0x03B3)

If the response is normal, the following response data will be returned.

Read data															
High								Low							
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Edge position 0 (0x00 to 0xFF)								Edge position 1 (0x00 to 0xFF) (Note 1)							

Notes: 1) If edge information 2 is set to "Only one edge enabled", edge position 1 will be indeterminate.
2) If it is unnecessary to obtain the edge position associated with the waveform, there is no need to send the command.

4-10-3 Reading reference waveforms

The following procedure is used to read waveforms.

■ Flowchart of reference waveform reading

1. "Waveform read setting" (WRITE)

The command selects a waveform type (reference waveform).

2. "Waveform read setting" (READ)

The command saves the current reference waveform information into the controller.

3. "Waveform read data" (READ)

The command reads waveform data.

4. Measurement range
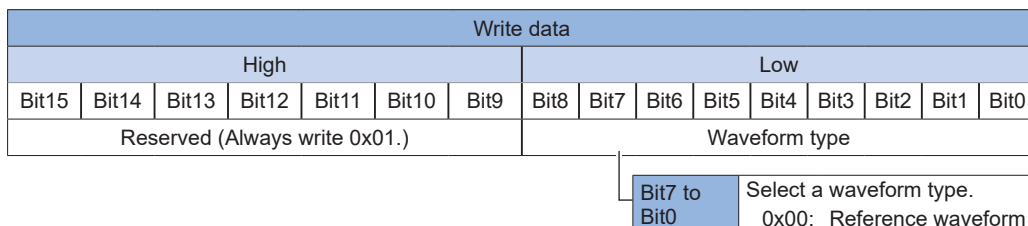   (between the measurement start point and measurement end point)

The command reads the measurement range (between the measurement start point and measurement end point).
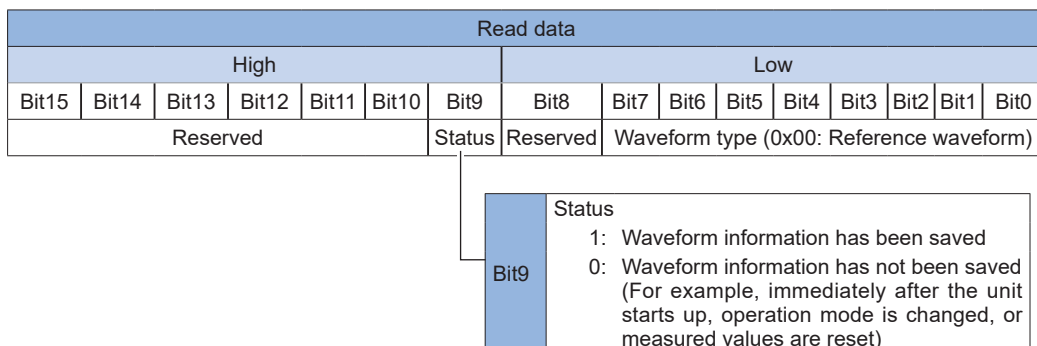
■ Examples of sent commands

1. Send the "Waveform read setting" command (WRITE) to set the waveform type.
(Command code: 0x0370)

Send this command only for the first time after starting the communication unit or when switching the type of the waveform to be read.

Write data															
High							Low								
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved (Always write 0x01.)							Waveform type								

Bit7 to Bit0	Select a waveform type. 0x00: Reference waveform

2. Send the "Waveform read setting" command (READ). (Command code: 0x0370)

If the response is normal, the following response data will be returned.

Read data															
High							Low								
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved						Status	Reserved	Waveform type (0x00: Reference waveform)							

Bit9	Status
	1: Waveform information has been saved
	0: Waveform information has not been saved (For example, immediately after the unit starts up, operation mode is changed, or measured values are reset)

3. Send the "Waveform read data" command (READ). (Command code: 0x0371 to 0x03B0)

The "Waveform read data" command can obtain four bytes of received light data by using a single address. Reference waveform data can be obtained by sending command codes from 0x0371 through to 0x03B0 in this order and then concatenating the data obtained.

If the response is normal, the following response data will be returned.

<Example: When the command code is 0x0371>

Read data			
Received light intensity [0] 0x00 to 0xFF	Received light intensity [1] 0x00 to 0xFF	Received light intensity [2] 0x00 to 0xFF	Received light intensity [3] 0x00 to 0xFF

4. To obtain the measurement range (between the measurement start point and measurement end point), send the "Measurement range acquisition" command (READ) (command code: 0x03B1).

If the response is normal, the following response data will be returned.

