

# EH-150

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## APPLICATION MANUAL

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HITACHI



# HITACHI PROGRAMMABLE CONTROLLER

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# HIDIC EH-150

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## APPLICATION MANUAL


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NJI-281 B (X)


# Safety Precautions

Read this manual and related documents thoroughly before installing, operating, performing preventive maintenance or performing inspection, and be sure to use the unit correctly. Use this product after acquiring adequate knowledge of the unit, all safety information, and all cautionary information. Also, make sure this manual enters the possession of the chief person in charge of safety maintenance.

Safety caution items are classified as “Danger” and “Caution” in this document.



 **DANGER** : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible death or severe injury.



 **CAUTION** : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible minor to medium injury to the body, or only mechanical damage.

However, depending on the circumstances, items marked with  **CAUTION** may result in major accidents.

In any case, they both contain important information, so please follow them closely.

Icons for prohibited items and required items are shown below:

 : Indicates prohibited items (items that may not be performed). For example, when open flames are prohibited,  is shown.

 : Indicates required items (items that must be performed). For example, when grounding must be performed,  is shown.

## 1. About installation

### **CAUTION**

- Use this product in an environment as described in the catalog and this document.  
If this product is used in an environment subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or shock, it may result in electric shock, fire or malfunction.
- Perform installation according to this manual.  
If installation is not performed adequately, it may result in dropping, malfunction or an operational error in the unit.
- Do not allow foreign objects such as wire chips to enter the unit.  
They may become the cause of fire, malfunction or failure.

## 2. About wiring



### REQUIRED

- Always perform grounding (FE terminal).  
If grounding is not performed, there is a risk of electric shocks and malfunctions.



### CAUTION

- Connect power supply that meets rating.  
If a power supply that does not meet rating is connected, fire may be caused.
- The wiring operation should be performed by a qualified personnel.  
If wiring is performed incorrectly, it may result in fire, damage, or electric shock.

## 3. Precautions when using the unit



### DANGER

- Do not touch the terminals while the power is on.  
There is risk of electric shock.
- Structure the emergency stop circuit, interlock circuit, etc. outside the programmable controller (hereinafter referred to as PLC).  
Damage to the equipment or accidents may occur due to failure of the PLC.  
However, do not interlock the unit to external load via relay drive power supply of the relay output module.



### CAUTION

- When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to verify safety.  
Damage to the equipment or accidents may occur due to operation error.
- Supply power according to the power-up order.  
Damage to the equipment or accidents may occur due to malfunctions.

#### 4. About preventive maintenance

##### DANGER

- Do not connect the  $\oplus$ ,  $\ominus$  of the battery in reverse. Also, do not charge, disassemble, heat, place in fire, or short circuit the battery.  
There is a risk of explosion or fire.

##### PROHIBITED

- Do not disassemble or modify the unit.  
These actions may result in fire, malfunction, or malfunction.

##### CAUTION

- Turn off the power supply before removing or attaching module/unit.  
Electric shock, malfunction or failure may result.

## Revision History

[illegible]

## ○ Warranty period and coverage

The product warranty period will be one year after the product has been delivered to the location designated in the order. If a malfunction occurs within the warranty period even though the product has been used within the range of correct conditions according to the product specifications given in this document, we will exchange or repair the defective part free of charge.

However, the following conditions are not covered under this warranty:

- (1) Damage due to negligent handling or misuse by the user.
- (2) When the cause of the malfunction is due to components other than the product delivered.
- (3) When the cause of the error is due to a modification or repair performed by an entity other than the supplier.
- (4) When the cause of the error is due to weather or accidents that are out of the supplier's control.

Further, the warranty here refers to that of the product itself, and does not include any damage caused by the malfunction of the product.

## ○ General repair

Investigations and repairs outside the warranty period (1 year) will be charged. Also, we will repair damaged products caused by any reason not covered by the warranty and investigate the cause of malfunctions for a charge even within the warranty period. Please contact the place of purchase. (Research may not be possible, depending on the area of malfunction.)

## ○ Ordering parts or asking questions

When contacting us for repair, ordering parts or inquiring about other items, please have the following details ready before contacting the place of purchase.

- (1) Model
- (2) Manufacturing number (MFG no.)
- (3) Details of the malfunction

### Warning

- (1) This manual may not be reproduced in its entirety or any portion thereof without prior consent.
- (2) The content of this document may be changed without notice.
- (3) This document has been created with utmost care. However, if errors or questionable areas are found, please contact us.

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# Table of contents

Chapter 1	Features	1-1 to 1-2
Chapter 2	System Configuration	2-1 to 2-2
Chapter 3	Function and Performance Specifications	3-1 to 3-8
	3.1 General Specifications .....	3 - 1
	3.2 Function Specifications.....	3 - 2
	3.3 Performance Specifications.....	3 - 6
Chapter 4	System Equipment	4-1 to 4-58
	4.1 List of System Equipment.....	4 - 1
	4.2 CPU Module .....	4 - 4
	4.3 AC Power Module .....	4 - 7
	4.4 DC Power Module .....	4 - 10
	4.5 Base Unit.....	4 - 13
	4.6 Input Module .....	4 - 14
	4.7 32-point Input Module.....	4 - 17
	4.8 64-point Input Module.....	4 - 19
	4.9 Output Module.....	4 - 21
	4.10 32-point Output Module .....	4 - 26
	4.11 64-point Output Module .....	4 - 28
	4.12 Input/Output Controller .....	4 - 30
	4.13 Analog I/O Module .....	4 - 31
	4.14 Dummy Module .....	4 - 36
	4.15 Expansion Cable .....	4- 36
	4.16 Memory Board .....	4 - 37
	4.17 Counter Module .....	4 - 38
	4.18 Single-Axis Pulse Positioning Module .....	4 - 41
	4.19 Resistance Temperature Detective Input Module .....	4 - 44
	4.20 Ethernet Module .....	4 - 46
	4.21 DeviceNet Master Module .....	4 - 49
	4.22 DeviceNet Slave Module .....	4 - 51
	4.23 PROFIBUS Master Module.....	4 - 54
	4.24 PROFIBUS Slave Module .....	4 - 56
	4.25 Conversion Cable for Connecting between CPU and Programmer, etc. ....	4 - 58
	4.26 Cable for Connecting between CPU and PC (IBM-PC/AC Compatible Personal Computer).....	4 - 58
Chapter 5	Command Specifications	5-1 to 5-288
	5.1 Command Classifications.....	5 - 1
	5.2 List of Commands .....	5 - 2
	5.3 Command Specification Details.....	5 - 19
Chapter 6	I/O Specifications	6-1 to 6-4
	6.1 External I/O.....	6 - 2
	6.2 Internal Output .....	6 - 4



Chapter 7	User Program	7-1 to 7-6
7.1	Memory Capacity .....	7 - 1
7.2	Programming Method .....	7 - 1
Chapter 8	Operating and Stopping EH-150	8-1 to 8-12
8.1	RUN Start .....	8 - 2
8.1.1	Scan operation .....	8 - 2
8.1.2	Setting System Processing Time (EH-CPU448) .....	8 - 3
8.1.3	Setting System Processing Time (EH-CPU308/316) .....	8 - 4
8.1.4	Normal Scan .....	8 - 5
8.1.5	Periodical Scan (Other than the EH-CPU448) .....	8 - 6
8.1.6	Periodical Scan (EH-CPU448) .....	8 - 7
8.2	Online Change in RUN .....	8 - 8
8.2.1	Cautionary Items for Changing Programs in RUN .....	8 - 8
8.2.2	HALT time .....	8 - 9
8.3	Instantaneous Power Failure .....	8 - 10
8.4	Operation Parameter .....	8 - 11
8.5	Test Operation .....	8 - 12
Chapter 9	PLC Installation, Loading, Wiring	9-1 to 9-8
9.1	Installation .....	9 - 1
9.2	Loading the Module .....	9 - 2
9.3	Wiring .....	9 - 3
Chapter 10	Communication Specifications	10-1 to 10-20
10.1	Features .....	10 - 1
10.1.1	Communication port functions .....	10 - 1
10.1.2	Port 1 setup method .....	10 - 1
10.2	Dedicated Port .....	10 - 3
10.3	General-Purpose Port .....	10 - 5
10.3.1	RS-232C interface .....	10 - 6
10.3.2	RS-422/485 interface .....	10 - 6
10.3.3	1:N communication (RS-485) .....	10 - 7
10.4	Modem Control Function .....	10 - 13
10.4.1	Configuration .....	10 - 13
10.4.2	Connection specifications .....	10 - 13
10.4.3	Additional task codes .....	10 - 14
10.4.4	AT commands .....	10 - 15
10.5	Port and Peripheral Unit Connection .....	10 - 17
10.6	Connection method for RS-422/485 communication .....	10 - 19
Chapter 11	Real Time Clock Function · Memory Board Function	11-1 to 11-10
11.1	Real Time Clock Function .....	11 - 1
11.1.1	Operation using a special internal output .....	11 - 1
11.1.2	Operation using task codes .....	11 - 2
11.2	Memory Board Function .....	11 - 3
11.2.1	Program transfer function .....	11 - 3
11.2.2	Logging Function .....	11 - 5

Chapter 12	Error Code List	12-1 to 12-6
12.1	Error Codes .....	12 - 1
12.2	Grammar and Assemble Error Codes .....	12 - 4
12.3	Operation Error Codes .....	12 - 5
Chapter 13	Special Internal Outputs	13-1 to 13-10
13.1	Bit Special Internal Output Area.....	13 - 1
13.2	Word Special Internal Output Area.....	13 - 4
13.3	Remote Error Flag Area .....	13 - 8
13.4	Link Error Flag Area.....	13 - 9
Chapter 14	Troubleshooting	14-1 to 14-14
14.1	Error Indication and Countermeasure Procedures.....	14 - 1
14.2	Checklist when Abnormal Occur .....	14 - 5
14.3	Procedures to Solve Abnormals .....	14 - 6
Chapter 15	Operation Examples	15-1 to 15-16
Chapter 16	Daily and Periodic Inspection	16-1 to 16-4
Appendix 1	Cable Connection Diagram	A-1 to A-3
Appendix 2	H-series Command Support Comparison Chart	A-4 to A-12
Appendix 3	Task Code Specifications	A-13 to A-61



# Chapter 1 Features

## 1. Compact and space saving

The EH-150 has realized a compact size; 372.5 mm (W) × 100 mm (H) × 109 mm (D) with 1,024 I/Os. The standard I/O module accommodates both a terminal block and LED display as standard, the same as our previous series of programmable controllers. It can also be installed on a DIN rail.

Each module is enclosed in a capsule-type case for easier handling. By introducing a curved line on the front cover, the system can be neatly consolidated into an ultra high-tech image.

## 2. 2 communication ports provided as standard

The EH-150 comes standard with 2 communication ports (serial port 1 and serial port 2) supported by the same type communication method as that for connecting a programming device (personal computer). The display and programming device sold in the market that have been developed for the H series can both be used simultaneously to seamlessly construct a system.

The setting for the port 1 can be changed, which allows it to function as a general-purpose port that can be controlled by the user program. A communication program can be created for the specific device connected (printer, bar code reader, etc.).

## 3. Built-in modem connection interface function

The EH-CPU208/308/316/448, with a modem connected to the port 1, can communicate with a distant location via commercial phone lines. A system located some distance away can be monitored from an office or a monitor room.

## 4. Built-in RS-422/485 interface

By setting the special internal output, serial port 1 can perform communication as an RS-422/485 interface. By using the RS-422/485 interface, a small data link system can be formed between CPU modules or with personal computers via 1:N connection. (Only with the EH-CPU308/316/448)

## 5. State-of-art technology and functions have been packed in a compact size.

The EH-150 contains 32-bit RISC processor (Super H series made by Hitachi, Ltd.) that allows high-speed operations. The user program is stored in FLASH memory so that the user program can be retained in case the battery goes dead. However, batteries are necessary when backing up the data memory.

## 6. Compatibility with H-series protects software properties

The EH-150 was developed as part of the H-series family. Those who are currently using the H-series can create and debug programs using the same concepts as they are now. Those who use the EH-150 for the first time, will find that using the H-series programmable controller will greatly broaden the applications of the software properties when they seek to expand their system in the future.

## 7. Memory board function is supported

The EH-CPU308/316/448 can use the new memory boards (EH-MEMP/MEMD) that have been made available. The EH-MEMP is capable of storing up to 48 k steps of user programs. Also, by using the program transfer function, the programs can be copied without the use of peripheral devices. Furthermore, the EH-MEMD is capable of storing a maximum of 384 k words of data.

When using a memory board, the contents of the memory board are not changed during transfer of programs from peripheral devices or when RUN is in progress. (Only the program within the CPU will be changed.) If changes are necessary, copy the program within the CPU using the program transfer function of the memory board. (Can only be used with the EH-CPU308/316/448)

## 8. PID operation function is supported

PID control can be performed without the use of additional modules. A variety of process inputs and outputs can be supported by directly controlling the analog I/O module. By using this function, continuous control targets such as temperature and flow rate can be controlled in a prompt and smooth manner. (Can only be used with the EH-CPU308/316/448)

9. Ease of use to facilitate incorporation into other devices

The EH-150 is designed so that it can be installed on easy-to-use DIN rails.

The user programs can be retained even if he or she does not wish to use a battery with the system.

The EH-150 supports a “Online change in RUN” function that allows the user to change the program while it is running.

The standard I/O module uses a removable terminal block, greatly reducing the trouble involved when having to replace the module. LEDs are provided as standard to confirm operation status and wiring. Further, the battery can be replaced without having to remove the CPU module from the base unit. The battery is replaced from the front simply by opening the cover of the CPU module.

# Chapter 2 System Configuration

The system configuration of the EH-150 is shown below.

The EH-150 is a module-type programmable controller with the configuration shown in Figure 2.1.

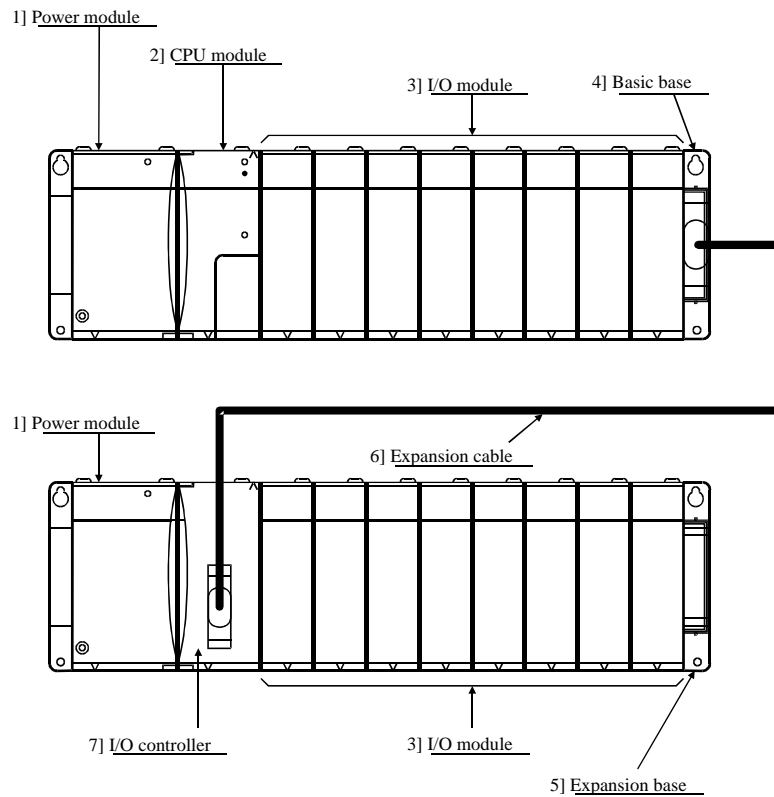


Figure 2.1 EH-150 System configuration diagram

No.	Device name	Description of function
1]	Power module	Converts power supply to the power to be used within the EH-150.
2]	CPU module	Performs operations based on the contents of the user program, receives input and controls output.
3]	I/O module	Input module, output module, analog module, etc.
4]	Basic base	Base in which the power module, CPU module, I/O module, etc. are loaded.
5]	Expansion base	Base in which the power module, I/O controller, I/O module, etc. are loaded.
6]	Expansion cable	Cable that connects the I/O controllers for the basic base and expansion base.
7]	I/O controller	Interface with expansion base and CPU module.

\* Expansion is possible only when using the EH-CPU208/308/316/448 as CPU module 2].

\* The basic base 4] and expansion base 5] are the same product.



# Chapter 3      Function and Performance Specifications

## 3.1 General Specifications

Item		Specification
Power voltage	AC receiving power	100/110/120 V AC (50/60 Hz), 200/220/240 V AC (50/60 Hz)
	DC receiving power	24 V DC
Power voltage fluctuation range		85 to 264 V AC wide range
		21.6 to 26.4 V DC
Allowable instantaneous power failure		85 to 100 V AC: for a momentary power failure of less than 10 ms, operation continues 100 to 264 V AC: for a momentary power failure of less than 20 ms, operation continues
Operating ambient temperature		0 to 55 °C (Storage ambient temperature -10 to 75 °C)
Operating ambient humidity		20 to 90 % RH (no condensation) (Storage ambient humidity 10 to 90 % RH (no condensation))
Vibration resistance		Conforms to JIS C 0911 (16.7 Hz double amplitude 3 mm X, Y and Z each direction)
Noise resistance		<ul style="list-style-type: none"> <li>○ Noise voltage 1,500 Vpp Noise pulse width 100 ns, 1 μs (Noise created by the noise simulator is applied across the power supply module's input terminals. This is determined by this company's measuring methods.)</li> <li>○ Based on NEMA ICS 3-304 (with the exception of input module)</li> <li>○ Static noise: 3,000 V at metal exposed area</li> </ul>
Insulation resistance		20 M Ω or more between the AC external terminal and case ground (FE) terminal (based on 500 V DC mega)
Dielectric withstand voltage		1,500 V AC for 1 minute between the AC external terminal and case ground (FE) terminal
Grounding		Class D grounding (ground with power supply module)
Usage environment		No corrosive gases, no excessive dust
Structure		Open, wall-mounted type
Cooling		Natural air cooling



## 3.2 Function Specifications

The functions available in the EH-150 are described in the table below.

No.	Item	Description of function
1	Basic functions	<p>The following functions can be achieved when constructing a system using the EH-150.</p> <ol style="list-style-type: none"> <li>1] An input signal is received from the control object, operations are performed according to the contents of the program created by the user and the results are output as an output signal. Also, operation results and information during the process can be retained in the internal output area.</li> <li>2] After power is supplied to the main module and system begins to run, the operation described above is performed continuously until the power is shut off or the system stops running.</li> <li>3] The information retained internally can be extracted by a device connected externally or can be set in other information. Also, this information is initialized at the time the system begins running, but it can also be retained according to user settings.</li> <li>4] Operating status can be confirmed with the LED display of the CPU module or I/O module or with an external device that is connected.</li> </ol>
2	Setting and display	<p>The following have been provided for the user to set or confirm various types of operation status:</p> <ol style="list-style-type: none"> <li>1] Setting switch (CPU module) This sets the CPU communication function setting and operation mode, etc. It can also instruct run and stop.</li> <li>2] LED display (Power module, CPU module, I/O module) Indicates the power system status, operating status and I/O operation status.</li> <li>3] Connector (CPU module, basic base, I/O controller) This can connect external devices using RS-232C, etc. It can also add I/O modules.</li> <li>4] Terminal block (Power module, I/O module) This performs the connections for supplying power, and for exchanging signals with the control object.</li> </ol>
3	Number of I/O points	<p>The number of points that can be controlled with respect to the control object is as follows.</p> <ol style="list-style-type: none"> <li>1] External I/O At the time 16-point module is used, a total of 128 points is for EH-CPU104 and 256 points for EH-CPU208/308/316/448. The I/O numbers for inputs are indicated by X, WX, DX and outputs are indicated by Y, WY, DY.</li> <li>2] Internal outputs These are areas for temporarily storing information. The I/O numbers are M, WM, DM, R, WR, DR, etc.</li> <li>3] A timer and a counter are provided internally.</li> <li>4] Array (only corresponding to substitution statement) Array of I/O numbers can be indicated by placing parentheses ( ) around them.</li> </ol>
4	User program memory	<p>The program where the control contents have been described can be stored. The memory for this is in the CPU module and the capacity differs for each CPU module.</p> <ol style="list-style-type: none"> <li>1] The memory has a function whereby its contents are retained even if the battery dies. Because of this, it is necessary to initialize the memory since it may have uncertainties right after the unit is purchased.</li> <li>2] Programming is performed using the programming software (LADDER EDITOR) and peripheral device, etc. for the H-series programmable controllers.</li> <li>3] The commands that can be used are those designated by the H-series ladder. Refer to the list of EH-150 commands for details.</li> </ol>

No.	Item	Description of function
5	Back-up memory	<p>The contents of a user program can be maintained without a battery.</p> <ol style="list-style-type: none"> <li>1] A battery is not required to retain the contents of the user program. Always store the created programs to a floppy disk, etc. just in case something unexpected occurs.</li> <li>2] When a user program is transferred from a peripheral device or the contents of a user program are changed in the RUN state, the EH-CPU448 writes the user program to the back-up memory without disturbing CPU running. It takes approximately two minutes to write the user program to the back-up memory.</li> </ol> <p>* To protect a user program while writing it to the back-up memory (while the special internal output R7EF stays "1"), do not turn off the power of the system.</p>
6	Control method	<p>With the EH-150, the user programs are batch converted when operation begins, and the programs after conversion will be executed in order as they are read one by one.</p> <ol style="list-style-type: none"> <li>1] The method used for I/O data is that after the I/O data (information) is scanned (execution from the head of the program to the end), it is updated in group (refresh method). If refresh of external I/O is required in the middle of scanning, use the refresh command.</li> <li>2] Apart from the program that will be normally executed, a periodic scan program which interrupts the normal program at set time intervals and is executed, can be created. The time intervals are 10 ms, 20 ms, and 40 ms. (The EH-CPU448 also supports 5 ms.)</li> <li>3] The user program is executed from the head of the program to the end, and is once again repeated after the system processing that updates the lapsed timer value, refreshes I/O, and performs communication with peripheral devices, has been performed.</li> </ol>
7	Run/stop control	<p>Running and stopping of the CPU module is normally performed by the user.</p> <ol style="list-style-type: none"> <li>1] Turn the RUN switch on to begin operation. Turn the switch off to stop operation.</li> <li>2] The start and stop operation can be performed via communication from peripheral devices (PC) by changing to the REMOTE mode using the setting switch.</li> <li>3] The start and stop operation can be performed with designated external inputs or internal outputs by designating operation control inputs with a programming device.</li> <li>4] Apart from the above described operation, if a malfunction is detected in the system while it is running, operation stops and the outputs are shut down (OFF).</li> <li>5] If the power is shut off and then turned back on while the system is running, operation starts. When the power shuts off, turn off the power to the EH-150, then shut off the external input power. When turning the power back on, turn on the external input power before turning on the power to the EH-150.</li> <li>6] When starting operation, do so after clearing internal information which is not designated for storage during power failure. When stopping operation, leave the internal information as is, turn off the outputs and then stop.</li> <li>7] When the power has been cut off for longer than the time allowed for instantaneous power failure, then depending on the system load status, either operation continues or the system perceives that a power shut off has occurred and restarts operation. To ensure operation resumes correctly, have the power remain off for 1 minute or longer.</li> </ol>
8	Operation parameters	<p>Each type of condition for operating the EH-150 can be set. The possible settings for operation when an error occurs are given below.</p> <ol style="list-style-type: none"> <li>1] Operation can be continued when I/O information does not match.</li> <li>2] Overload check time can be set. The initial value is 100 ms and operation stops when the time for one scan takes longer than the set overload check time. (overload error)</li> <li>3] Operation can be made to continue when an overload error occurs.</li> <li>4] When a power failure (power shutoff) occurs, the internal output area for retaining information and the timer and the counter range can be designated.</li> </ol> <p>And, the setting below is possible.</p> <ol style="list-style-type: none"> <li>1] The name of the user program can be registered.</li> <li>2] A password can be set up so that a third party cannot reference the program.</li> <li>3] It is necessary to register the type of I/O module used as an I/O assignment table. In order to create this I/O assignment table, the type of I/O module that is connected can be read.</li> </ol>

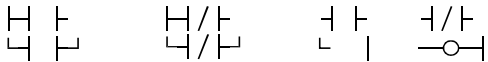
No.	Item	Description of function
9	Online change in RUN	<p>A section of a program can be revised while it is running.</p> <ol style="list-style-type: none"> <li>1] If revision is done with a programming device and the online change is performed in RUN, the user program in the CPU is changed and the altered program is switched internally at the end of scanning, and operation continues with the new program.</li> <li>2] When a control command is to be included in the revisions to the program, make the changes after first performing the control command change procedure in the programming device and checking for safety.</li> <li>3] Until operation starts to continue with the new program, a 'halt period' occurs when the module does not run. External input information is not being received during this time, so leave plenty of allowance in the timing for executing a online change in RUN.</li> </ol>
10	Forced set/reset	Forced set and forced reset of the designated I/O can be performed from the programming device connected to the CPU module.
11	Forced output	Output can be forced with respect to the designated I/O number from the programming device connected to the CPU module. For I/O that are not designated, outputs are shut off.
12	Calendar clock function (only EH-CPU 208/308/316/448)	<p>The EH-CPU208/308/316/448 has a calendar clock function.</p> <ol style="list-style-type: none"> <li>1] The year, month, date, day of the week, hour, minute and second can be set.</li> <li>2] There is a function for making adjustments in 30 second units.</li> <li>3] When a battery is not installed, the calendar clock information is not retained when power goes off. The calendar clock must be set again.</li> </ol>
13	Dedicated port	<p>This is a communication port with dedicated protocol for the H-series. The communication command called the task code is defined in the port.</p> <ol style="list-style-type: none"> <li>1] A programming device can be connected.</li> <li>2] The ports that can be used as dedicated ports are Port 1 and Port 2. Transmission speed, etc. can be switched using the setting switch.</li> </ol>
14	General-purpose port	This is a serial port that can be controlled by the user program. The various settings for communication, actual transmit and receive processing are carried out by the user program. Port 1 can be assigned for this function by switching the setting switch.
15	Modem control (only EH-CPU 208/308/316/448)	<p>A modem can be connected externally for use. It becomes operable when something arrives from outside, and after that, task code communication can be performed.</p> <p>When transmitting from the EH-150, set the port as a general-use port and have it controlled independently with the user program.</p> <p>Port 1 can be assigned for this function by switching the setting switch.</p>
16	Self-diagnosis	<p>Self-diagnostic tests for the following items are performed:</p> <ol style="list-style-type: none"> <li>1] Microcomputer check</li> <li>2] System program area check</li> <li>3] Memory check</li> <li>4] User program check</li> <li>5] Internal output area check</li> <li>6] Mounted I/O check</li> </ol>
17	Abnormal handling	<p>When an abnormal occurs, the error code that shows the error contents are output to special internal output WRF000 as a hexadecimal value. Also, the error is indicated to the outside by the ERR lamp, etc. If the error level is high, the CPU stops operation, but depending on the error, the operation may be continued using user settings.</p> <p>If multiple errors occur, the error code with higher error severity is set. The detailed information is also set to the special internal output. Also, this information is always recorded in the power failure memory, so the information can be referenced even after the power is cut off. (However, a battery is required.) The clearing of the error information can be conducted by turning on R7EC.</p>

No.	Item	Description of function
18	Task code	By combining individual task codes, the following functions can be realized by the program in the host computer: 1] CPU control (RUN/STOP control of CPU, occupy/release, CPU status read, etc.) 2] I/O control (various types of monitoring) 3] Memory write (all clear, batch transfer, etc.) 4] Memory read (reading of programs, etc.) 5] Response (various responses from CPU)
19	Command	Programming can be performed for various purposes and uses by combining ladders and the command language.

Note: The EH-150 does not support some functions that are supported by the rest of the H series (debugging, tracing, forcing and simulation functions).

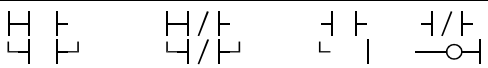
Don't select the tracing function among them, because an occupy error will occur when peripheral devices are used and the trace function is selected. If an occupy error should occur, recover by first going off-line and then going back on-line and reconnecting.

### 3.3 Performance Specifications

Model	Type		EH-CPU104	EH-CPU208
Number of I/O points	At the time 64 points I/O module is used		512 points maximum	1,024 points maximum
Control specifications	CPU		32-bit RISC processor	
	Processing method		Stored program cyclic method	
	Processing speed	Basic commands	1.0 $\mu$ s/command	
		Application commands	Several 10 $\mu$ s/command	
	User program memory		4 k steps maximum (RAM) 4 k steps (FLASH MEMORY)	8 k steps maximum (RAM) 8 k steps (FLASH MEMORY)
Operation processing specifications	Command language	Basic commands	39 types such as LD, LDI, AND, ANI, OR, ORI, ANB, ORB, OUT, MPS, MRD, MPP	
		Arithmetic command Application commands	59 types such as arithmetic (+ - $\times$ $\div$ =, etc.), jump, subroutine, division, extraction, etc.	
	Ladder	Basic commands	39 types, such as 	
		Arithmetic command Application commands	59 types such as arithmetic (+ - $\times$ $\div$ =, etc.), jump, subroutine, division, extraction, etc.	
I/O processing specifications	External I/O	I/O processing method		Refresh processing
		16 points I/O module		128 points maximum      256 points maximum
	Internal output	Bit		1,984 points (R0 to R7BF)
		Word		4,096 words (WR0 to WRFFF)      8,192 words (WR0 to WR1FFF)
		Special	Bit	64 points (R7C0 to R7FF)
			Word	512 words (WRF000 to WRF1FF)
		CPU link		16,384 points    1,024 words $\times$ 2 loops (L0 to L3FFF/L10000 to L13FFF, WL0 to WL3FF/WL1000 to WL13FF)
		Remote I/O		512 points $\times$ 4 master stations
		Bit/word shared		16,384 points    1,024 words (M0 to M3FFF, WM0 to WM3FF)
	Timer and counter	Number of points		512 points (TD + CU) However, TD is up to 256 points *1
		Timer set value		0 to 65,535, time base 0.01s, 0.1s, 1s (64 points are maximum for 0.01 s. *2)
		Counter set value		1 to 65,535
	Edge detection		512 points (DIF0 to DIF511: decimal) + 512 points (DFN0 to DFN511: decimal)	
Peripheral devices	Program method		Command language, ladder diagram	
	Peripheral device		Programming software (LADDER EDITOR DOS version/Windows® version) Command language programmer, Portable graphic programmer, Graphic input device	
Maintenance functions	Self-diagnosis		PC abnormal (LED display): microcomputer error, watchdog timer error, memory error, program error, system ROM/RAM error, scan time monitoring, battery under-voltage detection, and others	

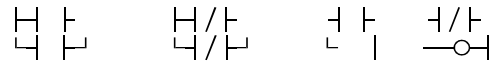
\*1: The same numbers cannot be shared by the time and the counter. TD is 0 to 255.

\*2: Only timers numbered 0 to 63 can use 0.01s for their time base.

Model	Type		EH-CPU308	EH-CPU316
Number of I/O points	At the time 64 points I/O module is used		1,024 points maximum	1,024 points maximum
Control specifications	CPU		32-bit RISC processor	
	Processing method		Stored program cyclic method	
	Processing speed	Basic commands	1.0 $\mu$ s/command	
		Application commands	Several 10 $\mu$ s/command	
Operation processing specifications	User program memory		8 k steps maximum (RAM) 8 k steps (FLASH MEMORY)	16 k steps maximum (RAM) 16 k steps (FLASH MEMORY)
	Command language	Basic commands	39 types such as LD, LDI, AND, ANI, OR, ORI, ANB, ORB, OUT, MPS, MRD, MPP	
		Arithmetic command Application commands	59 types such as arithmetic (+ - $\times$ $\div$ =, etc.), jump, subroutine, division, extraction, etc.	
	Ladder	Basic commands	39 types, such as 	
		Arithmetic command Application commands	59 types such as arithmetic (+ - $\times$ $\div$ =, etc.), jump, subroutine, division, extraction, etc.	
I/O processing specifications	External I/O	I/O processing method		Refresh processing
		16 points I/O module		256 points maximum      256 points maximum
	Internal output	Bit		1,984 points (R0 to R7BF)
		Word		17,408 words (WR0 to WR43FF)      22,528 words (WR0 to WR57FF)
		Special	Bit	64 points (R7C0 to R7FF)
			Word	512 words (WRF000 to WRF1FF)
		CPU link		16,384 points 1,024 words $\times$ 2 loops (L0 to L3FFF/L10000 to L13FFF, WL0 to WL3FF/WL1000 to WL13FF)
		Remote I/O		512 points $\times$ 4 master stations
		Bit/word shared		16,384 points 1,024 words (M0 to M3FFF, WM0 to WM3FF)
	Timer and counter	Number of points		512 points (TD + CU) However, TD is up to 256 points *1
		Timer set value		0 to 65,535, time base 0.01s, 0.1s, 1s (64 points are maximum for 0.01 s. *2)
		Counter set value		1 to 65,535
	Edge detection		512 points (DIF0 to DIF511: decimal) + 512 points (DFN0 to DFN511: decimal)	
Peripheral devices	Program method		Command language, ladder diagram	
	Peripheral device		Programming software (LADDER EDITOR DOS version/Windows® version) Command language programmer, Portable graphic programmer, Graphic input device	
Maintenance functions	Self-diagnosis		PC abnormal (LED display): microcomputer error, watchdog timer error, memory error, program error, system ROM/RAM error, scan time monitoring, battery under-voltage detection, and others	
Additional functions	Memory board		For program transfer, for data logger	
	Commands		PID commands, data logging commands	
	RS-422/RS-485		Port I switching	

\*1: The same numbers cannot be shared by the time and the counter. TD is 0 to 255.

\*2: Only timers numbered 0 to 63 can use 0.01s for their time base.

Model	Type		EH-CPU448	
Number of I/O points	At the time 64 points I/O module is used		1,024 points maximum	
Control specifications	CPU		32-bit RISC processor	
	Processing method		Stored program cyclic method	
	Processing speed	Basic commands	0.1 μs/command	
		Application commands	Several 10 μs/command	
	User program memory		48 k steps maximum (RAM) 48 k steps (FLASH MEMORY)	
Operation processing specifications	Command language	Basic commands	39 types such as LD, LDI, AND, ANI, OR, ORI, ANB, ORB, OUT, MPS, MRD, MPP	
		Arithmetic command Application commands	113 types such as arithmetic (+ − × ÷ =, etc.), jump, subroutine, division, extraction, etc.	
	Ladder	Basic commands	39 types, such as 	
		Arithmetic command Application commands	113 types such as arithmetic (+ − × ÷ =, etc.), jump, subroutine, division, extraction, etc.	
I/O processing specifications	External I/O	I/O processing method	Refresh processing	
		64 points I/O module	1,024 points maximum	
	Internal output	Bit	1,984 points (R0 to R7BF)	
		Word	50,176 words (WR0 to WRC3FF)	
		Special	Bit	64 points (R7C0 to R7FF)
			Word	512 words (WRF000 to WRF1FF)
		CPU link	16,384 points 1,024 words × 2 loops (L0 to L3FFF/L10000 to L13FFF, WL0 to WL3FF/WL1000 to WL13FF)	
		Remote I/O	1,024 points × 4 master stations	
		Bit/word shared	16,384 points 1,024 words (M0 to M3FFF, WM0 to WM3FF)	
	Timer and counter	Number of points	512 points (TD + CU) However, TD is up to 256 points *1	
		Timer set value	0 to 65,535, timer base 0.01s, 0.1s, 1s (64 points are maximum for 0.01 s. *2)	
		Counter set value	1 to 65,535 times	
Edge detection		512 points (DIF0 to DIF511: decimal) + 512 points (DFN0 to DFN511: decimal)		
Peripheral devices	Program method	Command language, ladder diagram		
	Peripheral device	Programming software (LADDER EDITOR DOS version/Windows® version) Command language programmer, Portable graphic programmer, Graphic input device		
Maintenance functions	Self-diagnosis	PC abnormal (LED display): microcomputer error, watchdog timer error, memory error, program error, system ROM/RAM error, scan time monitoring, battery under-voltage detection, and others		
Extended functions	Memory board	For program transfer, for data logger		
	Commands	PID command (3 types), data logging command (4 types), floating point command (19 types), high function module transfer command (TRNS7, RECV7), ASCII/binary conversion command (FUN42, FUN43), dialing command (TRNS8), extended timer command (2,048 points, time base fixed at 0.01s)		
	Simplified procedure dedicated port communication	Dedicated port communication by transfer control procedure 2		
	RS-422/RS-485 dedicated port communication	1:N dedicated port communication with station number		
	RS-422/RS-485 general port communication	Port 1 switching		

\*1: The same numbers cannot be shared by the timer and the counter. TD is 0 to 255.

\*2: Only timers numbered 0 to 63 can use 0.01s for their time base.

# Chapter 4 System Equipment

## 4.1 List of System Equipment

### (1) Basic devices

Table 4.1 List of system equipment (1/2)

Product	Model name	Specification	I/O assignment symbol	Occupied slot number	Remarks
CPU module	EH-CPU104	512 I/O points maximum *1, 4 k steps (Cannot be expanded)	—	Fixed *2	
	EH-CPU208	1,024 I/O points maximum *1, 8 k steps, clock function, modem control function	—	Fixed *2	
	EH-CPU308	1,024 I/O points maximum *1, 8 k steps, clock function, modem control function memory board function, RS-422/RS-485 communication support, PID command, floating point operation support	—	Fixed *2	
	EH-CPU316	1,024 I/O points maximum *1, 16 k steps, clock function, modem control function memory board function, RS-422/RS-485 communication support, PID command, floating point operation support	—	Fixed *2	
	EH-CPU448	1,024 I/O points maximum *1, 48 k steps, clock function, modem control function memory board function, RS-422/RS-485 dedicated/general port communication support, PID command, floating point operation support		Fixed *2	
Memory board	EH-MEMP	Program capacity 48 k steps	—	Fixed	Loaded in optional slot
	EH-MEMD	Program capacity 16 k steps Data capacity 384 k words	—	Fixed	
Power module	EH-PSA	Input 100 to 240 V AC Output 5 V DC 3.8 A, 24 V DC 0.4 A	—	Fixed *2	
	EH-PSD	Input 21.6 to 26.4 V DC Output 5 V DC 3.8 A	—	Fixed *2	
Base unit	EH-BS3	3 I/O modules installed	—	—	Basic base and expansion base are the same product.
	EH-BS5	5 I/O modules installed	—	—	
	EH-BS8	8 I/O modules installed	—	—	
Input module	EH-XD8	8 points, 24 V DC input	X16	1	
	EH-XD16	16 points, 24 V DC input	X16	1	
	EH-XD32	32 points, 24 V DC input	X32	1	
	EH-XD64	64 points, 24 V DC input	X64	1	
	EH-XA16	16 points, 100 to 120 V AC input	X16	1	
	EH-XAH16	16 points, 200 to 240 V AC input	X16	1	
Output module	EH-YT8	8 points, transistor output 12/24 V DC (sink type)	Y16	1	
	EH-YTP8	8 points, transistor output 12/24 V DC (source type)	Y16	1	
	EH-YR12	12 points, relay output, 100/240 V AC, 24 V DC	Y16	1	
	EH-YT16	16 points, transistor output 12/24 V DC (sink type)	Y16	1	
	EH-YTP16	16 points, transistor output 12/24 V DC (source type)	Y16	1	
	EH-YTP16S	16 points, transistor output 12/24 V DC (source type)	Y16	1	With short-circuit protection function
	EH-YT32	32 points, transistor output, 12/24 V DC (sink type)	Y32	1	
	EH-YTP32	32 points, transistor output, 12/24 V DC (source type)	Y32	1	
	EH-YT64	64 points, transistor output, 12/24 V DC (sink type)	Y64	1	With short-circuit protection function
	EH-YTP64	64 points, transistor output, 12/24 V DC (source type)	Y64	1	
	EH-YS4	4 points, triac output , 100/240 V AC	Y16	1	
Analog module	EH-AX44	Current input (channels 0 to 3) 4 to 20 mA, Voltage input (channels 4 to 7) 0 to 10 VDC	WX8W	1	
	EH-AX8V	Voltage input (channels 0 to 7) 0 to 10 VDC	WX8W	1	
	EH-AX8H	Voltage input (channels 0 to 7) -10 to 10 VDC	WX8W	1	
	EH-AY22	Voltage output (channels 0 to 1) 0 to 10 VDC, Current output (channels 2 to 3) 4 to 20 mA	WY8W	1	
	EH-AY2H	Voltage output (channels 0 to 1) -10 to 10 VDC	WY8W	1	
	EH-AY4V	Voltage output (channels 0 to 4) 0 to 10 VDC	WY8W	1	
	EH-AY4H	Voltage output (channels 0 to 4) -10 to 10 VDC	WY8W	1	

\*1: When 64 points I/O module is used

\*2: The CPU module, power supply module, I/O controller and other devices may only be installed at the designated locations. They cannot be installed in any other locations. Always assign open 16 points when assigning an I/O to an open slot.



Table 4.1 List of system equipment (2/2)

Product	Model name	Specification	I/O assignment symbol	Occupied slot number	Remarks
Resistance temperature detective input module	EH-PT4	Signed 15 bits, temperature-measuring register input, 4 channels, platinum (Pt 100 $\Omega$ /Pt 1,000 $\Omega$ )	WX4	1	
I/O controller	EH-IOC	I/O control module (1 unit/1 extension, extension is not available with the EH-CPU104)	—	Fixed *2	
Dummy module	EH-DUM	Module for open slots	Empty 16	1	
High function module	EH-CU	High speed counter input, maximum frequency of 100 kHz, 2 channels, 1/2-phase switchable, 4-point open collector output	FUN0	1	
	EH-CUE	High speed counter input, maximum frequency of 100 kHz, 1 channel, 1/2-phase switchable, 2-point open collector output	FUN0	1	
	EH-POS	Positioning module	4W/4W	1	
	EH-ETH	Ethernet module IEEE802.3 standard, 10BASE-T	COMM	1	Only 0-2 slots are effective
	EH-RMD	DeviceNet master module 256-word input/256-word output, up to 2 units per CPU can be installed.	LINK	1	Only 0-2 slots are effective
	EH-IOCD	DeviceNet slave module 256-word input/256-word output	—	Fixed *2	
	EH-RMP	PROFIBUS-DP master module 256-word input/256-word output, up to 2 units per CPU can be installed.	LINK	1	Only 0-2 slots are effective
	EH-IOCP	PROFIBUS-DP slave controller 209-word input and output	—	Fixed *2	

\*2: The CPU module, power module, and I/O controller can only be installed at the designated locations. They cannot be installed in areas other than the designated locations. Always assign 16 points as open when assigning an I/O to an open slot.

## (2) Peripheral devices

Table 4.2 List of peripheral devices

Product	Form	Specification	Remarks
Portable graphic programmer	PGM-GPH	Portable graphic programmer with a 2 m (6.56 ft.) connection cable (PGCB02H)	*3
Command language programmer	PGM-CHH	Command language programmer	
Graphic input device support software	HL-GPCL	Ladder diagram/Command language editor LADDER EDITOR (for GPCL01H)	
	HL-PC3	Ladder diagram/Command language editor LADDER EDITOR (for PC98 series) with CPU connection cable	
	HL-AT3E	Ladder diagram/Command language editor LADDER EDITOR (for PC/AT compatible personal computer)	
	HLW-PC3	Ladder diagram/Command language editor LADDER EDITOR (for Windows® 95/NT 4.0)	
	HLW-PC3E	Ladder diagram/Command language editor (English version) LADDER EDITOR (for Windows® 95/98/NT)	

Note: MS-DOS, Windows® 95, and Windows NT® are registered trademarks of Microsoft Corporation in the United States. HI-LADDER (attached to GPCL01H) can also be used.

\*3: Don't use the option box (model name: PGMIF1H) for the portable graphic programmer. Its high current may cause the EH-150 system to break down.

## (3) Connection cable

Table 4.3 List of connection cables

Product	Model name	Specification	Remarks
Cable for connecting basic base to I/O controller	EH-CB10	Length: 1 m (3.28 ft.) (Basic base - I/O controller)	
Conversion cable for connecting peripheral devices	EH-RS05	Length: 0.5 m (19.69 in.)	*4
For portable graphic programmer, command language programmer	PGCB02H	Length: 2 m (6.56 ft.), between CPU and programmer	
Peripheral devices	GPCB02H	Length: 2 m (6.56 ft.), between CPU and graphic input device	
	GPCB05H	Length: 5 m (16.40 ft.), between CPU and graphic input device	
	GPCB15H	Length: 15 m (49.22 ft.), between CPU and graphic input device	
	CBPGB	Length: 2 m (6.56 ft.), between graphic input device and printer	
	LP100	Length: 2 m (6.56 ft.), between graphic input device and kanji printer	
	KBADPTH	Length: 15 m (49.22 ft.), between graphic input device and JIS keyboard	
	PCCB02H	Length: 2 m (6.56 ft.), between CPU and PC98 series	
	WPCB02H	Length: 2 m (6.56 ft.), between CPU and PC98 series (25-pin)	*5
	WVCB02H	Length: 2 m (6.56 ft.), between CPU and DOS/V (9-pin)	*5
	EH-VCB02	Length: 2 m (6.56 ft.), between CPU (modular jack type) and DOS/V (9-pin)	*5

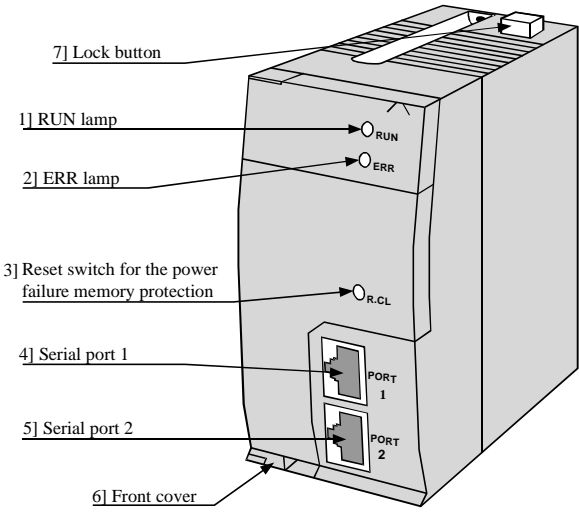
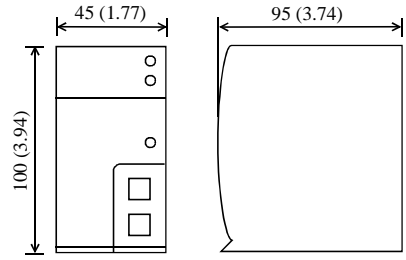
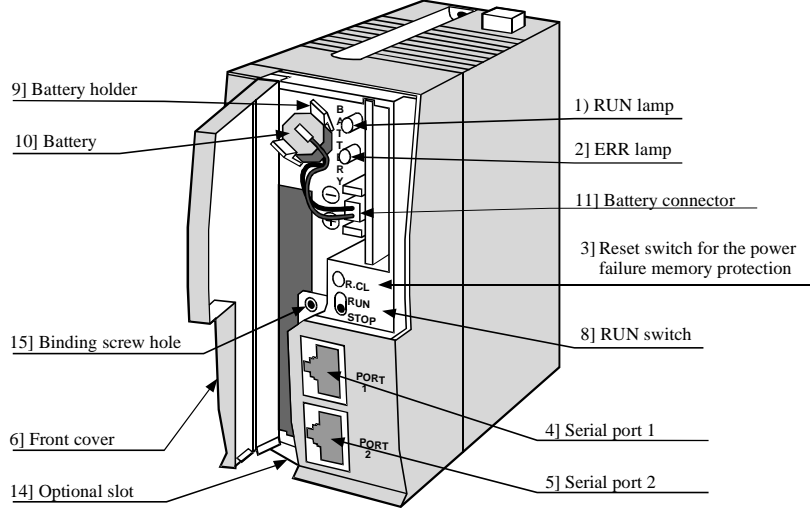
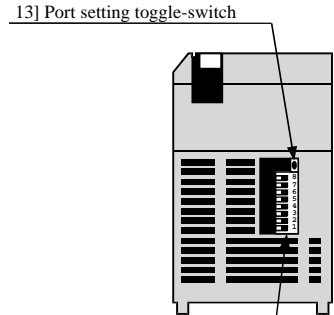
\*4: Required when connecting to programmer peripheral device (including PC98, DOS/V, and PC/AT compatibles)

\*5: EH-VCB02, WPCB02H and WVCB02H are cables for LADDER EDITOR for Windows®.



## (4) Others

Form	Usage	Remarks
LIBAT-H	Lithium battery	The battery is used in common with the H series.

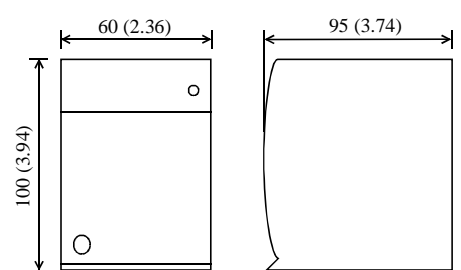
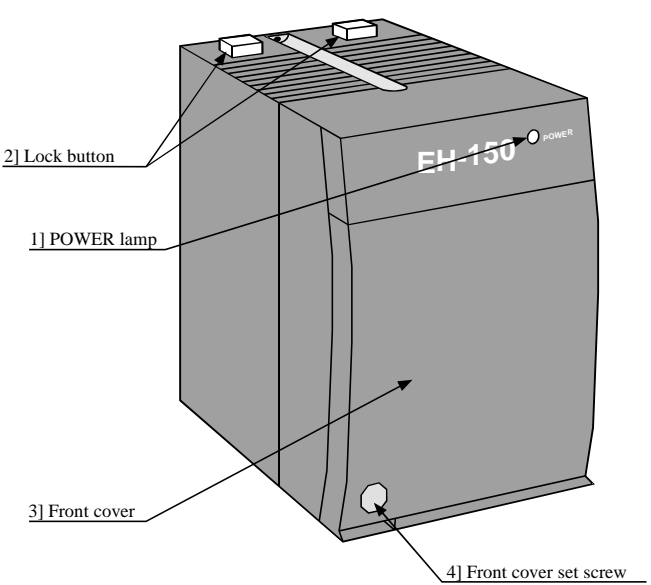
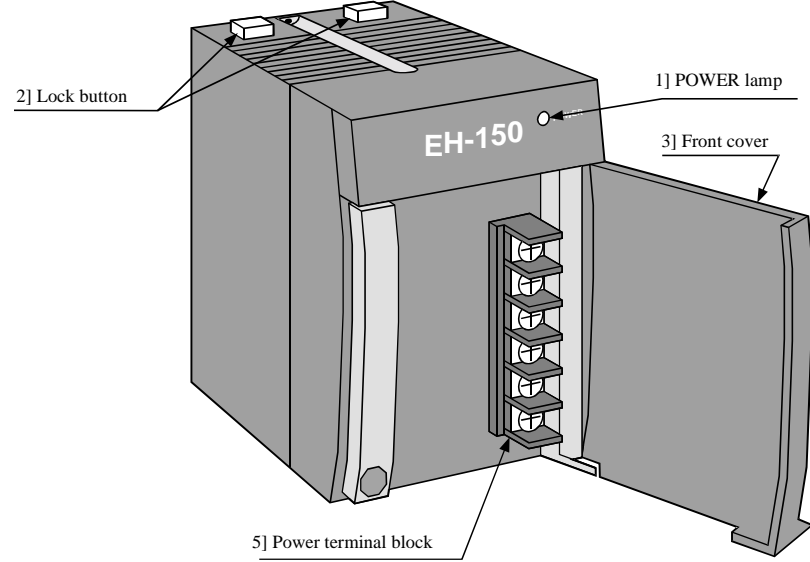
## 4.2 CPU Module



Name and function of each part		Type	EH-CPU104 EH-CPU208 EH-CPU308 EH-CPU316 EH-CPU448
		Weight	Approx. 0.18 kg (0.4 lb.) (EH-CPU448 weights approx. 0.20 kg (0.44 lb.).)
		Current consumption	500 mA
		Dimensions (mm (in.))	
		 <p>Drawing of CPU module bottom</p>	
No.	Name	Function	Remark2s
1]	RUN lamp	Indicates that the CPU is running.	Green
2]	ERR lamp	Indicates that the CPU is generating an abnormal.	Red
3]	Reset switch for the power failure memory protection	Clears the area designated for power failure memory.	Enabled only during a stoppage
4]	Serial port 1	Connects a programming device, etc..	Refer to the detailed explanation.
5]	Serial port 2	Connects a programming device, etc..	Refer to the detailed explanation.
6]	Front cover	This is used when operating the RUN switch or replacing the battery.	
7]	Lock button	This is used when removing the module from the base unit.	
8]	RUN switch	Used to control the running status.	
9]	Battery holder	Used for putting a battery in.	
10]	Battery	Retains power failure memory data or clock data.	
11]	Battery connector	Used to connect a battery.	
12]	Mode setting DIP-switch	Sets the operating status for the serial port, etc.	
13]	Port setting toggle-switch	Switches the operating status for the serial port 2.	
14]	Optional slot	Memory board is loaded.	
15]	Binding screw hole	Fix the memory board with binding screw.	

No.	Item	Detailed explanation	Remarks						
	Explanation of operation	Operations are performed according to the contents of the program created by the user. The programming device connected to the CPU module communication port writes and reads the user program. Memory is installed inside the CPU module in which the user program and internal output information are stored. The internal output data and clock information can be backed up with the battery. (The clock function is not available with the EH-CPU104)							
1]	RUN lamp	This indicates the CPU is running and lights up during normal operation.	The lamp is green.						
2]	ERR lamp	The error contents can be determined by the combination of lighting and flashing of the ERR and RUN lamps. For details, refer to “Chapter 12 The Error Code List”.	The lamp is red.						
3]	Reset switch for the power failure memory protection	Pressing this switch when the operation is stopped, clears data from the area designated for power failure memory. The program information is retained as is.							
4]	Serial port 1	Can be switched to use as a dedicated port or general-purpose port using the mode setting switch. It is also equipped with modem control functions. (The modem control function is not available with the EH-CPU104)							
5]	Serial port 2	Can be used as a dedicated port. A programming device can be connected and tasks such as CPU programming or monitoring can be performed.							
6]	Front cover	Open and close the front cover when operating the RUN switch or replacing the battery. Keep the cover closed while the module is running. Also, when the cover is open, do not touch the printed wiring board with your hands.							
7]	Lock button	It is used to remove the CPU module from the base unit. Hold this button down while releasing the module from the unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.							
8]	RUN switch	To designate run status, push this switch lever to the "RUN" side. The following conditions are necessary for the module to run correctly: 1. A user program must be written to the module. 2. When a run definition input has been set, the designated input must be on. 3. There should be no sources of errors. 4. The mode setting switch is set to the normal run status. 5. When the mode setting switch is set to "REMOTE," there should be a run start command from the personal computer, etc. that is connected. Also, to stop operation, set this switch lever to the "STOP" side.							
9] 10] 11]	Battery holder Battery Battery connector	The module is shipped with the battery connector disconnected so as to prevent unnecessary consumption of battery during distribution or storage. When using the CPU module, check the battery and connect the lead connector on the battery to the mating connector on the circuit board. 1. Clock data is retained by battery power and thus has not been written to the clock element initially. When using the clock function, first write the clock data to the clock element. (The EH-CPU104 does not provide clock function.) See Chapter 11 for procedures for setting the clock data. 2. Use the reference table below to determine the remaining life of battery. As a guideline, replace the battery every two years even when the total power failure time is less than the guaranteed value shown in the table. <table border="1"><tr><th colspan="2">Battery life (Total power failure time) [Hr]</th></tr><tr><th>Guaranteed value (MIN) *1</th><th>Actual value (MAX) *2</th></tr><tr><td>2,000</td><td>32,000</td></tr></table> *1 The guaranteed value indicates the total power failure time at the ambient temperature of 55°C. *2 The actual value indicates the total power failure time at the ambient temperature of 25°C.	Battery life (Total power failure time) [Hr]		Guaranteed value (MIN) *1	Actual value (MAX) *2	2,000	32,000	
Battery life (Total power failure time) [Hr]									
Guaranteed value (MIN) *1	Actual value (MAX) *2								
2,000	32,000								

No.	Item	Detailed explanation				Remarks	
12]	Mode setting switch	The following operating modes are designated by setting this switch. Even if the switch setting is changed while the module is energizing, the operating mode will not change. To switch operating modes, turn the power off, then do the settings correctly. (When DR signal turns on, modifying the baud rate.)					
		Switch number	ON		OFF		Supplementary explanation
		1	"REMOTE"		Normal mode		In REMOTE mode, RUN/STOP is executed via communication.
		2	Modem control		TRNS0 operation		Port 1 operation (When switch number 5 is turned off, it is valid.)
		3, 4	3	4	Port 1 transmission speed		
			ON	ON	4,800 bps		
			OFF	ON	9,600 bps		
			ON	OFF	19,200 bps		
			OFF	OFF	38,400 bps		
		5	Dedicated port		General-purpose port		Port 1 operation
		6	6	PHL	Port 2 transmission speed		Port 2 operation
			ON	Low	9,600 bps		PHL signal: Port 2 connector 5 pin
			ON	High	38,400 bps		
OFF	Low		4,800 bps				
OFF	High		19,200 bps				
7	(System mode)		Normal operation mode	Do not turn on.			
8	(System mode)		Normal operation mode	Do not turn on.			
13]	Port switching switch	This is used when a LADDER EDITOR for Windows® or programmer is connected to serial port 2.				At the time the port switching switch is set to programmer connection (set to ON side), the PHL signal is set to HIGH. Simultaneously, +12 V is output from the connector pin 5, so exercise caution.	
		<div>ON OFF</div> <div></div> <div>When LADDER EDITOR (For PC98 series, PC/AT compatible personal computer, GPCL) is used</div> <div>When a programmer is not connected</div>		<div>ON OFF</div> <div></div> <div>When LADDER EDITOR for Windows® is used</div> <div>When a programmer is connected</div>			
14]	Optional slot	The optional memory board is inserted in this slot.				Can only be used with the EH-CPU308/316/448.	
15]	Binding screw hole	Install the memory board in the slot by sliding it in along the guide. <ul style="list-style-type: none"><li>When installing the memory board First install the CPU module in the base unit, then insert the memory board in the optional slot. After installing the memory board, be sure to fix it securely using the binding screws (supplied with the memory board).</li><li>When removing the memory board With the memory board still attached to the CPU module, remove the entire CPU module from the base unit</li></ul> Note on installing the memory board Do not install the CPU module in the base unit with the memory board still attached to the CPU module. Doing so may cause inappropriate connection at the base connector on the memory board.					

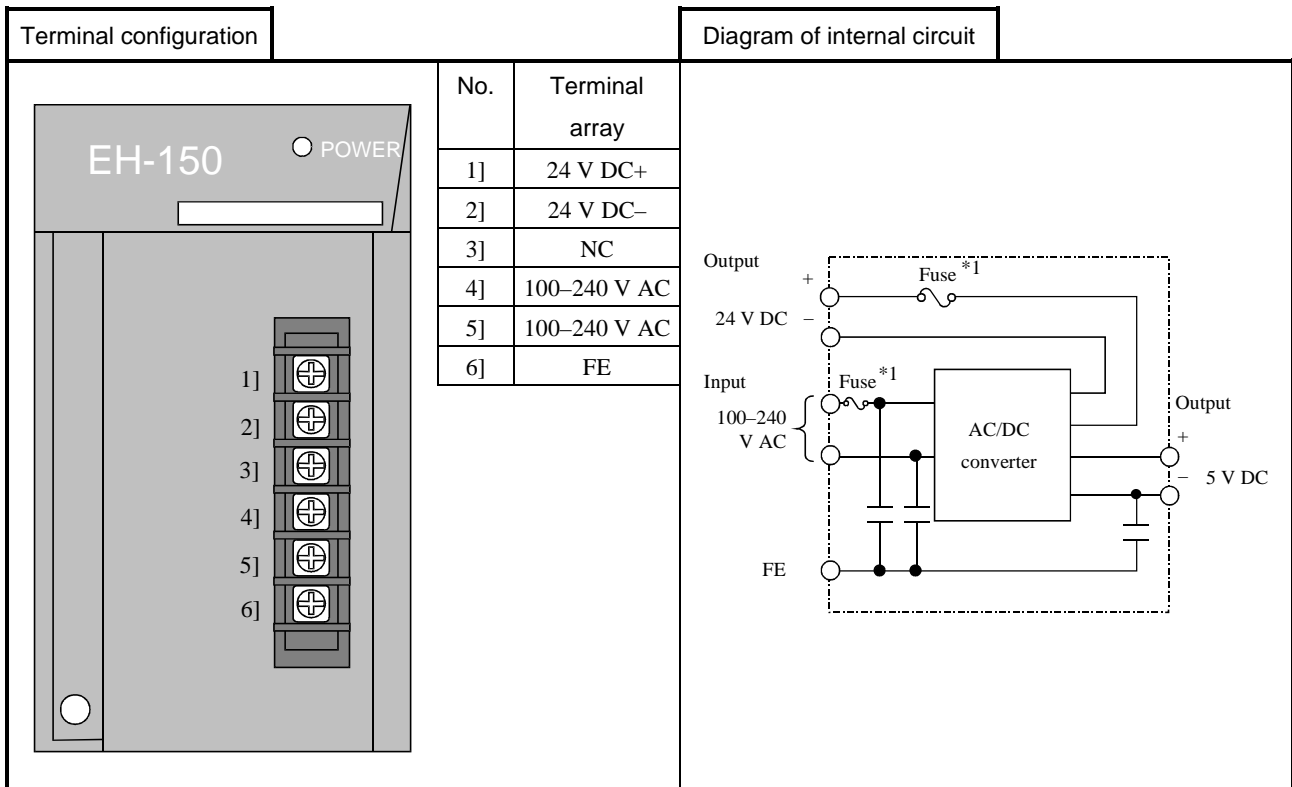
## 4.3 AC Power Module

Name and function of each part		Type	EH-PSA
		Weight	Approx. 0.36 kg (0.79 lb.)
		Dimensions (mm (in.))	
			
			
			
No.	Name	Function	Remarks
1]	POWER lamp	This indicates that the AC power is supplied.	Green
2]	Lock button	This is used when removing the power module from the base unit.	
3]	Front cover	This is used when wiring.	
4]	Front cover set screw	This is used to fix the front cover. When fixing is necessary, use M3 × 6 mm (0.24 in.) set screws.	
5]	Power terminal block	This is used when power is supplied externally, for 24 V output wiring, and for the grounding wiring.	

