

RS-485 Communication Unit for
Digital Displacement Sensors

SC-HG1-485

User's Manual

(MEMO)

INTRODUCTION

Thank you for purchasing an RS-485 communication unit **SC-HG1-485**.

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-HG1-485** 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
RS-485 communication unit for digital displacement sensors	SC-HG1-485 User's Manual	WUME-SCHG1485
Contact-type digital displacement sensor HG-S series	HG-S User's Manual	WUME-HGS
Thru-beam type digital displacement sensor HG-T series	HG-T User's Manual	WUME-HGT
Tool software for HG-T HG-T Configuration Tool	HG-T Configuration Tool User's Manual	WUME-HGTCT

Please note

- 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.

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Chapter 1 Introduction

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1-1 Safety Cautions

1-1 Safety Cautions

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 device has been developed / produced for industrial use only.
- Do not use this product outside the range of the specifications. Risk of an accident and product damage. There is also a risk of a noticeable reduction of service life.

Power supply

- Verify that fluctuations of power input supply voltage do not exceed the rating, including controllers.
- Do not use during the initial transient time (1s) after the power supply is switched ON.

Wiring

- 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 to ground.
- Make sure that the power is OFF while performing wiring or connection work.
- Risk of damage and burning if the load is incorrectly wired or short-circuiting occurs.
- 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.

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.

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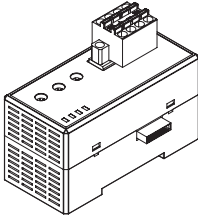
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2-1 Contents of Package

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

- **Communication unit: 1 pc.**



- **Termination resistor switching jumper pin: 1 pc.**



- **Instruction manual**
- **General Information for Safety, Compliance, and Instructions**

2-2 System Configuration

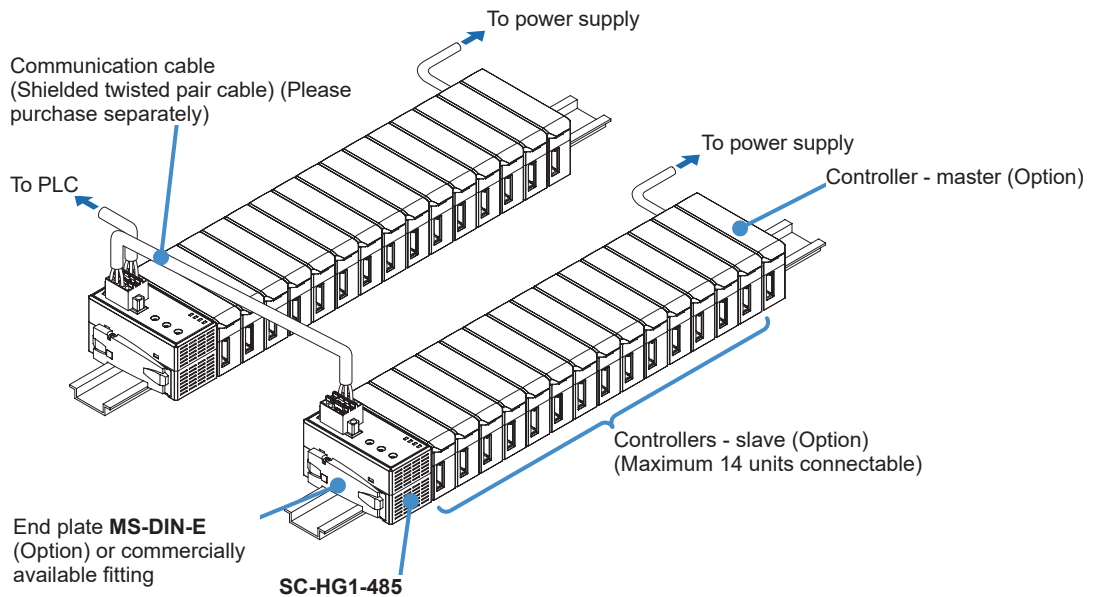
This product can be connected to a maximum of 15 controllers (one master controller, 14 slave controllers).

This product is an interface unit that is used to monitor measured values and ON / OFF states of outputs on controllers connected via a host controller (PLC), and turn inputs ON / OFF.

This product can also be used to read and change controller settings.

You can select MODBUS (RTU mode / ASCII mode) or MEWTOCOL for the communication protocol.

The power that drives this product is supplied from a connected master controller.

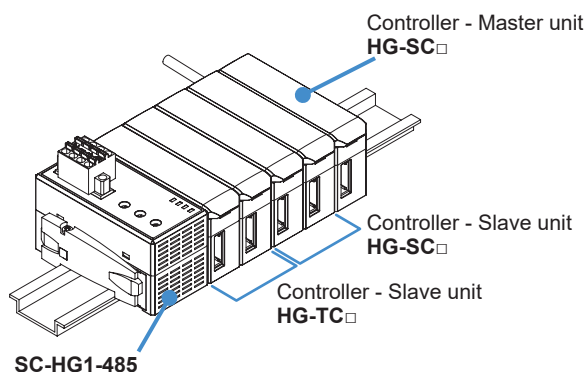


Before Using This Product

<Reference>

- If **HG-SC** series and **HG-TC** series controllers are used in combination, connect the slave controllers of the same series as the master controller on the near side of the master controller and connect the slave controllers of different series from the master controller on the far side of the master controller.

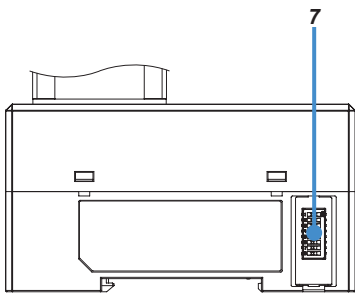
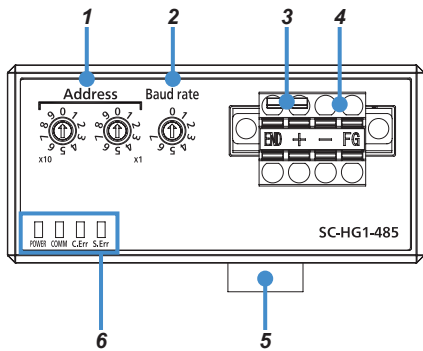
Example: When the master controller is HG-SC□



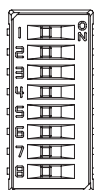
- If **HG-TC** series and **HG-SC** series controllers are used in combination, there are limitations on the functions below.

	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 displays 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 are 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. "NOW COPY" appears on the displays of the master unit and slave unit when the slave unit is different series from the master unit, but copying is not performed.
4	Interference prevention	This function is only available on the HG-TC series controller. The function is not executed on the HG-SC series controller.

2-3 Description of Parts



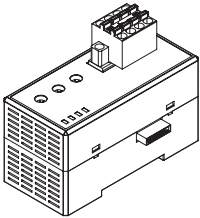
<Switch cover removed>

Name		Function				
1	Address setting switches	MODBUS: 01 (station 1) to 99 (station 99) MEWTOCOL: 01 (station 1) to 64 (station 64) [Factory setting: 01 (station 1)] (00: Prohibited)				
2	Baud rate setting switch	0: 19,200bps, 1: 38,400bps, 2: 57,600bps, 3: 115,200bps 4: 1,200bps, 5: 2,400bps, 6: 4,800bps, 7: 9,600bps [Factory setting: 19,200bps]				
3	Termination resistor switching jumper pin	Use to enable the termination resistor incorporated in the product.				
4	Communication connectors	Connect to a host device or other SC-HG1-485 .				
5	Male connector	Connect to a master controller or slave controller.				
6	Indicator	S.Err: Lower communication error indicator (Red)	Lights up when a communication error occurs between the SC-HG1-485 and a controller.			
		C.Err: Upper communication error indicator (Red)	Lights up when a command error or communication error occurs between the PLC and communication unit.			
		COMM: Communication indicator (Green)	Lights up during communication.			
		Power: Power indicator (Green)	Lights up when power is supplied.			
7	Communication switch		SW No.	Name	Function (0: OFF, 1: ON)	Factory default state
			1	Communication protocol settings	0: MODBUS 1: MEWTOCOL	MODBUS
			2	MODBUS: Transmission mode setting	0: RTU 1: ASCII	RTU
				MEWTOCOL: Data bit setting	0: 8 bits 1: 7 bits	8 bits
			3	Parity check setting	00: Even 01: Odd	Even
			4	(SW3: Upper) (SW4: Lower)	10: None 11: Prohibited	
			5	Stop bit length setting (Note)	0: 1 bit 1: 2 bits	1 bit
			6 to 8	Not used.		

Note: Only valid when MEWTOCOL is used.

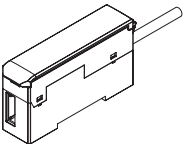
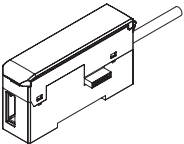
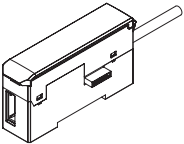
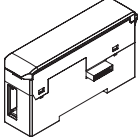
2-4 Unit types

Communication unit

Product name	Appearance	Model
RS-485 communication unit for digital displacement sensors		SC-HG1-485

Controller

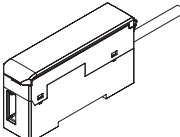
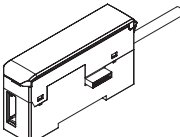
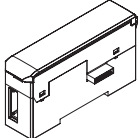
● **HG-SC series**

		Type	Appearance	Model	Output
Contact-type digital displacement sensor	Master unit	High-performance type (Analog current + I/O)		HG-SC101	NPN open-collector transistor
				HG-SC101-P	PNP open-collector transistor
	Slave unit	High-performance type (Analog current + I/O)		HG-SC111	NPN open-collector transistor
				HG-SC111-P	PNP open-collector transistor
		Standard type (I/O)		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 to an **HG-TC** series controller, operation will not take place normally. If they are used together, use 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 + I/O)		HG-TC101	NPN open-collector transistor
				HG-TC101-P	PNP open-collector transistor
	Slave unit	High-performance type (Analog current + I/O)		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 to an **HG-TC** series controller, operation will not take place normally. If they are used together, connect to an **HG-SC** series controller manufactured in February 2019 or later.

Option

Product name	Appearance	Model
End plate		MS-DIN-E

(MEMO)

Chapter 3 Installation And Connections

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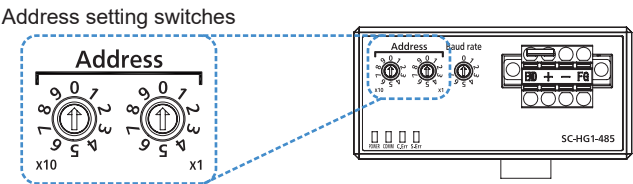
Installation And Connections

3-1 Communication Settings

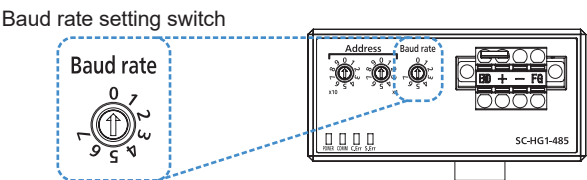
! • After changing the settings, always turn the power OFF and then ON.

Follow the procedure below to configure settings.

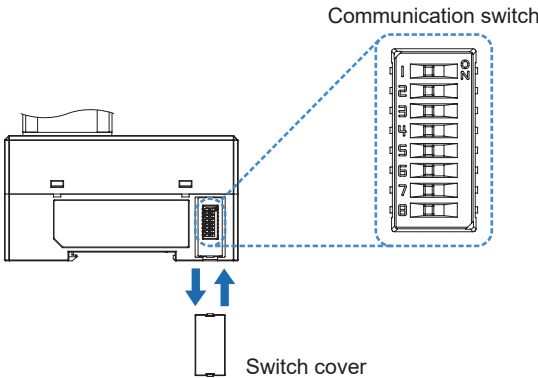
1. Set the address with the address setting switches.



2. Set the communication speed with the baud rate setting switch.



3. Set the communication settings (communication protocol, transmission mode / data bit, parity check, stop bit length) with the communication switches. When you have completed the communication switch settings, attach the switch cover.



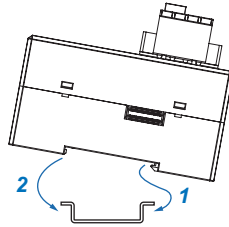
SW No.	Name	Function (0: OFF, 1: ON)	Factory default state
1	Communication protocol setting	0: MODBUS, 1: MEWTOCOL	MODBUS
2	MODBUS: Transmission mode setting	0: RTU, 1: ASCII	RTU
	MEWTOCOL: Data bit setting	0: 8 bits, 1: 7 bits	8 bits
3	Parity check setting	00: Even, 01: Odd	Even
4	(SW3: Upper, SW4: Lower)	10: None, 11: Prohibited	
5	Stop bit length setting (Note)	0: 1 bit, 1: 2 bits	1 bit
6 to 8	Not used.		

Note: Only valid when MEWTOCOL is used.

3-2 Mounting

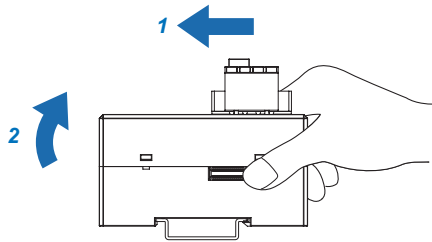
3-2-1 Mounting on a DIN Rail

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.



3-2-2 Removing from a DIN Rail

1. Grasp the product and push forward.
2. Lift the front to remove.



Installation And Connections

3-3 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.

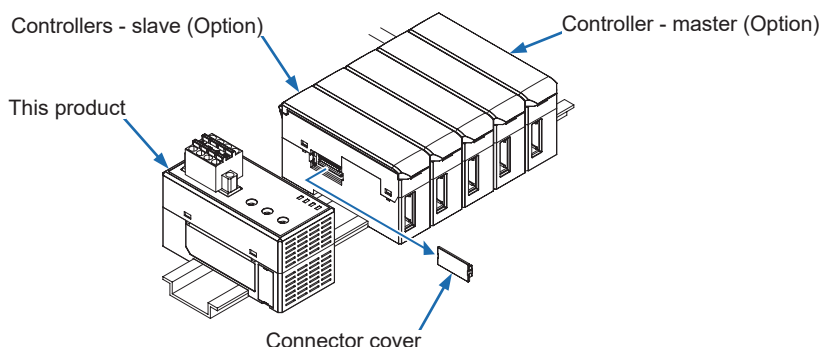
- ⊘ Always shut OFF the power before connecting the product to a controller, or disconnecting the product from a controller. Risk of damage to the product and controller if connected with the power on.
- Insert the male connector firmly into the female connector.
- Risk of damage to the product and controller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

<Reference>

For cautions on using controllers, refer to the user's manual for the controller that you use.

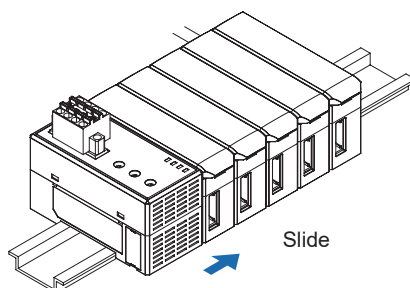
3-3-1 Connection Method

1. Mount the product on a 35mm width DIN rail.
2. Remove the connector cover from the controller. (Note 1)



Note 1: Be sure to keep the connector cover you removed from the controller.

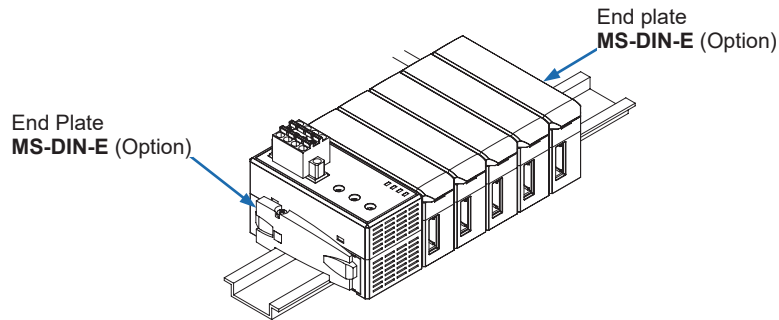
3. Slide the product so that it directly contacts the controller.



4. Attach end plates **MS-DIN-E** (optional) with the flat side facing in so as to enclose the connected units at the ends. (Note 2)

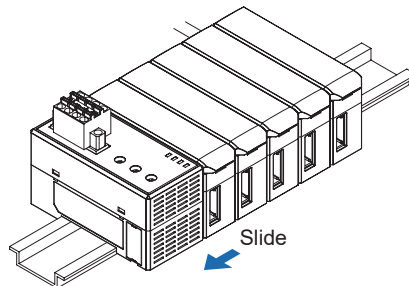
Note 2: Be sure to configure the communication switch settings on the side of the product before attaching the end plates.

5. Tighten the screws to fasten the end plates.



3-3-2 Removal Method

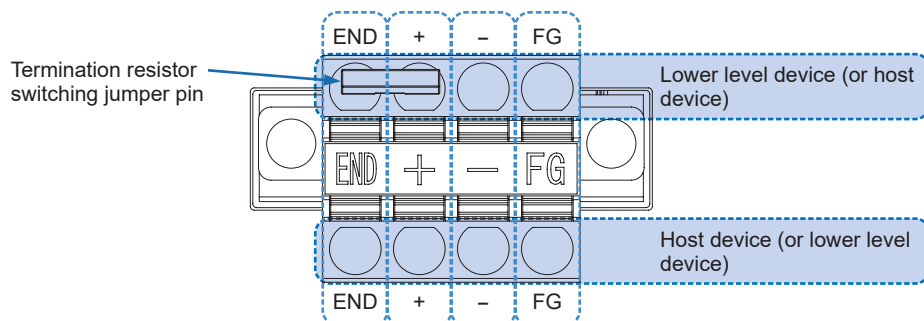
1. Loosen the screws on the end plates.
2. Remove the end plates.
3. Slide and remove the product and controllers.



Installation And Connections

3-4 Connecting an External Device

3-4-1 Pin Assignment Diagram



3-4-2 Connecting the Host Communication Cable

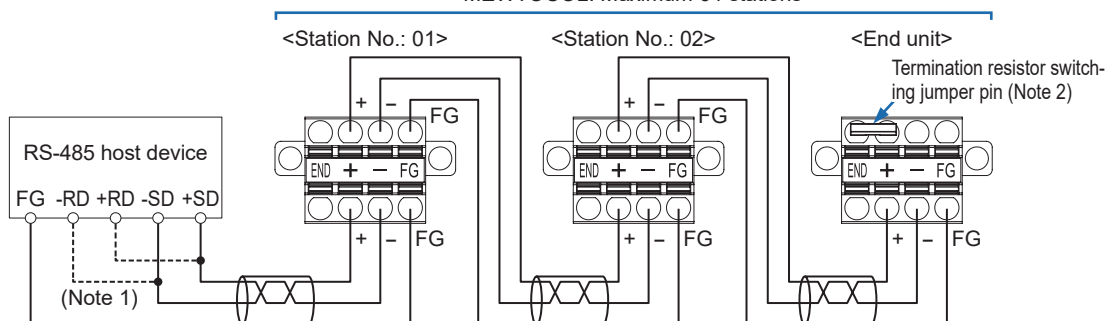


- Make sure that the power supply is OFF while performing wiring work.
- Use only the specified communication cable.
- The communication distance must be within the specified range.

When two **SC-HG1-485** units are connected together, up to 99 stations can be connected when using MODBUS, or up to 64 stations when using MEWTOCOL. Connect as shown below.

Make there is no duplication when setting addresses.

MODBUS: Maximum 99 stations
MEWTOCOL: Maximum 64 stations

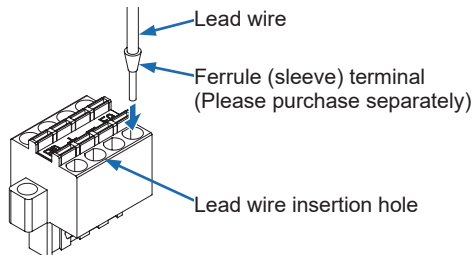


- Notes:
- 1) Connect in accordance with the device specifications.
 - 2) A termination resistor is incorporated in this product. Be sure to attach the termination resistor switching jumper pin (accessory) on the end **SC-HG1-485**.
 - 3) Wire communication routes using transition wiring.

3-4-3 Terminal Block Connections

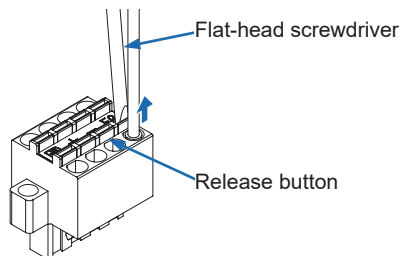
When connecting the terminal block, use solid wires, or stranded wires (lead wires) with a ferrule (sleeve) terminal (please purchase separately) attached as shown below, and insert sufficiently into the connection hole.

When inserted correctly, the wire is locked and cannot be pulled out. Take care not to pull with excessive force, as the wire may break.



To connect stranded wire (lead wire) to the terminal block without using a ferrule (sleeve) terminal, insert sufficiently into the connection hole while pressing the release button.

To disconnect solid wire or stranded (lead) wire, pull out the wire while pressing the release button.



The following solid wire or stranded wire (lead wire) is recommended.
0.2 to 2.5mm² (AWG24 to 12)

For the communication cable, use the specified cable (shielded twisted pair cable).

<Recommended cable>

Taiyo Cabletec Corporation: Sunlight SX-1P-0.2

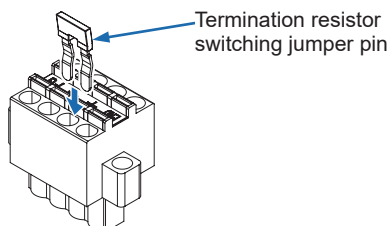
When attaching the connector, tighten to a torque of no more than 0.2N·m.

Installation And Connections

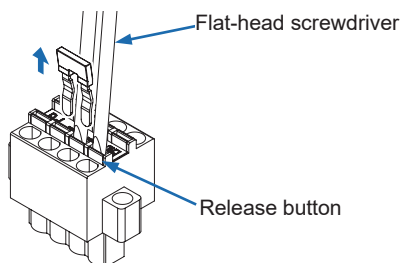
3-4-4 Attachment and Removal of Termination Resistor Switching Jumper Pin

Be sure to attach the termination resistor switching jumper pin (accessory) to the end **SC-HG1-485**.

Attach the termination resistor switching jumper pin to “END” and “+” on the communication connector.



To remove the termination resistor switching jumper pin, remove while pressing the release buttons (×2).



Chapter 4 Overview of Communication

- 4-1 Data that can be Handled 4-2
- 4-2 ID Numbers 4-4
- 4-3 External Input 4-5

4-1 Data that can be Handled

The **SC-HG1-485** can be connected to a maximum of 15 controllers (one master controller, 14 slave controllers). Measured values, input and output, and settings of connected controllers can be read or set from a host device.

4-1 Data that can be Handled

The **SC-HG1-485** can handle the data below.