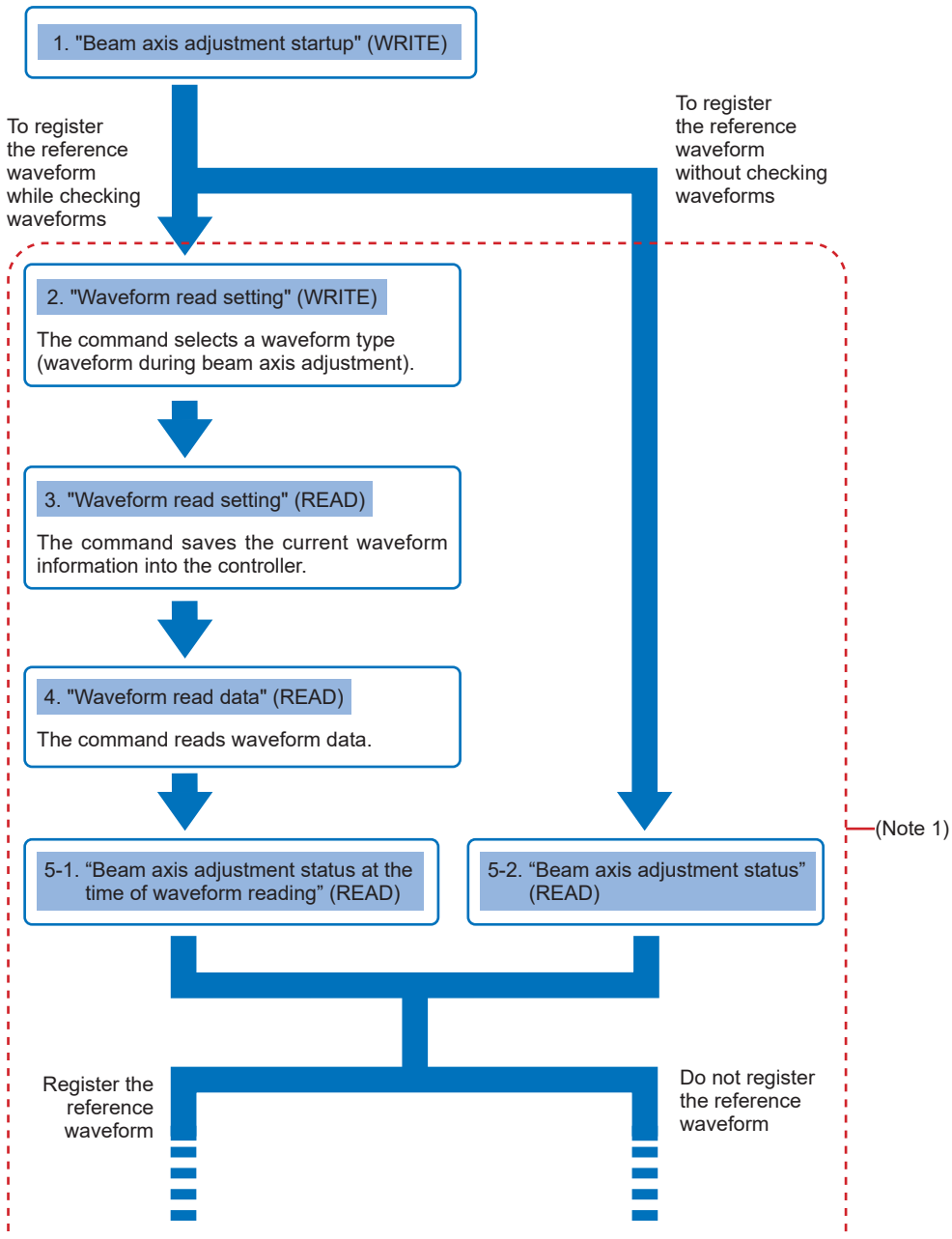| Read data	
Measurement end point	Measurement start point
0x00 to 0xFF	0x00 to 0xFF

Note: If it is unnecessary to obtain the measurement range, there is no need to send the command.

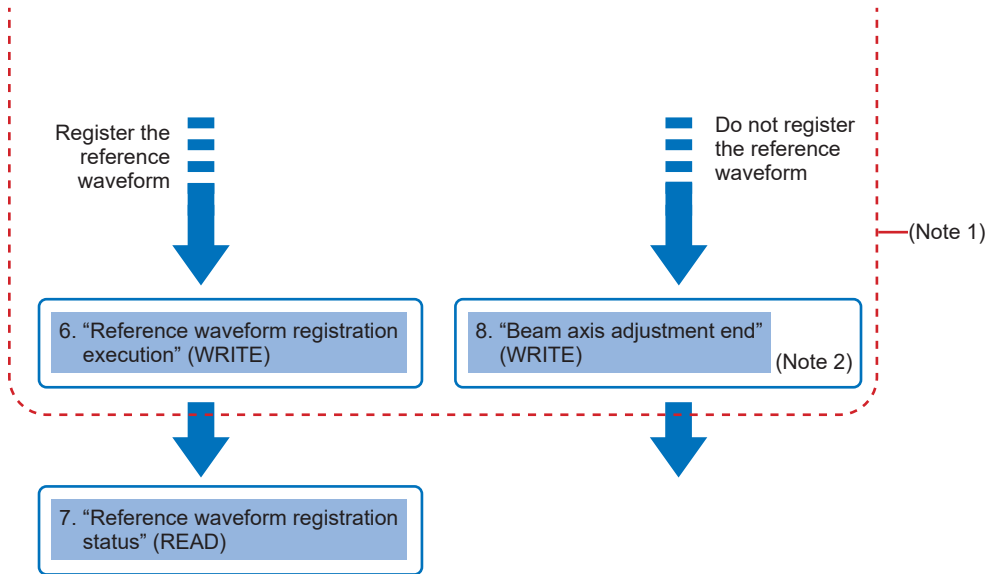## 4-11 Registering the reference waveform (For the HG-T only)

The following flowchart shows the procedure for reading and registering waveforms to register the reference waveform.
To register the reference waveform, you must invoke beam axis adjustment mode.

■ Flowchart of reference waveform registration

1. "Beam axis adjustment startup" (WRITE)

To register the reference waveform while checking waveforms

To register the reference waveform without checking waveforms

2. "Waveform read setting" (WRITE)

The command selects a waveform type (waveform during beam axis adjustment).

3. "Waveform read setting" (READ)

The command saves the current waveform information into the controller.

4. "Waveform read data" (READ)

The command reads waveform data.

(Note 1)

5-1. "Beam axis adjustment status at the time of waveform reading" (READ)

5-2. "Beam axis adjustment status" (READ)

Register the reference waveform

Do not register the reference waveform

Register the
reference
waveform

Do not register
the reference
waveform

(Note 1)

6. "Reference waveform registration
   execution" (WRITE)

8. "Beam axis adjustment end"
   (WRITE)

(Note 2)

7. "Reference waveform registration
   status" (READ)

Notes: 1) The inside of the frame indicated by the red dotted lines represents beam axis adjustment mode.
       2) Beam axis adjustment mode can be terminated at any procedure step by using "8. Beam axis
          adjustment end (WRITE)" command.

■ Examples of sent commands

1. Send the "Beam axis adjustment startup" command (WRITE). (Command code: 0x0360) Write data "0".

To adjust the beam axis without checking waveforms, go to Step **5-2.**

2. Send the "Waveform read setting" command (WRITE) to set the waveform type. (Command code: 0x0370)
Send this command only for the first time after starting the communication unit or when switching the type of the waveform to be read.

Write data															
High							Low								
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved (Always write 0x01.)							Waveform type								

Bit7 to Bit0	Select a waveform type.
	0x10: Waveform during beam axis adjustment

3. Send the "Waveform read setting" command (READ). (Command code: 0x0370)
The waveform information that is obtained when this command is sent will be saved in the controller.