No.	Item	Detailed explanation	Remarks																			
Operation explanation		<p>Converts power supplied externally into the power (5 V DC) that can be used inside the EH-150. Also, it prepares power (24 V DC) for driving relays, etc. 100 V to 240 V AC can be used for the external supply voltage.</p> <p>When using the 24 V DC after conversion, connect it externally.</p> <p>The operating status can be confirmed with the POWER lamp on the front of the module.</p> <p>Refer to the specification table for the types of protective functions.</p>																				
1]	POWER lamp	<p>When lit: Indicates that AC power is on (supply).</p> <p>When unlit: Indicates that AC power is not turned on or the DC power output is shorted.</p> <p>When flashing: Indicates that the power has exceeded the rated output.</p>	The lamp is green.																			
2]	Lock button	<p>It is used to remove the power module from the base unit. Hold this button down while releasing the module from the unit.</p> <p>The module loaded to the base unit can be further tightened with screws. In this case, use M4 × 10 mm (0.39 in.) screws.</p>																				
3] 4]	Front cover Front cover set screws	<p>Open and close the cover when performing cable wiring. During operation, keep the front cover closed. When opening the cover, shut the power off first to avoid getting an electric shock.</p> <p>When fixing is necessary, use M3 × 6 mm (0.24 in.) screws for the set screws.</p>																				
5]	Power terminal block	<table><tr><td colspan="3">Upper side</td></tr><tr><td>1</td><td>24 V DC (+) output</td><td rowspan="2">Connect these when using 24 V DC.</td></tr><tr><td>2</td><td>24 V DC (GND) output</td></tr><tr><td>3</td><td>(Empty)</td><td>Do not connect anything.</td></tr><tr><td>4</td><td>AC input</td><td rowspan="2">Connect input power supply.</td></tr><tr><td>5</td><td>AC input</td></tr><tr><td>6</td><td>FE (functional earth)</td><td>Connect to a class D ground.</td></tr></table> <p>Lower side</p> <p>The recommended crimp terminal is indicated below.</p> <div><div><p>(Recommended)</p></div><div><p>Care must be exercised when handling the terminal since it may fall off if the screw is loose.</p></div></div> <p>Unit: mm (in.)</p>	Upper side			1	24 V DC (+) output	Connect these when using 24 V DC.	2	24 V DC (GND) output	3	(Empty)	Do not connect anything.	4	AC input	Connect input power supply.	5	AC input	6	FE (functional earth)	Connect to a class D ground.	
Upper side																						
1	24 V DC (+) output	Connect these when using 24 V DC.																				
2	24 V DC (GND) output																					
3	(Empty)	Do not connect anything.																				
4	AC input	Connect input power supply.																				
5	AC input																					
6	FE (functional earth)	Connect to a class D ground.																				

Specification table

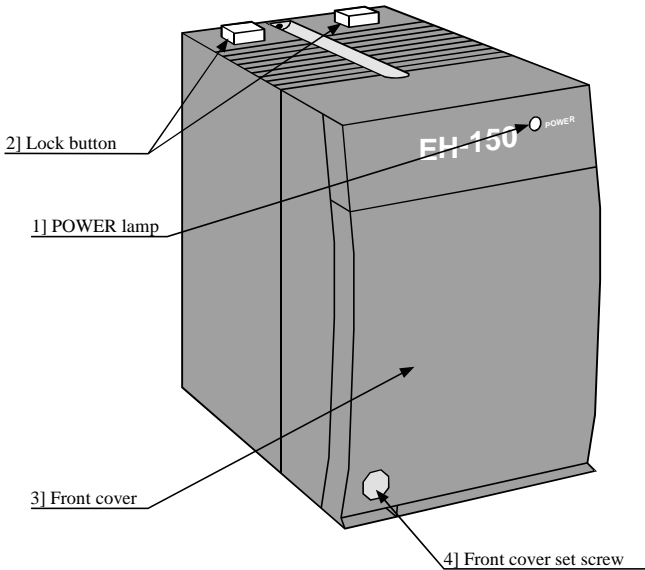
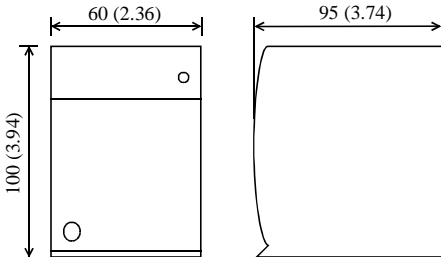
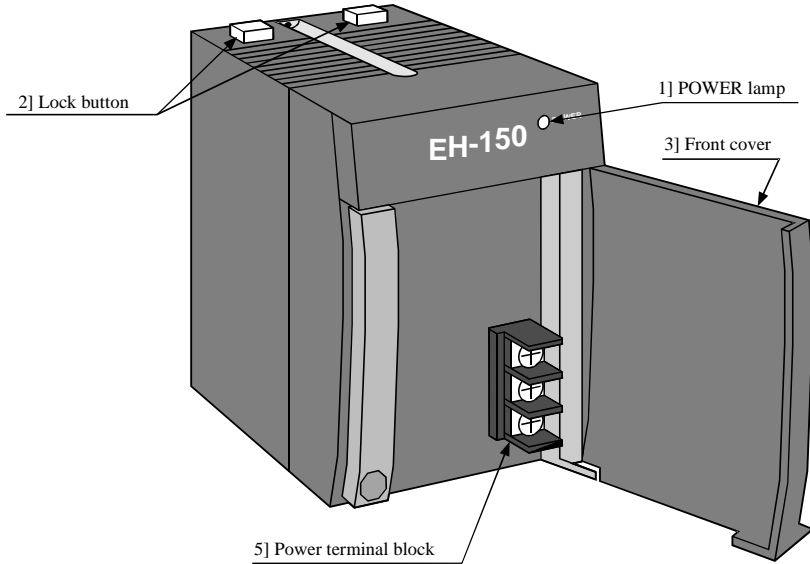
Item	Specifications	
Rated output voltage	5 V DC	24 V DC
Maximum DC output current	3.8 A	0.4 A
Efficiency	65% or more (Load of 5 V 3.8 A, 24 V 0.4 A after energizing for 5 minutes at room temperature and humidity)	
Input voltage range	85 to 264 V AC wide range	
Input current	1 A or less (85 to 264 V AC)	
Input rush current	50 A or less (Ta=25°C), 100 A or less (Ta=55°C)	
Output overcurrent protection	Output short circuit protection	
Instantaneous power failure guarantee	10 ms or more (85 to 100 V AC), 20 ms (Exceed 100 V AC to 264 V AC)	
Input leak current	3.5 mA or less (60 Hz, 264 V AC)	
Operating ambient temperature	0 to 55°C (with rated load)	
Operating ambient humidity	20% to 90% RH (Non condensing)	
Storage ambient temperature	-10 to 75°C	
Storage ambient humidity	10% to 90% RH (Non condensing)	
Dielectric withstand voltage	1 minute at 1,500 V AC between (AC input) and (DC output) 1 minute at 750 V AC between (DC output) and (FE)	
Insulation resistance	20 M $\Omega$ or more (500 V DC) (1) Between AC input and FE (2) Between AC input and DC output	
Vibration resistance	Conforms to JIS C 0911 (16.7 Hz double amplitude 3 mm (0.12 in.) X, Y and Z each direction) Conforms to JIS C 0040 (10 to 57 Hz single amplitude 0.075 mm) (57 to 150 Hz constant acceleration 9.8 m/s <sup>2</sup> )	
Shock resistance	Conforms to JIS C 0912 (10 G in X, Y and Z directions) Conforms to JIS C 0040 (15 G in X, Y and Z directions)	





\*1: The POWER lamp will not be lit when the fuse is blown. The module must be repaired. The fuse may not be replaced by the end user.



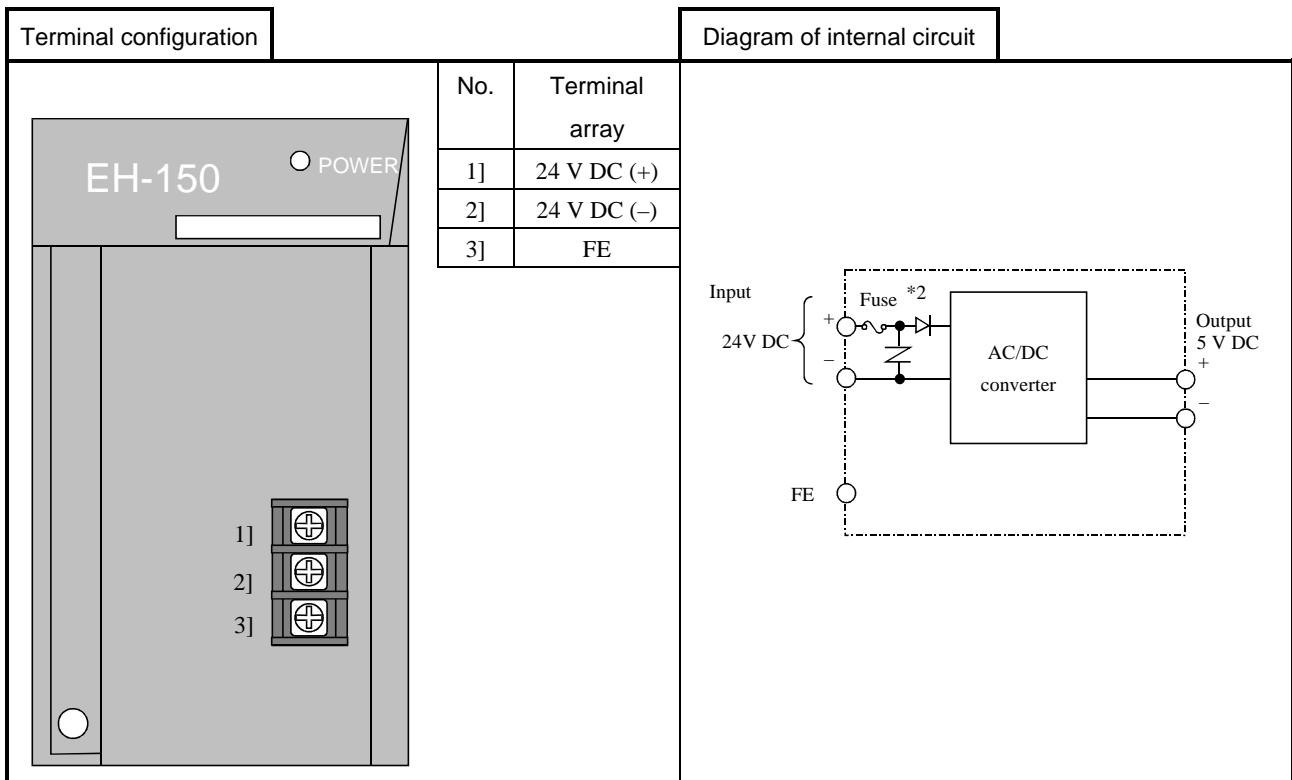
## 4.4 DC Power Module

Name and function of each part		Type	EH-PSD
		Weight	Approx. 0.28 kg (0.62 lb.)
		Dimensions (mm (in.))	
			
			
No.	Name	Function	Remarks
1]	POWER lamp	This indicates that the DC power is supplied.	Green
2]	Lock button	This is used when removing the power module from the base unit.	
3]	Front cover	This is used when wiring.	
4]	Front cover set screw	This is used to fix the front cover. When fixing is necessary, use M3 × 6 mm (0.24 in.) set screws.	
5]	Power terminal block	This is used when power is supplied externally, and for the grounding wiring.	

No.	Item	Detailed explanation	Remarks								
Operation explanation		Converts 24 V DC power supplied externally into the power (5 V DC) that can be used inside the EH-150. 21.6 V to 26.4 V DC can be used for the external power voltage. Connect the power supply (24 V DC) to drive relays, etc., directly with the external power supply.  The operating status can be confirmed with the POWER lamp on the front of the module.									
1]	POWER lamp	When lit: Indicates that DC power is on (supply). When unlit: Indicates that the DC power supply is not energized, the power supply is shorted, or there is a voltage overload. When flashing: Indicates that the power has exceeded the rated output.	The lamp is green.								
2]	Lock button	It is used to remove the power module from the base unit. Hold this button down while releasing the module from the unit.  The module loaded to the base unit can be further tightened with screws. In this case, use M4 × 10 mm (0.39 in.) screws.									
3]	Front cover	Open and close the cover when performing cable wiring. During operation, keep the front cover closed. When opening the cover, shut the power off first to avoid getting an electric shock.  When fixing is necessary, use M3 × 6 mm (0.24 in.) screws for the set screws.									
4]	Front cover set screws										
5]	Power terminal block	<div>Upper side</div> <table><tr><td>1</td><td>24 V DC (+) input</td><td rowspan="2">Connect input power supply.</td></tr><tr><td>2</td><td>24 V DC (–) input</td></tr><tr><td>3</td><td>FE (functional earth)</td><td>Connect to a class D ground In order to comply with the CE marking, connect to 24 V DC (–). *1</td></tr></table> <div>Lower side</div> <div>The recommended crimp terminal is indicated below.</div> <div><div></div><div>(Recommended)</div><div></div><div>Care must be exercised when handling the terminal since it may fall off if the screw is loose.</div></div> <div>Unit: mm (in.)</div>	1	24 V DC (+) input	Connect input power supply.	2	24 V DC (–) input	3	FE (functional earth)	Connect to a class D ground In order to comply with the CE marking, connect to 24 V DC (–). *1	*1:When performing insulation resistance measurements or dielectric withstand voltage measurements, always remove the connection between the FE and 24 VDC (–).
1	24 V DC (+) input	Connect input power supply.									
2	24 V DC (–) input										
3	FE (functional earth)	Connect to a class D ground In order to comply with the CE marking, connect to 24 V DC (–). *1									

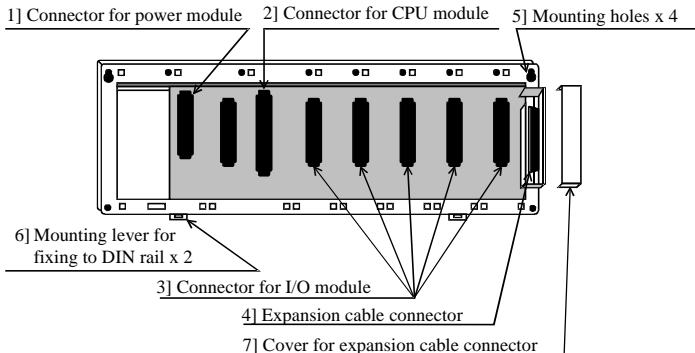
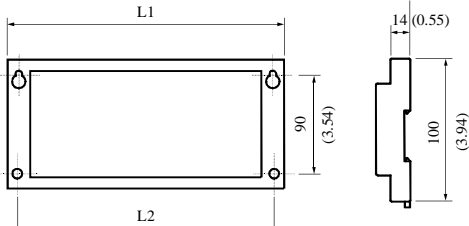
Specification table

Item	Specifications
Rated output voltage	5 V DC
Maximum DC output current	3.8 A
Efficiency	70% or more (Load of 5 V DC 3.8 A)
Input voltage range	21.6 to 26.4 V DC
Input current	1.25 A or less (with 24 V DC)
Input rush current	50 A or less (Ta=25°C), 100 A or less (Ta=55°C)
Output overcurrent protection	Output short circuit protection
Instantaneous power failure guarantee	1 ms or more (21.6 to 26.4 V DC)
Operating ambient temperature	0 to 55°C (with rated load)
Operating ambient humidity	20% to 90% RH (Non condensing)
Storage ambient temperature	-10 to 75°C
Storage ambient humidity	10% to 90% RH (Non condensing)
Dielectric withstand voltage	1 minute at 1,500 V AC between DC input and FE
Insulation resistance	20 M $\Omega$ or more (500 V DC) (Between DC input and FE)



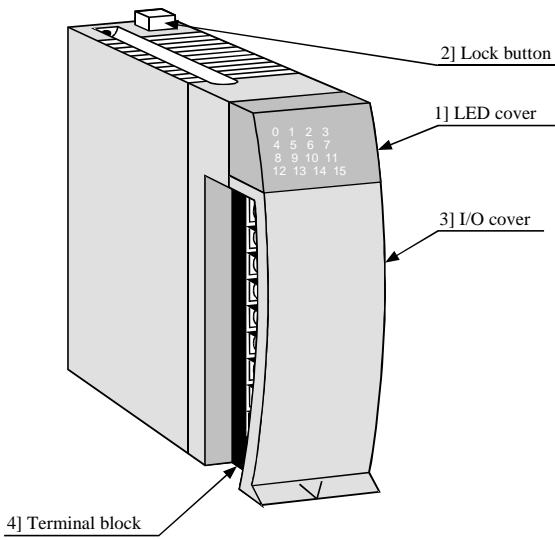
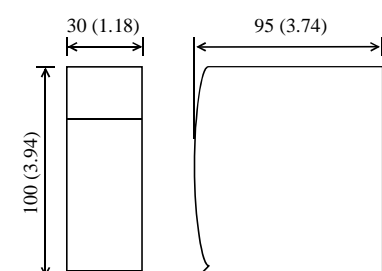
\*2: The POWER lamp will not be lit when the fuse is blown. The module must be repaired. The fuse may not be replaced by the end user.

## 4.5 Base Unit



<div>Name and function of each part</div> <div></div>		Type	EH-BS3												
			EH-BS5												
			EH-BS8												
		Weight	EH-BS3 Approx. 0.22 kg (0.48 lb.)												
			EH-BS5 Approx. 0.28 kg (0.62 lb.)												
			EH-BS8 Approx. 0.36 kg (0.79 lb.)												
		Current consumption	Approx. 200 mA												
Dimensions (mm (in.))		<div></div> <table><thead><tr><th></th><th>L1 (Outer dimensions)</th><th>L2 (Mounted dimensions)</th></tr></thead><tbody><tr><td>EH-BS3</td><td>222.5 (8.76)</td><td>207 (8.15)</td></tr><tr><td>EH-BS5</td><td>282.5 (11.12)</td><td>267 (10.51)</td></tr><tr><td>EH-BS8</td><td>372.5 (14.67)</td><td>357 (14.06)</td></tr></tbody></table>			L1 (Outer dimensions)	L2 (Mounted dimensions)	EH-BS3	222.5 (8.76)	207 (8.15)	EH-BS5	282.5 (11.12)	267 (10.51)	EH-BS8	372.5 (14.67)	357 (14.06)
	L1 (Outer dimensions)	L2 (Mounted dimensions)													
EH-BS3	222.5 (8.76)	207 (8.15)													
EH-BS5	282.5 (11.12)	267 (10.51)													
EH-BS8	372.5 (14.67)	357 (14.06)													
No.	Name	Function		Remarks											
1]	Connector for power module	This is the connector for loading the power module.													
2]	Connector for CPU module	This is the connector for loading the CPU module. When the unit is used as an expansion base, this becomes the connector for loading the I/O controller.													
3]	Connector for I/O module	This is the connector for loading the I/O module.													
		Type	Number of I/O modules that can be loaded												
		EH-BS3	3												
		EH-BS5	5												
		EH-BS8	8												
4]	Expansion cable connector	This is the connector for connecting the expansion cable. It can only be used in a base unit in which a CPU is loaded. Expansion is not possible when the unit is used as an expansion base.		Expansion is possible only when EH-CPU208/308/316/448 is used.											
5]	Mounting holes (4 locations)	These are used when the base unit is attached to a panel, etc. Use M4 × 20 mm (0.79 in.) screws.													
6]	Mounting lever for fixing to DIN rail	This is used when attaching the unit to a DIN rail.													
7]	Cover for expansion cable connector	This cover is used for protecting the expansion cable connector when it is not used.													

No.	Item	Detailed explanation	Remarks
	Operation explanation	This is the basic unit for loading all the modules. Using the base unit, power is supplied from the power module to each of the other modules. Also, signals are sent to each module from the CPU module or the I/O controller. Select the base unit according to the number of I/O modules that are used.	

## 4.6 Input Module

Name and function of each part  		Type	EH-XD8
			EH-XD16
			EH-XA16
			EH-XAH16
		Weight	Approx. 0.16 kg (0.35 lb.) (EH-XD**) Approx. 0.18 kg (0.4 lb.) (EH-XA**)
		Dimensions (mm (in.))	

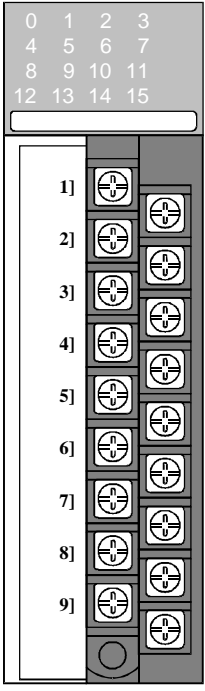
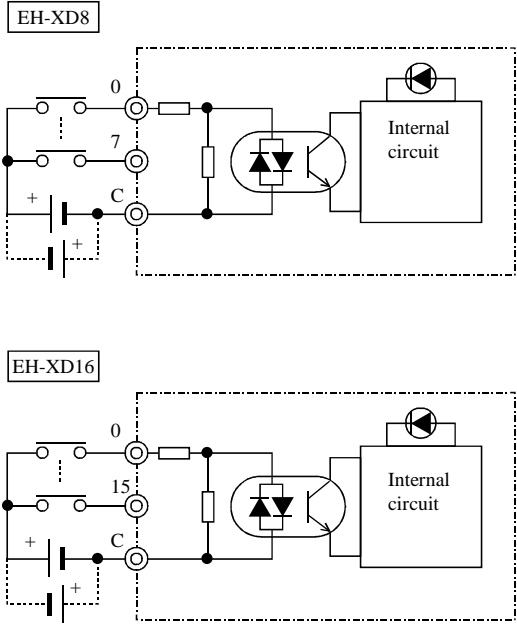
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the input status. When the input signal turns on, the LED for the relevant number lights up. The LED only lights when the module is energized.	
2]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
3]	I/O cover	This is the cover attached to the terminal block area	
4]	Terminal block	This is the terminal block for connecting input signals. The terminal block is removable.	

No.	Item	Detailed explanation	Remarks
	Operation explanation	This module inputs digital signals. The LED's light up while the corresponding digital signal is ON. The CPU reads the status of the mounted modules. If the status accords with actual I/O configuration in the user program, the CPU inputs digital signals according to the user program.	
	Terminal block	<p>The screws for the terminal block are M3 screws. Use a crimp terminal that fits the screw diameter. The maximum thickness of the cable should be only up to 0.75 mm<sup>2</sup>. (If you attach two crimp terminals to the same terminal, use a cable with the thickness of 0.5 mm<sup>2</sup>.)</p> <p>The recommended crimp terminal is indicated below.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">(Recommended)</div> </div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> { Care must be exercised when handling the terminal since it may fall off if the screw is loose. </div> </div> <p style="text-align: center;">Unit: mm (in.)</p>	

Specification table

Item		Specification	
Type		EH-XD8	EH-XD16
Input specification		DC input	
Input voltage		24 V DC	
Allowable input voltage range		19.2 to 30 V DC	
Input impedance		Approximately 3.5 k $\Omega$	Approximately 5.9 k $\Omega$
Input current		Approximately 6.9 mA	Approximately 4.0 mA
Operating voltage	ON voltage	15 V or more	
	OFF voltage	5 V or less	
Input lag	OFF $\rightarrow$ ON	5 ms or less (4 ms TYP)	
	ON $\rightarrow$ OFF	5 ms or less (4 ms TYP)	
Number of input points		8 points/module	16 points/module
Number of common points		8 points/1 common (common terminal is 2*)	16 points/1 common (common terminal is 2*)
Polarity		None	
Insulation system		Photocoupler insulation	
Input display		LED (green)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approximately 26 mA	Approximately 51 mA
I/O assignment		X16	

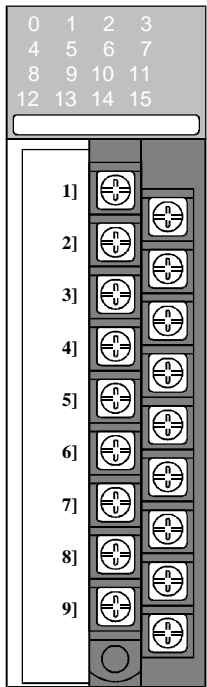
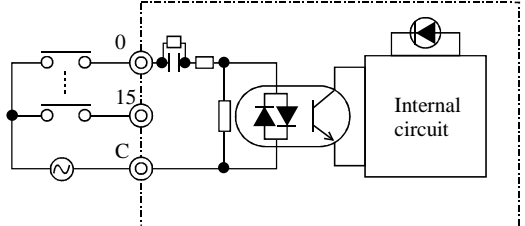
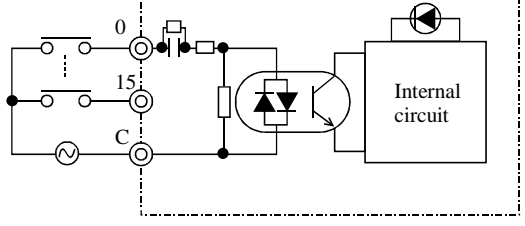
\* Commons are connected internally.

Terminal configuration		Diagram of internal circuit	
	No.	Signal name	
		EH-XD8	EH-XD16
	1]	0	0
	2]	1	1
	3]	2	2
	4]	3	3
	5]	4	4
	6]	5	5
	7]	6	6
	8]	7	7
	9]	C	C
	10]	NC	8
	11]	NC	9
	12]	NC	10
	13]	NC	11
	14]	NC	12
	15]	NC	13
	16]	NC	14
	17]	NC	15
	18]	C	C
			

Specification table

Item		Specification	
Type		EH-XA16	EH-XAH16
Input specification		AC input	
Input voltage		100 to 120 V AC	200 to 240 V AC
Allowable input voltage range		85 to 132 V AC	170 to 264 V AC
Input impedance		Approx. 16 k $\Omega$ (50 Hz)/ Approx. 13 k $\Omega$ (60 Hz)	Approx. 32 k $\Omega$ (50 Hz)/ Approx. 27 k $\Omega$ (60 Hz)
Input current		4.8 to 7.6 mA (100 V AC/50 Hz)	4.3 to 8.0 mA (200 V AC/50 Hz)
Operating voltage	ON voltage	79 V AC	164 V AC
	OFF voltage	20 V AC	40 V AC
Input lag	OFF $\rightarrow$ ON	15 ms or less	
	ON $\rightarrow$ OFF	25 ms or less	
Number of input points		16 points/module	
Number of common points		16 points/1 common (common terminal is 2*)	
Polarity		None	
Insulation system		Photocoupler insulation	
Input display		LED (green)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approximately 51 mA	
I/O assignment		X16	

\* Commons are connected internally.

Terminal configuration			Diagram of internal circuit	
	No.	Signal name		
		EH-XA16	EH-XAH16	
	1]	0	0	<div>EH-XA16</div>  <div>EH-XAH16</div> 
	2]	1	1	
	3]	2	2	
	4]	3	3	
	5]	4	4	
	6]	5	5	
	7]	6	6	
	8]	7	7	
	9]	C	C	
	10]	8	8	
	11]	9	9	
	12]	10	10	
	13]	11	11	
	14]	12	12	
	15]	13	13	
	16]	14	14	
	17]	15	15	
	18]	C	C	

## 4.7 32-point Input Module

Name and function of each part		Type	EH-XD32
		Weight	Approx. 0.15 kg (0.33 lb.)
		Dimensions (mm (in.))	<div> <div> <div>30 (1.18)</div> <div>100 (3.94)</div> </div> <div> <div>95 (3.74)</div> </div> </div>
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the input status. When the input signal turns on, the LED for the relevant number lights up. The LED only lights when the module is energized.	
2]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
3]	LED display switch	This is a switch used to toggle between the LED's for the upper level 16 points and the LED's for the lower level 16 points of the input display.  When the switch is toggled to the left side (towards the silk-screened [L] on the surface) the lower level 16 points (0 through 15) will be displayed.  When the switch is toggled to the right side (towards the silk-screened [H] on the surface) the upper level 16 points (16 through 31) will be displayed.	
4]	External wiring connector – Caution – <ul style="list-style-type: none"> <li>Approximately 120 mm (4.72 in.) of space will be required in the front of the module for the connector and cable. Please choose the installation location (space) accordingly.</li> <li>Use a shielded cable and always use a Class D grounding.</li> </ul>	A connector for input signals. Please refer to the Remarks column and purchase the appropriate connector separately.	Applicable connectors (Manufacturer: Fujitsu Takamizawa) <ul style="list-style-type: none"> <li>Solder type Socket: FCN-361J040-AU Cover: FCN-360C040-E</li> <li>Crimp type Housing: FCN-363J040 Contact: FCN-363J-AU Cover: FCN-360C040-E</li> <li>Pressure-displacement type FCN-367J040-AU/F</li> </ul>

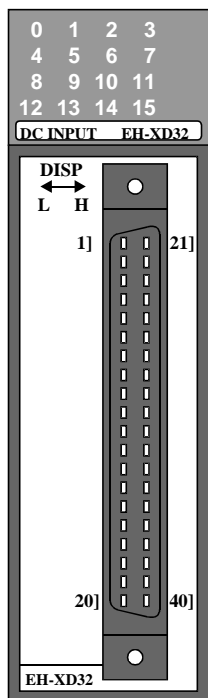


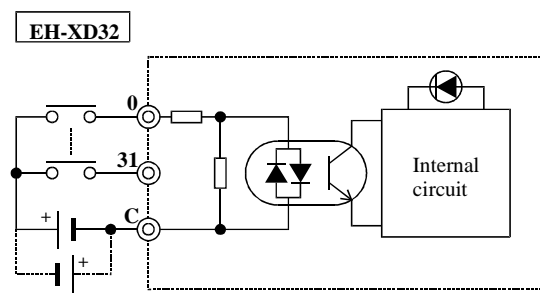
Specification table

Item		Specification
Type		EH-XD32
Input specification		DC input
Input voltage		24 V DC
Allowable input voltage range		19.2 to 30 V DC
Input impedance		Approximately 5.6 k $\Omega$
Input current		Approximately 4.3 mA
Operating voltage	ON voltage	15 V or more
	OFF voltage	5 V or less
Input lag	OFF $\rightarrow$ ON	5 ms or less
	ON $\rightarrow$ OFF	5 ms or less
Number of input points		32 points/module
Number of common points		32 points/1 common (common terminal is 4 *1)
Polarity		None
Insulation system		Photocoupler insulation
Input display		LED (green) *2
External connection		Connector
Internal current consumption (5 V DC)		Approximately 100 mA
I/O assignment		X32

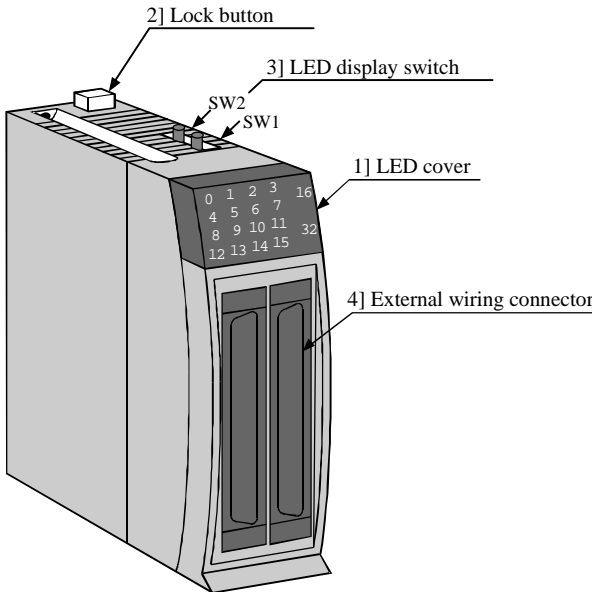
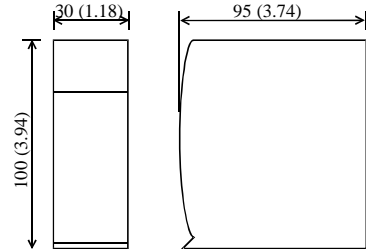
\*1: Commons are connected internally.

\*2: There are 16 points for each LED display. The displaying of the upper/lower 16 points is toggled using a switch.

Terminal configuration		Diagram of internal circuit		
	No.	Signal name	No.	Signal name
	1]	0	21]	16
	2]	1	22]	17
	3]	2	23]	18
	4]	3	24]	19
	5]	4	25]	20
	6]	5	26]	21
	7]	6	27]	22
	8]	7	28]	23
	9]	C	29]	C
	10]	8	30]	24
	11]	9	31]	25
	12]	10	32]	26
	13]	11	33]	27
	14]	12	34]	28
	15]	13	35]	29
	16]	14	36]	30
	17]	15	37]	31
	18]	C	38]	C
	19]	NC	39]	NC
	20]	NC	40]	NC

EH-XD32	
	

## 4.8 64-point Input Module

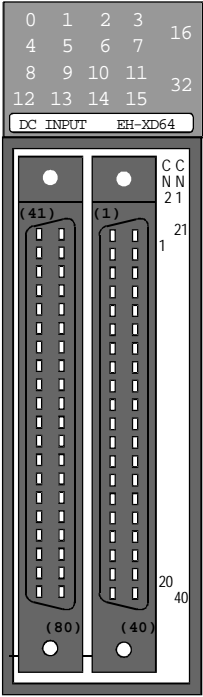
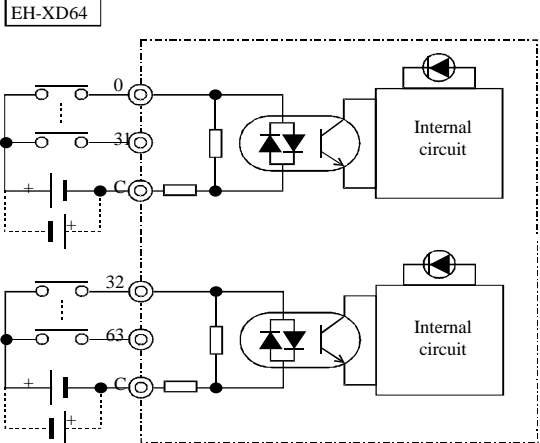
Name and function of each part		Type	EH-XD64																									
		Weight	Approx. 0.14 kg (0.31 lb.)																									
		Dimensions (mm (in.))																										
No.	Name	Function	Remarks																									
1]	LED cover	This is the cover for the LED that displays the input status and displayed group. When the input signal turns on, the LED for the relevant number lights up. The LED only lights when the module is energized.																										
2]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.																										
3]	LED display switch	<div>This is a switch used to toggle the group to be displayed on the input display. It switches as follows:<table border="1"><thead><tr><th>SW1</th><th>SW2</th><th>LED16</th><th>LED32</th><th>Display group</th></tr></thead><tbody><tr><td>OFF</td><td>OFF</td><td>Not lit</td><td>Not lit</td><td>0 to 15</td></tr><tr><td>ON</td><td>OFF</td><td>Lit</td><td>Not lit</td><td>16 to 31</td></tr><tr><td>OFF</td><td>ON</td><td>Not lit</td><td>Lit</td><td>32 to 47</td></tr><tr><td>ON</td><td>ON</td><td>Lit</td><td>Lit</td><td>48 to 63</td></tr></tbody></table></div>	SW1	SW2	LED16	LED32	Display group	OFF	OFF	Not lit	Not lit	0 to 15	ON	OFF	Lit	Not lit	16 to 31	OFF	ON	Not lit	Lit	32 to 47	ON	ON	Lit	Lit	48 to 63	
SW1	SW2	LED16	LED32	Display group																								
OFF	OFF	Not lit	Not lit	0 to 15																								
ON	OFF	Lit	Not lit	16 to 31																								
OFF	ON	Not lit	Lit	32 to 47																								
ON	ON	Lit	Lit	48 to 63																								
4]	External wiring connector – Caution – <ul style="list-style-type: none"><li>Approximately 120 mm (4.72 in.) of space will be required in the front of the module for the connector and cable. Please choose the installation location (space) accordingly.</li><li>Use a shielded cable and always use a Class D grounding.</li></ul>	A connector for input signals.  Please refer to the Remarks column and purchase the appropriate connector separately.	Applicable connectors (Manufacturer: Fujitsu Takamizawa) <ul style="list-style-type: none"><li>Solder type Socket: FCN-361J040-AU Cover: FCN-360C040-E</li><li>Crimp type Housing: FCN-363J040 Contact: FCN-363J-AU Cover: FCN-360C040-E</li><li>Pressure-displacement type FCN-367J040-AU/F</li></ul>																									

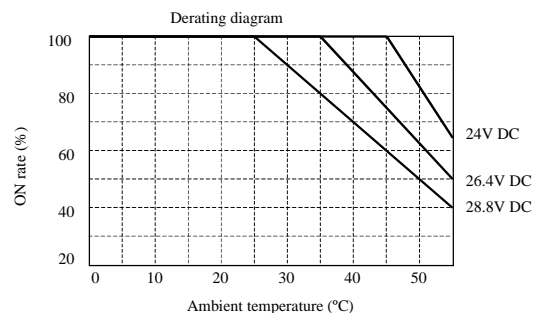
Specification table

Item		Specification
Type		EH-XD64
Input specification		DC input
Input voltage		24 V DC
Allowable input voltage range		20.4 to 28.8 V DC
Input impedance		Approximately 5.6 k $\Omega$
Input derating		See the derating diagram.
Input current		Approximately 4.3 mA
Operating voltage	ON voltage	15 V or more
	OFF voltage	5 V or less
Input lag	OFF $\rightarrow$ ON	1 ms or less
	ON $\rightarrow$ OFF	1 ms or less
Number of input points		64 points/module
Number of common points		32 points/1 common (common terminal is 4 *1)
Polarity		None
Insulation system		Photocoupler insulation
Input display		LED (green) *2
External connection		Connector
Internal current consumption (5 V DC)		Approximately 70 mA
I/O assignment		X64

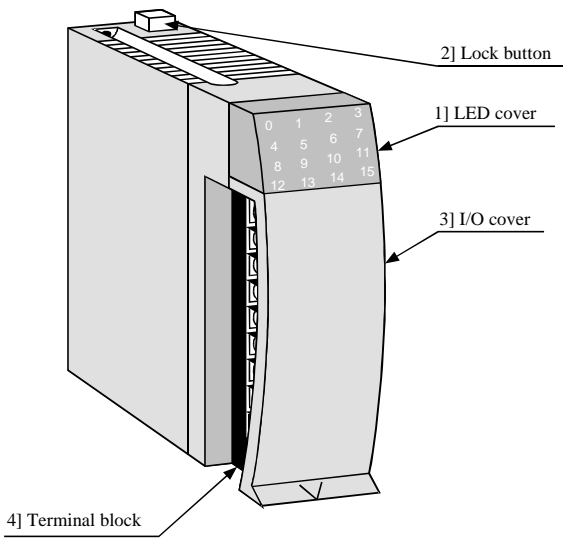
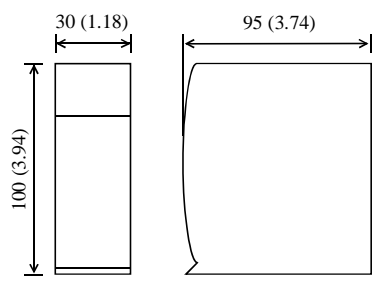
\*1: Commons are connected internally.



\*2: There are 16 points for each LED display. The displayed group is toggled using a switch. The LED display is updated by refresh processing.

Terminal configuration	Pin number and signal name of external wiring connector								Diagram of internal circuit
	Left (CN2)				Right (CN1)				
	No.	Signal name	No.	Signal name	No.	Signal name	No.	Signal name	
	(41)	32	(61)	48	(1)	0	(21)	16	
	(42)	33	(62)	49	(2)	1	(22)	17	
	(43)	34	(63)	50	(3)	2	(23)	18	
	(44)	35	(64)	51	(4)	3	(24)	19	
	(45)	36	(65)	52	(5)	4	(25)	20	
	(46)	37	(66)	53	(6)	5	(26)	21	
	(47)	38	(67)	54	(7)	6	(27)	22	
	(48)	39	(68)	55	(8)	7	(28)	23	
	(49)	C	(69)	C	(9)	C	(29)	C	
	(50)	40	(70)	56	(10)	8	(30)	24	
	(51)	41	(71)	57	(11)	9	(31)	25	
	(52)	42	(72)	58	(12)	10	(32)	26	
	(53)	43	(73)	59	(13)	11	(33)	27	
	(54)	44	(74)	60	(14)	12	(34)	28	
	(55)	45	(75)	61	(15)	13	(35)	29	
	(56)	46	(76)	62	(16)	14	(36)	30	
	(57)	47	(77)	63	(17)	15	(37)	31	
	(58)	C	(78)	C	(18)	C	(38)	C	
	(59)	NC	(79)	NC	(19)	NC	(39)	NC	
	(60)	NC	(80)	NC	(20)	NC	(40)	NC	



## 4.9 Output Module

<div> <div>Name and function of each part</div>  </div>		Type	EH-YT8, EH-YTP8 EH-YT16, EH-YTP16 EH-YTP16S, EH-YR12 EH-YS4
		Weight	Approx. 0.16 kg (0.35 lb.) (EH-YR12, Approx. 0.20 kg (0.44 lb.)) (EH-YS4, Approx. 0.18 kg (0.4 lb.))
		Dimensions (mm (in.))	
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the output status. When the output signal turns on, the LED for the relevant number lights up. The LED only works when the module is energized.	
2]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
3]	I/O cover	This is the cover attached to the terminal block area.	
4]	Terminal block	This is the terminal block for connecting output signals. The terminal block is removable.	

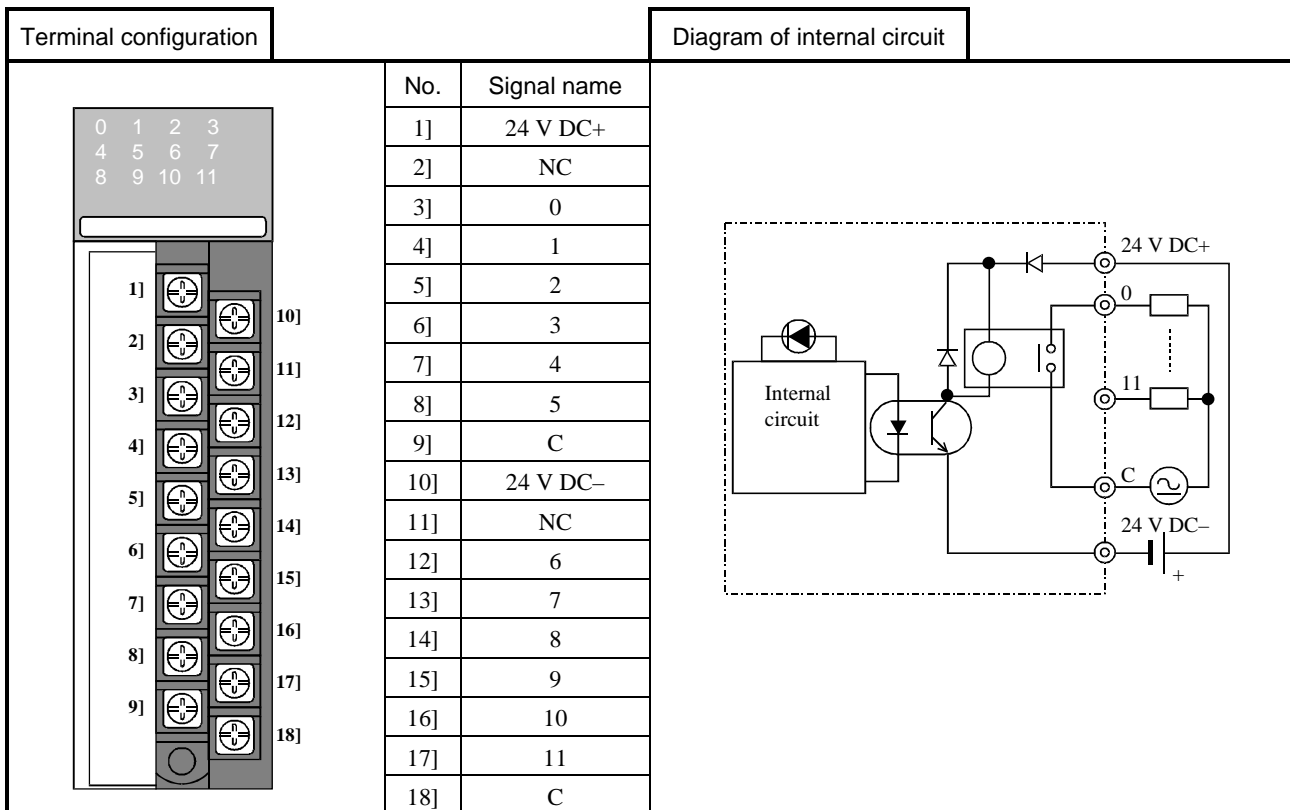
No.	Item	Detailed explanation	Remarks
Operation explanation		This module outputs digital signals. The LED's light up while the corresponding digital signal is ON. The CPU reads the status of the mounted modules. If the status accords with actual I/O configuration in the user program, the CPU outputs digital signals according to the user program.	
Terminal block		<p>The screws for the terminal block are M3 screws. Use a crimp terminal that fits the screw diameter. The maximum thickness of the cable should be only up to 0.75 mm<sup>2</sup>. (If you attach two crimp terminals to the same terminal, use a cable with the thickness of 0.5 mm<sup>2</sup>.)</p> <p>The recommended crimp terminal is indicated below.</p> <div>  <span>(Recommended)</span> </div> <div>  <span>Care must be exercised when handling the terminal since it may fall off if the screw is loose.</span> </div> <p>Unit: mm (in.)</p>	

Specification table (relay output module)

Item		Specification
Type		EH-YR12
Output specification		Relay output
Rated load voltage		100/240 V AC, 24 V DC
Minimum switching current		1 mA
Leak current		None
Maximum load current	1 circuit	2 A
	1 common	5 A
Output response time	OFF → ON	10 ms or less
	ON → OFF	10 ms or less
Number of output points		12 points/module
Number of common points		12 points/1 common (Common terminal is 2) *1
Surge removal circuit		None
Fuse		None
Insulation system		Photocoupler insulation
Output display		LED (green)
External connection		Removable type screw terminal block (M3)
Internal current consumption (5 V DC)		Approximately 40 mA
Externally supplied power *2 (For driving relays)		24 V DC (+10%, -5%) (maximum 70 mA)
I/O assignment		Y16

\*1: The common terminals are connected internally.

\*2: 24 V DC must be supplied externally to drive the relays. (The 24 V output of the power module can be used.)



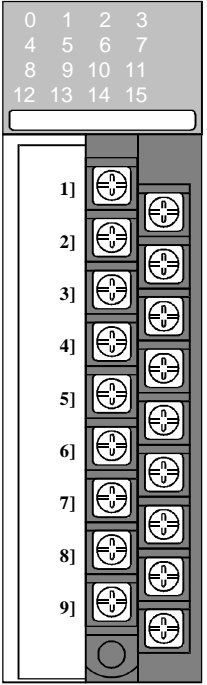
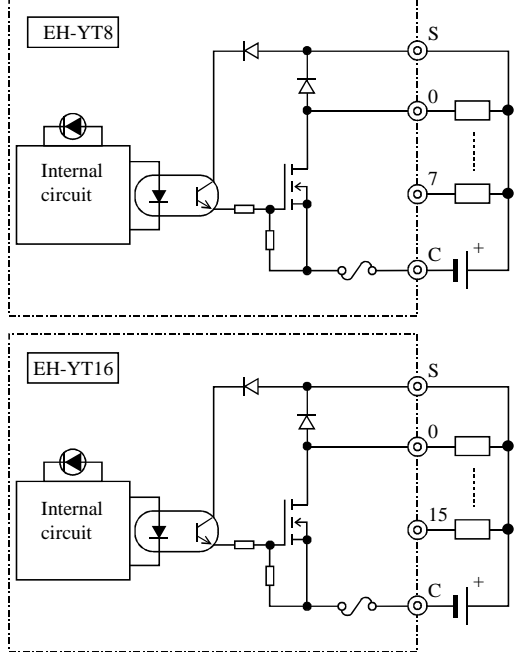
Specification table (transistor output module)

Item		Specification	
Type		EH-YT8	EH-YT16
Output specification		Transistor output (sink type)	
Rated load voltage		12/24 V DC (+10%, -15%)	
Minimum switching current		1 mA	
Leak current		0.1 mA	
Maximum load current	1 circuit	0.3 A	
	1 common	2.4 A	4 A
Output response time	OFF → ON	0.3 ms or less	
	ON → OFF	1 ms or less	
Number of output points		8 points/module	16 points/module
Number of common points		8 points/1 common	16 points/1 common
Surge removal circuit		Diode	
Fuse *1		4 A/common	8 A/common
Insulation system		Photocoupler insulation	
Output display		LED (green)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approximately 30 mA	Approximately 50 mA
External power supply *2 (For supplying power to the S terminal)		12/24 V DC (+10%, -15%) (maximum 30 mA)	
I/O assignment		Y16	

\*1: The module needs to be repaired in case a load short causes a blown fuse.

Furthermore, the fuse cannot be replaced by the user.

\*2: It is necessary to supply 12/24 V DC from outside to the S terminal.

Terminal configuration		Diagram of internal circuit	
	No.	Signal name	
		EH-YT8	EH-YT16
	1]	0	0
	2]	1	1
	3]	2	2
	4]	3	3
	5]	4	4
	6]	5	5
	7]	6	6
	8]	7	7
	9]	C	C
	10]	NC	8
	11]	NC	9
	12]	NC	10
	13]	NC	11
	14]	NC	12
	15]	NC	13
	16]	NC	14
	17]	NC	15
	18]	S	S
			

Specification table (transistor output module)

Item		Specification		
Type		EH-YTP8	EH-YTP16	EH-YTP16S
Output specification		Transistor output (source type)		
Rated load voltage		12/24 V DC (+10%, -15%)		
Minimum switching current		1 mA		
Leak voltage		0.1 mA		
Maximum load current	1 circuit	0.3 A		0.8 A
	1 common	2.4 A	4 A	5 A
Output response time	OFF → ON	0.3 ms or less		
	ON → OFF	1 ms or less		
Number of output points		8 points/module	16 points/module	16 points/module
Number of common points		8 points/1 common	16 points/1 common	16 points/1 common
Surge removal circuit		Diode		Built in
Fuse *1		4 A/common	8 A/common	None
Insulation system		Photocoupler insulation		
Output display		LED (green)		
External connection		Removable type screw terminal block (M3)		
Internal current consumption (5 V DC)		Approximately 30 mA	Approximately 50 mA	
External power supply *2 (For supplying power to the S terminal)		12/24 V DC (+10%, -15%) (maximum 30 mA) *3		
I/O assignment		Y16		
Short-circuit protection function		Not available		Available

\*1: The module needs to be repaired in case a load short causes a blown fuse.

Furthermore, the fuse cannot be replaced by the user.

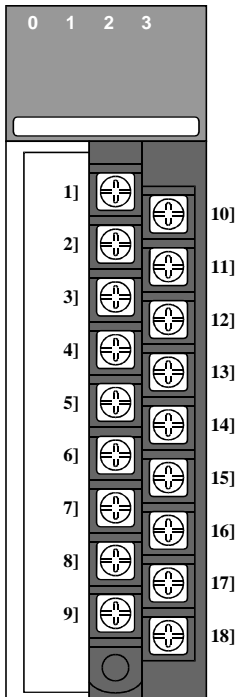
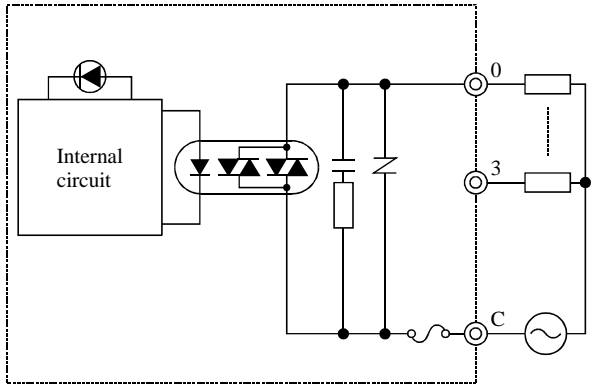
\*2: It is necessary to supply 12/24 V DC from outside to the S terminal.

\*3: Indicates the module's internal current consumption. To operate a device other than the module, separate current is required.

Terminal configuration		Diagram of internal circuit	
	No.	Signal name	
		EH-YTP8	EH-YTP16, YTP16S
	1]	0	0
	2]	1	1
	3]	2	2
	4]	3	3
	5]	4	4
	6]	5	5
	7]	6	6
	8]	7	7
	9]	C	C
	10]	NC	8
	11]	NC	9
	12]	NC	10
	13]	NC	11
	14]	NC	12
	15]	NC	13
	16]	NC	14
	17]	NC	15
	18]	S	S

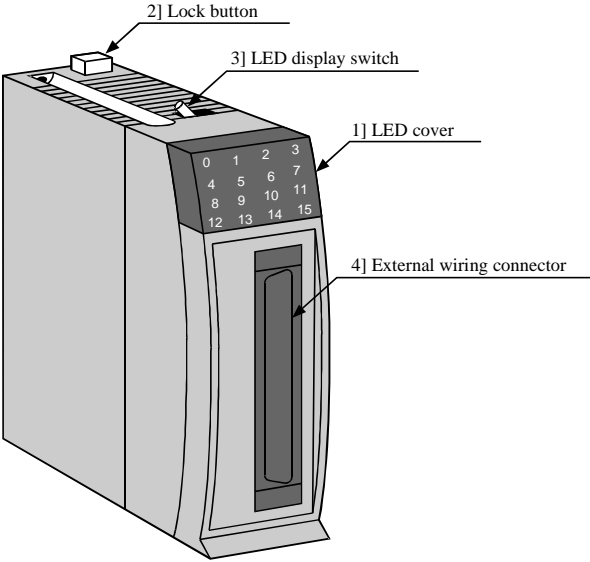
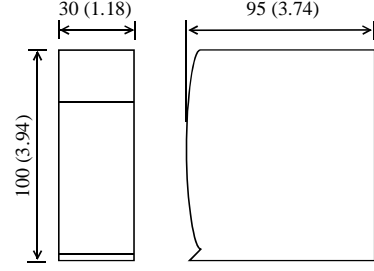
Specification table (SSR output module)

Item		Specification
Type		EH-YS4
Output specification		Triac output
Rated load voltage		100/240 V AC (85 to 250 V AC)
Minimum switching current		100 mA
Leak voltage		5 mA or less
Maximum load current	1 circuit	0.5 A
	1 common	2 A
Output response time	OFF → ON	1 ms or less
	ON → OFF	1 ms+1/2 cycles or less
Number of output points		4 points/module
Number of common points		4 points/module
Surge removal circuit		Varistor
Fuse		4 A/1 common
Insulation system		Photo-triac insulation
Output display		LED (green)
External connection		Removable type screw terminal block (M3)
Internal current consumption (5 V DC)		Approximately 100 mA
I/O assignment		Y16

Terminal configuration		Diagram of internal circuit	
	No.	Signal name	
	1]	0	
	2]	NC	
	3]	1	
	4]	NC	
	5]	2	
	6]	NC	
	7]	3	
	8]	NC	
	9]	C	
	10]	NC	
	11]	NC	
	12]	NC	
	13]	NC	
	14]	NC	
	15]	NC	
	16]	NC	
	17]	NC	
	18]	NC	



## 4.10 32-point Output Module

Name and function of each part		Type	EH-YT32 EH-YTP32
		Weight	Approx. 0.16 kg (0.32 lb.)
		Dimensions (mm (in.))	
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the output status. When the output signal turns on, the LED for the relevant number lights up. The LED only works when the module is energized.	
2]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
3]	LED display switch	<p>This is a switch used to toggle between the LED's for the upper level 16 points and the LED's for the lower level 16 points of the output display.</p> <p>When the switch is toggled to the left side (towards the silk-screened [L] on the surface) the lower level 16 points (0 through 15) will be displayed.</p> <p>When the switch is toggled to the right side (towards the silk-screened [H] on the surface) the upper level 16 points (16 through 31) will be displayed.</p>	
4]	External wiring connector – Caution – <ul style="list-style-type: none"> <li>Approximately 120 mm (4.72 in.) of space will be required in the front of the module for the connector and cable. Please choose the installation location (space) accordingly.</li> <li>Use a shielded cable and always use a class D grounding.</li> </ul>	A connector for output signals. Please refer to the Remarks column and purchase the appropriate connector separately.	Applicable connectors (Manufacturer: Fujitsu Takamizawa) <ul style="list-style-type: none"> <li>Solder type Socket: FCN-361J040-AU Cover: FCN-360C040-E</li> <li>Crimp type Housing: FCN-363J040 Contact: FCN-363J-AU Cover: FCN-360C040-E</li> <li>Pressure-displacement type FCN-367J040-AU/F</li> </ul>

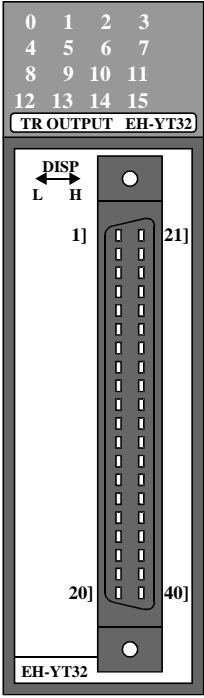
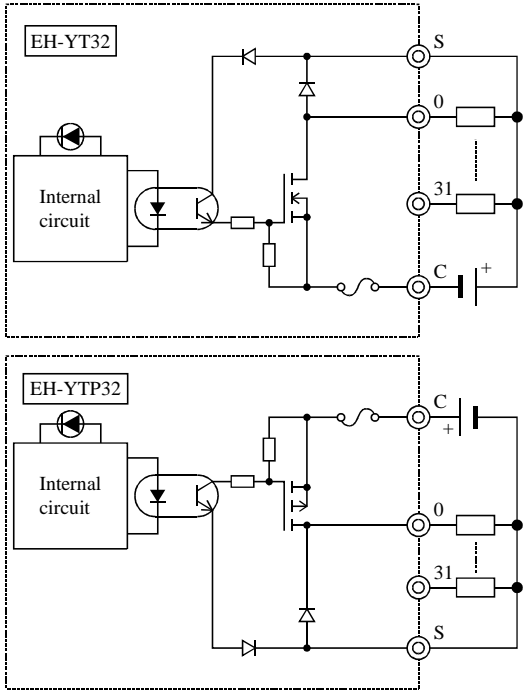
Specification table (transistor output module)

Item		Specification	
Type		EH-YT32	EH-YTP32
Output specification		Transistor output (sink type)	Transistor output (source type)
Rated load voltage		12/24 V DC (+10%, -15%)	
Minimum switching current		1 mA	
Leak voltage		0.1 mA or less	
Maximum load current	1 circuit	0.2 A	
	1 common	3.2 A	
Output response time	OFF → ON	0.3 ms or less	
	ON → OFF	1 ms or less	
Number of output points		32 points/module	
Number of common points		32 points/1 common	
Surge removal circuit		Diode	
Fuse *1		8 A/1 common	
Insulation system		Photocoupler insulation	
Output display		LED (green) *2	
External connection		Connector	
Internal current consumption (5 V DC)		Approximately 250 mA	
External power supply *3 (For supplying power to the S terminal)		12/24 V DC (+10%, -15%) (maximum 100 mA)	
I/O assignment		Y32	

\*1: The module needs to be repaired in case a load short causes a blown fuse.  
Furthermore, the fuse cannot be replaced by the user.

\*2: There are 16 points for each LED display. The displaying of the upper/lower 16 points is toggled using a switch.

\*3: It is necessary to supply 12/24 V DC from outside to the S terminal.

Terminal configuration		Diagram of internal circuit	
		No.	Signal name
		No.	Signal name
		21]	16
		22]	17
		23]	18
		24]	19
		25]	20
		26]	21
		27]	22
		28]	23
		29]	C
		30]	S
		31]	24
		32]	25
		33]	26
		34]	27
		35]	28
		36]	29
		37]	30
		38]	31
		39]	C
		40]	S
			

## 4.11 64-point Output Module

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Specification table (transistor output module)

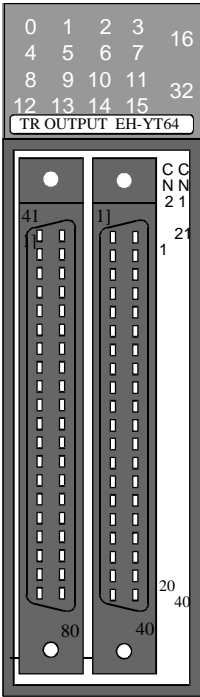
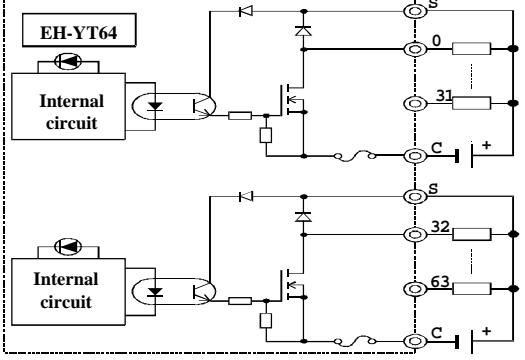
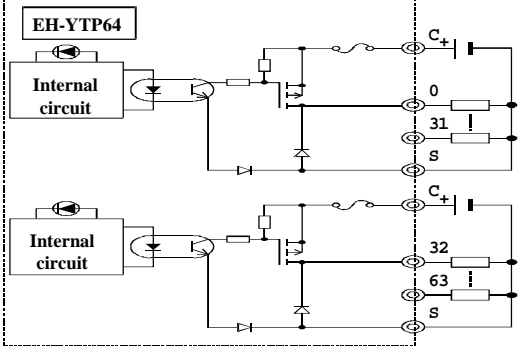
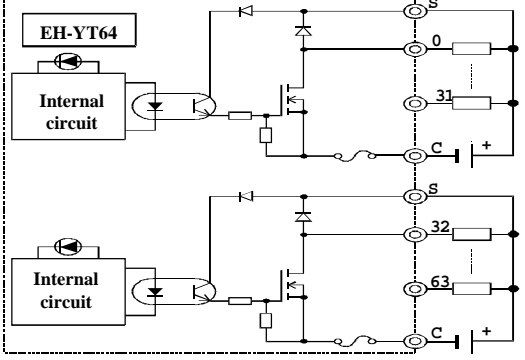
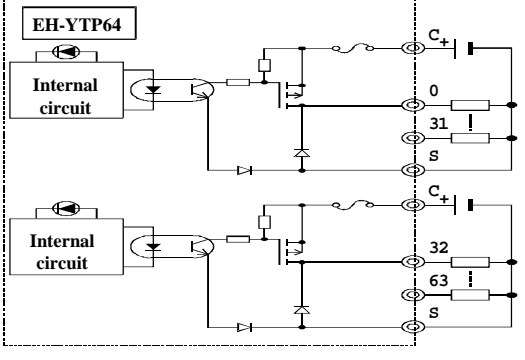
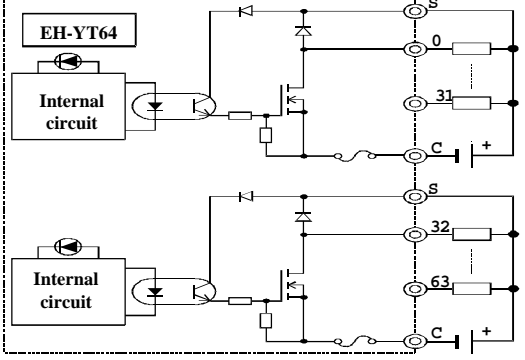
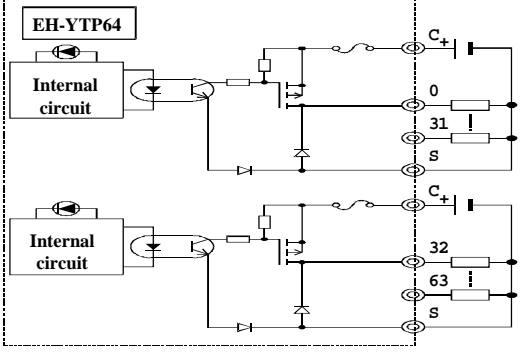
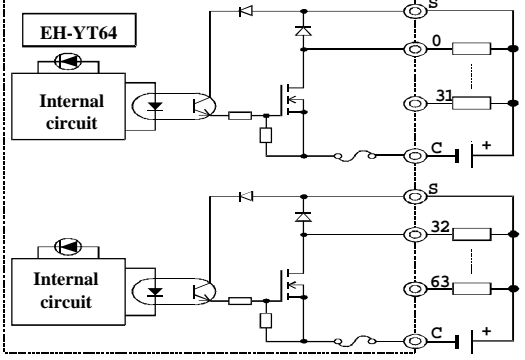
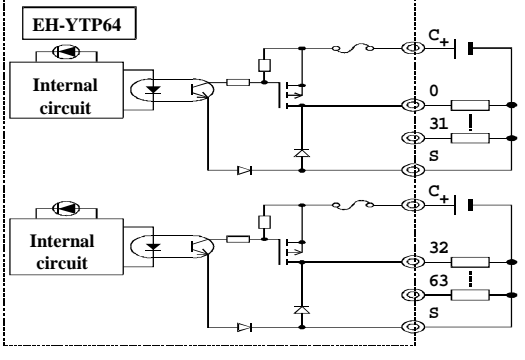
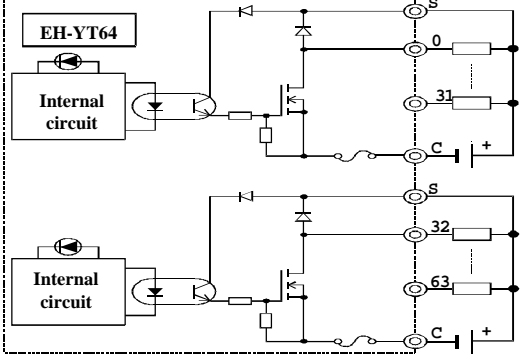
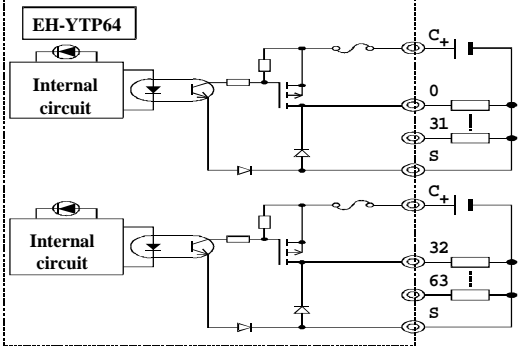
Item		Specification	
Type		EH-YT64	EH-YTP64
Output specification		Transistor output (sink type)	Transistor output (source type)
Rated load voltage		12/24 V DC (+10%, -15%)	
Minimum switching current		1 mA	
Leak voltage		0.1 mA or less	
Maximum load current	1 circuit	0.1 A	
	1 common	3.2 A	
Output response time	OFF → ON	0.3 ms or less	
	ON → OFF	1 ms or less	
Number of output points		64 points/module	
Number of common points		32 points/1 common	
Surge removal circuit		Diode	
Fuse *1		5 A/1 common	
Insulation system		Photocoupler insulation	
Output display		LED (green) *2	
Short-circuit protection		Short-circuit protection function	
External connection		Connector	
Internal current consumption (5 V DC)		Approximately 120 mA	
External power supply *3 (For supplying power to the S terminal)		12/24 V DC (+10%, -15%) (maximum 100 mA)	
I/O assignment		Y64	

\*1: The module needs to be repaired in case a load short causes a blown fuse.