1. Measured values
2. Controller external output
3. Settings for controller external input
4. Controller set values (Note)

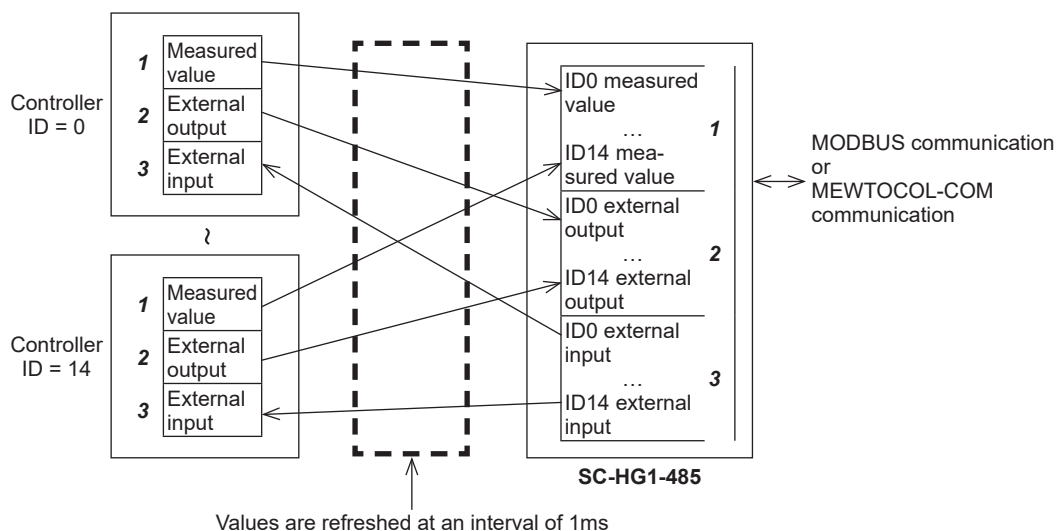
Note: Set values include sensor head measured values, and peak and bottom measured values of peak-to-peak measurement. Teaching and bank load can also be executed.

<Measured values, external output, external input>

The **SC-HG1-485** refreshes controller measured values, external output values and external input values of 15 units at an interval of 1ms.

Refreshed values are held in the **SC-HG1-485**.

This enables fast reading of the latest measured values.



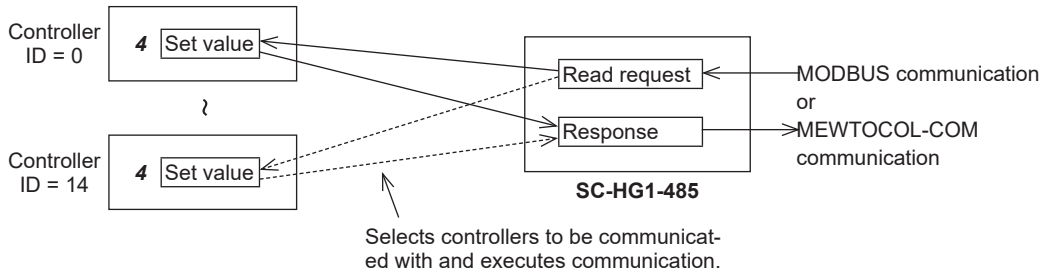
<Measured values>

The measured values that are read vary depending on whether controller calculation is ON or OFF.

Controller type	Calculation mode		
	No calculation	Calculate	
		Calculation application selection	
		Other than standard difference	Standard difference
Master unit	Judgment value (JUDGE.V)	Judgment value (JUDGE.V)	Judgment value (JUDGE.V)
Slave unit	Judgment value (JUDGE.V)	Normal measured value (NORM.V)	Judgment value (JUDGE.V)

<Set values>

Each time the **SC-HG1-485** receives a request from a host device, it reads the set values of the controllers and sends a response. Controller set values can be changed at any time, regardless of the state of the controller. (Except while a command is being processed.)

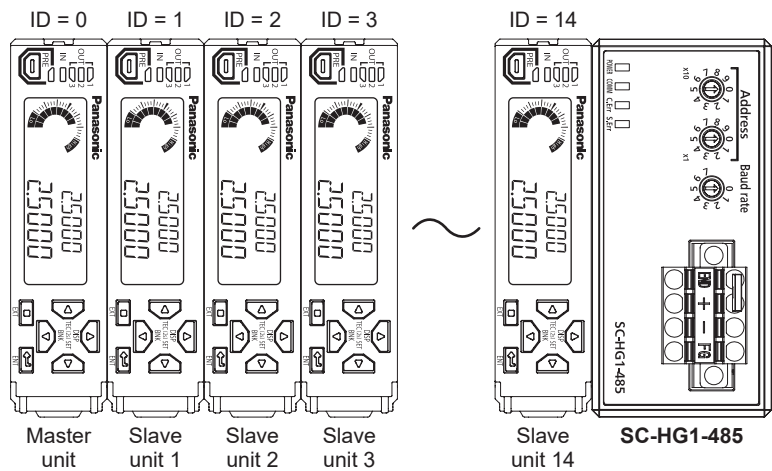


Note: When changing controller settings from the **SC-HG1-485** by communication, do not simultaneously change settings using the controller buttons.

4-2 ID Numbers

4-2 ID Numbers

ID numbers from 0 to 14 are assigned to connected controllers in order from the master unit. Addresses are assigned for data access based on the assigned ID numbers. When you need to change set values on a controller, select the controller using the assigned ID number.

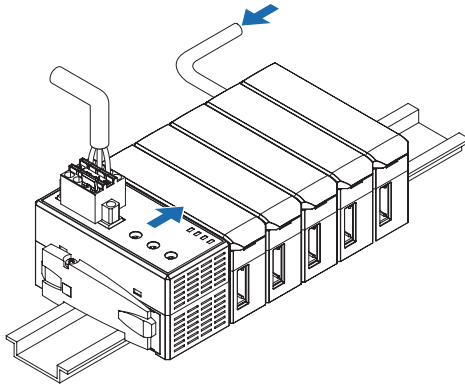


<Reference>
ID numbers are assigned automatically. The order of the numbers cannot be changed.

4-3 External Input

External input from a host device cable and external input from the **SC-HG1-485** are controlled by OR operation.

Settings from the **SC-HG1-485** and input from external input are controlled by OR operation. When either is ON, the controller performs ON operation.



(MEMO)

Chapter 5 MODBUS Communication

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MODBUS Communication

For detailed communication specifications, refer to the Modbus Organization website (<http://www.modbus.org/>).

5-1 Communication Specifications

The MODBUS communication parameters below can be set.

Item	Description
Device address	1 to 99
Communication speed	1,200bps / 2,400bps / 4,800bps / 9,600bps / 19,200bps / 38,400bps / 57,600bps / 115,200bps
Parity bit	Even / Odd / None
Data bits	MODBUS-RTU: Automatically set to 8 bits. MODBUS-ASCII: Automatically set to 7 bits.
Stop bit length	Automatically set to 1 bit when the parity bit is Even or Odd. Automatically set to 2 bits when the parity bit is None.

5-2 MODBUS Function Support Table

MODBUS functions supported by the **SC-HG1-485** are shown below.

Function code	Sub-function code	Function code	Function	Supported
1(01 _H)	-	Read Coils	Read coils	○
2(02 _H)	-	Read Discrete Inputs	Read discrete inputs	×
3(03 _H)	-	Read Holding Registers	Read holding registers	○
4(04 _H)	-	Read Input Registers	Read input registers	×
5(05 _H)	-	Write Single Coil	Write to single coil	○
6(06 _H)	-	Write Single Register	Write to single register	○
7(07 _H)	-	Read Exception status	Read exception status	×
8(08 _H)	0(0000 _H)	Return Query Data	Return query data	○
	1(0001 _H)	Restart Communications Option	Restart serial communication unit	○
	2(0002 _H)	Return Diagnostic Register	Return diagnostic register	×
	3(0003 _H)	Change ASCII Input Delimiter	Change ASCII delimiter	×
	4(0004 _H)	Force Listen Only Mode	Force listen only mode	○
	10(000A _H)	Clear Counters and Diagnostic Register	Clear counters and diagnostic register	○
	11(000B _H)	Return Bus Message Count	Return bus message count	○
	12(000C _H)	Return Bus Communication Error Count	Return bus communication error count	○
	13(000D _H)	Return Bus Exception Count	Return bus exception count	○
	14(000E _H)	Return Server Message Count	Return server message count	○
	15(000F _H)	Return Server No Response Count	Return server no response count	○
	16(0010 _H)	Return Server NAK Count	Return server NAK count	○
	17(0011 _H)	Return Server Busy Count	Return server busy count	○
	18(0012 _H)	Return Bus Character Overrun Count	Return communication data overrun error count	○
	20(0014 _H)	Clear Overrun Counter and Flag	Clear overrun counter and flag	○
11(0B _H)	-	Get Com event counter	Get communication event counter	○
12(0C _H)	-	Get Com event Log	Get communication event log	○
15(0F _H)	-	Write Multiple Coils	Write to multiple coils	○
16(10 _H)	-	Write Multiple registers	Write to multiple registers	○
17(11 _H)	-	Report Server ID	Report server ID	○
20(14 _H)	-	Read File record	Read file record	×
21(15 _H)	-	Write File record	Write to file record	×
22(16 _H)	-	Mask Write Register	Mask write to register	○
23(17 _H)	-	Read / Write Multiple Registers	Read / write to multiple registers	○
24(18 _H)	-	Read FIFO queue	Read FIFO queue	×
43(2B _H)	-	Read device Identification	Read device ID	×

○: Supported
 ×: Not supported

MODBUS Communication

5-3 Frame Format

Two frame modes can be used on the **SC-HG1-485**: RTU mode and ASCII mode.
Select the same frame mode on the **SC-HG1-485** as the other device.

RTU mode

In RTU mode, data is sent in binary.

• Message frame

Start	Slave address	Function code	Data	CRC		End (Start)
At interval of 3.5 characters or more	1 byte	1 byte	0 to 252 bytes	2 bytes		At interval of 3.5 characters or more
				Lower	Upper	

CRC calculation range

• CRC check

A CRC check is performed in RTU mode.

Use the method below to calculate the CRC.

1. Load all 1's in the CRC 16-bit register.
2. Calculate the exclusive OR (XOR) of the lower byte of the CRC register and the first eight bits of data of the message frame.
3. If the lowest bit is 0, execute step 4. If the lowest bit is 1, execute step 5.
4. Shift the result 1 bit to the right. After shifting the result, execute step 6.
5. Shift the result 1 bit to the right. After shifting the result, calculate the exclusive OR (XOR) of the polynomial value 0xA001 (1010000000000001) and the result of the shift.
6. Repeat steps 3 through 5 eight times.
7. Using the next eight bits of data of the message frame, repeat steps 2 through 6.
8. The final value you obtain is the CRC. The CRC is stored first in the lower 8 bits of the message frame, and then in the upper 8 bits.

ASCII mode

In ASCII mode, the message frame starts with ":" and ends with CRLF. All other transmitted data is from "0" to "9" and "A" to "F" ASCII.

• Message frame

Start	Slave address	Function code	Data	LRC	End	
: (3A)	2 bytes	2 bytes	0 to 252 × 2 bytes	2 bytes	CR	LF
					(0D)	(0A)

LRC calculation range

1. Take the total sum of each byte of data. Discard the carryover.
2. Take the complement of 2.
3. Convert the result of 2 into hex ASCII characters.

On the **SC-HG1-485**, addresses can be set from 1 to 99 (01_H to 63_H).

For the function codes used in MODBUS and the function codes supported by the **SC-HG1-485**, refer to “**5-2 MODBUS Function Support Table**”.

For details on the data, refer to the explanation of the function.

- Coil (1-bit access, R/W)
- Input (1-bit access, read only)
- Input register (16-bit access, read only)
- Holding register (16-bit access, R/W)

* Not supported on the **SC-HG1-485**.
* Not supported on the **SC-HG1-485**.

The Nth data set corresponds to address $N - 1$.

Number entered	Address N-1	Description
000001 to 065536	00000 to 65535	Coil 1 to coil 65536
100001 to 165536	00000 to 65535	Input 1 to input 65536
300001 to 365536	00000 to 65535	Input register 1 to input register 65536
400001 to 465536	00000 to 65535	Holding register 1 to holding register 65536

Number of data (N: 1 to 65536)
Type of data (coil / input / input register / holding register)

5-4 Command Formats by Function

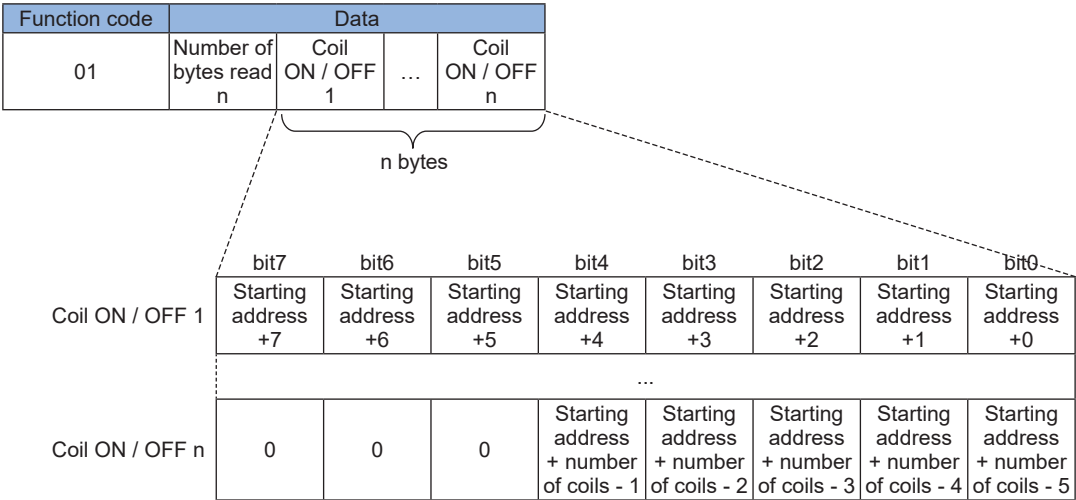
5-4-1 Read Coils (01H)

Reads the coil statuses of successive areas. Specify the starting coil address and number of coils read.
The coil status is indicated by one bit (1 = ON, 0 = OFF). The data to be sent is stored in order from the LSB of the initial byte.
The coil range is 000001 to 065536; however, 000161 to 000256 are used on the **SC-HG1-485**. In the command, the address minus 000001 is specified as a hexadecimal number from 0000 to FFFF; however, 00A0 to 00FF is used on the **SC-HG1-485**.
For information on addresses, refer to “Chapter 7 Memory Map”.
This function checks if the output of the controller connected to the **SC-HG1-485** is ON or OFF, and if the input is set to ON or OFF.

● Request message

Function code	Data			
01	Starting coil address 0000 to FFFF		Number of coils read 0001 to 07D0	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

● Normal response message



n = number of coils / 8. If the remainder is not 0, n = n + 1.
Upper bits that do not have read data are filled with zeros.

• Abnormal response message

Function code	Data
81	Exception code 01 or 02 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of reading external output 1 of the controller master unit in RTU mode>

• Request message

Slave address	Function code	Starting coil address		Number of coils read		CRC	
01 _H	01 _H	00 _H Upper 8 bits	A0 _H Lower 8 bits	00 _H Upper 8 bits	01 _H Lower 8 bits	FD _H Lower	E8 _H Upper

• Normal response message

Slave address	Function code	Number of bytes read	Coil ON / OFF	CRC	
01 _H	01 _H	01 _H	00 _H	51 _H Lower	88 _H Upper

MODBUS Communication

5-4-2 Read Holding Registers (03H)

Reads the values in the holding registers of successive areas. Specify the starting register address and number of registers read.
The register data is 16 bits, and therefore is stored in two bytes in the response message. The data is sent in order from the upper byte.
The holding register range is 400001 to 465536; however, 400101 to 402000 (includes unused areas) are used on the **SC-HG1-485**.
In the command, the address minus 400001 is specified as a hexadecimal number from 0000 to FFFF; however, 0064 to 07CF is used on the **SC-HG1-485**.
For information on addresses, refer to “Chapter 7 Memory Map”.
This function is used to read measured values and set values on controllers connected to the **SC-HG1-485**.

● Request message

Function code	Data			
03	Starting register address 0000 to FFFF		Number of registers read 0001 to 007D	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

● Normal response message

Function code	Data					
03	Number of bytes read n x 2	Register data 1		...	Register data n	
		Upper 8 bits	Lower 8 bits		Upper 8 bits	Lower 8 bits
n x 2 bytes						

● Abnormal response message

Function code	Data
83	Exception code 01 or 02 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of reading measured values of the controller master unit in RTU mode>

• Request message

Slave address	Function code	Starting register address		Number of registers read		CRC	
01 _H	03 _H	00 _H	64 _H	00 _H	02 _H	85 _H	D4 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

Slave address	Function code	Number of bytes read	Register data 1		Register data 2		CRC	
01 _H	03 _H	04 _H	23 _H	45 _H	00 _H	01 _H	21 _H	A2 _H
			Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

MODBUS Communication

5-4-3 Write Single Coil (05H)

Writes a state to a single coil. Write 0xFF00 to set to ON, or 0x0000 to set to OFF. The coil range is 000001 to 065536; however, 000209 to 000256 are used on the **SC-HG1-485**. In the command, the address minus 000001 is specified as a hexadecimal number from 0000 to FFFF; however, 00D0 to 00FF is used on the **SC-HG1-485**. For information on addresses, refer to “Chapter 7 Memory Map”. This function is used to set the input of a controller connected to the **SC-HG1-485** to ON or OFF.

• Request message

Function code	Data			
05	Coil address 0000 to FFFF		Coil state ON: FF00 OFF: 0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Normal response message

Function code	Data			
05	Coil address 0000 to FFFF		Coil state ON: FF00 OFF: 0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Abnormal response message

Function code	Data
85	Exception code 01 or 02 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

The coil and external input of a controller connected to the **SC-HG1-485** operate by OR operation. If you only want the input from the **SC-HG1-485** to operate, set the external input of the controller to OFF.

<Example of setting external input 1 of the controller master unit to ON in RTU mode>

• Request message

Slave address	Function code	Coil address		Coil state		CRC	
01 _H	05 _H	00 _H	D0 _H	FF _H	00 _H	8D _H	C3 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

Slave address	Function code	Coil address		Coil state		CRC	
01 _H	05 _H	00 _H	D0 _H	FF _H	00 _H	8D _H	C3 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

5-4-4 Write Single Register (06H)

Writes data to a holding register. Specify the register address and data.

The register data is 16 bits, and therefore is stored in two bytes in the request message.

The data is sent in order from the upper byte.

The holding register range is 400001 to 465536; however, 400101 to 402000 (includes unused areas) are used on the **SC-HG1-485**.

In the command, the address minus 400001 is specified as a hexadecimal number from 0000 to FFFF; however, 0064 to 07CF is used on the **SC-HG1-485**.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used for various settings on controllers connected to the **SC-HG1-485**.

• Request message

Function code	Data			
06	Register address 0000 to FFFF		Data written 0000 to FFFF	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Normal response message

Function code	Data			
06	Register address 0000 to FFFF		Data written 0000 to FFFF	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Abnormal response message

Function code	Data
86	Exception code 01 or 02 or 03 or 04

For information on exception codes, refer to "5-6 Exception Response".

<Example of setting the setting register of a controller accessed in RTU mode>

• Request message

Slave address	Function code	Register address		Data written		CRC	
01 _H	06 _H	03 _H	E8 _H	00 _H	00 _H	09 _H	BA _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

Slave address	Function code	Register address		Data written		CRC	
01 _H	06 _H	03 _H	E8 _H	00 _H	00 _H	09 _H	BA _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

MODBUS Communication

5-4-5 Diagnostic Functions (08H)

To define a diagnosis type, specify a 2-byte diagnosis sub-function code in the data. You must also specify 2-byte data values to control or diagnose slave units.

For diagnose sub-function codes and their descriptions, refer to “5-5 Diagnose Sub-function Codes”.

The following example is “Return Query Data (00H)”.

• Request message

Function code	Sub-function code	Data
08	0000 Upper 8 bits Lower 8 bits	Any data N x 2 bytes

• Normal response message

Function code	Sub-function code	Data
08	0000 Upper 8 bits Lower 8 bits	Any data N x 2 bytes

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of echo back in RTU mode>

• Request message

Slave address	Function code	Sub-function code	Any data	CRC
01 _H	08 _H	00 _H 00 _H Upper 8 bits Lower 8 bits	12 _H 34 _H Upper 8 bits Lower 8 bits	ED _H 7C _H Lower Upper

• Normal response message

Slave address	Function code	Sub-function code	Any data	CRC
01 _H	08 _H	00 _H 00 _H Upper 8 bits Lower 8 bits	12 _H 34 _H Upper 8 bits Lower 8 bits	ED _H 7C _H Lower Upper

5-4-6 Get Com event counter (0BH)

Gets the communication event count. The event count is incremented each time message processing completes normally.

The count is not incremented when an exception response or get event count command is received. The data field of the response consists of the 2-byte status and 2-byte event count value.

• Request message

Function code
0B

• Normal response message

Function code	Data			
0B	Status 0000 (Note 1)		Communication event count 0000 to FFFF (Note 2)	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

Notes: 1) FFH FFH indicates that the status is "processing program command". 00H 00H indicates any other status. The **SC-HG1-485** does not support program commands, so 00H 00H is always returned.

2) The count is initialized when the power is turned on, the serial communication unit is restarted, or the counters and diagnostic register are cleared. When the count reaches FFFF, it stops. To resume the count, execute initialization.

• Abnormal response message

Function code	Data
8B	Exception code 01 or 03 or 04

For information on exception codes, refer to "5-6 Exception Response".

<Example of getting the communication event count in RTU mode>

• Request message

Slave address	Function code	CRC	
01 _H	0B _H	41 _H Lower	E7 _H Upper

• Normal response message

Slave address	Function code	Status		Communication event count		CRC	
01 _H	0B _H	00 _H Upper 8 bits	00 _H Lower 8 bits	00 _H Upper 8 bits	00 _H Lower 8 bits	A4 _H Lower	0B _H Upper

MODBUS Communication

5-4-7 Get Com event Log (0CH)

Gets the communication event log.
The communication event log is initialized when the power is turned on, the serial communication unit is restarted, or the counters and diagnostic register are cleared.

● Request message

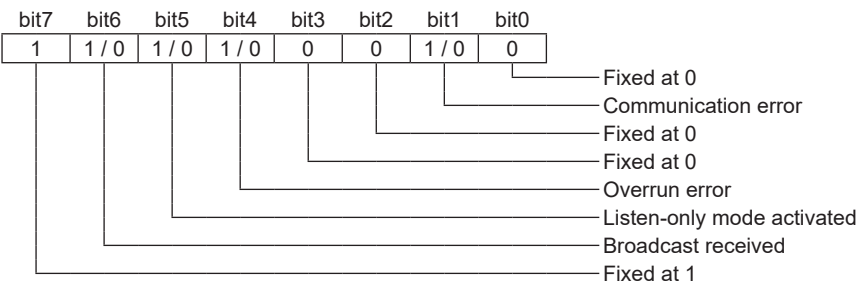
Function code
0C

● Normal response message

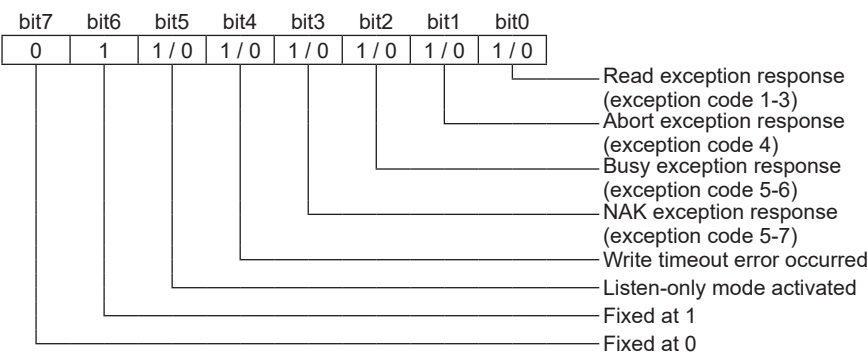
Function code	Data									
0C	Number of bytes read n	Status 0000 (Note 1)		Communication event count 0000 to FFFF (Note 2)		Bus message count 0000 to FFFF (Note 2)		Event log 1 (Note 3)	...	Event log 64
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	New → Old		
		n bytes								

Event log

Reception



Transmission



Change to listen-only mode

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	1	0	0

Restarting of serial communication unit

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	0	0	0

- Notes: 1) FFH FFH indicates that the status is "processing program command". 00H 00H indicates any other status. The **SC-HG1-485** does not support program commands, so 00H 00H is always returned.
- 2) The log is initialized when the power is turned on, the serial communication unit is restarted, or the counters and diagnostic register are cleared.
When a count reaches FFFF, it stops.
To resume the count, execute initialization.
- 3) The log is initialized when the power is turned on.
If FF00 is specified in the data field when the serial communication unit is restarted, the log is cleared.
When the number of communication events reaches 64, each new event deletes the oldest event.