If the response is normal, the following response data will be returned.

Read data															
High							Low								
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved						Status	Reserved	Waveform type (0x10: Waveform during beam axis adjustment)							

Bit9	Status
	1: Waveform information has been saved
	0: Waveform information has not been saved (For example, immediately after the unit starts up, operation mode is changed, or measured values are reset)

4. Send the "Waveform read data" command (READ). (Command code: 0x0371 to 0x03B0)

The "Waveform read data" command can obtain four bytes of received light data by using a single address. Measured waveform data can be obtained by sending command codes from 0x0371 through to 0x03B0 in this order and then concatenating the data obtained.

If the response is normal, the following response data will be returned.

<Example: When the command code is 0x0371>

Read data			
Received light intensity [0] 0x00 to 0xFF	Received light intensity [1] 0x00 to 0xFF	Received light intensity [2] 0x00 to 0xFF	Received light intensity [3] 0x00 to 0xFF

● Reading waveforms continuously

When continuously reading waveforms with the same waveform ID, repeatedly send the commands described in *3.* and subsequent steps. The update interval of compressed waveform information is 64 ms. Leave an interval of at least 1 ms when sending each command.

5. To check the beam axis status, execute either of the following commands.

5-1. To check the beam axis adjustment status after reading the waveform, send the "Beam axis adjustment status at the time of waveform reading" command (READ). (Command code: 0x03B1)

5-2. To check the beam axis adjustment status without reading waveforms, send the "Beam axis adjustment status" command (READ). (Command code: 0x0361)

If the response is normal, the following response data will be returned.

Read data															
High								Low							
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Beam axis state			Reserved												

Details of beam axis status

Bit15	Bit14	Bit13	Beam axis state
0	0	0	Immediately after beam axis adjustment starts
0	0	1	Beam axis aligned state
0	1	0	Receiver has shifted toward TOP side (emitter has shifted toward BOTTOM side)
0	1	1	Receiver has shifted toward BOTTOM side
1	0	0	Beam axis is completely out of alignment (fully blocked state)
1	0	1	The light intensity is too much
1	1	0	The light intensity has decreased
1	1	1	Objects intercepting light or stains (adhering substances) exist inside measurement area

6. To register the reference waveform after checking the beam axis adjustment status, send the "Reference waveform registration execution" command (WRITE). (Command code: 0x0362)
Write data "0".

Notes: 1) To save data in EEPROM when registering the reference waveform with the command, set the "Reference waveform save [BW.SAVE]" command (READ/WRITE) (command code: 0x0307) to ON beforehand.
2) By default, data is not saved in EEPROM when the reference waveform is registered with the command. When the power is turned OFF and then ON again, the reference waveform returns to the pre-registration state.

After the command is executed, the system is automatically reset from beam axis adjustment mode .

7. To check whether the reference waveform has been registered after registering it, send the "Reference waveform registration status" command (READ). (Command code: 0x0363)

If the response is normal, the following response data will be returned.

Read data															
High								Low							
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved														Status	

Details of "Status"

0	The "Reference waveform registration execution" command (WRITE) that was executed last time is successful.
1	The "Reference waveform registration execution" command (WRITE) that was executed last time is unsuccessful and the reference waveform status has not been updated from the previous state. (If the power is turned OFF and then ON, the history of beam axis adjustment failures will be erased.)
2	Reference waveform registration is in progress.

8. To quit beam axis adjustment mode without registering the reference waveform, send the "Beam axis adjustment end" command (WRITE).(Command code: 0x0364)
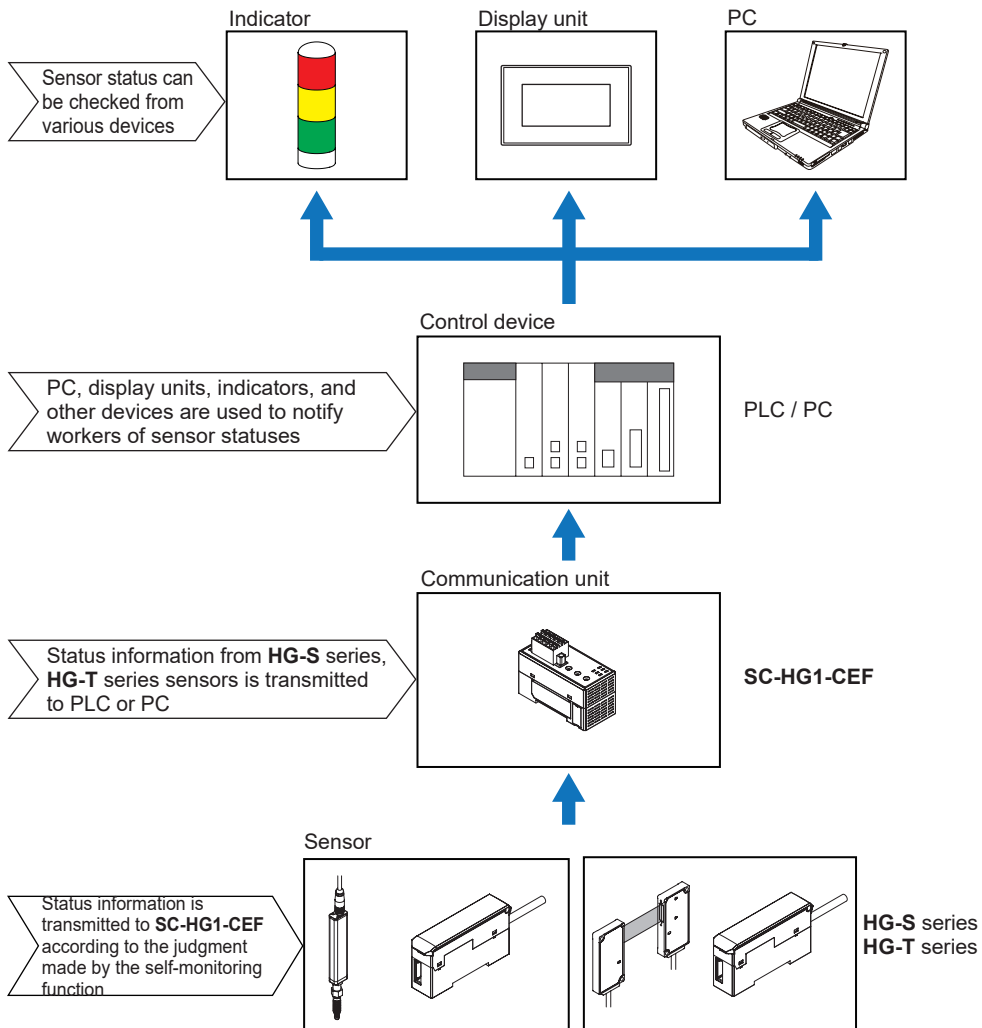
4-12 Self-monitoring Function

Self-monitoring Function enables the sensor itself to judge various statuses ("normal status", "unstable detection status", "caution-required status", and "abnormal status") within its own device and send the status information to the host device. **HG-S** series, and **HG-T** series sensors incorporate the self-monitoring function.