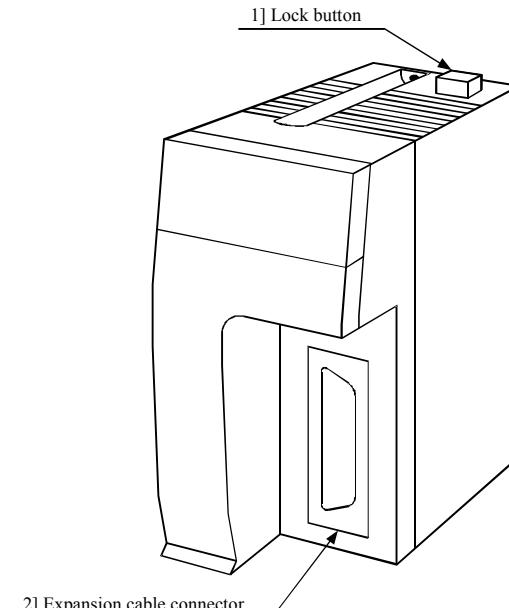
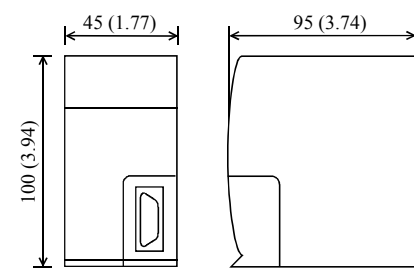
Furthermore, the fuse cannot be replaced by the user.

\*2: There are 16 points for each LED display. The display group is switched using a switch. The LED display is updated by refresh processing.

\*3: It is necessary to supply 12/24 V DC from outside to the S terminal.

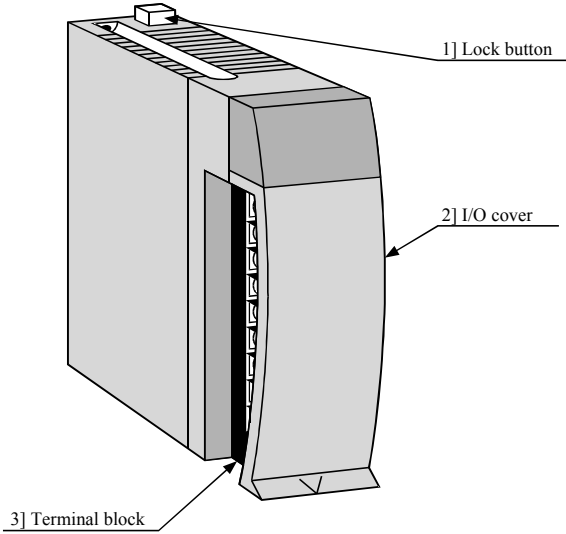
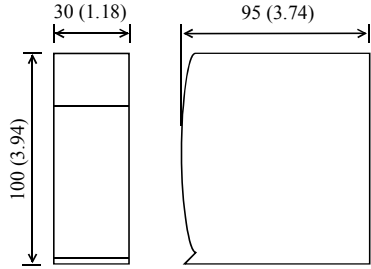
Terminal configuration	Pin number and signal name of external wiring connector								Diagram of internal circuit
	Left (CN2)				Right (CN1)				
	No.	Signal name	No.	Signal name	No.	Signal name	No.	Signal name	
	(41)	32	(61)	48	(1)	0	(21)	16	
	(42)	33	(62)	49	(2)	1	(22)	17	
	(43)	34	(63)	50	(3)	2	(23)	18	
	(44)	35	(64)	51	(4)	3	(24)	19	
	(45)	36	(65)	52	(5)	4	(25)	20	
	(46)	37	(66)	53	(6)	5	(26)	21	
	(47)	38	(67)	54	(7)	6	(27)	22	
	(48)	39	(68)	55	(8)	7	(28)	23	
	(49)	C	(69)	C	(9)	C	(29)	C	
	(50)	S	(70)	S	(10)	S	(30)	S	
	(51)	40	(71)	56	(11)	8	(31)	24	
	(52)	41	(72)	57	(12)	9	(32)	25	
	(53)	42	(73)	58	(13)	10	(33)	26	
	(54)	43	(74)	59	(14)	11	(34)	27	
	(55)	44	(75)	60	(15)	12	(35)	28	
	(56)	45	(76)	61	(16)	13	(36)	29	
	(57)	46	(77)	62	(17)	14	(37)	30	
	(58)	47	(78)	63	(18)	15	(38)	31	
	(59)	C	(79)	C	(19)	C	(39)	C	
	(60)	S	(80)	S	(20)	S	(40)	S	



## 4.12 Input/Output Controller

Name and function of each part   <p>1] Lock button</p> <p>2] Expansion cable connector</p>		Type	EH-IOC
		Weight	Approx. 0.14 kg (0.31 lb.)
		Current consumption	Approx. 100 mA
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	Lock button	Used when removing the controller from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
2]	Expansion cable connector	Connector used to connect the expansion cable.	

No.	Item	Detailed explanation	Comments
	Explanation of operation	The I/O controller is a module that outputs the output signals from the CPU module to the output module mounted on the expansion base unit and sends the input signals of the expansion base unit to the CPU module. It is attached adjacent to the power supply module of the expansion base unit on the right side.	It is possible to use when EH-CPU208/308/316/448 is used.

## 4.13 Analog I/O Module

<div> <div>Name and function of each part</div>  </div>		Type	EH-AX44, EH-AX8V, EH-AX8H EH-AY22, EH-AY2H, EH-AY4V EH-AY4H
		Weight	Approx. 0.18 kg (0.41 lb.)
		Dimensions (mm (in.))	
No.	Name	Function	Remarks
1]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
2]	I/O cover	This is the cover attached to the terminal block area.	
3]	Terminal block	This is the terminal block for connecting output signals. The terminal block can be connected or disconnected.	

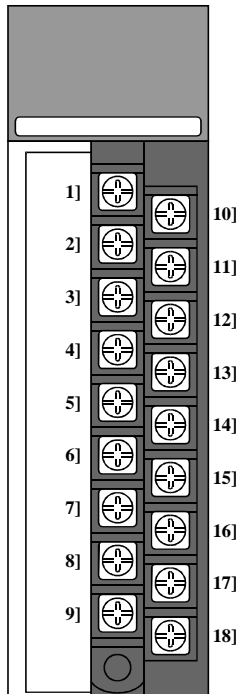
No.	Item	Detailed explanation	Comments
Explanation of operation		<p><b>Analog Input Module</b></p> <p>The CPU module verifies the status of the installed module and if the I/O assignment information matches that contained in the user program, the input information is received according to the contents of the user program.</p> <p>EH-AX44: Receives an analog output signal (voltage or current).</p> <p>EH-AX8V/EH-AY8H: Receives an analog input signal (voltage).</p> <p><b>Analog Output Module</b></p> <p>The CPU module verifies the status of the installed module and if the I/O assignment information matches with that contained in the user program, the output information is output according to the contents of the user program.</p> <p>EH-AY22/EH-AY2H: Outputs an analog output signal (voltage or current). (Current is used for the EH-AY22 only.)</p> <p>EH-AY4V/EH-AY4H: Outputs an analog output signal (voltage).</p>	When the CPU module is an EH-CPU104/208, this module cannot be used unless the revision of hardware is REV.01* <sup>1</sup> or later.
Terminal block		<p>The screws for the terminal block are M3 screws. Use a crimp terminal that fits the screw diameter. The maximum thickness of the cable should be only up to 0.75 mm<sup>2</sup>. (Use 0.5 mm<sup>2</sup> cable when two crimp terminals are attached to the same terminal.)</p> <p>The recommended crimp terminal is indicated below.</p> <div style="text-align: center;">  <span>(Recommended)</span> </div> <div style="text-align: center;">  <span>Care must be exercised when handling the terminal since it may fall off if the screw is loose.</span> </div> <p>Unit: mm (in.)</p>	

\*1: The hardware revision of the CPU module was updated to REV.01 in March of 1998. The revision of the CPU module is noted on the specifications plate attached on the side of the unit.

Specification table (analog input module)

Item		Specification
Type		EH-AX44
Input current range (0 to 3 channels)		4 to 20 mA
Input voltage range (4 to 7 channels)		0 to 10 V DC
Resolution		12 bits
Conversion time		5 ms or less
Overall accuracy		± 1% or less (of full-scale value)
Input impedance	Current input (0 to 3 channels)	Approximately 100 Ω
	Voltage input (4 to 7 channels)	Approximately 100 k Ω
Insulation	Channel · Internal circuit	Photocoupler insulation
	Between channels	No insulation
Number of channels	Input current range	4 channels/module (0 to 3 channels)
	Input voltage range	4 channels/module (4 to 7 channels)
Weight		Approximately 0.18 kg (0.4 lb.)
External connection		Removable type screw terminal block (M3)
Internal current consumption (5 V DC)		Approximately 100 mA
External power supply		24 V DC (+20%, -15%) Approx. 0.15 A (Approx. 0.4 A at power On)
External wiring		2-core shield wire (20 m (65.62 ft.) or less)
I/O assignment		WX8W

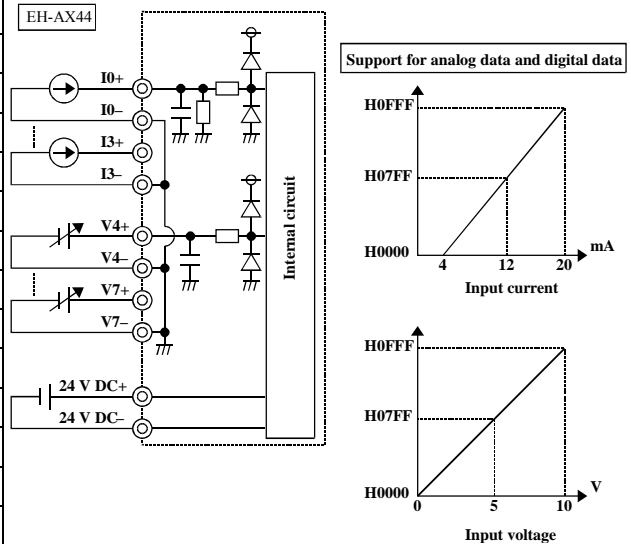
Terminal configuration



No. Signal name

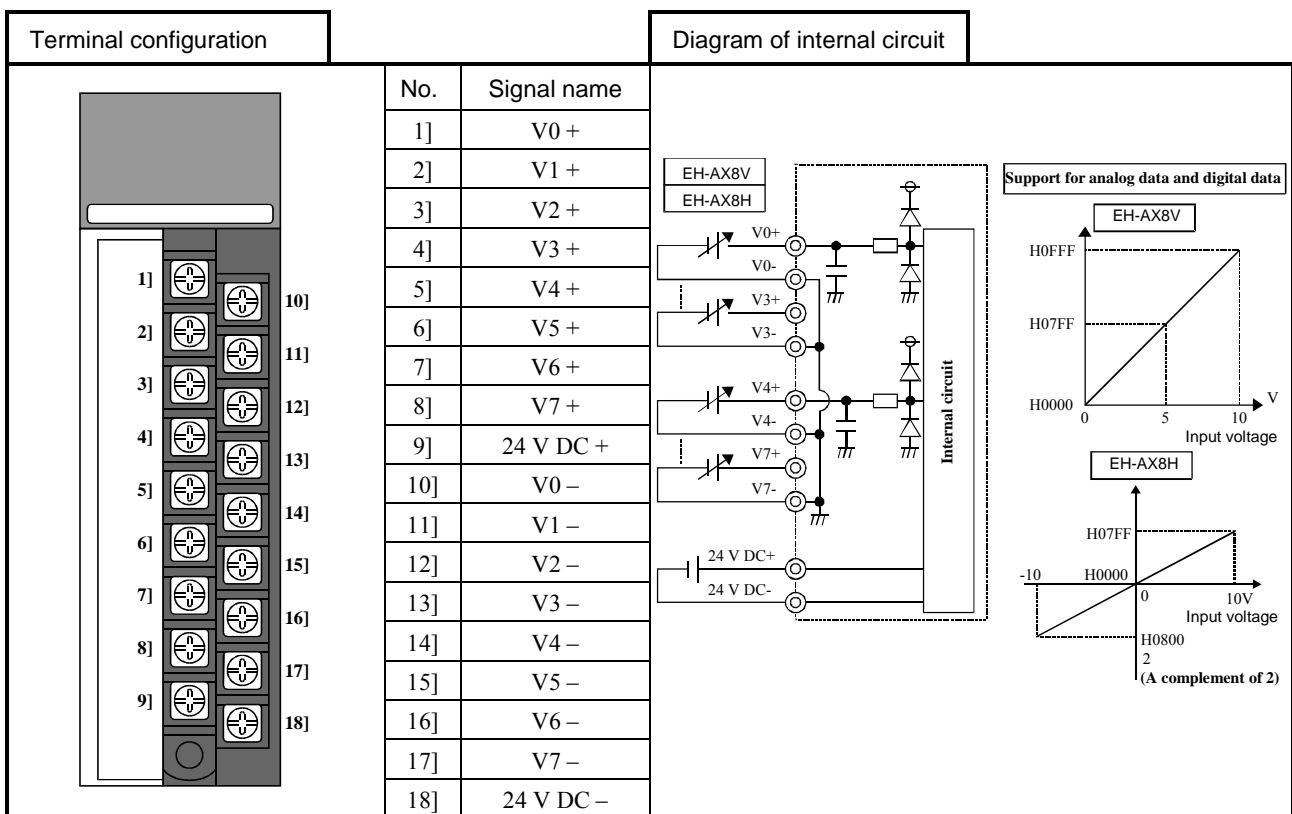
1]	I0 +
2]	I1 +
3]	I2 +
4]	I3 +
5]	V4 +
6]	V5 +
7]	V6 +
8]	V7 +
9]	24 V DC +
10]	I0 -
11]	I1 -
12]	I2 -
13]	I3 -
14]	V4 -
15]	V5 -
16]	V6 -
17]	V7 -
18]	24 V DC -

Diagram of internal circuit



Specification table (analog voltage input module)

Item		Specification	
Type		EH-AX8V	EH-AX8H
Input voltage range		0 to 10 V DC	-10 to 10 V DC
Resolution		12 bits	
Conversion time		5 ms or less	
Overall accuracy		$\pm 1\%$ or less (of full-scale value)	
Input impedance		Approx. 100 k $\Omega$	
Insulation	Channel · Internal circuit	Photocoupler insulation	
	Between channels	No insulation	
Number of channels		8 channels/module (0 to 7 channel)	
Weight		Approximately 0.18 kg (0.4 lb.)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approx. 100 mA	
External power supply		24 V DC (+20%, -15%) Approx. 0.15 A (Approx. 0.4 A at power On)	
External wiring		2-core shield wire (20 m (65.62 ft.) or less)	
I/O assignment		WX8W	

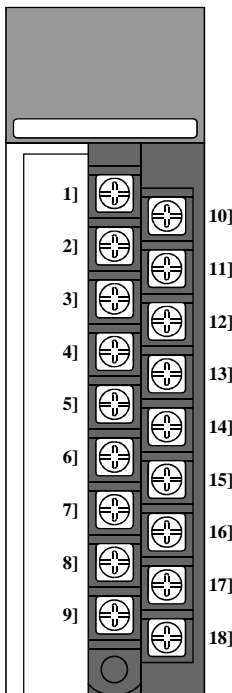
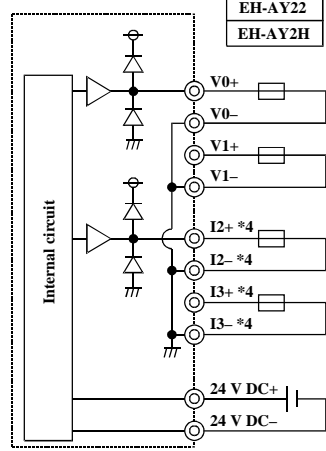
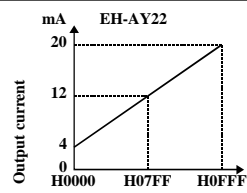
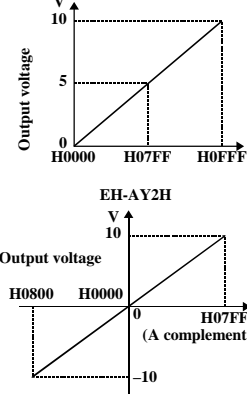




Specification table (analog output module)

Item		Specification	
Type		EH-AY22	EH-AY2H
Output voltage range (0 to 1 channel)		0 to 10 V DC	-10 to 10 V DC
Output current range (2 to 3 channels)		4 to 20 mA	—
Resolution		12 bits	
Conversion time		5 ms or less	
Overall accuracy		$\pm 1\%$ or less (of full-scale value)	
External load resistor	Voltage output (0 to 1 channel)	10 k $\Omega$ or more	
	Current output (2 to 3 channels)	0 to 500 $\Omega$	—
Insulation	Channel · Internal circuit	Photocoupler insulation	
	Between channels	No insulation	
Number of channels	Output voltage range *3	2 channels/module (0 to 1 channel)	
	Output current range *3	2 channels/module (2 to 3 channels)	—
Weight		Approximately 0.18 kg (0.4 lb.)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approximately 100 mA	
External power supply		24 V DC (+20 %, -15 %) Approx. 0.15 A (Approx. 0.5 A at power On)	
External wiring		2-core shield wire (20 m (65.62 ft.) or less)	
I/O assignment		WY8W	

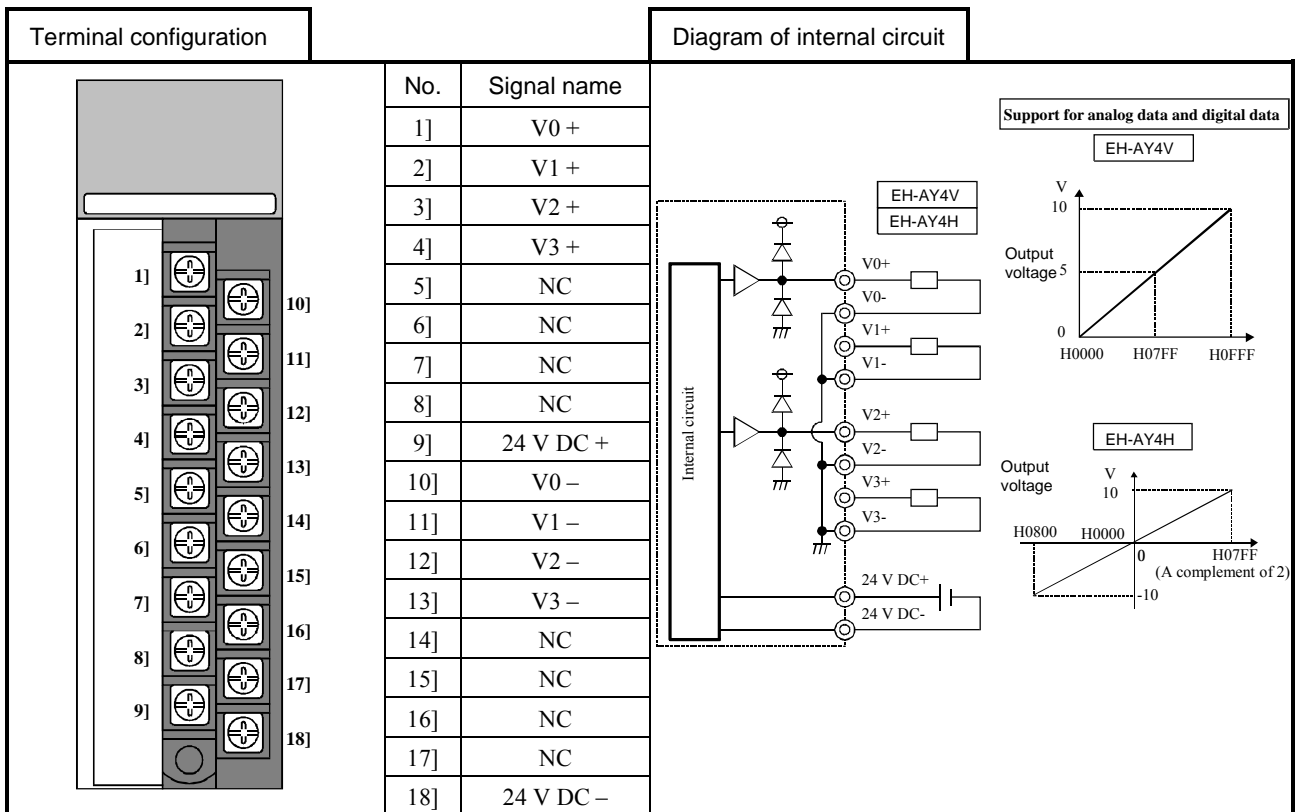
\*3: With the EH-AY22, voltage output and current output can be used simultaneously.

Terminal configuration	Diagram of internal circuit																																							
	<table><tr><th>No.</th><th>Signal name</th></tr><tr><td>1]</td><td>V0 +</td></tr><tr><td>2]</td><td>V1 +</td></tr><tr><td>3]</td><td>I2 + *4</td></tr><tr><td>4]</td><td>I3 + *4</td></tr><tr><td>5]</td><td>NC</td></tr><tr><td>6]</td><td>NC</td></tr><tr><td>7]</td><td>NC</td></tr><tr><td>8]</td><td>NC</td></tr><tr><td>9]</td><td>24 V DC +</td></tr><tr><td>10]</td><td>V0 -</td></tr><tr><td>11]</td><td>V1 -</td></tr><tr><td>12]</td><td>I2 - *4</td></tr><tr><td>13]</td><td>I3 - *4</td></tr><tr><td>14]</td><td>NC</td></tr><tr><td>15]</td><td>NC</td></tr><tr><td>16]</td><td>NC</td></tr><tr><td>17]</td><td>NC</td></tr><tr><td>18]</td><td>24 V DC -</td></tr></table>	No.	Signal name	1]	V0 +	2]	V1 +	3]	I2 + *4	4]	I3 + *4	5]	NC	6]	NC	7]	NC	8]	NC	9]	24 V DC +	10]	V0 -	11]	V1 -	12]	I2 - *4	13]	I3 - *4	14]	NC	15]	NC	16]	NC	17]	NC	18]	24 V DC -	<div><div></div><div><p>Support for analog data and digital data</p><p><b>EH-AY22</b></p><p><b>EH-AY2H</b></p></div></div>
No.	Signal name																																							
1]	V0 +																																							
2]	V1 +																																							
3]	I2 + *4																																							
4]	I3 + *4																																							
5]	NC																																							
6]	NC																																							
7]	NC																																							
8]	NC																																							
9]	24 V DC +																																							
10]	V0 -																																							
11]	V1 -																																							
12]	I2 - *4																																							
13]	I3 - *4																																							
14]	NC																																							
15]	NC																																							
16]	NC																																							
17]	NC																																							
18]	24 V DC -																																							

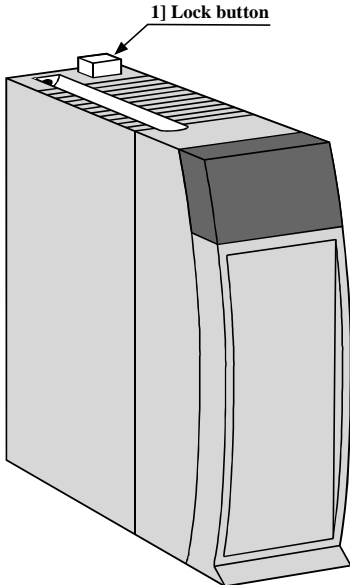
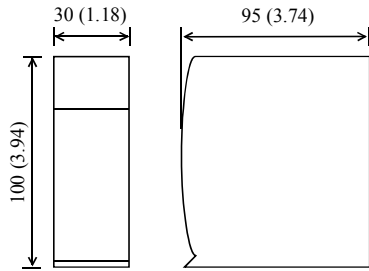
\*4: Only for the EH-AY22. "NC" for the EH-AY2H.

Specification table (analog voltage output module)

Item		Specification	
Type		EH-AY4V	EH-AY4H
Input voltage range		0 to 10 V DC	-10 to 10 V DC
Resolution		12 bits	
Conversion time		5 ms or less	
Overall accuracy		$\pm 1\%$ or less (of full-scale value)	
External load resistor		10 k $\Omega$ or more	
Insulation	Channel · Internal circuit	Photocoupler insulation	
	Between channels	No insulation	
Number of channels		4 channels/module (0 to 3 channel)	
Weight		Approx. 0.18 kg (0.4 lb.)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approx. 100 mA	
External power supply		24 V DC (+20%, -15%) Approx. 0.15 A (Approx. 0.5 A at power On)	
External wiring		2-core shield wire (20 m (65.62 ft.) or less)	
I/O assignment		WY8W	



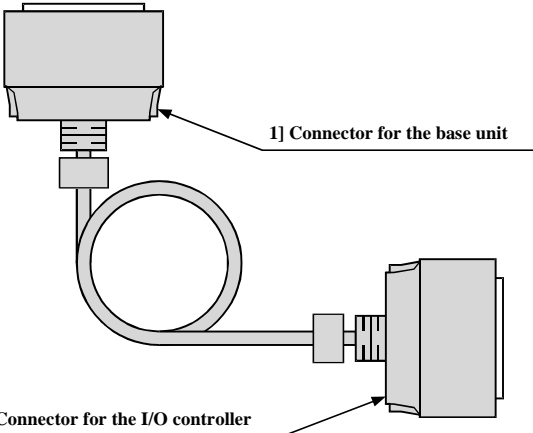
## 4.14 Dummy Module

Name and function of each part		Type	EH-DUM
		Weight	Approx. 0.06 kg (0.132 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	Lock button	Use when removing the unit from the base unit.	

Electronic parts are not mounted on the dummy module.

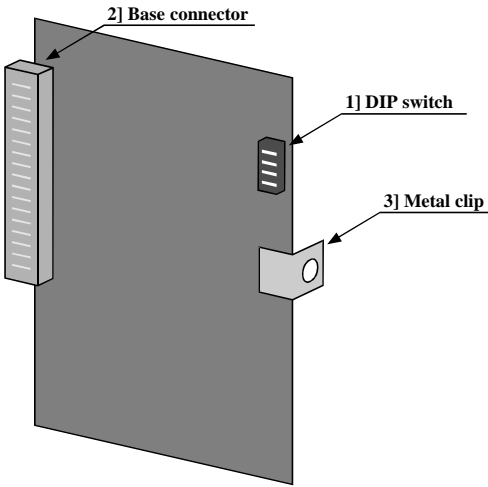
Use "Open 16" for I/O assignment.

## 4.15 Expansion Cable

Name and function of each part		Type	EH-CB10
		Weight	Approx. 0.24 kg (0.53 lb.)
		Length	1 m (3.281 ft.)
No.	Name	Function	Remarks
1]	Connector for the base unit *	Connect to the connector of the basic base unit.	
2]	Connector for the I/O controller *	Connect to the connector of the I/O controller.	

\* The connectors are represented as the base unit side and I/O controller side for presentation purposes, but either one can be connected to either side.

## 4.16 Memory Board

Name and function of each part		Type	EH-MEMP
			EH-MEMD
		Weight	Approx. 0.05 kg (0.11 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	DIP switch	Sets the switching of the program transfer direction and compare function.	
2]	Base connector	Connector with base unit.	
3]	Metal clip	Screw bracket for CPU case.	

### Memory board specifications

Item	EH-MEMP	EH-MEMD
Program capacity	48 k steps	16 k steps
Data capacity	—	384 k words
Program transfer function	Available	
Memory types	FLASH	

\* With the EH-MEMP and EH-MEMD, the operation upon startup will change depending on the dip switch settings:

- (1) Transfer from CPU to EH-MEMP
- (2) Transfer to CPU from EH-MEMP
- (3) Comparison between CPU and EH-MEMP
- (4) Operation with information stored in the EH-MEMP

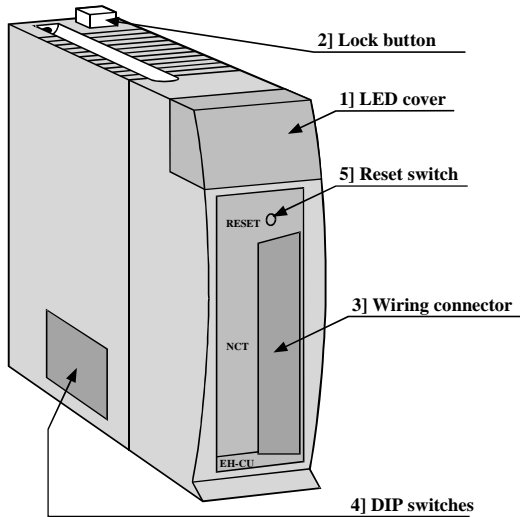
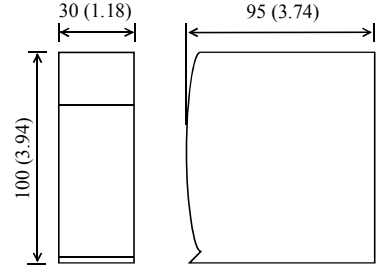
\* The EH-MEMD can delete, write and read log data by using commands. When using the EH-MEMD for the first time, the RUN LED will rapidly flash (at 250 ms intervals) for approximately 3 seconds for initialization of the memory board when power is first supplied.

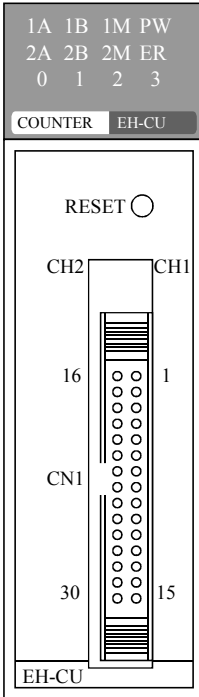
\* Be sure to turn off the power supply of the PLC unit when mounting or removing the memory board from the CPU module.

When mounting it to the CPU module, be sure to fix it to the CPU module case with binding screw (M3 × 4) attached. Additionally, do not install the CPU module in the base unit with the memory board still attached to the CPU module. Doing so may cause inappropriate connection at the base connector on the memory board. When removing, first remove whole CPU module from the base and then lift out the memory board.

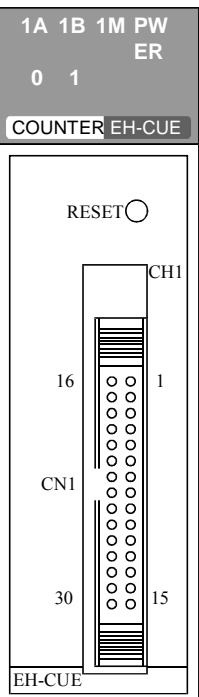
\* Because flash memory is used, data is retained in memory even if the power is turned off. However, note that the write count is approximately 100,000.

## 4.17 Counter Module

Name and function of each part		Type	EH-CU (2ch)
			EH-CUE (1ch)
		Weight	Approx. 0.16 kg (0.352 lb.)
		Dimensions (mm(in.))	
			
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the I/O status. When the I/O signal turns on, the LED for the relevant number lights up.	
2]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
3]	Wiring connector	15 × 2 lines 30-pin connector used to connect external wiring. (Note) Common to the two channels for the EH-CU.	
4]	DIP switches	Performs various initialization settings of the EH-CU and EH-CUE. Turn off the power and remove the module to perform settings.	
5]	Reset switch	This is used when the module generates a hardware error. (Note) After the power is turned on, pressing down the reset switch turns on the "ER" LED. This is normal.	

EH-CU	Terminal Layout	No.	CH2	No.	CH1	Meaning of signal	
		16	Vin A	1	Vin A	Phase A	Connect to a 12 - 24 V DC power supply when using voltage input.
		17	A (+)	2	A (+)		Connect to (+) polarity when using differential input.
		18	A (-)	3	A (-)		Connect to the open collector signal when using voltage input Connect to (-) polarity when using differential input.
		19	Vin B	4	Vin B	Phase B	Connect to a 12 - 24 V DC power supply when using voltage input.
		20	B (+)	5	B (+)		Connect to (+) polarity when using differential input.
		21	B (-)	6	B (-)		Connect to the open collector signal when using voltage input Connect to (-) polarity when using differential input.
		22	Vin M	7	Vin M	Marker	Connect to a 12 - 24 V DC power supply when using voltage input.
		23	M (+)	8	M (+)		Connect to (+) polarity when using differential input.
		24	M (-)	9	M (-)		Connect to the open collector signal when using voltage input Connect to (-) polarity when using differential input.
		25 to 27 N.C.		10 to 12 N.C.			Do not connect anything.
		28	Y2	13	Y0	Output	Coincidence output. Connect to the other input.
		29	Y3	14	Y1		Coincidence output. Connect to the other input.
		30	Com2	15	Com1		(-) common for coincidence output. Commons 1 and 2 are independent.

Note: The pin number defined in the EH-CU does not correspond to the pin number defined by the connector manufacturer.

EH-CUE	Terminal Layout	No.	CH2	No.	CH1	Meaning of signal	
		16	N.C.	1	Vin A	Phase A	Connect to a 12 - 24 V DC power supply when using voltage input.
		17	N.C.	2	A (+)		Connect to (+) polarity when using differential input.
		18	N.C.	3	A (-)		Connect to the open collector signal when using voltage input Connect to (-) polarity when using differential input.
		19	N.C.	4	Vin B	Phase B	Connect to a 12 - 24 V DC power supply when using voltage input.
		20	N.C.	5	B (+)		Connect to (+) polarity when using differential input.
		21	N.C.	6	B (-)		Connect to the open collector signal when using voltage input Connect to (-) polarity when using differential input.
		22	N.C.	7	Vin M	Marker	Connect to a 12 - 24 V DC power supply when using voltage input.
		23	N.C.	8	M (+)		Connect to (+) polarity when using differential input.
		24	N.C.	9	M (-)		Connect to the open collector signal when using voltage input Connect to (-) polarity when using differential input.
		25 to 27 N.C.		10 to 12 N.C.			Do not connect anything.
		28	N.C.	13	Y0	Output	Coincidence output. Connect to the other input.
		29	N.C.	14	Y1		Coincidence output. Connect to the other input.
		30	N.C.	15	Com1		(-) common for coincidence output.

Note: The pin number defined in the EH-CUE does not correspond to the pin number defined by the connector manufacturer.

## General specifications

Item	Specification	
Type	EH-CU	EH-CUE
Insulation withstand voltage	250 V DC between I/O signal and FE	
Internal current consumption	5 V 200 mA	
Operating ambient temperature/humidity	0 to 55 degrees, 20 to 90% RH (Non condensing)	
Storage ambient temperature/humidity	-10 to 75 degrees, 10 to 90% RH (Non condensing)	
I/O assignment	FUN0	

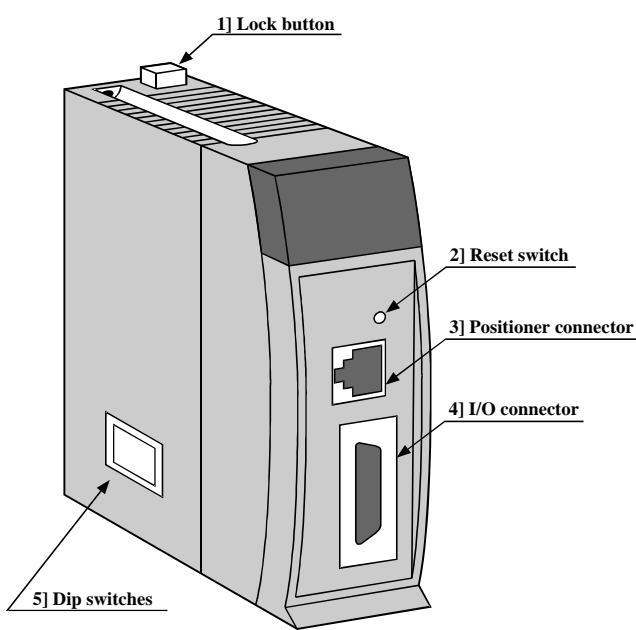
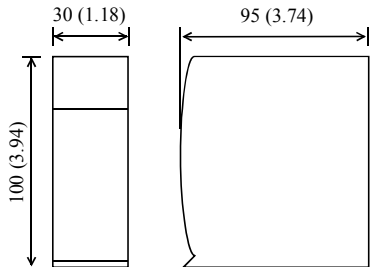
## Counter specifications

Item	Specification	
Type	EH-CU	EH-CUE
Maximum number of count	32 bit (0 to 4, 294, 967, 295)	
Maximum frequency	100 k Hz (25 k Hz when multiple of 4)	
Count mode	Select via dip switch settings. (Common to both channels for the EH-CU.) 2 phases; 1 phase (cw/ccw, ck, U/D); 2 phases, multiplication by 4	
Number of channels	2 channels	1 channel
Differential input current	4 mA or higher	
Differential input voltage	12 to 24 V DC	
	Minimum ON voltage	10 V DC
	Maximum OFF voltage	4 V DC
Insulation method	Photocoupler	
Number of input points 3 points x 2 channels	A: A, CW, CK B: B, CCW, U/D M: Marker (z)	Phase difference of each channel (A - B) during 2-phase counting +45° to +125° when up, -45° to -125° when down
Minimum counter pulse width	ON: 4 $\mu$ s or higher, OFF: 4 $\mu$ s or higher	
Minimum marker pulse width	10 $\mu$ s or higher (Detected via ON edge)	
External wiring method	30-Pin batch connector for both channels	30-pin connector
External wiring	Wired with twisted pair wires and batch shielded wires	

## Output specifications

Item	Specification	
Type	EH-CU	EH-CUE
Output voltage	12/24 V DC (30 V DC maximum)	
Load current	20 mA/point maximum	
Output method	Open collector output	
Minimum load current	1 mA	
Output delay time	ON $\rightarrow$ OFF	1 ms or less
	OFF $\rightarrow$ ON	1 ms or less
Voltage drop when ON	1.5 V maximum	
Number of external output points	4 points/module External terminal of output destination may be specified for each channel.	2 points/module
	Normal counter	Current value = Set Value 1 or current value > Set Value 1
	Ring counter	Current value = Set Value 2
Leak current	0.5 mA maximum	
Polarity	(–) common within the module	
External power supply	12/24 V DC (30 V DC maximum)	
Insulation method	Photocoupler	

## 4.18 Single-Axis Pulse Positioning Module

<div></div>		Type	EH-POS
		Weight	Approx. 0.18 kg (0.4 lb.)
		Dimensions (mm(in.))	
		<div></div>	

No.	Name	Function	Remarks	
1]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.		
2]	Reset switch	Resets the unit when the module is malfunctioning.		
3]	Positioner connector	Used to connect the positioner		
4]	I/O connector	Pulse output, external control input connector (20-pin)	Connector on cable: Sumitomo 3M Solder type: 10120-3000VE Case: 10320-52F0-008 (or equivalent)	
5]	Dip switches	Perform initialization settings for the pulse output method (CW/CWW, CK/Direction switching) and output logic (positive/negative logic). Also used to set whether or not external input is used. Turn off the power and remove the module to perform settings.	(Note) Setting dip switches 5 and 6 to ON causes the external RUN input to become invalid (± 0).	
	Switch number	ON	OFF	Additional information
	1, 2	1	2	
		ON	ON	CW/CCW pulse output (Negative logic)
		ON	OFF	CW/CCW pulse output (Positive logic)
		OFF	ON	Clock pulse/Directional signal output (Negative logic)
		OFF	OFF	Clock pulse/Directional signal output (Positive logic)
	3	Unused	Unused	
	4	COIN not input	COIN input	Sets whether or not the positioning complete signal (COIN) is externally input.
	5	+ 0. RUN not input	+ 0. input	Sets whether or not the + direction over-run (+O.RUN) is externally input.
	6	- 0. RUN not input	– 0. input	Sets whether or not the – direction over-run (–O.RUN) is externally input.



## General specifications

Item	Specification
Current consumption	5 V DC, 300 mA, 600 mA (When the positioner is connected) Supply power from the power supply module.
Operating ambient temperature	0 to 55°C (Storage ambient temperature -10 to 75°C)
Operating ambient humidity	20 to 90% RH (no condensation) (Storage ambient humidity 10 to 90% RH (no condensation))
Usage environment	No corrosive gases, no excessive dirt
Cooling method	Natural air cooling
Weight	Approx. 0.18 kg (0.4 lb.)
External dimensions (mm)	30 (1.18 in.) (W) × 100 (3.94 in.) (H) × 95 (37.4 in.) (D) (170 (6.7 in.) (D) with I/O connector)
External power supply	5 V DC ± 5%, 100 mA (For pulse chain output) 24 V DC, 10 mA/point (For external control input)

## Function specifications

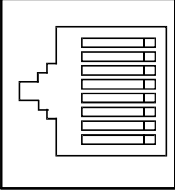
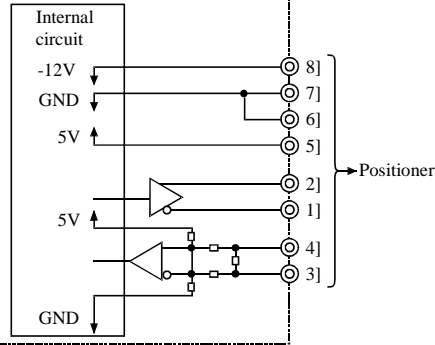
Item		Specification
Number of control axes		1 axis
Highest frequency		400 k pulse/s
Positioning data	Capacity	256 points
	Setting procedures	1. Sequence program 2. Positioner (Note that the positioner is optional.)
Positioning	Method	1. Absolute system 2. Absolute system + increment system 3. Increment system
	Positioning command	1. Pulse specification 2. μ m specification 3. inch specification 4. degree specification
	Speed command	Automatic, manual, home position return 6.25 pulse/s to 400 k pulse/s μ m/s, inch/s, degree/s input function
	Speed stage	10 stages
	Acceleration/deceleration system	Trapezoid acceleration/deceleration S-curve acceleration/deceleration (3-stage acceleration/deceleration)
	Acceleration/deceleration time	1 to 65,535 ms
	Backlash	0 to 255 pulse
	High/low limit setting	+2,147,483,647 to -2,147,483,648 pulse
	Pulse output method	1. Pulse chain (CW/CCW) 2. Clock + direction signal (CK/direction) (Use dip switches 1 and 2 to select the pulse output method and to switch between positive and negative logic for the selected method.)
	Pulse output procedures	1. Open collector output (Photocoupler insulation) 2. Line driver output (Photocoupler insulation)
Home position return function		1. Arbitrary origin 2. Low speed origin return 3. High speed origin return 1 4. High speed origin return 2 5. Absolute value encoder home position return
Teaching		Possible
Manual (JOG) operation		Pulse output by manual input signal
Operation when the CPU has stopped		Operation may be performed via I/O setting or using the positioner.
I/O allocation		Word 4W/4W
Absolute value encoder input		Supports the Σ series and ΣII series by Yasukawa Denki and the P series by Sanyo Denki.

- (Notes) • Stopping the CPU during operation causes the motor to decelerate and come to a stop.
- The maximum travel per single movement is 2,147,483,647 pulses. When an operation was attempted to move beyond the maximum travel, the motor decelerates and stops at the maximum travel position.

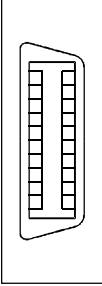
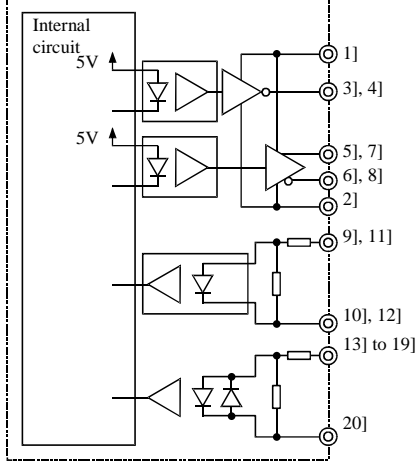
## I/O interface specifications

Item		Specification
Output	Pulse chain (CW/CCW) output Clock + direction signal (CK/direction) Pulse output	1. Open collector output Photocoupler insulation (30 V DC maximum, 30 mA resistive load) 2. Lone driver output Photocoupler insulation (5 V DC)
	Maximum leakage current	100 $\mu$ A or less
	Maximum voltage drop at ON	0.8 V maximum (at output current 30 mA)
Input	Input voltage	10.8 to 30 V DC
	Input impedance	Approximately 2.2 k $\Omega$
	Input current	Approximately 10 mA (24 V DC)
	Operation voltage	Minimum ON voltage 9 V
		Maximum OFF voltage 3.6 V
	Input lag	ON $\rightarrow$ OFF 1 ms or less
		OFF $\rightarrow$ ON 1 ms or less
	Polarity	Only the encoder signal input uses the plus common inside the module. Other inputs do not specify polarity.
	Insulation method	Photocoupler

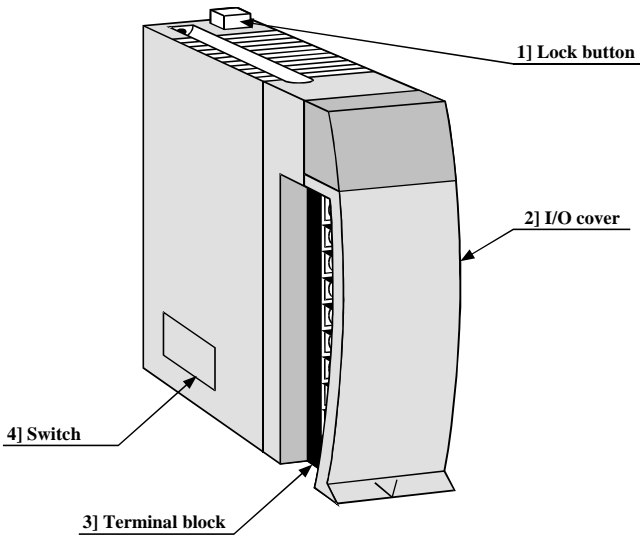
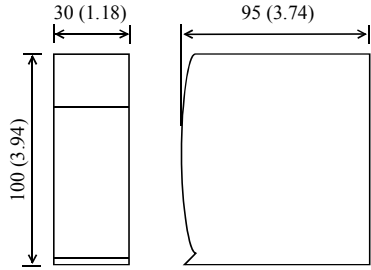
## A) Positioner connector (CN1): Conforms to RS-422.


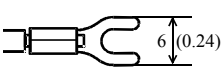
Terminal layout	No.	Signal	Signal name	Internal ladder diagram
	1]	Do -	Driver output -	
	2]	Do +	Driver output +	
	3]	Ri -	Receiver input -	
	4]	Ri +	Receiver input +	
	5]	5 V DC +	+ 5 V	
	6]	0 V	GND	
	7]	0 V	GND	
	8]	12 V DC -	-12 V	

## B) I/O connector (CN2)

Terminal layout	No.	Signal	Signal name	Internal ladder diagram
	1]	5 V DC +	Pulse output	
	2]	0 V	power supply	
	3]	CW	Open collector pulse output	
	4]	CCW	Open collector pulse output	
	5]	CW +	Line driver pulse output	
	6]	CW -	Line driver pulse output	
	7]	CCW +	Line driver pulse output	
	8]	CCW -	Line driver pulse output	
	9]	C +	Encoder C phase	
	10]	C -	Encoder C phase	
	11]	PS -	Encoder location signal	
	12]	PS +	Encoder location signal	
	13]	COIN	Positioning complete	
	14]	PROG	Home position LS	
	15]	+ 0. RUN	+ Over run	
	16]	- 0. RUN	- Over run	
	17]	MODE-SEL	Control mode switch	
	18]	M-CW	Manual CW	
	19]	M-CCW	Manual CCW	
	20]	24 V DC +	Control power supply	

## 4.19 Resistance Temperature Detective Input Module

		Type	EH-PT4
		Weight	Approx. 0.18 kg (0.4 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
2]	I/O cover	This is the cover attached to the terminal block area	
3]	Terminal block	This is the terminal block for connecting input signals. The terminal block can be connected or disconnected.	
4]	Switch	This is to set the temperature range.	

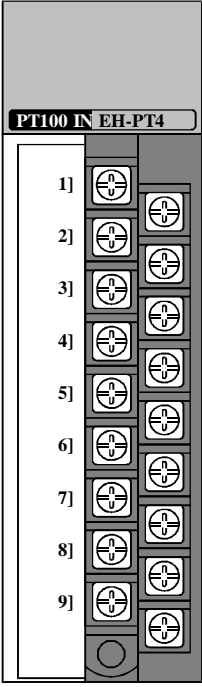
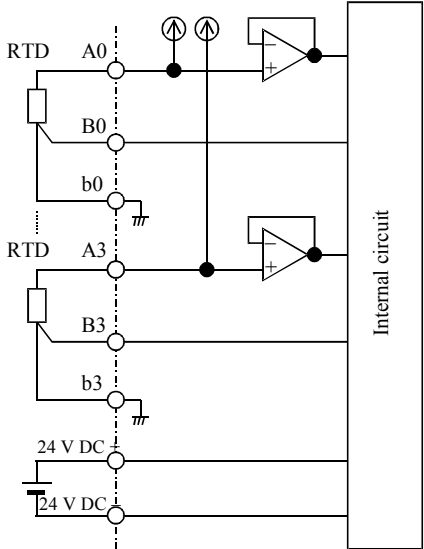
No.	Item	Detailed explanation	Remarks
	Operation explanation	The module receives input signals from outside. The CPU module recognizes the status of the loaded module and when it matches the I/O assignment information included in the user program, input information is received according to the contents of the user program.	
	Terminal block	<p>The screws for the terminal block are M3 screws. Use a crimp terminal that fits the screw diameter. The maximum thickness of the cable should be only up to 0.75 mm<sup>2</sup>. (Use 0.5 mm<sup>2</sup> cable when two crimp terminals are attached to the same terminal.)</p> <p>The recommended crimp terminal is indicated below.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">(Recommended)</div> </div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Care must be exercised when handling the terminal since it may fall off if the screw is loose.</p> </div> </div> <p style="text-align: center;">Unit: mm (in.)</p>	

Specification table

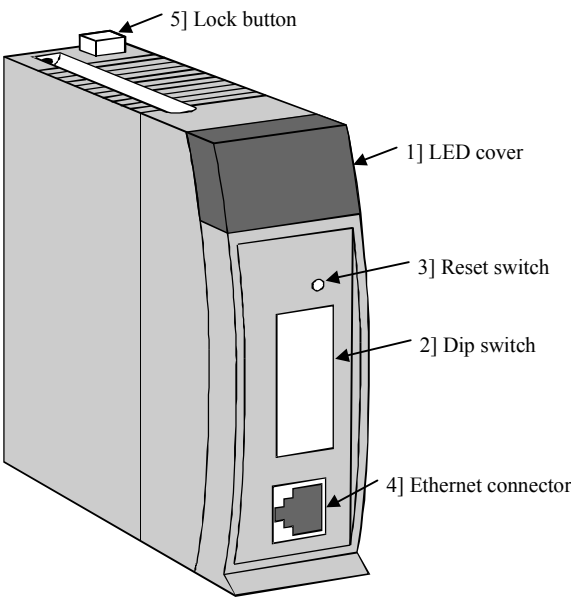
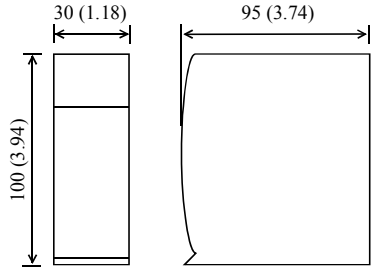
Item		Specifications
Type		EH-PT4
Applicable temperature-measuring		Platinum temperature-measuring resistor Pt 100 (JIS C 1604-1989)/Pt 1000
Temperature conversion data		Signed 15 bits
Accuracy *1	-20 to 40°C (Pt 100)	$\pm 0.5^{\circ}\text{C}$
	-50 to 400°C (Pt 100)	$\pm 3^{\circ}\text{C}$
	-50 to 400°C (Pt 1000)	$\pm 6^{\circ}\text{C}$
Temperature measuring range		-20 to + 40°C/-50 to + 400°C (2 mA constant current system)
Number of input points		4
Conversion time		Approx. 1 second per four values
Insulation	Between value and internal circuit	Photocoupler insulation
	Between values	No insulation
Externally supplied power		24 V DC
Unused terminal processing		The temperature conversion data for one of the four values is H7FFF.
External wiring register		The maximum total resistance of four values is 400 $\Omega$ .
External wiring		Shielded cable
Additional function		Linearization
Error detection		The temperature conversion data at or below -51°C or at or above 410°C is H7FFF.
Wire breakage processing		The temperature conversion data for one of the four values is H7FFF.
I/O assignment		X4W

\*1: The accuracy indicates the value after 10 minutes from the power-up. The value may become slightly higher immediately after the power-up. Also check the temperature-measuring resistor beforehand because it is also subject to error.


\*2: Indicates the current terminal wiring in open state. When an open error occurs in the voltage terminal wiring, the data becomes inconsistent. 7

Terminal configuration		Diagram of internal circuit	
		No.	Signal name
			EH-PT4
		1]	b0
		2]	B0
		3]	b1
		4]	B1
		5]	b2
		6]	B2
		7]	b3
		8]	B3
		9]	24 V DC +
		10]	A0
		11]	NC
		12]	A1
		13]	NC
		14]	A2
		15]	NC
		16]	A3
		17]	NC
		18]	24 V DC -
			

## 4.20 Ethernet Module

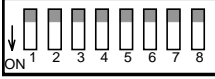
Name and function of each part		Type	EH-ETH
		Weight	Approx. 0.15 kg (0.33 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the status.	
2]	Dip switch	Sets the operation mode.	
3]	Reset switch	Resets when the module is abnormal.	
4]	Ethernet connector	RJ45 type connector	
5]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	

### Explanation of LED display

Front diagram	Display	Description of display	ON status	OFF status
	POW	Indicates the Ethernet line connection status.	Connected	Not connected
	Tx/Rx	Indicates the data transmission and reception status.	Sending or receiving	No data transmission
	I. ERR	Indicates Ethernet information setting error.	Error present	No error
	ERR	Indicates whether or not a transmission or reception error has occurred.	Error present	No error
	STATUS	Indicates whether or not a hardware error has occurred.	Error present (flashes) <sup>*1</sup>	No error

\*1: Displays the type of a hardware error by the illumination color and flash count. For details, refer to the Ethernet Module Application Manual (NJI-361(X)).

## Operation mode setting

External view	Bit								Description
	1	2	3	4	5	6	7	8	
	O N	O N	Least significant byte of IP address						Sets Ethernet information from the user program
		O F F							Sets Ethernet information using general Web browser.
	O F F	*	*	*	*	*	O N	O N	Transmission/reception test mode
								O F F	External loop-back check
							O F F	O N	Internal loop-back check
								O F F	Normal operation

Note: (1) “\*” indicates that it is not dependent of the bit status.

(2) When the least significant byte of the IP address is to be set, the switch OFF becomes “0,” and ON becomes “1.”

(3) Do not set all of the least significant bits of the IP address to OFF.

## General specifications

Item	Specification
Internal current consumption	5 V DC, 260 mA
Operating ambient temperature, humidity	0 to 55°C, 20 to 90% RH (no condensation)
Storage ambient temperature, humidity	-10 to 75°C, 10 to 90% RH (no condensation)
Noise proof feature	<ul style="list-style-type: none"> <li>Noise voltage 1,500 Vpp, noise pulse width 100 nsec, 1 μsec</li> <li>3,000 V at the electrostatic noise metal exposing section</li> </ul>
Operating environment	No corrosive gases, no excessive dust
Structure	Open wall-mount type
Cooling method	Natural air cooling
Mounted slot position	Slots 0 to 2 on the basic base: up to two units can be mounted at the same time
I/O assignment	COMM

## Performance specifications

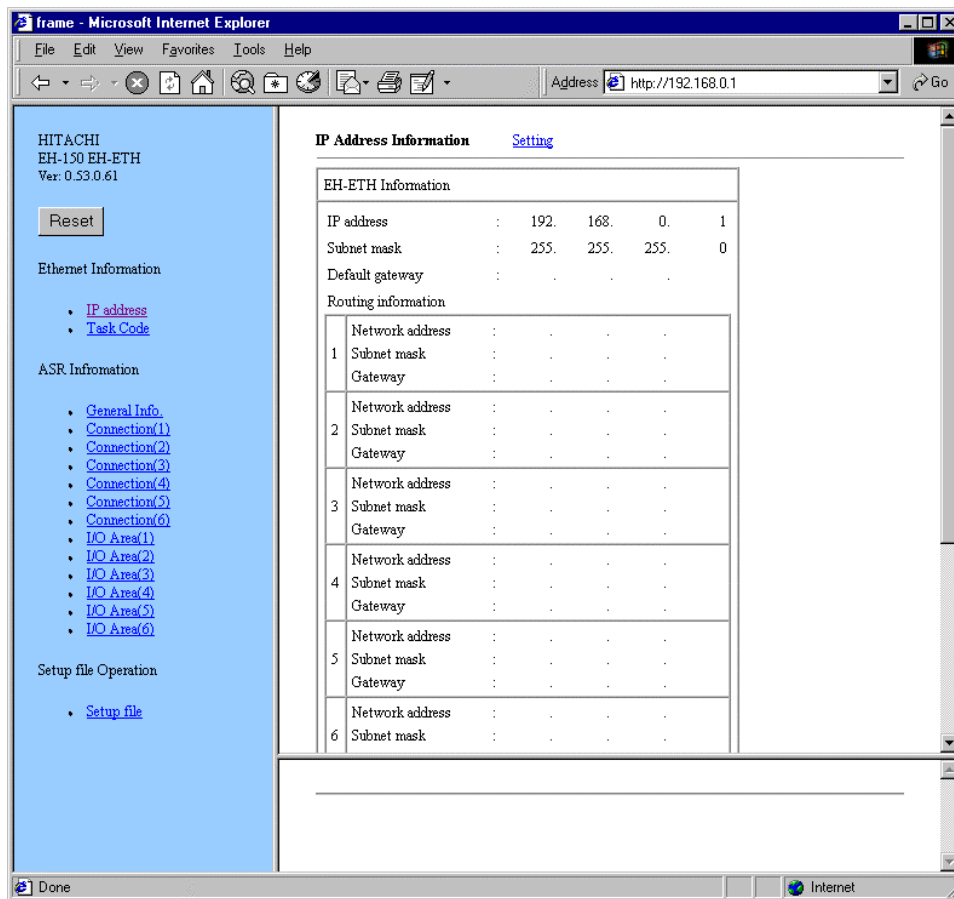
Item		Specification
Transfer specification	Ethernet standard	IEEE802.3 standard
	Transfer modulation method	Base band
	Medium access method	CSMA/CD
	Transfer speed	10 Mbps
	Maximum inter-node distance	4,000 (m)
	Maximum segment length	100 (m)
	Number of maximum nodes	1,024 nodes/total hub
Auto/event transmission and reception function		Number of simultaneous connections: Maximum 6 Transmission data: Maximum 1,454 bytes/try

## Functional specifications

Item	Specification
Setup function	<ul style="list-style-type: none"> <li>Select the setup mode using a DIP switch, and perform initial settings such as the IP address, transmission operation specification, transmission/reception area specification using a general-purpose Web browser.</li> <li>The IP address can also be set by programming with a ladder program.</li> </ul>
Auto Sending/Receiving function, event transmission function	<ul style="list-style-type: none"> <li>Data can be transmitted and received periodically by specifying an internal output signal in a table format.</li> <li>Data can be transmitted and received by signal variation (event) in a ladder program.</li> </ul>
Task code communication	<ul style="list-style-type: none"> <li>Either TCP/IP or UDP/IP can be specified.</li> <li>H series task code communication can be performed.</li> </ul>
Test function	<ul style="list-style-type: none"> <li>Internal loop and external loop check functions are supported.</li> <li>One-to-one transmission/reception test function is supported.</li> </ul>

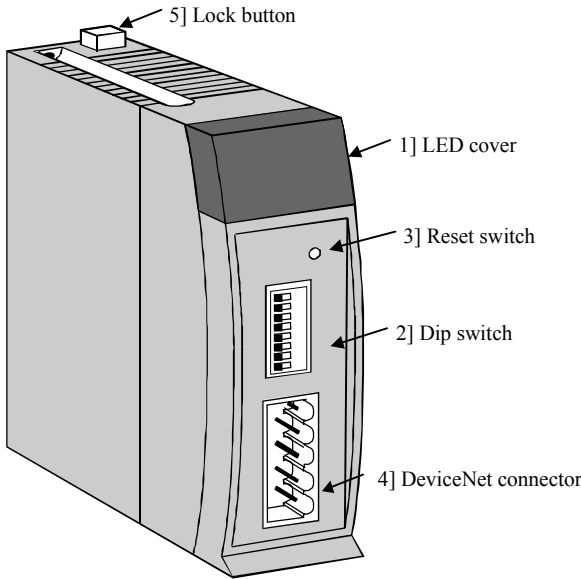
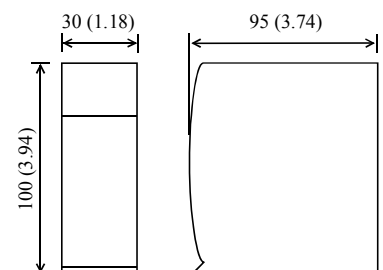
## (3) Example of setup function

To create Ethernet information and an auto communication table, the setup page of the general Web browser is used. The following shows the setup tool screen.