• Abnormal response message

Function code	Data
8C	Exception code 01 or 04

For information on exception codes, refer to "5-6 Exception Response".

<Example of getting the communication event log in RTU mode>

• Request message

Slave address	Function code	CRC	
01 _H	0C _H	00 _H Lower	25 _H Upper

• Normal response message

Slave address	Function code	Number of bytes read	Status		Communication event count		Bus message count	
01 _H	0C _H	07 _H	00 _H Upper 8 bits	00 _H Lower 8 bits	00 _H Upper 8 bits	00 _H Lower 8 bits	00 _H Upper 8 bits	01 _H Lower 8 bits

Event log 1	CRC	
80 _H	35 _H Lower	14 _H Upper

MODBUS Communication

5-4-8 Write Multiple Coils (0FH)

Writes the coil statuses of successive areas. Specify the starting coil address and number of coils written to.

The coil status is indicated by one bit (1 = ON, 0 = OFF). The data to be sent is stored in order from the LSB of the initial byte.

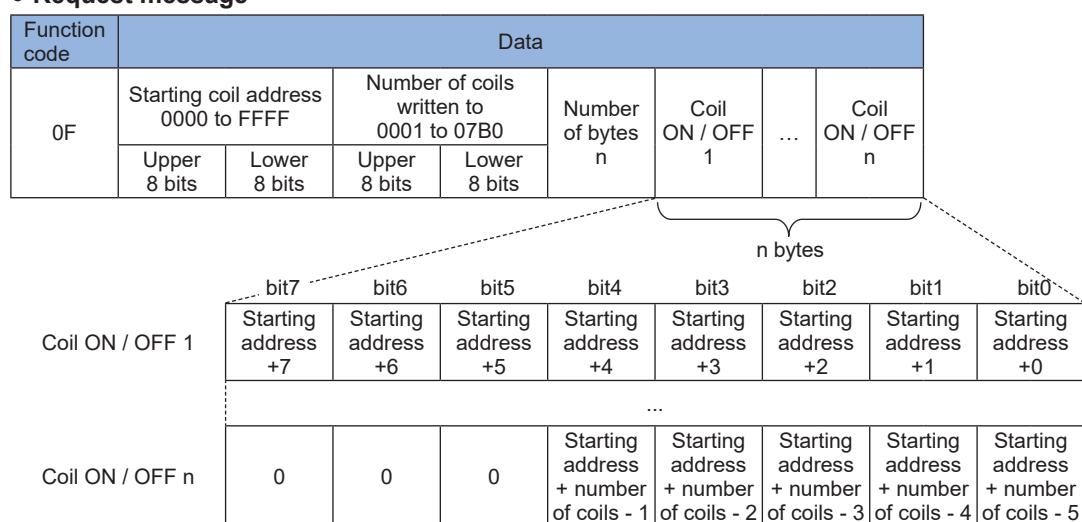
The coil range is 000001 to 065536; however, 000209 to 000256 are used on the **SC-HG1-485**.

In the command, the address minus 000001 is specified as a hexadecimal number from 0000 to FFFF; however, 00D0 to 00FF is used on the **SC-HG1-485**.

For information on addresses, refer to “Chapter 7 Memory Map”.

This function is used to set the input of a controller connected to the **SC-HG1-485** to ON or OFF.

• Request message



$n = \text{Number of coils} / 8$. If the remainder is not 0, $n = n + 1$.

Send 0 in upper bits that do not have data to be written.

• Normal response message

Function code	Data			
0F	Starting coil address 0000 to FFFF		Number of coils written to 0001 to 07B0	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Abnormal response message

Function code	Data
8F	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of setting external inputs 1 and 2 of the controller master unit to ON in RTU mode>

• Request message

Slave address	Function code	Starting coil address		Number of coils written to		Number of bytes	Coil ON / OFF	CRC	
01 _H	0F _H	00 _H Upper 8 bits	D0 _H Lower 8 bits	00 _H Upper 8 bits	02 _H Lower 8 bits	01 _H	03 _H	5F _H Lower	44 _H Upper

• Normal response message

Slave address	Function code	Starting coil address		Number of coils written to		CRC	
01 _H	0F _H	00 _H Upper 8 bits	D0 _H Lower 8 bits	00 _H Upper 8 bits	02 _H Lower 8 bits	D5 _H Lower	F3 _H Upper

MODBUS Communication

5-4-9 Write Multiple registers (10H)

Writes data to registers of successive areas. Specify the starting address, number of registers (1 to 123), and data to be written.
The holding register range is 400001 to 465536; however, 400101 to 402000 (includes unused areas) are used on the **SC-HG1-485**.
In the command, the address minus 400001 is specified as a hexadecimal number from 0000 to FFFF; however, 0064 to 07CF is used on the **SC-HG1-485**.
For information on addresses, refer to “Chapter 7 Memory Map”.
This function is used for various settings on controllers connected to the **SC-HG1-485**.

● Request message

Function code	Data									
10	Starting register address 0000 to FFFF		Number of registers 0001 to 007B		Number of bytes $n \times 2$	Register data 1		...	Register data n	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits		Upper 8 bits	Lower 8 bits		Upper 8 bits	Lower 8 bits
	$n \times 2$ bytes									

● Normal response message

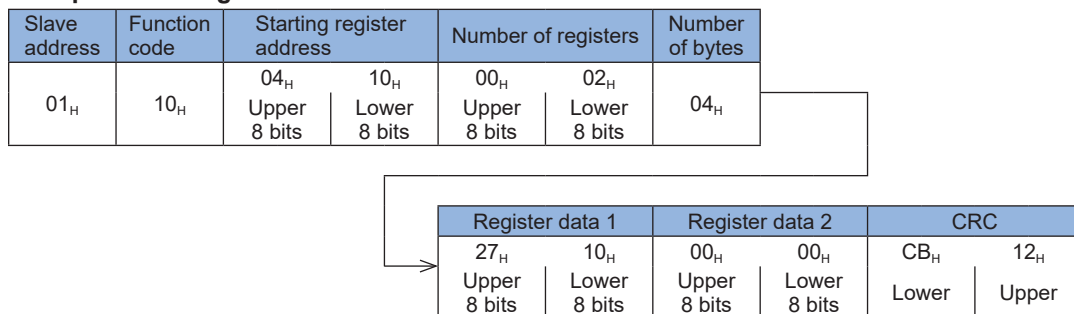
Function code	Data			
10	Starting register address 0000 to FFFF		Number of registers 0001 to 007B	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

● Abnormal response message

Function code	Data
90	Exception code 01 or 02 or 03 or 04

<Example of setting LOW value in RTU mode>

• Request message



• Normal response message

Slave address	Function code	Starting register address		Number of registers		CRC	
01 _H	10 _H	04 _H Upper 8 bits	10 _H Lower 8 bits	00 _H Upper 8 bits	02 _H Lower 8 bits	41 _H Lower	3D _H Upper

MODBUS Communication

5-4-10 Report Server ID (11H)

Shows the type code.

• Request message

Function code
11

• Normal response message

Function code	Data		
11	Number of bytes (3)	Type code 0000 to FFFF Upper 8 bits Lower 8 bits	RUN state (Note) (0)

• Abnormal response message

Function code	Data
91	Exception code 01 or 02 or 03 or 04

Note: 0 is always returned in the RUN state.

Model	Type code
SC-HG1-485	7023

<Example of setting in RTU mode>

• Request message

Slave address	Function code	CRC	
01 _H	11 _H	C0 _H Lower	2C _H Upper

• Normal response message

Slave address	Function code	Number of bytes	Type code		RUN state	CRC	
01 _H	11 _H	03 _H	70 _H Upper 8 bits	23 _H Lower 8 bits	00 _H	E5 _H Lower	66 _H Upper

5-4-11 Mask Write Register (16H)

Replaces the current register values with AND mask values and OR mask values.

The calculation formula is as follows:

New register value = ([Current register value] AND [AND mask value]) OR ([OR mask value] AND [AND mask value with bits inverted])

The holding register range is 400001 to 465536; however, 400101 to 402000 (includes unused areas) is used on the **SC-HG1-485**.

In the command, the address minus 400001 is specified as a hexadecimal number from 0000 to FFFF; however, 0064 to 07CF is used on the **SC-HG1-485**.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used for various settings on controllers connected to the **SC-HG1-485**.

• Request message

Function code	Data					
16	Target register address 0000 to FFFF		AND mask value 0000 to FFFF		OR mask value 0000 to FFFF	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Normal response message

Function code	Data					
16	Target register address 0000 to FFFF		AND mask value 0000 to FFFF		OR mask value 0000 to FFFF	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Abnormal response message

Function code	Data
96	Exception code 01 or 02 or 03 or 04

For information on exception codes, refer to "5-6 Exception Response".

<Example of setting external inputs 1 and 2 of the controller master unit to ON in RTU mode>

• Request message

Slave address	Function code	Target register address		AND mask value		OR mask value		CRC	
01 _H	16 _H	00 _H	85 _H	00 _H	00 _H	00 _H	03 _H	7B _H	D9 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

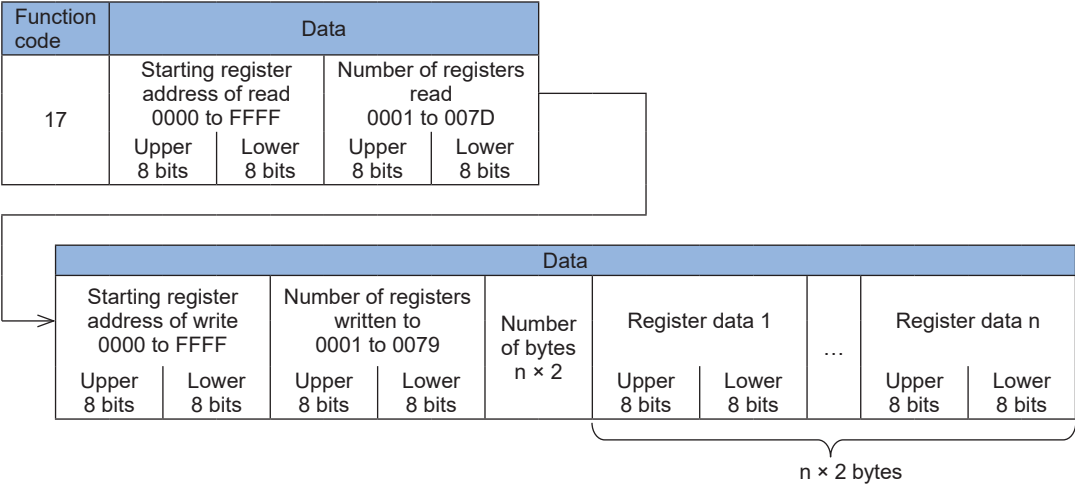
Slave address	Function code	Target register address		AND mask value		OR mask value		CRC	
01 _H	16 _H	00 _H	85 _H	00 _H	00 _H	00 _H	03 _H	7B _H	D9 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

MODBUS Communication

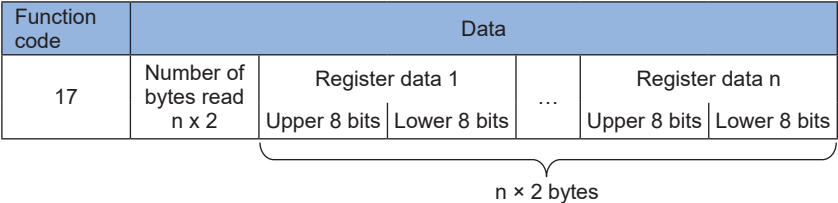
5-4-12 Read / Write Multiple Registers (17H)

Combination read and write command. Write is executed before read.
The holding register range is 400001 to 465536; however, 400101 to 402000 (includes unused areas) are used on the **SC-HG1-485**.
In the command, the address minus 400001 is specified as a hexadecimal number from 0000 to FFFF; however, 0064 to 07CF is used on the **SC-HG1-485**.
For information on addresses, refer to “Chapter 7 Memory Map”.
This function is used for various settings on controllers connected to the **SC-HG1-485**.

• Request message



• Normal response message



• Abnormal response message

Function code	Data
97	Exception code 01 or 02 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of reading LOW value and setting HIGH value in RTU mode>

• Request message

Slave address	Function code	Starting register address of read		Number of registers read		Starting register address of write	
01 _H	17 _H	04 _H Upper 8 bits	10 _H Lower 8 bits	00 _H Upper 8 bits	02 _H Lower 8 bits	04 _H Upper 8 bits	12 _H Lower 8 bits

Number of registers written to	Number of bytes	Register data 1		Register data 2		CRC	
00 _H Upper 8 bits	04 _H	C3 _H Upper 8 bits	50 _H Lower 8 bits	00 _H Upper 8 bits	00 _H Lower 8 bits	86 _H Lower	7B _H Upper

• Normal response message

Slave address	Function code	Number of bytes	Register data 1		Register data 2		CRC	
01 _H	17 _H	04 _H	27 _H Upper 8 bits	10 _H Lower 8 bits	00 _H Upper 8 bits	00 _H Lower 8 bits	F2 _H Lower	56 _H Upper

MODBUS Communication

5-5 Diagnose Sub-function Codes

5-5-1 Return Query Data (00H)

This command returns the same data as the query data as a response.

- Request message

Function code	Sub-function code	Data
08	0000 Upper 8 bits Lower 8 bits	Any data N x 2 bytes

- Normal response message

Function code	Sub-function code	Data
08	0000 Upper 8 bits Lower 8 bits	Arbitrary data N x 2 bytes

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of echo back in RTU mode>

- Request message

Slave address	Function code	Sub-function code	Any data	CRC
01 _H	08 _H	00 _H 00 _H Upper 8 bits Lower 8 bits	12 _H 34 _H Upper 8 bits Lower 8 bits	ED _H 7C _H Lower Upper

- Normal response message

Slave address	Function code	Sub-function code	Any data	CRC
01 _H	08 _H	00 _H 00 _H Upper 8 bits Lower 8 bits	12 _H 34 _H Upper 8 bits Lower 8 bits	ED _H 7C _H Lower Upper

5-5-2 Restart Serial Communication Unit (01H)

This command initializes and restarts the functions related to serial communication. It clears the bus message count, communication error count, exception response count, received message count, no-response count, NAK count, busy response count, communication event count, and overrun error count.

This command cancels listen-only mode if it is running.

If the data field is set to FF00, the event logs will also be cleared. If the data field is set to 0000, the event logs will be retained.

• Request message

Function code	Sub-function code	Data
08	0001	Event log clearing Yes: FF00 No: 0000
	Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits

• Normal response message

Function code	Sub-function code	Data
08	0001	Event log clearing Yes: FF00 No: 0000
	Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of restarting in RTU mode>

• Request message

Slave address	Function code	Sub-function code	Event log clearing	CRC
01 _H	08 _H	00 _H 01 _H	FF _H 00 _H	F0 _H 3B _H
		Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits	Lower Upper

• Normal response message

Slave address	Function code	Sub-function code	Event log clearing	CRC
01 _H	08 _H	00 _H 01 _H	FF _H 00 _H	F0 _H 3B _H
		Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits	Lower Upper

MODBUS Communication

5-5-3 Listen-only Mode (04H)

This command invokes listen-only mode. While in listen-only mode, even if the system receives any commands, it will not process them or return any responses. To cancel this mode, restart the serial communication unit by referring to “5-5-2 Restart Serial Communication Unit (01H)”.

- Request message

Function code	Sub-function code		Data	
08	0004		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

- Normal response message

No response is returned because listen-only mode is invoked.

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of invoking listen-only mode in RTU mode>

- Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	04 _H	00 _H	00 _H	A1 _H	CA _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

5-5-4 Clear counter and diagnostic register (0AH)

This command clears the bus message count, communication error count, exception response count, received message count, no-response count, NAK count, busy response count, overrun error count, and communication event count.

• Request message

Function code	Sub-function code		Data	
08	000A		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Normal response message

Function code	Sub-function code		Data	
08	000A		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of clearing counter and diagnostic register in RTU mode>

• Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	0A _H	00 _H	00 _H	C0 _H	09 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	0A _H	00 _H	00 _H	C0 _H	09 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

MODBUS Communication

5-5-5 Return Bus Message Count (0BH)

This command returns the number of messages detected on the bus.

- Request message

Function code	Sub-function code		Data	
08	000B		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

- Normal response message

Function code	Sub-function code		Data	
08	000B		Bus message count 0000 to FFFF (Note)	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.

When the count reaches FFFF, counting stops.

To restart counting, execute initialization.

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of returning the bus message count in RTU mode>

- Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	0B _H	00 _H	00 _H	91 _H	C9 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

- Normal response message

Slave address	Function code	Sub-function code		Data (Bus message count)		CRC	
01 _H	08 _H	00 _H	0B _H	00 _H	01 _H	50 _H	09 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

5-5-6 Return Communication Error Count (0CH)

This command returns the number of CRC errors that have occurred.

• Request message

Function code	Sub-function code		Data	
08	000C		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Normal response message

Function code	Sub-function code		Data	
08	000C		Communication error count 0000 to FFFF (Note)	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.

When the count reaches FFFF, counting stops.

To restart counting, execute initialization.

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of returning the communication error count in RTU mode>

• Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	0C _H	00 _H	00 _H	20 _H	08 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

Slave address	Function code	Sub-function code		Data (Communication error count)		CRC	
01 _H	08 _H	00 _H	0C _H	00 _H	00 _H	20 _H	08 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

MODBUS Communication

5-5-7 Return Exception Response Count (0DH)

This command returns the number of exception response messages.

- Request message

Function code	Sub-function code		Data	
08	000D		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

- Normal response message

Function code	Sub-function code		Data	
08	000D		Exception response count 0000 to FFFF (Note)	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.

When the count reaches FFFF, counting stops.

To restart counting, execute initialization.

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of returning the exception response count in RTU mode>

- Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	0D _H	00 _H	00 _H	71 _H	C8 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

- Normal response message

Slave address	Function code	Sub-function code		Data (Exception response count)		CRC	
01 _H	08 _H	00 _H	0D _H	00 _H	00 _H	71 _H	C8 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

5-5-8 Return Server Message Count (0EH)

This command returns the number of messages received (at the local station address and broadcast address).

• Request message

Function code	Sub-function code	Data
08	000E	0000
	Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits

• Normal response message

Function code	Sub-function code	Data
08	000E	Received message count 0000 to FFFF (Note)
	Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.

When the count reaches FFFF, counting stops.

To restart counting, execute initialization.

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of returning the received message count in RTU mode>

• Request message

Slave address	Function code	Sub-function code	Data	CRC
01 _H	08 _H	00 _H 0E _H Upper 8 bits Lower 8 bits	00 _H 00 _H Upper 8 bits Lower 8 bits	81 _H C8 _H Lower Upper

• Normal response message

Slave address	Function code	Sub-function code	Data (Received message count)	CRC
01 _H	08 _H	00 _H 0E _H Upper 8 bits Lower 8 bits	00 _H 01 _H Upper 8 bits Lower 8 bits	40 _H 08 _H Lower Upper

MODBUS Communication

5-5-9 Return Server No-Response Count (0FH)

This command returns the number of responses not returned to received messages.

- Request message

Function code	Sub-function code		Data	
08	000F		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

- Normal response message

Function code	Sub-function code		Data	
08	000F		No-response count 0000 to FFFF (Note)	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.

When the count reaches FFFF, counting stops.

To restart counting, execute initialization.

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of returning the no-response count in RTU mode>

- Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	0F _H	00 _H	00 _H	D0 _H	08 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

- Normal response message

Slave address	Function code	Sub-function code		Data (No-response count)		CRC	
01 _H	08 _H	00 _H	0F _H	00 _H	00 _H	D0 _H	08 _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

5-5-10 Return Server NAK Count (10H)

This command returns the number of NAK responses.
The **SC-HG1-485** always returns "0".

• Request message

Function code	Sub-function code		Data	
08	0010		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

• Normal response message

Function code	Sub-function code		Data	
08	0010		NAK response count 0000 to FFFF (Note)	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.
When the count reaches FFFF, counting stops.
To restart counting, execute initialization.

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to "5-6 Exception Response".

<Example of returning the NAK response count in RTU mode>

• Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	10 _H	00 _H	00 _H	E1 _H	CE _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

• Normal response message

Slave address	Function code	Sub-function code		Data (NAK response count)		CRC	
01 _H	08 _H	00 _H	10 _H	00 _H	00 _H	E1 _H	CE _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

MODBUS Communication

5-5-11 Return Server Busy Response Count (11H)

This command returns the number of busy responses.
The **SC-HG1-485** always returns “0”.

- Request message

Function code	Sub-function code	Data
08	0011	0000
	Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits

- Normal response message

Function code	Sub-function code	Data
08	0011	Busy response count 0000 to FFFF (Note)
	Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, or the counter and diagnostic register are cleared.
When the count reaches FFFF, counting stops.
To restart counting, execute initialization.

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of returning the busy response count in RTU mode>

- Request message

Slave address	Function code	Sub-function code	Data	CRC
01 _H	08 _H	00 _H 11 _H	00 _H 00 _H	B0 _H 0E _H
		Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits	Lower Upper

- Normal response message

Slave address	Function code	Sub-function code	Data (Busy response count)	CRC
01 _H	08 _H	00 _H 11 _H	00 _H 00 _H	B0 _H 0E _H
		Upper 8 bits Lower 8 bits	Upper 8 bits Lower 8 bits	Lower Upper

5-5-12 Return Communication Data Overrun Error Count (12H)

This command returns the number of overrun errors. The number of overrun errors is incremented by 1 each time received data is overwritten due to processing speed problems, hardware malfunctions, or other problems.

• Request message

Function code	Sub-function code	Data
08	0012 Upper 8 bits Lower 8 bits	0000 Upper 8 bits Lower 8 bits

• Normal response message

Function code	Sub-function code	Data
08	0012 Upper 8 bits Lower 8 bits	Overrun error count 0000 to FFFF (Note) Upper 8 bits Lower 8 bits

Note: The count is reset when the power is turned on, the serial communication unit is restarted, the counter and diagnostic register are cleared, or the overrun counter and flag are cleared.

When the count reaches FFFF, counting stops.

To restart counting, execute initialization.

• Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Examples of returning the communication data overrun error count in RTU mode>

• Request message

Slave address	Function code	Sub-function code	Data	CRC
01 _H	08 _H	00 _H 12 _H Upper 8 bits Lower 8 bits	00 _H 00 _H Upper 8 bits Lower 8 bits	40 _H 0E _H Lower Upper

• Normal response message

Slave address	Function code	Sub-function code	Data (Overrun error count)	CRC
01 _H	08 _H	00 _H 12 _H Upper 8 bits Lower 8 bits	00 _H 00 _H Upper 8 bits Lower 8 bits	40 _H 0E _H Lower Upper

MODBUS Communication

5-5-13 Clear Overrun Counter and Flag (14H)

This command clears the overrun error counter and resets the error flag.

- Request message

Function code	Sub-function code		Data	
08	0014		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

- Normal response message

Function code	Sub-function code		Data	
08	0014		0000	
	Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits

- Abnormal response message

Function code	Data
88	Exception code 01 or 03 or 04

For information on exception codes, refer to “5-6 Exception Response”.

<Example of clearing the overrun counter and flag in RTU mode>

- Request message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	14 _H	00 _H	00 _H	A0 _H	0F _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

- Normal response message

Slave address	Function code	Sub-function code		Data		CRC	
01 _H	08 _H	00 _H	14 _H	00 _H	00 _H	A0 _H	0F _H
		Upper 8 bits	Lower 8 bits	Upper 8 bits	Lower 8 bits	Lower	Upper

5-6 Exception Response

When an error occurs, an exception code is returned in an abnormal response message. Exception codes are indicated in the table.