> 🚫 The self-monitoring function is not supported by **SC-HG1-CEF** communication units manufactured in November 2019 or earlier.
> Use a **SC-HG1-CEF** communication unit manufactured in December 2019 or later.

4-12-1 Using the Self-monitoring Function

By combining the control system connected to PLC or PC via a network, this product, and the sensor(**HG-S** series, **HG-T** series) you can easily check the sensor status (normal, notification, caution, or fault).
The sensor itself judges even the causes of cautions and errors, making cause investigation easier.

Indicator　　　　　Display unit　　　　　PC

Sensor status can be checked from various devices

Control device

PC, display units, indicators, and other devices are used to notify workers of sensor statuses

PLC / PC

Communication unit

Status information from **HG-S** series, **HG-T** series sensors is transmitted to PLC or PC

SC-HG1-CEF

Sensor

Status information is transmitted to **SC-HG1-CEF** according to the judgment made by the self-monitoring function

HG-S series
HG-T series

4-12-2 Statuses and Measures

The statuses judged by the self-monitoring function are classified into the following four categories. When the status is "notification", "caution", or "fault", you must check the installation state or maintain or replace the product.

Status	Description	Remarks
Normal	Normal state	The device is operating normally.
Notification	Unstable detection state	Review the settings.
Caution	State in which the device must be replaced	The device has almost reached its service life.
Fault	State in which the device is uncontrollable	The device is short-circuited or broken.

If "notification", "caution", or "fault" status is notified, take measures as shown in the following table.

● **HG-SC** series

For details on Response Parameter adress, refer to **"4-9-1 HG-S series command list"**.

	Response parameter	Measures	Error code (Note)	Alarm (Note)
Notifi-cation	Sensor head unconnected	Status check	E200	–
	Connected unit count check error	Status check	E160 (For master units only)	–
	NPN / PNP output type mixture error	Status check	E100 (For master units only)	–
	Calculated unlit count error	Status check	E110 (For master units only)	–
	Copy executionerror (Slave unit problem)	Status check	E170 (For master units only)	–
	The thrust on the sensor head stroke is above the specified range.	Status check	E210	–
	Pressure check	Status check	–	Alarm
	Catch check	Status check	–	Alarm
Fault	Controller memory function damaged	Controller replacement	E600 / E610 / E620	–
	Sensor Head memory function damaged	Sensor head replacement	E630	–
	Output section short-circuit error	Status check / Replacement	E700	–
	Detection circuit damaged	Sensor head replacement	E240	–
	System error	Controller replacement	E900 / E910 / E911 / E912 / E920	–

Note: Error codes and alarms are displayed on **HG-SC□** controllers.

● **HG-TC** series

For details on Response Parameter adress, refer to **"4-9-2 HG-T series command list"**.

	Response parameter	Measures	Error code (Note 1)	measurement alarm (Note 1)
Notifi-cation	Sensor head unconnected	Status check	E200	–
	Connected sensor head incompatible	Status check	E230	–
	Connected unit count check error	Status check	E160 (For master units only)	–
	NPN / PNP output type mixture error	Status check	E100 (For master units only)	–
	Calculated unlit count error	Status check	E110 (For master units only)	–
	Copy executionerror (Slave unit problem)	Status check	E170 (For master units only)	–
	Detection capability limit (obtained edge information) (Note 2)	Sensing object check	–	Measurement alarm 1
	The amount of entering light is too much due to the influences of ambient light, etc. (Note 2)	Status check	–	Measurement alarm 1
	The amount of entering light decreases due to stain on the detection surface, beam axis misalignment, etc.	Sensing object check	–	Measurement alarm 2
	The specified measurement direction differs from the insertion direction of the detected object	Status check / Sensing object check	–	Measurement alarm 2
Cau-tion	Controller cumulative run time limit exceeded(87,600 hours)	Controller replacement	–	–
	Sensor head cumulative run time limit exceeded (87,600 hours)	Sensor head replacement	–	–
	Controller memory saving count limit exceeded (1,000,000 times)	Controller replacement	–	–
	Sensor head memory saving count limit exceeded (for receivers only, 1,000,000 times)	Sensor head replacement	–	–
Fault	Controller memory function damaged	Controller replacement	E600 / E610 / E620	–
	Sensor head memory function damaged	Sensor head replacement	E630 (For receivers only) E640 (For emitters only)	–
	Output section short-circuit error	Status check / Replacement	E700	–
	Detection circuit damaged	Sensor head replacement	E240	–
	System error	Controller replacement	E900 / E910 / E911 / E912 / E920	–

Notes: 1) Error codes and alarms are displayed on **HG-TC□** controllers.
2) If "Alarm condition selection (ALM.CND)" is set to "Hold last value (HOLD)", Measurement alarm 1 is not notified.

4-13 Other precautions

- For the **HG-T** series controllers, waveform values will be temporarily reset during measurement if the following commands are written.