Ethernet information setup page using a Web browser

## 4.21 DeviceNet Master Module

Name and function of each part		Type	EH-RMD
		Weight	Approx. 0.15 kg (0.33 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	LED cover	This is the cover for the LED that displays the network status and error information.	
2]	Dip switch	Sets the node address and baud rate.	
3]	Reset switch	Resets the module.	
4]	DeviceNet connector	Connects to the network.	
5]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	

### General specifications

Item	Specification
Current consumption	5 V DC, 450 mA
Operating ambient temperature	0 to 55°C (Storage ambient temperature –10 to 75°C)
Operating ambient humidity	20 to 90 % RH (no condensation) (Storage ambient humidity 10 to 90 % RH (no condensation))
Usage environment	No corrosive gases, no excessive dirt
Cooling method	Natural air cooling
External power supply	24 V DC ± 10 % (supplied from the network)



## Performance specifications

No.	Item	Specification																	
1	No. of installed units	2 units/CPU																	
2	No. of slave- connected units	63 units																	
3	I/O assignment	LINK																	
4	Output data	256 words (Head is fixed at WL0.)																	
5	Input data	256 words (Head is fixed at WL200.)																	
6	Communication protocol	DeviceNet 2.0 standard																	
7	Supported connections	1] Poll I/O connection 2] Bit strobe I/O connection 3] Cyclic I/O connection 4] Change of state (COS) I/O connection 5] Explicit message connection																	
8	Connection mode	1] Multi-drop connection 2] Multi-branch connection using T branch																	
9	Baud rate	500k/250k/125kbps (switched by DIP switches)																	
10	Cable	Dedicated DeviceNet cable (see Note below)																	
11	Communication distance	<table><tr><td>Communicati on speed</td><td>Maximum network length</td><td>Each sub-line length</td><td>Total sub-line length</td><td rowspan="4">The maximum network length shows the value when a thick trunk cable is used.</td></tr><tr><td>500 k bits/s</td><td>100 m or less</td><td>6 m or less</td><td>39 m or less</td></tr><tr><td>250 k bits/s</td><td>250 m or less</td><td>6 m or less</td><td>78 m or less</td></tr><tr><td>125 k bits/s</td><td>500 m or less</td><td>6 m or less</td><td>156 m or less</td></tr></table>	Communicati on speed	Maximum network length	Each sub-line length	Total sub-line length	The maximum network length shows the value when a thick trunk cable is used.	500 k bits/s	100 m or less	6 m or less	39 m or less	250 k bits/s	250 m or less	6 m or less	78 m or less	125 k bits/s	500 m or less	6 m or less	156 m or less
Communicati on speed	Maximum network length	Each sub-line length	Total sub-line length	The maximum network length shows the value when a thick trunk cable is used.															
500 k bits/s	100 m or less	6 m or less	39 m or less																
250 k bits/s	250 m or less	6 m or less	78 m or less																
125 k bits/s	500 m or less	6 m or less	156 m or less																

Note: The following are recommended communication cables and crimp type terminals for the cables:

Mfg'd by Showa Densen TDN18-\*\*G Trunk cable (thick cable)

TDN24-\*\*G Drop cable (thin cable)

(\*\* indicates the number of m's. However, available lengths are 10/30/50/100/300/500m.)

Mfg'd by Nichifu

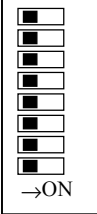
Trunk cable crimp type terminal TME TC-2-11 (power supply line)

TME TC-1.25-11 (communication line)

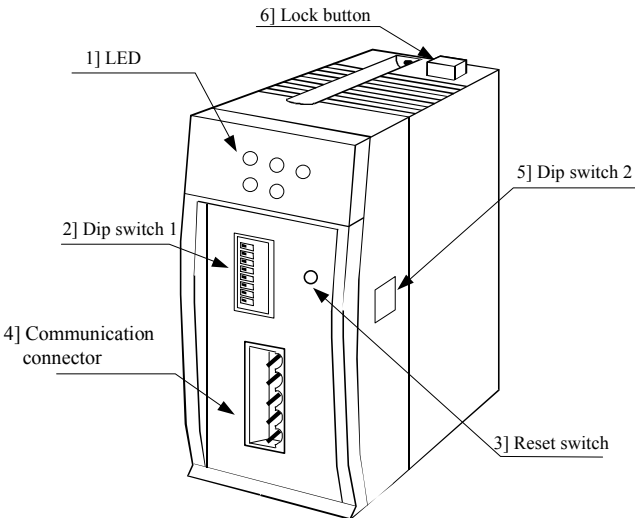
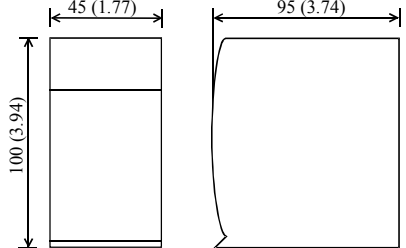
Drop cable crimp type terminal TME TC-0.5 (common power supply line/communication line)

Crimp tool NH-32

## Node address and communication speed settings

	Node address	NA1	NA2	NA4	NA8	NA16	NA32
	0	OFF	OFF	OFF	OFF	OFF	OFF
	1	ON	OFF	OFF	OFF	OFF	OFF
	2	OFF	ON	OFF	OFF	OFF	OFF
	.						
	.						
	62	OFF	ON	ON	ON	ON	ON
	63	ON	ON	ON	ON	ON	ON
	Band rate	DR0			DR1		
	125	OFF			OFF		
	250	ON			OFF		
	500	OFF			ON		
		ON			ON		

## 4.22 DeviceNet Slave Module

Name and function of each part		Type	EH-IOCD
		Weight	Approx. 0.17 kg (0.37 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	LED	This is the cover for the LED that displays the network status and error information.	
2]	Dip switch 1	Sets the node address and baud rate.	
3]	Reset switch	Resets the module.	
4]	Communication connector	Connects to the network.	
5]	Dip switch 2	Sets to retain/clear output for the output module on the EH-10CD.	
6]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	

### General specifications

Item	Specification
Current consumption	5 V DC, 450 mA
Operating ambient temperature	0 to 55°C (Storage ambient temperature -10 to 75°C)
Operating ambient humidity	20 to 90% RH (no condensation) (Storage ambient humidity 10 to 90% RH (no condensation))
Usage environment	No corrosive gases, no excessive dirt
Cooling method	Natural air cooling
External power supply	24 V DC ± 10 % (supplied from communication connector)

## Performance specifications

No.	Item	Specification																	
1]	No. of installed I/O modules	16 units/EH-IOCD (Use the EH-IOC to install 9 or more units.)																	
2]	Output data	256 words																	
3]	Input data	256 words																	
4]	Communication protocol	DeviceNet 2.0 standard																	
5]	Supported connections	1] Poll I/O connection 2] Bit Strobe I/O connection 3] Cyclic I/O connection 4] Change of state (COS) I/O connection 5] Explicit message connection																	
6]	Connection mode	1] Multi-drop connection 2] Multi-drop connection using T branch																	
7]	Baud rate	500k/250k/125kbps (switched by DIP switches)																	
8]	Cable	Dedicated DeviceNet cable (see Note below)																	
9]	Communication distance	<table><tr><td>Communication speed</td><td>Maximum network length</td><td>Each sub-line length</td><td>Total sub-line length</td><td rowspan="4">The maximum network length shows the value when a thick trunk cable is used.</td></tr><tr><td>500 k bits/s</td><td>100 m or less</td><td>6 m or less</td><td>39 m or less</td></tr><tr><td>250 k bits/s</td><td>250 m or less</td><td>6 m or less</td><td>78 m or less</td></tr><tr><td>125 k bits/s</td><td>500 m or less</td><td>6 m or less</td><td>156 m or less</td></tr></table>	Communication speed	Maximum network length	Each sub-line length	Total sub-line length	The maximum network length shows the value when a thick trunk cable is used.	500 k bits/s	100 m or less	6 m or less	39 m or less	250 k bits/s	250 m or less	6 m or less	78 m or less	125 k bits/s	500 m or less	6 m or less	156 m or less
Communication speed	Maximum network length	Each sub-line length	Total sub-line length	The maximum network length shows the value when a thick trunk cable is used.															
500 k bits/s	100 m or less	6 m or less	39 m or less																
250 k bits/s	250 m or less	6 m or less	78 m or less																
125 k bits/s	500 m or less	6 m or less	156 m or less																

Note: The following are recommended communication cables and crimp type terminals for the cables:

Mfg'd by Showa Densen TDN18-\*\*G Trunk cable (thick cable)

TDN24-\*\*G Drop cable (thin cable)

(\*\* indicates the number of m's. However, available lengths are 10/30/50/100/300/500m.)


Mfg'd by Nichifu Trunk cable crimp type terminal TME TC-2-11 (power supply line)

TME TC-1.25-11 (communication line)

Drop cable crimp type terminal TME TC-0.5 (common power supply line/communication line)

Crimp tool NH-32

## Node address and communication speed settings

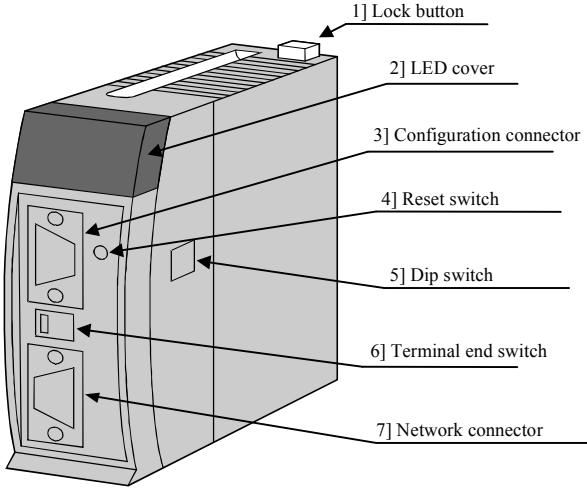
	Node address	NA1	NA2	NA4	NA8	NA16	NA32
	0	OFF	OFF	OFF	OFF	OFF	OFF
	1	ON	OFF	OFF	OFF	OFF	OFF
	2	OFF	ON	OFF	OFF	OFF	OFF
	.						
	.						
	62	OFF	ON	ON	ON	ON	ON
	63	ON	ON	ON	ON	ON	ON
	Band rate	DR0			DR1		
	125	OFF			OFF		
	250	ON			OFF		
	500	OFF			ON		
		ON			ON		

## Support I/O module

The I/O modules that are supported by the EH-IOCD are as follows:

Type	Input size (word)	Output size (word)
EH-XD8	1	0
EH-XD16		
EH-XA16		
EH-XAH16		
EH-XD32	2	0
EH-XD64	4	0
EH-PT4	4	0
EH-AX44	8	0
EH-AX8V		
EH-AX8H		
EH-YT8	0	1
EH-YT16		
EH-YTP8		
EH-YTP16		
EH-YTP16S		
EH-YS4		
EH-YR12	0	2
EH-YT32		
EH-YTP32		
EH-YT64	0	4
EH-YTP64		
EH-AY22	0	8
EH-AY2H		
EH-AY4V		
EH-AY4H		
EH-POS	4	4
EH-CU	5	3
EH-CUE		
EH-UNW	8	0
	0	8
	4	4
	6	2
	2	6


## 4.23 PROFIBUS Master Module

Name and function of each part		Type	EH-RMP
		Weight	Approx. 0.13 kg (0.286 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
2]	LED cover	Displays the communication and other statuses of the module.	
3]	Configuration connector	Used to transfer the configuration data. D-sub 9-pin male	The temperature gets high when connected. Exercise caution when handling the connector.
4]	Reset switch	Resets the unit when the module is malfunctioning.	
5]	Dip switch *1	Specifies the data transfer mode for the slave when the CPU is in the stop state.	
6]	Terminal end switch	Turns on when this module is at the end of a network.	
7]	Network connector	A connector for connecting to a network. D-sub 9-pin female	The temperature gets high when connected. Exercise caution when handling the connector.

\*1: Prior to setting the DIP switches, remove the module.

When the setting of the DIP switches is complete, paste the attached protective sheet

### Explanation of LED display

Front diagram	Display	Description of display
	RDY	Indicates the hardware abnormality of this module.
	RUN	Indicates the communicating status with the slave.
	ERR	Indicates an error on the network.
	TOKEN	Always lit.
	STATUS	Indicates a hardware abnormality, parameter abnormality and other status of this module.

## General specifications

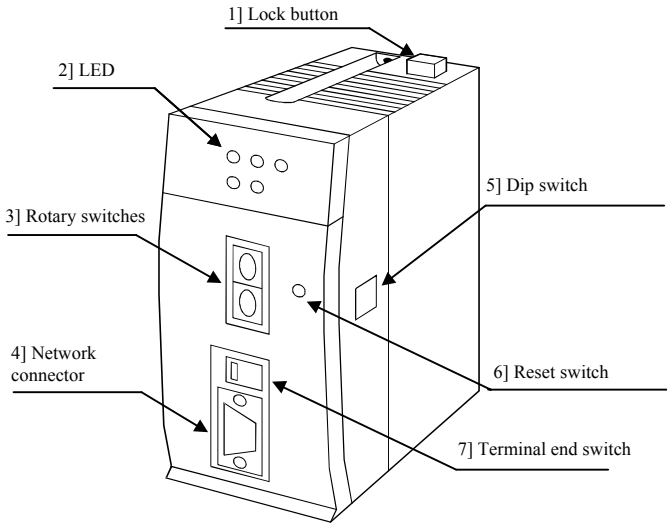
Item	Specification
Operating ambient temperature	0 to 55°C (Storage ambient temperature –10 to 75°C)
Operating ambient humidity	20 to 90 % RH (no condensation), storage ambient humidity 10 to 90 % RH (no condensation)
Current consumption	5 V DC 600 mA
Usage environment	No corrosive gases, no excessive dirt
Cooling method	Natural air cooling

## Functional specifications

Item	Specification
No. of installed units	2 units/CPU (can only be installed in slots 0 to 2)
No. of supported slave units	Maximum of 124 units. However, a repeater is required to connect 32 or more units.
No. of output words	256 words
No. of input words	256 words
I/O assignment	LINK <sup>Note 1</sup>
Band rate: Segment length	9.6 kbps : 1,200 m
	19.2 kbps : 1,200 m
	45.45 kbps : 1,200 m
	93.75 kbps : 1,200 m
	187.5 kbps : 1,000 m
	500 kbps : 400 m
	1,500 kbps : 200 m
	3 Mbps : 100 m
	6 Mbps : 100 m
12 Mbps : 100 m	
Self-diagnostics	System ROM/RAM check Watchdog timer
GSD file	File name: Hita1004.gsd Please contact our sales department.
Configurator	HMS Fieldbus, configuration software made by AB, is used. Please contact our sales department regarding the purchase.

Note 1: Among 1024 words, only 512 words are used. Do not use the remaining area.

## 4.24 PROFIBUS Slave Module

Name and function of each part		Type	EH-IOCP
		Weight	Approx. 0.16 kg (0.35 lb.)
		Dimensions (mm(in.))	
No.	Name	Function	Remarks
1]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screws.	
2]	LED	Displays the communication and other statuses of the module.	
3]	Rotary switches	Sets the node address.	
4]	Network connector	A connector for connecting to a network. D-sub 9-pin female	The temperature gets high when connected. Exercise caution when handling the connector.
5]	Dip switch	Specifies the output data for the output module when the network is abnormal.	
6]	Reset switch	Resets the unit when the module is malfunctioning.	
7]	Terminal end switch	Turns on when this module is at the end of a network.	

### General specifications

Item	Specification
Operating ambient temperature	0 to 55°C (Storage ambient temperature -10 to 75°C)
Operating ambient humidity	20 to 90 % RH (no condensation), storage ambient humidity 10 to 90 % RH (no condensation)
Current consumption	5 V DC 600 mA
Usage environment	No corrosive gases, no excessive dirt
Cooling method	Natural air cooling

## Functional specifications

Item	Specification
No. of installed I/O modules	16 units/EH-IOCP (use the EH-IOC to install 9 and more units.)
Node address setting range	1 to 99
Input/output capacity	208 words
Data update time	5 ms
Transmission speed: Segment length	9.6 kbps : 1,200 m 19.2 kbps : 1,200 m 93.75 kbps : 1,200 m 187.5 kbps : 1,000 m 500 kbps : 400 m 1,500 kbps : 200 m 3 Mbps : 100 m 6 Mbps : 100 m 12 Mbps : 100 m
Self-diagnostics	System ROM/RAM check Watchdog timer
GSD file	File name: Hita1004.gsd Please contact our sales department.

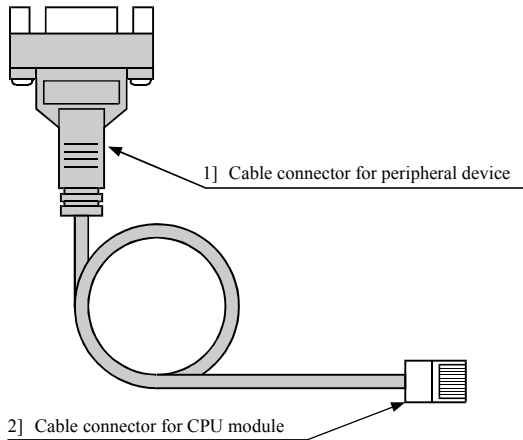
## Supported I/O list

The I/O modules that are supported by the EH-IOCP are as follows:

Type	Input size (word)	Output size (word)
EH-XD8	1	0
EH-XD16		
EH-XA16		
EH-XAH16		
EH-XD32	2	0
EH-XD64	4	0
EH-PT4	4	0
EH-AX44	8	0
EH-AX8V		
EH-AX8H		
EH-YT8		
EH-YT16	0	1
EH-YTP8		
EH-YTP16		
EH-YTP16S		
EH-YS4		
EH-YR12		
EH-YT32	0	2
EH-YTP32		
EH-YT64	0	4
EH-YTP64		
EH-AY22	0	8
EH-AY2H		
EH-AY4V		
EH-AY4H		
EH-POS	4	4
EH-CU	5	3
EH-CUE		
EH-UNW	8	0
	0	8
	4	4
	6	2
	2	6

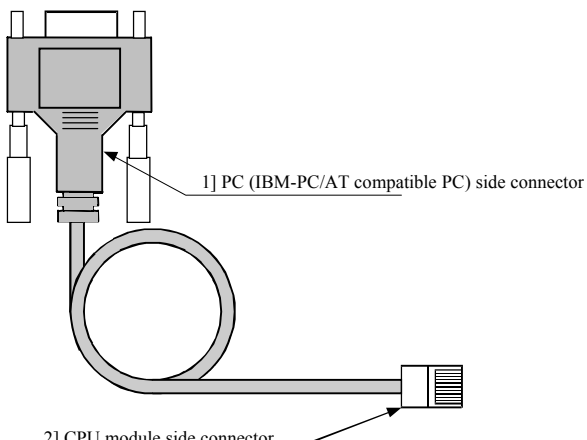


## 4.25 Conversion Cable for Connecting between CPU and Programmer, etc.

Name and function of each part		Type	EH-RS05
 <p>1] Cable connector for peripheral device</p> <p>2] Cable connector for CPU module</p>		Weight	Approx. 0.07 kg (0.154 lb.)
		Length	0.5 m (1.64 ft.)
No.	Name	Function	Remarks
1]	Cable connector for peripheral device	To be connected to the cable leading to a peripheral device.	
2]	Cable connector for CPU module	To be connected to CPU module port 1 or port 2.	

When EH-RS05 is used as the cable, connection to peripheral devices may be made similarly to the connector of the H-series CPU for peripheral devices. For connection to peripheral units, it is necessary to set the mode switches. For details, see Chapter 10, "Communication Specifications." (If the settings differ, communication cannot be performed.)

## 4.26 Cable for Connecting between CPU and PC (IBM-PC/AT Compatible Personal Computer)

Name and function of each part		Type	EH-VCB02
 <p>1] PC (IBM-PC/AT compatible PC) side connector</p> <p>2] CPU module side connector</p>		Weight	Approx. 0.13 kg (0.29 lb.)
		Length	2 m (6.56 ft.)
No.	Name	Function	Remarks
1]	Connector for peripheral device	To be connected to PC (IBM-PC/AT compatible PC)	
2]	Cable connector for CPU module	To be connected to CPU module port 1 or port 2.	

If the EH-VCB02 cable is used, the CPU and PC (IBM-PC/AT compatible PC) can directly be connected without a conversion cable. For connection to peripheral units, it is necessary to set the mode switches. For details, see Chapter 10, "Communication Specifications." (If the settings differ, communication cannot be performed.)

# Chapter 5 Command Specifications

## 5.1 Command Classifications

The commands used with the EH-150 are classified as shown in the following table.

Table 5.1 Command classification table

	Command classification	Description	Type
1	Basic commands	Sequence	21
		Timer/counter	11*
		Relational box	8
2	Arithmetic commands	Substitution (array variable)	1
		Mathematical operations	10
		Logical operations	3
		Relational expression	8
3	Application commands	Bit operation	3
		Shift/rotate	8
		Transfer	6
		Negation/Two's complement/Sign	6
		Conversion	5
		Application: Square root, bit count, swap, FIFO, unit, distribute, I/O conversion	9
4	Control commands	END, JMP, CAL, FOR, NEXT, RTS, RTI, LBL, SB, INT, CEND, CJMP	12
5	High-function module transfer commands	TRNS0, RECV0, TRNS7, RECV7, TRNS8	5*
6	FUN commands	Process stepping, trigonometry, comment, PID and others	71*

\* The number of commands that can be used is different depending on the CPU module type.

Caution:

For the EH-150, the WR internal output area differs depending on the type of CPU module.

EH-CPU104: WR000 to WRFFF

EH-CPU208: WR000 to WR1FFF

EH-CPU308: WR000 to WR43FF

EH-CPU316: WR000 to WR57FF

EH-CPU448: WR000 to WRC3FF

Exercise caution when programming.

## 5.2 List of Commands

### [Legend]

#### Condition code

- DER Data error (special internal output R7F4)  
Set to “1” as an error when the I/O number is exceeded or when the BCD was abnormally, etc. When there is no data error, it is set to “0.”
- ERR Error (special internal output R7F3)  
Set to “1” when an error is generated when a control command and a special command are executed. The error code is set in WRF015. When there are no errors, the prior condition is maintained.
- SD Shift data (special internal output R7F2)  
Performs shift-in of the contents of SD by SHR or SHL command.
- V Over flow (special internal output R7F1)  
Indicates that a digit overflow has occurred and the signed data range is exceeded as a result of signed data operations.
- C Carry (special internal output R7F0)  
Indicates the contents of digit increase due to addition, digit decrease due to subtraction, and shift-out due to shifting.
- Maintains the prior status.
- 1] Set to “1” when there is an error in operation results. Prior status is maintained if there is no error.
- ↑ Changes according to the operation result.

#### Processing time

This indicates the command processing time (average value) of the EH-CPU448. Since the processing time of some commands changes depending on the parameter setting and the number of data, refer to the details of the command specifications.

## 1. Basic commands (sequence commands)

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Sequence command	1		LD	Logical operation start	Indicates the commencement of a-contact operation.	X, Y R000 to R7FF L0000 to L3FFF L10000 to L13FFF M0000 to M3FFF TD, SS, WDT, MS, TMR, CU, RCU, CT Timer: 0 to 255 Counter: 0 to 511 DIF0 to DIF511 DFN0 to DFN511	●	●	●	●	●	0.1	1	
	2		LDI	Logical negation operation start	Indicates the commencement of b-contact operation.									
	3		AND	Logical AND	Indicates a-contact series connection.							0.1		
	4		ANI	Logical NAND	Indicates b-contact series connection.									
	5		OR	Logical OR	Indicates a-contact parallel connection.		●	●	●	●	●	7.1	2	
	6		ORI	Logical NOR	Indicates b-contact parallel connection.									
	7		NOT	Logical NOT	Reverses all operation results up to that point.	None	●	●	●	●	●	0.2	2	
	8		AND DIF	Rising edge detection	Indicates detection of the input rise.	DIF0 to DIF511 (Decimal)	●	●	●	●	●	0.3	3	Number overlap not allowed
			OR DIF									7.3	4	
	9		AND DFN	Falling edge detection	Indicates detection of the input fall.	DFN0 to DFN511 (Decimal)	●	●	●	●	●	0.3	3	Number overlap not allowed
			OR DFN									7.3	4	
	10		OUT	Coil output	Indicates an output coil.	X, Y R000 to R7FF L0000 to L3FFF L10000 to L13FFF M0000 to M3FFF TD, SS, WDT, MS, TMR, CU, RCU, CTU, CTD, CL Timer: 0 to 255 Counter: 0 to 511	●	●	●	●	●	0.1	1	
	11		SET	Set coil output	Indicates a set output.	X, Y R000 to R7FF L0000 to L3FFF	●	●	●	●	●	0.1	1	
	12		RES	Reset coil output	Indicates a reset output.	L10000 to L13FFF M0000 to M3FFF								
	13		MCS	Set master control	Indicates a master control set operation.	MCS0 to MCS49	●	●	●	●	●	0.3	3	Number overlap allowed
	14		MCR	Reset master control	Indicates a master control reset operation.	MCR0 to MCR49	●	●	●	●	●	0.2	2	Number overlap allowed

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
Sequence command	15		MPS	Operation result push	Saves the operation result immediately prior.	None	●	●	●	●	●	—	0	
	16		MRD	Operation result read	Reads the saved operation result and continues operation.									
	17		MPP	Operation result pull	Reads the saved operation result, continues operation and clears the saved result.									
	18		ANB	Logical block series connection	Indicates series connection between two logical blocks.	None	●	●	●	●	●	—	0	
	19		ORB	Logical block parallel connection	Indicates parallel connection between two logical blocks.	None						7.0	1	
	20		[ ]	Processing box start and end	Indicates start and end of a process box.	None	●	●	●	●	●	0.3	3	
	21		( )	Relational box start and end	Indicates start and end of a comparison box.	None	●	●	●	●	●	—	0	

## 2. Basic commands (timer, counter)

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
Timer	22		OUT TD	On delay timer	Indicates an on delay timer operation.	TD0 to TD255 When 0.01 s, it is possible to use from 0 to 63.	●	●	●	●	●	26.4	5	Number overlap not allowed (Duplicate numbers allowed only for TM)
	23		OUT TM	Extended on delay timer	Indicates the operation of the extended on delay timer (only for the EH-CPU448).	TM0 to TM2047 Fixed to 0.01 s	●	●	●	●	●	15.4	5	
	24		OUT SS	Single shot	Indicates a single shot operation.	SS0 to SS255 When 0.01 s, it is possible to use from 0 to 63.	●	●	●	●	●	21.4	5	
	25		OUT MS	Mono stable timer	Indicates a mono stable timer operation.	MS0 to MS255 When 0.01 s, it is possible to use from 0 to 63.	●	●	●	●	●	21.4	5	
	26		OUT TMR	Integral timer	Indicates a integral timer operation.	TMR0 to TMR255 When 0.01 s, it is possible to use from 0 to 63.	●	●	●	●	●	21.4	5	
	27		OUT WDT	Watchdog timer	Indicates a watchdog timer operation.	WTD0 to WTD255 When 0.01 s, it is possible to use from 0 to 63.	●	●	●	●	●	27.6	7	
	28		OUT CU	Counter	Indicates a counter operation.	CU0 to CU511	●	●	●	●	●	13.4	5	
Counter	29		OUT RCU	Ring counter	Indicates a ring counter operation.	RCU0 to RCU511	●	●	●	●	●	13.4	5	
	30		OUT CTU	Up of up/down counter	Indicates an up operation of up-down counter.	CTU0 to CTU511	●	●	●	●	●	13.4	5	
	31		OUT CTD	Down of up/down counter	Indicates a down operation of up-down counter.	CTD0 to CTD511	●	●	●	●	●	12.2	3	
	32		OUT CL	Counter clear	Indicates a clear operation for CU, RCU, CTU, CTD and WDT.	CL0 to CL511	●	●	●	●	●	0.1	1	

## 3. Basic commands (relational box)

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
Relational box	33		LD (s1 == s2)	= Relational box	When s1 = s2: Continuity When s1 ≠ s2: Noncontinuity	[Word] WX, WY, WR, WL, WM, Timer · Counter [Double word] DX, DY, DR, DL, DM Constant	●	●	●	●	●	0.5	5	*1 *2 Upper case: W  Lower case: DW
			AND (s1 == s2)									18.4	6	
			OR (s1 == s2)									0.5	7	
												18.4	8	
												7.5		
												25.4		
	34		LD (s1 S== s2)	Signed = Relational box	When s1 = s2: Continuity When s1 ≠ s2: Noncontinuity s1 and s2 are compared as signed 32-bit binary.	DX, DY, DR, DL, DM Constant	●	●	●	●	●	18.4	5	
			AND (s1 S== s2)									18.4	6	
			OR (s1 S== s2)									18.4	7	
	35		LD (s1 <> s2)	<> Relational box	When s1 = s2: Noncontinuity When s1 ≠ s2: Continuity	[Word] WX, WY, WR, WL, WM, Timer · Counter [Double word] DX, DY, DR, DL, DM Constant	●	●	●	●	●	0.5	5	
			AND (s1 <> s2)									18.4	6	
			OR (s1 <> s2)									0.5	7	
												18.4	8	
												7.5		
												25.4		
	36		LD (s1 S<> s2)	Signed <> Relational box	When s1 = s2: Noncontinuity When s1 ≠ s2: Continuity s1 and s2 are compared as signed 32-bit binary.	DX, DY, DR, DL, DM Constant	●	●	●	●	●	18.4	5	
			AND (s1 S<> s2)									18.4	6	
			OR (s1 S<> s2)									25.4	7	

\*1 In the case of word, it requires five steps for LD (s1□s2) and AND (s1□s2), and six steps for OR (s1□s2).

\*2 In the case of double word, for LD (s1□s2) and AND (s1□s2), it requires five steps when the combination of s1 and s2 is I/O and I/O, six steps when the combination is either I/O and constant or constant and I/O, and seven steps when the combination is constant and constant. For OR (s1□s2), 1 step is added respectively.

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
Relational box	37		LD (s1 < s2)	< Relational box	When s1 < s2: Continuity When s1 ≥ s2: Noncontinuity	[Word] WX, WY, WR, WL, WM, Timer · Counter [Double word] DX, DY, DR, DL, DM  Constant	●	●	●	●	●	0.5	5	*1 *2 Upper case: W  Lower case: DW
			AND (s1 < s2)									19.4	6	
			OR (s1 < s2)									0.5	7	
												19.4	8	
												7.5		
												26.5		
	38		LD (s1 S< s2)	Signed < Relational box	When s1 < s2: Continuity When s1 ≥ s2: Noncontinuity s1 and s2 are compared as signed 32-bit binary.	DX, DY, DR, DL, DM  Constant	●	●	●	●	●	19.4	5	
			AND (s1 S< s2)									19.4	6	
			OR (s1 S< s2)									26.4	7	
	39		LD (s1 <= s2)	<= Relational box	When s1 ≤ s2: Continuity When s1 > s2: Noncontinuity	[Word] WX, WY, WR, WL, WM, Timer · Counter [Double word] DX, DY, DR, DL, DM  Constant	●	●	●	●	●	0.5	5	*1 *2 Upper case: W  Lower case: DW
			AND (s1 <= s2)									19.4	6	
			OR (s1 <= s2)									0.5	7	
												19.4	8	
												7.5		
												26.5		
	40		LD (s1 S<= s2)	Signed <= Relational box	When s1 ≤ s2: Continuity When s1 > s2: Noncontinuity s1 and s2 are compared as signed 32-bit binary.	DX, DY, DR, DL, DM  Constant	●	●	●	●	●	19.4	5	
			AND (s1 S<= s2)									19.4	6	
			OR (s1 S<= s2)									26.4	7	
	40												8	

\*1 In the case of word, it requires five steps for LD (s1□s2) and AND (s1□s2), and six steps for OR (s1□s2).

\*2 In the case of double word, for LD (s1□s2) and AND (s1□s2), it requires five steps when the combination of s1 and s2 is I/O and I/O, six steps when the combination is either I/O and constant or constant and I/O, and seven steps when the combination is constant and constant. For OR (s1□s2), 1 step is added respectively.

## 4. Arithmetic command

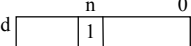
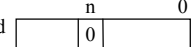
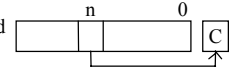
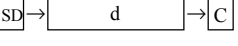
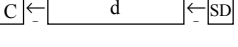
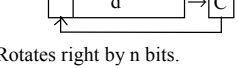
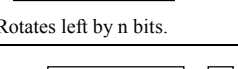
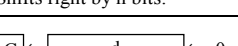
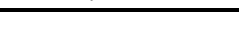
Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Substitution statement	1	d=s	Substitution statement	$d \leftarrow s$	[Bit] d: Y, R, L, M s: X, Y, R, L, M, Constant  [Word] d: WY, WR, WL, WM, Timer · Counter s: WX, WY, WR, WL, WM, Timer · Counter, Constant  [Double word] d: DY, DR, DL, DM s: DX, DY, DR, DL, DM, Constant * Array variables can be used.	$\updownarrow$	●	●	●	●	●	EH-150	3	I/O: I/O
												0.3	4	I/O: Array
												31	4	Array: I/O
												27	5	Array: Array
												43	5	Array: Array
							$\updownarrow$	●	●	●	●	0.3	3	I/O: I/O
												27	4	I/O: Array
												25	4	Array: I/O
												39	5	Array: Array
							$\updownarrow$	●	●	●	●	15	4	I/O: I/O
												29	4	I/O: Array
												27	5	Array: I/O
Mathematical operations	2	$d=s1+s2$	Binary addition	$d \leftarrow s1+s2$	[Word] d: WY, WR, WL, WM	●	●	●	$\updownarrow$	$\updownarrow$		0.4	4	Upper case: W
												22	6	Lower case: DW
	3	$d=s1 \text{ B}+s2$	BCD addition	$d \leftarrow s1+s2$	s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant	$\updownarrow$	●	●	●	$\updownarrow$		36	4	Upper case: W
												59	6	Lower case: DW
	4	$d=s1-s2$	Binary subtraction	$d \leftarrow s1-s2$	[Double word] d: DY, DR, DL, DM	●	●	●	$\updownarrow$	$\updownarrow$		0.4	4	Upper case: W
												20	6	Lower case: DW
	5	$d=s1 \text{ B}-s2$	BCD subtraction	$d \leftarrow s1-s2$	s1, s2: DX, DY, DR, DL, DM, Constant	$\updownarrow$	●	●	●	$\updownarrow$		34	4	Upper case: W
												54	6	Lower case: DW
	6	$d=s1 \times s2$	Binary multiplication	$d \leftarrow s1 \times s2$		$\updownarrow$	●	●	●	●		30	4	Upper case: W
												39	6	Lower case: DW
	7	$d=s1 \text{ B} \times s2$	BCD multiplication	$d \leftarrow s1 \times s2$		$\updownarrow$	●	●	●	●		63	4	Upper case: W
												132	6	Lower case: DW
	8	$d=s1 \text{ S} \times s2$	Signed binary multiplication	$d \leftarrow s1 \times s2$	[Double word] d: DY, DR, DL, DM s1, s2: DX, DY, DR, DL, DM, Constant	$\updownarrow$	●	●	●	●		42	6	
	9	$d=s1 / s2$	Binary division	[Word] $d \leftarrow s1 / s2$ $\text{WRF016} \leftarrow s1 \bmod s2$	[Word] d: WY, WR, WL, WM s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant	$\updownarrow$	●	●	●	●		28	4	Upper case: W
												32	6	Lower case: DW
	10	$d=s1 \text{ B} / s2$	BCD division	[Double word] $d \leftarrow s1 / s2$ $\text{DRF016} \leftarrow s1 \bmod s2$	[Double word] d: DY, DR, DL, DM s1, s2: DX, DY, DR, DL, DM, Constant							50	4	Upper case: W
												69	6	Lower case: DW
	11	$d=s1 \text{ S} / s2$	Signed binary division		[Double word] d: DY, DR, DL, DM s1, s2: DX, DY, DR, DL, DM, Constant	$\updownarrow$	●	●	$\updownarrow$	●		35	6	

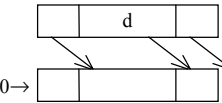
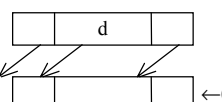


Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
Logical operations	12	d=s1 OR s2	Logical OR	$d \leftarrow s1 + s2$	[Bit] d: Y, R, L, M s1, s2: X, Y, R, L, M [Word] d: WY, WR, WL, WM, Constant	•	•	•	•	•	•	EH-150	4	Upper case: B
												0.4	4	Middle case: W
												18	6	Lower case: DW
	13	d=s1 AND s2	Logical AND	$d \leftarrow s1 \cdot s2$	Timer · Counter s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant [Double word]	•	•	•	•	•	•	0.4	4	Upper case: B
												0.4	4	Middle case: W
												18	6	Lower case: DW
	14	d=s1 XOR s2	Exclusive OR	$d \leftarrow s1 \oplus s2$	d: DY, DR, DL, DM s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	0.4	4	Upper case: B
												0.4	4	Middle case: W
												18	6	Lower case: DW
Relational expression	15	d=s1 == s2	= Relational expression	When s1 = s2, $d \leftarrow 1$ When s1 ≠ s2, $d \leftarrow 0$	[Word] d: Y, R, L, M s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant [Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	0.4	4	Upper case: W
												18	6	Lower case: DW
	16	d=s1 S== s2	Signed = Relational expression	When s1 = s2, $d \leftarrow 1$ When s1 ≠ s2, $d \leftarrow 0$ s1 and s2 are compared as signed 32-bit binary.	[Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	18	6	
	17	d=s1 <> s2	<> Relational expression	When s1 = s2, $d \leftarrow 0$ When s1 ≠ s2, $d \leftarrow 1$	[Word] d: Y, R, L, M s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant [Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	0.4	4	Upper case: W
												18	6	Lower case: DW
	18	d=s1 S<> s2	Signed <> Relational expression	When s1 = s2, $d \leftarrow 0$ When s1 ≠ s2, $d \leftarrow 1$ s1 and s2 are compared as signed 32-bit binary.	[Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	18	6	
	19	d=s1 < s2	< Relational expression	When s1 < s2, $d \leftarrow 1$ When s1 ≥ s2, $d \leftarrow 0$	[Word] d: Y, R, L, M s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant [Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	0.4	4	Upper case: W
												19	6	Lower case: DW
	20	d=s1 <= s2	Signed < Relational expression	When s1 = s2, $d \leftarrow 1$ When s1 ≠ s2, $d \leftarrow 0$ s1 and s2 are compared as signed 32-bit binary.	[Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	•	•	•	•	•	•	19	6	

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Relational expression	21	d=s1 <= s2		≤ Relational expression	When s1 ≤ s2, d ← 1 When s1 > s2, d ← 0	[Word] d: Y, R, L, M s1, s2: WX, WY, WR, WL, WM, Timer · Counter, Constant [Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant	●	●	●	●	●	0.4	4	Upper case: W
												19	6	Lower case: DW
	22	d=s1 S<= s2		Signed ≤ Relational expression	When s1 ≤ s2, d ← 1 When s1 > s2, d ← 0 s1 and s2 are compared as signed 32-bit binary.	[Double word] d: Y, R, L, M s1, s2: DX, DY, DR, DL, DM, Constant						19	6	

## 5. Application commands

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Bit operations	1	BSET(d, n)		Bit set	 Sets 1 to bit n.	[Word] d: WY, WR, WL, WM, TC n(0-15): WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	●	13	3	Upper case: W
												15		Lower case: DW
	2	BRES(d, n)		Bit reset	 Sets 0 to bit n.	n(0-15): WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	●	13	3	Upper case: W
Shift/rotate												15		Lower case: DW
	3	BTS(d, n)		Bit test	 Acquires the value in bit n to C (R7F0).	[Double word] d: DY, DR, DL, DM n(0-31): WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	↑	13	3	Upper case: W
												15		Lower case: DW
	4	SHR(d, n)		Shift right	 Shifts right by n bits.	[Word] d: WY, WR, WL, WM, TC	●	●	●	●	↑	17	3	Upper case: W
												18		Lower case: DW
	5	SHL(d, n)		Shift left	 Shifts left by n bits.	n: WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	↑	16	3	Upper case: W
												18		Lower case: DW
	6	ROR(d, n)		Rotate right	 Rotates right by n bits.	[Double word] d: DY, DR, DL, DM n: WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	↑	21	3	Upper case: W
												22		Lower case: DW
	7	ROL(d, n)		Rotate left	 Rotates left by n bits.	*C: R7F0 SD: R7F2	●	●	●	●	↑	21	3	Upper case: W
												22		Lower case: DW
	8	LSR(d, n)		Logical shift right	 Shifts right by n bits.		●	●	●	●	↑	16	3	Upper case: W
												18		Lower case: DW
	9	LSL(d, n)		Logical shift left	 Shifts left by n bits.		●	●	●	●	↑	16	3	Upper case: W
												18		Lower case: DW

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Shift/rotate	10	BSR(d, n)		BCD shift right	 <p>Shifts BCD to right by n digits.</p>	[Word] d: WY, WR, WL, WM, TC n: WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	●	15	3	Upper case: W
												17		Lower case: DW
	11	BSL(d, n)		BCD shift left	 <p>Shifts BCD to left by n digits.</p>	[Double word] d: DY, DR, DL, DM n: WX, WY, WR, WL, WM, TC, constant	●	●	●	●	●	15	3	Upper case: W
												17		Lower case: DW
Transfer	12	WSHR(d, n)		Batch shift right	Shifts n bits (or words) starting with I/O number d to the right by 1 bit (or word).	[Bit] d: R, L, M n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	31	3	*3 Upper case: B
												24		Lower case: W
	13	WSHL(d, n)		Batch shift left	Shifts n bits (or words) starting with I/O number d to the left by 1 bit (or word).	[Word] d: WR, WL, WM n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	31	3	*3 Upper case: B
												25		Lower case: W
	14	WBSR(d, n)		Batch BCD shift right	Shifts n digits of BCD starting with I/O number d to the right by 1 digit.	[Word] d: WR, WL, WM n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	25	3	*3
	15	WBSL(d, n)		Batch BCD shift left	Shifts n digits of BCD starting with I/O number d to the left by 1 digit.	[Word] d: WR, WL, WM n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	25	3	*3
	16	MOV(d, s, n)		Block transfer	Transfers (copies) n bits (or words) of data starting with I/O number s, to the n bit (or word) range starting with I/O number d.	[Bit] d, s: R, L, M n(0-255): WX, WY, WR, WL, WM, TC, Constant [Word] d, s: WR, WL, WM n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	87	4	*3 Upper case: B
												83		Lower case: W
	17	COPY(d, s, n)		Copy	Copies the bit (or word) data of I/O number s to the n bit (or word) range starting with I/O number d.	[Bit] d: R, L, M s: X, Y, R, L, M, Constant n(0-255): WX, WY, WR, WL, WM, TC, Constant [Word] d: WR, WL, WM s, n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	43	4	*3 Upper case: B
												93		Lower case: W
Negation / Two's complement / Sign	18	XCG(d1, d2, n)		Block exchange	Exchanges the n bit (or word) range starting with I/O number d1 and the n bit (or word) range starting with I/O number d2.	[Bit] d1, d2: R, L, M n(0-255): WX, WY, WR, WL, WM, TC, Constant [Word] d: WR, WL, WM n(0-255): WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	47	4	*3 Upper case: B
												42		Lower case: W

\*3 Processing time when n=1.

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Negation / Two's complement / Sign	19	NOT(d)	Reverse	Reverses the bit for the I/O number d value.	[Bit] Y, R, L, M [Word] WY, WR, WL, WM [Double word] DY, DR, DL, DM	●	●	●	●	●	13	2	Upper case: B	
	11										Middle case: W			
	13										Lower case: DW			
	20	NEG(d)	Two's complement	Stores two's complement of the value stored in I/O number d, in d.	[Word] WY, WR, WL, WM [Double word] DY, DR, DL, DM	●	●	●	●	●	12	2	Upper case: W	
	14										Lower case: DW			
	21	ABS(d, s)	Absolute value	Stores the absolute value of s in d, and the sign value of s in carry (R7F0). (0: Positive, 1: Negative)	[Word] d: WY, WR, WL, WM s: WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	↑	13	3	Upper case: W	
	16										4		Lower case: DW	
	22	SGET(d, s)	Sign addition	If the value of carry (R7F0) is 0, the value is stored in d, and if it is 1, two's complement of the s is stored in d.	[Double word] d: DY, DR, DL, DM s: DX, DY, DR, DL, DM, Constant	●	●	●	●	●	13	3	Upper case: W	
	16										4		Lower case: DW	
	23	EXT(d, s)	Sign expansion	Copies the sign bit value of s to all bits in the upper word of d, and stores the value of s in the lower word of d.	d: DY, DR, DL, DM s: WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	●	15	3		
Conversion	24	BCD(d, s)	Binary → BCD conversion	Converts the value of s into BCD and stores it in I/O number d. If there the value of s is erroneous, DER (R7F4) = 1 is set.	[Word] d: WY, WR, WL, WM s: WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	28	3	Upper case: W	
	31										4		Lower case: DW	
	25	BIN(d, s)	BCD → Binary conversion	Converts the value of s into binary and stores it in I/O number d. If there the value of s is erroneous, DER (R7F4) = 1 is set.	[Double word] d: DY, DR, DL, DM s: DX, DY, DR, DL, DM, Constant	↑	●	●	●	●	19	3	Upper case: W	
	27										4		Lower case: DW	
	26	DECO(d, s, n)	Decode	Decodes the value indicated by the least significant n bits of s, and sets the bit that corresponds to the decoding result of the bit row starting from I/O number d, to 1.	d: R, L, M s: WX, WY, WR, WL, WM, TC, Constant n: Constant(1-8)	↑	●	●	●	●	38	4	*3	
27	ENCO(d, s, n)	Encode	Encodes the bit location in which 1 is set within the bit row, which starts with I/O number s and lasts for the amount of nth power of 2, and stores it in I/O number d. If multiple bits that contain 1 exist, the one with the upper bit locations will be encoded.	d: WY, WR, WL, WM s: R, L, M n: Constant(1-8)	↑	●	●	●	↑	38	4	*3		
28	SEG(d, s)	7 segment decode	Coverts the value of s as a 1-digit 4-bit value to a 4-digit 7-segment display code and stores it in d.	d: DY, DR, DL, DM s: WX, WY, WR, WL, WM, TC, Constant	●	●	●	●	●	16	3			

\*3 Processing time when n=1.

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Application commands	29	SQR(d, s)		Square root	Calculates the square root of the value of s (8-digit BCD) and stores it in d (4-digit BCD).	d: WY, WR, WL, WM s: DX, DY, DR, DL, DM, Constant	↑	●	●	●	●	86	4	
	30	BCU(d, s)		Bit count	Among the contents of s (word, double-word), stores the number of bits that are set to 1 in I/O number d.	[Word] d: WY, WR, WL, WM s: WX, WY, WR, WL, WM, TC, Constant [Double word] d: WY, WR, WL, WM s: DX, DY, DR, DL, DM, Constant	●	●	●	●	●	14	3	Upper case: W
												17	4	Lower case: DW
	31	SWAP(d)		Swap	Swaps the upper 8 bits and the lower 8 bits of the value (word) for I/O number d.	d: WY, WR, WL, WM	●	●	●	●	●	12	2	
	32	FIFIT(P, n)		FIFO initialization	Stores the value of n in the FIFO size area (P) and stores 0 in the FIFO used number area (P+1).	P: WR, WL, WM n: Constant(0-255)	↑	●	●	●	●	24	3	
	33	FIFWR(P, s)		FIFO write	Stores the value of I/O number s in the FIFO write location and adds 1 to the FIFO used number area (P+1).	P: WR, WL, WM s: WX, WY, WR, WL, WM, TC, Constant	↑	●	●	●	●	25	3	
	34	FIFRD(P, d)		FIFO read	Reads data from the FIFO read location and stores it in d, then shifts the data in the FIFO by one data item and subtracts 1 from the value of the FIFO usage number area (P+1).	P: WR, WL, WM d: WY, WR, WL, WM, TC	↑	●	●	●	●	157	3	*4
	35	UNIT(d, s, n)		Unit	Stores the lower 4 bit values of the n words starting with s in the lower 4 bits each of d (word).	d: WY, WR, WL, WM s: WR, WL, WM n: Constant(0-4)	↑	●	●	●	●	30	4	
	36	DIST(d, s, n)		Distribute	Extracts the value of s (word) in 4 bit units starting with the least significant bits, and sets them in the lower 4 bits of each word starting with I/O number d (word). The upper bits are set to 0.	d: WR, WL, WM s: WX, WY, WR, WL, WM, TC, Constant n: Constant(0-4)	↑	●	●	●	●	27	4	
	37	ADRIO(d, s)		I/O address conversion	Stores the actual address of the I/O designated by s in d.	[Bit] s: X, Y, R, L, M d: WY, WR, WL, WM [Word] s: WX, WY, WR, WL, WM d: WY, WR, WL, WM	●	●	●	●	●	12	3	

\*4 Processing time when FIFO size is n=1.

## 6. Control commands

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
Control commands	1	END		Normal scan end	Indicates the end of a normal scan and re-executes normal scan from the head of the normal scan.	None	●	●	●	●	●	194	1	
	2	CEND(s)	Scan conditional end	Re-executes normal scan from the head of the normal scan when s=1, while the next command is executed when s=0.	s: X, Y, R, L, M	●	●	●	●	●	●	6	2	*5
												196		*6
	3	JMP n		Unconditional jump	Jumps to LBL n of the same No. n.	n: Constant(0-255)	●	1]	●	●	●	21	2	
	4	CJMP n (s)	Conditional jump	When s=1, jumps to the LBL n of the same No. n when s=0, executes the next command.	n: Constant(0-255) s: X, Y, R, L, M	●	1]	●	●	●	●	6	3	*5
												22		*6
	5	LBL n		Label	Indicates the jump destination of JMP or CJMP of the same No. n.	n: Constant(0-255)	●	●	●	●	●	0.1	1	
	6	FOR n (s)		FOR	When s=0, jumps to the location after the NEXT n of the same No. n when s is not 0, executes the next command.	n: Constant(0-49) s: WY, WR, WL, WM	●	1]	●	●	●	29	3	
	7	NEXT n		NEXT	Subtracts 1 from the s value of the FOR n of the same No. and jumps to FOR n.	n: Constant(0-49)	●	1]	●	●	●	23	2	
	8	CAL n		Call subroutine	Executes the SB n subroutine of the same No. n.	n: Constant(0-99)	●	1]	●	●	●	19	2	
	9	SB n		Start subroutine	Indicates the start of No. n subroutine.	n: Constant(0-99)	●	●	●	●	●	0.1	1	
	10	RTS		RETURN SUBROUTIN	Returns from subroutine.	None	●	●	●	●	●	17	1	
	11	INT n		Start interrupt scan	Indicates the start of No. n interrupt scan.	n: Constant(0-2)	●	●	●	●	●	0.1	1	
	12	RTI		RETURN INTERRUPT	Returns from interrupt scan.	None	●	●	●	●	●	8	1	

\*5 When conditions are not met.

\*6 When conditions are met.

## 7. High-function module transfer commands

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
High-function module transfer commands	1	TRNS 0 (d, s, t)		General-purpose port transmission command	Transmits data from the CPU's general-purpose port.	t: R, L, M d: WY(Dummy I/O) s: WR, WL, WM	↑	●	●	●	●	61	5	
	2	RECV 0 (d, s, t)		General-purpose port receiving command	Receives data at the CPU's general-purpose port.	t: R, L, M d: WX(Dummy I/O) s: WR, WL, WM	↑	●	●	●	●	61	5	

## High-function module transfer commands (additional commands for the EH-CPU448)

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
High-function module transfer commands	3	TRNS 7 (d, s, t)		ID reader transmission command	Sends data to the ID reader module with the CPU's ladder program.	t: R, L, M d: WY(Dummy I/O) s: WR, WL, WM	↑	●	●	●	●	63	5	
	4	RECV 7 (d, s, t)		ID reader reception command	Receives data from the ID reader module with the CPU's ladder program.	t: R, L, M d: WY(Dummy I/O) s: WR, WL, WM	↑	●	●	●	●	62	5	
	5	TRNS 8 (d, s, t)		Telecommunication command	Controls the modem with the CPU's ladder program.	t: R, L, M d: WY(Dummy I/O) s: WR, WL, WM	↑	●	●	●	●	128	5	*7

\*7 Also supported by the EH-CPU308T/316T.

## 8. FUN commands

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
FUN commands	1	FUN 0 (s) (PIDIT (s))		PID operation initialization	Initializes the area for PID operation.	s: WR	●	●	●	●	●	1,661	3	Number of loops = 1 *8
	2	FUN 1 (s) (PIDOP (s))		PID operation execution control	Performs control for PID operation execution.		●	●	●	●	●	83	3	*8
	3	FUN 2 (s) (PIDCL (s))		PID operation calculation	Executes PID operation.		●	●	●	●	●	87	3	Number of loops = 1 *8
	4	FUN 4 (s) (IFR (s))		Process stepping	Performs the process stepping processing.	s: WR,WL,WM	↑	●	●	●	●	208	3	
	5	FUN 10 (s) (SIN (s))		SIN function	Calculates the SIN of the value designated by s and stores the result in s+1, s+2.		↑	●	●	●	●	39	3	
	6	FUN 11 (s) (COS (s))		COS function	Calculates the COS of the value designated by s and stores the result in s+1, s+2.		↑	●	●	●	●	40	3	
	7	FUN 12 (s) (TAN (s))		TAN function	Calculates the TAN of the value designated by s and stores the result in s+1, s+2.		↑	●	●	●	●	40	3	
	8	FUN 13 (s) (ASIN (s))		ARC SIN function	Calculates the ARC SIN of the value designated by s (fractional portion) and s+1 (integer portion), and stores the result in s+2.		↑	●	●	●	●	62	3	
	9	FUN 14 (s) (ACOS (s))		ARC COS function	Calculates the ARC COS of the value designated by s (fractional portion) and s+1 (integer portion), and stores the results in s+2.		↑	●	●	●	●	63	3	
	10	FUN 15 (s) (ATAN (s))		ARC TAN function	Calculates the ARC TAN of the value designated by s (fractional portion) and s+1 (integer portion), and stores the results in s+2.		↑	●	●	●	●	41	3	
	33	FUN 80 (s) (ALREF (s))		I/O refresh (all points)	Refreshes all external I/O ranges.		↑	●	●	●	●	69	3	
	34	FUN 81 (s) (IOREF (s))		I/O refresh (I/O /link designation)	Refreshes only the input range, output range or link range.		↑	●	●	●	●	44	3	
	35	FUN 82 (s) (SLREF (s))		I/O refresh (any slot)	Refreshes the I/O at the designated slot.		↑	●	●	●	●	80	3	
	36	FUN 100 (s) (INTW (s))		Floating point operation (Real number to integer)	Real number to integer (Word) conversion.		↑	●	●	●	●	57	3	*8
	37	FUN 101 (s) (INTD (s))		Floating point operation (Real number to integer)	Real number to integer (Double word) conversion.		↑	●	●	●	●	69	3	*8
	38	FUN 102 (s) (FLOAT (s))		Floating point operation (Integer to real number)	Integer (Word) to real number conversion.		↑	●	●	●	●	43	3	*8
	39	FUN 103 (s) (FLOATD (s))		Floating point operation (Integer to real number)	Integer (Double word) to real number conversion.		↑	●	●	●	●	47	3	*8
	40	FUN 104 (s) (FADD (s))		Floating point operation (addition)	The addition of the real number.		↑	●	●	●	●	70	3	*8
	41	FUN 105 (s) (FSUB (s))		Floating point operation (subtraction)	The subtraction of the real number.		↑	●	●	●	●	70	3	*8
	42	FUN 106 (s) (FMUL (s))		Floating point operation (multiplication)	The multiplication of the real number.		↑	●	●	●	●	69	3	*8

\*8: These commands are supported by the EH-CPU308, 316 and 448.



Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C	EH-150		
FUN commands	43	FUN 107 (s)		Floating point operation (division)	The division of the real number.	s: WR,WL,WM	↑↓	●	●	●	●	119	3	*8
	44	FUN 108 (s)		Floating point operation (radian conversion)	Angle to radian conversion.		↑↓	●	●	●	●	63	3	*8
	45	FUN 109 (s)		Floating point operation (angle conversion)	Radian to angle conversion.		↑↓	●	●	●	●	63	3	*8
	46	FUN 110 (s)		Floating point operation (calculate the SIN)	Calculates the SIN of the floating point number.		↑↓	●	●	●	●	282	3	*8
	47	FUN 111 (s)		Floating point operation (calculate the COS)	Calculates the COS of the floating point number.		↑↓	●	●	●	●	303	3	*8
	48	FUN 112 (s)		Floating point operation (calculate the TAN)	Calculates the TAN of the floating point number.		↑↓	●	●	●	●	343	3	*8
	49	FUN 113 (s)		Floating point operation (calculate the ARC SIN)	Calculates the ARC SIN of the floating point number.		↑↓	●	●	●	●	200	3	*8
	50	FUN 114 (s)		Floating point operation (calculate the ARC COS)	Calculates the ARC COS of the floating point number.		↑↓	●	●	●	●	192	3	*8
	51	FUN 115 (s)		Floating point operation (calculate the ARC TAN)	Calculates the ARC TAN of the floating point number.		↑↓	●	●	●	●	394	3	*8
	52	FUN 116 (s)		Floating point operation (calculate the square root)	Calculates the square root of the floating point number.		↑↓	●	●	●	●	481	3	*8
	53	FUN 117 (s)		Floating point operation (calculate the exponent)	Calculates the exponent of the floating point number.		↑↓	●	●	●	●	329	3	*8
	54	FUN 118 (s)		Floating point operation (logarithm)	Calculates the logarithm of the floating point number.		↑↓	●	●	●	●	187	3	*8
	58	FUN 123 (s)		Increment (Word I/O)	Add 1 to the number specified with word I/O.		●	●	●	●	●	29	3	*8
	59	FUN 124 (s)		Increment (Double word I/O)	Add 1 to the number specified with double word I/O.		↑↓	●	●	●	●	42	3	*8
	60	FUN 125 (s)		Decrement (Word I/O)	Subtract 1 from the number specified with word I/O.		●	●	●	●	●	30	3	*8
	61	FUN 126 (s)		Decrement (Double word I/O)	Subtract 1 from the number specified with double word I/O.		↑↓	●	●	●	●	42	3	*8
	66	FUN 210 (s)		Data logging initialization setting	Initializes the data logging function.		↑↓	●	●	●	●	1,728	3	*8
	67	FUN 211 (s)		Log data write	Writes the data to the memory board.		↑↓	●	●	●	●	645	3	*8
	68	FUN 212 (s)		Log data clear	Clears the log data in the memory board.		↑↓	●	●	●	●	164	3	*8
	69	FUN 213 (s)		Log data read	Reads the log data to the specified I/O area.		↑↓	●	●	●	●	268	3	*8
	70	FUN 254 (s)		BOX comment	Nothing is processed in the CPU.		●	●	●	●	●	0.3	3	
	71	FUN 255 (s)		Memo comment	Nothing is processed in the CPU.		●	●	●	●	●	0.3	3	

\*8: These commands are supported by the EH-CPU308, 316 and 448.