Exception code	Name	Description	Action
01 _H	ILLEGAL FUNCTION	Function code not supported.	Use a function code that is supported.
02 _H	ILLEGAL DATA ADDRESS	Illegal address. Occurs when you attempt to access an address without allocated data.	Use a correct format code.
03 _H	ILLEGAL DATA VALUE	Illegal data value. Occurs when the data value is outside the allowed setting range.	Use a correct format code.
04 _H	SERVER DEVICE FAILURE	Error other than the above.	Execute resend.

(Only exceptions supported by the **SC-HG1-485** are indicated.)

(MEMO)

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6-1 Communication Specifications

6-1 Communication Specifications

The MEWTOCOL-COM communication parameters below can be set.

Item	Description
Device address	1 to 64
Communication speed	1,200bps / 2,400bps / 4,800bps / 9,600bps / 19,200bps / 38,400bps / 57,600bps / 115,200bps
Parity bit	Even / Odd / None
Data bits	8 bits, 7 bits
Stop bit length	1 bit, 2 bits

6-2 MEWTOCOL-COM Command Support Table

6-2 MEWTOCOL-COM Command Support Table

MEWTOCOL-COM commands supported by the **SC-HG1-485** are shown below.

Command	Code	Description	Supported
Read contact area	RC (RCS) (RCP) (RCC)	Reads the ON / OFF status of contacts. Specifies only one point Specifies multiple contacts. Specifies a range in word units.	○
Write contact area	WC (WCS) (WCP) (WCC)	Turns contacts ON / OFF. Specifies only one point Specifies multiple contacts. Specifies a range in word units.	○
Read data area	RD	Reads the contents of a data area.	○
Write data area	WD	Writes data to a data area.	○
Read timer / counter set value area	RS	Reads the value set for a timer / counter.	×
Write timer / counter set value area	WS	Writes a timer / counter setting value.	×
Read timer / counter elapsed value area	RK	Reads the timer / counter elapsed value.	×
Write timer / counter elapsed value area	WK	Writes the timer / counter elapsed value.	×
Register or reset contacts monitored	MC	Registers the contact to be monitored.	×
Register or reset data monitored	MD	Registers the data to be monitored.	×
Monitoring start	MG	Monitors a registered contact or data.	×
Preset contact area (fill command)	SC	Embeds the area of a specified range in a 16-point ON / OFF pattern.	×
Preset data area (fill command)	SD	Writes the same contents to the data area of a specified range.	○
Read system register	RR	Reads the contents of a system register.	×
Write system register	WR	Specifies the contents of a system register.	×
Read the status of PLC	RT	Reads the specifications of the programmable controller and error codes if an error occurs.	×
Remote control	RM	Switches the operation mode of the programmable controller.	×
Abort	AB	Aborts communication.	×

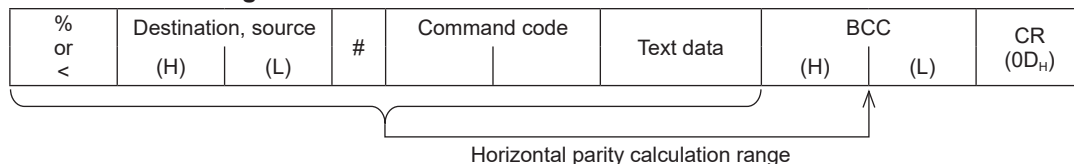
○: Supported
×: Not supported

6-3 Command / Response Formats

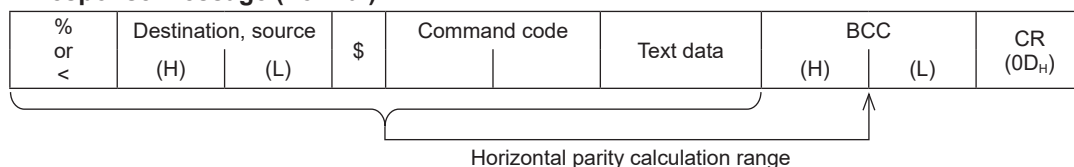
6-3 Command / Response Formats

Command / response formats start with "%" or "<", and end with CR.
The data to be transmitted is encoded in ASCII before transmission.

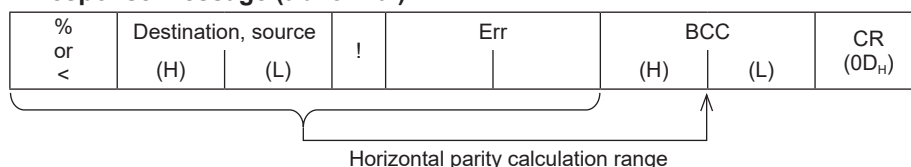
• Command message



• Response message (normal)



• Response message (abnormal)



Maximum message length

The maximum message length (number of characters from the header to the terminator) in a command / response frame is as follows.

% (header) 118 characters

< (extended header) 2048 characters

The maximum size of the address specification range in a read / write command is as follows.

Read: 125 words

Write: 123 words

Multiple-frame command is not supported.

Destination, source

Two decimal digits from 01 to 64 (ASCII code)

The device address of the unit that is to receive the command message is indicated in the command message.

The device address of the unit that sent the response message is indicated in the response message.

(H) indicates the higher digit. (L) indicates the lower digit.

When FF is specified for the address, the transmission is global (sent to all units). When the command message is for a global transmission, a response message is not returned.

Block check code BCC

Two hex digits from 00 to FF (ASCII code)

Code (horizontal parity) for detecting errors in transmitted data.

*** can be entered in place of BCC to send without a BCC. The BCC will be included in the response.

Use the method below to calculate the BCC.

1. Take the exclusive logical OR of each byte of data.
2. Convert the result of 1 into hex ASCII characters.

Command code

Specify a command code with 2 or 3 characters. A function is executed as specified by the command code.

For the command codes used in MEWTOCOL-COM and the command codes supported by the **SC-HG1-485**, refer to "6-2 MEWTOCOL-COM Command Support Table".

Text data

Data related to the command code is sent. The length is variable.

For details on the text data, refer to the explanations of the command codes.

Error code Err

Two hex digits from 00 to FF (ASCII code)

Indicates the error when an error occurs.

6-4 Formats by Command Code

6-4 Formats by Command Code

6-4-1 Read Contact Area [Single point] (RCS)

Reads the ON / OFF state of a contact.

The contact number range is 0000 to 999F; however, 1000 to 105F are used on the **SC-HG1-485**.

The least significant digit is 0 to F, and specifies the bit position.

For information on addresses, refer to "Chapter 7 Memory Map".

This function checks if the output of the controller connected to the **SC-HG1-485** is ON or OFF, and if the input is set to ON or OFF.

• Request message

% or <	Destination		#	R	C	S	Contact code R	Contact No.				BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$						$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 16^0$	(H)	(L)	

Contact codes

Contact	Code
External input X	"X"
External output Y	"Y"
Internal relay R	"R"
Link relay L	"L"
Timer T	"T"
Counter C	"C"

The **SC-HG1-485** only supports contact code "R".

• Normal response message

% or <	Source		\$	R	C	Contact data 1 / 0	BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$					(H)	(L)	

Contact data

Contact	Code
ON	"1"
OFF	"0"

• Error response message

% or <	Source		!	Error code		BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$		$\times 16^1$	$\times 16^0$	(H)	(L)	

For information on error codes, refer to "6-5 Error Codes".

<Example of reading external output 1 of the controller master unit>

• Request message

%	Destination		#	R	C	S	Contact code R	Contact No.				BCC		CR (0D _H)
	0	1						1	0	0	0	1	6	
	$\times 10^1$	$\times 10^0$						$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 16^0$	(H)	(L)	

• Normal response message

%	Source		\$	R	C	Contact data 0	BCC		CR (0D _H)
	0	1					2	1	
	$\times 10^1$	$\times 10^0$					(H)	(L)	

6-4-2 Read Contact Area [Plural points] (RCP)

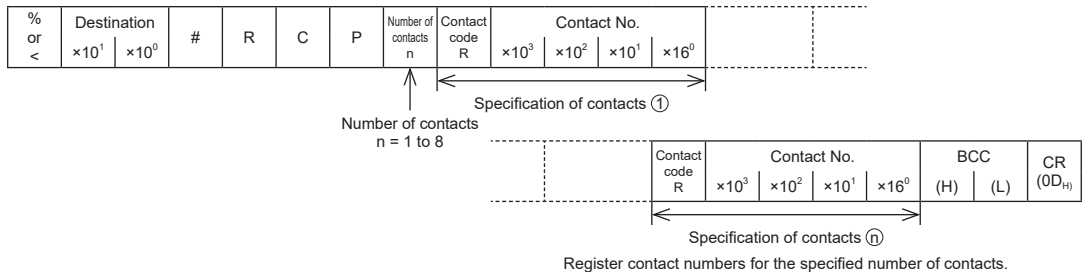
Reads the ON / OFF states of multiple contacts. Up to 8 contacts can be read at once. The contact number range is 0000 to 999F; however, 1000 to 105F are used on the **SC-HG1-485**.

The least significant digit is 0 to F, and specifies the bit position.

For information on addresses, refer to "Chapter 7 Memory Map".

This function checks if the output of the controller connected to the **SC-HG1-485** is ON or OFF, and if the input is set to ON or OFF.

• Request message



Contact codes

Contact	Code
External input X	"X"
External output Y	"Y"
Internal relay R	"R"
Link relay L	"L"
Timer T	"T"
Counter C	"C"

The **SC-HG1-485** only supports contact code "R".

• Normal response message

% or <	Source	\$	R	C	Contact data ①	...	Contact data ②	BCC	CR
	x10 ¹ x10 ⁰				①		②	(H) (L)	(0D _H)

Contact data

Contact	Code
ON	"1"
OFF	"0"

• Error response message

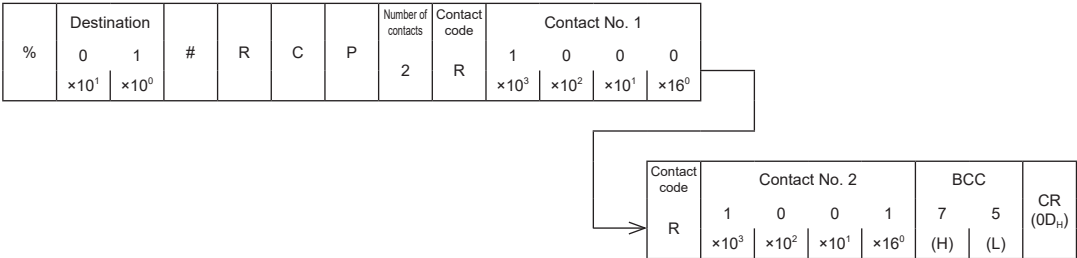
% or <	Source	!	Error code	BCC	CR
	x10 ¹ x10 ⁰		x16 ¹ x16 ⁰	(H) (L)	(0D _H)

For information on error codes, refer to "6-5 Error Codes".

6-4 Formats by Command Code

<Example of reading external outputs 1 and 2 of the controller master unit>

● Request message



● Normal response message

%	Source		\$	R	C	Contact data 1	Contact data 2	BCC		CR (0D _H)
	0	1						1	1	
	$\times 10^1$	$\times 10^0$				0	0	(H)	(L)	

6-4-3 Read Contact Area [Word units block] (RCC)

Reads the ON / OFF state of a contact in units of words. Contact information is read in hex. The contact number range is 0000 to 9999; however, 0100 to 0105 are used on the **SC-HG1-485**.

For information on addresses, refer to "Chapter 7 Memory Map".

This function checks if the output of the controller connected to the **SC-HG1-485** is ON or OFF, and if the input is set to ON or OFF.

• Request message

% or <	Destination		#	R	C	C	Contact code R	Starting word No.				Ending word No.				BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$						$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	(H)	(L)	

Contact codes

Contact	Code
External input X	"X"
External output Y	"Y"
Internal relay R	"R"
Link relay L	"L"
Timer T	"T"
Counter C	"C"

The **SC-HG1-485** only supports contact code "R".

• Normal response message

% or <	Source		\$	R	C	First contact information				...	Last contact information				BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$				$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$		$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	(H)	(L)	

Contact data

Contact	Code
ON	"1"
OFF	"0"

• Error response message

% or <	Source		!	Error code		BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$		$\times 16^1$	$\times 16^0$	(H)	(L)	

For information on error codes, refer to "6-5 Error Codes".

<Example of reading external outputs 1, 2, and 3 of the controller master unit and up to four slave units>

• Request message

%	Destination		#	R	C	C	Contact code R	Starting word No.				Ending word No.				BCC		CR (0D _H)
	0	1						0	1	0	0	0	1	0	0	0	7	
	$\times 10^1$	$\times 10^0$						$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	(H)	(L)	

• Normal response message

%	Source		\$	R	C	Contact information				BCC		CR (0D _H)
	0	1				0	0	0	0	1	1	
	$\times 10^1$	$\times 10^0$				$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	(H)	(L)	

6-4 Formats by Command Code

6-4-4 Write Contact Area [Single point] (WCS)

Sets the ON / OFF state of the contact.

The contact number range is 0000 to 999F; however, 1030 to 105F are used on the **SC-HG1-485**.

The least significant digit is 0 to F, and specifies the bit position.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used to set the input of a controller connected to the **SC-HG1-485** to ON or OFF.

• Request message

% or <	Destination		#	W	C	S	Contact code R	Contact No.				Contact data 1 / 0	BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$						$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$		(H)	(L)	

Contact codes

Contact	Code
External output Y	"Y"
Internal relay R	"R"
Link relay L	"L"

Contact data

Contact	Code
ON	"1"
OFF	"0"

The **SC-HG1-485** only supports contact code "R".

• Normal response message

% or <	Source		\$	W	C	BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$				(H)	(L)	

• Error response message

% or <	Source		!	Error code		BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$		$\times 16^1$	$\times 16^0$	(H)	(L)	

For information on error codes, refer to "6-5 Error Codes".

<Example of setting external input 1 of the controller master unit to ON>

• Request message

%	Destination		#	W	C	S	Contact code R	Contact No.				Contact data	BCC		CR (0D _H)
	0	1						1	0	3	0	1	2	1	
	$\times 10^1$	$\times 10^0$						$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$		(H)	(L)	

• Normal response message

%	Source		\$	W	C	BCC		CR (0D _H)
	0	1				1	4	
	$\times 10^1$	$\times 10^0$				(H)	(L)	

6-4-5 Write Contact Area [Plural points] (WCP)

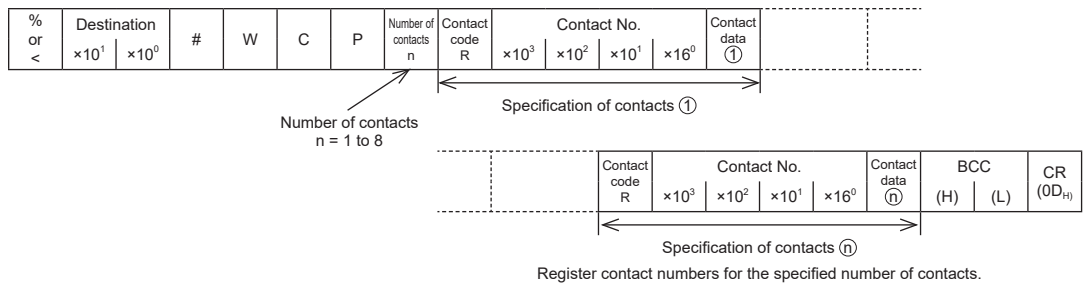
Sets the ON / OFF state of multiple contacts. Up to 8 contacts can be read at once. The contact number range is 0000 to 999F; however, 1030 to 105F are used on the **SC-HG1-485**.

The least significant digit is 0 to F, and specifies the bit position.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used to set multiple inputs of a controller connected to the **SC-HG1-485** to ON or OFF.

• Request message



Contact codes

Contact	Code
External output Y	"Y"
Internal relay R	"R"
Link relay L	"L"

Contact data

Contact	Code
ON	"1"
OFF	"0"

The **SC-HG1-485** only supports contact code "R".

• Normal response message

% or <	Source	\$	W	C	BCC	CR
	x10 ¹ x10 ⁰				(H) (L)	(0D _H)

• Error response message

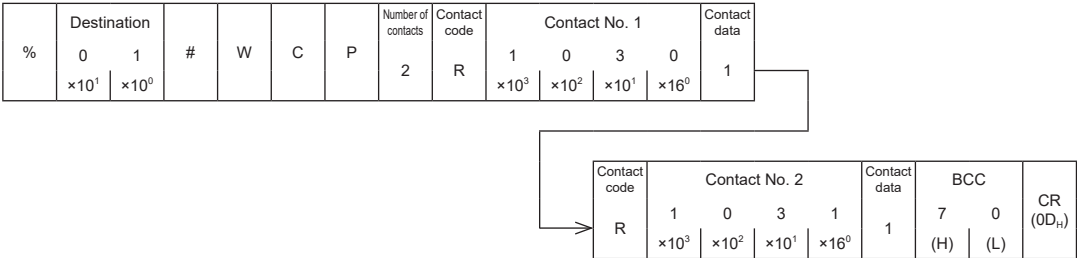
% or <	Source	!	Error code	BCC	CR
	x10 ¹ x10 ⁰		x16 ¹ x16 ⁰	(H) (L)	(0D _H)

For information on error codes, refer to "6-5 Error Codes".

6-4 Formats by Command Code

<Example of setting external inputs 1 and 2 of the controller master unit to ON>

● Request message



● Normal response message

%	Source		\$	W	C	BCC		CR (0D _H)
	0	1				1	4	
	$\times 10^1$	$\times 10^0$				(H)	(L)	

6-4-6 Write Contact Area [Word units block] (WCC)

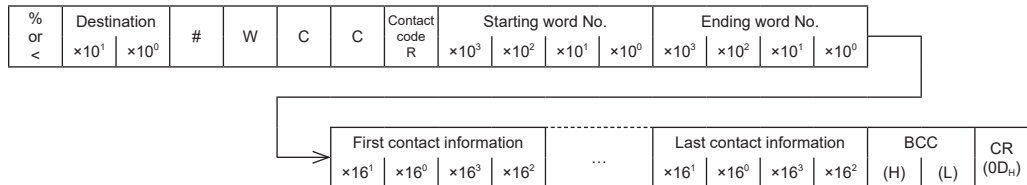
Sets the ON / OFF state of a contact in units of words. The contact information written is specified in hex.

The contact number range is 0000 to 9999; however, 0103 to 0105 are used on the **SC-HG1-485**.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used to set the input of a controller connected to the **SC-HG1-485** to ON or OFF in units of words.

• Request message



Contact codes

Contact	Code
External output Y	"Y"
Internal relay R	"R"
Link relay L	"L"

The **SC-HG1-485** only supports contact code "R".

• Normal response message

% or <	Source $\times 10^1$ $\times 10^0$	\$	W	C	BCC (H) (L)		CR (0D _H)
--------------	---	----	---	---	------------------	--	--------------------------

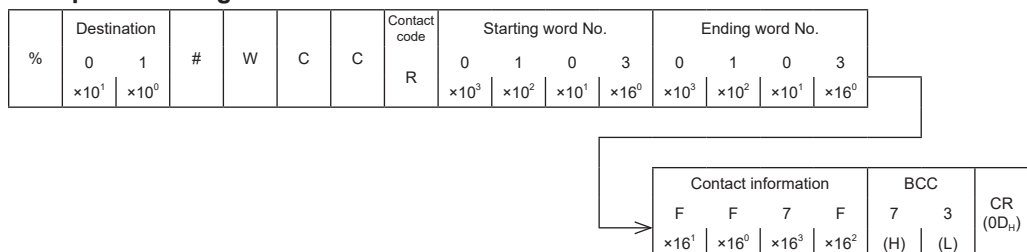
• Error response message

% or <	Source $\times 10^1$ $\times 10^0$	!	Error code $\times 16^1$ $\times 16^0$		BCC (H) (L)		CR (0D _H)
--------------	---	---	---	--	------------------	--	--------------------------

For information on error codes, refer to "6-5 Error Codes".

<Example of setting external inputs 1, 2, and 3 of the controller master unit and up to four slave units to ON>

• Request message



• Normal response message

%	Source 0 1 $\times 10^1$ $\times 10^0$	\$	W	C	BCC 1 4 (H) (L)		CR (0D _H)
---	--	----	---	---	---------------------------	--	--------------------------

6-4 Formats by Command Code

6-4-7 Read Data Area (RD)

Reads the values in the data areas of successive areas. Specify the leading word number and the ending word number.

The word number range is 00000 to 99999; however, 00100 to 01999 (includes unused areas) are used on the **SC-HG1-485**.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used to read measured values and set values on controllers connected to the **SC-HG1-485**.

• Request message

% or <	Destination		#	R	D	Data code D	Starting word No.					Ending word No.					BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$					$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	(H)	(L)	

Data Code

Data	Code
Data register DT	"D"
Link data register LD	"L"
File register FL	"F"

The **SC-HG1-485** only supports data code "D".

• Normal response message

% or <	Source		\$	R	D	First register contents				...	Last register contents				BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$				$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$		$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	(H)	(L)	

• Error response message

% or <	Source		!	Error code	BCC		CR (0D _H)
	$\times 10^1$	$\times 10^0$		$\times 16^1$ $\times 16^0$	(H)	(L)	

For information on error codes, refer to "6-5 Error Codes".

<Example of reading measured values of the controller master unit>

• Request message

%	Destination		#	R	D	Data code D	Starting word No.					Ending word No.					BCC		CR (0D _H)
	0	1					0	0	1	0	0	0	0	1	0	1	5	4	
	$\times 10^1$	$\times 10^0$					$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	(H)	(L)	

• Normal response message

%	Source		\$	R	D	Register contents 1				Register contents 2				BCC		CR (0D _H)
	0	1				4	5	2	3	0	1	0	0	1	7	
	$\times 10^1$	$\times 10^0$				$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	(H)	(L)	

6-4-8 Write Data Area (WD)

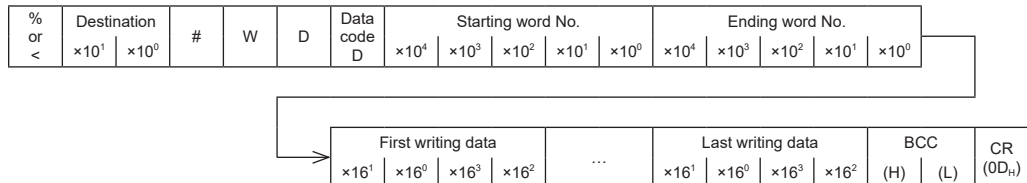
Writes values to the data areas of successive areas. Specify the leading word number and the ending word number.

The word number range is 00000 to 99999; however, 00133 to 01999 (includes unused areas) are used on the **SC-HG1-485**.

For information on addresses, refer to “Chapter 7 Memory Map”.

This function is used for various settings on controllers connected to the **SC-HG1-485**.

• Request message



Data Code

Data	Code
Data register DT	"D"
Link data register LD	"L"
File register FL	"F"

The **SC-HG1-485** only supports data code "D".

• Normal response message

% or <	Source $\times 10^1$ $\times 10^0$		\$	W	D	BCC (H) (L)		CR (0D _H)
--------------	---	--	----	---	---	------------------	--	--------------------------

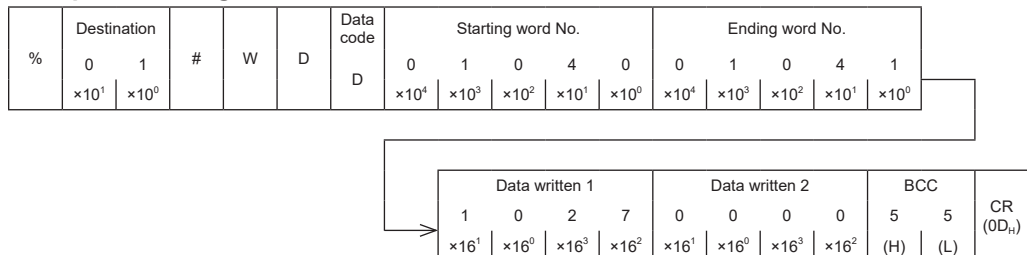
• Error response message

% or <	Source $\times 10^1$ $\times 10^0$		!	Error code $\times 16^1$ $\times 16^0$		BCC (H) (L)		CR (0D _H)
--------------	---	--	---	---	--	------------------	--	--------------------------

For information on error codes, refer to “6-5 Error Codes”.