Command code	Name	Remarks
0x001E	BANK LOAD execution (LOAD)	—
0x0046	Average count (SPEED)	—
0x0047	Measurement direction (DIRECT)	—
0x0048	Alarm delay count (DELAY)	For write only
0x0059	Sampling cycle (SAMPLI)	For write only
0x0300	Operation mode (OP.MODE)	For write only
0x0304	Sensitivity setting	For write only
0x0305	Judgment level (JDG.LVL)	For write only
0x0306	Judgment filter (JDG.FIL)	For write only
0x030C	Stain check (STA.CHK)	For write only
0x030D	Stain threshold (STA.THR)	For write only
0x031E	Sensor head cumulative run time (HD.TIME)	—
0x0325	Reverse insertion check (DIR.CHK)	For write only
0x03EF	Reverse of measured value (REVERS)	For write only

- For the **HG-T** series controllers, approximately five seconds after the power is turned ON, measured values are synchronously collected from the heads connected to each controller.

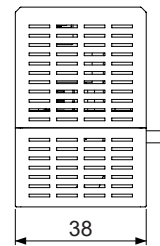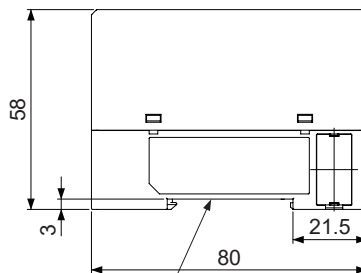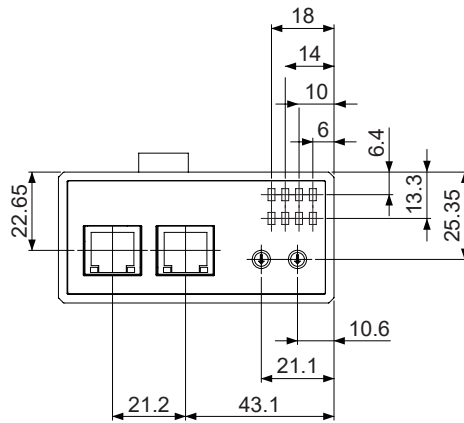# Chapter 5 Specifications

Specifications

5-1 Specifications

Product name	CC-Link IE Field Communication Unit for **HG** Series
Model	**SC-HG1-CEF**
Compatible controllers	**HG-SC□ / HG-TC□**
Maximum number of connectable controllers	Maximum of 15 controllers (one master, 14 slaves) per **SC-HG1-CEF** unit
Supply voltage (Note 1)	24V DC ±10%, including 0.5V ripple (P-P)
Current consumption	200mA or less
Communication method	CC-Link IE Field
Remote station type	Remote device station
Network number setting	1 to 239 (decimal) [1 to EF (hex)] (0 and 240 or higher result in error) (Note 2)
Cyclic transmission (Maximum number of links per station)	RX/RY:128 points each (128 bits), 16 bytes, RWr/RWw: 64 points each (64 words), 128 bytes
Transient transmission	Server function only, data size 1024 bytes
Station number setting	1 to 120 (decimal) (0 and 121 or higher result in error)
Communication speed	1Gbps
Transmission route type	Line type, star type (mixed line type and star type possible), ring type
Maximum transmission distance	100m
Maximum number of units connectable	121 units (1 master station, 120 slave units)
Cascade connection levels	Maximum 20
Ambient temperature	-10 to +45°C (no condensation or icing), Storage: -20 to +60°C
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH
Withstand voltage	1,000V AC for one minute between all supply terminals and case
Insulation resistance	20MΩ or higher, using 250V DC megger connected between all supply terminals and case
Vibration resistance	10 to 150Hz with 0.75mm amplitude in X, Y and Z directions for two hours each
Shock resistance	98m/s^2 (approx. 10G) in X, Y and Z directions 5 times each
Communication cable	Ethernet cable that satisfies 1000BASE-T standard Category 5e or higher (Double-shielded/STP, straight cable) (Note 3)
Material	Unit cases: Polycarbonate
Weight (main unit only)	Approx. 100g
Standards	EU Law : EMC Directive/British Legislation: EMC Regulations (Note 4)

Notes: 1) Power is supplied from a connected controller / master controller.
2) For the network number setting on this product, convert the network number to hex and set the hex value.
3) Use CC-Link Partner Association recommended cable.
4) Always functionally ground the shield wire of Ethernet cable on the host device side.
   This product does not have a ground terminal.
   For detailed information, refer to the "CC-Link IE Field Network Installation Manual" published by the CC-Link Partner Association.

5-2 Dimensions

Units: mm

Compatible with 35mm width DIN rail

(MEMO)

Chapter 6 Warranty

Warranty

6-1 When you purchase and use the product

The product and specifications described in this manual are subject to change without notice (including specification changes and termination of production). When you place an order, check with the representative to make sure the information in the manual is up to date.

Our company works hard to improve product quality and reliability; however, electrical components and devices generally fail at a certain probability rate. The environment and conditions of use also affect durability.

Always conduct testing using the actual product in the conditions of use before deploying the product. Risk of abnormal heat generation, smoke emission, and fire due to isolation deterioration if you continue to use the product after performance has deteriorated. To prevent injury and death, fire, and property damage due to product failure or end of life, conduct regular maintenance and implement safety design such as redundant design, fire spreading countermeasures, and malfunction prevention.

Cautionary points regarding applications

- This product has been developed and manufactured for industrial use only.
- Before using this product in a system, machine, or other equipment, check all applicable standards, regulations, and laws. Please verify the conformity of the product yourself.
  Our company bears no responsibility for product conformity in the event that the customer does not verify these matters.
- Before using the product for the applications below, consult a representative and exchange specifications. To prevent injury and death, fire, and property damage, implement thorough safety design such as redundant design, fire spreading countermeasures, and malfunction prevention.
  - Possibility of use in an environment or under conditions that exceed the specifications and ranges indicated in this catalog, such as outdoor use, use in an chemically contaminated environment, or use in an environment subject to the effects of electromagnetic radiation.
  - Use in transportation equipment or other systems, machinery, instruments, or 24-hour continuous operation systems that pose a potential risk of death, injury, or property damage; especially applications that require high reliability.
  - Any other applications that require a high level of safety in conformity with the above.
- The applications indicated in the catalog are examples for reference only. Verify equipment/system functionality and safety before using the product. This product cannot be used in any human protective detection applications other than that of a safety sensor.
- Always observe the safety information indicated in the catalog and manual to prevent incorrect use that results in unexpected harm or damages to the customer or a 3rd party.

Receiving inspection

- Please conduct receiving inspection promptly when the product is delivered, and implement thorough management maintenance prior to and during inspection of the product.