## FUN commands (additional commands for the EH-CPU448) (1/2)

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μs)	Step	Remarks
							DER	ERR	SD	V	C			
FUN commands	11	FUN 30 (s) (BINDA (s))		BIN → ASCII conversion (16 bits)	Converts 16-bit unsigned binary data to a decimal ASCII code, then stores it.	s: WR,WL,WM	↑	●	●	●	●	140	3	
	12	FUN 31 (s) (DBINDA (s))		BIN → ASCII conversion (32 bits)	Converts 32-bit unsigned binary data to a decimal ASCII code, then stores it.		↑	●	●	●	●	199	3	
	13	FUN 32 (s) (BINHA (s))		BIN → ASCII conversion (16 bits)	Converts 16-bit unsigned binary data to an ASCII code, then stores it.		↑	●	●	●	●	124	3	
	14	FUN 33 (s) (DBINHA (s))		BIN → ASCII conversion (32 bits)	Converts 32-bit unsigned binary data to an ASCII code, then stores it.		↑	●	●	●	●	168	3	
	15	FUN 34 (s) (BCDDA (s))		BIN → ASCII conversion (16 bits)	Converts 16-bit BCD (BCD 4-digit) data to an ASCII code, then stores it.		↑	●	●	●	●	112	3	
	16	FUN35 (s) (DBCDDA (s))		BIN → ASCII conversion (32 bits)	Converts 32-bit BCD (BCD 8-digit) data to an ASCII code, then stores it.		↑	●	●	●	●	171	3	
	17	FUN 36 (s) (DABIN (s))		ASCII → BIN conversion (16 bits)	Converts unsigned BCD 5-digit data to an ASCII code, then stores it.		↑	●	●	●	●	60	3	
	18	FUN 37 (s) (DDABIN (s))		ASCII → BIN conversion (32 bits)	Converts signed BCD 10-digit data to an ASCII code, then stores it.		↑	●	●	●	●	97	3	
	19	FUN 38 (s) (HABIN (s))		ASCII → BIN conversion (16 bits)	Converts a 4-digit hexadecimal ASCII code to 16-bit binary data, then stores it.		↑	●	●	●	●	63	3	
	20	FUN 39 (s) (DHABIN (s))		ASCII → BIN conversion (32 bits)	Converts a 8-digit hexadecimal ASCII code to 32-bit binary data, then stores it.		↑	●	●	●	●	94	3	
	21	FUN 40 (s) (DABCD (s))		ASCII → BIN conversion (16 bits)	Converts a 4-digit ASCII code to 4-digit BCD data, then stores it.		↑	●	●	●	●	64	3	
	22	FUN 41 (s) (DDABCD (s))		ASCII → BIN conversion (32 bits)	Converts a 8-digit ASCII code to 8-digit BCD data, then stores it.		↑	●	●	●	●	93	3	
	23	FUN 42 (s) (ASC (s))		BIN → ASCII conversion (designated)	Converts binary data to an ASCII code of the designated number of characters, then stores it.		↑	●	●	●	●	119	3	
	24	FUN 43 (s) (HEX (s))		ASCII → BIN conversion (designated)	Converts an ASCII code of the designated number of characters to binary data, then stores it.		↑	●	●	●	●	191	3	
	25	FUN 44 (s) (SADD (s))		Merge character strings	Merges the designated character strings (up to NULL), then stores it in the I/O at the designated position.		↑	●	●	●	●	196	3	
	26	FUN 45 (s) (SCMP (s))		Compare character strings	Compares the designated character strings (up to NULL), then stores the comparison result.		↑	●	●	●	●	157	3	
	27	FUN 46 (s) (WTOB (s))		Word → byte conversion	Divides 16-bit word data, converts it to 8-bit byte data, then stores it.		↑	●	●	●	●	115	3	
	28	FUN 47 (s) (BTOW (s))		Byte → word conversion	Divides 8-bit byte data, merges it into 16-bit word data, then stores it.		↑	●	●	●	●	109	3	

## FUN commands (additional commands for the EH-CPU448) (2/2)

Classification	Item number	Ladder symbol	Command symbol	Command name	Process descriptions	I/O types used	R7F4	R7F3	R7F2	R7F1	R7F0	Process time (μ s)	Step	Remarks
							DER	ERR	SD	V	C			
FUN commands	29	FUN 48 (s) (BSHR (s))		Right-shift byte unit	Shifts the designated data string to the right for the number of the designated bytes (8 bits*n).	s: WR,WL,WM	↑	●	●	●	●	81	3	
	30	FUN 49 (s) (BSHL (s))		Left-shift byte unit	Shifts the designated data string to the left for the number of the designated bytes (8 bits*n).		↑	●	●	●	●	85	3	
	31	FUN 60 (s)		Binary square root	Calculates the square root of a 32-byte binary value.		↑	●	●	●	●	453	3	
	32	FUN 61 (s)		Dynamic scan pulse	Repeats on and off operations for the number of the designated scans.	s: WR,WL,WM (s+2: R, L, M)	↑	●	●	●	●	73	3	
	55	FUN 120 (s) (INDXD (s))		Index setting (argument d)	Sets the argument used as an index in respect to argument d of the MOV and COPY commands.	s: WR,WL,WM	●	●	●	●	●	18	3	
	56	FUN 121 (s) (INDXS (s))		Index setting (argument s)	Sets the argument used as an index in respect to argument s of the MOV and COPY commands.		●	●	●	●	●	18	3	
	57	FUN 122 (s) (INDXC (s))		Index cancel	Cancels the index specification that is set for argument d or s of the MOV and COPY commands.		↑	●	●	●	●	18	3	
	62	FUN 127 (s) (BITTOW (s))		Expand bit data to word data	Sets the data equivalent to the number of bits starting from the specified I/O number in the word I/O number.		↑	●	●	●	●	139	3	
	63	FUN 128 (s) (WTOBIT (s))		Compress word data to bit data	Sets the data equivalent to the number of bits starting from the specified I/O number in the bit I/O number.		↑	●	●	●	●	145	3	
	64	FUN 200 (s) (XYR/W (s))		X/Y area read/write command	Command for reading and writing data using the X and Y areas.		↑	●	●	●	●	65	3	
	65	FUN 201 (s) (SCR/W (s))		Status control read/write command	Command for reading and writing data in the status control area.		↑	●	●	●	●	66	3	

### 5.3 Command Specification Details

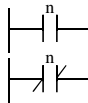


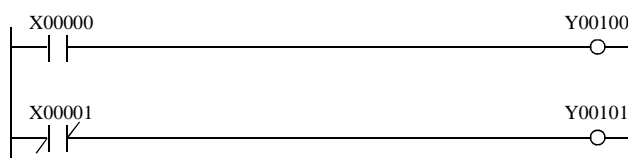
(1) Basic commands	
(2) Arithmetic commands	
(3) Application commands	
(4) Control commands	
(5) High-function module transfer commands	
(6) FUN commands	

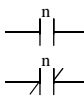


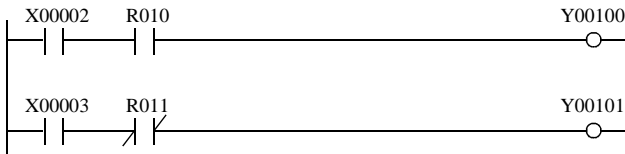
The classification of the processing time column in each command table is shown in the table below:

Description in the table	Classification
EH-CPU448	EH-CPU448
EH-CPU3**	EH-CPU308/316 of ROM Ver. 04 or later
Other than left	EH-CPU104/208, and EH-CPU308/316 of ROM Ver. 03 or earlier




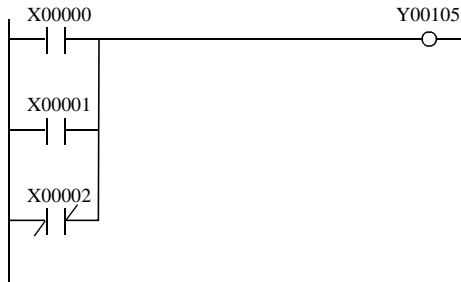
Depending on the CPU model, all of the commands may not be supported. For the commands that are supported by each CPU, see the explanation of each command or Appendix 2, “H-series Command Support Comparison Chart”.

LD  
LDI

Item number		Basic commands-1, 2				Name		Logical operation start (LD, LDI)													
Ladder format				Condition code						Processing time (μs)						Remark					
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: LD Lower case: LDI						
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				●	●	●	●	●													
Command format				Number of steps						0.1		←		1.1		←		1.3		1.5	
LD    n				Condition			Steps							1.5		←					
LDI   n				—			1														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
n	I/O number			○	○	○	○														
Function																					
				Starts the a-contact logical operation. Enters the continuity state when input is on.																	
				Starts the b-contact logical operation. Enters the continuity state when input is off.																	
Cautionary notes				● L and WL become the internal output when link modules are not used.																	
Program example																					
				<div><div>LD    X00000 OUT   Y00100</div><div>LDI   X00001 OUT   Y00101</div></div>																	
Program description				● When input X00000 is on, output Y00100 is on; when off, the output is off. ● When input X00001 is off, output Y00101 is on; when on, the output is off.																	

Item number		Basic commands-3, 4				Name		Contact series connection (AND, ANI)									
Ladder format				Condition code						Processing time (μs)						Remark	
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: AND Lower case: ANI		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						0.1	←	1.05	←	1.0	1.2		
AND    n				Condition			Steps										
ANI    n				—			1					1.30	←				
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
n	I/O number			○	○	○	○										
Function																	
				Obtains AND of the previous operation result and the a-contact operation.													
				Obtains AND of the previous operation result and the b-contact operation.													
Cautionary notes				● L and WL become the internal output when link modules are not used.													
Program example																	
				<div>LD    X00002 AND   R010 OUT   Y00100</div> <div>LD    X00003 ANI    R011 OUT   Y00101</div>													
Program description				● When input X00002 and R010 are both on, output Y00100 is on and all others are off. ● When input X00003 is on and R011 is off, output Y00101 is on and all others are off.													

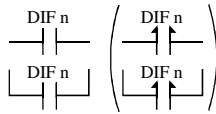
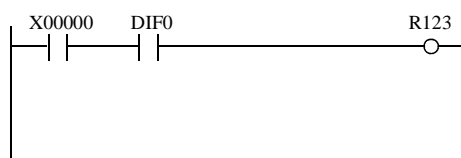
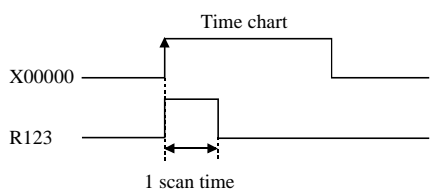
OR n  
ORI n

Item number		Basic commands-5, 6				Name		Contact parallel connection (OR, ORI)									
Ladder format				Condition code					Processing time (μs)						Remark		
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: OR Lower case: ORI		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps					7.1	←	1.15	←	1.3	1.5			
OR n				Condition			Steps										
ORI n				—			2				1.37	←					
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
n	I/O number			○	○	○	○										
Function																	
		Obtains OR of the previous operation result and the a-contact operation.															
		Obtains OR of the previous operation result and the b-contact operation.															
Cautionary notes																	
● L and WL become the internal output when link modules are not used.																	
Program example																	
		<div>LD X00000</div> <div>OR X00001</div> <div>ORI X00002</div> <div>OUT Y00105</div>															
Program description																	
● When X00000 is on, X00001 is on, or X00002 is off, the operation is 1 and Y00105 turns on.																	



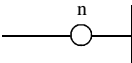
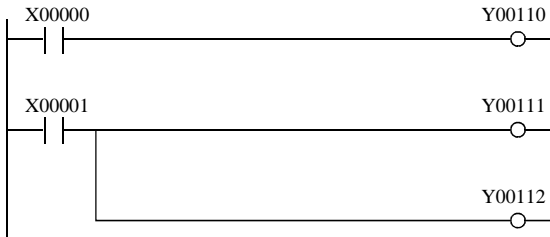


AND DIF n  
OR DIF n

Item number		Basic commands-8				Name				Rising edge detection (AND DIF, OR DIF)									
Ladder format						Condition code					Processing time (μs)						Remark		
						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: AND DIF Lower case: OR DIF		
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
						●	●	●	●	●									
Command format						Number of steps					0.3	←	3.05	←	2.7	2.9			
AND DIF n						Condition			Steps										
OR DIF n						AND DIF n			3										
						OR DIF n			4				3.1	←					
				Bit				Word				Double word			Constant	Other			
Usable I/O				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
n	Number															○	0 to 511 (Decimal)		
Function																			
<ul style="list-style-type: none"><li>Detects the rise of an input signal and retains the operation result for one scan.</li><li>( ) indicates the display when the LADDER EDITOR is used.</li></ul>																			
Cautionary notes																			
<ul style="list-style-type: none"><li>DIF number may not be overlapped. (However, no error is generated even if overlapped numbers are used.)</li><li>DIF cannot use the b contact.</li></ul>																			
Program example																			
						<pre>LD X00000 AND DIF0 OUT R123</pre>													
Program description																			
<p>Time chart</p>  <ul style="list-style-type: none"><li>Upon rising of X00000 on, R123 turns on for one scan.</li><li>If b-contact is used for X00000, operation will be the same as the a-contact DFN operation.</li></ul>																			

Item number	Basic commands-9				Name		Falling edge detection (AND DFN, OR DFN)									
Ladder format				Condition code					Processing time (μs)						Remark	
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: AND DFN Lower case: OR DFN	
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
				●	●	●	●	●								
Command format				Number of steps					0.3	←	3.05	←	2.7	2.9		
AND DFN n				Condition			Steps				3.10	←				
OR DFN n				AND DFN n			3									
				OR DFN n			4									
Usable I/O			Bit				Word			Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY				DR, DL, DM
n	Number												○	0 to 511 (Decimal)		
Function																
<ul style="list-style-type: none"><li>• Detects the fall of an input signal and retains the operation result for one scan. ( ) indicates the display when the LADDER EDITOR is used.</li></ul>																
Cautionary notes																
<ul style="list-style-type: none"><li>• DFN number may not be overlapped. (However, no error is generated even if overlapped numbers are used.)</li><li>• DFN cannot use the b contact.</li></ul>																
Program example																
				LD X00000 AND DFN0 OUT R124												
Program description																
<ul style="list-style-type: none"><li>• Upon a fall of X00000, R124 turns on for one scan.</li><li>• If b-contact is used for X00000, operation will be the same as the a-contact DIF operation.</li></ul>																

OUT n

Item number		Basic commands-10				Name		Coil output (OUT)													
Ladder format				Condition code						Processing time (μs)						Remark					
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				●	●	●	●	●													
Command format				Number of steps						0.1		←		1.04		←		1.0		1.7	
OUT n				Condition			Steps														
				—			1														
Usable I/O			Bit				Word				Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM								
n	I/O number				○	○	○														
Function																					
<ul style="list-style-type: none"><li>Switches on the coil when the operation result obtained up to that point is “1.”</li><li>Switches off the coil when the operation result obtained up to that point is “0.”</li></ul>																					
Cautionary notes																					
<ul style="list-style-type: none"><li>L and WL become the internal output when link modules are not used.</li></ul>																					
Program example																					
<div><div></div><div><div>LD X00000 OUT Y00110</div><div>LD X00001 OUT Y00111 OUT Y00112</div></div></div>																					
Program description																					
<ul style="list-style-type: none"><li>When input X00000 is on, the operation is “1” and Y00110 turns on.</li><li>When input X00001 is on, the operation is “1,” and Y00111 and Y00112 turn on.</li></ul>																					

Item number		Basic commands-11, 12				Name		Set/reset coil output (SET, RES)									
Ladder format				Condition code					Processing time (μs)						Remark		
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: SET Lower case: RES		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps					0.1	←	2.07	←	0.9	1.7			
SET n				Condition			Steps										
RES n				—			1				2.12	←					
Usable I/O			Bit				Word			Double word			Constant	Other			
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM		
n	I/O number			○	○												
Function																	
		Switches on the device when the operation result obtained up to that point is “1.” The device that is switched on will not be switched off even if the operation result is “0.”															
		Switches off the device when the operation result obtained up to that point is “1.” ( ) indicates the display when the LADDER EDITOR is used.															
Cautionary notes																	
<ul style="list-style-type: none"><li>When a set/reset coil is used on a multi layer coil, it must be set to the highest level or an arbitrary coil must be entered immediately before the set/reset coil.</li></ul>																	
Example of OK																	
Example of NG																	
Program example																	
		<pre>LD X00000 SET R100 LD X00001 RES R100</pre>															
Program description																	
<ul style="list-style-type: none"><li>When input X00000 turns on, output R100 turns on. Even if X00000 turns off, R100 remains on.</li><li>When input X00001 turns on, output R100 turns off.</li><li>When input X00000 and X00001 both turn on, the one executed later than the other in the program takes priority.</li></ul>																	

MCS n  
MCR n

Item number		Basic commands-13, 14				Name		Set (start)/reset (cancel) master control (MCS, MCR)									
Ladder format				Condition code					Processing time (μs)						Remark		
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: MCS Lower case: MCR		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps					0.3	←	3.05	←	2.3	←			
<div>MCS n</div> <div>MCR n</div>				Condition			Steps		0.2	←	2.15	←	1.6	←			
				MCS n			3										
				MCR n			2										
Usable I/O				Bit				Word			Double word			Constant	Other		
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
n	Number													○	0 to 49 (Decimal)		
Function																	
		<ul style="list-style-type: none"><li>Controls the input to the ladder sandwiched by the master control set (MCS n) and reset (MCR n). (An AND operation is performed with respect to each input and MCS.)</li><li>The master control can be used up to eight layers. ( ) indicates the display when the LADDER EDITOR is used.</li></ul>															
Cautionary notes																	
		<ul style="list-style-type: none"><li>Always use the master control MCS and MCR in pairs.</li></ul>															
Program example																	
		<div><div></div><div><pre>LD X00000 MCS1 LD X00001 OUT Y00100 MCR1</pre></div><div></div><div>← Up to eight layers are allowed.</div></div>															
Program description																	
		<div></div> <ul style="list-style-type: none"><li>When input X00000 is on, the ladders surrounded by MCS and MCR obeys input X00001, and output Y00100 turns on/off.</li><li>When input X00000 is off, the ladders surrounded by MCS and MCR are independent of input X00001, and output Y00100 turns off.</li></ul>															

MPS  
MRD  
MPP

Save  
Read  
Clear

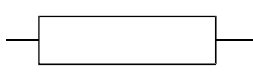
Item number	Basic commands-15, 16, 17					Name	Save/read/clear operation result (Branching of ladder)									
Ladder format			Condition code					Processing time (μs)						Remark		
<div><div></div><div>Save</div><div>Read</div><div>Clear</div></div>	R7F4		R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left					
	DER		ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max				
	●		●	●	●	●										
Command format			Number of steps					—	—	—	—	—	—			
MPS Save		Condition			Steps											
MRD Read		—			0											
MPP Clear																
Usable I/O		Bit				Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
Function																
		<div><div><div>X00100</div><div>R001</div><div>R002</div><div>R003</div><div>R004</div></div><div><div>Y00001</div><div>Y00002</div><div>Y00003</div><div>Y00004</div></div></div> <div><div>LD X00100</div><div>MPS</div><div>AND R001</div><div>MPS</div><div>OUT Y00001</div><div>MPP</div><div>AND R002</div><div>OUT Y00002</div><div>MRD</div><div>AND R003</div><div>OUT Y00003</div><div>MPP</div><div>AND R004</div><div>OUT Y00004</div></div>														
		<div><div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div></div> 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ANB

Item number		Basic commands-18				Name		Logical block series connection (ANB)								
Ladder format				Condition code					Processing time (μs)						Remark	
(See Function column)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
				●	●	●	●	●								
Command format				Number of steps					—		—		—		—	
ANB				Condition		Steps										
				—		0										
Usable I/O			Bit				Word				Double word			Constant	Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
Function																
<div><div><div><div><div>X00001</div><div>R010</div><div>M0020</div><div>M0021</div><div>Y00110</div></div><div><div>R011</div><div>M0022</div></div></div></div></div> <div><div>LD X00001</div><div>LD R010</div><div>OR R011</div><div>ANB</div><div>LD M0020</div><div>AND M0021</div><div>OR M0022</div><div>ANB</div><div>OUT Y00110</div></div> <div><p>This command is used to perform AND operation with respect to the logical operation blocks (dotted line areas).</p></div>																

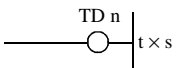
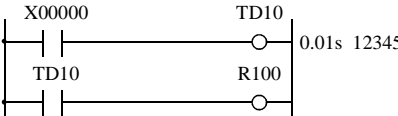
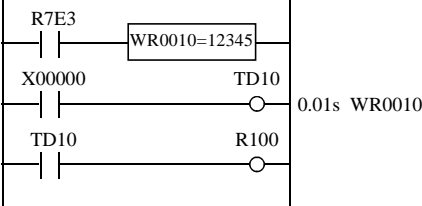
Item number	Basic commands-19					Name	Logical block parallel connection (ORB)												
Ladder format			Condition code					Processing time (μs)						Remark					
(See Function column)			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
			●	●	●	●	●												
Command format			Number of steps					7.0		←		0.95		←		0.7		—	
ORB			Condition		Steps														
			—		1														
Usable I/O			Bit				Word				Double word			Constant	Other				
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
Function																			
		<div><div><div><div><div>X00000</div><div></div></div><div><div>R010</div><div></div></div><div><div>R011</div><div>R012</div></div><div><div>X00001</div><div></div></div></div></div><div><div>Y00115</div><div></div></div></div> <div><div>LD X00000</div><div>LD R010</div><div>LD R011</div><div>AND R012</div><div>ORB</div><div>OR X00001</div><div>ANB</div><div>OUT Y00115</div></div>																	
<p>This command is used to perform OR operation with respect to the logical operation blocks (dotted line areas).</p>																			



Item number	Basic commands-20					Name		Processing box start and end (PROCESSING BOX)										
Ladder format			Condition code					Processing time (μs)						Remark				
			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
			●	●	●	●	●											
Command format			Number of steps					0.3		←		2.15			←	1.8		←
[       ]			Condition		Steps													
			—		3													
Usable I/O			Bit				Word				Double word			Constant	Other			
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
Function																		
			<ul style="list-style-type: none"><li>Indicates the start and end of the processing box.</li></ul> <div><div><div>X00001</div><div><div></div><div></div></div><div>WY0010=WX0000</div></div><div>LD X00001 [ WY0010=WX0000 ]</div></div> <p>In the above example, the operation of inside the processing box will be executed when input X00001 is on.</p>															

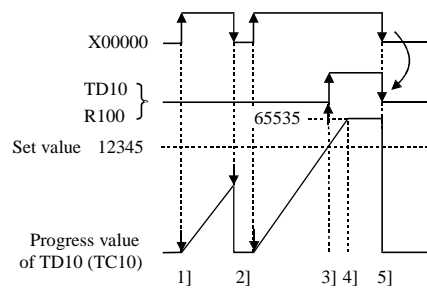
Item number		Basic commands-21				Name		Relational box start and end (RELATIONAL BOX)									
Ladder format				Condition code						Processing time (μs)						Remark	
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						—		—		—		—	
(      )				Condition			Steps										
				—			0										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
Function			<div><ul style="list-style-type: none"><li>● Indicates the start and end of the relational box.</li></ul></div>														

OUT TD n t s

Item number		Basic commands-22				Name		On delay timer (ON DELAY TIMER)									
Ladder format				Condition code					Processing time (μs)						Remark		
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps													
OUT TD n t s				Condition			Steps		26.4		←	8.95		←	11.5	12.0	
				—			5										
Usable I/O		Bit				Word				Double word			Constant	Other			
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
n	Timer number												○	0 to 255 (Decimal)			
t	Time base													.01s, .1s, 1s			
s	Set value					○	○	○					○	1 to 65,535 (Decimal)			
Function																	
<ul style="list-style-type: none"><li>The progress value is updated when the startup condition is on, and the coil switches on when the progress value is greater than or equal to the set value.</li><li>If the startup condition switches off, the progress value is cleared and the coil switches off.</li><li>The progress value is set in TC n and does not exceed 65,535 (decimal).</li><li>If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>The .01s time base can only be used for timer numbers 0 to 63 (64 points).</li><li>The .1s and 1s time bases can be used for all timer numbers (0 to 255).</li><li>A maximum of 256 points can be used for the timers TD, SS, MS, TMR and WDT in total. However, the same area as the counter is used. Timer number and counter number may not be overlapped.</li><li><u>The progress value is updated when the timer command is expected in the EH-CPU448.</u> Therefore, if a program that does not scan the timer command execution section after the timer is activated is created using the JMP command or master control (MCS), the timer may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																	
Program example																	
		<pre>LD X00000 OUT TD10 .01s 12345 LD TD10 OUT R100</pre>															
<ul style="list-style-type: none"><li>An example of a word I/O being used as the set value for the ladder shown above.</li></ul>																	
		<pre>LD R7E3 [ WR0010=12345 ] LD X00000 OUT TD10 .01s WR0010 LD TD10 OUT R100</pre>															

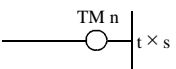
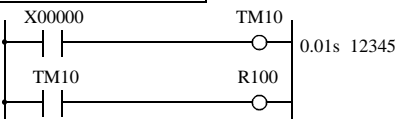
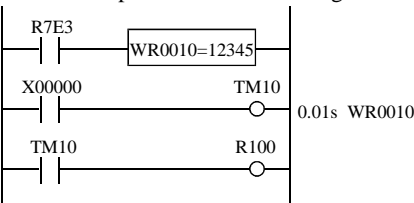
Program description

[Time chart]

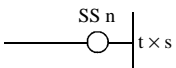

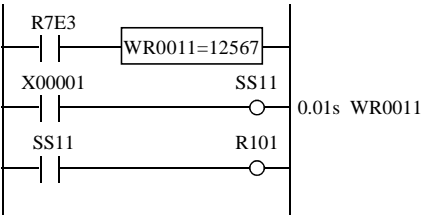


- 1] When input X00000 turns on, TD progress value is updated.
- 2] When input X00000 turns off, the TD progress value is cleared.
- 3] TD10 turns on when progress value  $\geq$  set value.
- 4] While X00000 is on, the progress value increases, but will not increase exceeding 65,535.
- 5] When X00000 turns off, TD10 also turns off and the progress value is cleared.

- Example using word I/O as the set value  
When RUN is commenced, the set value is set to word I/O.  
Or, designate the word I/O for the set value to store in the power failure memory beforehand.

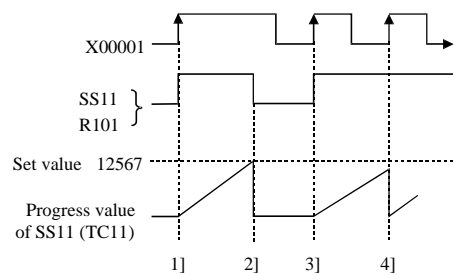
Item number		Basic commands-23				Name		Expansion on delay timer <sup>†</sup> (EXPANSION ON DELAY TIMER)									
Ladder format				Condition code					Processing time (μs)						Remark		
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps					15.4		←						
OUT TM n t s				Condition		Steps											
				—		5											
Usable I/O		Bit				Word				Double word		Constant	Other				
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM			
n	Timer number												○	0 to 2,047 (Decimal)			
t	Time base													Fixed at .01s			
s	Set value					○	○	○					○	1 to 65,535 (Decimal)			
Function																	
<ul style="list-style-type: none"><li>• The progress value is updated while the startup condition stays on, and the coil turns on when progress value becomes larger or equal to the set value.</li><li>• The progress value is cleared when the startup condition turns off, and the coil turns off.</li><li>• The progress value is set in TV n and does not exceed 65,535 (decimal).</li><li>• If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>• If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>• The time base is fixed at .01s.</li><li>• A maximum of 2,048 points can be used for the expansion on delay timer in addition to the TD, SS, MS, TMR and WDT timers. Since an area that is different from the counter area is used, the same numbers can be used for the timer and counter numbers.</li><li>• <u>This timer is updated when the timer command is executed.</u> Therefore, note that if a program that does not scan the timer command execution section using the JMP command or master control (MCS) after the timer is activated, the time may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																	
Program example																	
<div><pre>LD X00000 OUT TM10 0.01s 12345 LD TM10 OUT R100</pre></div> <ul style="list-style-type: none"><li>• An example of a word I/O being used as the set value for the ladder shown above.</li></ul> <div><pre>LD R7E3 [ WR0010=12345 ] LD X00000 OUT TM10 0.01s WR0010 LD TM10 OUT R100</pre></div>																	
Program example																	
<ol style="list-style-type: none"><li>1] When input X00000 turns on, TM progress value is updated.</li><li>2] When input X00000 turns off, the TM10 also turns off and the progress value is cleared.</li><li>3] TM10 turns on when progress value ≥ set value.</li><li>4] While X00000 is on, the progress value increases, but will not increase exceeding 65,535.</li></ol> <ul style="list-style-type: none"><li>• Example using word I/O as the set value When RUN is commenced, the set value is set to word I/O. Or, designate the word I/O for the set value to store in the power failure memory beforehand.</li></ul>																	

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number		Basic commands-24				Name		Single shot (SINGLE SHOT)								
Ladder format				Condition code					Processing time (μs)						Remark	
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
				●	●	●	●	●								
Command format				Number of steps					21.4		←		9.85		←	
OUT SS n t s				Condition		Steps										
				—		5										
Usable I/O		Bit				Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
n	Timer number												○	0 to 255 (Decimal)		
t	Time base													.01s, .1s, 1s		
s	Set value					○	○	○					○	1 to 65,535 (Decimal)		
Function																
<ul style="list-style-type: none"><li>• Detects the rising edge of the startup condition, starts updating progress values, and switches on the coil.</li><li>• The coils switches off when the progress value is greater than or equal to the set. If a rising edge is detected while the progress value is less than the set value, the progress value is set to 0 and the counter is reset.</li><li>• The progress value is set in TC n and does not exceed 65535 (decimal).</li><li>• If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>• If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																
Cautionary notes																
<ul style="list-style-type: none"><li>• The .01s time base can only be used for timer numbers 0 to 63 (64 points).</li><li>• The .1s and 1s time bases can be used for all timer numbers (0 to 255).</li><li>• A maximum of 256 points can be used for the timers TD, SS, MS, TMR and WDT in total. However, the same area as the counter is used. Timer number and counter number may not be overlapped.</li><li>• Since the startup condition of a single shot is edge detection, the condition cannot be detected during the first scan after the running is started.</li><li>• <u>The progress value is updated when the timer command is expected in the EH-CPU448.</u> Therefore, if a program that does not scan the timer command execution section after the timer is activated is created using the JMP command or master control (MCS), the timer may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																
Program example																
		<pre>LD X00001 OUT SS11 0.01s 12567 LD SS11 OUT R101</pre>														
<ul style="list-style-type: none"><li>• An example of a word I/O being used as the set value for the ladder shown above.</li></ul>																
		<pre>LD R7E3 [ WR0011=12567 ] LD X00001 OUT SS11 0.01s WR0011 LD SS11 OUT R101</pre>														

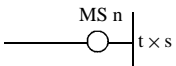
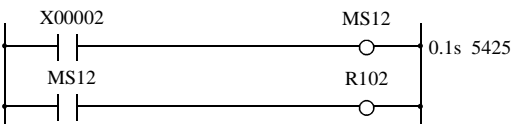
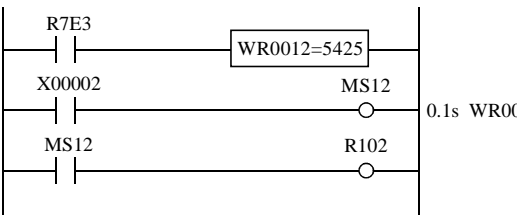
Program description

[Time chart]



- 1] The progress value is updated and SS11 turns on at the rising edge of X00001.
- 2] SS11 turns off when set value  $\geq$  progress value. X00001 is turned on at this time, but the single shot startup conditions are ignored because it uses edge trigger.
- 3] SS11 is turned on at the rising edge of X00001 again, and the progress value is updated.
- 4] When the rising edge of X00001 is detected while the progress value does not reach the set value, the single shot timer is triggered again and the progress value returns to 0, then starts increasing. The SS11 remains on.

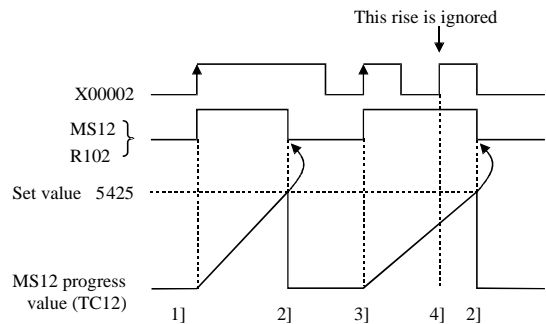
- Example using word I/O as the set value  
When RUN is commenced, the set value is set to word I/O.  
Or, designate the word I/O for the set value to store in the power failure memory beforehand.

Item number		Basic commands-25				Name		Mono stable timer (MONO STABLE TIMER)													
Ladder format				Condition code						Processing time (μs)						Remark					
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				●	●	●	●	●													
Command format				Number of steps						21.4		←		9.75		←		12.2		←	
OUT MS n t s				Condition			Steps														
				—			5														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
n	Timer number													○	0 to 255 (Decimal)						
t	Time base														.01s, .1s, 1s						
s	Set value						○	○	○					○	1 to 65,535 (Decimal)						
Function																					
<ul style="list-style-type: none"><li>• Detects the rising edge of the startup condition, starts updating progress values, and switches on the coil.</li><li>• The coil switches off when the progress value is greater than or equal to the set value. The rise of the startup condition is ignored while the MS is on.</li><li>• The progress value is set in TC n and does not exceed 65,535 (decimal).</li><li>• If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>• If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																					
Cautionary notes																					
<ul style="list-style-type: none"><li>• The .01s time base can only be used for timer numbers 0 to 63 (64 points).</li><li>• The .1s and 1s time bases can be used for all timer numbers (0 to 255).</li><li>• A maximum of 256 points can be used for the timers TD, SS, MS, TMR and WDT in total. However, the same area as the counter is used. Timer number and counter number may not be overlapped.</li><li>• Since the startup condition of the mono stable timer is edge detection, the condition may not be detected during the first scan after the running is started.</li><li>• <u>The progress value is updated when the timer command is expected in the EH-CPU448.</u> Therefore, if a program that does not scan the timer command execution section after the timer is activated is created using the JMP command or master control (MCS), the timer may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																					
Program example																					
<div><div></div><div><pre>LD X00002 OUT MS12 0.1s 5425 LD MS12 OUT R102</pre></div></div> <ul style="list-style-type: none"><li>• An example of a word I/O being used as the set value for the ladder shown above.</li></ul> <div><div></div><div><pre>LD R7E3 [ WR0012=5425 ] LD X00002 OUT MS12 0.1s WR0012 LD MS12 OUT R102</pre></div></div>																					



Program description


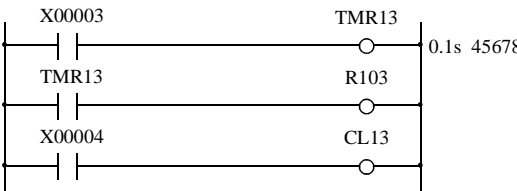
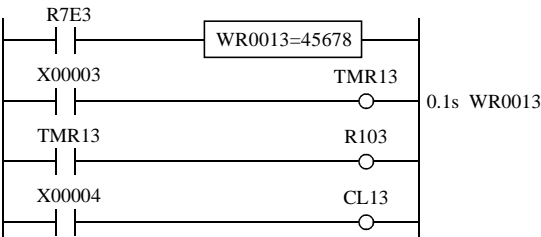
[Time chart]



- 1] The progress value is updated and MS12 turns on at the rising edge of X00002.
- 2] MS12 turns off when set value  $\geq$  progress value. X00002 is on at this time, but it is ignored since the startup condition for a mono-stable timer is edge trigger.
- 3] MS12 is turned on at the rising edge of X00002 again, and progress value is updated.
- 4] Even if the rising edge of X00002 is detected while the progress value does not reach the set value, the mono-stable timer ignores the rise.

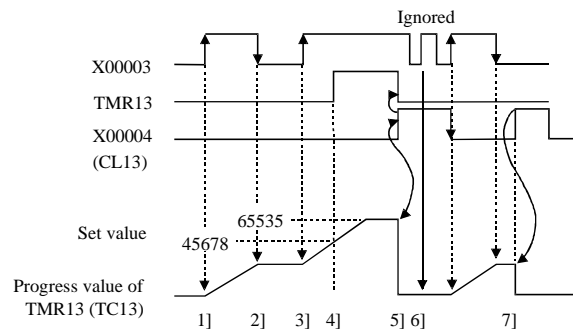
- Example using word I/O as the set value  
When RUN is commenced, the set value is set to word I/O.  
Or, designate the word I/O for the set value to store in the power failure memory beforehand.

OUT TMR n t s

Item number		Basic commands-26				Name		Integral timer (INTEGRAL TIMER)													
Ladder format				Condition code					Processing time (μs)						Remark						
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				●	●	●	●	●													
Command format				Number of steps					21.4		←		9.35			←		12.2		←	
OUT TMR n t s				Condition		Steps															
				—		5															
Usable I/O		Bit				Word				Double word			Constant	Other							
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM									
n	Timer number													○	0 to 255 (Decimal)						
t	Time base														.01s, .1s, 1s						
s	Set value						○	○	○					○	1 to 65,535 (Decimal)						
Function		<ul style="list-style-type: none"><li>Updates the progress value while the startup condition is on. The progress value is not cleared even if the startup condition switches off, and the update resumes when the condition switches on again.</li><li>The coil switches on when the progress value is greater than or equal to the set value, and will not turn off until the clear input CL n switches on.</li><li>The progress value is set in TC n and does not exceed 65,535 (decimal).</li><li>If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																			
Cautionary notes		<ul style="list-style-type: none"><li>The .01s time base can only be used for timer numbers 0 to 63 (64 points).</li><li>The .1s and 1s time bases can be used for all timer numbers (0 to 255).</li><li>A maximum of 256 points can be used for the timers TD, SS, MS, TMR and WDT in total. However, the same area as the counter is used. Timer number and counter number may not be overlapped.</li><li>While the clear input CL n is on, the turning on of the startup condition is ignored.</li><li><u>The progress value is updated when the timer command is expected in the EH-CPU448.</u> Therefore, if a program that does not scan the timer command execution section after the timer is activated is created using the JMP command or master control (MCS), the timer may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																			
Program example		<div><pre>LD X00003 OUT TMR13 0.1s 45678 LD TMR13 OUT R103 LD X00004 OUT CL13</pre></div> <p>An example of a word I/O being used as the set value for the ladder shown above.</p> <div><pre>LD R7E3 [ WR0013=45678 ] LD X00003 OUT TMR13 0.1s WR0013 LD TMR13 OUT R103 LD X00004 OUT CL13</pre></div>																			

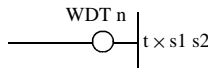
Program description

[Time chart]

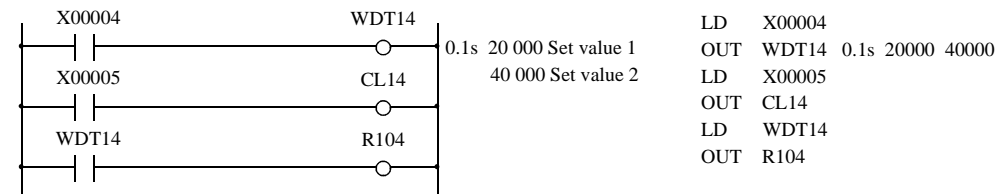


- 1] The progress value is updated while X00003 is on.
- 2] When X00003 turns off, the update of the progress value is stopped, but the progress value is maintained.
- 3] When X00003 is turned on again, the progress value is re-updated.
- 4] Timer coil TMR13 is turned on while the progress value  $\geq$  set value. This state is maintained until the timer clear is turned on.
- 5] When timer clear (CL13) is turned on, the timer coil and progress value are both cleared.
- 6] While timer clear (CL13) is on, the startup condition is ignored.
- 7] The progress value is cleared to 0 when the timer is cleared.

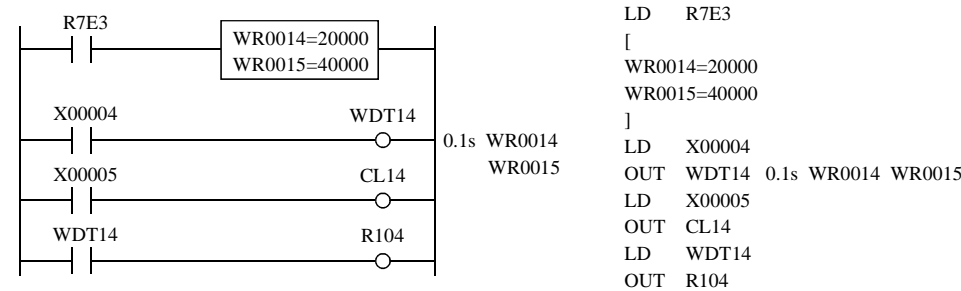
- Example using word I/O as the set value  
When RUN is commenced, the set value is set to word I/O.  
Or, designate the word I/O for the set value to store in the power failure memory beforehand.
- Timer is cleared by the conditions immediately prior to the execution of the timer coil command.

Item number		Basic commands-27				Name		Watchdog timer (WATCH DOG TIMER)													
Ladder format				Condition code						Processing time (μs)						Remark					
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				●	●	●	●	●													
Command format				Number of steps						27.6		←		13.6		←		14.4		15.1	
OUT WDT n t s1 s2				Condition			Steps														
				—			7														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
n	Timer number														○	0 to 255 (Decimal)					
t	Time base															.01s, .1s, 1s					
s1	Set value 1							○	○	○					○	1 to 65,535 (Decimal)					
s2	Set value 2							○	○	○					○	1 to 65,535 (Decimal)					
Function																					
				<ul style="list-style-type: none"><li>• Updates the progress value while the startup condition is switched on. The coil will not turn on if the clear input CL n is accessed while set value 1 ≤ progress value &lt; set value 2. The coil switches on if the clear input CL n is accessed while the progress value is less than set value 1 or if set value 2 is less than or equal to the progress value. If the startup condition switches off, everything is cleared.</li><li>• The progress value is set in TC n and does not exceed 65,535 (decimal).</li><li>• If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>• If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																	
Cautionary notes																					
				<ul style="list-style-type: none"><li>• The .01s time base can only be used for timer numbers 0 to 63 (64 points).</li><li>• The .1s and 1s time bases can be used for all timer numbers (0 to 255).</li><li>• A maximum of 256 points can be used for the timers TD, SS, MS, TMR and WDT in total. However, the same area as the counter is used. Timer number and counter number may not be overlapped.</li><li>• The s1 of the set value must always be less than s2. If s1 is greater than or equal to s2, the coil turns on when the progress value reaches s2.</li><li>• <u>The progress value is updated when the timer command is expected in the EH-CPU448.</u> Therefore, if a program that does not scan the timer command execution section after the timer is activated is created using the JMP command or master control (MCS), the timer may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																	

Program example

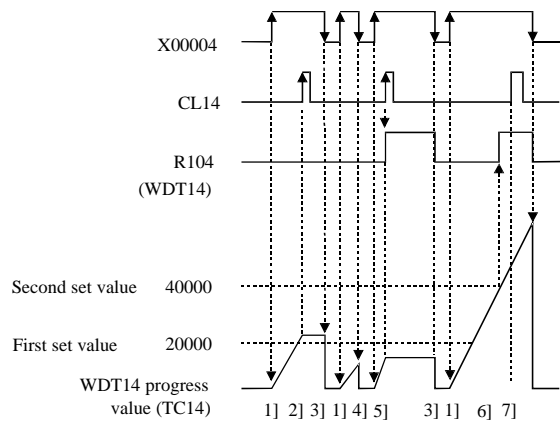


- An example of a word I/O being used as the set value for the ladder shown above.



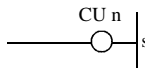
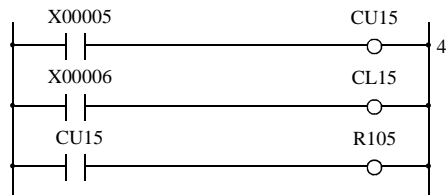
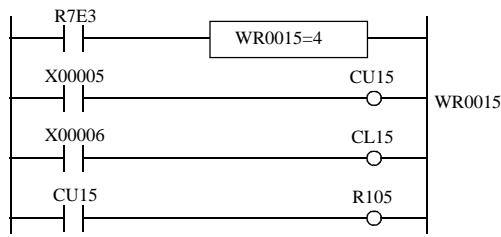
Program description

[Time chart]



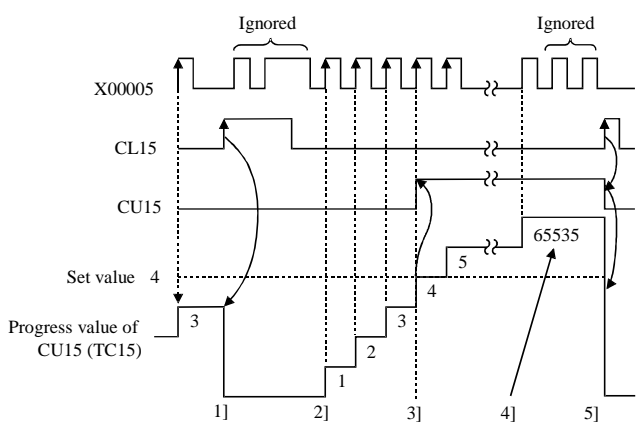
- 1] The progress value is updated while X00004 is on.
- 2] Since watchdog clear (CL14) turned on after the first set value is exceeded and before the second set value is exceeded, it is considered a normal operation, so R104 (WDT14) does not turn on.
- 3] When X00004 turns off, the progress value and WDT coil output are cleared.
- 4] Since the startup condition turned off before the progress value exceeded the first set value, the WDT coil does not turn on, and the progress value is cleared to 0.
- 5] Since the watchdog clear (CL14) turned on before the progress value exceeded the first set value, it is considered an abnormal operation and R104 (WDT14) turns on. The progress value is retained as is.
- 6] Even if the progress value exceeded the second set value, since the watchdog clear (CL14) did not turn on, it is considered an abnormal operation and R104 (SDT14) turns on. The progress value keeps being updated.
- 7] Even if the watchdog clear (CL14) turns on after the WDT coil is turned on after the progress value exceeds the second set value, it is ignored.

- The clear is performed under the conditions set immediately prior to the execution of the WDT coil command.
- Example using word I/O as the set value  
When RUN is commenced, the set value is set to word I/O.  
Or, designate the word I/O for the set value to store in the power failure memory beforehand.

Item number		Basic commands-28				Name				Counter (COUNTER)											
Ladder format				Condition code						Processing time (μs)						Remark					
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				●	●	●	●	●													
Command format				Number of steps						13.4		←		9.45		←		15.2		18.4	
OUT CU n s				Condition			Steps														
				—			5														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
n	Counter number														○	0 to 511 (Decimal)					
s	Set value							○	○	○					○	1 to 65,535 (Decimal)					
Function				<ul style="list-style-type: none"><li>• Increments the progress value by 1 each time the rising edge of the startup condition is detected, and switches on the coil when the progress value is greater than or equal to the set value. The coil that is switched on turns off when the counter clear CL n is switched on, and the progress value is cleared to 0.</li><li>• The progress value is set in TC n and does not exceed 65,535 (decimal).</li><li>• If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>• If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>																	
Cautionary notes				<ul style="list-style-type: none"><li>• The counter can be used up to 512 points (No. 0 to 511). However, the first 256 points (No. 0 to 255) will use the same area as the timer.</li><li>• The timer numbers and counter numbers can not overlap.</li><li>• While the counter clear CL n is on, the rise of startup condition is ignored.</li><li>• Since the startup condition of the counter is edge detection, the condition can not be detected during the first scan after the operation is started.</li><li>• If the set value is set to 0, it is regarded as a coil that is always on and controlled by the CL n.</li></ul>																	
Program example				<div><pre>LD X00005 OUT CU15 4 LD X00006 OUT CL15 LD CU15 OUT R105</pre></div> <ul style="list-style-type: none"><li>• An example of a word I/O being used as the set value for the ladder shown above.</li></ul> <div><pre>LD R7E3 [ WR0015=4 ] LD X00005 OUT CU15 WR0015 LD X00006 OUT CL15 LD CU15 OUT R105</pre></div>																	

Program description

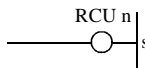
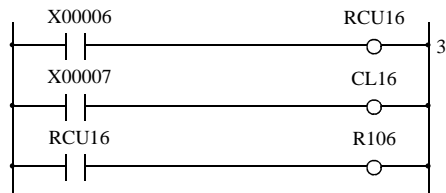
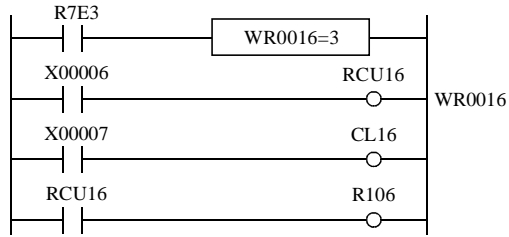
[Time chart]



- 1] The progress value (count) is cleared to 0 by the counter clear (CL15). While the counter clear is on, the progress value will not be updated.
- 2] The progress value is updated at the rising edge of X00005.
- 3] Counter coil (CU15) is turned on since set value  $\geq$  progress value.
- 4] The count value will not exceed 65,535 (decimal).
- 5] The progress value and counter coil are cleared by counter clear (CL15).
  - The clear is performed under the conditions set immediately prior to the execution of the counter coil command.

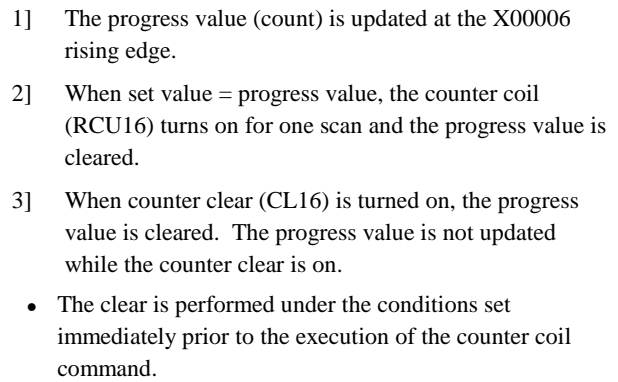
- Example using word I/O as the set value  
 When RUN is commenced, the set value is set to word I/O.  
 Or, designate the word I/O for the set value to store in the power failure memory beforehand.

OUT RCU n s

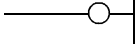
Item number		Basic commands-29				Name		Ring counter (RING COUNTER)									
Ladder format				Condition code						Processing time (μs)						Remark	
				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						13.4 ← 9.85 ← 14.3 16.9							
OUT RCU n s				Condition			Steps										
				—			5										
Usable I/O				Bit				Word				Double word		Constant	Other		
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
n	Counter number													○	0 to 511 (Decimal)		
s	Set value							○	○	○					○	1 to 65,535 (Decimal)	
Function																	
		<ul style="list-style-type: none"><li>• Increments the progress value by 1 each time the rising edge of the startup condition is detected, and clears the progress value to 0 when the progress value is greater than or equal to the set value. The progress value becomes 0 when the counter clear CL n is switched on, and the coil switches off.</li><li>• The progress value is set in TC n and does not exceed the set value.</li><li>• If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>• If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul>															
Cautionary notes																	
		<ul style="list-style-type: none"><li>• The counter can be used up to 512 points (No. 0 to 511). However, the first 256 points (No. 0 to 255) will use the same area as the timer.</li><li>• The timer numbers and counter numbers can not overlap.</li><li>• While the counter clear CL n is on, the rise of startup condition is ignored.</li><li>• Since the startup condition of the counter is edge detection, the condition can not be detected during the first scan after the operation is started.</li><li>• If the set value is set to 0, it is regarded as a coil that is always on and controlled by the CL n.</li></ul>															
Program example																	
		<div><pre>LD X00006 OUT RCU16 3 LD X00007 OUT CL16 LD RCU16 OUT R106</pre></div> <ul style="list-style-type: none"><li>• An example of a word I/O being used as the set value for the ladder shown above.</li></ul> <div><pre>LD R7E3 [ WR0016=3 ] LD X00006 OUT RCU16 WR0016 LD X00007 OUT CL16 LD RCU16 OUT R106</pre></div>															



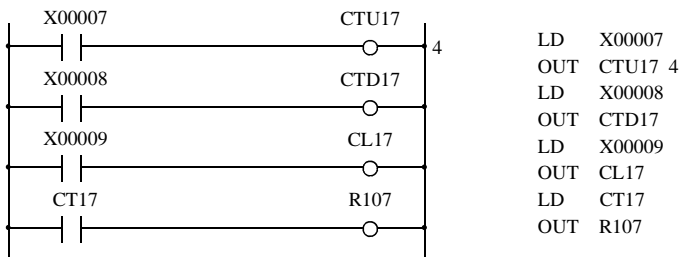
[Time chart]



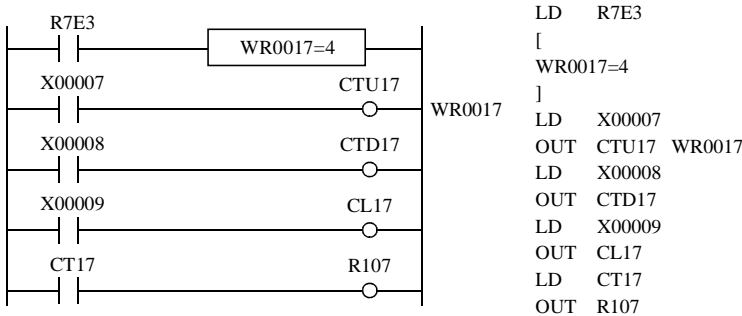
- Or, designate the word I/O for the set value to store in the power failure memory beforehand.

Item number	Basic commands-30, 31	Name		Up (CTU n) and down (CTD n) of up/down counter (UP/DOWN COUNTER)										
Ladder format			Condition code					Processing time (μs)						Remark
<div>CTU n s</div> <div>CTD n</div> 			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: CTU Lower case: CTD
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
			●	●	●	●	●	13.4	←	9.35	←	12.5	13.1	
Command format			Number of steps											
OUT CTU n s OUT CTD n			Condition			Steps								
			CTU			5			12.2	←	8.85	←	4.6	5.7
			CTD			3								
Usable I/O		Bit				Word				Double word			Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
n	Counter number												○	0 to 511 (Decimal)
s	Set value					○	○	○					○	1 to 65,535 (Decimal)
Function														
<div><div></div><div><ul style="list-style-type: none"><li>For the UP counter, increments the progress value by 1 each time the rising edge of the startup condition is detected, while it decrements the progress value by 1 for the DOWN counter. The coil switches on when the progress value is greater than or equal to the set value and switches off when the progress value is less than the set value. When the counter clear CL n switches on, the progress value is cleared to 0 and the coil switches off.</li><li>The progress value is set in TC n, and the value will be in the range of 0 to 65,535 (decimal).</li><li>If the progress value is updated while the system is running, the operation will be performed using the new progress value at that point.</li><li>If an I/O is set for the set value, the set value can be changed during operation by changing the I/O value, since the set values are updated during each scan.</li></ul></div></div>														
Cautionary notes														
<div><div></div><div><ul style="list-style-type: none"><li>The counter can be used up to 512 points (No. 0 to 511). However, the first 256 points (No. 0 to 255) will use the same area as the timer.</li><li>The timer numbers and counter numbers cannot overlap.</li><li>The numbers for the UP coil and DOWN coil must be the same.</li><li>While the counter clear CL n is on, the rise of startup condition is ignored.</li><li>Since the startup condition of the counter is edge detection, the condition may not be detected during the first scan after the operation is started.</li><li>If the set value is set to 0, it is regarded as a coil that is always on and controlled by the CL n.</li></ul></div></div>														

Program example

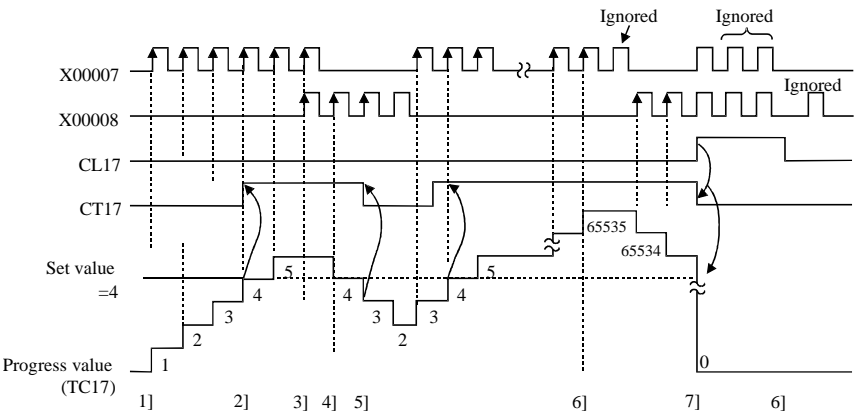


- An example of a word I/O being used as the set value for the ladder shown above.



Program description

[Time chart]



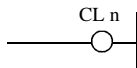
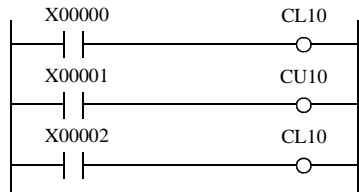
- 1] The progress value is up-counted at the rising edge of X00007.
- 2] The counter coil (CT17) is turned on when set value  $\geq$  progress value.
- 3] When the up-coil and down-coil startup conditions turn on simultaneously, the progress value does not change.
- 4] The progress value is down-counted at the rising edge of X00008.
- 5] The counter coil turns off when set value  $>$  progress value.

- 6] The progress value will never exceed 65,535 (decimal). Also, it will not be below 0.
- 7] When counter clear (CL17) turns on, the progress value and the counter coil are cleared. The progress value is not updated while the counter clear is on.

- The clear is performed under the conditions set immediately prior to the execution of the counter coil command.
- Example using word I/O as the set value

When RUN is commenced, the set value is set to word I/O.

Or, designate the word I/O for the set value to store in the power failure memory beforehand.