<Example of setting LOW value>

• Request message



• Normal response message

%	Source 0 1 $\times 10^1$ $\times 10^0$		\$	W	D	BCC 1 3 (H) (L)		CR (0D _H)
---	--	--	----	---	---	---------------------------	--	--------------------------

6-4 Formats by Command Code

6-4-9 Preset Data Area (SD)

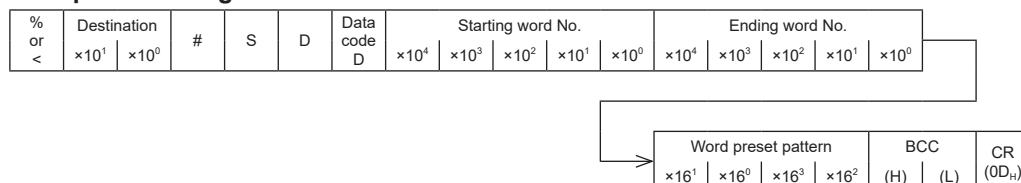
Writes the same values to the data areas of successive areas. Specify the leading word number and the ending word number.

The word number range is 00000 to 99999; however, 00133 to 01999 (includes unused areas) are used on the **SC-HG1-485**.

For information on addresses, refer to "Chapter 7 Memory Map".

This function is used for various settings on controllers connected to the **SC-HG1-485**.

• Request message



Data codes

Data	Code
Data register DT	"D"
Link data register LD	"L"
File register FL	"F"

The **SC-HG1-485** only supports data code "D".

• Normal response message

% or <	Source $\times 10^1$ $\times 10^0$		\$	S	D	BCC (H) (L)		CR (0D _H)
--------------	---	--	----	---	---	------------------	--	--------------------------

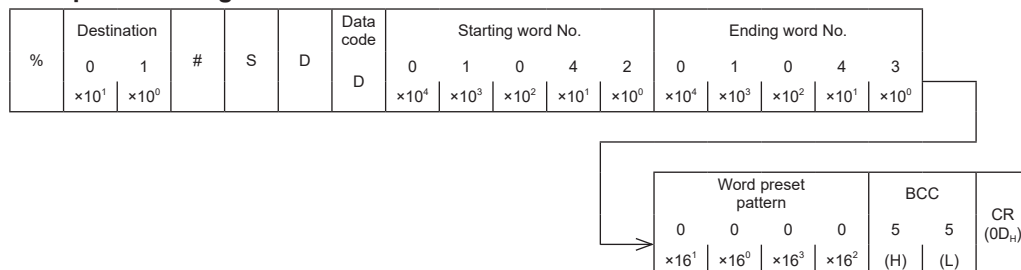
• Error response message

% or <	Source $\times 10^1$ $\times 10^0$		!	Error code $\times 16^1$ $\times 16^0$		BCC (H) (L)		CR (0D _H)
--------------	---	--	---	---	--	------------------	--	--------------------------

For information on error codes, refer to "6-5 Error Codes".

<Example of clearing HIGH value>

• Request message



• Normal response message

%	Source 0 1 $\times 10^1$ $\times 10^0$		\$	S	D	BCC 1 7 (H) (L)		CR (0D _H)
---	--	--	----	---	---	---------------------------	--	--------------------------

6-5 Error Codes

When an error occurs, an error code is returned in an abnormal response message. Error codes are indicated in the table.

Error code	Error name	Description	Action
26H	Abnormal MEWTOCOL station number	A number other than 01 to 64 is set for the MEWTOCOL station number of own node.	Set the MEWTOCOL station number within the range 01 to 64.
28H	No-response error	A timeout error occurred while waiting for a response from the other station.	Execute the resend process in the application program.
30H	Timeout	Unable to send.	Execute the resend process in the application program.
32H	Transmission error	Transmission canceled due to overflow of own node buffer.	Do not exceed the maximum data size.
38H	Other communication error	Communication error other than the above	Execute resend in the application program.
40H	BCC error	A BCC error occurred in the command data.	Execute resend in the application program.
41H	Format error	The command message that was sent does not match the transmission format. Excessive or insufficient command data. No "#", no "Destination", etc.	Correct the format of the command.
42H	NOT support error	An unsupported command was sent. A command was sent to an unsupported destination, etc.	Use a supported command.
43H	Procedure error	In the send request message wait state (data to be sent remains), an unrelated command was sent.	Send a send request message to the other node.
60H	Parameter error	Code without an area specification parameter, or code that cannot be used in that command. (X, Y, D, etc.) Code with an inappropriate function specification parameter (0, 1, 2, etc.).	Use a correct format code.
61H	Data error	A contact number, area number, data code format (BCD, HEX, etc.) excess / insufficiency, or range specification error occurred.	Use a correct format code.
66H	Address error	Address (program address, absolute address, etc.) data code format (BCD, HEX, etc.) excess / insufficiency or range specification error	Use a correct format code.
67H	Missing data error	No read data.	Use a correct format code.
72H	Timeout error	Send answer timeout error	Execute a resend in the application program.

(MEMO)

Chapter 7 Memory Map

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Memory Map

7-1 Addresses

Addresses used on the **SC-HG1-485** are shown in the table below.

Description	R/W	MODBUS		MEWTOCOL-COM	
		Holding register	Coil	Data register	Internal relay
Status Register	R	400137	-	DT00136	-
Measured Values	R	400101 to 400129	-	DT00100 to DT00128	-
External Output	R	400131 to 400133	000161 to 000208	DT00130 to DT00132	R1000 to R102F
External Input	R/W	400134 to 400136	000209 to 000256	DT00133 to DT00135	R1030 to R105F
Set Values	R/W	401001 to 402919 (Note)	-	DT01000 to DT01999 (Note)	-
GT Communication Area	R/W	400001 to 400003	000001 to 000048	DT00000 to DT00002	R0000 to R002F

Note: Includes unused addresses.

7-2 Status Register

Reads the status of the communication unit.

MODBUS	MEWTOCOL-COM	R/W	Description
Holding register	Data register		
400137	DT00136	R	Status. Refer to the following for bit assignments.

Status

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	Number of connected controllers				0	0	0	SIDE	0	0	0	RDY

Number of connected controllers: Number of controllers connected to the communication unit.
1 to 15 controllers (0H to FH).

SIDE: Flag indicating whether communication with the connected controllers is normal.
(1: Normal, 0: Error)

RDY: Operating status of the unit. (1: Normal, 0: Error)

Memory Map

7-3 Measured Values

Reads the measured values of the connected controller master unit and slave units.

The data size is 32 bits, so read in units of two words.

The values of the lower 16 bits are stored in the lower address. The values of the upper 16 bits are stored in the upper address.

MODBUS	MEWTOCOL-COM	R/W	Description
Holding register	Data register		
400101 to 400102	DT00100 to DT00101	R	Controller master unit measured values
400103 to 400104	DT00102 to DT00103	R	1st controller slave unit measured values
400105 to 400106	DT00104 to DT00105	R	2nd controller slave unit measured values
400107 to 400108	DT00106 to DT00107	R	3rd controller slave unit measured values
400109 to 400110	DT00108 to DT00109	R	4th controller slave unit measured values
400111 to 400112	DT00110 to DT00111	R	5th controller slave unit measured values
400113 to 400114	DT00112 to DT00113	R	6th controller slave unit measured values
400115 to 400116	DT00114 to DT00115	R	7th controller slave unit measured values
400117 to 400118	DT00116 to DT00117	R	8th controller slave unit measured values
400119 to 400120	DT00118 to DT00119	R	9th controller slave unit measured values
400121 to 400122	DT00120 to DT00121	R	10th controller slave unit measured values
400123 to 400124	DT00122 to DT00123	R	11th controller slave unit measured values
400125 to 400126	DT00124 to DT00125	R	12th controller slave unit measured values
400127 to 400128	DT00126 to DT00127	R	13th controller slave unit measured values
400129 to 400130	DT00128 to DT00129	R	14th controller slave unit measured values

Measured values are output in the minimum units of the controller.

Value range	
HG-S□	-1999999 to 1999999
HG-T□	

When the controller is in certain states, the measured values are as follows.

Controller display	Description	Measured values
+OVER	Over the upper display limit	9500000
-OVER	Under the lower display limit	-9500000
ALARM	Alarm	9999999
HW.ERR	Error	
-----	Immediately after the power is turned ON or a reset is input	-9999999

7-4 External Output

- This memory area is used to monitor the external output status of each controller from the host PLC.
- The operation of external outputs 1 to 3 is read based on the output operation (normal open, normal closed) and the external output (3-value, 2-value, logic, logic 2) controller settings. If individual settings are specified for the output operation of the controllers, output is read based on the setting of each controller.
- In MODBUS, the same information is read from the holding register and coil. In MEWTOCOL-COM, the same information is read from the data register and internal relay.

MODBUS			MEWTOCOL-COM			R/W	Description
Holding register	Coil		Data register	Internal relay			
400131	bit0	000161	DT00130	bit0	WR0100	R1000	Master unit, external output 1
	bit1	000162		bit1		R1001	Master unit, external output 2
	bit2	000163		bit2		R1002	Master unit, external output 3
	bit3	000164		bit3		R1003	1st slave unit, external output 1
	bit4	000165		bit4		R1004	1st slave unit, external output 2
	bit5	000166		bit5		R1005	1st slave unit, external output 3
	bit6	000167		bit6		R1006	2nd slave unit, external output 1
	bit7	000168		bit7		R1007	2nd slave unit, external output 2
	bit8	000169		bit8		R1008	2nd slave unit, external output 3
	bit9	000170		bit9		R1009	3rd slave unit, external output 1
	bit10	000171		bit10		R100A	3rd slave unit, external output 2
	bit11	000172		bit11		R100B	3rd slave unit, external output 3
	bit12	000173		bit12		R100C	4th slave unit, external output 1
	bit13	000174		bit13		R100D	4th slave unit, external output 2
	bit14	000175		bit14		R100E	4th slave unit, external output 3
	bit15	000176		bit15		R100F	—
400132	bit0	000177	DT00131	bit0	WR0101	R1010	5th slave unit, external output 1
	bit1	000178		bit1		R1011	5th slave unit, external output 2
	bit2	000179		bit2		R1012	5th slave unit, external output 3
	bit3	000180		bit3		R1013	6th slave unit, external output 1
	bit4	000181		bit4		R1014	6th slave unit, external output 2
	bit5	000182		bit5		R1015	6th slave unit, external output 3
	bit6	000183		bit6		R1016	7th slave unit, external output 1
	bit7	000184		bit7		R1017	7th slave unit, external output 2
	bit8	000185		bit8		R1018	7th slave unit, external output 3
	bit9	000186		bit9		R1019	8th slave unit, external output 1
	bit10	000187		bit10		R101A	8th slave unit, external output 2
	bit11	000188		bit11		R101B	8th slave unit, external output 3
	bit12	000189		bit12		R101C	9th slave unit, external output 1
	bit13	000190		bit13		R101D	9th slave unit, external output 2
	bit14	000191		bit14		R101E	9th slave unit, external output 3
	bit15	000192		bit15		R101F	—

Memory Map

MODBUS			MEWTOCOL-COM				R/W	Description
Holding register	Coil		Data register		Internal relay			
400133	bit0	000193	DT00132	bit0	WR0102	R1020	R	10th slave unit, external output 1
	bit1	000194		bit1		R1021	R	10th slave unit, external output 2
	bit2	000195		bit2		R1022	R	10th slave unit, external output 3
	bit3	000196		bit3		R1023	R	11th slave unit, external output 1
	bit4	000197		bit4		R1024	R	11th slave unit, external output 2
	bit5	000198		bit5		R1025	R	11th slave unit, external output 3
	bit6	000199		bit6		R1026	R	12th slave unit, external output 1
	bit7	000200		bit7		R1027	R	12th slave unit, external output 2
	bit8	000201		bit8		R1028	R	12th slave unit, external output 3
	bit9	000202		bit9		R1029	R	13th slave unit, external output 1
	bit10	000203		bit10		R102A	R	13th slave unit, external output 2
	bit11	000204		bit11		R102B	R	13th slave unit, external output 3
	bit12	000205		bit12		R102C	R	14th slave unit, external output 1
	bit13	000206		bit13		R102D	R	14th slave unit, external output 2
	bit14	000207		bit14		R102E	R	14th slave unit, external output 3
	bit15	000208		bit15		R102F	R	—

Values read

- Read Contact Area [Single Contact] and Read Contact Area [Multiple Contacts] of MEWTOCOL-COM communication

External output status	Value read
OFF	0
ON	1

- Other commands

External output status	bit0 to bit15
OFF	0
ON	1

7-5 External Input

- This memory area is used to control (turn ON/OFF) the external inputs of each controller from the host PLC.
 - The settings execute the operation of external inputs 1 to 3 based on the input operation setting (Preset, Reset, Trigger, Bank A, Bank B) in the controller settings.
 - When Read is executed, the input state set by the **SC-HG1-485** is returned.
 - In MODBUS, the same information is written to the holding register and coil.
 - In MEWTOCOL-COM, the same information is written to the data register and internal relay.
- If “1” is written when individual settings are specified for the input operation of the controllers, operation takes place based on the setting of each controller.
- Even when “ALL” is set for the all input setting of the controller master unit, settings from communication are not input by “ALL” input. Write “1” to all controllers

MODBUS			MEWTOCOL-COM			R/W	Description
Holding register	Coil		Data register	Internal relay			
400134	bit0	000209	DT00133	bit0	R1030	R/W	Master unit, external input 1
	bit1	000210		bit1	R1031	R/W	Master unit, external input 2
	bit2	000211		bit2	R1032	R/W	Master unit, external input 3
	bit3	000212		bit3	R1033	R/W	1st slave unit, external input 1
	bit4	000213		bit4	R1034	R/W	1st slave unit, external input 2
	bit5	000214		bit5	R1035	R/W	1st slave unit, external input 3
	bit6	000215		bit6	R1036	R/W	2nd slave unit, external input 1
	bit7	000216		bit7	R1037	R/W	2nd slave unit, external input 2
	bit8	000217		bit8	R1038	R/W	2nd slave unit, external input 3
	bit9	000218		bit9	R1039	R/W	3rd slave unit, external input 1
	bit10	000219		bit10	R103A	R/W	3rd slave unit, external input 2
	bit11	000220		bit11	R103B	R/W	3rd slave unit, external input 3
	bit12	000221		bit12	R103C	R/W	4th slave unit, external input 1
	bit13	000222		bit13	R103D	R/W	4th slave unit, external input 2
	bit14	000223		bit14	R103E	R/W	4th slave unit, external input 3
	bit15	000224		bit15	R103F	R/W	—
400135	bit0	000225	DT00134	bit0	R1040	R/W	5th slave unit, external input 1
	bit1	000226		bit1	R1041	R/W	5th slave unit, external input 2
	bit2	000227		bit2	R1042	R/W	5th slave unit, external input 3
	bit3	000228		bit3	R1043	R/W	6th slave unit, external input 1
	bit4	000229		bit4	R1044	R/W	6th slave unit, external input 2
	bit5	000230		bit5	R1045	R/W	6th slave unit, external input 3
	bit6	000231		bit6	R1046	R/W	7th slave unit, external input 1
	bit7	000232		bit7	R1047	R/W	7th slave unit, external input 2
	bit8	000233		bit8	R1048	R/W	7th slave unit, external input 3
	bit9	000234		bit9	R1049	R/W	8th slave unit, external input 1
	bit10	000235		bit10	R104A	R/W	8th slave unit, external input 2
	bit11	000236		bit11	R104B	R/W	8th slave unit, external input 3
	bit12	000237		bit12	R104C	R/W	9th slave unit, external input 1
	bit13	000238		bit13	R104D	R/W	9th slave unit, external input 2
	bit14	000239		bit14	R104E	R/W	9th slave unit, external input 3
	bit15	000240		bit15	R104F	R/W	—

Memory Map

MODBUS			MEWTOCOL-COM				R/W	Description
Holding register	Coil		Data register		Internal relay			
400136	bit0	000241	DT00135	bit0	WR0105	R1050	R/W	10th slave unit, external input 1
	bit1	000242		bit1		R1051	R/W	10th slave unit, external input 2
	bit2	000243		bit2		R1052	R/W	10th slave unit, external input 3
	bit3	000244		bit3		R1053	R/W	11th slave unit, external input 1
	bit4	000245		bit4		R1054	R/W	11th slave unit, external input 2
	bit5	000246		bit5		R1055	R/W	11th slave unit, external input 3
	bit6	000247		bit6		R1056	R/W	12th slave unit, external input 1
	bit7	000248		bit7		R1057	R/W	12th slave unit, external input 2
	bit8	000249		bit8		R1058	R/W	12th slave unit, external input 3
	bit9	000250		bit9		R1059	R/W	13th slave unit, external input 1
	bit10	000251		bit10		R105A	R/W	13th slave unit, external input 2
	bit11	000252		bit11		R105B	R/W	13th slave unit, external input 3
	bit12	000253		bit12		R105C	R/W	14th slave unit, external input 1
	bit13	000254		bit13		R105D	R/W	14th slave unit, external input 2
	bit14	000255		bit14		R105E	R/W	14th slave unit, external input 3
	bit15	000256		bit15		R105F	R/W	—

Values and operation

- Write Coil (05) in MODBUS communication

Set value	External input status
0000	OFF
FF00	ON

- Write Contact Area [Single Contact] and Write Contact Area [Multiple Contacts] of MEWTOCOL-COM communication

Set value	External input status
0	OFF
1	ON

- Other commands

bit0 to bit15	External input status
0	OFF
1	ON

The settings from the **SC-HG1-485** and controller external input operate by OR operation.

7-6 Set Values

Reading and writing of set values of a connected controller are described below.
The registers consist of the accessed controller setting register and the set value registers.

Note: When changing controller settings from the **SC-HG1-485** by communication, do not simultaneously change settings using the controller buttons.

Accessed controller setting register

Set the controller accessed for reading or writing of set values.

MODBUS	MEWTOCOL-COM	R/W	Description
Holding register	Data register		
401001	DT01000	R/W	Accessed controller 0: Master unit, 1 to 14: 1st slave unit to 14th slave unit

Set values

Register value	Description
0	Master unit
1 to 14	1st slave unit to 14th slave unit

An error will be returned if you write an unconnected unit or a value of 15 or higher.

Memory Map

Set value registers

You can read and write set values from/to the controller set in the accessed controller setting register.

The data size is 32 bits. Data must be accessed in units of two words.

Lower 16 bit and upper 16 bit values are stored in the lower and upper addresses, respectively. For details on each item, refer to the user's manual of the controller that you use.

■ HG-S series specific registers

Attributes (R: Read, W: Write, R/W: Read/Write)

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-S series	401003 to 401004	DT01002 to DT01003	R	Status error	When status is normal: 0 When error occurs: Error code
	401005 to 401009	DT01004 to DT01008	—	System reserved	Do not use.
	401011 to 401012	DT01010 to DT01011	W	Controller reset	Resets the controller. (Master unit only)
	401013	DT01012	W	Settings initialization (RESET)	Returns the settings to the factory default state. Do not specify "0".
	401015 to 401031	DT01014 to DT01030	—	System reserved	Do not use.
	401033	DT01032	R	Judgment value (JUDGE.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	401035	DT01034	R	Normal measured value (NORM.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	401037	DT01036	R	Calculated value (CALC)	Integer in minimum resolution units of controller If a calculated value is not set, a judgment value is output. -1999999 to 1999999
	401039	DT01038	R	Sensor head measured value (HEAD.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	401041	DT01040	R/W	LOW set value (LO.SET)	Integer in minimum resolution units of controller -1999999 to 1999999
	401043	DT01042	R/W	HIGH set value (HI.SET)	Integer in minimum resolution units of controller -1999999 to 1999999
	401045 to 401047	DT01044 to DT01046	—	System reserved	Do not use.
	401049	DT01048	R/W	Hysteresis (HYSTER)	Integer in minimum resolution units of controller 0 to 1999999
	401051	DT01050	—	System reserved	Do not use.
	401053	DT01052	R/W	Output operation (OUTPUT)	0: N.O. 1: N.C.
	401055	DT01054	—	System reserved	Do not use.
	401057	DT01056	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 upper bits are set to "0".
	401059	DT01058	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 upper bits are set to "0".
	401061	DT01060	W	Bank load execution (LOAD)	Bank number from which to load data (1 to 3)

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-S series	401063	DT01062	W	Bank save execution (SAVE)	Bank number in which to save data (1 to 3)
	401065	DT01064	R/W	Key lock (LOCK)	0: Key lock OFF 1: Key lock ON
	401067	DT01066	R/W	Eco mode (ECO)	0: Eco mode OFF 1: Eco mode ON
	401069	DT01068	R	Maximum value during P-P measurement	Integer in 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
	401071	DT01070	R	Minimum value during P-P measurement	Integer in 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
	401073 to 401127	DT01072 to DT01126	—	System reserved	Do not use.
	401129	DT01128	R/W	Preset (PRESET)	0: OFF 1: ON
	401131	DT01130	R/W	Preset value (PR.VAL)	Integer in minimum resolution units of controller -1999999 to 1999999
	401133	DT01132	R/W	Preset data selection (PR.OBJ)	0: Normal measured value (NORM.V) 1: Judgment value (JUDGE.V)
	401135	DT01134	R/W	Preset save (PR.SAVE)	0: OFF 1: ON
	401137	DT01136	R/W	Label 1 (LABEL)	Label [1st to 4th characters] Part of character code is usable. (Note 1)
	401139	DT01138	R/W	Label 2 (LABEL)	Label [5th and 6th characters] Part of character code is usable. (Note 1)
	401141	DT01140	R/W	Response time (SPEED)	0: 3ms 1: 5ms 2: 10ms 3: 100ms 4: 500ms 5: 1000ms
	401143	DT01142	R/W	Measurement direction (DIRECT)	0: Normal display 1: Reverse display
	401145	DT01144	R/W	Alarm delay count (DELAY)	Delay count: 1 to 1000
	401147	DT01146	R/W	Teaching type (TEACH)	0: 1-point teaching 1: 2-point teaching 2: 3-point teaching
	401149	DT01148	R/W	Input all (ALL IN)	0: Individual input 1: Simultaneous input
	401151	DT01150	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)
	401153	DT01152	R/W	External output (EXT.OUT)	0: 3-value 1: 2-value 2: Logic 3: Logic 2
	401155	DT01154	R/W	Analog scaling (ANALOG)	0: Default 1: Free

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-S series	401157	DT01156	R/W	Scaling upper limit value (ANA.HI)	Integer in minimum resolution units of controller -1999999 to 1999999
	401159	DT01158	R/W	Scaling lower limit value (ANA.LO)	Integer in minimum resolution units of controller -1999999 to 1999999
	401161	DT01160	R/W	Number of digits displayed (DIGIT)	0: 0.0001 1: 0.001 2: 0.01 3: 0.1
	401163	DT01162	R/W	Calibration selection (CAL.SEL)	0: Default 1: User setting
	401165	DT01164	W	Calibration zero-point execution (CL.SET1)	Acquires the zero-point. Specify "0".
	401167	DT01166	R/W	Calibration target value (AJ.VAL2)	Integer in minimum resolution units of controller -1999999 to 1999999
	401169	DT01168	W	Calibration target value acquisition (CL.SET2)	Acquires the target value. Specify "0".
	401171	DT01170	R/W	1-point teaching tolerance (TOL< $\pm$ >)	Integer in minimum resolution units of controller -1999999 to 1999999
	401173	DT01172	W	1st-point teaching execution (SET.1)	Executes 1st-point teaching. Specify "0".
	401175	DT01174	W	2nd-point teaching execution (SET.2)	Executes 2nd-point teaching. Specify "0".
	401177	DT01176	W	3rd-point teaching execution (SET.3)	Executes 3rd-point teaching. Specify "0".
	401179 to 401187	DT01178 to DT01186	—	Other model command area	Do not use.
	401189 to 401319	DT01188 to DT01318	—	System reserved	Do not use.
	401321	DT01320	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
	401323	DT01322	—	System reserved	Do not use.
	401325	DT01324	R	Notification	bit0 : Sensor head unconnected bit2 : Connected unit count check error bit3 : NPN / PNP output type mixture error bit4 : Calculated unit count error bit5 : Copy execution error (Slave unit problem) bit10 : Out-of-specification pressure error bit11 : Catch check bit12 : Pressure check
	401327 to 401511	DT01326 to DT01510	—	System reserved	Do not use.
	401513	DT01512	R/W	Leverage ratio (LEVER)	Leverage ratio $\times 10$ (1 to 1000)

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-S series	401515	DT01514	R/W	Pressure check (PRS.CHK)	0: OFF 1: ON
	401517	DT01516	R/W	Set value for pressure check (PRS.SET)	Integer in minimum resolution units of controller -1999999 to 1999999
	401519	DT01518	R/W	Stuckness check (CAT.CHK)	0: OFF 1: ON
	401521	DT01520	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 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
	401523	DT01522	R/W	Self trigger level (SLF.LV)	Integer in minimum resolution units of controller -1999999 to 1999999
	401525	DT01524	R/W	Static width (DLY.WD)	Integer in minimum resolution units of controller -1999999 to 1999999
	401527	DT01526	R/W	Self trigger delay timer (DLY.TIM)	Delay time: 0 to 9999ms
	401529	DT01528	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)

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-S series	401531	DT01530	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 <±>
	401533	DT01532	W	Copy execution (CPY.EXE)	Executes copying. Specify "0".
	401535	DT01534	R/W	Copy lock (LOCK)	0: Copy lock OFF 1: Copy lock ON
	401537	DT01536	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
	401539	DT01538	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
	401541	DT01540	R	Total stroke operation log (SUM.REC)	Units of 1 m
	401543	DT01542	R	Maximum peak value (MAX.VAL)	Integer in minimum resolution units of controller -1999999 to 1999999
	401545	DT01544	R	Maximum peak value operation log (MAX.REC)	Units of 1 m
	401547	DT01546	R	Overstroke log (OVR.NUM)	Number of times
	401549	DT01548	R/W	Connected unit count check (Note 2)	0: OFF 1: ON

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

		1st digit															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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.