Warranty period

- Unless otherwise agreed upon, the warranty period for our company's products is one year after purchase or delivery to the customer's specified location. The warranty does not apply to consumables and supplies such as batteries and light-source lamps.

Scope of warranty

- If a failure or defect for which our company is responsible is discovered during the warranty period, our company will provide a substitute product or required replacement parts free of charge, or will replace or repair the defective part free of charge at the location where the product was purchased or delivered.
  Failures and defects to which any of the following apply are excluded.
  (1) The problem originated in the customer's specifications, standards, or handling procedures.
  (2) The problem originated in structural, performance, specification, or other modifications made by the customer after purchase or delivery without our approval.
  (3) The problem was caused by a phenomenon not foreseeable by technology in practical application at the time of purchase or contract.
  (4) The product was used outside of the condition/environment ranges indicated in the catalog and specifications.
  (5) When our product was incorporated and used in the customer's equipment, damages occurred that could have been avoided if the customer's equipment had a structure, functions, or other features commonly accepted in the industry.
  (6) The problem was caused by a natural disaster or other Act of God.

"Warranty" as used here is limited to the product itself that was purchased or delivered. Damages caused by a failure or defect in our product are excluded.

Scope of service

- Expenses for service such as dispatching a technician are not included in the product price.
  If you are interested in service, please consult with a sales representative

The above applies to purchases and use in Japan.
For questions and information on specifications, warranties, and service related to purchases and use in regions other than Japan, please consult a representative.

(MEMO)

Chapter 7 Maintenance

Maintenance

7-1 Maintenance and Inspection

7-1-1 Maintenance cautions

- Always turn OFF the power before cleaning the unit.
- Never use thinner, benzene, or other organic solvents to clean the unit.
- Use a clean, soft cloth to wipe off any dirt that adheres to the unit.

7-1-2 Main inspection items

Inspect the unit regularly to maintain performance and enable optimum use. The main inspection items are as follows:

- Have any input / output terminals become loose or come OFF?
- Is the supplied power within the rated voltage range (24V DC ±10%)?
- Is the ambient operating temperature within the specified range (-10 to +45°C)?
- Is the ambient operating humidity within the specified range (35 to 85% RH)?

Chapter 8 Troubleshooting
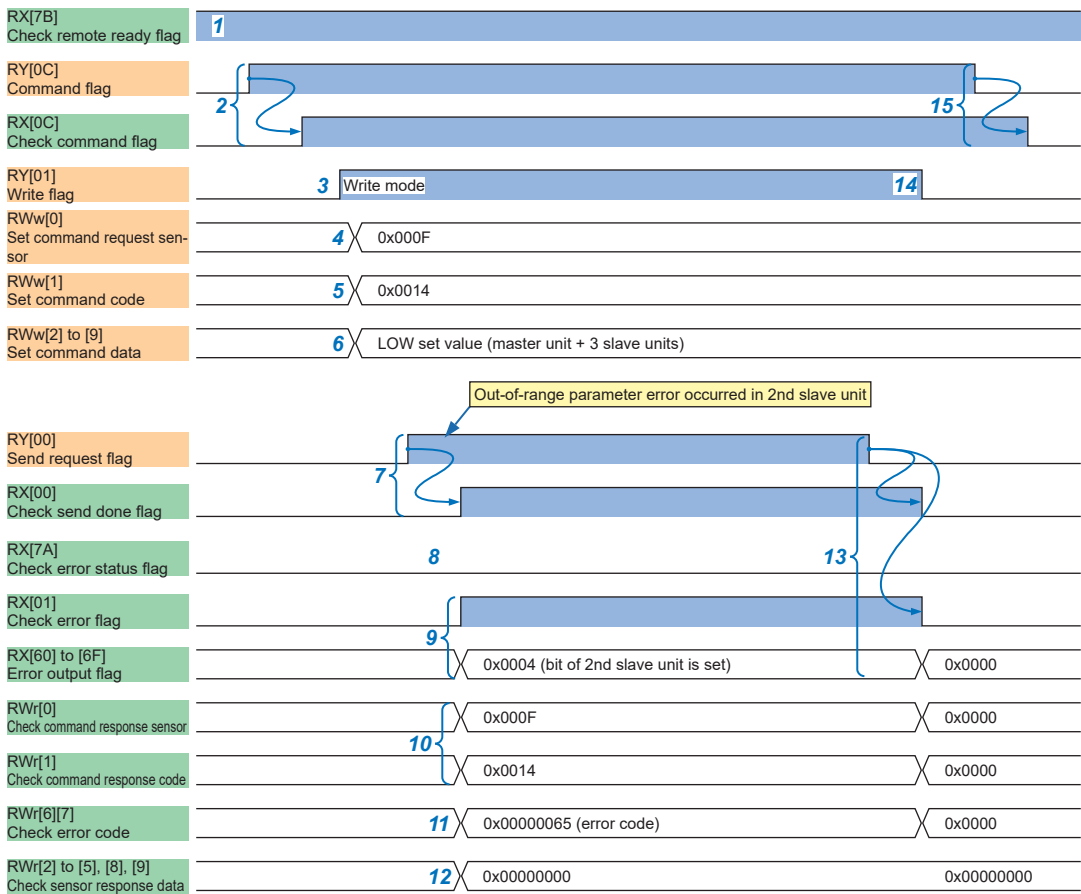
Troubleshooting

Solutions to frequently encountered problems and errors are described below.

8-1 Command error

A command error will occur in response to a sent command if the command setting is outside the range. Check the error code and take appropriate action.
The example of an out-of-range parameter error in slave unit 2 when the LOW set value command "0x0014" (Write) is sent to a master unit and slave units 1 to 3 is given below.
For error codes and solutions, refer to **"Table of error codes"**.