Item number	Basic commands-32	Name				Counter clear (COUNTER CLEAR)									
Ladder format		Condition code					Processing time (μs)						Remark		
		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	●									
Command format		Number of steps					0.1	←	6.8	←	1.0	1.7			
OUT CL n s		Condition			Steps										
		—			1										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
n	Counter number												○	0 to 511 (Decimal)	
Function															
<div><div><ul style="list-style-type: none"><li>Clears the TD, SS and MS progress values of the integral timer and switches off the timer coil.</li><li>In the case of WDT, a time monitor check is performed (see WDT for details).</li><li>In the case of counters, the progress value is cleared and the counter coil is switched off.</li><li>The clearing operation is conducted immediately before the counter or timer indicated by the clear coil executes the coil command.</li></ul></div><div><div>Example</div><div></div></div><div><div>1) When X00000 is turned on, the CL10 immediately prior to CU10 turns on, and CU10 is cleared.</div><div>2) Even if X00002 turns on, if X00001 is off, the CL10 is turned off by the ladder before CU10 is executed. Therefore, the CU10 will not be cleared.</div></div></div>															
Cautionary notes															
<div><ul style="list-style-type: none"><li>The number same as on the timer or counter must be used.</li></ul></div>															

LD (s1 == s2)  
AND (s1 == s2)  
OR (s1 == s2)

Item number		Basic commands-33				Name		=Relational box (=RELATIONAL BOX)																																									
Ladder format						Condition code					Processing time (μs)						Remark																																
(See Function column)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW ( ) indicates the case of OR																																
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																	
						●	●	●	●	●	0.5 (7.5)	← (←)	51.1	91.9	76.7	185.6																																	
Command format						Number of steps																																											
LD (s1 == s2) AND (s1 == s2) OR (s1 == s2)						Condition		Steps			15.8 (22.8)	18.4 (25.4)	71.3	123.5	100.2	130.1																																	
						Word		(See Cautionary notes)																																									
						Double word		(See Cautionary notes)																																									
Usable I/O				Bit				Word				Double word		Constant	Other																																		
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM																																	
s1	Relational number 1										○	○	○	○	○	○																																	
s2	Relational number 2										○	○	○	○	○	○																																	
Function																																																	
[Ladder format]		<div><div><div><div></div><div>s1</div><div>=</div><div>s2</div></div><div></div></div><div><div></div><div>s1</div><div>=</div><div>s2</div></div><div><div></div><div>s1</div><div>=</div><div>s2</div></div></div>																																															
		<div><div><div><div><div>•</div><div>Compares s1 and s2 as unsigned numbers, and if s1 is equals to s2, it enters the continuity status (on) and if s1 is not equal to s2, enters the noncontinuity status (off).</div></div><div><div><div>•</div><div>When s1 and s2 are words : 0 to 65,535 (decimal) or H0000 to HFFFF (hexadecimal) When s1 and s2 are double words : 0 to 4,294,967,295 (decimal) or H00000000 to HFFFFFFF (hexadecimal)</div></div></div></div></div></div>																																															
Cautionary notes																																																	
[Number of steps]																																																	
		<table><tr><th colspan="2">Word</th><th></th></tr><tr><td>LD (s1 == s2)</td><td></td><td>5 steps</td></tr><tr><td>AND (s1 == s2)</td><td></td><td>5 steps</td></tr><tr><td>OR (s1 == s2)</td><td></td><td>6 steps</td></tr></table>				Word			LD (s1 == s2)		5 steps	AND (s1 == s2)		5 steps	OR (s1 == s2)		6 steps	<table><tr><th colspan="2">Double word</th><th>LD, AND (s1==s2)</th><th>OR (s1==s2)</th></tr><tr><td>I/O</td><td>I/O</td><td>5 steps</td><td>6 steps</td></tr><tr><td>I/O</td><td>Constant</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>I/O</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>Constant</td><td>7 steps</td><td>8 steps</td></tr></table>												Double word		LD, AND (s1==s2)	OR (s1==s2)	I/O	I/O	5 steps	6 steps	I/O	Constant	6 steps	7 steps	Constant	I/O	6 steps	7 steps	Constant	Constant	7 steps	8 steps
Word																																																	
LD (s1 == s2)		5 steps																																															
AND (s1 == s2)		5 steps																																															
OR (s1 == s2)		6 steps																																															
Double word		LD, AND (s1==s2)	OR (s1==s2)																																														
I/O	I/O	5 steps	6 steps																																														
I/O	Constant	6 steps	7 steps																																														
Constant	I/O	6 steps	7 steps																																														
Constant	Constant	7 steps	8 steps																																														
Program example																																																	
		<div><div><div><div><div></div><div>WR0000</div><div>=</div><div>WR0002</div></div><div></div></div><div><div></div><div>R001</div></div><div>LD (WR0000 == WR0002) OUT R001</div></div></div>																																															
Program description																																																	
		<div><div><div><div><div>•</div><div>When WR0000 = WR0002, R001 turns on.</div></div></div></div></div>																																															

Item number		Basic commands-34				Name		Signed = Relational box (SIGNED = RELATIONAL BOX)									
Ladder format						Condition code					Processing time (μs)				Remark		
(See Function column)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
						●	●	●	●	●							
Command format						Number of steps					18.4	25.4	71.3	123.5	76.7	130.1	
LD		(s1 S== s2)		Condition		Steps											
AND		(s1 S== s2)		Double word		(See Cautionary notes)											
OR		(s1 S== s2)															
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
s1	Relational number 1										○	○	○	○			
s2	Relational number 2										○	○	○	○			
Function																	
[Ladder format]			<div><div><div><div></div><div>s1</div><div>S==</div><div>s2</div></div><div></div></div><div><div></div><div>s1</div><div>S==</div><div>s2</div></div><div><div></div><div>s1</div><div>S==</div><div>s2</div></div></div>														
<div><div><div><div>•</div><div>Compares s1 and s2 as signed double-word numbers, and if s1 is equals to s2, it enters the continuity status (on) and if s1 is not equal to s2, enters the noncontinuity status(off).</div></div><div><div><div>s1, s2</div><div>– 2,147,483,648 to + 2,147,483,647 (decimal)</div><div>H80000000 to H7FFFFFFF (hexadecimal)</div></div></div></div></div>			<div><div><div>b31</div><div></div><div>b0</div></div><div><div></div><div>Sign bit: 0 - Positive; 1 - Negative</div></div></div>														
Cautionary notes																	
[Number of steps]																	
Double word			LD, AND (s1S==s2)				OR (s1S==s2)										
I/O		I/O	5 steps				6 steps										
I/O		Constant	6 steps				7 steps										
Constant		I/O	6 steps				7 steps										
Constant		Constant	7 steps				8 steps										
Program example																	
<div><div><div><div></div><div>DR0000</div><div>S ==</div><div>DR0002</div></div><div></div><div>R002</div></div></div>			<div><div><div>LD</div><div>(DR0000 S== DR0002)</div></div><div><div>OUT</div><div>R002</div></div></div>														
Program description																	
<div><div><div>•</div><div>When DR0000 = DR0002, R002 turns on (signed).</div></div></div>																	

LD  
AND  
OR

LD (s1 <> s2)  
AND (s1 <> s2)  
OR (s1 <> s2)

Item number		Basic commands-35				Name		<> Relational box (<> RELATIONAL BOX)																																							
Ladder format				Condition code					Processing time (μs)						Remark																																
(See Function column)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW ( ) indicates the case of OR																																
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																	
				●	●	●	●	●	0.5 (7.5)	← (←)	50.9	91.9	100.3	185.7																																	
Command format				Number of steps																																											
LD (s1 <> s2) AND (s1 <> s2) OR (s1 <> s2)				Condition		Steps			15.8 (22.8)	18.4 (25.4)	72.3	124.3	78.7	133.9																																	
				Word		(See Cautionary notes)																																									
				Double word		(See Cautionary notes)																																									
Usable I/O				Bit				Word				Double word		Constant	Other																																
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM																															
s1	Relational number 1							○	○	○	○	○	○	○																																	
s2	Relational number 2							○	○	○	○	○	○	○																																	
Function																																															
[Ladder format]																																															
<ul style="list-style-type: none"><li>Compares s1 and s2 as unsigned numbers, and if s1 is equals to s2, it enters the noncontinuity status (off) and if s1 is not equal to s2, enters the continuity status (on).</li><li>When s1 and s2 are words : 0 to 65,535 (decimal) or H0000 to HFFFF (hexadecimal) When s1 and s2 are double words : 0 to 4,294,967,295 (decimal) or H00000000 to HFFFFFFF (hexadecimal)</li></ul>																																															
Cautionary notes																																															
[Number of steps]																																															
				<table><tr><th colspan="2">Word</th><th></th></tr><tr><td>LD (s1 &lt;&gt; s2)</td><td></td><td>5 steps</td></tr><tr><td>AND (s1 &lt;&gt; s2)</td><td></td><td>5 steps</td></tr><tr><td>OR (s1 &lt;&gt; s2)</td><td></td><td>6 steps</td></tr></table>				Word			LD (s1 <> s2)		5 steps	AND (s1 <> s2)		5 steps	OR (s1 <> s2)		6 steps	<table><tr><th colspan="2">Double word</th><th>LD, AND (s1&lt;&gt;s2)</th><th>OR (s1&lt;&gt;s2)</th></tr><tr><td>I/O</td><td>I/O</td><td>5 steps</td><td>6 steps</td></tr><tr><td>I/O</td><td>Constant</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>I/O</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>Constant</td><td>7 steps</td><td>8 steps</td></tr></table>								Double word		LD, AND (s1<>s2)	OR (s1<>s2)	I/O	I/O	5 steps	6 steps	I/O	Constant	6 steps	7 steps	Constant	I/O	6 steps	7 steps	Constant	Constant	7 steps	8 steps
Word																																															
LD (s1 <> s2)		5 steps																																													
AND (s1 <> s2)		5 steps																																													
OR (s1 <> s2)		6 steps																																													
Double word		LD, AND (s1<>s2)	OR (s1<>s2)																																												
I/O	I/O	5 steps	6 steps																																												
I/O	Constant	6 steps	7 steps																																												
Constant	I/O	6 steps	7 steps																																												
Constant	Constant	7 steps	8 steps																																												
Program example																																															
				LD (WR0000 <> WR0002) OUT R003																																											
Program description																																															
<ul style="list-style-type: none"><li>When WR0000 ≠ WR0002, R003 turns on.</li></ul>																																															

Item number		Basic commands-36				Name				Signed ◇ Relational box (SIGNED ◇ RELATIONAL BOX)																															
Ladder format				Condition code						Processing time (μs)						Remark																									
(See Function column)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																												
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																											
				●	●	●	●	●																																	
Command format				Number of steps						18.4		25.4		72.3		124.3		78.7		133.9																					
LD		(s1 S◇ s2)		Condition		Steps																																			
AND		(s1 S◇ s2)		Double word		(See Cautionary notes)																																			
OR		(s1 S◇ s2)																																							
Usable I/O				Bit				Word				Double word			Constant	Other																									
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																											
s1	Relational number 1											○	○	○	○																										
s2	Relational number 2											○	○	○	○																										
Function																																									
[Ladder format]				<div><div><div><div></div><div>s1</div><div>S◇</div><div>s2</div></div><div></div></div><div><div></div><div>s1</div><div>S◇</div><div>s2</div></div><div><div></div><div>s1</div><div>S◇</div><div>s2</div></div></div>																																					
<div><div><div>• Compares s1 and s2 as signed double-word numbers, and if s1 is equals to s2, it enters the noncontinuity status (off) and if s1 is not equal to s2, enters the continuity status (on).</div><div>• s1, s2 – 2,147,483,648 to + 2,147,483,647 (decimal) H80000000 to H7FFFFFFF (hexadecimal)</div></div></div>				<div><div><div>b31</div><div></div><div>b0</div></div><div>Sign bit: 0 - Positive; 1 - Negative</div></div>																																					
Cautionary notes																																									
[Number of steps]																																									
				<table><tr><td colspan="2">Double word</td><td>LD, AND (s1S◇s2)</td><td>OR (s1S◇s2)</td></tr><tr><td>I/O</td><td>I/O</td><td>5 steps</td><td>6 steps</td></tr><tr><td>I/O</td><td>Constant</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>I/O</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>Constant</td><td>7 steps</td><td>8 steps</td></tr></table>																		Double word		LD, AND (s1S◇s2)	OR (s1S◇s2)	I/O	I/O	5 steps	6 steps	I/O	Constant	6 steps	7 steps	Constant	I/O	6 steps	7 steps	Constant	Constant	7 steps	8 steps
Double word		LD, AND (s1S◇s2)	OR (s1S◇s2)																																						
I/O	I/O	5 steps	6 steps																																						
I/O	Constant	6 steps	7 steps																																						
Constant	I/O	6 steps	7 steps																																						
Constant	Constant	7 steps	8 steps																																						
Program example																																									
<div><div><div><div></div><div>DR0000</div><div>S &lt; &gt;</div><div>DR0002</div></div><div></div><div>R004</div></div><div>LD (DR0000 S &lt; &gt; DR0002) OUT R004</div></div>																																									
Program description																																									
<div><div><div>• When DR0000 ≠ DR0002, R004 turns on (signed).</div></div></div>																																									



LD (s1 < s2)  
AND (s1 < s2)  
OR (s1 < s2)

Item number		Basic commands-37				Name		<Relational box (<RELATIONAL BOX)																																								
Ladder format				Condition code					Processing time (μs)						Remark																																	
(See Function column)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW ( ) indicates the case of OR																																	
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																		
				●	●	●	●	●	0.5 (7.5)	← (←)	50.9	91.9	100.3	185.7																																		
Command format LD (s1 < s2) AND (s1 < s2) OR (s1 < s2)				Number of steps					16.5 (23.5)	19.4 (26.4)	74.0	126.7	80.6	136.2																																		
				Condition		Steps																																										
				Word		(See Cautionary notes)																																										
				Double word		(See Cautionary notes)																																										
Usable I/O			Bit				Word			Double word			Constant	Other																																		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY				DR, DL, DM																																
s1	Relational number 1							○	○	○	○	○	○	○		○																																
s2	Relational number 2							○	○	○	○	○	○	○	○																																	
Function																																																
[Ladder format]		<div><div><div></div><div>s1 &lt; s2</div></div></div> <div><div></div><div>s1 &lt; s2</div></div> <div><div></div><div>s1 &lt; s2</div></div> <div><ul style="list-style-type: none"><li>Compares s1 and s2 as unsigned numbers, and if s1 is less than s2, it enters the continuity status (on) and if s1 is greater than or equal to s2, enters the noncontinuity status (off).</li><li>When s1 and s2 are words : 0 to 65,535 (decimal) or H0000 to HFFFF (hexadecimal) When s1 and s2 are double words : 0 to 4,294,967,295 (decimal) or H00000000 to HFFFFFFF (hexadecimal)</li></ul></div>																																														
Cautionary notes																																																
[Number of steps]		<div><table><tr><th colspan="2">Word</th><th></th></tr><tr><td>LD</td><td>(s1 &lt; s2)</td><td>5 steps</td></tr><tr><td>AND</td><td>(s1 &lt; s2)</td><td>5 steps</td></tr><tr><td>OR</td><td>(s1 &lt; s2)</td><td>6 steps</td></tr></table><table><tr><th colspan="2">Double word</th><th>LD, AND (s1&lt;s2)</th><th>OR (s1&lt;s2)</th></tr><tr><td>I/O</td><td>I/O</td><td>5 steps</td><td>6 steps</td></tr><tr><td>I/O</td><td>Constant</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>I/O</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant</td><td>Constant</td><td>7 steps</td><td>8 steps</td></tr></table></div>															Word			LD	(s1 < s2)	5 steps	AND	(s1 < s2)	5 steps	OR	(s1 < s2)	6 steps	Double word		LD, AND (s1<s2)	OR (s1<s2)	I/O	I/O	5 steps	6 steps	I/O	Constant	6 steps	7 steps	Constant	I/O	6 steps	7 steps	Constant	Constant	7 steps	8 steps
Word																																																
LD	(s1 < s2)	5 steps																																														
AND	(s1 < s2)	5 steps																																														
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Double word		LD, AND (s1<s2)	OR (s1<s2)																																													
I/O	I/O	5 steps	6 steps																																													
I/O	Constant	6 steps	7 steps																																													
Constant	I/O	6 steps	7 steps																																													
Constant	Constant	7 steps	8 steps																																													
Program example																																																
<div><div><div></div><div>WR0000 &lt; WR0002</div></div></div> <div><div></div><div>R005</div></div> <div>LD (WR0000 &lt; WR0002) OUT R005</div>																																																
Program description																																																
When WR0000 < WR0002, R005 turns on.																																																

LD (s1 S< s2)  
AND (s1 S< s2)  
OR (s1 S< s2)

Item number		Basic commands-38				Name		Signed<Relational box (SIGNED < RELATIONAL BOX)												
Ladder format				Condition code					Processing time (μs)						Remark					
(See Function column)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				●	●	●	●	●												
Command format				Number of steps					19.4		26.4		74.0		126.7		80.9		136.7	
LD	(s1 S< s2)		Condition		Steps															
AND	(s1 S< s2)		Double word		(See Cautionary notes)															
OR				(s1 S< s2)																
Usable I/O			Bit				Word				Double word			Constant	Other					
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
s1	Relational number 1										○	○	○	○						
s2	Relational number 2										○	○	○	○						
Function																				
[Ladder format]			<div><div><div><div><div></div><div>s1</div><div>S&lt;</div><div>s2</div></div></div><div><div></div><div>s1</div><div>S&lt;</div><div>s2</div></div><div><div></div><div>s1</div><div>S&lt;</div><div>s2</div></div></div></div> <div><div><div>b31</div><div></div><div>b0</div></div><div>Sign bit: 0 - Positive; 1 - Negative</div></div>																	
<ul style="list-style-type: none"><li>Compares s1 and s2 as signed double-word numbers, and if s1 is less than s2, it enters the continuity status (on) and if s1 is greater than or equal to s2, enters the noncontinuity status (off).</li><li>s1, s2      − 2,147,483,648 to + 2,147,483,647 (decimal) H80000000 to H7FFFFFFF (hexadecimal)</li></ul>																				
Cautionary notes																				
[Number of steps]																				
Program example																				
<div><div><div><div><div></div><div>DR0000</div><div>S &lt;</div><div>DR0002</div></div></div><div><div></div><div>R006</div></div></div><div><div>LD (DR0000 S&lt; DR0002)</div><div>OUT R006</div></div></div>																				
Program description																				
<ul style="list-style-type: none"><li>When DR0000 &lt; DR0002, R006 turns on (signed).</li></ul>																				

LD (s1 <= s2)  
AND (s1 <= s2)  
OR (s1 <= s2)

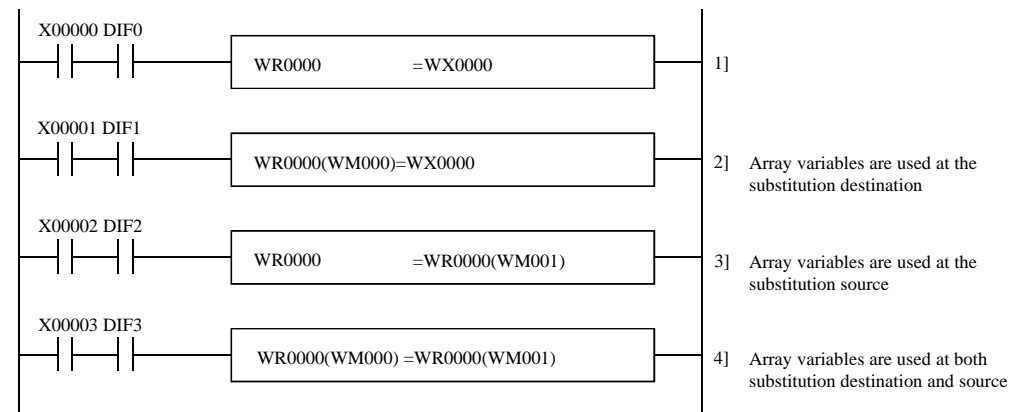
Item number		Basic commands-39				Name		≤ Relational box (≤ RELATIONAL BOX)																														
Ladder format				Condition code						Processing time (μs)						Remark																						
(See Function column)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW ( ) indicates the case of OR																							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																								
				●	●	●	●	●	0.5 (7.5)	← (←)	50.9	91.9	100.2	185.6																								
Command format				Number of steps																																		
LD (s1 ≤ s2) AND (s1 ≤ s2) OR (s1 ≤ s2)				Condition		Steps				16.5 (23.5)	19.4 (26.4)	74.0	126.7	80.7	136.4																							
				Word		(See Cautionary notes)																																
				Double word		(See Cautionary notes)																																
Usable I/O				Bit				Word				Double word			Constant	Other																						
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																								
s1	Relational number 1								○	○	○	○	○	○	○																							
s2	Relational number 2								○	○	○	○	○	○	○																							
Function																																						
[Ladder format]				<div><div><div></div><div>s1</div><div>≤</div><div>s2</div></div><div></div></div> <div><div></div><div>s1</div><div>≤</div><div>s2</div></div> <div></div> <div><div></div><div>s1</div><div>≤</div><div>s2</div></div> <div></div>																																		
<div><div>• Compares s1 and s2 as unsigned numbers, and if s1 is less than or equal to s2, it enters the continuity status (on) and if s1 is greater than s2, it enters the noncontinuity status (off).</div><div>• When s1 and s2 are words : 0 to 65,535 (decimal) or H0000 to HFFFF (hexadecimal) When s1 and s2 are double words : 0 to 4,294,967,295 (decimal) or H00000000 to HFFFFFFF (hexadecimal)</div></div>																																						
Cautionary notes																																						
[Number of steps]																																						
<table><tr><th>Word</th><th></th></tr><tr><td>LD (s1 ≤ s2)</td><td>5 steps</td></tr><tr><td>AND (s1 ≤ s2)</td><td>5 steps</td></tr><tr><td>OR (s1 ≤ s2)</td><td>6 steps</td></tr></table>				Word		LD (s1 ≤ s2)	5 steps	AND (s1 ≤ s2)	5 steps	OR (s1 ≤ s2)	6 steps	<table><tr><th>Double word</th><th>LD, AND (s1≤s2)</th><th>OR (s1≤s2)</th></tr><tr><td>I/O I/O</td><td>5 steps</td><td>6 steps</td></tr><tr><td>I/O Constant</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant I/O</td><td>6 steps</td><td>7 steps</td></tr><tr><td>Constant Constant</td><td>7 steps</td><td>8 steps</td></tr></table>												Double word	LD, AND (s1≤s2)	OR (s1≤s2)	I/O I/O	5 steps	6 steps	I/O Constant	6 steps	7 steps	Constant I/O	6 steps	7 steps	Constant Constant	7 steps	8 steps
Word																																						
LD (s1 ≤ s2)	5 steps																																					
AND (s1 ≤ s2)	5 steps																																					
OR (s1 ≤ s2)	6 steps																																					
Double word	LD, AND (s1≤s2)	OR (s1≤s2)																																				
I/O I/O	5 steps	6 steps																																				
I/O Constant	6 steps	7 steps																																				
Constant I/O	6 steps	7 steps																																				
Constant Constant	7 steps	8 steps																																				
Program example																																						
<div><div><div><div></div><div>WR0000</div></div><div>≤</div><div><div></div><div>WR0002</div></div></div><div></div><div>R007</div></div> <div>LD (WR0000 ≤ WR0002) OUT R007</div>																																						
Program description																																						
<div><div>• When <math>WR0000 \leq WR0002</math>, R007 turns on.</div></div>																																						

Item number		Basic commands-40				Name		Signed ≤ Relational box (SIGNED ≤ RELATINAL BOX)														
Ladder format						Condition code					Processing time (μs)						Remark					
(See Function column)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
						●	●	●	●	●												
Command format						Number of steps					19.4		26.4		74.0		126.7		81.3		137.4	
LD		(s1 S≤ s2)		Condition		Steps																
AND		(s1 S≤ s2)		Double word		(See Cautionary notes)																
OR		(s1 S≤ s2)																				
Usable I/O				Bit				Word				Double word			Constant	Other						
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM								
s1	Relational number 1																					
s2	Relational number 2																					
Function																						
[Ladder format]		<div><div><div></div><div>s1</div><div>S≤</div><div>s2</div></div><div></div><div><div></div><div>s1</div><div>S≤</div><div>s2</div></div><div></div><div><div></div><div>s1</div><div>S≤</div><div>s2</div></div><div></div></div>																				
<ul style="list-style-type: none"><li>Compares s1 and s2 as signed double-word numbers, and if s1 is less than or equal to s2, it enters the continuity status (on) and if s1 is greater than s2, it enters the noncontinuity status (off).</li><li>s1, s2        − 2,147,483,648 to + 2,147,483,647 (decimal) H80000000 to H7FFFFFFF (hexadecimal)</li></ul>		<div><div>b31</div><div></div><div>b0</div></div> <div>Sign bit: 0 - Positive; 1 - Negative</div>																				
		Cautionary notes																				
[Number of steps]																						
		Double word		LD, AND (s1S≤s2)				OR (s1S≤s2)														
		I/O	I/O	5 steps				6 steps														
		I/O	Constant	6 steps				7 steps														
		Constant	I/O	6 steps				7 steps														
		Constant	Constant	7 steps				8 steps														
Program example																						
		<div><div><div></div><div>DR0000</div></div><div>S ≤</div><div>DR0002</div></div>				R008				<div>LD (DR0000 S≤ DR0002)</div> <div>OUT R008</div>												
Program description																						
		<ul style="list-style-type: none"><li>When DR0000 ≤ DR0002, R008 turns on (signed).</li></ul>																				

Item number		Arithmetic commands-1				Name		Substitution statement (ASSIGNMENT STATEMENT)									
Ladder format				Condition code						Processing time (μs)						Remark	
d = s				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↑	●	●	●	●	See following table								
Command format				Number of steps													
d = s				Condition			Steps										
				(See Cautionary notes)													
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
d	Substitution destination				○	○			○	○	○		○	○			
s	Substitution source			○	○	○		○	○	○	○	○	○	○	○		
( )	Index value							○	○	○							
Function																	
<ul style="list-style-type: none"><li>Substitutes the content of s into d.</li><li>It is possible to use array variables for d and s.</li><li>When d is a word, the constant is 0 to 65,535 or – 32,768 to + 32,767 (decimal) H0000 to HFFFF or H8000 to H7FFF (hexadecimal)</li><li>When d is a double word, the constant is 0 to 4,294,967,295 or –2,147,483,648 to +2,147,483,647 (decimal) H00000000 to HFFFFFFF or H80000000 to H7FFFFFFF</li></ul>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>When using an array variable, DER is set to 1 if the maximum usable I/O number is exceeded, and DER is reset to “0” if it is normal.</li><li>The combinations of d and s are as follows:</li></ul>																	
<ul style="list-style-type: none"><li>Step numbers and processing time are as follows:</li></ul>																	
<div><div>EH-CPU448</div><div>EH-CPU3**</div><div>Other than the above</div></div>				d	s	Number of steps ( ) indicates DW						Processing time (μ s)					
										Bit	Word		Double word				
				I/O	I/O	3 (4)						0.3	0.3		15		
				I/O	Array	4						31	27		29		
				Array	I/O	4 (5)						27	25		27		
				Array	Array	5						43	39		42		
				I/O	I/O	3 (4)						32	49		69		
				I/O	Array	4						71	104		144		
				Array	I/O	4 (5)						51	68		92		
				Array	Array	5						86	119		165		
				I/O	I/O	3 (4)						71	84		69		
				I/O	Array	4						172	250		173		
Array	I/O	4 (5)						101	182		125						
Array	Array	5						246	301		225						

S  
D  
=

Program example



I/O assignment

		0	1	2
A	CPU	X	Y	X
V		16	16	16
R				

Program description

- 1] The value of WX0000 is substituted into WR0000 at the rising edge of input X00000.
- 2] The value of WX0000 is substituted into the WR number designated by WR0000 + WM000 at the rising edge of input X00001.
  - 1) When WM000 = H0010, it holds the same meaning as WR0010 = WX0000.
- 3] The word number of the I/O advanced by the amount designated by WR0000 + WM001 due to the I/O assignment is substituted into WR0000 at the rising edge of input X0002.
  - 1) When WM001 = H0010, it holds the same meaning as WR0000 = WR0010.
- 4] The I/O value designated by WR0000 + WM001 at the rising edge of input X00003 is substituted into the I/O of the value designated by WR0000 + WM000.

Example) When WM000 = H0010 and WM001 = H0015, it holds the same meaning as WR0010 = WR0015.

Item number		Arithmetic commands-2				Name		Binary addition (BINARY ADDITION)									
Ladder format				Condition code						Processing time (μs)						Remark	
d = s1 + s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	↑	↑	0.4	←	56	←	123	←			
Command format				Number of steps													
d = s1 + s2				Condition				Steps									
				Word				4		22		←		80		←	
				Double word				6									
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	Substitution destination								○	○	○		○	○			
s1	Augend							○	○	○	○	○	○	○	○		
s2	Addend							○	○	○	○	○	○	○	○		
Function																	
<div><div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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Item number		Arithmetic commands-3				Name		BCD addition (BCD ADDITION)																
Ladder format				Condition code						Processing time (μs)						Remark								
d = s1 B+ s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW									
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max										
				↑	●	●	●	↑	36	←	82	←	193	←										
Command format				Number of steps						36	←	82	←	193			←							
d = s1 B+ s2				Condition			Steps			59	←	129	←	246			←							
				Word			4																	
				Double word			6																	
Usable I/O		Bit				Word				Double word			Constant	Other										
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM												
d	Substitution destination						○	○	○		○	○												
s1	Augend					○	○	○	○	○	○	○	○											
s2	Addend					○	○	○	○	○	○	○	○											
Function																								
<div>• Adds s1 and s2 as BCD data, and stores the result in d as BCD data.</div> <div>• The C flag is 1 if there is a digit increase, and 0 if not.</div> <div>• The DER flag is 1 if the operation result s1 and s2 are invalid BCD data. In such cases, operation is not performed and the C flag retains the previous state without outputting to d. If the s1 and s2 are valid BCD data, the DER is set to 0.</div> <div>• When s1, s2 are words : 0000 to 9999 (BCD)</div> <div>• When s1, s2 are double words : 00000000 to 99999999 (BCD)</div>																								
Cautionary notes																								
<div>• The combinations of d, s1 and s2 are as follows.</div> <table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table>																d	s1	s2	Word	Word	Word	Double word	Double word	Double word
d	s1	s2																						
Word	Word	Word																						
Double word	Double word	Double word																						
Program example																								
<div><div>X00000 DIF0</div><div>WL002 = WL000 B+ WL001</div></div>										<div>LD X00000</div> <div>AND DIF0</div> <div>[</div> <div>WL002 = WL000 B+ WL001</div> <div>]</div>														
Program description																								
<div>• The sum of the values of WL000 and WL001 is substituted into WL002 as BCD data at the rising edge of input X00000.</div>																								



d = s1 - s2

Item number		Arithmetic commands-4				Name		Binary subtraction (BINARY SUBTRACTION)																																				
Ladder format				Condition code					Processing time (μs)					Remark																														
d = s1 – s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW																													
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																														
				●	●	●	↑	↑	0.4	←	54	←	121	←																														
Command format				Number of steps																																								
d = s1 – s2				Condition			Steps		20		←		80			←		96	←																									
				Word			4																																					
				Double word			6																																					
Usable I/O		Bit				Word				Double word			Constant	Other																														
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																																
d	Substitution destination								○	○	○			○	○																													
s1	Minuend								○	○	○	○	○	○	○	○																												
s2	Subtrahend								○	○	○	○	○	○	○	○																												
Function																																												
<div><div><div><div>• Subtracts s2 from s1 as binary data, and substitutes the result into d as binary data.</div><div>• The C flag is 1 if there is a digit decrease, and 0 if not. C = <math>\overline{s1m} \cdot s2m + \overline{s1m} \cdot dm + s2m \cdot dm</math></div><div>• The V flag is 1 if the operation result is a meaningless signed-binary data, and 0 if it has meaning.</div></div><div><table><tr><th>s1</th><th>s2</th><th>d</th><th>V</th></tr><tr><td>Positive</td><td>Positive</td><td>Positive/Negative</td><td>0</td></tr><tr><td>Negative</td><td>Negative</td><td>Positive/Negative</td><td>0</td></tr><tr><td>Positive</td><td>Negative</td><td>Positive</td><td>0</td></tr><tr><td>Positive</td><td>Negative</td><td>Negative</td><td>1</td></tr><tr><td>Negative</td><td>Positive</td><td>Positive</td><td>1</td></tr><tr><td>Negative</td><td>Positive</td><td>Negative</td><td>0</td></tr></table><div><div><div><div></div><div>Most significant bit</div></div><div><div>s1m</div><div></div><div>0</div></div><div>s1</div></div><div><div>-</div><div><div>s2m</div><div></div><div>0</div></div><div>s2</div></div><div><div></div><div><div>C</div><div>dm</div><div>0</div></div><div>d</div></div></div><div><math display="block">V = \overline{s1m} \cdot s2m \cdot dm + s1m \cdot \overline{s2m} \cdot \overline{dm}</math></div></div></div></div>																	s1	s2	d	V	Positive	Positive	Positive/Negative	0	Negative	Negative	Positive/Negative	0	Positive	Negative	Positive	0	Positive	Negative	Negative	1	Negative	Positive	Positive	1	Negative	Positive	Negative	0
s1	s2	d	V																																									
Positive	Positive	Positive/Negative	0																																									
Negative	Negative	Positive/Negative	0																																									
Positive	Negative	Positive	0																																									
Positive	Negative	Negative	1																																									
Negative	Positive	Positive	1																																									
Negative	Positive	Negative	0																																									
Cautionary notes																																												
<div><div><div><div>• The combinations of d, s1 and s2 are as follows:</div><div><table><tr><th>d</th><th>s1</th><th>s2</th></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table></div></div></div></div>																	d	s1	s2	Word	Word	Word	Double word	Double word	Double word																			
d	s1	s2																																										
Word	Word	Word																																										
Double word	Double word	Double word																																										
Program example																																												
<div><div><div><div><div>X00000</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><d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Item number		Arithmetic commands-5				Name		BCD subtraction (BCD SUBTRACTION)																	
Ladder format						Condition code					Processing time (μs)					Remark									
d = s1 B- s2						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW								
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max									
						↑	●	●	●	↑	34	←	79	←	193	←									
Command format						Number of steps																			
d = s1 B- s2						Condition			Steps																
						Word			4		54	←	117	←	247	←									
						Double word			6																
Usable I/O				Bit				Word				Double word			Constant	Other									
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM											
d	Substitution destination																								
s1	Minuend																								
s2	Subtrahend																								
Function																									
<ul style="list-style-type: none"><li>Subtracts s2 from s1 as BCD data, and substitutes the result into d as BCD data.</li><li>The C flag is 1 if there is a digit decrease, and 0 if not.</li><li>The DER flag is 1 if s1 or s2 is not a valid BCD data. In such cases, operation is not performed and the C flag retains the previous state without outputting to d. If the s1 and s2 are valid BCD data, the DER is set to 0.</li></ul>																									
Cautionary notes																									
<ul style="list-style-type: none"><li>The combinations of d, s1 and s2 are as follows:</li></ul> <table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table>																	d	s1	s2	Word	Word	Word	Double word	Double word	Double word
d	s1	s2																							
Word	Word	Word																							
Double word	Double word	Double word																							
Program example																									
<div><div><div>X00000</div><div><div></div><div>WR0003 = WR0004 B- WR0005</div></div></div><div>LD X00000 [ WR0003 = WR0004 B- WR0005 ]</div></div>																									
Program description																									
<ul style="list-style-type: none"><li>When input X00000 turns on, the difference between the values in WR0004 and WR0005 is substituted into WR0003 as BCD data.</li></ul>																									

d = s1 × s2

Item number		Arithmetic commands-6				Name		Binary multiplication (BINARY MULTIPLICATION)																
Ladder format				Condition code						Processing time (μs)						Remark								
d = s1 × s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW									
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max										
				↑	●	●	●	●	30	←	76	←	87	←										
Command format				Number of steps						39	←	85	←	139	←									
d = s1 × s2				Condition			Steps			39	←	85	←	139	←									
				Word			4																	
				Double word			6																	
Usable I/O			Bit				Word				Double word			Constant	Other									
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM											
d	Substitution destination								○	○	○		○	○										
s1	Multiplicand							○	○	○	○	○	○	○	○									
s2	Multiplier							○	○	○	○	○	○	○	○									
Function																								
<div>• Multiplies s1 and s2 as binary data, and substitutes the result into d+1 (upper digit) and d (lower digit) in binary.</div> <div>• The DER flag is 1 if d+1 has exceeded the usable I/O range (in this case only the lower word is substituted), and 0 when it is not exceeded.</div>																								
<div><div><div><div>MSB0</div><div><div>s1</div></div></div><div><div>MSB0</div><div><div>s2</div></div></div><div><div>×</div><div>MSB0</div><div><div>d+1</div><div>d</div></div></div></div><div><div>Example) WR0012 = WR0010 × WR0011</div><div><div>WR0010</div><div>WR0011</div><div>×</div><div>WR0013WR0012</div><div>DR0012</div></div></div><div><div>Example) DR0014 = DR0010 × DR0012</div><div><div>WR0011WR0010</div><div>DR0010</div><div>WR0013WR0012</div><div>DR0012</div><div>×</div><div>WR0017WR0016WR0015WR0014</div><div>DR0016DR0014</div></div></div></div>																								
Cautionary notes																								
<div>• The combinations of d, s1 and s2 are as follows:</div> <table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table> <div>• Since the operation results are always substituted into d and d + 1, exercise caution so that the word or double-word at d + 1 is not used as the I/O of others.</div>																d	s1	s2	Word	Word	Word	Double word	Double word	Double word
d	s1	s2																						
Word	Word	Word																						
Double word	Double word	Double word																						
Program example																								
<div><div><div>X00000</div><div><div>LD X00000</div><div>[</div><div>WR0002 = WR0000 * WR0001</div><div>]</div></div></div></div>																								
Program description																								
<div>• When input X00000 turns on, the product of the values in WR0000 and WR0001 is substituted into WR0002.</div>																								

Cautionary notes

- The combinations of d, s1 and s2 are as follows:

d	s1	s2
Word	Word	Word
Double word	Double word	Double word

- Since the operation results are always substituted into d and d + 1, exercise caution so that the word or double-word at d + 1 is not used as the I/O of others.

Program example

X00000

LD X00000

[

WR0002 = WR0000 \* WR0001

]

Program description

- When input X00000 turns on, the product of the values in WR0000 and WR0001 is substituted into WR0002.

Item number		Arithmetic commands-7				Name		BCD multiplication (BCD MULTIPLICATION)																
Ladder format				Condition code					Processing time (μs)						Remark									
d = s1 B× s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW									
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max										
				↕	●	●	●	●																
Command format				Number of steps					63	←	110	←	227	←										
d = s1 B× s2				Condition			Steps		132	←	203	←	323	←										
				Word			4																	
				Double word			6																	
Usable I/O			Bit				Word			Double word			Constant	Other										
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM									
d	Substitution destination								○	○	○		○	○										
s1	Multiplicand								○	○	○	○	○	○	○									
s2	Multiplier								○	○	○	○	○	○	○									
Function																								
<div><div><div><div><div>• Multiplies s1 and s2 as BCD data, and substitutes the result into d+1 (upper digit) and d (lower digit) as BCD.</div><div>• The DER flag is 1 if s1 or s2 is an invalid BCD data. In this case the operation is not performed. Also, if d+1 exceeds the usable I/O range, the DER flag is set to 1 and only the lower digit word is substituted. The DER flag is 0 if s1 and s2 are valid BCD data and d+1 is within the usable I/O range.</div></div></div><div><div><div><div><div>MSB0</div><div></div></div><div>s1</div></div><div><div><div>MSB0</div><div></div></div><div>s2</div></div><div><div><div>~</div><div>MSB0</div><div></div></div><div>d+1</div><div>d</div></div></div><div><div><div>Example) WR0016 = WR0014 B ~ WR0015</div><div><div><div>WR0014</div><div>s1</div></div><div><div>WR0015</div><div>s2</div></div><div><div>~</div><div><div>WR0017</div><div>WR0016</div></div><div>d</div></div><div>DR0016</div></div></div><div><div><div>Example) DR0022 = DR0018 B ~ DR0020</div><div><div><div>WR0019</div><div>WR0018</div></div><div>s1</div></div><div><div>DR0018</div><div><div>WR0021</div><div>WR0020</div></div><div>s2</div></div><div><div>DR0020</div><div><div>~</div><div><div>WR0025</div><div>WR0024</div></div><div>d+1</div></div><div>DR0024</div></div><div><div><div>WR0023</div><div>WR0022</div></div><div>d</div></div><div>DR0022</div></div></div></div></div></div></div>																								
Cautionary notes																								
<div><div><div><div>• The combinations of d, s1 and s2 are as follows:</div><div><table><tr><th>d</th><th>s1</th><th>s2</th></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table></div></div><div><div><div>• Since the operation results are always substituted into d and d + 1, exercise caution so that the word or double-word at d + 1 is not used as the I/O of others.</div></div></div></div></div>																d	s1	s2	Word	Word	Word	Double word	Double word	Double word
d	s1	s2																						
Word	Word	Word																						
Double word	Double word	Double word																						
Program example																								
<div><div><div><div>X00000</div><div><div><div>LD X00000</div><div>[</div><div>WR0016 = WR0014 B * WR0015</div><div>]</div></div></div></div></div></div>																								
Program description																								
<div><div><div><div>• When input X00000 turns on, the product of the values in WR0014 and WR0015 is substituted into WR0016 as BCD data.</div></div></div></div>																								

d = s1 Sx s2

Item number		Arithmetic commands-8				Name		Signed binary multiplication (SIGNED BINARY MULTIPLICATION)												
Ladder format				Condition code					Processing time (μs)						Remark					
d = s1 S× s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				↕	●	●	●	●												
Command format				Number of steps					42		←		92		←		143		←	
d = s1 S× s2				Condition		Steps														
				Double word		6														
Usable I/O			Bit				Word				Double word			Constant	Other					
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
d	Substitution destination										○	○								
s1	Multiplicand										○	○	○	○						
s2	Multiplier										○	○	○	○						
Function																				
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Example) DR0031 = DR0026 S ~ DR0028

WR0027

WR0026

s1

DR0026

WR0029

WR0028

s2

DR0028

WR0034

WR0033

DR0033

WR0032

WR0031

DR0031

Item number		Arithmetic commands-9				Name		Binary division (BINARY DIVISION)									
Ladder format				Condition code						Processing time (μs)						Remark	
d = s1 / s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↑	●	●	●	●									
Command format				Number of steps						28	←	72	←	138	←		
d = s1 / s2				Condition				Steps		32	←	95	←	111	←		
				Word				4									
				Double word				6									
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	Substitution destination								○	○	○		○	○			
s1	Dividend							○	○	○	○	○	○	○	○		
s2	Divisor							○	○	○	○	○	○	○	○		
Function																	
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$$d = s_1 B / s_2$$

Item number		Arithmetic commands-11				Name		Signed binary division (SIGNED BINARY DIVISION)													
Ladder format				Condition code						Processing time (μs)						Remark					
d = s1 S/ s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				↑	●	●	↑	●													
Command format				Number of steps						35		←		97		←		111		←	
d = s1 S/ s2				Condition			Steps														
				Double word			6														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
d	Substitution destination											○	○								
s1	Dividend											○	○	○	○						
s2	Divisor											○	○	○	○						
Function																					
				<div><div><div><div><div>WR0061</div><div>WR0060</div></div><div>DR0060</div></div><div>...</div><div><div><div>WRF017</div><div>WRF016</div></div><div>DRF016</div></div></div><div><div><div>WR0059</div><div>WR0058</div></div><div>DR0058</div></div><div><div><div>WR0057</div><div>WR0056</div></div><div>DR0056</div></div></div> 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d = s1 S/ s2



d = s1 OR s2

Item number	Arithmetic commands-12	Name				Logical OR (OR)									
Ladder format			Condition code					Processing time (μs)						Remark	
d = s1 OR s2			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: B Middle case: W Lower case: DW	
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
			●	●	●	●	●	0.4	←	36	←	76	←		
Command format			Number of steps					0.4	←	55	←	89	←		
d = s1 OR s2			Condition		Steps										
			Bit, word		4										
			Double word		6										
Usable I/O		Bit				Word				Double word		Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
d	Substitution destination		○	○			○	○	○		○	○			
s1	Comparand	○	○	○		○	○	○	○	○	○	○			
s2	Relational number	○	○	○		○	○	○	○	○	○	○			
Function															
● Obtains OR of s1 and s2, and substitutes the result into d.															

Item number		Arithmetic commands-13				Name		Logical AND (AND)																						
Ladder format				Condition code						Processing time (μs)						Remark														
d = s1 AND s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: B Middle case: W Lower case: DW															
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																
				●	●	●	●	●	0.4	←	36	←	76	←																
Command format				Number of steps						0.4	←	52	←	89	←															
d = s1 AND s2				Condition			Steps																							
				Bit, word			4																							
				Double word			6																							
Usable I/O		Bit				Word				Double word			Constant	Other																
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																		
d	Substitution destination		○	○			○	○	○		○	○																		
s1	Comparand	○	○	○		○	○	○	○	○	○	○	○																	
s2	Relational number	○	○	○		○	○	○	○	○	○	○	○																	
Function																														
<ul style="list-style-type: none"><li>Obtains AND of s1 and s2, and substitutes the result into d.</li></ul> <table><tr><td>s1</td><td>s2</td><td>d</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>																s1	s2	d	0	0	0	0	1	0	1	0	0	1	1	1
s1	s2	d																												
0	0	0																												
0	1	0																												
1	0	0																												
1	1	1																												
Cautionary notes																														
<ul style="list-style-type: none"><li>The combinations of d, s1 and s2 are as follows:</li></ul> <table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Bit</td><td>Bit</td><td>Bit</td></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table>																d	s1	s2	Bit	Bit	Bit	Word	Word	Word	Double word	Double word	Double word			
d	s1	s2																												
Bit	Bit	Bit																												
Word	Word	Word																												
Double word	Double word	Double word																												
Program example																														
<div><div><div>X00111</div><div>DIF111</div><div></div></div><div></div><div>WR0102= WR0100 AND WR0101</div></div> <div><div>LD X00111</div><div>AND DIF111</div><div>[</div><div>WR0102=WR0100 AND WR0101</div><div>]</div></div>																														
Program description																														
<ul style="list-style-type: none"><li>At the rising edge of X00111, the AND of WR0100 and WR0101 is set in WR0102.</li></ul> <table><tr><td>WR0100 = H1234</td><td rowspan="3">When ⇒</td><td>WR0100 = 0001001000110100</td></tr><tr><td>WR0101 = H5678</td><td>WR0101 = 0101011001111000</td></tr><tr><td>WR0102 = H1230</td><td>WR0102 = 0001001000110000</td></tr></table>																WR0100 = H1234	When ⇒	WR0100 = 0001001000110100	WR0101 = H5678	WR0101 = 0101011001111000	WR0102 = H1230	WR0102 = 0001001000110000								
WR0100 = H1234	When ⇒	WR0100 = 0001001000110100																												
WR0101 = H5678		WR0101 = 0101011001111000																												
WR0102 = H1230		WR0102 = 0001001000110000																												

d = s1 XOR s2

Item number		Arithmetic commands-14				Name		Exclusive OR (EXCLUSIVE - OR)																					
Ladder format				Condition code					Processing time (μs)						Remark														
d = s1 XOR s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: B Middle case: W Lower case: DW														
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max															
				●	●	●	●	●	0.4	←	36	←	76	←															
Command format				Number of steps					0.4	←	52	←	89	←															
d = s1 XOR s2				Condition		Steps																							
				Bit, word		4																							
				Double word		6																							
Usable I/O		Bit				Word				Double word			Constant	Other															
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																	
d	Substitution destination		○	○			○	○	○		○	○																	
s1	Comparand	○	○	○		○	○	○	○	○	○	○																	
s2	Relational number	○	○	○		○	○	○	○	○	○	○																	
Function																													
<div>● Obtains exclusive OR (XOR) of s1 and s2, and substitutes the result into d.</div> <table><tr><td>s1</td><td>s2</td><td>d</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>															s1	s2	d	0	0	0	0	1	1	1	0	1	1	1	0
s1	s2	d																											
0	0	0																											
0	1	1																											
1	0	1																											
1	1	0																											
Cautionary notes																													
<div>● The combinations of d, s1 and s2 are as follows:</div> <table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Bit</td><td>Bit</td><td>Bit</td></tr><tr><td>Word</td><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td><td>Double word</td></tr></table>															d	s1	s2	Bit	Bit	Bit	Word	Word	Word	Double word	Double word	Double word			
d	s1	s2																											
Bit	Bit	Bit																											
Word	Word	Word																											
Double word	Double word	Double word																											
Program example																													
		<div><div><div>X00112</div><div>DIF112</div><div></div></div><div>WR0102= WR0100 XOR WR0101</div></div> <div><div>LD X00112</div><div>AND DIF112</div><div>[</div><div>WR0102=WR0100 XOR WR0101</div><div>]</div></div>																											
Program description																													
<div>● At the rising edge of X00112, the XOR of WR0100 and WR0101 is set in WR0102.</div> <div><div>WR0100 = H1234</div><div>When ⇒</div><div>WR0100 = 0001001000110100</div></div> <div><div>WR0101 = H5678</div><div></div><div>WR0101 = 0101011001111000</div></div> <div><div>WR0102 = H444C</div><div></div><div>WR0102 = 0100010001001100</div></div>																													

Item number		Arithmetic commands-15				Name		= Relational expression (= RELATIONAL EXPRESSION)																
Ladder format				Condition code						Processing time (μs)						Remark								
d = s1 == s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW									
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max										
				●	●	●	●	●	0.4	←	36	←	82	85										
Command format				Number of steps																				
d = s1 == s2				Condition			Steps			18	←	44	←	84	85									
				s is a word			4																	
				s is a double word			6																	
Usable I/O			Bit				Word				Double word			Constant	Other									
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM											
d	Substitution destination			○	○																			
s1	Comparand						○	○	○	○	○	○	○											
s2	Relational number						○	○	○	○	○	○	○											
Function																								
			● Substitutes 1 when s1 is equal to s2 and otherwise 0 into d, assuming s1 and s2 as binary data.																					
Cautionary notes																								
			● The combinations of d, s1 and s2 are as follows:																					
			<table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Bit</td><td>Word</td><td>Word</td></tr><tr><td>Bit</td><td>Double word</td><td>Double word</td></tr></table>													d	s1	s2	Bit	Word	Word	Bit	Double word	Double word
d	s1	s2																						
Bit	Word	Word																						
Bit	Double word	Double word																						
Program example																								
			<div><div></div><div>M0000 = WX0000 == WX0001</div><div></div></div> <div>[ M0000 = WX0000 == WX0001 ]</div>																					
Program description																								
			● When WX0000 = WX0001, “1” is set in M0000. Otherwise, M0000 is reset to “0.”																					

d = s1 == s2

d = s1 S== s2

Item number		Arithmetic commands-16				Name				Signed = Relational expression (SIGNED = RELATIONAL EXPRESSION)									
Ladder format				Condition code						Processing time (μs)						Remark			
d = s1 S== s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
				●	●	●	●	●											
Command format				Number of steps						18	←	44	←	84		202			
d = s1 S== s2				Condition			Steps												
				s is a double word			6												
Usable I/O			Bit				Word				Double word			Constant	Other				
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
d	Substitution destination			○	○														
s1	Comparand									○	○	○	○						
s2	Relational number									○	○	○	○						
Function																			
<div><div><div><div></div></div><div><div></div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> 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d = s1 <> s2

Item number		Arithmetic commands-17				Name		<> Relational expression (<> RELATIONAL EXPRESSION)																
Ladder format				Condition code						Processing time (μs)						Remark								
d = s1 <> s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW									
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max										
				●	●	●	●	●	0.4	←	36	←	75	192										
Command format				Number of steps																				
d = s1 <> s2				Condition			Steps																	
				s is a word			4			18	←	43	←	84	202									
				s is a double Word			6																	
Usable I/O			Bit				Word				Double word			Constant	Other									
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM											
d	Substitution destination				○	○																		
s1	Comparand						○	○	○	○	○	○	○											
s2	Relational number						○	○	○	○	○	○	○											
Function																								
		● Substitutes 1 when s1 is not equal to s2 and otherwise 0 into d, assuming s1 and s2 as binary data.																						
Cautionary notes																								
		● The combinations of d, s1 and s2 are as follows:																						
		<table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Bit</td><td>Word</td><td>Word</td></tr><tr><td>Bit</td><td>Double word</td><td>Double word</td></tr></table>														d	s1	s2	Bit	Word	Word	Bit	Double word	Double word
d	s1	s2																						
Bit	Word	Word																						
Bit	Double word	Double word																						
Program example																								
		<div><div>Y00000= WR0000 &lt; &gt; WR0001</div><div>[ Y00000= WR0000 &lt; &gt; WR0001 ]</div></div>																						
Program description																								
		● When WR0000 ≠ WR0001, “1” is set in Y00000. Otherwise, Y00000 is reset to “0.”																						

d = s1 S<> s2

Item number		Arithmetic commands-18				Name		Signed $\diamond$ Relational expression (SIGNED $\diamond$ RELATIONAL EXPRESSION)									
Ladder format				Condition code						Processing time (μs)						Remark	
d = s1 S $\diamond$ s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						18	←	43	←	85	←		
d = s1 S $\diamond$ s2				Condition			Steps										
				s is a double word			6										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	Substitution destination				○	○											
s1	Comparand									○	○	○	○				
s2	Relational number									○	○	○	○				
Function																	
<div><div><div><div>●</div><div>Substitutes 1 when s1 is not equal to s2 and otherwise 0 into d, assuming s1 and s2 as signed binary data.</div></div><div><div>●</div><div>s1 and s2 are both signed binary data. When the most significant bit is 0, the value is positive; when the most significant bit is 1, the value is negative.</div></div></div><div><div>s1, s2</div><div>– 2,147,483,648 to +2,147,483,647 (decimal)</div><div>H80000000 to H7FFFFFFF (hexadecimal)</div></div><div><div><div><div>b31</div><div>b16 b15</div><div>b0</div></div><div><div></div><div></div><div></div></div><div><div>↑</div><div>Sign bit: 0 - Positive; 1 - Negative</div></div></div></div></div>																	
Program example																	
<div><div><div><div></div><div>Y00100 = DR0000 S<math>\diamond</math> DR0002</div><div></div></div><div>[ Y00100 = DR0000 S<math>\diamond</math> DR0002 ]</div></div></div>																	
Program description																	
<div><div><div>●</div><div>When the values of DR0000 and DR0002 are not equal, Y00100 is turned on. Otherwise, Y00100 is turned off.</div></div></div>																	

Item number		Arithmetic commands-19				Name		< Relational expression (< RELATIONAL EXPRESSION)																				
Ladder format				Condition code						Processing time (μs)						Remark												
d = s1 < s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW													
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max														
				●	●	●	●	●	0.4	←	36	←	76	←														
Command format				Number of steps						19		←		44		←		86		←								
d = s1 < s2				Condition			Steps																					
				s is a word			4																					
				s is a double word			6																					
Usable I/O			Bit				Word				Double word			Constant	Other													
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM															
d	Substitution destination				○	○																						
s1	Comparand							○	○	○	○	○	○	○	○	○	○											
s2	Relational number							○	○	○	○	○	○	○	○	○	○											
Function																												
				● Substitutes 1 when s1 is less than s2 and otherwise 0 into d, assuming s1 and s2 as binary data.																								
Cautionary notes																												
				● The combinations of d, s1 and s2 are as follows:																								
				<table><tr><td>d</td><td>s1</td><td>s2</td></tr><tr><td>Bit</td><td>Word</td><td>Word</td></tr><tr><td>Bit</td><td>Double word</td><td>Double word</td></tr></table>																d	s1	s2	Bit	Word	Word	Bit	Double word	Double word
d	s1	s2																										
Bit	Word	Word																										
Bit	Double word	Double word																										
Program example																												
				<div><div>L10000= TC100 &lt; TC101</div><div>[ L10000= TC100 &lt; TC101 ]</div></div>																								
Program description																												
				● When TC100 < TC101, 1 is set in L10000. Otherwise, L10000 is reset to 0. (TC n is the progress value of the no. n timer or counter.)																								



d = s1 S< s2

Item number		Arithmetic commands-20				Name				Signed < Relational expression (SIGNED < RELATIONAL EXPRESSION)							
Ladder format				Condition code						Processing time (μs)						Remark	
d = s1 S< s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						19	←	45	←	86	←		
d = s1 S< s2				Condition			Steps										
				s is a double word			6										
Usable I/O			Bit				Word			Double word			Constant	Other			
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM		
d	Substitution destination				○	○											
s1	Comparand										○	○	○	○			
s2	Relational number										○	○	○	○			
Function																	
<div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> <div><div></div><div></div></div> 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d = s1 <= s2

Item number	Arithmetic commands-21				Name		≤ Relational expression (≤ RELATIONAL EXPRESSION)									
Ladder format			Condition code					Processing time (μs)						Remark		
d = s1 <= s2			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
			●	●	●	●	●	0.4	←	36	←	76	←			
Command format			Number of steps					19	←	45	←	86	←			
d = s1 <= s2			Condition		Steps											
			s is a word		4											
			s is a double word		6											
Usable I/O		Bit				Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	Substitution destination			○	○											
s1	Comparand					○	○	○	○	○	○	○	○			
s2	Relational number					○	○	○	○	○	○	○	○			
Function																
● Substitutes 1 when s1 is less than or equal to s2 and otherwise 0 into d, assuming s1 and s2 as binary data.																
Cautionary notes																
● The combinations of d, s1 and s2 are as follows:																
d		s1		s2												
Bit		Word		Word												
Bit		Double word		Double word												
Program example																
		Y00001 = WL3FF <= WL13FF				[ Y00001 = WL3FF <= WL13FF ]										
Program description																
● When $WL3FF \leq WL13FF$ , 1 is set in Y00001. Otherwise, Y00001 is reset to 0.																

d = s1 S<= s2

Item number		Arithmetic commands-22				Name				Signed ≤ Relational expression (SIGNED ≤ RELATIONAL EXPRESSION)							
Ladder format				Condition code						Processing time (μs)						Remark	
d = s1 S<= s2				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						19	←	45	←	86	←		
d = s1 S<= s2				Condition			Steps										
				s is a double word			6										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	Substitution destination				○	○											
s1	Comparand										○	○	○	○			
s2	Relational number										○	○	○	○			
Function																	
<div><ul style="list-style-type: none"><li>Substitutes 1 when s1 is less than or equal to s2 and otherwise 0 into d, assuming s1 and s2 as signed binary data.</li><li>s1 and s2 are both signed binary data. When the most significant bit is 0, the value is positive; when the most significant bit is 1, the value is negative. s1, s2            – 2,147,483,648 to +2,147,483,647 (decimal)                     H80000000 to H7FFFFFFF (hexadecimal)</li></ul><div><div><div>b31</div><div>b16 b15</div><div>b0</div></div><div><div></div><div></div><div></div></div><div><div>↑</div><div>Sign bit: 0 - Positive; 1 - Negative</div></div></div></div>																	
Program example																	
<div><div><div></div><div>Y00100 = DL3FE S&lt;= DL13FE</div><div></div></div><div>[ Y00100 = DL03FE S&lt;= DL13FE ]</div></div>																	
Program description																	
<div><ul style="list-style-type: none"><li>When the value in DL3FE is less than or equal the value in DL13FE, Y00100 is turned on. Otherwise, Y00100 is turned off.</li></ul></div>																	

BSET (d, n)

Item number		Application commands-2				Name		Bit reset (BIT RESET)									
Ladder format				Condition code						Processing time (μs)						Remark	
BRES (d, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●	13	←	50	←	86	←			
Command format				Number of steps						13	←	50	←	86	←		
BRES (d, n)				Condition			Steps			15	←	66	←	66	←		
				—			3										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	I/O to be set the bit								○	○	○		○	○			
n	Bit location to be reset							○	○	○	○				○	The constant is set in decimal.	
Function																	
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BRES (d, n)

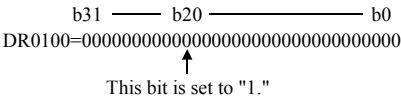
Item number		Application commands-3				Name		Bit test (BIT TEST)									
Ladder format				Condition code						Processing time (μs)						Remark	
BTS (d, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	↑	13	←	50	←	86	←			
Command format				Number of steps						13	←	50	←	86	←		
BTS (d, n)				Condition			Steps			15	←	67	←	67	←		
				—			3										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	I/O to be tested								○	○	○		○	○			
n	Bit location to be tested							○	○	○	○				○	The constant is set in decimal.	
Function																	
<div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> 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BTS (d, n)

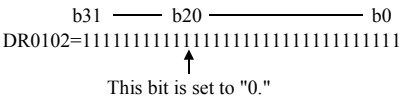
Program description

When WX0000 = H1234 at the rising edge of X00200 (WX0000 = 0001001000110100)  
20 (decimal)

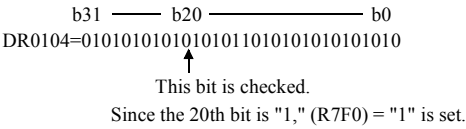
If DR0100 = H00000000, DR0102 = HFFFFFFF and DR0104 = H5555AAAA are set, the 20th bit of DR0100 is set to “1” by the BSET at the rising edge of X00200.



Also, the 20th bit of DR0102 is reset to “0” by BRES.



Also, the 20th bit of DR0104 is checked by BTS.

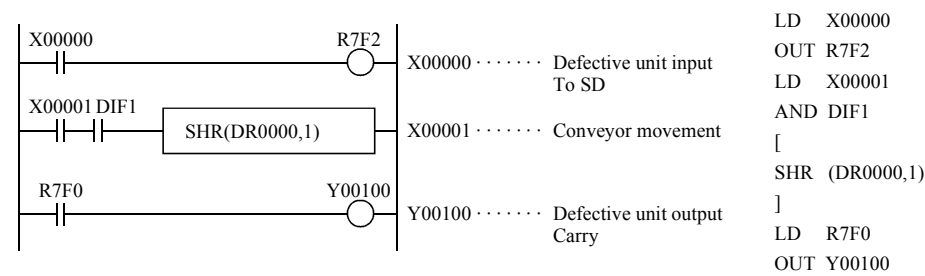


BTS (d, n)

Item number		Application commands-4				Name		Shift right (SHIFT RIGHT)									
Ladder format						Condition code					Processing time (μs)					Remark	
SHR (d, n)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
						●	●	●	●	↑	17	←	53	←	90	←	
Command format						Number of steps											
SHR (d, n)						Condition			Steps								
						—			3		18	←	71	←	71	←	
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
d	I/O to be shifted											○	○	○			
n	Number of bits to be shifted											○	○	○	○		The constant is set in decimal.
Function																	
<ul style="list-style-type: none"><li>Shifts the contents of d to the right (toward the lower digits) by n bits.</li><li>Sets n bits of SD (R7F2) contents starting with the most significant bit.</li><li>Sets the content of the nth bit from the least significant bit in C (R7F0).</li></ul>																	
<p>Before execution</p> <div><div><div>SD</div><div>SD (R7F2)</div></div><div><div>d</div><div>n bits</div></div><div><div>B</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div>C (R7F0)</div></div></div> <p>After execution</p> <div><div>SD</div><div>SD</div><div>SD</div><div>SD</div><div></div><div></div><div></div><div></div></div> <div><div>n bits</div></div> <div><div>B</div></div> <div><div>Most significant bit (MSB)</div><div>Least significant bit (LSB)</div></div>																	
<p>If d is a word :      Designates the shift amount, depending on the contents (0 to 15) of the lower 4 bits (b3 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered 0.) The n (constant) can be set to 0 to 15 (decimal).</p> <p>If d is a double word :      Designates the shift amount, depending on the contents (0 to 31) of the lower 5 bits (b4 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered 0.) The n (constant) can be set to 0 to 31 (decimal).</p>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>If n is equal to 0, the shift is not performed. The previous state is retained in C.</li></ul>																	

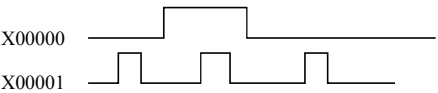


Program example

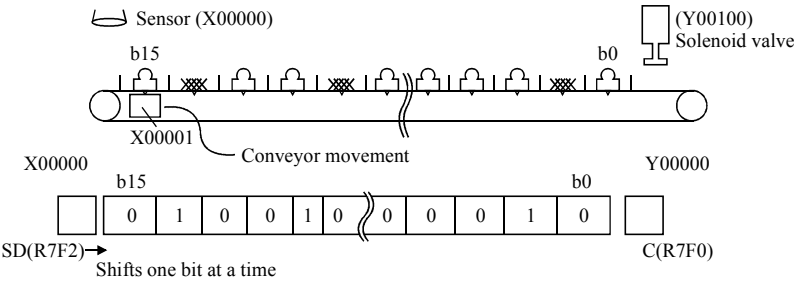


Program description

- There exists a conveyor that has 16 stands and is moving to the right.
- Each time the conveyor moves one stand to the right, a pulse input enters X00001.
- There is a sensor on the left end of the conveyor, and when a defective unit is placed on the conveyor, X00000 turns on. X00000 (sensor input) and X00001 (conveyor movement) signals are as follows:



- As the conveyor moves to the right, the data is also shifted one bit at a time, and when data exits to the carry (on the right end of the conveyor), the (Y00100) solenoid valve turns on and rejects the defective unit.



SHR (d,n)

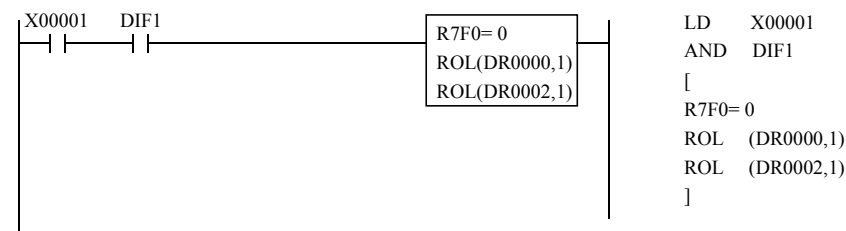
Item number		Application commands-5				Name		Shift left (SHIFT LEFT)							
Ladder format				Condition code					Processing time (μs)					Remark	
SHL (d, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
				●	●	●	●	↑	16	←	54	←	90	←	
Command format				Number of steps											
SHL (d, n)				Condition			Steps								
				—			3		18	←	71	←	71	←	
Usable I/O			Bit				Word			Double word			Constant	Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
d	I/O to be shifted							○	○	○		○	○		
n	Number of bits to be shifted						○	○	○	○				○	The constant is set in decimal.
Function															
<div><div><div><div>Before execution</div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>C (R7F0)</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>SD (R7F2)</div></div></div><div>After execution</div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>B</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>SD</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>SD</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>SD</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>SD</div></div></div><div><div>Most significant bit (MSB)</div><div>Least significant bit (LSB)</div></div></div><div><div>If d is a word :</div><div>Designates the shift amount, depending on the contents (0 to 15) of the lower 4 bits (b3 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered 0.) The n (constant) can be set to 0 to 15 (decimal).</div></div><div><div>If d is a double word :</div><div>Designates the shift amount, depending on the contents (0 to 31) of the lower 5 bits (b4 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered 0.) The n (constant) can be set to 0 to 31 (decimal).</div></div></div></div>															
Cautionary notes															
<div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div>If n is equal to 0, the shift is not performed. The previous state is retained in C.</div></div></div>															
Program example															
<div><div><div><div><div>X00000</div><div></div><div></div></div><div><div>X00001</div><div>DIF1</div><div></div></div><div><div>R7F0</div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div></div>			<div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>R7F2</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>Y00100</div></div></div> <div><div><div><div>LD</div><div>X00000</div></div><div><div>OUT</div><div>R7F2</div></div><div><div>LD</div><div>X00001</div></div><div><div>AND</div><div>DIF1</div></div><div><div>[</div><div>SHL(DR0000,1)</div><div>]</div></div><div><div>LD</div><div>R7F0</div></div><div><div>OUT</div><div>Y00100</div></div></div></div>												
Program description															
<div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div>The R7F2 value of the DR0000 after the shift is determined by the on/off of X00000.</div><div>The content of DR0000 is shifted to the left when X00001 rises. At this time, the value of R7F2 is set in b0 and the value of b31 (b15 of WR0001) in R7F0.</div><div>The Y00100 turns on/off depending on the b31 value of DR0000 (b15 of WR0001) prior to the shift.</div></div></div>															

ROR (d, n)

Item number	Application commands-6	Name		Rotate right (ROTATE RIGHT)										
Ladder format			Condition code					Processing time (μs)					Remark	
ROR (d, n)			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
			●	●	●	●	↑	21	←	60	←	96	←	
Command format			Number of steps											
ROR (d, n)			Condition			Steps								
			—			3		22	←	76	←	77	←	
Usable I/O		Bit				Word			Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
d	I/O to be rotated						○	○	○		○	○		
n	Number of bits to be rotated					○	○	○	○				○	The constant is set in decimal.
Function														
<div><div><div>Before execution</div><div><div><div>d</div><div><div><div><div>Bn</div><div></div><div></div><div></div><div>B3</div><div>B2</div><div>B1</div></div></div><div>C (R7F0)</div></div></div></div></div><div><div>After execution</div><div><div><div><div>Bn-1</div><div></div><div>B3</div><div>B2</div><div>B1</div><div>C</div></div><div><div>n bits</div></div></div><div><div>Most significant bit (MSB)</div><div>Least significant bit (LSB)</div></div></div></div></div> <div><div>If d is a word :</div><div>Designates the shift amount, depending on the contents (0 to 15) of the lower 4 bits (b3 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered 0.) The n (constant) can be set to 0 to 15 (decimal).</div></div> <div><div>If d is a double word :</div><div>Designates the shift amount, depending on the contents (0 to 31) of the lower 5 bits (b4 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered 0.) The n (constant) can be set to 0 to 31 (decimal).</div></div>														
Cautionary notes														
<div><div><div>If n is equal to 0, the rotation is not performed. The previous state is retained in C.</div></div></div>														
Program example														
<div><div><div><div><div>R000</div><div>DIF0</div></div><div><div>ROR (WR0000 ,1 )</div></div></div></div><div><div>LD R000</div><div>AND DIF0</div><div>[ ROR (WR0000,1)</div><div>]</div></div></div>														
Program description														
<div><div><div><div>When R000 rises, WR0000 is shifted to the right by one bit.</div><div>At this time, the value of the least significant bit, b0, is set in R7F0, and the value of R7F0 immediately prior to the is set in the most significant bit, b15.</div></div></div></div>														

Item number		Application commands-7				Name		Rotate left (ROTATE LEFT)									
Ladder format				Condition code					Processing time (μs)						Remark		
ROL (d, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	↑	21	←	59	←	95	←			
Command format				Number of steps													
ROL (d, n)				Condition			Steps										
				—			3		22	←	76	←	77	←			
Usable I/O			Bit				Word			Double word			Constant	Other			
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM		
d	I/O to be rotated							○	○	○		○	○				
n	Number of bits to be rotated						○	○	○	○				○	The constant is set in decimal.		
Function																	
<div><div><div><div></div><div></div></div><div>Before execution</div><div><div><div></div><div></div></div><div>After execution</div></div><div><div><div></div><div></div></div><div>Most significant bit (MSB)</div><div><div></div><div></div></div><div>Least significant bit (LSB)</div></div></div><div><div><div></div><div></div></div><div>If d is a word :</div><div><div></div><div></div></div><div>If d is a double word :</div></div><div><div><div></div><div></div></div><div>Cautionary notes</div></div></div> <div><div><div></div><div></div></div><div><div><div></div><div></div></div><div>If n is equal to 0, the rotation is not performed. The previous state is retained in C.</div></div></div>																	

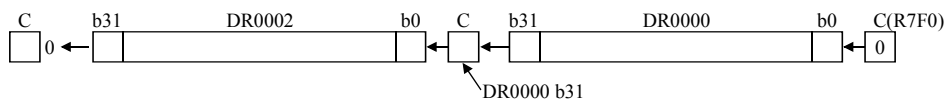
Program example



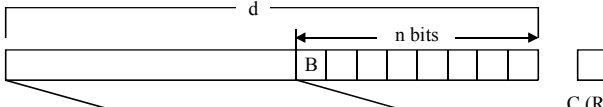
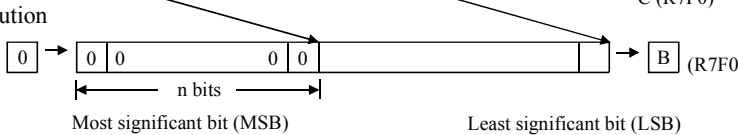
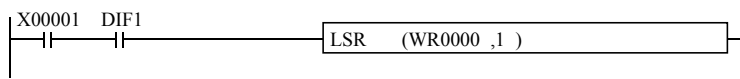
Program description

- When X00001 rises, the 64 bit data is shifted one bit at a time.  
The open area after the shift is filled with “0.”