■ HG-T series specific registers

Attributes (R: Read, W: Write, R/W: Read/Write)

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	401003	DT01002	R	Status/Error	When status is normal: 0 When error occurs: Error code
	401005 to 401009	DT01004 to DT01008	—	System reserved	Do not use.
	401011	DT01010	W	Controller reset	Resets the controller. (Master unit only)
	401013	DT01012	W	Settings initialization (RESET)	Returns the settings to the factory default state. Do not specify "0".
	401015 to 401031	DT01014 to DT01030	—	System reserved	Do not use.
	401033	DT01032	R	Judgment value (JUDGE.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	401035	DT01034	R	Normal measured value (NORM.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	401037	DT01036	R	Calculated value (CALC)	Integer in minimum resolution units of controller If a calculated value is not set, a judgment value is output. -1999999 to 1999999
	401039	DT01038	R	Sensor head measured value (HEAD.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	401041	DT01040	R/W	LOW set value (LO.SET)	Integer in minimum resolution units of controller -1999999 to 1999999
	401043	DT01042	R/W	HIGH set value (HI.SET)	Integer in minimum resolution units of controller -1999999 to 1999999
	401045 to 401047	DT01044 to DT01046	—	System reserved	Do not use.
	401049	DT01048	R/W	Hysteresis (HYSTER)	Integer in minimum resolution units of controller 0 to 1999999
	401051	DT01050	—	System reserved	Do not use.
	401053	DT01052	R/W	Output operation (OUTPUT)	0: N.O. 1: N.C.
	401055	DT01054	—	System reserved	Do not use.
	401057	DT01056	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 upper bits are set to "0".
	401059	DT01058	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 upper bits are set to "0".
	401061	DT01060	W	Bank load execution (LOAD)	Bank number from which to load data (1 to 3)
	401063	DT01062	W	Bank save execution (SAVE)	Bank number in which to save data (1 to 3)
	401065	DT01064	R/W	Key lock (LOCK)	0: Key lock OFF 1: Key lock ON
	401067	DT01066	R/W	Eco mode (ECO)	0: Eco mode OFF 1: Eco mode ON
	401069	DT01068	R	Maximum value during P-P measurement	Integer in minimum resolution units of controller If the measurement mode is not P-P, a judgment value is output. -1999999 to 1999999

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	401071	DT01070	R	Minimum value during P-P measurement	Integer in minimum resolution units of controller If the measurement mode is not P-P, a judgment value is output. -1999999 to 1999999
	401073 to 401127	DT01072 to DT01126	—	System reserved	Do not use.
	401129	DT01128	R/W	Preset	0: OFF 1: ON
	401131	DT01130	R/W	Preset value (PR. VAL)	Integer in minimum resolution units of controller -1999999 to 1999999
	401133	DT01132	R/W	Preset data selection (PR.OBJ)	0: Normal measured value (NORM.V) 1: Judgment value (JUDGE.V)
	401135	DT01134	R/W	Preset save (PR.SAVE)	0: OFF 1: ON
	401137	DT01136	R/W	Label 1 (LABEL)	Label [1st to 4th characters] Part of character code is usable. (Note 1)
	401139	DT01138	R/W	Label 2 (LABEL)	Label [5th and 6th characters] Part of character code is usable. (Note 1)
	401141	DT01140	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
	401143	DT01142	R/W	Measurement direction (DIRECT)	0: TOP 1: BOTTOM
	401145	DT01144	R/W	Alarm delay count (DELAY)	Delay count: 1 to 1000
	401147	DT01146	R/W	Teaching type (TEACH)	0: 1-point teaching 1: 2-point teaching 2: 3-point teaching
	401149	DT01148	R/W	Input all (ALL IN)	0: Individual input 1: Simultaneous input
	401151	DT01150	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)
	401153	DT01152	R/W	External output (EXT.OUT)	0: 3-value 1: 2-value 2: Logic 3: Logic 2 4: Hold
	401155	DT01154	R/W	Analog scaling (ANALOG)	0: Default 1: Free
	401157	DT01156	R/W	Scaling upper limit value (ANA.HI)	Integer in minimum resolution units of controller -1999999 to 1999999
	401159	DT01158	R/W	Scaling lower limit value (ANA.LO)	Integer in minimum resolution units of controller -1999999 to 1999999

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	401161	DT01160	R/W	Number of digits displayed (DIGIT)	1: 0.001 2: 0.01 3: 0.1
	401163	DT01162	R/W	Calibration selection (CAL.SEL)	0: Default 1: User setting 2: Calibration start
	401165	DT01164	W	1st-point calibration execution (CL.SET1)	Acquire the first point measurement value. Specify "0".
	401167	DT01166	R/W	2nd-point calibration target value (AJ.VAL2)	Integer in minimum resolution units of controller -1999999 to 1999999
	401169	DT01168	W	2nd-point calibration execution (CL.SET2)	Acquires the 2nd-point measured value. Specify "0".
	401171	DT01170	R/W	1-point teaching tolerance (TOL< $\pm$ >)	Integer in minimum resolution units of controller -1999999 to 1999999
	401173	DT01172	W	1st-point teaching execution (SET.1)	Executes 1st-point teaching. Specify "0".
	401175	DT01174	W	2nd-point teaching execution (SET.2)	Executes 2nd-point teaching. Specify "0".
	401177	DT01176	W	3rd-point teaching execution (SET.3)	Executes 3rd-point teaching. Specify "0".
	401179	DT01178	R/W	Sampling cycle (SAMPLI)	0: Standard sampling (NORMAL) 1: High-speed sampling (HI-SPD)
	401181	DT01180	R/W	Analog output selection (A/O.SEL)	0: Voltage output 1: Current output
	401183	DT01182	R/W	External output delay timer selection (OUT.DLY)	0: OFF 1: On delay 2: Off delay 3: Single shot delay
	401185	DT01184	R/W	External output delay timer time (OD.TIME)	1 to 9999ms
	401187	DT01186	R/W	1st-point calibration target value (AJ.VAL1)	Integer in minimum resolution units of controller -1999999 to 1999999
	401189 to 401319	DT01188 to DT01318	—	System reserved	Do not use.
	401321	DT01320	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
	401323	DT01322	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

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	401325	DT01324	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
	401327 to 401511	DT01549 to DT02534	—	System reserved	Do not use.
	401513 to 401549	DT01512 to DT01548	R/W	Other model command area	Do not use.
	401550 to 402535	DT01549 to DT02534	—	System reserved	Do not use.
	402537	DT02536	R/W	Operation mode (OP.MODE)	0: Auto edge detection mode 1: Edge detection mode 2: Outer diameter/width detection mode 3: Inside diameter/gap detection mode 5: Center position detection mode 8: User assigned edge detection mode
	402539	DT02538	—	System reserved	Do not use.
	402541	DT02540	R/W	edge1 (EDGE1)	0: TOP 1~10: 1st to 10th counting from TOP 255: BOTTOM
	402543	DT02542	R/W	edgw2 (EDGE2)	0: TOP 1~10: 1st to 10th counting from TOP 255: BOTTOM
	402545	DT02544	R/W	Sensitivity setting (SEN.ADJ)	0: Default 1: User setting
	402547	DT02546	R/W	Judgment level (JDG.LVL)	10 to 90
	402549	DT02548	R/W	Judgment filter (JDG.FIL)	3 to 50
	402551	DT02550	R/W	Reference waveform save (BW.SAVE)	0: OFF 1: ON
	402553	DT02552	R/W	Interference prevention function (INTF.PR)	0: OFF 1: ON
	402555	DT02554	R/W	Alarm state selection (ALM.CND)	0: HOLD (hold previous value) 1: ALARM (alarm output)
	402557 to 402558	DT02556 to DT02557	—	System reserved	Do not use.
	402561	DT02560	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)
	402563	DT02562	R/W	Stain threshold (STA.THR)	50 to 95

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	402565	DT02564	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
	402567 to 402571	DT02566 to DT02570	—	System reserved	Do not use.
	402573	DT02572	R/W	Tab threshold (TB.THRS)	1000~200000
	402575	DT02574	R/W	Tab counts (TB.CNT)	5~23
	402577 to 402579	DT02576 to DT02578	—	System reserved	Do not use.
	402581	DT02580	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)
	402583	DT02582	R/W	Copy select individual (CPY.SEL)	0: Not target / 1: Target For each target, set 0 or 1 for the bit. bit0 : Operation mode bit1 : Measurement direction bit2 : HIGH set value bit3 : LOW set value bit4 : Hysteresis bit5 : Teaching type bit6 : Tolerance <±> bit7 : Preset value bit8 : Preset data selection bit9 : Preset save bit10: Reference waveform save bit11: Average count bit12: Output operation bit13: Analog output selection bit14: Hold setting bit15: External input bit16: External output bit17: External output delay timer selection bit18: Number of digits displayed bit19: Eco mode bit20: Alarm setting bit21: Key lock setting selection bit22: Reverse of measured value
	402584	DT02583	—	System reserved	Do not use.
	402587	DT02586	W	Copy execution (CPY.EXE)	Executes copying. Specify "0".
	402589	DT02588	R/W	Copy lock (LOCK)	0: Copy lock OFF 1: Copy lock ON
	402591	DT02590	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

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	402593	DT02592	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: Workpiece insertion direction (Note 2)
	402595	DT02594	R	Controller cumulative run time (RUN.TIM)	Units of 1 hour
	402597	DT02596	R	Sensor head cumulative run time (HD.TIME)	Units of 1 hour
	402599 to 402605	DT02598 to DT02604	—	System reserved	Do not use.
	402607	DT02606	R/W	Connected unit count check (CON.CHK)	0: OFF 1: ON
	402609	DT02608	R/W	Key lock (KEYLOC)	0: MANUAL 1: AUTO
	402611	DT02610	R/W	Reverse insertion check (DIR.CHK)	0: OFF 1: ON
	402613	DT02612	R	Workpiece 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
	402614 to 402728	DT02613 to DT02727	—	System reserved	Do not use.
	402729	DT02728	W	Beam axis adjustment mode start	Start beam axis adjustment. Specify "0". Always send during measurement.

MODBUS		MEWTOCOL-COM	Attribute	Name	Response/Setting parameter																																				
Holding register	Data register																																								
HG-T series	402731	DT02730	R	Beam axis adjustment status	bit0 to bit12: Reserved <table><tr><th>bit15</th><th>bit14</th><th>bit13</th><th>Beam axis state</th></tr><tr><td>0</td><td>0</td><td>0</td><td>Immediately after beam axis adjustment starts</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Beam axis aligned state</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Receiver has shifted toward TOP side (emitter has shifted toward BOTTOM side)</td></tr><tr><td>0</td><td>1</td><td>1</td><td>Receiver has shifted toward BOTTOM side (emitter has shifted toward TOP side)</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Beam axis is completely out of position (fully blocked state)</td></tr><tr><td>1</td><td>0</td><td>1</td><td>The light intensity is too much</td></tr><tr><td>1</td><td>1</td><td>0</td><td>The light intensity is too little</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Objects intercepting light or stains (adhering substances) exist inside measurement area</td></tr></table>	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
	bit15	bit14	bit13	Beam axis state																																					
	0	0	0	Immediately after beam axis adjustment starts																																					
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	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																																					
402733	DT02732	W	Reference waveform registration execution	Executes reference waveform registration. Specify "0". Always send with beam axis in aligned state.																																					
402735	DT02734	R	Reference waveform registration status	0: Registration completed 1: Registration failed 2: Registering																																					
402737	DT02736	W	Beam axis adjustment end	Ends beam axis adjustment. Specify "0".																																					
402761	DT02760	R/W	Waveform read setting (Note 3)	• Read data (R) 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 read incomplete (For example, immediately after the unit starts up, operation mode is changed, or measured values are reset) 1: Waveform read complete bit10 to bit15: Reserved • Write data (W) bit0 to bit7: Select a waveform type. 0x00: Reference waveform 0x10: Waveform during beam axis adjustment 0x11: Measured waveform bit8 to bit15: Reserved Always write "0x01".																																					
402763	DT02762	R	Waveform read data 1	Obtains four bytes of received light waveform data ("Received light intensity 0" to "Received light intensity 3")																																					
402765	DT02764	R	Waveform read data 2	Obtains four bytes of received light waveform data ("Received light intensity 4" to "Received light intensity 7")																																					

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	402767	DT02766	R	Waveform read data 3	Obtains four bytes of received light waveform data ("Received light intensity 8" to "Received light intensity 11")
	402769	DT02768	R	Waveform read data 4	Obtains four bytes of received light waveform data ("Received light intensity 12" to "Received light intensity 15")
	402771	DT02770	R	Waveform read data 5	Obtains four bytes of received light waveform data ("Received light intensity 16" to "Received light intensity 19")
	402773	DT02772	R	Waveform read data 6	Obtains four bytes of received light waveform data ("Received light intensity 20" to "Received light intensity 23")
	402775	DT02774	R	Waveform read data 7	Obtains four bytes of received light waveform data ("Received light intensity 24" to "Received light intensity 27")
	402777	DT02776	R	Waveform read data 8	Obtains four bytes of received light waveform data ("Received light intensity 28" to "Received light intensity 31")
	402779	DT02778	R	Waveform read data 9	Obtains four bytes of received light waveform data ("Received light intensity 32" to "Received light intensity 35")
	402781	DT02780	R	Waveform read data 10	Obtains four bytes of received light waveform data ("Received light intensity 36" to "Received light intensity 39")
	402783	DT02782	R	Waveform read data 11	Obtains four bytes of received light waveform data ("Received light intensity 40" to "Received light intensity 43")
	402785	DT02784	R	Waveform read data 12	Obtains four bytes of received light waveform data ("Received light intensity 44" to "Received light intensity 47")
	402787	DT02786	R	Waveform read data 13	Obtains four bytes of received light waveform data ("Received light intensity 48" to "Received light intensity 51")
	402789	DT02788	R	Waveform read data 14	Obtains four bytes of received light waveform data ("Received light intensity 52" to "Received light intensity 55")
	402791	DT02790	R	Waveform read data 15	Obtains four bytes of received light waveform data ("Received light intensity 56" to "Received light intensity 59")
	402793	DT02792	R	Waveform read data 16	Obtains four bytes of received light waveform data ("Received light intensity 60" to "Received light intensity 63")
	402795	DT02794	R	Waveform read data 17	Obtains four bytes of received light waveform data ("Received light intensity 64" to "Received light intensity 67")
	402797	DT02796	R	Waveform read data 18	Obtains four bytes of received light waveform data ("Received light intensity 68" to "Received light intensity 71")
	402799	DT02798	R	Waveform read data 19	Obtains four bytes of received light waveform data ("Received light intensity 72" to "Received light intensity 75")
	402801	DT02800	R	Waveform read data 20	Obtains four bytes of received light waveform data ("Received light intensity 76" to "Received light intensity 79")
	402803	DT02802	R	Waveform read data 21	Obtains four bytes of received light waveform data ("Received light intensity 80" to "Received light intensity 83")
	402805	DT02804	R	Waveform read data 22	Obtains four bytes of received light waveform data ("Received light intensity 84" to "Received light intensity 87")
	402807	DT02806	R	Waveform read data 23	Obtains four bytes of received light waveform data ("Received light intensity 88" to "Received light intensity 91")
	402809	DT02808	R	Waveform read data 24	Obtains four bytes of received light waveform data ("Received light intensity 92" to "Received light intensity 95")
	402811	DT02810	R	Waveform read data 25	Obtains four bytes of received light waveform data ("Received light intensity 96" to "Received light intensity 99")
	402813	DT02812	R	Waveform read data 26	Obtains four bytes of received light waveform data ("Received light intensity 100" to "Received light intensity 103")
	402815	DT02814	R	Waveform read data 27	Obtains four bytes of received light waveform data ("Received light intensity 104" to "Received light intensity 107")
	402817	DT02816	R	Waveform read data 28	Obtains four bytes of received light waveform data ("Received light intensity 108" to "Received light intensity 111")
	402819	DT02818	R	Waveform read data 29	Obtains four bytes of received light waveform data ("Received light intensity 112" to "Received light intensity 115")
	402821	DT02820	R	Waveform read data 30	Obtains four bytes of received light waveform data ("Received light intensity 116" to "Received light intensity 119")

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	402823	DT02822	R	Waveform read data 31	Obtains four bytes of received light waveform data ("Received light intensity 120" to "Received light intensity 123")
	402825	DT02824	R	Waveform read data 32	Obtains four bytes of received light waveform data ("Received light intensity 124" to "Received light intensity 127")
	402827	DT02826	R	Waveform read data 33	Obtains four bytes of received light waveform data ("Received light intensity 128" to "Received light intensity 131")
	402829	DT02828	R	Waveform read data 34	Obtains four bytes of received light waveform data ("Received light intensity 132" to "Received light intensity 135")
	402831	DT02830	R	Waveform read data 35	Obtains four bytes of received light waveform data ("Received light intensity 136" to "Received light intensity 139")
	402833	DT02832	R	Waveform read data 36	Obtains four bytes of received light waveform data ("Received light intensity 140" to "Received light intensity 143")
	402835	DT02834	R	Waveform read data 37	Obtains four bytes of received light waveform data ("Received light intensity 144" to "Received light intensity 147")
	402837	DT02836	R	Waveform read data 38	Obtains four bytes of received light waveform data ("Received light intensity 148" to "Received light intensity 151")
	402839	DT02838	R	Waveform read data 39	Obtains four bytes of received light waveform data ("Received light intensity 152" to "Received light intensity 155")
	402841	DT02840	R	Waveform read data 40	Obtains four bytes of received light waveform data ("Received light intensity 156" to "Received light intensity 159")
	402843	DT02842	R	Waveform read data 41	Obtains four bytes of received light waveform data ("Received light intensity 160" to "Received light intensity 163")
	402845	DT02844	R	Waveform read data 42	Obtains four bytes of received light waveform data ("Received light intensity 164" to "Received light intensity 167")
	402847	DT02846	R	Waveform read data 43	Obtains four bytes of received light waveform data ("Received light intensity 168" to "Received light intensity 171")
	402849	DT02848	R	Waveform read data 44	Obtains four bytes of received light waveform data ("Received light intensity 172" to "Received light intensity 175")
	402851	DT02850	R	Waveform read data 45	Obtains four bytes of received light waveform data ("Received light intensity 176" to "Received light intensity 179")
	402853	DT02852	R	Waveform read data 46	Obtains four bytes of received light waveform data ("Received light intensity 180" to "Received light intensity 183")
	402855	DT02854	R	Waveform read data 47	Obtains four bytes of received light waveform data ("Received light intensity 184" to "Received light intensity 187")
	402857	DT02856	R	Waveform read data 48	Obtains four bytes of received light waveform data ("Received light intensity 188" to "Received light intensity 191")
	402859	DT02858	R	Waveform read data 49	Obtains four bytes of received light waveform data ("Received light intensity 192" to "Received light intensity 195")
	402861	DT02860	R	Waveform read data 50	Obtains four bytes of received light waveform data ("Received light intensity 196" to "Received light intensity 199")
	402863	DT02862	R	Waveform read data 51	Obtains four bytes of received light waveform data ("Received light intensity 200" to "Received light intensity 203")
	402865	DT02864	R	Waveform read data 52	Obtains four bytes of received light waveform data ("Received light intensity 204" to "Received light intensity 207")
	402867	DT02866	R	Waveform read data 53	Obtains four bytes of received light waveform data ("Received light intensity 208" to "Received light intensity 211")
	402869	DT02868	R	Waveform read data 54	Obtains four bytes of received light waveform data ("Received light intensity 212" to "Received light intensity 215")
	402871	DT02870	R	Waveform read data 55	Obtains four bytes of received light waveform data ("Received light intensity 216" to "Received light intensity 219")
	402873	DT02872	R	Waveform read data 56	Obtains four bytes of received light waveform data ("Received light intensity 220" to "Received light intensity 223")
	402875	DT02874	R	Waveform read data 57	Obtains four bytes of received light waveform data ("Received light intensity 224" to "Received light intensity 227")
	402877	DT02876	R	Waveform read data 58	Obtains four bytes of received light waveform data ("Received light intensity 228" to "Received light intensity 231")

Memory Map

	MODBUS Holding register	MEWTOCOL-COM Data register	Attribute	Name	Response/Setting parameter
HG-T series	402879	DT02878	R	Waveform read data 59	Obtains four bytes of received light waveform data ("Received light intensity 232" to "Received light intensity 235")
	402881	DT02880	R	Waveform read data 60	Obtains four bytes of received light waveform data ("Received light intensity 236" to "Received light intensity 239")
	402883	DT02882	R	Waveform read data 61	Obtains four bytes of received light waveform data ("Received light intensity 240" to "Received light intensity 243")
	402885	DT02884	R	Waveform read data 62	Obtains four bytes of received light waveform data ("Received light intensity 244" to "Received light intensity 247")
	402887	DT02886	R	Waveform read data 63	Obtains four bytes of received light waveform data ("Received light intensity 248" to "Received light intensity 251")
	402889	DT02888	R	Waveform read data 64	Obtains four bytes of received light waveform data ("Received light intensity 252" to "Received light intensity 255")
	402891	DT02890	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 → "7-7-3 Reading Reference Waveforms" • When "Waveform during beam axis adjustment" (0x10) is selected → "7-8 Registering the Reference Waveform (For the HG-T only)" • When "Measured waveform" (0x11) is selected → "7-7-2 Reading Measured Waveforms"
	402893	DT02892	R	Measured value at the time of waveform reading (HEAD.V)	Integer in minimum resolution units of controller -1999999 to 1999999
	402895	DT02894	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
	402913	DT02912	R/W	Edge data read setting	• Read data (R) bit0 to bit7: Reserved 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 15 : Reserved • Write data (W) bit0 to bit7: Reserved Always write "0x00". bit8 to bit15: Reserved Always write "0x01".