Signal	Description
RX[7B] Check remote ready flag	**1**
RY[0C] Command flag	**2** **15**
RX[0C] Check command flag	
RY[01] Write flag	**3** Write mode **14**
RWw[0] Set command request sensor	**4** 0x000F
RWw[1] Set command code	**5** 0x0014
RWw[2] to [9] Set command data	**6** LOW set value (master unit + 3 slave units)

Out-of-range parameter error occurred in 2nd slave unit

Signal	Description
RY[00] Send request flag	**7**
RX[00] Check send done flag	
RX[7A] Check error status flag	**8** **13**
RX[01] Check error flag	**9**
RX[60] to [6F] Error output flag	0x0004 (bit of 2nd slave unit is set) 0x0000
RWr[0] Check command response sensor	0x000F 0x0000
RWr[1] Check command response code	**10** 0x0014 0x0000
RWr[6][7] Check error code	**11** 0x00000065 (error code) 0x0000
RWr[2] to [5], [8], [9] Check sensor response data	**12** 0x00000000 0x00000000

1. Check that RX[7B]: remote ready flag is set.

2. Set RY[0C]: command flag and then check that RX[0C]: command flag is set. This changes the mode to command mode. Clear sensor response data switching request flags other than the command flag in advance.

3. Set the RY[01]: write flag and activate Write mode.

4. Specify the controller to which the command will be sent with RWw [0]: command request sensor.

5. Set the command code to be sent to RWw [1].

6. Set the command data to be sent to RWw [2] to [9].

7. Set RY[00]: send request flag and send the command. When command transmission is completed, RX[00]: send done flag is set. Verify that RX[00]: send done flag is set, and then proceed with the steps below.

8. Verify that a communication error has not occurred with the RX[7A]: error flag cleared. If a communication error has occurred, refer to **"8-2 Communication errors"**.

9. Because a command error occurred, RX[01]: error flag is set. Among the RX[60] to [6F] error output flags, the bit corresponding to the controller in which the error occurred is set at the same time.

10. The value specified in step 4 (master unit, slave unit 1, slave unit 2, slave unit 3: 0x000F) is set in RWr [0]: command response sensor. The command code sent to RWr [1] is stored.

11. The error code is stored in the sensor response data of the RWr that corresponds to the controller in which the command error occurred.

12. The sensor response data of RWr that correspond to controllers in which a command error did not occur is "0".

13. Clear RY[00]: send request flag. The communication unit ends command transmission, and RX[00]: send done flag and RX[01]: error flag are cleared. RX[60] to [6F] error output flags are also cleared.

14. Clear RY[01]: write flag.

15. Clear RY[0C]: command flag. The communication unit exits command mode, and RX[0C]: command flag is cleared. After removing the cause of the error, re-execute the command.

Troubleshooting

Table of error codes

The following table shows error codes and corrective actions.

Error code		Description	Action
DEC	**HEX**		
101	0x0065	An out-of-range setting parameter was requested.	Invalid setting parameter. Check the settable parameter values in **"4-9 Commands"**.
102	0x0066	A write request using an unusable setting was made in the target controller.	Invalid setting parameter. Check the settable parameter values in **"4-9 Commands"**.
103	0x0067	A read request using an unusable setting was made in the target controller.	Invalid setting parameter. Check the settable parameter values in **"4-9 Commands"**.
200	0x00C8	A sensor head is not connected.	Check the status of the sensor head connection.
300	0x012C	A command was received that cannot be used because a calculation setting was not configured.	Set the master unit to calculation mode. For the setting procedure, refer to the User's Manual of the controller you are using.
301	0x012D	A command was received that cannot be used because "P-P" or "P-P/2" was not configured for the hold setting.	Set "P-P" or "P-P/2" in the master unit. For the setting procedure, refer to the User's Manual of the controller you are using.
400	0x0190	When calibration was executed, an alarm, undefined, or over display range state was in effect.	Invalid sensor head value. Check the state of the sensor head.
401	0x0191	Calibration was not executed normally.	Calibration failed. For the calibration procedure, refer to the User's Manual of the controller you are using.
500	0x01F4	When teaching was executed, an alarm, undefined, or over display range state was in effect.	Invalid sensor head value. Check the state of the sensor head.
501	0x01F5	Unable to execute teaching.	Teaching failed. For the teaching procedure, refer to the User's Manual of the controller you are using.
600	0x0258	When preset was executed, an alarm, undefined, or over display range state was in effect.	Invalid sensor head value. Check the state of the sensor head.
700	0x02BC	When bank load or bank save was executed, the bank number was outside the range.	Invalid setting parameter. Check the settable parameter values in **"4-9 Commands"**.
800	0x0320	Unable to write to internal memory.	The controller may have failed. Replace the controller.
1100	0x044C	Before a response to a request was received, the next request was received.	After sending a request, do not send the next request until a response to the first request is received. Requests sent before a response is received will be disregarded.
1200	0x04B0	The response to a request timed out.	Check the status of the communication unit and controller connection.
2000	0x07D0	Communication unit and controller communication failed.	• Cycle the power ON - OFF. • Check the status of the communication unit and controller connection. • If the problem persists, the controller may have failed.

Note: This product cannot detect errors that occur in a controller.
To check the error code in a controller, use a 0x0001 command (status/error) in command mode to read the error code.

8-2 Communication errors

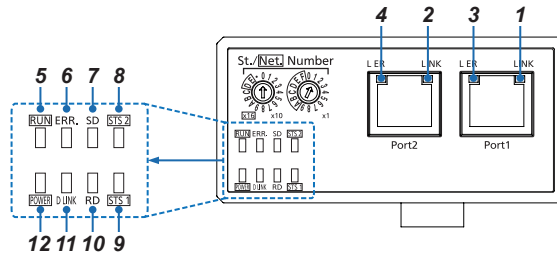If a communication error occurs and recovery is not possible, execute restart.
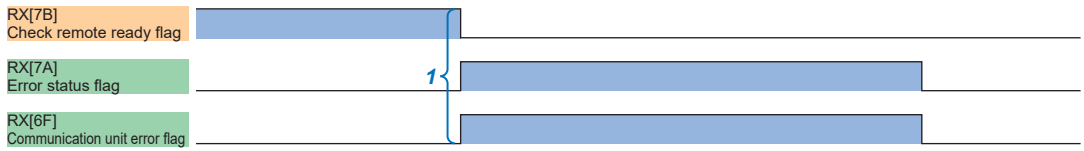
1. If a communication error between the communication unit and controller occurs, RX[7B]: remote ready flag is cleared and RX[7A]: error status flag and RX[6F]: communication unit error flag are set. In this case, the communication unit error cannot be cleared, so remove the cause of the error and restart the power. By entering error mode (refer to **"4-8 Error mode"**) in this state, you can check the communication unit error code (0x07D0).