Overall movement



ROL (d, n)

Item number		Application commands-8				Name		Logical shift right (LOGICAL SHIFT RIGHT)									
Ladder format		Condition code								Processing time (μs)						Remark	
		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
		●	●	●	●	↑	16	←	53	←	89	←					
Command format		Number of steps														Upper case: W Lower case: DW	
LSR (d, n)		Condition				Steps											
		—				3				18	←	70	←	71	←		
Usable I/O		Bit				Word				Double word			Constant	Other			
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
d	I/O to be shifted						○	○	○		○	○					
n	Number of bits to be shifted					○	○	○	○				○	The constant is set in decimal.			
Function																	
		<ul style="list-style-type: none"><li>Shifts the contents of d to the right (toward the lower digits) by n bits.</li><li>“0” is set from the most significant bit to the nth bit.</li><li>The content of the nth bit from the least significant bit is set in C (R7F0).</li></ul> <div><p>Before execution</p><p>After execution</p><p>If d is a word : Designates the shift amount, depending on the contents (0 to 15) of the lower 4 bits (b3 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered “0”). The n (constant) can be set to 0 to 15 (decimal).</p><p>If d is a double word : Designates the shift amount, depending on the contents (0 to 31) of the lower 5 bits (b4 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered “0”). The n (constant) can be set to 0 to 31 (decimal).</p></div>															
Cautionary notes																	
		<ul style="list-style-type: none"><li>If n is equal to 0, the shift is not performed. The previous state is retained in C.</li></ul>															
Program example																	
												<pre>LD    X00001 AND   DIF1 [     LSR    (WR0000,1) ]</pre>					
Program description																	
		<ul style="list-style-type: none"><li>When X00001 rises, the content of WR0000 is shifted to the right by one bit.</li><li>At this time, “0” is set in b15 and the value of b0 immediately prior to the shift is set in R7F0.</li></ul>															

LSL (d, n)

Item number	Application commands-9	Name		Logical shift left (LOGICAL SHIFT LEFT)											
Ladder format		Condition code						Processing time (μs)						Remark	
LSL (d, n)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	↕	16	←	53	←	89	←			
Command format		Number of steps													
LSL (d, n)		Condition			Steps										
		—			3			18	←	70	←	71	←		
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
d	I/O to be shifted						○	○	○		○	○			
n	Number of bits to be shifted					○	○	○	○				○	The constant is set in decimal.	
Function															
		<div><div><div><div>• Shifts the contents of d to the left (toward the upper digits) by n bits.</div><div>• 0 is set from the least significant bit to the nth bit.</div><div>• The content of the nth bit from the most significant bit is set in C (R7F0).</div></div><div><div>Before execution</div><div>After execution</div></div><div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div></div> 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Item number		Application commands-10				Name		BCD shift right (BCD SHIFT RIGHT)									
Ladder format				Condition code						Processing time (μs)						Remark	
BSR (d, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●	15	←	52	←	88	←			
Command format				Number of steps						15	←	52	←	88		←	
BSR (d, n)				Condition			Steps			17	←	70	←	70		←	
				—			3										
Usable I/O				Bit				Word				Double word		Constant	Other		
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
d	I/O to be shifted								○	○	○		○	○			
n	Number of digits to be shifted							○	○	○	○				○	The constant is set in decimal.	
Function																	
<div><ul style="list-style-type: none"><li>Shifts the contents of d to the right (toward the lower digits) by n digits (1 digit is equivalent to 4 bits).</li><li>0 is set from the most significant bit to the nth digit.</li><li>The digits from least significant bit to the nth digit are discarded.</li></ul><div><div>Before execution</div><div>After execution</div><div><div><div>0</div><div>0000</div><div></div><div></div><div>0000</div><div></div></div><div><div>←</div><div>←</div><div>←</div><div>←</div></div><div><div>Most significant bit (MSB)</div><div>Least significant bit (LSB)</div></div></div><div><div>Discarded</div></div></div></div>																	
				If d is a word : Designates the shift amount, depending on the contents (0 to 3) of the lower 2 bits (b1, b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered “0”). The n (constant) can be set to 0 to 3 (decimal).													
				If d is a double word : Designates the shift amount, depending on the contents (0 to 7) of the lower 3 bits (b2 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered “0”). The n (constant) can be set to 0 to 7 (decimal).													
Cautionary notes																	
<ul style="list-style-type: none"><li>If n is equal to 0, the shift is not performed.</li></ul>																	
Program example																	
<div><div><div>X00001</div><div>DIF1</div></div><div>BSR (WR0000 ,1 )</div></div>				<div><div>LD X00001</div><div>AND DIF1</div><div>[</div><div>BSR (WR0000 ,1)</div><div>]</div></div>													
Program description																	
<ul style="list-style-type: none"><li>When X00001 rises, the content of WR0000 is regarded as BCD code and shifted to the right by four bits. At this time, the values in the lower 4 bits (b3 to b0) are deleted and “0000” is set in the upper four bits (b15 to b12).</li></ul>																	
				<div><div><div>H123④</div><div>0001001000110100</div><div>Before the shift</div><div>Deleted</div></div><div>→</div><div><div>H①123</div><div>0000000100100011</div><div>After the shift</div><div>Set to "0"</div></div></div>													

BSR (d, n)



BSL (d, n)

Item number		Application commands-11				Name		BCD shift left (BCD SHIFT LEFT)									
Ladder format						Condition code					Processing time (μs)						Remark
BSL (d, n)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
						●	●	●	●	●	15	←	52	←	88	←	
Command format						Number of steps											
BSL (d, n)						Condition			Steps								
						—			3		17	←	69	←	70	←	
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
d	I/O to be shifted																
n	Number of digits to be shifted														○	The constant is set in decimal.	
Function																	
		<ul style="list-style-type: none"><li>Shifts the contents of d to the left (toward the upper digits) by n digits (1 digit is equivalent to 4 bits).</li><li>0 is set from the least significant bit to the nth digit.</li><li>The digits from the most significant bit to the nth digit are discarded.</li></ul> <div><div>Before execution</div><div>After execution</div><div><div>Discarded</div><div>MSB</div><div>LSB</div></div></div> <p>If d is a word : Designates the shift amount, depending on the contents (0 to 3) of the lower 2 bits (b1, b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered “0”). The n (constant) can be set to 0 to 3 (decimal).</p> <p>If d is a double word : Designates the shift amount, depending on the contents (0 to 7) of the lower 3 bits (b2 to b0) of n (WX, WY, WR, WL, WM, TC). (Upper bits are ignored and considered “0”). The n (constant) can be set to 0 to 7 (decimal).</p>															
Cautionary notes																	
		<ul style="list-style-type: none"><li>If n is equal to 0, the shift is not performed.</li></ul>															
Program example																	
		<div><div><div>X00001</div><div>DIF1</div><div>BSL (WR0000 ,1 )</div></div><div><div>LD X00001</div><div>AND DIF1</div><div>[ BSL (WR0000 ,1)</div><div>]</div></div></div>															
Program description																	
		<ul style="list-style-type: none"><li>When X00001 rises, the content of WR0000 is regarded as BCD code and shifted to the left by four bits. At this time, the data of the lower 4 bits are deleted and “0000” is set in the upper four bits.</li></ul> <div><div><div>H</div><div>①</div><div>2</div><div>3</div><div>4</div><div>Before the shift</div><div>H</div><div>2</div><div>3</div><div>4</div><div>②</div><div>After the shift</div></div><div><div>Deleted</div><div>0001</div><div>0010</div><div>0011</div><div>0100</div><div>0010</div><div>0011</div><div>0100</div><div>0000</div><div>Set to "0"</div></div></div>															

Item number		Application commands-12				Name		Batch shift right (SHIFT RIGHT BLOCK)									
Ladder format						Condition code					Processing time (μs)				Remark		
WSHR (d, n)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left	Upper case: B Lower case: W			
						DER	ERR	SD	V	C	Ave	Ave	Ave				
						↑	●	●	●	●	31.3+0.08n	54.6+0.09n	45.1+0.08n				
Command format						Number of steps											
WSHR (d, n)						Condition			Steps								
						—			3		23.1+0.08n	64.6+0.75n	57+0.8n				
Usable I/O				Bit				Word			Double word		Constant	Other			
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX			DY	DR, DL, DM	
d	Head I/O to be shifted							○			○						
n	Number of bits (words) to be shifted									○	○	○	○		○	The constant is set in decimal.	
Function																	
<div><div><div>• Shifts n bits (words) between d and d + n – 1 to the right (toward smaller I/O number) by one bit (word).</div><div>• 0 (H0000) is set to the d + n – 1 bit (word).</div><div>• The content of d is discarded.</div></div><div><div><div>Before execution</div><div>After execution</div></div><div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></di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WSHL (d, n)

Item number		Application commands-13				Name		Batch shift left (SHIFT LEFT BLOCK)						
Ladder format				Condition code					Processing time (μs)			Remark		
WSHL (d, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left	Upper case: B Lower case: W		
				DER	ERR	SD	V	C	Ave	Ave	Ave			
				↑	●	●	●	●	30.7+0.11n	55.0+0.11n	43.3+0.11n			
Command format				Number of steps										
WSHL (d, n)				Condition			Steps							
				—			3		24.1+0.75n	64.6+0.75n	58+0.75n			
Usable I/O			Bit				Word			Double word		Constant	Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX			DY
d	Head I/O to be shifted					○			○					
n	Number of bits (words) to be shifted							○	○	○	○		○	The constant is set in decimal.
Function														
		<ul style="list-style-type: none"><li>Shifts n bits (words) between d and d + n – 1 to the left (toward greater I/O number) by one bit (word).</li><li>0 (H0000) is set to the bit (word) for d.</li><li>The content of d + n – 1 is discarded.</li></ul> <div><div>Before 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Item number	Application commands-14	Name				Batch shift right (BCD SHIFT RIGHT BLOCK)								
Ladder format		Condition code					Processing time (μs)			Remark				
WBSR (d, n)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left					
		DER	ERR	SD	V	C	Ave	Ave	Ave					
		↑	●	●	●	●								
Command format		Number of steps					23.6+1.3n	64.6+1.3n	57.5+1.3n					
WBSR (d, n)		Condition			Steps									
		—			3									
Usable I/O		Bit				Word				Double word		Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
d	Head I/O to be shifted							○						
n	Number of words to be shifted						○	○	○	○			○	The constant is set in decimal.
Function														
		<ul style="list-style-type: none"><li>Shifts n words between d and d + n – 1 to the right (toward smaller I/O number) by one digit (1 digit is equivalent to 4 bits) as BCD data.</li><li>0 is set to the most significant digit of d + n – 1.</li><li>The content of the least significant digit of d is discarded.</li></ul> <div><div>Before execution</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><di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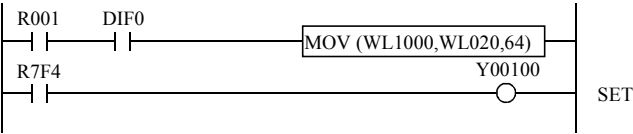
WBSR (d, n)

Item number		Application commands-15				Name		Batch shift left (BCD SHIFT LEFT BLOCK)						
Ladder format		Condition code					Processing time (μs)			Remark				
WBSL (d, n)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left					
		DER	ERR	SD	V	C	Ave	Ave	Ave					
		↑	●	●	●	●								
Command format		Number of steps					23.8+1.4n		64.6+1.4n		57.5+1.4n			
WBSL (d, n)		Condition			Steps									
		—			3									
Usable I/O		Bit				Word				Double word		Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
d	Head I/O to be shifted							○						
n	Number of words to be shifted					○	○	○	○				○	The constant is set in decimal.
Function														
<div><div><div>• Shifts n words between d and d + n – 1 to the left (toward greater I/O number) by one digit (1 digit is equivalent to 4 bits) as BCD data.</div><div>• “0” is set to the least significant digit of d + n – 1.</div><div>• The content of the most significant digit of d is discarded.</div></div><div><div><div>Before execution</div><div>After execution</div></div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><di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Item number	Application commands-16	Name	Block transfer (MOVE)										
Ladder format		Condition code					Processing time (μs)			Remark			
MOV (d, s, n)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left	Upper case: B Lower case: W			
		DER	ERR	SD	V	C	Ave	Ave	Ave				
		↑	●	●	●	●	172+112a	260+165a	245+164a				
Command format		Number of steps					a:Quotient of n/32	a:Quotient of n/32	a:Quotient of n/32				
MOV (d, s, n)		Condition			Steps		148+80b	201+91b	264+91b				
		—			4		b:Quotient of n/64	b:Quotient of n/64	b:Quotient of n/64				
Usable I/O		Bit				Word				Double word		Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM	
d	Transfer destination head I/O			○				○					
s	Transfer source head I/O			○				○					
n	Number of bits (words) to be transferred					○	○	○	○			○	The constant is set in decimal.
Function		<ul style="list-style-type: none"> <li>Transfers n bits (words) between s and s + n – 1 to d + n – 1.</li> <li>The values between s and s + n – 1 are retained. However, if the transfer source and transfer destination ranges overlap, the transferred values will be used.</li> </ul> <div style="text-align: center;"> <p>Before execution</p> <p>After execution</p> </div> <p>If n is a word : The contents (0 to 255) of the lower 8 bits (b7 to b0) of n (WX, WY, WR, WL, WM, TC) are set to the number of bits (words) to be transferred.</p> <p>If n is a constant : 0 to 255 (decimal) can be designated for the number of bits (words) to be transferred.</p>											
Cautionary notes		<ul style="list-style-type: none"> <li>Use this command so that d + n – 1 and s + n – 1 do not exceed the I/O range *. If the I/O range is exceeded, DER is equal to “1” and the transfer is performed to the maximum range.</li> <li>* For I/O ranges, refer to the P3-6 and P3-7 performance specification table.</li> <li>If n is equal to 0, the block transfer is not performed and DER (R7F4) will be “0”.</li> </ul>											

Program example

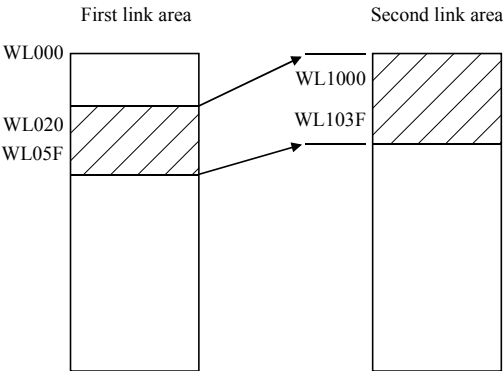
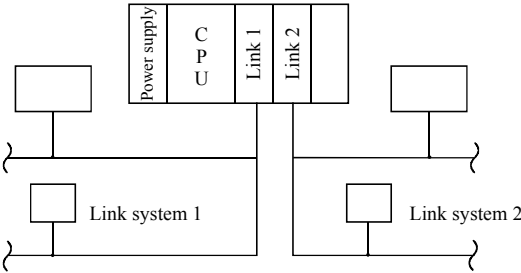
- The data in the first link area (WL020 to WL05F) is transferred to the second link area (WL1000 to WL103F).



```
LD R001
AND DIF0
[
MOV (WL1000,WL020,64)
]
LD R7F4
SET Y00100
```

Program description

- 64 words of data are transferred from link system 1 of the first link to link system 2 of the second link. WL020 to WL05F and WL1000 to WL103F are used as the respective transfer areas.



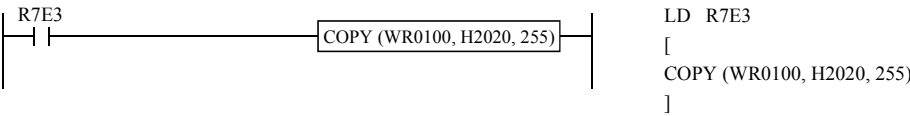
MOV (d.s.n)

Item number	Application commands-17	Name				Copy (COPY)								
Ladder format		Condition code					Processing time (μs)			Remark				
COPY (d, s, n)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left	Upper case: B Lower case: W				
		DER	ERR	SD	V	C	Ave	Ave	Ave					
		↑	●	●	●	●	97+64a	137+95a	124+95a					
Command format		Number of steps					a:Quotient of n/32	a:Quotient of n/32	a:Quotient of n/32					
COPY (d, s, n)		Condition			Steps		128+41b	174+46b	173+46b					
		—			4		b:Quotient of n/64	b:Quotient of n/64	b:Quotient of n/64					
Usable I/O		Bit				Word				Double word			Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
d	Copy destination head I/O			○				○						
s	Copy source head I/O	○	○	○		○	○	○	○				○	
n	Number of bits (words) to be copied					○	○	○	○				○	The constant is set in decimal.
Function														
		<div><ul style="list-style-type: none"><li>• The value of s (bit, word) is copied to the range d to d + n - 1.</li><li>• The value of s is retained.</li><li>• A bit is copied to bits and a word is copied to words.</li></ul><div><div>s</div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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Program example

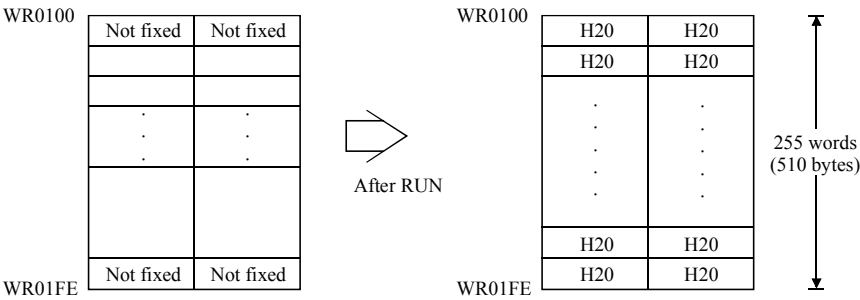
The default value (H2020) is set in the range of WR0100 to WR01FE.



Program description

WR0100 to WR01FE is considered as the communication data area and is filled with space codes (H20) as the default value during the first scan after RUN commencement.

R7E3: The first scan ON after RUN



Item number		Application commands-18				Name		Block exchange (EXCHANGE)						
Ladder format				Condition code					Processing time (μs)			Remark		
XCG (d1, d2, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left	Upper case: B Lower case: W		
				DER	ERR	SD	V	C	Ave	Ave	Ave			
				↑	●	●	●	●	44.1+2.5n	89.9+3.1n	76.0+3.1n			
Command format				Number of steps										
XCG (d1, d2, n)				Condition			Steps							
				—			4		40.1+1.4n	123.4+1.9n	116+1.9n			
Usable I/O				Bit				Word			Double word		Constant	Other
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX		
d1	Block exchange (EXCHANGE)					○			○					
d2	Exchange source head I/O					○			○					
n	Number of bits (words) to be exchanged						○	○	○	○			○	The constant is set in decimal.
Function														
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NOT (d)

Item number		Application commands-19				Name		Reverse (NOT)																																								
Ladder format				Condition code						Processing time (μs)						Remark																																
NOT (d)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW																																	
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																		
				●	●	●	●	●	11	←	45	←	80	←																																		
Command format				Number of steps						11	←	45	←	80	←																																	
NOT (d)				Condition			Steps			13	←	61	←	61	←																																	
				—			2																																									
Usable I/O			Bit				Word				Double word			Constant	Other																																	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																																			
d	I/O to be reversed				○	○			○	○			○	○																																		
Function																																																
		<ul style="list-style-type: none"><li>Reverses the contents of d.</li></ul> <p>Before execution</p> <table><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> <p>After execution</p> <table><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>															1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
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Cautionary notes																																																
		<ul style="list-style-type: none"><li>Use edge trigger as the startup condition for this command.</li></ul>																																														
Program example																																																
		<div><div><div><div><div></div><div>R000</div></div><div><div></div><div>DIF0</div></div></div><div></div><div>NOT (WR0000)</div></div><div><pre>LD R000 AND DIF0 [ NOT WR0000 ]</pre></div></div>																																														
Program description																																																
		<ul style="list-style-type: none"><li>When R000 rises, the content of WR0000 is reversed.</li></ul> <p>Example) If WR0000 is H1234, WR0000 = HEDCB after the command is executed; WR0000 = H1234 when executed again</p>																																														

Item number		Application commands-20				Name		Two's complement (NEGATE)																																																																							
Ladder format				Condition code					Processing time (μs)						Remark																																																																
NEG (d)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW																																																																
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																																																	
				●	●	●	●	●	12	←	45	←	80	←																																																																	
Command format				Number of steps																																																																											
NEG (d)				Condition			Steps																																																																								
				—			2		14	←	62	←	63	←																																																																	
Usable I/O			Bit				Word			Double word			Constant	Other																																																																	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM																																																																
d	I/O to take complement							○	○			○	○																																																																		
Function																																																																															
		● Calculates two's complements of d (Reverses each bit contained in d and adds 1. However, C (R7F0) remains unchanged).																																																																													
Before execution		<table><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td colspan="15"></td><td>1</td></tr></table>														1	1	0	0	1	1	0	0	0	0	0	1	1	0	1	0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	0	1	1	0	0	1	1	1	1	1	0	0	1	0	1																1
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After execution		<table><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr></table>														0	0	1	1	0	0	1	1	1	1	1	0	0	1	1	0																																																
0	0	1	1	0	0	1	1	1	1	1	0	0	1	1	0																																																																
Cautionary notes																																																																															
		● Use edge trigger as the startup condition for this command.																																																																													
Program example																																																																															
		<table><tr><td>R000</td><td>DIF0</td><td>NEG (WR0000)</td></tr></table> <div>LD R000 AND DIF0 [ NEG WR0000 ]</div>														R000	DIF0	NEG (WR0000)																																																													
R000	DIF0	NEG (WR0000)																																																																													
Program description																																																																															
		● When R000 rises, 2's complement of the content of WR0000 is obtained. Example) If WR0000 is H1234, WR0000 = HEDCC after the command is executed; WR0000 = H1234 when executed again																																																																													

NEG (d)

ABS (d, s)

Item number		Application commands-21				Name		Absolute value (ABSOLUTE)									
Ladder format				Condition code						Processing time (μs)						Remark	
ABS (d, s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	↑	13	←	50	←	85	←			
Command format				Number of steps						16	←	70	←	71		←	
ABS (d, s)				Condition			Steps			16	←	70	←	71		←	
				Word			3										
				Double word			4										
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
d	I/O after absolute value is taken								○	○			○	○			
s	I/O before absolute value is taken							○	○	○	○	○	○	○	○		
Function																	
<div><div><div>• Given s is signed, set the absolute value of s in d.</div><div>• If s is positive or 0: The content of s is set to d. C (R7F0) is set to “0”.</div><div>• If s is negative: Two’s complements of the contents of s are set in d. C (R7F0) is set to “1”.</div><div>• Perform with d and s as both words or both double words.</div></div><div><div>Example)</div><div><div><div><div><div></div><div>R000</div><div></div><div>DIF0</div><div></div><div>ABS(WR0000, WX0000)</div></div></div></div><div><div>(When the value of WX is positive or 0) WX0000 = H4C1A</div><div>(When the value of WX is negative) WX0000 = HCC1A</div></div><div><div><div><div><div><div>d ← s</div><div>WX0000 s</div><div>011001110000011010</div><div>R7F0</div><div>0</div></div><div>⇓</div><div><div>WR0000 d</div><div>011001110000011010</div><div>0</div></div></div></div><div><div><div><div><div>d ← <math>\bar{s}+1</math></div><div>WX0000 s</div><div>111001110000011010</div><div>R7F0</div><div>0</div></div><div>⇓</div><div><div><div><div>001110011111100110</div><div>+</div><div>001110011111100110</div></div><div>⇓</div><div><div>WR0000 d</div><div>001110011111100110</div><div>1</div></div></div></div></div></div></div></div></div></div></div></div>																	
Cautionary notes				<div><div><div>• When s is a word: 0 to 32,767 (decimal) correspond to H0000 to H7FFF (hexadecimal). -32,768 to -1(decimal) correspond to H8000 to HFFFF (hexadecimal).</div><div>• When s is a double word: 0 to 2,147,483,647 (decimal) correspond to H00000000 to H7FFFFFFF (hexadecimal). -2,147,483,648 to -1 (decimal) correspond to H80000000 to HFFFFFFF (hexadecimal).</div></div></div>													
				<div><div><div>• Use edge trigger as the startup condition for this command.</div></div></div>													

Item number		Application commands-22				Name		Sign addition (SIGN GET)							
Ladder format				Condition code					Processing time (μs)						Remark
SGET (d, s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
				●	●	●	●	●							
Command format				Number of steps					13	←	49	←	85	←	
SGET (d, s)				Condition			Steps		16	←	69	←	70	←	
				Word			3								
				Double word			4								
Usable I/O			Bit				Word			Double word			Constant	Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
d	I/O after absolute value is taken							○	○			○	○		
s	I/O before absolute value is taken							○	○	○	○	○	○	○	
Function															
<div><div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div></div><div>SGET(WR0001, WX0000)</div></div> <div><div>When C (R7F0) is "0"</div><div><div><div><div><div>WX0000</div><div>s</div><div>1100110000011010</div></div><div><div>R7F0</div><div>0</div></div></div><div><div>↓</div></div><div><div><div>WR0001</div><div>d</div><div>1100110000011010</div></div><div><div>R7F0</div><div>0</div></div></div></div></div><div><div>When C (R7F0) is "1"</div><div><div><div><div><div>WX0000</div><div>s</div><div>1100110000011010</div></div><div><div>R7F0</div><div>1</div></div></div><div><div>↓</div></div><div><div><div><div><div>0011001111110101</div><div>+</div><div>0011001111110101</div></div><div><div>1</div><div>R7F0</div></div></div><div><div>WR0001</div><div>d</div><div>0011001111110101</div></div><div><div>1</div><div>R7F0</div></div></div></div></div></div></div></div>															
Cautionary notes															
<div><div><div></div><div></div><div></div></div><div>Use edge trigger as the startup condition for this command.</div></div>															

EXT (d, s)

Item number		Application commands-23				Name		Sign expansion (EXTEND)																		
Ladder format						Condition code					Processing time (μs)						Remark									
EXT (d, s)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left											
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max										
						●	●	●	●	●																
Command format						Number of steps					15						←		66		←		66		←	
EXT (d, s)						Condition			Steps																	
						—			3																	
Usable I/O				Bit				Word				Double word			Constant	Other										
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM												
d	I/O after sign expansion												○	○												
s	I/O before sign expansion									○	○	○	○			○										
Function																										
<ul style="list-style-type: none"><li>• The sign bit (MSB) of s is extended to the upper word of d.</li><li>• The lower word of d is set to the contents of s.</li></ul>																										
<div><div><div><div>15</div><div>B</div><div>0</div></div><div><div>31</div><div>B</div><div>16</div><div>B</div><div>15</div><div>B</div><div>0</div></div><div><div>d+1</div><div>d</div></div></div></div>																										
Program example																										
<div><div><div>R000</div><div>EXT (DR0100, WX0000)</div></div><div><div>LD R000</div><div>[</div><div>EXT (DR0100, WX0000)</div><div>]</div></div></div>																										
Program description																										
<div><div><div><div>• When R000 is turned on, the content of WX0000 is extended to DR0100.</div><div>When WX0000 is positive or 0</div><div>Example) WX0000 = H7FFF (+32767)</div><div>↓</div><div>DR0100 = H00007FFF (+32767)</div></div><div><div>When WX0000 is negative</div><div>Example) WX0000 = H8000 (− 32768)</div><div>↓</div><div>DR0100 = HFFFF8000 (− 32768)</div></div></div></div>																										

Item number		Application commands-24				Name		Binary → BCD conversion (BCD)									
Ladder format				Condition code					Processing time (μs)						Remark		
BCD (d, s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↑	●	●	●	●	28	←	66	←	139	←			
Command format				Number of steps													
BCD (d, s)				Condition			Steps										
				Word			3		31	←	86	←	191	←			
				Double word			4										
Usable I/O			Bit				Word				Double word			Constant		Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	I/O after conversion (BCD)								○	○			○	○			
s	I/O before conversion (BIN)							○	○	○	○	○	○	○	○		
Function																	
<div><div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> 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BIN (d, s)

Item number	Application commands-25	Name		BCD → Binary conversion (BINARY)																																																																												
Ladder format			Condition code					Processing time (μs)						Remark																																																																		
BIN (d, s)			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: W Lower case: DW																																																																		
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																																																			
			↕	●	●	●	●	19	←	57	←	92	93																																																																			
Command format			Number of steps					27	←	83	←	83	201																																																																			
BIN (d, s)			Condition			Steps		27	←	83	←	83	201																																																																			
			Word			3																																																																										
			Double word			4																																																																										
Usable I/O		Bit				Word				Double word			Constant	Other																																																																		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																																																																				
d	I/O after conversion (BIN)							○	○			○	○																																																																			
s	I/O before conversion (BCD)						○	○	○	○	○	○	○																																																																			
Function																																																																																
<div><div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>Before execution s</div><div>6991</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>(BCD)</div></div></div><div><div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>After execution d</div><div>1B4F</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>(Binary)</div></div></div><div><div></div><div>Combinations of d and s.</div><div><table><tr><td>d</td><td>s</td></tr><tr><td>Word</td><td>Word</td></tr><tr><td>Double word</td><td>Double word</td></tr></table></div></div></div><tr><td colspan="2">Cautionary notes</td><td colspan="13"></td></tr><tr><td colspan="15"><div><div></div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div></div><div>If data is error, the previous contents of d are retained.</div></div></td></tr><tr><td colspan="2">Program example</td><td colspan="13"></td></tr><tr><td colspan="15"><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>X00000</div><div></div><div>BIN (WY0010, WL000 )</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>LD X00000</div><div>[</div><div>BIN (WY0010, WL000)</div><div>]</div></td></tr></div>															d	s	Word	Word	Double word	Double word	Cautionary notes															<div><div></div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div></div><div>If data is error, the previous contents of d are retained.</div></div>															Program example															<div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>X00000</div><div></div><div>BIN (WY0010, WL000 )</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div>LD X00000</div> <div>[</div> <div>BIN (WY0010, WL000)</div> <div>]</div>														
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Word	Word																																																																															
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<div><div></div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div></div><div>If data is error, the previous contents of d are retained.</div></div>																																																																																
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Program description																																																																																
<div><div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>When X00000 turns on, the content of WL000 is converted from BCD to binary and output.</div><div>WL000 H6691</div><div>After conversion</div><div>WY0010 H1B4F</div></div>																																																																																


Item number		Application commands-26				Name		Decode (DECODE)									
Ladder format				Condition code						Processing time (μs)				Remark			
DECO (d, s, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left						
				DER	ERR	SD	V	C	Ave	Ave	Ave						
				↑	●	●	●	●									
Command format				Number of steps						35.1+1.35×2 <sup>n</sup> 77.1+1.56×2 <sup>n</sup> 62+1.65×2 <sup>n</sup>							
DECO (d, s, n)				Condition			Steps										
				—			4										
Usable I/O				Bit				Word				Double word		Constant	Other		
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
d	Decode destination head I/O					○											
s	Word I/O to be decoded							○	○	○	○				○		
n	Number of bits to be decoded														○	1 to 8 (decimal)	
Function																	
				<div>• Decodes the lower n bits of s to 2<sup>n</sup> and outputs “1” to the decoded bits in the bit rows between d and d + 2<sup>n</sup> – 1 (where n = 1 to 8).</div> <div>• If n is 0, the command will not be executed, and the contents of d to d + 2<sup>n</sup> – 1 remain unchanged.</div>													
				<div><div><div>b15b7b0</div><div>s<div>H0B</div></div><div>nbits (n=1 to 8)</div></div><div><div>d+2<sup>n</sup>-1d+Bd</div><div><div>0100</div></div><div>2<sup>n</sup></div></div></div>													
Cautionary notes																	
				<div>• Use this command so that d + 2<sup>n</sup> – 1 does not exceed the I/O range*. If the I/O range is exceeded, DER is equal to “1” and the decoding is performed at the maximum range starting from d.</div> <div>* For I/O ranges, refer to the P3-6 and P3-7 performance specification table.</div> <div>• Use 1 to 8 for n.</div>													
Program example																	
				<div><div><div>R100DIF1</div><div>DECO (R000, WX0000, 4)</div></div><div>LD R100AND DIF1[DECO (R000, WX0000, 4)]</div></div>													
Program description																	
				<div>• When WX0000 = HFFFF, R00F, which is the 15th bit from R000 among the bits indicated by the lower four bit values of WX0000, is set to “1” upon rising of R100.</div>													

DECO (d, s, n)

Item number		Application commands-27				Name		Encode (ENCODE)						
Ladder format				Condition code					Processing time (μs)			Remark		
ENCO (d, s, n)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448	EH-CPU3**	Other than left	Upper case: Bit position of less than higher 16 bits  Lower case: Other than the above		
				DER	ERR	SD	V	C	Ave	Ave	Ave			
				↑	●	●	●	↑	33+1.4×2 <sup>n</sup>	84+1.6×2 <sup>n</sup>	84+1.6×2 <sup>n</sup>			
Command format				Number of steps										
ENCO (d, s, n)				Condition			Steps					1 to 8 (decimal)		
				—			4		84+0.1×2 <sup>n</sup>	170+0.2×2 <sup>n</sup>	170+0.2×2 <sup>n</sup>			
Usable I/O			Bit				Word			Double word			Constant	Other
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY		
d	Decode destination head I/O							○	○					
s	Word I/O to be encoded					○								
n	Number of bits to be encoded												○	1 to 8 (decimal)
Function														
				<div><div><div>• Encodes the bit location 2<sup>n</sup> in the range between s and s + 2<sup>n</sup> – 1 where the bit is 1, and outputs the result to d (n = 1 to 8). Upper bits (16-n) of d are set to “0.”</div><div>• If n is 0, the command will not be executed and the contents of d retain the original values.</div><div>• If there are more than one bits that are set to 1 between s and s + 2<sup>n</sup> – 1, the upper bit location will be encoded.</div><div>• If all the bits from s to s + 2<sup>n</sup> – 1 are “0”, “0” is output to d, and C (R7F0) is equal to “1.” In other cases, C (R7F0) is set to “0.”</div></div><div><div><div><div><div>s+2<sup>n</sup>-1</div><div>0</div></div><div><div>s+B</div><div>1</div></div><div><div>s</div><div>0</div><div>0</div></div></div><div><div>2<sup>n</sup></div></div></div><div><div><div>b15</div><div>b7</div><div>b0</div></div><div><div>d</div><div><div>H0B</div></div></div><div><div>n bits (1 to 8)</div></div></div></div></div>										
Cautionary notes														
				<div><div><div>• Use this command so that s + 2<sup>n</sup> – 1 does not exceed the I/O range*. If the I/O range is exceeded, DER is set to “1” and the encoding is performed at the maximum range starting from s.</div><div>* For I/O ranges, refer to the P3-6 and P3-7 performance specification table.</div><div>• Use 1 to 8 for n.</div></div></div>										
Program example														
				<div><div><div><div><div>X00001</div><div>DIF1</div></div><div><div>ENCO (WR0000, R000, 4)</div></div></div></div><div><div>LD X00001</div><div>AND DIF1</div><div>[</div><div>ENCO (WR0000, R000, 4)</div><div>]</div></div></div>										
Program description														
				<div><div><div>• Upon the rising of X00001, the most significant bit that is set to “1” is detected within the row of bits R000 to R00F (2<sup>4</sup> – 1 = 15 bits), and a four-bit binary number is set in the word I/O of d</div><div>Example) Of R000 to R00F, if “1” is set in the 7th and 6th bits, WR0000 is set to H0007.</div></div></div>										

Item number		Application commands-28				Name		7 segment decode (SEGMENT)																																			
Ladder format				Condition code						Processing time (μs)						Remark																											
SEG (d, s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																														
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																													
				●	●	●	●	●																																			
Command format				Number of steps						16		←		68		←		94		98																							
SEG (d, s)				Condition			Steps																																				
				—			3																																				
Usable I/O			Bit				Word				Double word			Constant	Other																												
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																														
d	Decode destination head I/O											○	○																														
s	Decode contents							○	○	○	○			○																													
Function																																											
				<div><div><div><div><div>a</div><div>b</div><div>c</div><div>d</div><div>e</div><div>f</div><div>g</div></div></div><div><div><div><div><div>Input data (4 bits)</div><div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div><div>A</div><div>B</div><div>C</div><div>D</div><div>E</div><div>F</div></div><div><div><div><div>Output data</div><div><div><div>g</div><div>f</div><div>e</div><div>d</div><div>c</div><div>b</div><div>a</div></div></div><div><div><div>Display</div><div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div><div>A</div><div>B</div><div>C</div><div>D</div><div>E</div><div>F</div></div></div></div></div></div></div><div><div><div><div><div>X00000</div><div>DIF0</div></div><div><div><div>SEG (DR0002, WR0000 )</div></div></div></div></div><div><div><div>LD X00000</div><div>AND DIF0</div><div>[</div><div>SEG (DR0002, WR0000)</div><div>]</div></div></div></div></div><tr><td colspan="4">Program description</td><td colspan="18"><div><div><div><div><div>Upon the rising of X00000, the content of WR0000 is converted to an 8-bit 4-digit 7 segment LED display data. (The most significant bit of the eight bits in each digit is always “0.”)</div></div></div></div></div></td></tr></div></div></div>																		Program description				<div><div><div><div><div>Upon the rising of X00000, the content of WR0000 is converted to an 8-bit 4-digit 7 segment LED display data. (The most significant bit of the eight bits in each digit is always “0.”)</div></div></div></div></div>																	
Program description				<div><div><div><div><div>Upon the rising of X00000, the content of WR0000 is converted to an 8-bit 4-digit 7 segment LED display data. (The most significant bit of the eight bits in each digit is always “0.”)</div></div></div></div></div>																																							

SQR (d, s)

Item number	Application commands-29	Name		Square root (SQUARE ROOT)										
Ladder format			Condition code					Processing time (μs)						Remark
SQR (d, s)			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
			↑	●	●	●	●							
Command format			Number of steps					86	←	143	←	107	108	
SQR (d, s)			Condition		Steps									
			—		4									
Usable I/O		Bit				Word			Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
d	Square Root (BCD)						○	○						
s	Take square root (BCD)									○	○	○	○	
Function														
<ul style="list-style-type: none"><li>• The square root of the contents of s is calculated and output to d.</li><li>• Set BCD data to s.</li><li>• If s has a BCD data error, the DER (R7F4) is set to “1” and calculation is not performed (data other than H0 to H9 exists).</li><li>• The fractional portion is rounded down.</li></ul>														
<div><div>d</div><div>←</div><div>s</div></div>														
Program example														
		<div><div><div>X00000</div><div>DIF0</div></div><div><div>SQR (WR0001, DR0020)</div></div></div> <div><div>LD X00000</div><div>AND DIF0</div><div>[</div><div>SQR (WR0001, DR0020)</div><div>]</div></div>												
Program description														
<ul style="list-style-type: none"><li>• Upon the rising of X00000, the square root of the value in DR0020 is calculated and is substituted into WR0001.</li></ul> <p>Example) In the case of DR0020 = H00002159 (BCD), it becomes WR0001=H0046 (BCD) after the operation. ( <math>\sqrt{2159} = 46.465 \cdots</math> )</p>														

5-117

Item number	Application commands-31	Name				Swap (SWAP)									
Ladder format			Condition code						Processing time (μs)						Remark
SWAP (d)			R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
			DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
			●	●	●	●	●								
Command format			Number of steps						12	←	45	←	81	198	
SWAP (d)			Condition			Steps									
			—			2									
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
d	I/O to be exchanged							○	○						
Function															
		<div><div>● Switches the upper 8 bits and lower 8 bits contained in d.</div><div><div>(Before execution) d</div><div>0001110101101101</div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>(After execution) d</div><div>011011010100011101</div></div></div>													
Cautionary notes															
		<div><div>● Use edge trigger as the startup condition for this command.</div></div>													
Program example															
		<div><div><div><div>X00000</div><div>DIF0</div></div><div></div><div>SWAP (WR0010 )</div></div><div><div>LD X00000</div><div>AND DIF0</div><div>[</div><div>SWAP (WR0010)</div><div>]</div></div></div>													
Program description															
		<div><div><div>● Upon rising of X00000, the upper 8 bits and lower 8 bits of WR0010 are swapped and stored in WR0010.</div><div><div>WR0010 H1234 Before execution</div><div>WR0010 H3412 After execution</div></div><div>Note) When there is no rising edge of DIF0, it is executed during each scan, so the upper and lower bits of WR0010 are swapped in each scan.</div></div></div>													

5-119

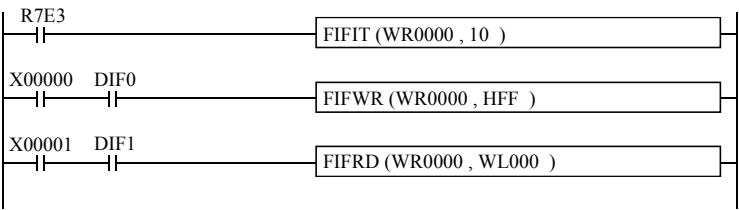


FIFWR (P, s)

Item number		Application commands-33				Name		FIFO write (FIFO WRITE)									
Ladder format				Condition code						Processing time (μs)						Remark	
FIFWR (P, s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↕	●	●	●	●									
Command format				Number of steps						25	←	67	←	72	189		
FIFWR (P, s)				Condition			Steps										
				—			3										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
P	Head I/O of FIFO								○								
s	Data to be written to FIFO							○	○	○	○				○		
Function																	
<div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Item number		Application commands-34				Name		FIFO read (FIFO READ)														
Ladder format						Condition code					Processing time (μs)						Remark					
FIFRD (P, d)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
						↑	●	●	●	●												
Command format						Number of steps					157		285		232		360		141		258	
FIFRD (P, d)						Condition			Steps													
						—			3													
Usable I/O		Bit				Word				Double word			Constant	Other								
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM										
P	FIFO head I/O							○														
d	I/O that stores the read data							○	○	○					○							
Function																						
<div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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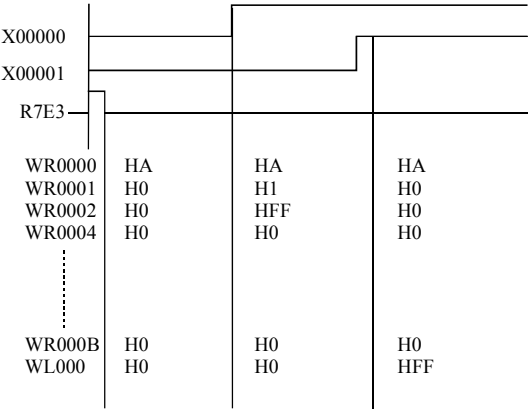
Program example



```
LD    R7E3
[
FIFIT (WR0000, 10)
]
LD    X00000
AND   DIF0
[
FIFWR (WR0000, HFF)
]
LD    X00001
AND   DIF1
[
FIFRD (WR0000, WL000)
]
```

Program description

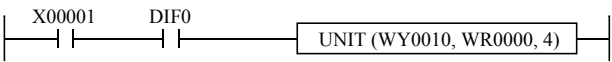
- The FIFO buffer is set at WR0002 through WR000B during the first scan after RUN execution
- HFF is stored when X00000 rises.
- HFF is read to WL000 when X00001 rises.



FIFRD (P, d)

Item number	Application commands-35	Name				Unit (UNIT)									
Ladder format		Condition code					Processing time (μs)						Remark		
UNIT (d, s, n)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↕	●	●	●	●									
Command format		Number of steps					30	←	107	←	149	267			
UNIT (d, s, n)		Condition			Steps										
		—			4										
Usable I/O		Bit				Word				Double word		Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
d	Unity result write destination I/O						○	○							
s	Unity destination head I/O							○							
n	Numbers of words to be united											○	n=0 to 4		
Function															
<div><div><div><div><div></div><div></div><div></div><div></div></div><div>When n=4</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>4 bits</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B1</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B2</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B3</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B4</div></div></div><div>Ignored</div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>Upper digits</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B4</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B3</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B2</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>B1</div></div></div><div>Lower digits</div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>When n is 0 : B1 to B4 of d are 0</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>When n is 1 : B2 to B4 of d are 0</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>When n is 2 : B3 to B4 of d are 0</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>When n is 3 : B4 of d is 0</div></div></div></div></div></div></div></div></div></div></div></div>															
Cautionary notes															
<div><div><div><div></div><div></div><div></div><div></div></div><div>When n=0, DER = “0” and 0 will be set in the write destination I/O.</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>When n&gt;5, nothing is executed.</div></div></div></div>															

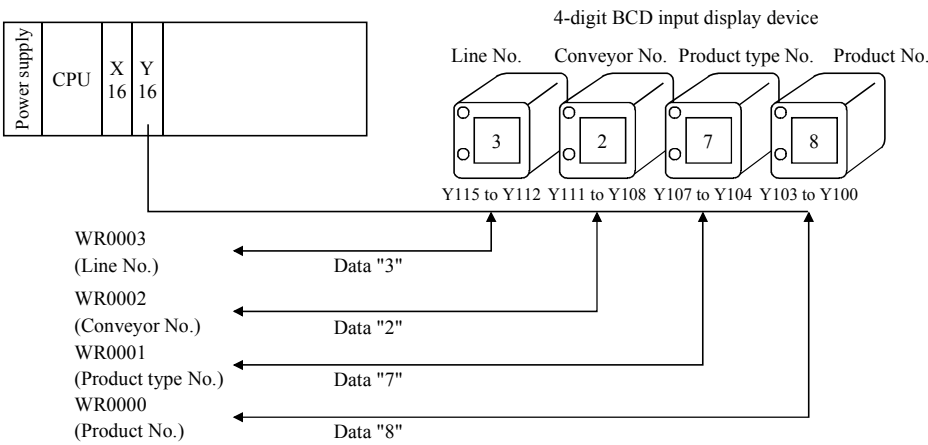
Program example



```
LD X00001
AND DIF0
[
UNIT (WY0010, WR0000, 4)
]
```

Program description

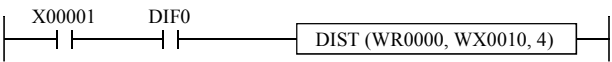
A 4-digit BCD input display device is connected to the WY0010, and each digit displays WR0000 to WR0003 data independently. (Only the lower four bits are considered valid data for WR0000 to WR0003.)



UNIT (d, s, n)

DIST (d, s, n)

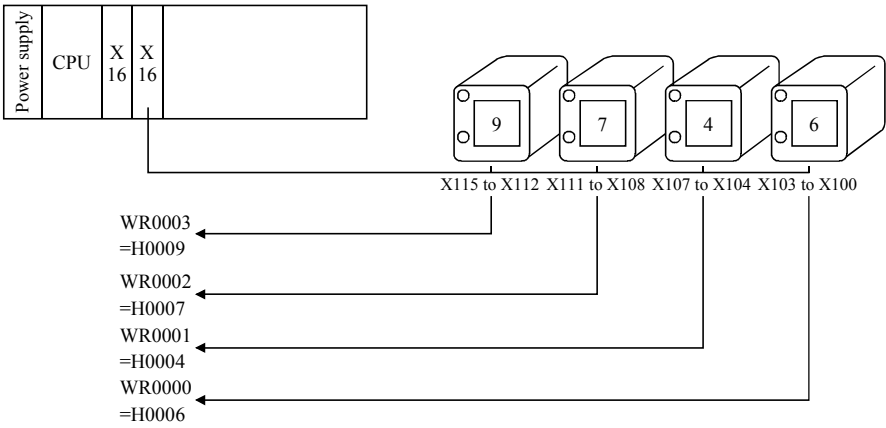
Program example



```
LD X00001
AND DIF0
[
DIST (WR0000, WX0010, 4)
]
```

Program description

A 4-bit 4-digit Digit switch is connected to the WX0010, and the data for each digit is stored in WR0000 to WR0003 as independent data.

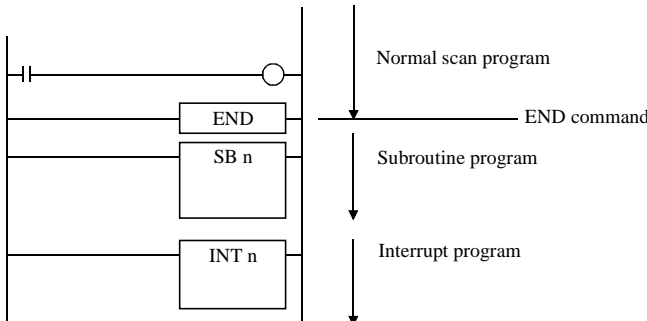


DIST (d, s, n)

Item number		Application commands-37				Name		I/O address conversion (I/O ADDRESS CONVERSION)									
Ladder format				Condition code						Processing time (μs)						Remark	
ADRIO (d, s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: B Lower case: W		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				●	●	●	●	●									
Command format				Number of steps						12	←	49	←	145	262		
ADRIO (d, s)				Condition			Steps							84	202		
				—			3										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
d	Conversion address							○	○								
s	I/O to be converted			○	○	○		○	○	○					The EH-CPU448 can not be used.		
Function																	
		● Obtains the actual address of the I/O designated by s, and sets the result in d.															
Program example																	
		<div><div><div>X00200 DIF0</div><div></div><div>ADRIO(WR0100,WR0000)</div></div><div><div>LD X00200</div><div>AND DIF0</div><div>[</div><div>ADRIO (WR0100, WR0000)</div><div>]</div></div></div>															
Program description																	
		● Upon X00200 rise, the actual address of WR0000 (H3C00) is set in WR0100. After command execution, WR0100 becomes H3C00.															

ADRIO (d, s)



Item number	Control commands-1					Name		Normal scan end (END)																				
Ladder format				Condition code						Processing time (μs)						Remark												
END				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left															
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max														
				●	●	●	●	●																				
Command format				Number of steps						194	214	311	320	285		304												
END				Condition			Steps																					
				—			1																					
Usable I/O			Bit				Word				Double word			Constant	Other													
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM															
Function																												
		<ul style="list-style-type: none"><li>Indicates the end of a normal scan program. (The execution of this command returns to the beginning of the program, and a normal scan is executed.)</li><li>This command is not necessary when there are no subroutine programs or interrupt scan programs.</li><li>If there is a subroutine program or interrupting program, write this command at the end of the normal scan program.</li><li>This command is used only once in a program. Do not use any startup conditions.</li></ul>																										
Cautionary notes																												
		<ul style="list-style-type: none"><li>The END command is checked prior to the execution, and if there is an error, the following error codes are set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul>																										
		<table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="3">34</td><td rowspan="3">WRF001</td><td>H0010</td><td>There is no END command.</td></tr><tr><td>H0022</td><td>There are two or more END commands.</td></tr><tr><td>H0032</td><td>A startup condition is used for the END command.</td></tr></table>															CPU error code	Special internal output	Error code	Error description	34	WRF001	H0010	There is no END command.	H0022	There are two or more END commands.	H0032	A startup condition is used for the END command.
CPU error code	Special internal output	Error code	Error description																									
34	WRF001	H0010	There is no END command.																									
		H0022	There are two or more END commands.																									
		H0032	A startup condition is used for the END command.																									
Instruction for use																												
																												

CEND (s)

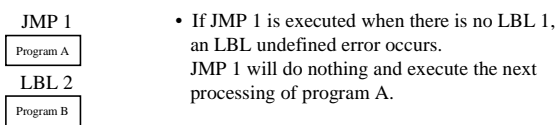
Item number		Control commands-2				Name		Scan conditional end (CONDITIONAL END)															
Ladder format				Condition code						Processing time (μs)						Remark							
CEND (s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: Conditions do not meet Lower case: Conditions meet								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max									
				●	●	●	●	●															
Command format				Number of steps						6	←	13	←	12	←								
CEND (s)				Condition			Steps																
				—			2			196	216	306	←	164	315								
Usable I/O				Bit				Word				Double word			Constant	Other							
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM									
s	Scan end condition			○	○	○																	
Function																							
				<ul style="list-style-type: none"><li>• If the scan end condition (s) is on, the execution of this command returns to the head of the scan program and executes the program.</li><li>• If (s) is off, the next command is executed.</li><li>• This command can only be used in normal scan programs, and can be used as many times as desired.</li><li>• This command can specify a startup condition. In this case, if the startup condition and (s) are both on, this command is executed.</li></ul>																			
Cautionary notes																							
				<ul style="list-style-type: none"><li>• The CEND command is checked prior to the execution, and if there is an error, the following error codes are set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul>																			
				<table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td>34</td><td>WRF001</td><td>H0023</td><td>The CEND command exists after the END command.</td></tr></table>												CPU error code	Special internal output	Error code	Error description	34	WRF001	H0023	The CEND command exists after the END command.
CPU error code	Special internal output	Error code	Error description																				
34	WRF001	H0023	The CEND command exists after the END command.																				
Instruction for use																							

Item number		Control commands-3				Name		Unconditional jump (JUMP)																					
Ladder format				Condition code						Processing time (μs)						Remark													
JMP n				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max															
				●	1]	●	●	●																					
Command format				Number of steps						21		45		28		57		77		104									
JMP n				Condition			Steps																						
				—			2																						
Usable I/O			Bit				Word				Double word			Constant	Other														
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																
n	Code number													○	0 to 255 (Decimal)														
Function		<ul style="list-style-type: none"><li>• If the startup condition of JMP n switches on, the control jumps the program from this command to the LBL n of the same code number. Always use JMP n and LBL n in pairs.</li><li>• If the startup condition is not met, the next command will be executed.</li><li>• If setting this command in conjunction with other commands in the same arithmetic-operation box, set this command at the end.</li><li>• The JMP n command is valid only within the same program. (A jump to a subroutine or interrupt scan cannot be performed from a normal scan, nor vice versa.)</li><li>• Nesting of JMP n commands is possible, but caution must be exercised so that an overload error does not occur.</li></ul>																											
Cautionary notes		<ul style="list-style-type: none"><li>• This command is checked prior to the execution, and if there is an error, the following error codes are set in the special internal outputs R7F3 and WRF015. In this case, jump is not performed and the next command will be executed.</li></ul> <table><tr><th colspan="2">Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="2">R7F3=1</td><td rowspan="2">WRF015</td><td>H0015</td><td>There is no LBL n.</td></tr><tr><td>H0040</td><td>A jump is attempted to a different program area.</td></tr></table>																		Special internal output		Error code	Error description	R7F3=1	WRF015	H0015	There is no LBL n.	H0040	A jump is attempted to a different program area.
Special internal output		Error code	Error description																										
R7F3=1	WRF015	H0015	There is no LBL n.																										
		H0040	A jump is attempted to a different program area.																										
Instruction for use		<div><div><div><div><div></div><div>JMP n</div></div><div>Program</div></div><div><div><div></div><div>LBL n</div></div><div>Program</div></div></div><div></div></div> <ul style="list-style-type: none"><li>• When the startup condition turns on, it jumps to LBL n.</li><li>• If there is a timer within the program it jumped to, the progress value is updated, but since commands are not executed, output will not turn on even if the ON conditions are met.</li></ul>																											

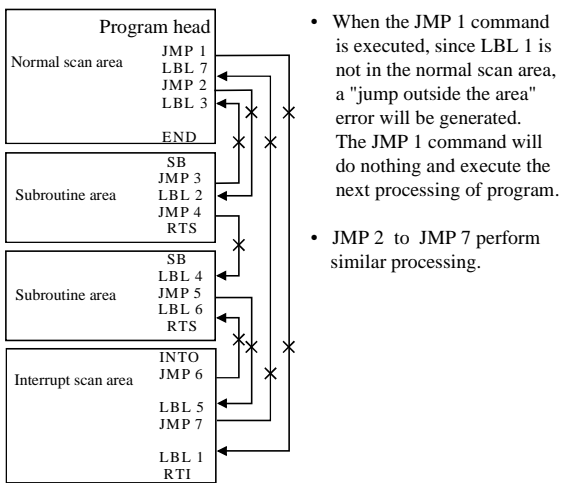
Item number		Control commands-4				Name		Conditional jump (CONDITIONAL JUMP)									
Ladder format						Condition code					Processing time (μs)					Remark	
CJMP n (s)						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Upper case: Conditions do not meet Lower case: Conditions meet
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
						●	1]	●	●	●	6	←	10	←	14	←	
Command format						Number of steps											
CJMP n (s)						Condition			Steps								
						—			3		22	46	31	60	59	105	
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
n	Code number														○	0 to 255 (Decimal)	
s	Jump condition					○	○	○									
Function																	
<ul style="list-style-type: none"><li>If the jump condition (s) of CJMP n(s) switches on, the control jumps the program from this command to the LBL n of the same code number. Always use CJMP n(s) and LBL n in pairs.</li><li>If the startup or jump condition is not met, the next command will be executed.</li><li>If setting this command in conjunction with other commands in the same arithmetic-operation box, caution must be used because the jump takes place without performing the operations specified after the command.</li><li>The CJMP n(s) command is valid only within the same program. (A jump to a subroutine or interrupt scan cannot be performed from a normal scan, nor vice versa.)</li><li>Nesting of CJMP n(s) commands is possible, but caution must be exercised so that an overload error does not occur.</li></ul>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>This command is checked prior to the execution, and if there is an error, the following error codes are set in the special internal outputs R7F3 and WRF015. In this case, jump is not performed and the next command will be executed.</li></ul>																	
Special internal output		Error code		Error description													
R7F3=1	WRF015	H0015		There is no LBL n.													
		H0040		A jump is attempted to a different program area.													
Instruction for use																	
<div><div><div>R101</div><div>CJMP n(R000)</div><div>Program</div><div>LBL n</div><div>Program</div></div><div><ul style="list-style-type: none"><li>When the startup condition and the R000 jump condition bit I/O are both on, it jumps to LBL n.</li><li>If there is a timer within the program it jumped to, the progress value is updated, but since commands are not executed, output will not turn on even if the ON conditions are met.</li></ul></div></div>																	

Syntax of JMP, CJMP

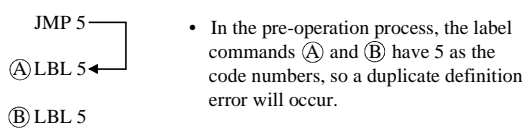
- 1) LBL n with the same code number as the code number n of the JMP command is required.



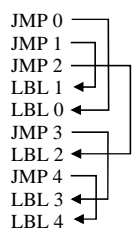
- 2) Jump is not permitted to outside the area in which the JMP command resides.



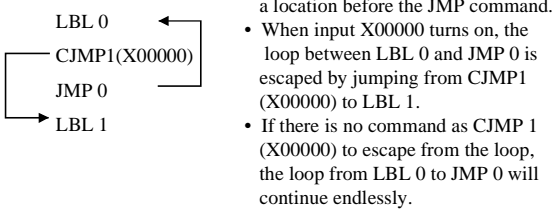
- 3) Code number n of the JMP command and the LBL n with the same code number may not be overlapped.



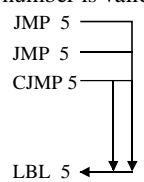
- 4) Nesting of JMP commands is allowed.



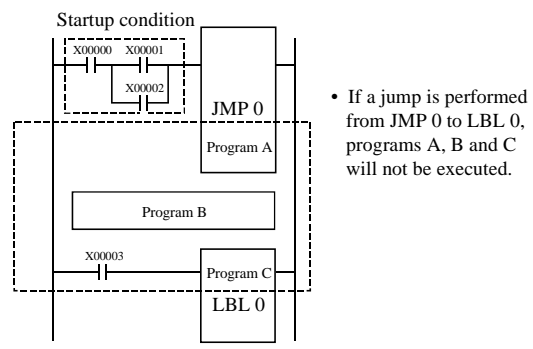
- 5) The JMP command can jump to a location before the command itself.



- 6) An overlap of JMP commands with the same code number is valid.

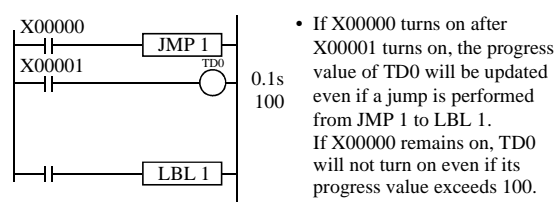


- 7) A startup condition can be programmed with respect to JMP commands.

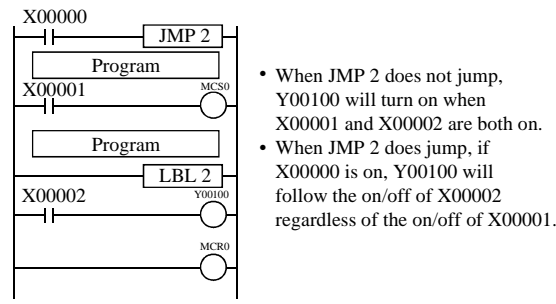


- 8) The CJMP command also follows the same syntax as 1) through 7).