MODBUS		MEWTOCOL-COM	Attribute	Name	Response/Setting parameter		
Holding register	Data register						
HG-T series	402915	DT02914	R	Edge information at the time of edge data reading	bit0 to bit12: Reserved		
					bit14 and bit13: Edge information 2		
					bit14	bit13	Description
					0	0	Both edges disabled ("Indeterminate", "fully blocked state", or "measurement alarm 1")
					0	1	Only one edge enabled
					1	0	Both edges enabled
	bit15: Edge information 1 0: Falling edge 1: Rising edge						
	402917	DT02916	R	Measured value at the time of edge data reading (HEAD.V)	Integer in minimum resolution units of controller -1999999 to 1999999		
	402919	DT02918	R	Edge position at the time of edge data reading	bit8 to bit15: Edge position 0 (0x00 to 0xFF) bit0 to bit7: Edge position 1 (0x00 to 0xFF)		
	403015	DT03014	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		

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

		1st digit															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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) In auto edge detection mode, the workpiece 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 "7-7 Reading Received Light Waveforms (For the HG-T only)".

<Reference>

Setting changes are saved in the EEPROM of each controller.

The EEPROM has a service life of one million setting operations.

GT communication area

This register is used for connection to our Programmable Display **GT** Series.

To directly connect to the **GT** Series, set in the base PLC communication area.

Description	R/W	MODBUS		MEWTOCOL-COM	
		Holding register	Coil	Data register	Internal relay
GT communication area	R/W	400001 to 400003	000001 to 000048	DT00000 to DT00002	R0000 to R002F

Memory Map

7-7 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), so that you can read waveform data and other information.

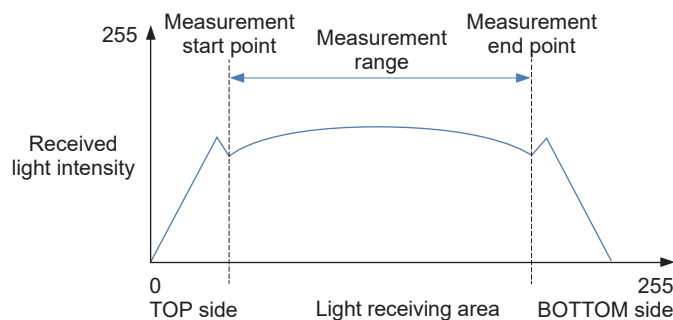
Note: For details on waveforms during beam axis adjustment, refer to “7-8 Registering the Reference Waveform (For the HG-T only)”.

7-7-1 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).

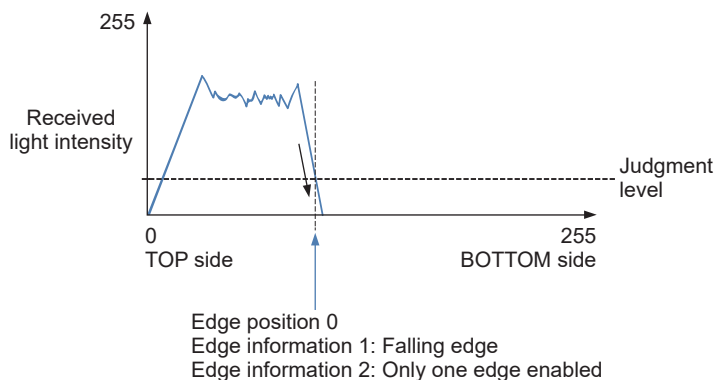
- **Measurement start point and measurement end point**

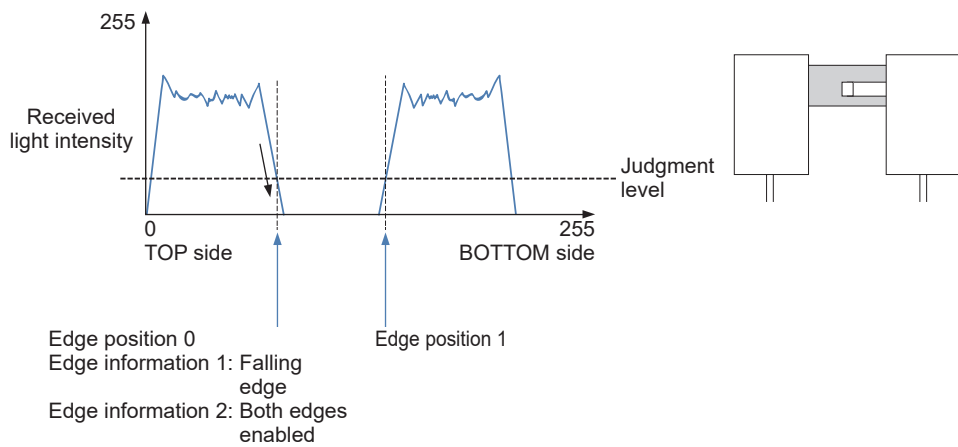
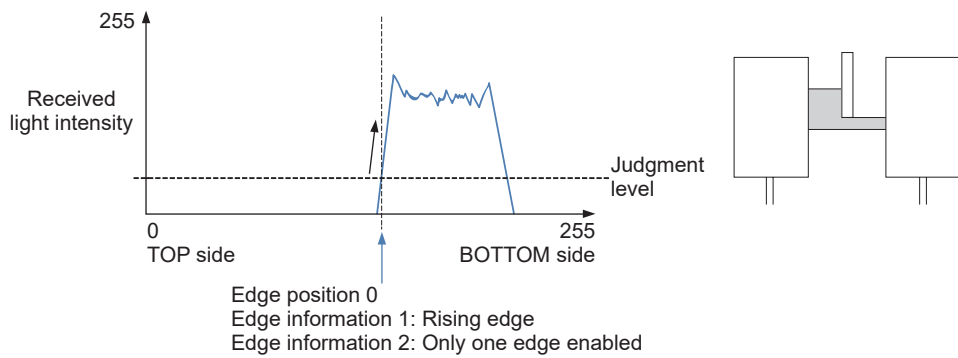
Measurement start points and measurement end points can be obtained only in reference waveform acquisition mode. Obtaining the measurement start point and measurement end point makes it possible to know the range that is used for measurement within the simplified received light waveform.



- **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.





Memory Map

7-7-2 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” (WRITE) command to set the waveform type.
(MODBUS: 402761 / MEWTOCOL-COM: DT02760)

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” (READ) command .
(MODBUS: 402761 / MEWTOCOL-COM: DT02760)

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” (READ) command .
(MODBUS: 402763 to 402889 / MEWTOCOL-COM: DT02762 to DT02888)

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 402763/DT02762 through to 402889/DT02888 in this order and then concatenating the data obtained.

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

<Example: When the holding register for MODBUS is 402763 and the data register for MEWTOCOL-COM is DT02762>

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.

Memory Map

4. To read the measured value associated with the saved waveform, send the “Measured value at the time of waveform reading[HEAD.V]” (READ) command. (MODBUS: 402893 / MEWTOCOL-COM: DT02892)

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 1): 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” command (READ). (MODBUS: 402891 / MEWTOCOL-COM: DT02890)

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
	1	Rising edge
Information about whether edge position 0 is a rising edge or falling edge when viewed from the TOP side		

Item	Bit14	Bit13	Set value	Description
Edge information 2	0	0	Both edges disabled (When the beam axis state is "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 1): 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” (READ) command . (MODBUS: 402895 / MEWTOCOL-COM: DT02894)

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.

7-7-3 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 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).

Memory Map

■ Examples of sent commands

1. Send the “Waveform read setting” command (WRITE) to set the waveform type.
(MODBUS: 402761 / MEWTOCOL-COM: DT02760)

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).
(MODBUS: 402761 / MEWTOCOL-COM: DT02760)

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).
(MODBUS: 402763 to 402889 / MEWTOCOL-COM: DT02762 to DT02888)

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 402763/DT02762 through to 402889/DT02888 in this order and then concatenating the data obtained.

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

<Example: When the holding register for MODBUS is 402763 and the data register for MEWTOCOL-COM is DT02762>

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) .
(MODBUS: 402891 / MEWTOCOL-COM: DT02890)

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

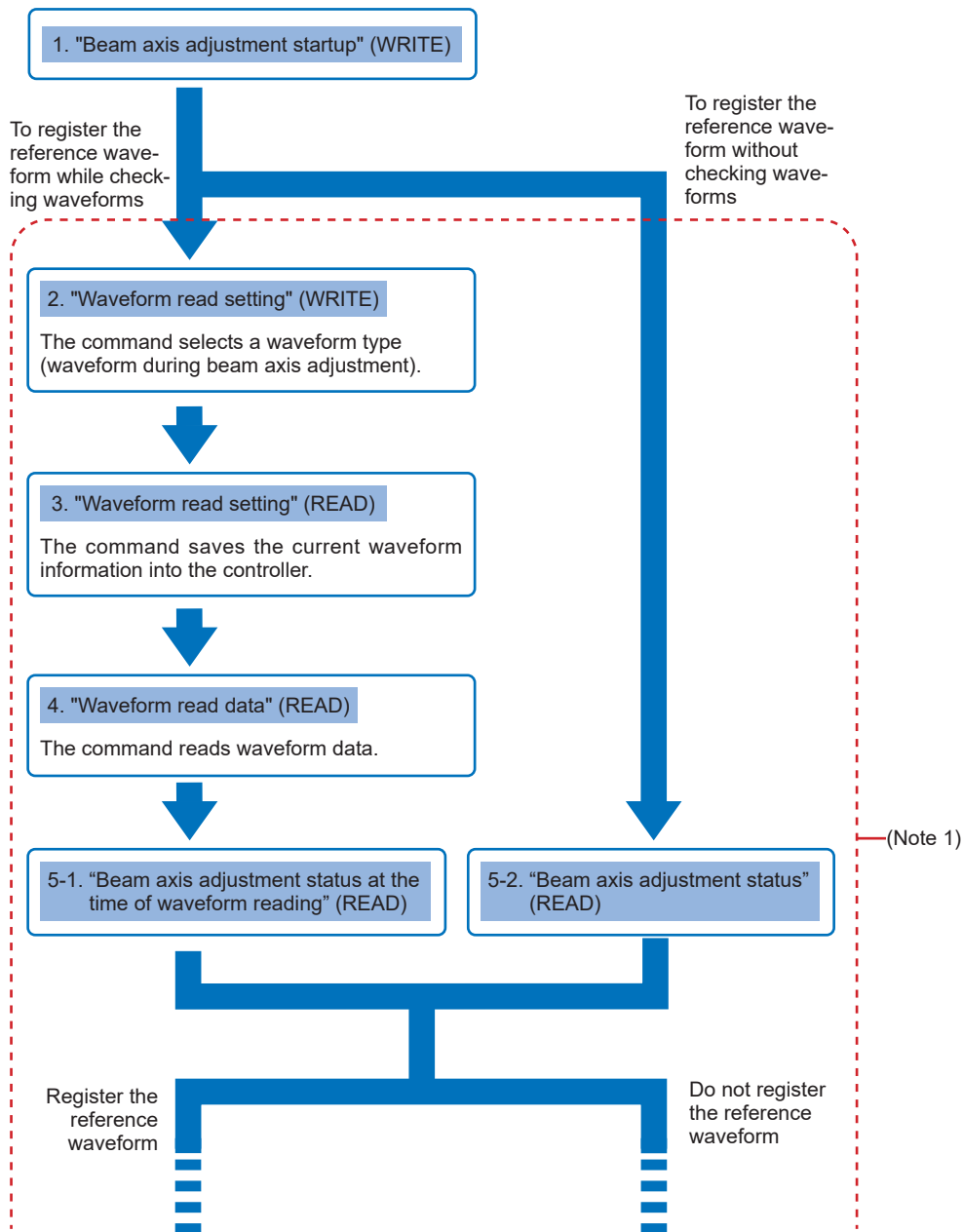
Read data	
Measurement end point	Measurement start point
0x00 to 0xFF	0x00 to 0xFF

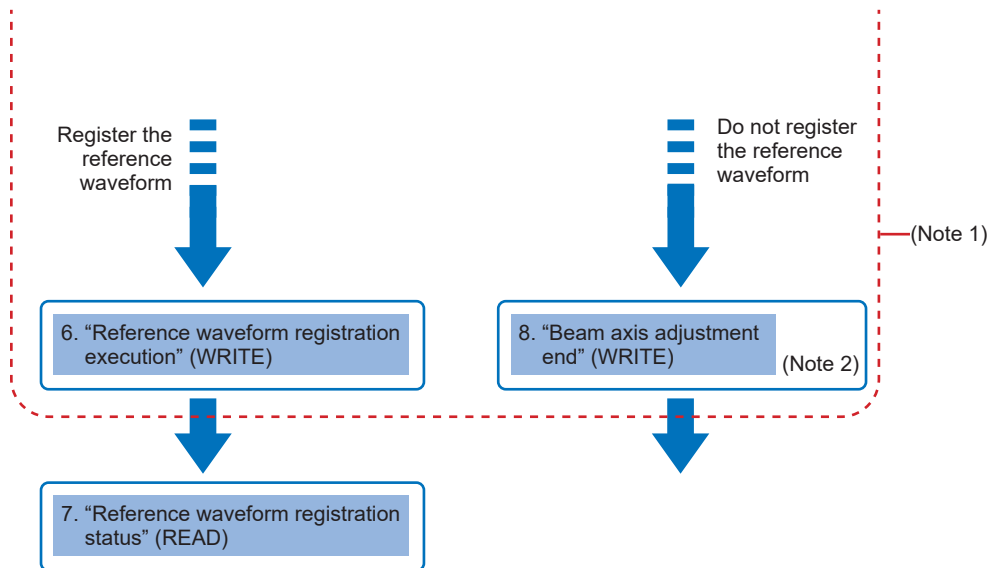
Note: If it is unnecessary to obtain the measurement range, there is no need to send the command.

7-8 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





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.

Memory Map

■ Examples of sent commands

1. Send the “Beam axis adjustment startup” command (WRITE). (MODBUS: 402729 / MEWTOCOL-COM: DT02728) 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.
(MODBUS: 402761 / MEWTOCOL-COM: DT02760)

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). (MODBUS: 402761 / MEWTOCOL-COM: DT20760)

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).
(MODBUS: 402763 to 402889 / MEWTOCOL-COM: DT02762 to DT02888)

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 402763/DT02762 through to 402889/DT02888 in this order and then concatenating the data obtained.

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

<Example: When the holding register for MODBUS is 402763 and the data register for MEWTOCOL-COM is DT02762>

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). (MODBUS: 402891 / MEWTOCOL-COM: DT02890)

5-2. To check the beam axis adjustment status without reading waveforms, send the “Beam axis adjustment status” command (READ). (MODBUS: 402731 / MEWTOCOL-COM: DT02730)

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 status
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 and adjusting the beam axis, send the “Reference waveform registration execution” command (WRITE). (MODBUS: 402733 / MEWTOCOL-COM: DT02732) 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) (MODBUS: 402551 / MEWTOCOL-COM: DT02550) 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.

Memory Map

7. To check whether the reference waveform has been registered after registering it, send the "Reference waveform registration status" command (READ). (MODBUS: 402735 / MEWTOCOL-COM: DT02734)

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). (MODBUS: 402737 / MEWTOCOL-COM: DT02736)

7-9 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.

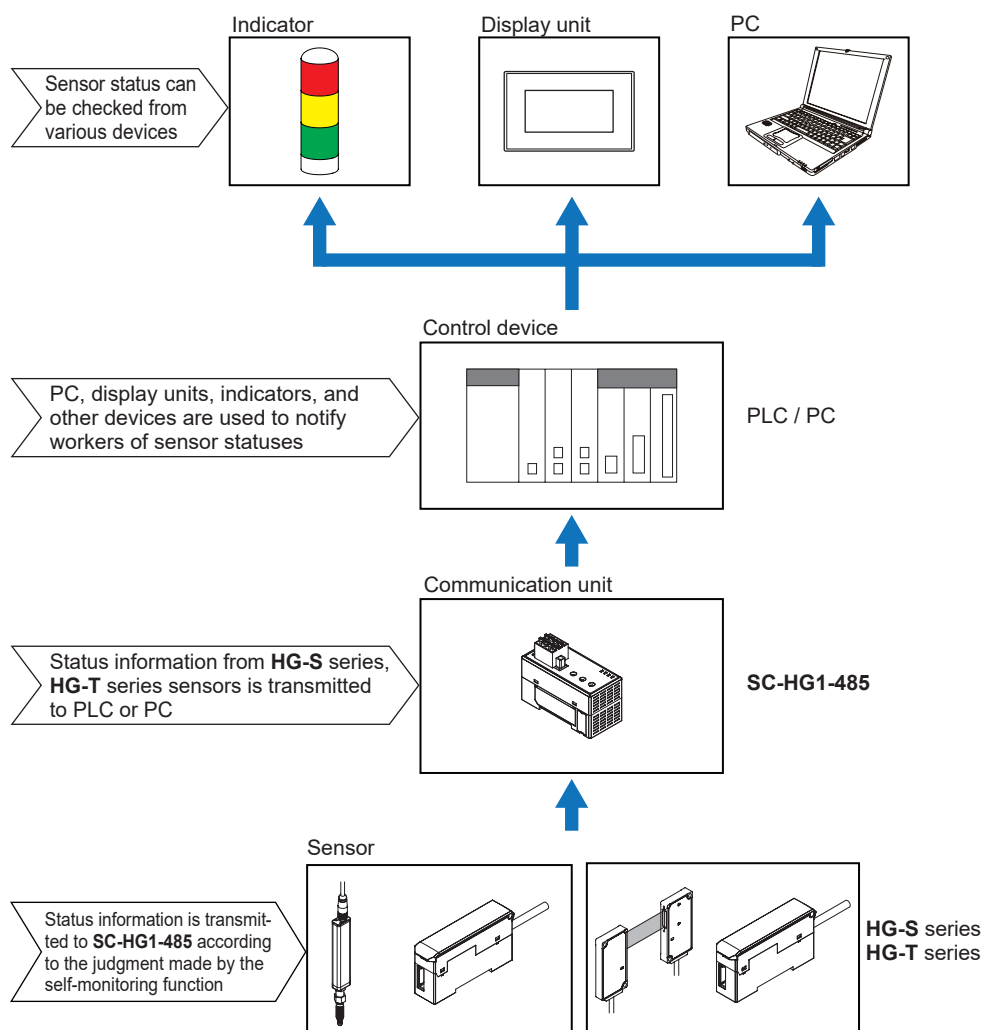


The self-monitoring function is not supported by **SC-HG1-485** communication units manufactured in November 2019 or earlier.

Use a **SC-HG1-485** communication unit manufactured in December 2019 or later.

7-9-1 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.



Memory Map

7-9-2 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 address, refer to “■ HG-S series specific registers”.

	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 address, refer to “■ HG-T series specific registers”.

	Response parameter	Measures	Error code (Note 1)	measurement alarm (Note 1)
Notifi- cation	Sensor head unconnected	Status check	E200	—
	Connected sensor head incompati- ble	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 ambi- ent light, etc. (Note 2)	Status check	—	Measurement alarm 1
	The amount of entering light de- creases due to stain on the detection surface, beam axis misalignment, etc.	Sensing object check	—	Measurement alarm 2
	The specified measurement direc- tion differs from the insertion direc- tion 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.

(MEMO)

Chapter 8 Communication Response Time

8-1 Measured Value and External Output Communication Response Time	8-2
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8-10 Other Precautions	8-12

Communication Response Time

8-1 Measured Value and External Output Communication Response Time

1. Time taken to read newly updated data.

Measured values are read from 400101 to 400130 or DT00100 to DT00129.

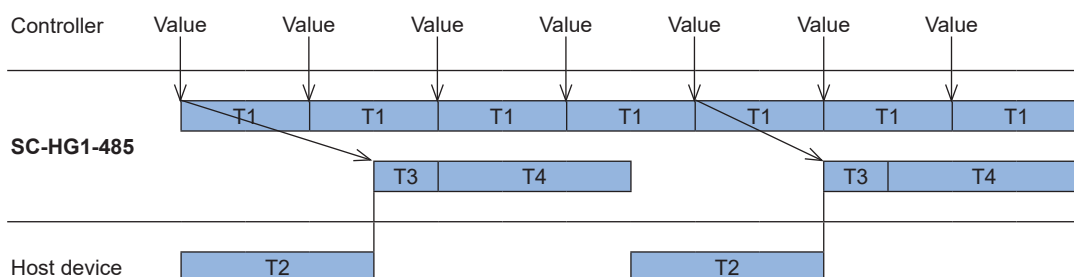
External outputs are read from 400131 to 400133 or DT00130 to DT00132.

Alternatively, external outputs are read from 000161 to 000208 or R1000 to R102F.

• Commands used

Data type	Communication	Command
Measured Values	MODBUS	Read Holding Registers (03)
	MEWTOCOL-COM	Read Data Area (RD)
External output	MODBUS	Read Coil (01), Read Holding Registers (03)
	MEWTOCOL-COM	Read Contact Area [Single Contact] (RCS), Read Data Area (RD)

• Time chart



Code	Description	Time
T1	Data refresh time	1.00ms
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T3	Command processing time	0.20ms
T4	SC-HG1-485 response transmission time	Refer to "8-9 Command Transmission Time, Response Transmission Time"

<Calculation example>

Communication time when obtaining measured values.

The host device uses MODBUS RTU and communicates at 19,200bps.

T2: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T3: 0.20ms

T4: 7.16ms = (9 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

$$\begin{aligned} \text{Response time} &= T2 + T3 + T4 \\ &= 13.95\text{ms} \end{aligned}$$

The communication time with a host device is longer than the data refresh interval of the SC-HG1-485, so new data is read each time data is read from a host device.

Communication Response Time

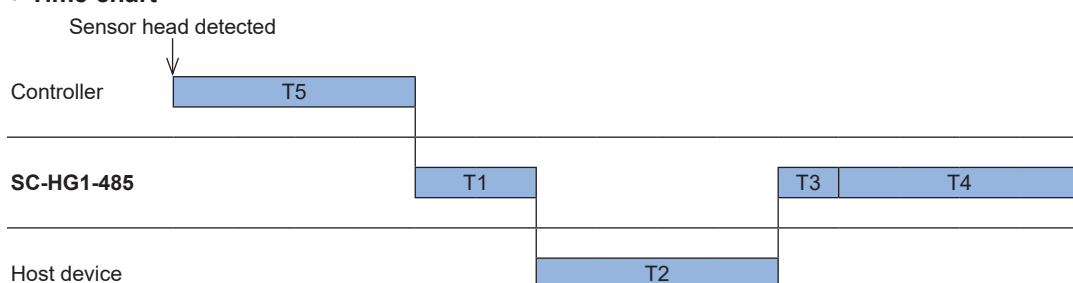
2. With regard to measured values and external outputs, the following time chart shows the time taken to import the latest data measured by the sensor head.

Reads 400101 to 400130 / DT00100 to DT00129 or 000161 to 000208 / R1000 to R102F.

• Commands used

Data type	Communication	Command
Measured Values	MODBUS	Read Holding Registers (03)
	MEWTOCOL-COM	Read Data Area (RD)
External output	MODBUS	Read Coil (01), Read Holding Registers (03)
	MEWTOCOL-COM	Read Contact Area [Single Contact] (RCS), Read Data Area (RD)

• Time chart



Code	Description	Time
T1	Data refresh time	1.00ms
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T3	Command processing time	0.20ms
T4	Response transmission time of the SC-HG1-485	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T5	Controller response time	Depends on the HG series controller settings.