8-3 Description of indicators

You can check the indicators on the product to identify the cause of a problem and take corrective action.

	Name	Function
1	Port1 LINK indicator (Green)	ON: Linking up. OFF: Linking down.
2	Port2 LINK indicator (Green)	
3	Port1 L ER. indicator (Yellow)	ON: Abnormal data received. OFF: Normal data received.
4	Port2 L ER. indicator (Yellow)	
5	RUN indicator (Green)	Indicates the operation status of the communication unit. ON: Normal operation. OFF: Communication unit error occurred.
6	ERR. indicator (Red)	Indicates the error status of the communication unit. ON: Communication error occurred. Blinking: "Station/Network No. setting switch" was changed after the power was turned ON. (Station number changes made after the power is turned ON are not applied.) OFF: Normal operation.
7	SD indicator (Green)	Indicates the data transmission status. ON: Sending data. OFF: Data not sent.
8	STS2 indicator (Red)	• Network number setting mode ON: Network number setting is outside range. OFF: Network number setting is inside range. • Normal Mode ON: Command to controller resulted in an error. OFF: Command to controller processed normally.
9	STS1 indicator (Green)	• Network number setting mode Blinking: Network number setting preparation completed. ON: Network number setting save completed. • Normal Mode ON: Communicating with controller. OFF: Not communicating with controller.
10	RD indicator (Green)	Indicates the data reception status. ON: Receiving data. OFF: Data not received.
11	D LINK indicator (Green)	Indicates the Data Link status of the communication unit. ON: Data Link in effect (cyclic transmission in progress). Blinking: Data Link in effect (cyclic transmission stopped). OFF: Data Link not executed (parallel off).
12	Power indicator (Green)	Indicates the power status of the communication unit. ON: Power is ON. OFF: Power is OFF.

8-4 What to do when a problem occurs

■ **Normal mode and network number setting mode**

Indicator	State	Description	Solution
Power indicator (Green)	OFF	Power error	• Check the power wiring. For the power supply connections, refer to the User's Manual of the controller you are using. • Check if power (24V) is supplied to the communication unit. For the power supply specifications of the communication unit, refer to **"5-1 Specifications"**. • Power supply capacity varies by controller type and the number of units connected. Check the specifications of the connected controllers.
STS2 indicator (Red)	ON	Mode selection error	• Check if the mode setting switch is correctly set. • For the mode settings and procedure for changing modes, refer to **"3-3-3 Communication unit settings"**.

■ **Network number setting mode**

Indicator	State	Description	Check
STS2 indicator (Red)	ON	Network number setting error	• Check if the network number setting is outside the range. (Network number valid range is 1 to 239.) • For the procedure for setting the network number and cautions, refer to **Network number setting**.

■ **Normal mode**

Indicator	State	Description	Check
RUN indicator (Green)	OFF	Station number setting error	• Check if the station number setting is outside the range. (Station number valid range is 1 to 120.) • For the procedure for setting the station number and cautions, refer to **"Station number setting"**.
D LINK indicator (Green)	Blinking	Communication setting error	CC-Link IE Field network communication settings may not be correct. Check the following settings. Station number setting • Check if the communication unit's station number is set in the station number assigned from the master station. • For the procedure for setting the station number and cautions, refer to **Network number setting**. Network number setting • Check if the communication unit's network number matches the master station. • For the procedure for setting the network number and cautions, refer to **Network number setting**. Other items • Set the station type of the communication unit in the remote device station. • The network status of the master station or communication unit is set to "stop link" and the link stop interval is in effect.

Troubleshooting

Indicator	State	Description	Check
ERR. indicator (Red)	ON	Transmission route error	A failure may have occurred in the network transmission route. Check the following. • Check if the Ethernet cable has a wire break or contact failure. • Check if CC-Link Partner Association recommended cable is used for the Ethernet cable. • Check if the cable length between stations is no more than 100m. • Check if other stations connected to the communication unit and network devices (switching hubs, etc.) are powered ON. • If a loop-back function is set in the master station, check if the connection is a ring connection. • Check the noise environment near the communication unit and Ethernet cable.
	Blink-ing	Setting change error	This warning is displayed if you attempt to change a station number while the unit is in operation after the power was turned ON. • A station number for which a warning is in effect is not applied. The blinking stops when the setting is returned to the original station number. • To apply a station number change, restart the power of the communication unit.
Port1 L ER. indicator (Yellow)	ON	Transmission route error	If a loop-back function is set in the master station, check if the connection is a ring connection.
Port2 L ER. indicator (Yellow)	ON	Transmission route error	If a loop-back function is set in the master station, check if the connection is a ring connection.
STS1 indicator (Green)	OFF	Communication error between controllers	Check if the controllers are correctly connected. For the connection method, refer to **"3-2-2 Connection"**.
STS2 indicator (Red)	ON	Communication unit error	• Check if there is a problem in the command send setting for sending commands to the controller. • To send a command to a controller, the command code, command data, and command request sensor must be correctly set. For command specifications, refer to **"4-9 Commands"**.

■ An EEPROM error (E600 or E620) is displayed on the connected controller.

Cause	Corrective action
A command is sent immediately after the power supply is turned ON.	Send a command after five seconds has elapsed since the power supply is turned ON.

<Important>

If the product still does not operate normally after you check the above, consult our technical support center.

Revision history	Revision date	Revision item
First edition	May 12, 2017	
Second edition	April 12, 2019	Function added
Third edition	September 30, 2019	"4-9-1 Table of commands for **HG-S** series" error correction "4-9-2 Table of commands for **HG-T** series" added "4 -10 Reading received light waveforms (For the **HG-T** only)" added "4-11 Registering the reference waveform (For the **HG-T** only)" added "4-12 Other precautions" added
Fourth edition	December 1, 2019	Commands related to the self-monitoring function were added "4.7 Self-monitoring Function" added
Fifth edition	December 4, 2020	Commands related to the addition of **HG-T** functions have been added.
Sixth edition	April 1, 2024	Company name change Added troubleshooting items

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