<Calculation example>

Communication time when obtaining measured values.

The **HG-S** response time is set to 3ms. The host device uses MODBUS RTU and communicates at 19,200bps.

T1: 1.00ms

T2: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T3: 0.20ms

T4: 7.16ms = (9 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T5: 3.00ms

$$\begin{aligned} \text{Response time} &= T1 + T2 + T3 + T4 + T5 \\ &= 17.95\text{ms} \end{aligned}$$

Communication Response Time

8-2 External Input Communication Response Time

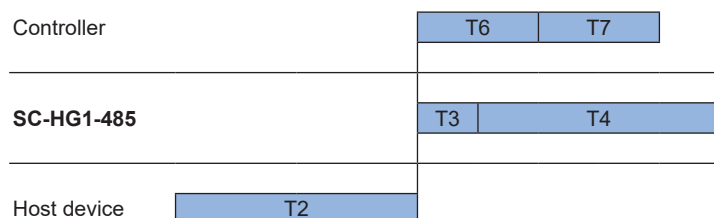
Indicates the time from setting of the external input from the host device until the external input is applied on the controller.

The data is written to 000209 to 000256 / R1030 to R105F.

• Commands used

Data type	Communication	Command
External input	MODBUS	Write Coil (05)
	MEWTOCOL-COM	Write Contact Area [Single Contact] (WCS)

• Time chart



Code	Description	Time
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T3	Command processing time	0.20ms
T4	Response transmission time of the SC-HG1-485	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T6	Data refresh time	1.00ms
T7	Input response time	Depends on the HG-S Series controller settings. Trigger input: 2ms, other input: 20ms

<Calculation example>

Communication time when setting trigger input

The host device uses MODBUS RTU and communicates at 19,200bps.

T2: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T6: 1.00ms

T7: 2.00ms

$$\begin{aligned}\text{Response time} &= T2 + T6 + T7 \\ &= 9.59\text{ms}\end{aligned}$$

8-3 Communication Response Time of Read Status Register

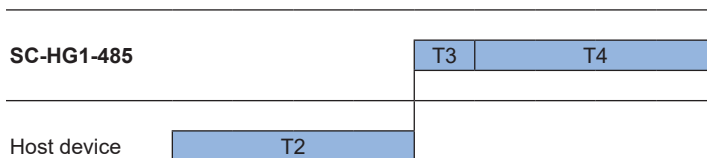
Reading the 400137 / DT00136 register.

• Commands used

Data type	Communication	Command
Status Register	MODBUS	Read Holding Registers (03)
	MEWTOCOL-COM	Read Data Area (RD)

• Time chart

Controller



Code	Description	Time
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T3	Command processing time	0.20ms
T4	Response transmission time of the SC-HG1-485	Refer to "8-9 Command Transmission Time, Response Transmission Time"

<Calculation example>

The host device uses MODBUS RTU and communicates at 19,200bps.

T2: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T3: 0.20ms

T4: 6.02ms = (7 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

$$\begin{aligned} \text{Response time} &= T2 + T3 + T4 \\ &= 12.81\text{ms} \end{aligned}$$

Communication Response Time

8-4 Communication Response Time of Write Accessed Controller Setting Register

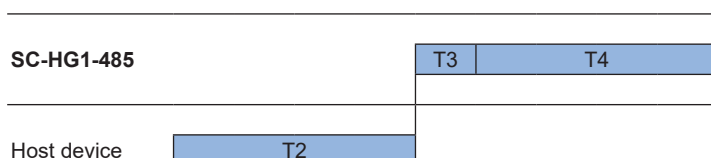
Writing to the 401001 / DT01000 register.

• Commands used

Data type	Communication	Command
Accessed controller setting register	MODBUS	Read Holding Registers (03)
	MEWTOCOL-COM	Read Data Area (RD)

• Time chart

Controller



Code	Description	Time
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T3	Command processing time	0.20ms
T4	Response transmission time of the SC-HG1-485	Refer to "8-9 Command Transmission Time, Response Transmission Time"

<Calculation example>

The host device uses MODBUS RTU and communicates at 19,200bps.

T2: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T3: 0.20ms

T4: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

$$\begin{aligned}\text{Response time} &= T2 + T3 + T4 \\ &= 13.38\text{ms}\end{aligned}$$

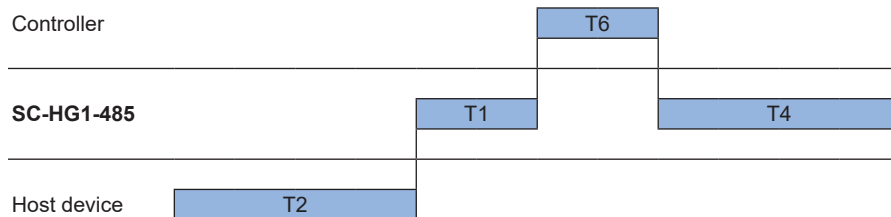
8-5 Communication Response Time When Settings are Read

Register data is read from the set value area in the memory map. For details on the set value area in the memory map, refer to “7-6 Set Values”.

• Commands used

Data type	Communication	Command
Set value	MODBUS	Read Holding Registers (03)
	MEWTOCOL-COM	Read Data Area (RD)

• Time chart



Code	Description	Time
T2	Data refresh time	1.00ms
T3	Command transmission time of host device	Refer to “8-9 Command Transmission Time, Response Transmission Time”
T4	Response transmission time of the SC-HG1-485	Refer to “8-9 Command Transmission Time, Response Transmission Time”
T6	Data refresh time	1.00ms

<Calculation example>

The host device uses MODBUS RTU and communicates at 19,200bps.

T1: 1.00ms

T2: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T4: 7.16ms = (9 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T6: 1.00ms

$$\begin{aligned}\text{Response time} &= T1 + T2 + T4 + T6 \\ &= 15.75\text{ms}\end{aligned}$$

Communication Response Time

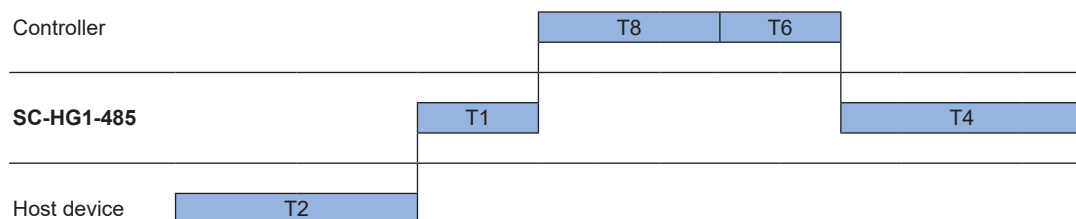
8-6 Communication Response Time When Settings are Written

Data is written to a writable register in the set value area in the memory map. For details on the set value area in the memory map, refer to “7-6 Set Values”.

• Commands used

Data type	Communication	Command
Set value	MODBUS	Write Multiple registers (16)
	MEWTOCOL-COM	Write Data Area (WD)

• Time chart



Code	Description	Time
T1	Data refresh time	1.00ms
T2	Command transmission time of host device	Refer to “8-9 Command Transmission Time, Response Transmission Time”
T4	Response transmission time of the SC-HG1-485	Refer to “8-9 Command Transmission Time, Response Transmission Time”
T6	Data refresh time	1.00ms
T8	Setting save time	HG-S : 6.00ms (Note) HG-T : 18ms (Note)

Note: When multiple settings are written at once, more time may be required.

<Calculation example>

When the communication unit is connected to the host device via a MODBUS RTU and communicates with **HG-S** controllers at 19,200bps

T1: 1.00ms

T2: 9.45ms = (13 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T4: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T6: 1.00ms

T8: 6.00ms

$$\begin{aligned} \text{Response time} &= T1 + T2 + T4 + T6 + T8 \\ &= 24.04\text{ms} \end{aligned}$$

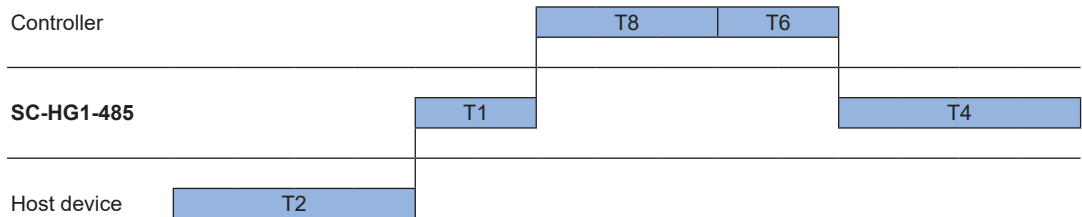
8-7 Communication Response Time When Bank Save/Load is Executed

Data is written to the 401061 / DT01060 register.

• Commands used

Data type	Communication	Command
Set value	MODBUS	Write Multiple registers (16)
	MEWTOCOL-COM	Write Data Area (WD)

• Time chart



Code	Description	Time
T1	Data refresh time	1.00ms
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T4	Response transmission time of the SC-HG1-485	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T6	Data refresh time	1.00ms
T8	LOAD execution time	Bank save selection HIGH set value, LOW set value: 20.00ms HIGH set value, LOW set value, preset value: 20.00ms All HG-S : 50.00ms HG-T : 85.00ms

<Calculation example>

When the communication unit is connected to the host device via a MODBUS RTU and communicates with **HG-S** controllers at 19,200bps with "Bank save selection" set to "HIGH set value, LOW set value"

T1: 1.00ms

T2: 9.45ms = (13 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T4: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T6: 1.00ms

T8: 20.00ms

$$\begin{aligned} \text{Response time} &= T1 + T2 + T4 + T6 + T8 \\ &= 38.04\text{ms} \end{aligned}$$

Communication Response Time

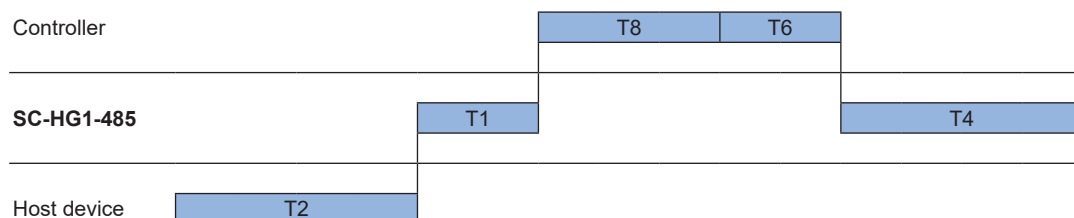
8-8 Communication Response Time When Initialization is Executed

Data is written to register 401013 or DT01012.

- Command used

Data type	Communication	Command
Set value	MODBUS	Write to multiple registers (16)
	MEWTOCOL-COM	Write to data area (WD)

- Time chart



Code	Description	Time
T1	Data refresh time	1.00ms
T2	Command transmission time of host device	Refer to "8-9 Command Transmission Time, Response Transmission Time".
T4	Response transmission time of the SC-HG1-485	Refer to "8-9 Command Transmission Time, Response Transmission Time"
T6	Data refresh time	1.00ms
T8	Initialization execution time	Bank save selection HIGH set value, LOW set value: 20.00ms HIGH set value, LOW set value, preset value: 20.00ms All: HG-S : 75.00ms HG-T : 105.00ms

<Calculation example>

When the communication unit is connected to the host device via a MODBUS RTU and communicates with **HG-S** controllers at 19,200bps with "Bank save selection" set to "All"

T1: 1.00ms

T2: 9.45ms = (13 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T4: 6.59ms = (8 bytes + 3.5 characters) × (8 + 1 + 1 + 1) ÷ 19200

T6: 1.00ms

T8: 75.00ms

$$\begin{aligned}\text{Response time} &= T1 + T2 + T4 + T6 + T8 \\ &= 93.04\text{ms}\end{aligned}$$

8-9 Command Transmission Time, Response Transmission Time

The command transmission time and response transmission time depend on the communication speed and data bit length per character.

For the communication settings, refer to the communication specifications of each protocol.

The calculation formula for the communication time is as follows:

$$T3, T5 = \text{Number of characters} \times (\text{number of data bits} + \text{number of start bits} + \text{number of stop bits} + \text{number of parity bits}) \div \text{communication speed}$$

<Reference>

In MODBUS RTU, 3.5 characters or an interval of 1.75ms or more is required for start / stop. If the baud rate is over 19,200bps, add 1.75ms. If the baud rate is 19,200bps or less, add 3.5 to "number of characters".

<Example>

When parity is set to EVEN in MODBUS RTU.

Number of characters	Communication speed	Command transmission time, Response transmission time
8	19,200bps	6.59ms
9	19,200bps	7.16ms
13	19,200bps	9.45ms
8	38,400bps	4.04ms
9	38,400bps	4.33ms
13	38,400bps	5.47ms

When set to Parity bit: EVEN, data bits: 8 bits, stop bit length: 1 bit (Other than MODBUS RTU)

Number of characters	Communication speed	Command transmission time, Response transmission time
9	19,200bps	5.16ms
17	19,200bps	9.74ms
20	19,200bps	11.46ms
28	19,200bps	16.04ms
9	38,400bps	2.58ms
17	38,400bps	4.87ms
20	38,400bps	5.73ms
28	38,400bps	8.02ms

Communication Response Time

8-10 Other Precautions

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

MODBUS	MEWTOCOL-COM	Name	Remarks
Holding register	Data register		
401061	DT01060	Bank load execution (LOAD)	—
401141	DT01140	Average count (SPEED)	—
401143	DT01142	Measurement direction (DIRECT)	—
401145	DT01144	Alarm delay count (DELAY)	For write only
401179	DT01178	Sampling cycle (SAMPLI)	For write only
402537	DT02536	Operation mode (OP.MODE)	For write only
402545	DT02544	Sensitivity setting	For write only
402547	DT02546	Judgment level (JDG.LVL)	For write only
402549	DT02548	Judgment filter (JDG.FIL)	For write only
402561	DT02560	Stain check (STA.CHK)	For write only
402563	DT02562	Stain threshold (STA.THR)	For write only
402597	DT02596	Sensor head cumulative run time (HD.TIME)	—
402611	DT02610	Reverse insertion check (DIR.CHK)	For write only
403015	DT03014	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 9 Specifications

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9-2 Dimension Drawings..... 9-3

9-1 Specifications

9-1 Specifications

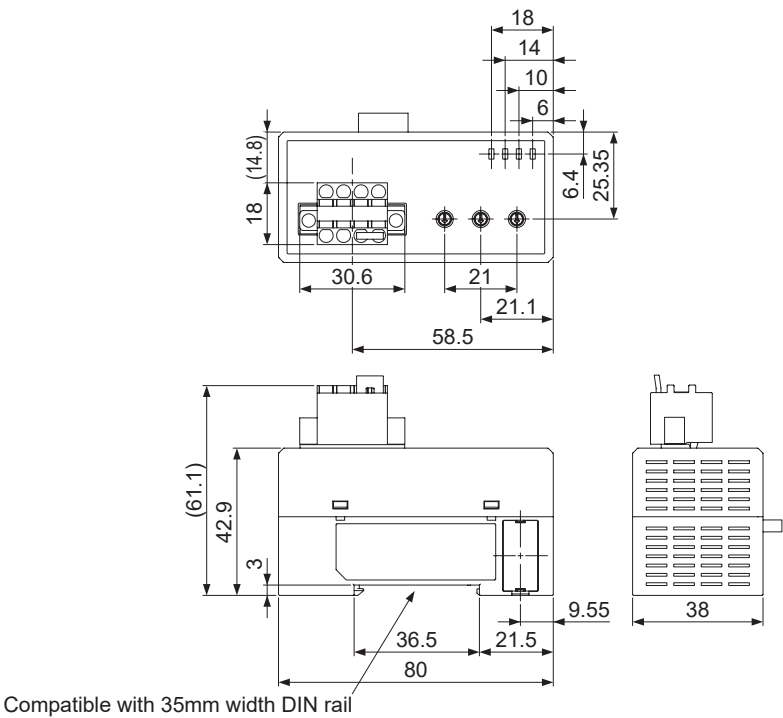
Product name	RS-485 Communication Unit
Model No.	SC-HG1-485
Compatible controllers	HG-SC□,HG-TC□
Number of connectable units	Maximum of 15 controllers (one master, 14 slaves) per SC-HG1-485 unit
Number of blocks	MODBUS: Maximum 99 stations, MEWTOCOL: Maximum 64 stations
Supply voltage (Note 1)	24V DC $\pm 10\%$, Ripple 10% or less
Current consumption	40mA or less
Communication method	Two-wire half duplex communication
Synchronization method	Start-stop synchronization
Communication protocol	MODBUS (RTU / ASCII) / MEWTOCOL-COM
Communication speed	1,200bps / 2,400bps / 4,800bps / 9,600bps / 19,200bps / 38,400bps / 57,600bps / 115,200bps
Electrical characteristics	Complies with EIA RS-485
Stop bit length	1 bit / 2 bits
Parity check	Even / Odd / None
Data bit length	8 bits / 7 bits
Total extension distance	Communication cable: 1,200m or less between SC-HG1-485 (terminal) and PLC
Power indicator	Green LED (lights up when power is supplied)
Communication indicator	Green LED (lights up during communication)
Upper communication error indicator	Red LED (lights up when a command error or communication error occurs between the PLC and the communication unit)
Lower communication error indicator	Red LED (lights up when a communication error occurs between the SC-HG1-485 and a controller)
Protection	IP40 (IEC)
Degree of pollution	2
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
Operating altitude	2,000m or less (Note 2)
Insulation resistance	20M Ω or higher, using 250V DC megger connected between all supply terminals and case
Withstand voltage	1,000V AC for one minute 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
Material	Unit case: PC
Weight (main unit only)	Approx. 75g

Notes: 1) Power is supplied from a connected master controller.

2) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0m.

9-2 Dimensions

Units: mm



(MEMO)

Chapter 10 Appendix

- 10-1 Maintenance and Inspection 10-2
 - 10-1-1 Maintenance Cautions 10-2
 - 10-1-2 Main Inspection Items 10-2
- 10-2 Troubleshooting 10-3

10-1 Maintenance and Inspection

10-1 Maintenance and Inspection

10-1-1 Maintenance Cautions

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

10-1-2 Main Inspection Items

Inspect the controller 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 $\pm 10\%$)?
- Is the ambient operating temperature within the specified range (-10 to +50°C)?
- Is the ambient operating humidity within the specified range (35 to 85% RH)?

10-2 Troubleshooting

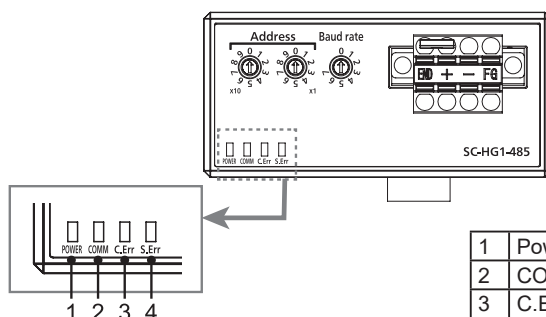
10-2-1 Solutions to Problems

Solutions to frequently encountered problems and errors are described below.

<Reference>

- Check the wiring.
- Check the voltage and capacity of the power supply.

You can check the indicators on the **SC-HG1-485** to identify the cause of a problem and take appropriate action.



1	Power: Power indicator (Green)
2	COMM: Communication indicator (Green)
3	C.Err: Upper communication error indicator (Red)
4	S.Err: Lower communication error indicator (Red)

■ Power indicator (green) does not light up

Cause	Solution
Power is not supplied.	Check if the capacity of the power supply is sufficient. Connect the power supply correctly.
The power supply voltage is not within the specified range.	Set the correct power supply voltage.
A connector is not firmly connected to a controller.	Firmly connect the connector to the controller.

■ Communication indicator (green) does not light up

Cause	Solution
Unable to receive communication from the host device.	Execute communication from the host device. When communication ends, the indicator automatically turns OFF.
Incorrect wiring of communication line.	Check if the communication line is wired correctly.
A communication connector is not firmly connected.	Firmly connect the communication connector.

■ Upper communication error indicator (red) lights up

Cause	Solution
Communication settings are not appropriate for the host device.	Set the correct conditions for communication with the host device. For the settings, refer to "3-1 Communication Settings". After you change communication settings, turn the power of the SC-HG1-485 off and on.
The station number setting is outside the range.	Set the correct station number. For the settings, refer to "3-1 Communication Settings". After you change the station number, turn the power of the SC-HG1-485 off and on.
The baud rate setting is outside the range.	Set the correct baud rate. For the settings, refer to "3-1 Communication Settings". After you change the baud rate, turn the power of the SC-HG1-485 off and on.

10-2 Troubleshooting

■ Upper communication error indicator (red) lights up (continued from previous page)

Cause	Solution
Incorrect command. Unsupported command.	Send a correct command. Refer to "5-2 MODBUS Function Support Table" or "6-2 MEW-TOCOL-COM Command Support Table". Refer to "5-6 Exception Response" or "6-5 Error Codes" and take appropriate action.
Incorrect communication format.	Use the correct communication format. Refer to "5-6 Exception Response" or "6-5 Error Codes" and take appropriate action.
Incorrect parameter sent.	Send correct parameters. Refer to "5-6 Exception Response" or "6-5 Error Codes" and take appropriate action.
CRC, LRC, or BCC is not correct.	Send the correct CRC, LRC, or BCC.
The command cannot be processed because copying from the master controller to a slave unit is in progress.	Send the command after copying from the master controller to the slave unit finishes.
The command cannot be processed because controller processing is in progress.	Resend the command.
The command cannot be processed because an error has occurred on the controller.	Clear the error on the controller and then send the command. For the procedure for clearing a controller error, refer to the user's manual for the controller.
Noise is affecting operation.	Take measures to reduce noise on the communication cable. Install the SC-HG1-485 and controllers away from the source of the noise.
Incorrect wiring of communication line.	Check if the communication line is wired correctly.
A communication connector is not firmly connected.	Firmly connect the communication connector.

■ Lower communication error indicator (red) lights up

Cause	Solution
Communication between controllers does not take place.	Switch OFF the power, make sure the controllers and SC-HG1-485 are connected correctly, and then switch ON the power again.

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

Cause	Solution
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 31, 2016	—
Second edition	September 30, 2016	—
Third edition	September 30, 2019	—
Fourth edition	December 1, 2019	Commands related to the self-monitoring function were added “4.7 Self-monitoring Function” added
Fifth edition	December 1, 2020	Commands related to the addition of HG-T functions have been added.
Sixth edition	April 1, 2024	Made revisions in line with the change of the company name.

(MEMO)

1. WARRANTIES:

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 - (ii) which was due to unauthorized modification by Purchaser, in part or in whole, whether in structure, performance or specification;
 - (iii) which was not discoverable by a person with the state-of-the-art scientific and technical knowledge at the time of manufacture;
 - (iv) which was due to an operation or use by Purchaser outside of the limits of operation or environment specified by Panasonic Industry;
 - (v) which was due to normal wear and tear;
 - (vi) which was due to Force Majeure; and
 - (vii) which was due to any use or application expressly discouraged by Panasonic Industry in 4 (CAUTIONS FOR SAFE USE) hereunder.
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 - (b) which are used outdoors or in environments subject to any likelihood of chemical contamination or electromagnetic influence;
 - (c) which are likely to be used beyond the limits of operations or environments specified by Panasonic Industry in the catalogue or otherwise;
 - (d) which may cause risk to life or property, such as nuclear energy control equipment, transportation equipment (whether on rail or land, or in air or at sea), and medical equipment;
 - (e) which are operated continuously each day for 24 hours; and
 - (f) which otherwise require a high level of safety performance similar to that required in those equipment, facilities or systems as listed in (a) through (e) above.

5. EXPORT CONTROL LAWS

In some jurisdictions, the Products may be subject to local export laws and regulations. If any diversion or re-export is to be made, Purchaser is advised to abide by such local export laws and regulations, if any, at its own responsibility.

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