Note 1: When a JMP command jumps to LBL, the status of each I/O between JMP and LBL is retained. However, the timer progress value will be updated.



Note 2: If the JMP command is used in conjunction with the MCS or MCR command, the following actions will result, so exercise caution when programming.



Note 3: Do not create a circuit that jumps to outside from between MCS and MCR.

CJMP n(s)

Item number		Control commands-5				Name		Label (LABEL)												
Ladder format				Condition code					Processing time (μs)				Remark							
LBL n				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				●	●	●	●	●												
Command format				Number of steps					0.05		←		0.65		←		1.3		←	
LBL n				Condition			Steps													
				—			1													
Usable I/O			Bit				Word			Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY					DR, DL, DM			
n	Code number													○	0 to 255 (Decimal)					
Function																				
<div><div></div><div><div></div><div></div></div><div><div>JMP n or CJMP n command is executed (n is always used in pairs).</div><div>The n in the LBL n cannot be used multiple times in the same program.</div><div>This command alone does not do anything.</div><div>Even if a startup condition is used for LBL n, it will be ignored.</div></div></div>																				
Cautionary notes																				
<div><div></div><div><div></div><div></div></div><div><div>This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</div></div></div>																				
CPU error code		Special internal output				Error code		Error description												
34		WRF001				H0001		Duplicate definition of LBL												
Instruction for use																				
<div><div><div><div>R100</div><div><div></div><div></div></div></div><div><div>JMP 0</div><div>(00001)</div></div></div><div><div></div><div><div></div><div></div></div></div><div><div>WR0000 = WR0000 + 1</div><div>(00002)</div></div></div> <div><div></div><div><div></div><div></div></div></div> <div><div>LBL 0</div><div>(00003)</div></div> <div><div><div><div>R100</div><div><div></div><div></div></div></div><div><div>JMP 1</div><div>(00004)</div></div></div><div><div></div><div><div></div><div></div></div></div><div><div>WR0000 = WR0000 - 1</div><div>(00005)</div></div></div> <div><div></div><div><div></div><div></div></div></div> <div><div>LBL 1</div><div>(00006)</div></div>																				
<div><div></div><div><div></div><div></div></div><div><div>When R100 is on, JMP 0 will be executed but JMP 1 will not be executed. Therefore, the content of WR0000 will decrement by one during each scan.</div><div>When R100 is off, JMP 0 will not be executed but JMP 1 will be executed. Therefore, the content of WR0000 will increment by one during each scan.</div></div></div>																				

R100

JMP 1

(00004)

WR0000 = WR0000 - 1

(00005)

LBL 1

(00006)

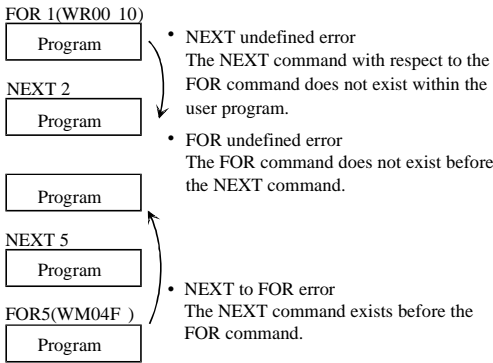
Item number		Control commands-6				Name		FOR																																					
Ladder format				Condition code						Processing time (μs)						Remark																													
FOR n (s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																																
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																															
				●	1]	●	●	●																																					
Command format				Number of steps						29		49		84		102		90		102																									
FOR n (s)				Condition			Steps																																						
				—			3																																						
Usable I/O				Bit				Word				Double word			Constant	Other																													
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																															
n	Code number													○	0 to 49 (Decimal)																														
s	Number of times repeated								○	○																																			
Function																																													
				<ul style="list-style-type: none"><li>Jumps from the NEXT n of the same code number to this command.</li><li>If the number of times repeated (s) is greater than 0, the command following the FOR n (s) is executed.</li><li>If the number of times repeated (s) is equal to 0, it jumps to the command following the NEXT n.</li><li>Use FOR n (s) and NEXT n in pairs. Also, place the NEXT n after FOR n.</li><li>The FOR n (s) may not be used multiple times.</li><li>Use the FOR n (s) and NEXT n in the same program area. (It is not allowed to include FOR n (s) in the normal scan and NEXT n in the subroutine area.)</li><li>The FOR n (s) to NEXT n nesting can be made up to 5 levels.</li></ul>																																									
Cautionary notes																																													
				<ul style="list-style-type: none"><li>This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul> <table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td>34</td><td>WRF001</td><td>H0002</td><td>Duplicate definition of FOR</td></tr></table> <ul style="list-style-type: none"><li>If an error is generated during the execution of the command, an error code will be set in the special internal outputs R7F3 and WRF015, and the following program will be executed.</li></ul> <table><tr><th colspan="2">Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="5">R7F3=1</td><td rowspan="5">WRF015</td><td>H0017</td><td>NEXT undefined</td></tr><tr><td>H0043</td><td>FOR to NEXT error</td></tr><tr><td>H0044</td><td>Area error for NEXT</td></tr><tr><td>H0045</td><td>FOR to NEXT nesting error</td></tr><tr><td>H0046</td><td>FOR nesting overflow</td></tr></table>																		CPU error code	Special internal output	Error code	Error description	34	WRF001	H0002	Duplicate definition of FOR	Special internal output		Error code	Error description	R7F3=1	WRF015	H0017	NEXT undefined	H0043	FOR to NEXT error	H0044	Area error for NEXT	H0045	FOR to NEXT nesting error	H0046	FOR nesting overflow
CPU error code	Special internal output	Error code	Error description																																										
34	WRF001	H0002	Duplicate definition of FOR																																										
Special internal output		Error code	Error description																																										
R7F3=1	WRF015	H0017	NEXT undefined																																										
		H0043	FOR to NEXT error																																										
		H0044	Area error for NEXT																																										
		H0045	FOR to NEXT nesting error																																										
		H0046	FOR nesting overflow																																										
Instruction for use																																													
				For the command to use this, refer to NEXT n.																																									

Item number		Control commands-7				Name				NEXT												
Ladder format						Condition code					Processing time (μs)						Remark					
NEXT n						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
						●	1]	●	●	●												
Command format						Number of steps																
NEXT n						Condition			Steps		23		←		63		←		76		←	
						—			2													
Usable I/O						Bit				Word				Double word			Constant	Other				
						X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
n	Code number															○	0 to 49 (Decimal)					
Function																						
<ul style="list-style-type: none"><li>Subtracts 1 from the number of times repeated (s) for the FORn(s) command of the same code number, then jumps to FORn(s).</li></ul>																						
Cautionary notes																						
<ul style="list-style-type: none"><li>This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul>																						
CPU error code				Special internal output				Error code				Error description										
34				WRF001				H0003				Duplicate definition of NEXT										
<ul style="list-style-type: none"><li>If an error is generated during the execution of the command, an error code will be set in the special internal outputs R7F3 and WRF015, and the following program will be executed.</li></ul>																						
Special internal output				Error code				Error description														
R7F3=1		WRF015		H0016				FOR undefined														
				H0046				FOR nesting overflow														
Instruction for use																						
<div><div><div>R000 DIF0</div><div>When WR0000&gt;0</div><div>When WR0000=0</div></div><div><div>WR0000=512</div><div>WR0001=0</div><div>FOR 0(WR0000)</div><div>TC0(WR0001)=0</div><div>WR0001=WR0001+1</div><div>NEXT 0</div></div><div><div>To the next program</div></div></div> <ul style="list-style-type: none"><li>When R000 is turned on, the progress value (TC n) of the timer or counter is cleared with 0 for 512 points.</li><li>Once the FOR to NEXT is begun, the command keeps executing until (s) is 0.</li><li>FOR0 (WR0000) performs commands after TC0 (WR0001) = 0 while WR0000&gt;0, subtracts 1 from WR0000 at NEXT0, then jumps to FOR0 (WR0000).</li><li>FOR0 (WR0000) jumps to the next command within the current box upon WR0000 = 0.</li></ul>																						

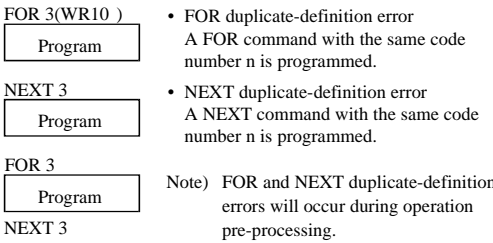


# Syntax of FOR to NEXT

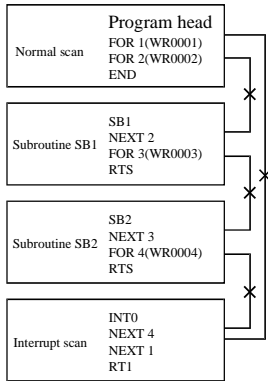
- 1] A NEXT command with the same code number as the code number n of the FOR command is required after the FOR command.



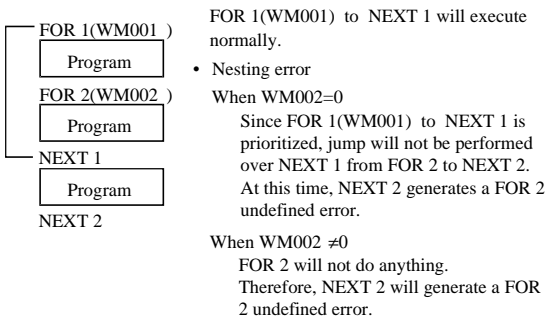
- 2] An overlap of FOR and NEXT commands with the same code number n is not allowed.



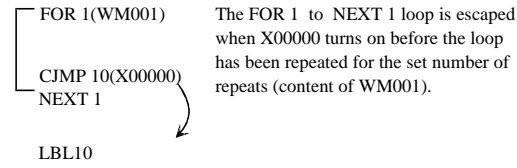
- 3] FOR and NEXT must be within the same area.



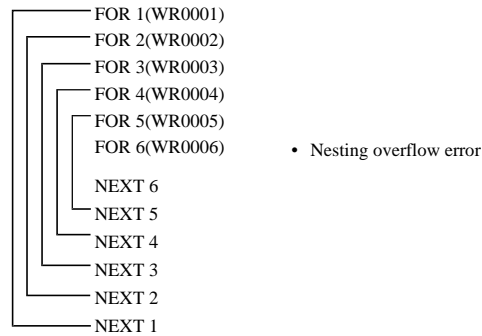
- 4] Use FOR to NEXT as a nest.



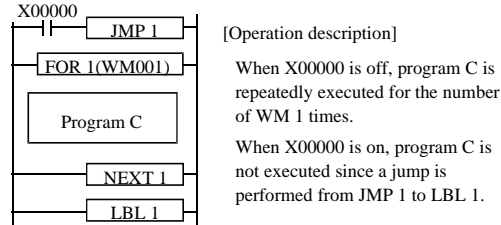
- 5] It is possible to escape from a FOR to NEXT loop using a jump command.



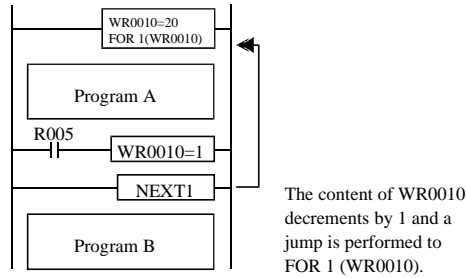
- 6] FOR to NEXT may be nested up to 5 levels. When a subroutine is included, the FOR to NEXT within the subroutine is counted.



- 7] Do not include a startup condition between FOR and NEXT. If a startup condition is required, create a circuit as shown below:



- 8] The number of repeats may be modified within the program.



- When R005 is off  
Program B is executed after program A is repeated 20 times.
- When R005 is on  
The repeat counter WR0010 changes to 1, and since the NEXT 1 processing subtracts 1 from it, the content of WR0010 becomes 0. Therefore, the repeating of program A is terminated and program B is executed.

Item number	Control commands-8	Name				Call subroutine (CALL)																		
Ladder format		Condition code					Processing time (μs)						Remark											
CAL n		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left													
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max												
		●	1]	●	●	●																		
Command format		Number of steps					19	←	23	←	43	←												
CAL n		Condition			Steps																			
		—			2																			
Usable I/O		Bit			Word				Double word			Constant	Other											
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM										
n	Code number												○	0 to 99 (Decimal)										
Function		<ul style="list-style-type: none"><li>• If the startup condition of CAL n is on, this commands executes the subroutine program (the program sandwiched by SB n and RTS) of the same code number.</li><li>• If the startup condition is off, the next program is executed.</li><li>• Up to 5 levels of CAL (nesting) for another subroutine can be performed within a subroutine.</li><li>• It is possible to call a subroutine from within an interrupt scan program.</li></ul>																						
Cautionary notes		<ul style="list-style-type: none"><li>• If an error is generated during the execution of the command, an error code will be set in the special internal outputs R7F3 and WRF015, and the following program will be executed.</li></ul> <table><tr><th colspan="2">Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="2">R7F3=1</td><td rowspan="2">WRF015</td><td>H0013</td><td>SB undefined</td></tr><tr><td>H0041</td><td>Nesting error</td></tr></table>													Special internal output		Error code	Error description	R7F3=1	WRF015	H0013	SB undefined	H0041	Nesting error
Special internal output		Error code	Error description																					
R7F3=1	WRF015	H0013	SB undefined																					
		H0041	Nesting error																					
Instruction for use		<div><div><div>R000</div><div>Other program</div><div>END</div><div>SB n</div><div>Subroutine program</div><div>RTS</div></div><div><div>R000 turns ON</div><div>R000 turns OFF</div></div><div><ul style="list-style-type: none"><li>• When R000 is on, a subroutine program is executed by CAL n. After the execution, the program is re-executed from the code following the CAL n.</li><li>• When R000 is off, the subroutine program is not executed, and the next program is executed.</li></ul></div></div>																						

CAL n

Item number		Control commands-9				Name				Start subroutine program (SUBROUTINE)																			
Ladder format						Condition code					Processing time (μs)						Remark												
SB n						R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left														
						DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max													
						●	1]	●	●	●																			
Command format						Number of steps					0.05		←		0.65		←		1.3		←								
SB n						Condition			Steps																				
						—			1																				
Usable I/O				Bit				Word				Double word			Constant	Other													
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM															
n	Code number															○	0 to 99 (Decimal)												
Function																													
<div><div></div><div><ul style="list-style-type: none"><li>• This command indicates the start of a subroutine program (processing is not performed).</li><li>• The n in the SB n cannot be used multiple times in the same program.</li><li>• Even if a startup condition is used for SB n, it will be ignored.</li><li>• Always use SB n and RTS in pairs.</li><li>• Code the SB n to RTS subroutine program after the END command.</li></ul></div></div>																													
Cautionary notes																													
<div><div></div><div><ul style="list-style-type: none"><li>• This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul></div></div> <table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="2">34</td><td rowspan="2">WRF001</td><td>H0004</td><td>Duplicate definition of SB</td></tr><tr><td>H0013</td><td>SB undefined</td></tr></table>																				CPU error code	Special internal output	Error code	Error description	34	WRF001	H0004	Duplicate definition of SB	H0013	SB undefined
CPU error code	Special internal output	Error code	Error description																										
34	WRF001	H0004	Duplicate definition of SB																										
		H0013	SB undefined																										
Instruction for use																													
<div><div><div><div>END</div></div><div><div>SB 0</div><div>Subroutine 0 program</div><div>SB 1</div><div>Subroutine 0.1 program</div><div>RTS</div></div></div><div><div>SB 0</div><div>SB 1</div></div></div> <div><ul style="list-style-type: none"><li>• When CAL 0 is executed, SB 0 to RTS is executed as a subroutine.</li><li>• When CAL 1 is executed, SB 1 to RTS is executed as a subroutine.</li></ul></div>																													

Item number	Control commands-10				Name		End of subroutine program (RETURN SUBROUTINE)																					
Ladder format					Condition code					Processing time (μs)						Remark												
RTS					R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left														
					DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max													
					●	●	●	●	●																			
Command format					Number of steps					17 ← 21 ← 38 ←																		
RTS					Condition			Steps																				
					—			1																				
Usable I/O					Bit				Word				Double word		Constant	Other												
					X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM											
Function																												
		<ul style="list-style-type: none"><li>• This command declares the end of a subroutine program.</li><li>• When this command is executed, the program is resumed starting from the line following the CAL n command that called the subroutine.</li><li>• Do not set a startup condition for this command.</li></ul>																										
Cautionary notes																												
		<ul style="list-style-type: none"><li>• This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul>																										
		<table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="3">34</td><td rowspan="3">WRF001</td><td>H0011</td><td>RTS undefined</td></tr><tr><td>H0020</td><td>RTS area error</td></tr><tr><td>H0030</td><td>RTS startup condition error</td></tr></table>															CPU error code	Special internal output	Error code	Error description	34	WRF001	H0011	RTS undefined	H0020	RTS area error	H0030	RTS startup condition error
CPU error code	Special internal output	Error code	Error description																									
34	WRF001	H0011	RTS undefined																									
		H0020	RTS area error																									
		H0030	RTS startup condition error																									
Instruction for use																												
		<div><div><div><div>R000</div><div></div><div></div><div>Subroutine 0</div><div>R001 program</div><div>Subroutine 0 program</div><div></div><div>Subroutine 1 program</div><div></div></div><div><div>CAL 0</div><div>END</div><div>SB 0</div><div>CAL 1</div><div>RTS</div><div>SB 1</div><div>RTS</div></div></div><div><div>1) 2) 3)</div></div><div><div>1]</div><div>2]</div><div>3]</div></div><div><p>Program execution when R000 and R001 are both off</p><p>Program execution when R000 is on and R001 is off</p><p>CAL 0 is executed, then the subroutine 0 program is executed. CAL 1 is not executed, the subroutine 0 program is terminated and the execution is returned to the code following the CAL 0.</p><p>Program execution when R000 and R001 are both on</p><p>CAL 0 is executed, then the subroutine 0 program is executed. CAL 1 is executed, then the subroutine 1 program is executed. The subroutine 1 program is completed and execution is returned to the code following the CAL 1.</p><p>The subroutine 0 program is completed and execution is returned to the code following the CAL 0.</p></div></div>																										

Item number		Control commands-11				Name		Start interrupt scan program (INTERRUPT)																					
Ladder format				Condition code						Processing time (μs)						Remark													
INT n				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max															
				●	●	●	●	●																					
Command format				Number of steps						0.05		←		0.65		←		1.3		←									
INT n				Condition			Steps																						
				—			1																						
Usable I/O				Bit				Word				Double word			Constant	Other													
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM															
n	Interrupt priority														○	0 to 2 (Decimal)													
Function																													
<ul style="list-style-type: none"><li>• This command declares the start of an interrupt scan program.</li><li>• n=0 to 2 indicates a periodical interrupt scan.</li><li>• It is set to the 10 ms periodic scan when n=0, 20 ms periodic scan when n=1, and 40 ms periodic interrupt scan when n=2.</li><li>• The smaller the number n, the higher the interrupt priority.</li><li>• Always use INT n and RTI in pairs.</li><li>• Even if a startup condition is used for INT n, it will be ignored.</li><li>• Code the INT n to RTI subroutine program after the END command.</li><li>• The n in INT n cannot be used multiple times within the same program.</li></ul>																													
Cautionary notes																													
<ul style="list-style-type: none"><li>• This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul> <table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="2">34</td><td rowspan="2">WRF001</td><td>H0005</td><td>Duplicate definition of INT</td></tr><tr><td>H0014</td><td>INT undefined</td></tr></table> <ul style="list-style-type: none"><li>• <u>The progress value is updated when the timer command is expected in the EH-CPU448.</u> Therefore, if a program that does not scan the timer command execution section after the timer is activated is created using the interrupt scan, the timer may not turn on correctly. (The timer does not turn on correctly when the time that does not scan the timer command execution section exceeds the time calculated by multiplying the time base by 65,535.) Note that the previous progress value is also retained until the timer command is executed.</li></ul>																				CPU error code	Special internal output	Error code	Error description	34	WRF001	H0005	Duplicate definition of INT	H0014	INT undefined
CPU error code	Special internal output	Error code	Error description																										
34	WRF001	H0005	Duplicate definition of INT																										
		H0014	INT undefined																										
Instruction for use																													
<div><div><div>END</div><div>INT 0</div><div>10 ms interrupt scan program</div><div>RTI</div></div><div>⇓ INT 0 scan</div><ul style="list-style-type: none"><li>• The program between INT0 and RTI is started and executed every 10 ms.</li></ul></div>																													

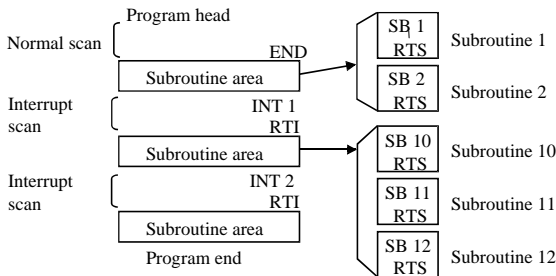
INT n

Item number	Control commands-12					Name		End interrupt scan program (RETURN INTERRUPT)																									
Ladder format				Condition code						Processing time (μs)						Remark																	
RTI				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																			
				●	●	●	●	●																									
Command format				Number of steps						8		←		5		←		22		←													
RTI				Condition			Steps																										
				—			1																										
Usable I/O				Bit				Word				Double word			Constant	Other																	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																			
Function																																	
				<ul style="list-style-type: none"><li>• This command declares the end of an interrupt scan program.</li><li>• When this program is executed, the processing is returned to the program that was executing before the interrupt scan was performed.</li><li>• Do not set a startup condition for this command.</li></ul>																													
Cautionary notes																																	
				<ul style="list-style-type: none"><li>• This command is checked prior to execution, and when there is an error, the following error code is set in the special internal output WRF001. Also, the CPU error code “34” is set to special internal output WRF000.</li></ul>																													
				<table><tr><th>CPU error code</th><th>Special internal output</th><th>Error code</th><th>Error description</th></tr><tr><td rowspan="3">34</td><td rowspan="3">WRF001</td><td>H0012</td><td>RTI undefined</td></tr><tr><td>H0021</td><td>RTI area error</td></tr><tr><td>H0031</td><td>RTI startup condition error</td></tr></table>																		CPU error code	Special internal output	Error code	Error description	34	WRF001	H0012	RTI undefined	H0021	RTI area error	H0031	RTI startup condition error
CPU error code	Special internal output	Error code	Error description																														
34	WRF001	H0012	RTI undefined																														
		H0021	RTI area error																														
		H0031	RTI startup condition error																														
Instruction for use																																	
				<div><div><div><div><div>INT 0</div><div>X00000</div><div>┌───┐ └───┘</div></div><div><div>WR0000=0</div><div>R000=0</div></div></div><div><div>X00000</div><div>┌───┐ └───┘</div><div>┌───┐ └───┘</div><div>WR0000=WR0000+1</div></div><div><div>WM000</div><div>&lt;=</div><div>WR0000</div></div><div><div>R000</div><div>○</div></div><div>SET</div><div>RTI</div></div></div> <div><ul style="list-style-type: none"><li>• A 0.01s timer is created using 10 ms interval interrupts.</li><li>• WM000 is used for the set value, WR0000 for the progress value and R000 for the timer coil.</li><li>• When X00000 is off, the progress value and timer coil are cleared.</li><li>• When X00000 is on, the progress value increments by 1 every 10 ms.</li><li>• The timer coil is turned on upon WM000&lt;=WR0000.</li></ul></div>																													

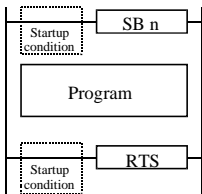
RTI

Syntax of SB n, RTS, INT n and RTI

- 1] A subroutine can be programmed between a normal scan and interrupt scan, between two interrupt scans, or after the final interrupt scan.

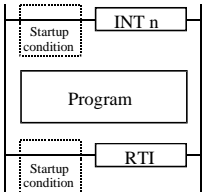


- 2] Program the subroutine start (SB n) and subroutine end (RTS) commands without specifying startup conditions.

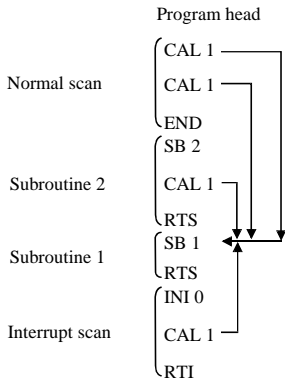


- The RTS startup condition error will occur during operation pre-processing.

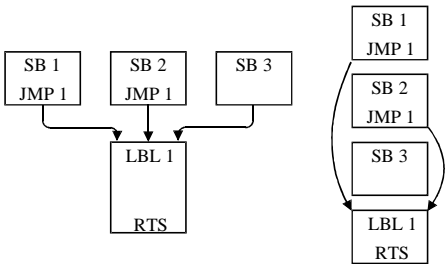
- 3] Program the interrupt scan start (INT n) and scan complete (RTI) commands without specifying startup conditions.



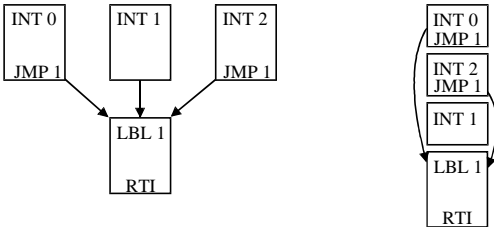
- 4] The same subroutine can be called from a normal scan, interrupt scan or subroutine.



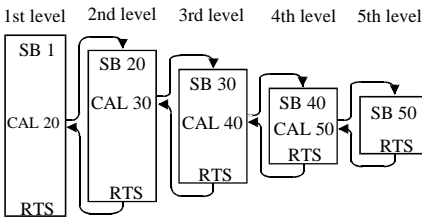
- 5] It is also possible to program a subroutine with multiple entry points and one exit.



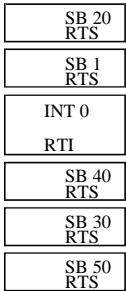
- 6] It is also possible to program a interrupt scan with many entry points and one exit.



- 7] Nesting of subroutines is allowed up to 5 levels.



Program head  
END




- (1) As shown to the left, the subroutine program order and nesting order have no relationship.


Item number		Transfer commands-1				Name		General-purpose port transmission command (GENERAL PURPOSE PORT COMMUNICATION COMMAND)													
Ladder format				Condition code						Processing time (μs)						Remark					
TRNS 0 (d, s, t)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				↑	●	●	●	●													
Command format				Number of steps						61		589		142		1,465		168		1,301	
TRNS 0 (d, s, t)				Condition			Steps														
				—			5														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
d	Module loading location							○													
s	Head of parameter area								○										s uses up to s+14.		
t	Head of communication control bit					○													t uses up to t+11.		

## Function

- This is a communication command for general-purpose serial ports used in the CPU ladder program.
- The WY to which an arbitrary I/O is assigned is set in d. (Since this is used as a dummy, it is possible to set open n points to a slot that does not actually exist.)
- s is used to set the head I/O number of the parameter area, in which various communication parameters (head and size of communication data area, timeout value, receiving data length, transmission code and transmission parameter) are set.
- t is used to set the head I/O number of the communication control bit area, in which the start of communication, control bits for initial settings and the determination as to whether or not the communication ended properly are stored.
- The TRNS 0 command is a command to perform reception after transmission.
- Area description of s

s	1] Return code
s+1	2] System area
	(Cannot be used by the user)
s+3	3] Timeout time
s+4	4] Head I/O of transmitting data area
s+6	5] Size of transmitting data area
s+7	6] Head I/O of receiving data area
s+9	7] Size of receiving data area
s+10	8] Receiving data length
s+11	9] Start code
s+12	10] End code
s+13	11] Transmission speed
s+14	12] Transmission format

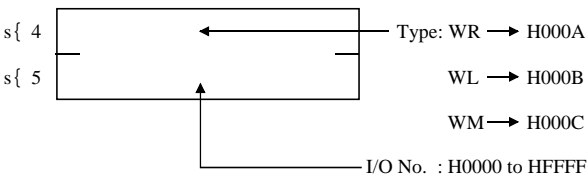
 : User write-prohibited area

 : User setting area

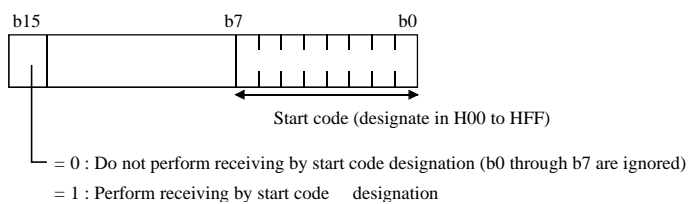
- Return code: Set in the lower 8 bits of the execution result of the TRNS 0 command as follows:  
Normal completion → 0  
Abnormal completion → ≠ 0
- System area: Used by the system processing of the TRNS 0 command when the command is executed.  
This area may not be used by the user.
- Timeout time: Designates the timeout time from the start of TRNS 0 command execution to completion, as follows:  
0: Timeout check is not performed.  
≠ 0: × 10ms timeout check is performed (The maximum possible set value is HFFFF.).



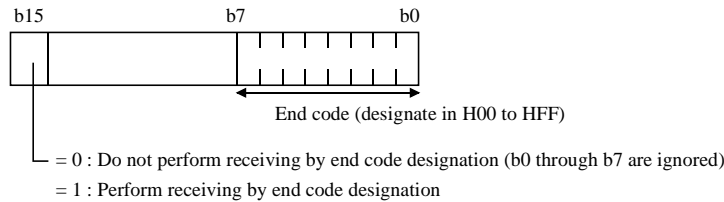
- 4] Head I/O of transmitting data area:  
When transmitted by the TRNS 0 command, designates the type and number of the head I/O of the area in which transmitting data is stored.



- 5] Size of transmitting data area:  
The size of the transmitting data area is designated in word units.
- 6] Head I/O of receiving data area:  
Designates the type and number of the head I/O of the area in which the response data, with respect to the command or data transmitted, is stored (the area composition is the same as the transmitting data area).
- 7] Size of receiving data area:  
The size of the receiving data area is designated in word units.
- 8]<sup>\*1</sup> Receiving data length:  
Receiving data length is designated in byte units. However, do not exceed the maximum value (256 bytes) or the receiving data area. If either is exceeded, DER is equal to "1" and ends abnormally.
- 9]<sup>\*1</sup> Start code:  
Designates the receiving start code.



- 10]<sup>\*1</sup> End code:  
Designates the receiving end code.



- 11] Transmission speed:  
Designates the transmission speed.

Baud rate	Set value
19200 bps	H0006
9600 bps	H0005
4800 bps	H0004
2400 bps	H0003
1200 bps	H0002
600 bps	H0001
300 bps	H0000

TRNS 0 (d, s, t)

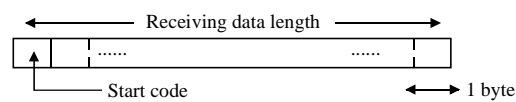
12] Transmission format:  
Designates the transmission format.

Transmission code	Set value
7-bit even parity, 2 stops	H0000
7-bit odd parity, 2 stops	H0001
7-bit even parity, 1 stop	H0002
7-bit odd parity, 1 stop	H0003
8-bit no parity, 2 stops	H0004
8-bit no parity, 1 stop	H0005
8-bit even parity, 1 stop	H0006
8-bit odd parity, 1 stop	H0007

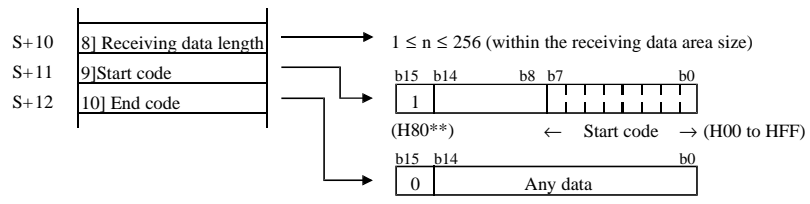
\*1 The following four types of data communication methods can be designated depending on the settings of 8] through 10].

(a) Designation by the start code and receiving data length \*2

(i) Receiving data structure

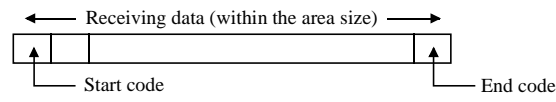


(ii) Parameter settings

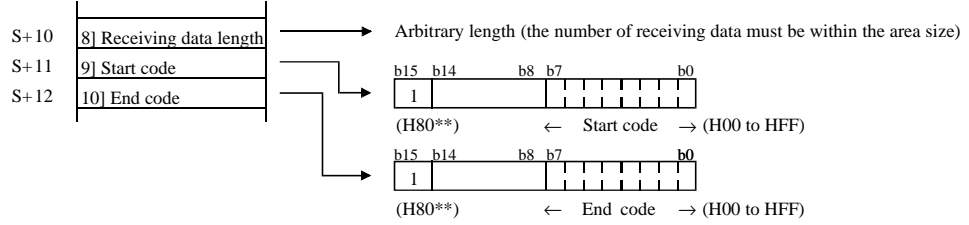


(b) Designation by the start and end codes \*2

(i) Receiving data structure

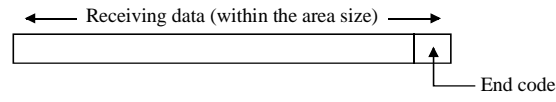


(ii) Parameter settings



(c) Designation by the end code

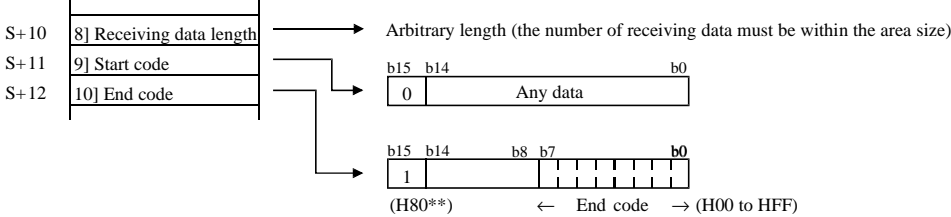
(i) Receiving data structure



\*2 When receiving data by specifying a start code, the receive buffer may overflow if data with a different start code is sent from the connected device. If this occurs, the data reception will not be executed. Make sure the specified start code is the same as the one used at the connected device.

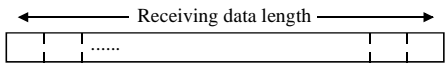
TRNS 0 (d, s, t)

(ii) Parameter settings

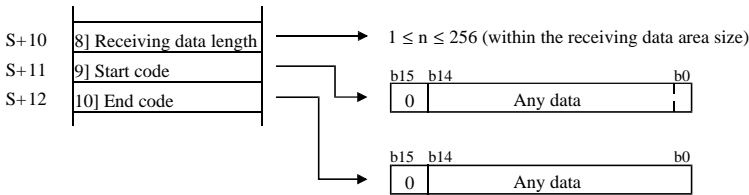


(d) Designation by receiving data length

(i) Receiving data structure



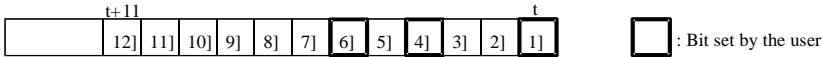
(ii) Parameter settings



Priority order among start code, end code and receiving data length

Start code	0	1	0	1
End code	0	0	1	1
Action	Receives according to the receiving data length	Received according to the start code and receiving data length	Receives according to the end code	Receives according to the codes (data length is ignored)

(7) Description of area t



- 1] Communication execution:  
This bit is set to "1" when the communication is performed using the TRNS 0 command. After communication is completed, the TRNS 0 command resets the area to "0."
- 2] Normal completion:  
This bit is set to "1" when communication started by the TRNS 0 command ends normally. Also, the TRNS 0 command resets this bit to "0" when communication is commenced.
- 3] Abnormal completion:  
This bit is set to "1" when communication started by the TRNS 0 command ends abnormally. Also, the TRNS 0 command resets this bit to "0" when communication is commenced.
- 4] Initialization request:  
This bit is set to "1" when the TRNS 0 command is initialized. If an initialization request is issued during transmission, communication is terminated forcibly.
- 5] Initialization end:  
This bit is set to "1" when the initialization of the TRNS 0 command is completed normally. At this time, 4] initialization request is reset to 0."
- 6] Continuation:  
This bit is set to "1" when receiving data immediately after transmission is complete. After the communication, the TRNS 0 command resets this bit to "0."
- 7] Parity error:  
This bit is set to "1" when a parity error occurs during communication.
- 8] Framing error:  
This bit is set to "1" when a framing error occurs during communication.

Supplement

- When the CPU receives data from a connected device after reception in your system, if reception is executed with the RECV 0 command after the completion of transmission with the TRNS 0 command, the reception data may not completely be received depending on the timing.  
In such systems, it is recommended that you set 6] Continuation bit to "1" and specify the reception mode after transmission.

- 9] Overrun error:  
This bit is set to “1” when an overrun error occurs during communication.
- 10] Timeout:  
This bit is set to “1” when a communication times out.
- 11] Input buffer full:  
This bit is set to “1” when the receiving buffer is full.
- 12] Conflict error:  
This bit is set to “1” when multiple TRNS 0 commands are started simultaneously in the user program, or when a TRNS 0 command and a RECV 0 command are started simultaneously. This forces the communication to terminate.

The TRNS 0 command resets 7] through 12] to “0” during initialization or when the TRNS 0 command is started.

(8) Description of the transmitting data area

This is the area to store the data to be transmitted by the TRNS 0 command. Set the data to be transmitted according to the following structure:

- 1] When even number of bytes are transmitted

Number of bytes to be transmitted (N)	
1st byte	2nd byte
3rd byte	4th byte
5th byte	6th byte
7th byte	8th byte
to	
N-1th byte	Nth byte

- 2] When odd number of bytes are transmitted

Number of bytes to be transmitted (N)	
1st byte	2nd byte
3rd byte	4th byte
5th byte	6th byte
7th byte	8th byte
to	
N-2th byte	N-1th byte
Nth byte	(Invalid data)

Transmitting data area

(9) Description of the receiving data area

This is the area to store the response with respect to the data transmitted by the TRNS 0 command. The received data is set according to the following structure:

- 1] When even number of bytes are received

Number of bytes to be received (N)	
1st byte	2nd byte
3rd byte	4th byte
5th byte	6th byte
7th byte	8th byte
to	
N-1th byte	Nth byte

- 2] When odd number of bytes are received

Number of bytes to be received (N)	
1st byte	2nd byte
3rd byte	4th byte
5th byte	6th byte
7th byte	8th byte
to	
N-2th byte	N-1th byte
Nth byte	(Invalid data)

Receiving data area

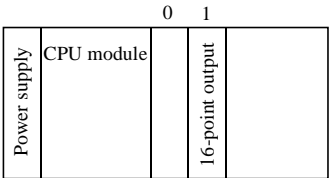
Cautionary notes

- The TRNS 0 command initializes the internal work area with one scan ON.  
If there are startup conditions before the TRNS 0 command, the system software may not be able to execute initialization processing normally. Therefore, do not specify startup conditions.
- Set 1] Communication execution bit of the TRNS 0 command at the second scan or later.
- Use this command so that s+14 and t+11 do not exceed the I/O range\*. If the I/O range is exceeded, DER is equal to “1” and communication will not be executed.  
\* For I/O ranges, refer to the P3-6 and P3-7 performance specification table.
- When there is an error in the parameters set by s to t, there may be cases in which the CPU module error “52” is set in special internal output WRF000.

Program example

The following shows a sample program that performs data output from the CPU module's general-purpose port to external devices using the TRNS 0 command.

(1) Mounting the module



Mount a 16-point output module in slot “1” of the basic base. Therefore, the I/O assignment of the output module is WY0010.  
Specify the d parameter of the TRNS 0 command as WY0010.  
(The WY is used as a dummy in the TRNS 0 command, so this could be any WY.)

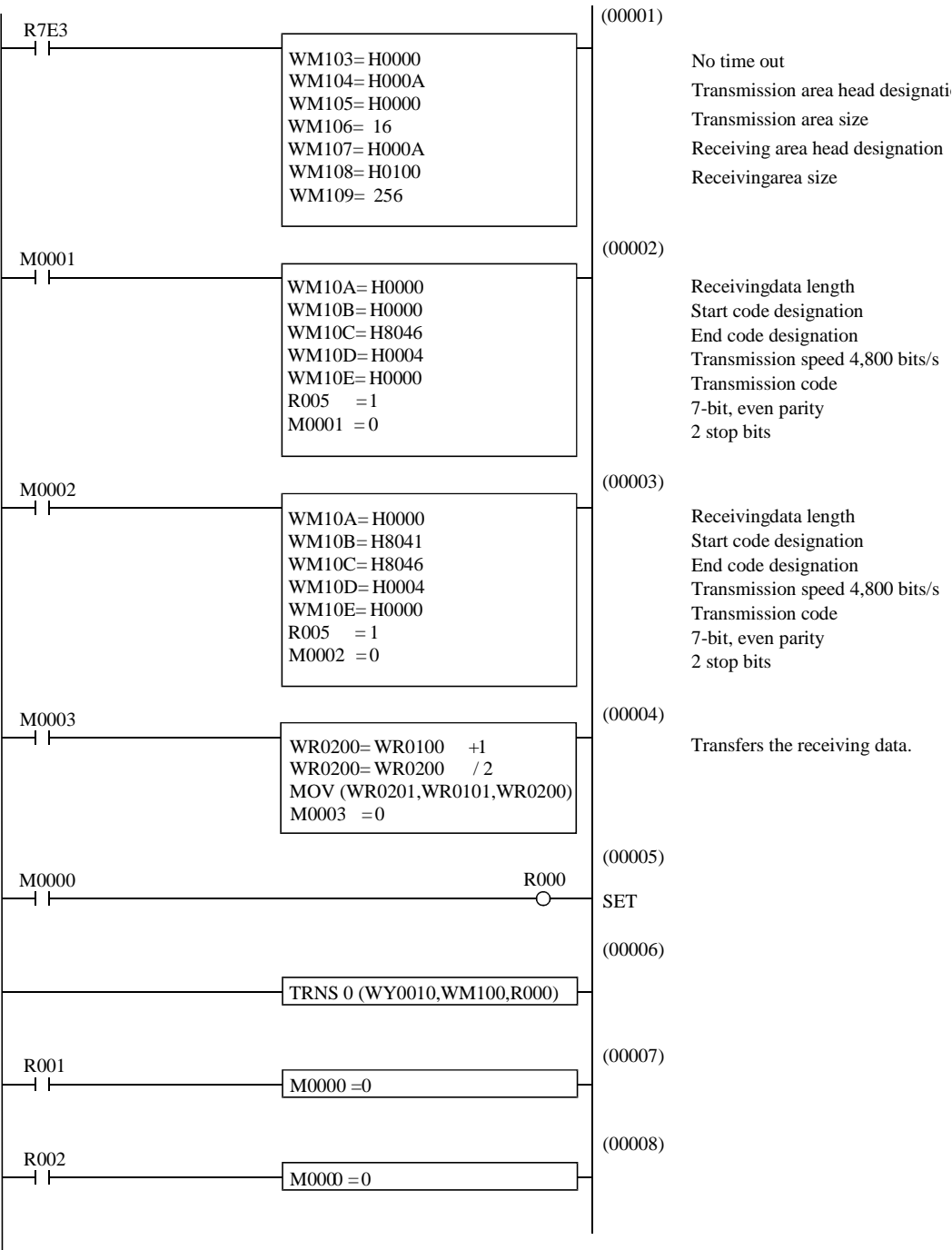
(2) Assigning internal outputs

The sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

I/O	No.	Usage	Remarks
WM	100 to 10E	TRNS 0 command Parameter area (s to s+14)	
R	000 to 00B	TRNS 0 command Communication control bit area (t to t+11)	
WR	0000 to 000F	Transmission data area (16-word)	
	0100 to 01FF	Receiving data area (256-word)	
M	0000	Communication request flag (TRNS 0 executed)	
	0001	Transmission parameter setting 1	
	0002	Transmission parameter setting 2	
	0003	Transfer receiving data	
WR	0200 to	Processing area for receiving data	The contents of the receiving data area are transferred to this area. WR0200 stores the number of bytes of the receiving data converted to number of words.

TRNS 0 (d, s, t)

Program example



TRNS 0 (d, s, t)

Program description

- 1] The TRNS 0 command parameters are set using special internal output R7E3 (turned on for one scan after RUN is commenced).
- 2] When M0001 is turned on, the following parameters are set for the TRNS 0 command:  
Receiving condition: No start code designated  
End code is designated as “F”  
Transmission speed: 4,800 bits/s  
Transmission code: 7 bits, even parity, 2 stop bits  
Continuation flag: ON (Receiving processing is commenced after transmission is complete.)
- 3] When M002 is turned on, the following parameters are set for the TRNS 0 command:  
Receiving condition: Start code is designated as “A”  
End code is designated as “F”  
Transmission speed: 4,800 bits/s  
Transmission code: 7 bits, even parity, 2 stop bits  
Continuation flag: ON (Receiving processing is commenced after transmission is complete.)
- 4] When M0003 is turned on, the receiving data that is set in the receiving data area is transferred to a location beyond WR0201, and the number of words in the receiving data is set in WR0200.
- 5] When the communication start condition M0000 is met, the communication execution flag R000 is turned on.
- 6] Communication processing is performed between the general-purpose serial port and external devices.
- 7] When the TRNS 0 normal command completion flag R001 turns on, the end processing and clearing of communication start condition M0000 are performed.
- 8] When the TRNS 0 abnormal command completion flag R002 turns on, the end processing and clearing of communication start condition M0000 are performed.

TRNS 0 (d, s, t)

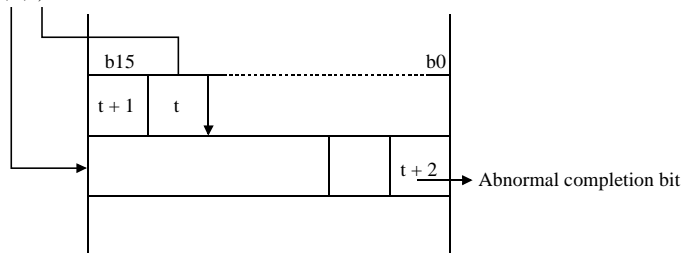
TRNS/RECV command return code list

Return code	Name	Description	Corrective action
H00	Normal completion	Transmitting and receiving completed normally.	—
H10	Module error *1	Watchdog timer error	Check the module loading, then restart power or replace the module.
H21	Range check error	The last entry in parameters s and t exceed the I/O range.	Set each parameter area in the valid range.
H22	Transmitting area setting error	The head of the transmitting area is not set correctly.	Set the head of the receiving area in the valid range.
H23	Transmitting area range error	The last entry in the transmitting area exceeds the I/O range.	Set the transmitting area in the valid range.
H24	Receiving area setting error	The head of the receiving area is not set correctly.	Set the head of the receiving area in the valid range.
H25	Receiving area range error	The last entry in the receiving area exceeds the I/O range.	Set the receiving area in the valid range.
H26	Transmitting data length setting error	The transmitting data length is set exceeding the transmitting area length.	Perform setting so that the transmitting data length is within the transmitting area.
H27	Receiving data length setting error	The receiving data length is set exceeding the receiving area length.	Perform setting so that the receiving data length is within the receiving area.
H28	Area overlap error *2	There is an overlapped area for parameters s and t, transmitting area and receiving area.	Set each area so there is no overlap.
H30	Timeout *1	The communication processing did not complete within the set time frame.	Increase the set value or review the processing contents.
H40	Receiving area full *3	Receiving data has been stored to the maximum capacity of the receiving area and there is no more open space.	Increase the receiving area.
H41	Parity error *4	Parity error has occurred during the communication processing.	Verify the transmission path, data format, etc. of the general-purpose port.
H42	Framing error *4	Framing error has occurred during the communication processing.	
H43	Overrun error	Overrun error has occurred during the communication processing.	
H44	Conflict error	TRNS 0/RECV 0 has been started at two or more locations simultaneously.	Change the setting so that it does not startup at two or more locations simultaneously.
H45	Parameter error	The settings for TRNS 0/RECV 0 baud rate, transmission code, etc. are invalid.	Set the valid value.
H46	Port designation error	TRNS 0 or RECV 0 was started when a general-purpose port was not designated.	Check port settings.
H80	Module specific error	The high-function module detected an error.	Refer to the user's manual of each module.

\*1 Since the I/F designations of various high-function modules are identical from the stand point of the TRNS or RECV command, it is not possible to determine if the intended type is used. Therefore, no error indicating that the command and the module are mismatched is returned. However, when communication cannot be established due to discrepancy in the register configuration or the handshake bit location, a timeout error (if timeout has been designated) or a module error is returned as the error code.

\*2 The return code for an area overlap error is H28, but when there is an area overlap as shown below, the return code may not be displayed as H28, so exercise caution.

TRNS n (d, s, t)



If the head area of s and the t area are overlapped, H28 is set in the head area of s, but the abnormal completion bit is set to "1" at the same time, making the value appear as H21.

\*3 It is set for the amount of the receiving area size (maximum 256 bytes).

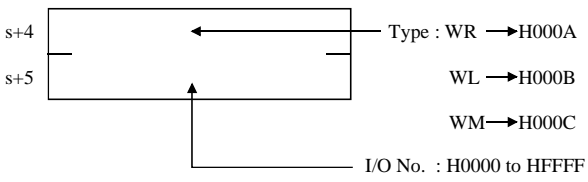
\*4 While receiving, the receiving data is not guaranteed.



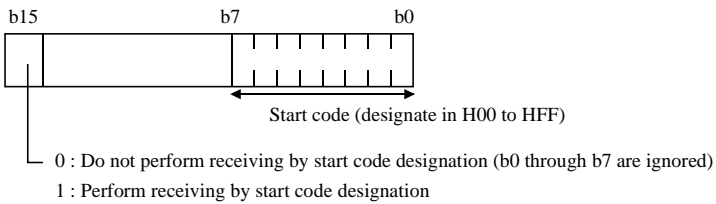
Item number		Transfer commands-2				Name		General-purpose port receiving command													
Ladder format				Condition code						Processing time (μs)						Remark					
RECV 0 (d, s, t)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				↕	●	●	●	●													
Command format				Number of steps						61		365		142		1,479		171		1,305	
RECV 0 (d, s, t)				Condition			Steps														
				—			5														
Usable I/O				Bit				Word				Double word			Constant	Other					
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
d	Module loading location							○													
s	Head of parameter area									○							s uses up to s + 14.				
t	Head of communication control bit					○											t uses up to t + 11.				
Function																					
<div><div><div>(1) This is a communication command for general-purpose serial ports used in the CPU ladder program.</div><div>(2) A WX to which an arbitrary I/O is assigned is set in d.</div><div>(3) s is used to set the head I/O number of the parameter area, in which various communication parameters (head and size of transmitting and receiving data area, timeout value, receiving data length, transmission code and transmission parameter) are set.</div><div>(4) t is used to set the head I/O number of the communication control bit area, in which the start of communication, control bits for initial settings and the determination as to whether or not the communication ended properly are stored.</div><div>(5) The RECV 0 command is a command to perform reception after transmission.</div><div>(6) Area description of s.</div></div><div><div><div><div>s</div><div>1] Return code</div></div><div><div>s+1</div><div>2] System area</div><div>(Cannot be used by the user)</div></div><div><div>s+3</div><div>3] Timeout time</div></div><div><div>s+4</div><div>4] Head I/O of transmitting data area</div></div><div><div>s+6</div><div>5] Size of transmitting data area</div></div><div><div>s+7</div><div>6] Head I/O of receiving data area</div></div><div><div>s+9</div><div>7] Size of receiving data area</div></div><div><div>s+10</div><div>8] Receiving data length</div></div><div><div>s+11</div><div>9] Start code</div></div><div><div>s+12</div><div>10] End code</div></div><div><div>s+13</div><div>11] Transmission speed</div></div><div><div>s+14</div><div>12] Transmission format</div></div></div><div><div><div>1] Return code:</div><div>Set in the lower 8 bits of the execution result of the RECV 0 command as follows:</div><div>Normal completion → 0</div><div>Abnormal completion → ≠ 0</div></div><div><div>2] System area:</div><div>Used by the system processing of the RECV 0 command when the command is executed.</div><div><u>This area may not be used by the user.</u></div></div><div><div>3] Timeout time:</div><div>Designates the timeout time from the start of RECV 0 command execution to completion, as follows:</div><div>0: Timeout check is not performed.</div><div>≠ 0: × 10 ms timeout check is performed (The maximum possible set value is HFFFF.).</div></div></div><div><div><div></div><div>: User write-prohibited area</div></div><div><div></div><div>: User setting area</div></div></div></div></div>																					

RECV 0 (d, s, t)

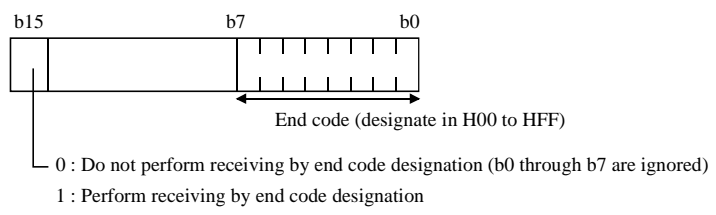
- 4] Head I/O of transmitting data area:  
When transmitted by the RECV 0 command, designates the type and number of the head I/O of the area in which transmitting data is stored.



- 5] Size of transmitting data area:  
The size of the transmitting data area is designated in word units.
- 6] Head I/O of receiving data area:  
Designates the type and number of the head I/O of the area in which receiving data is stored (the area composition is the same as the transmitting data area).
- 7] Size of receiving data area:  
The size of the receiving data area is designated in word units.
- 8] Receiving data length:  
Receiving data length is designated in byte units. However, do not exceed the maximum value (256 bytes) or the receiving data area. If either is exceeded, DER is equal to "1" and ends abnormally.
- 9] Start code:  
Designates the receiving start code. \*1



- 10] End code:  
Designates the receiving end code.

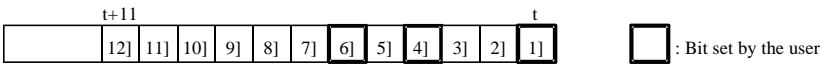


- 11] Transmission speed:  
Designates the transmission speed.  
See the TRNS 0.
- 12] Transmission format:  
Designates the transmission format.  
See the TRNS 0.

Designate 4] and 5] when transmitting after receiving by the RECV 0 command.

\*1 When receiving data by specifying a start code, the receive buffer may overflow if data with a different start code is sent from the connected device. If this occurs, the data reception will not be executed. Make sure the specified start code is the same as the one used at the connected device.

(7) Area description of t



- 1] Communication execution:  
This bit is set to “1” when the communication is performed using the RECV 0 command. After communication is completed, the RECV 0 command resets the area to “0.”
- 2] Normal completion:  
This bit is set to “1” when communication started by the RECV 0 command ends normally. Also, the RECV 0 command resets this bit to “0” when communication is commenced.
- 3] Abnormal completion:  
This bit is set to “0” when communication started by the RECV 0 command ends abnormally. Also, the RECV 0 command resets this bit to “0” when communication is commenced.
- 4] Initialisation request:  
This bit is set to “1” when the RECV 0 command is initialised. If an initialisation request is issued during transmission, communication is terminated forcibly.
- 5] Initialisation end:  
This bit is set to “1” when the initialisation of the RECV 0 command is completed normally. At this time, 4] initialisation request is reset to “0.”
- 6] Continuation:  
This bit is set to “1” when transmitting after receiving is complete. After the communication, the RECV 0 command resets this bit to “0.”
- 7] Parity error:  
This bit is set to “1” when a party error occurs during communication.
- 8] Framing error:  
This bit is set to “1” when a framing error occurs during communication.
- 9] Overrun error:  
This bit is set to “1” when an overrun error occurs during communication.
- 10] Timeout:  
This bit is set to “1” when a communication times out.
- 11] Input buffer full:  
This bit is set to “1” when the receiving buffer is full.
- 12] Conflict error:  
This bit is set to “1” when multiple RECV 0 commands are started simultaneously in the user program. This forces the communication to terminate.

The RECV 0 command resets 7] through 12] to “0” during initialisation or when the TRNS 0 command is started.

(8) Description of the transmission and receiving data area

See the TRNS 0.

Supplement

- If the CPU transmits data from a connected device after reception in your system, it is recommended that you set 6] Continuation bit to “1” and specify the transmission mode after reception.

RECV 0 (d, s, t)

Cautionary notes

- The RECV 0 command initializes the internal work area with one scan ON.  
If there are startup conditions before the RECV 0 command, the system software may not be able to execute initialization processing normally. Therefore, do not specify startup conditions.
- Set 1] Communication execution bit of the RECV 0 command at the second scan or later.
- Use this command so that s+14 and t+11 do not exceed the I/O range\*. If the I/O range is exceeded, DER is equal to “1” and communication will not be executed.  
\* For I/O ranges, refer to the P3-6 and P3-7 performance specification table.
- When the parameters set for s and after are abnormal, there may be cases when “52” is indicated on the CPU module error display.

Program example

The following shows a sample program that performs data input from an external device to the CPU module’s general-purpose port using the RECV 0 command.

(1) Mounting the module

		0	
Power supply	CPU module	16-point output	

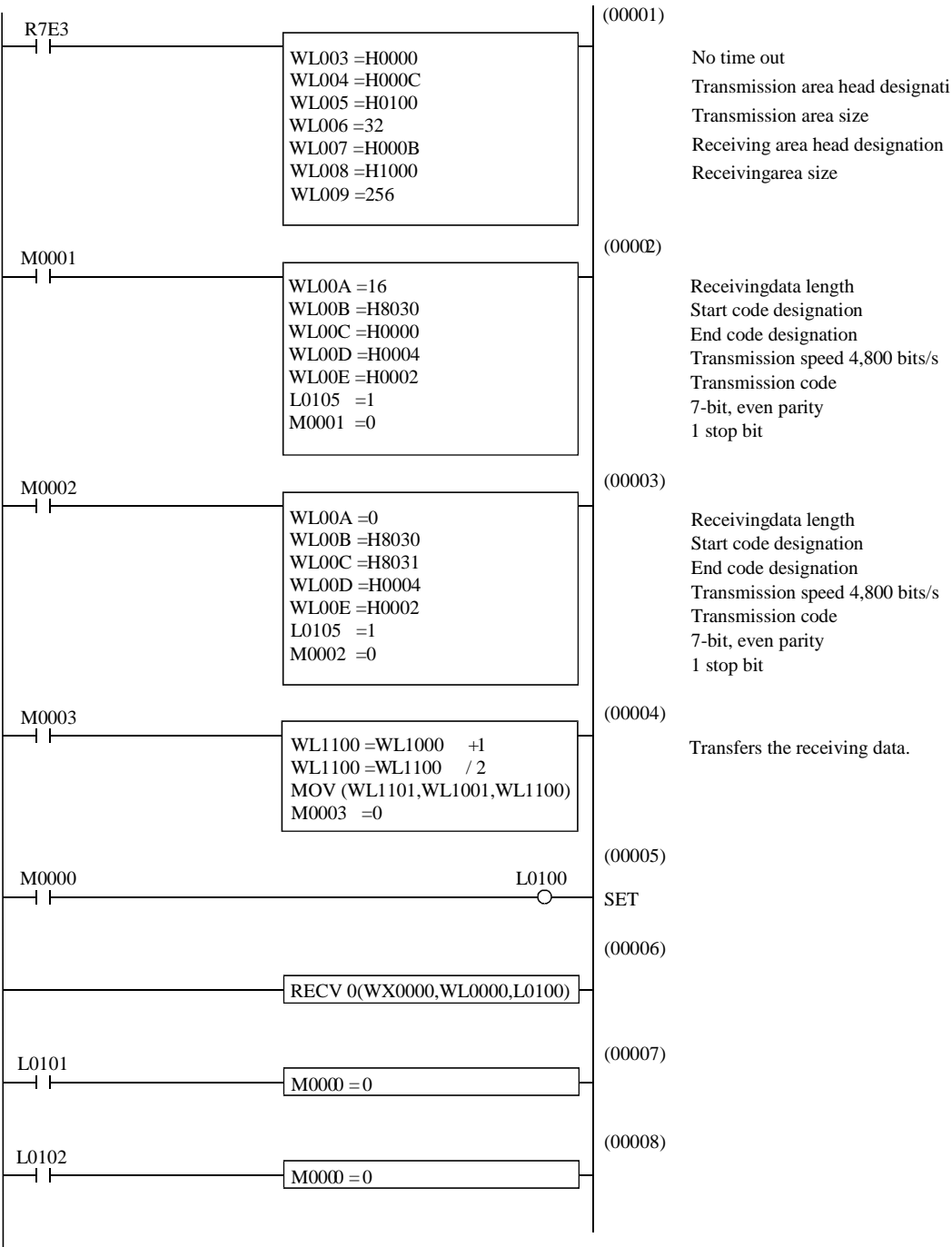
Mount a 16-point input module in slot “0” of the basic base. Therefore, the I/O assignment of the input module is WX0000.  
Specify the d parameter of the RECV 0 command as WX0000.  
(The WX is used as a dummy in the RECV 0 command, so this could be any WX.)

(2) Assigning internal outputs

The sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

I/O	No.	Usage	Remarks
WL	000 to 00E	RECV 0 command Parameter area (s to s+14)	
L	0100 to 010B	RECV 0 command Communication control bit area (t to t+11)	
WM	100 to 120	Transmission data area (32-word)	
WL	1000 to 10FF	Receiving data area (256-word)	
M	0000	Communication request flag (RECV 0 executed)	
	0001	Transmission parameter setting 1	
	0002	Transmission parameter setting 2	
	0003	Transfer receiving data	
WL	1100	Processing area for receiving data	The contents of the receiving data area are transferred to this area. WL1100 stores the number of bytes of the receiving data converted to number of words.

Program example



RECV 0 (d, s, t)

Program description	
	<div><div>1]</div><div>The RECV 0 command parameters are set using special internal output R7E3 (turned on for one scan after RUN is commenced).</div></div> <div><div>2]</div><div>When M001 is turned on, the following parameters are set for the RECV 0 command: Receiving condition: Receiving data length - 16 bytes End code is designated as "0" Transmission speed: 4800 bits/s Transmission code: 7 bits, even parity, 1 stop bit Continuation flag: ON (Transmission processing is commenced after receiving is complete.)</div></div> <div><div>3]</div><div>When M002 is turned on, the following parameters are set for the RECV 0 command: Receiving condition: Start code is designated as "0" End code is designated as "1" Transmission speed: 4800 bits/s Transmission code: 7 bits, even parity, 1 stop bit Continuation flag: ON (Transmission processing is commenced after receiving is complete.)</div></div> <div><div>4]</div><div>When M0003 is turned on, the receiving data that is set in the receiving data area is transferred to a location beyond WL1101, and the number of words in the receiving data is set in WL1100.</div></div> <div><div>5]</div><div>When the communication start condition M0000 is met, the communication execution flag L0100 is turned on.</div></div> <div><div>6]</div><div>Communication processing is performed between the general-purpose serial port and external devices.</div></div> <div><div>7]</div><div>When the RECV 0 normal command completion flag L0101 turns on, the end processing and clearing of communication start condition M0000 are performed.</div></div> <div><div>8]</div><div>When the RECV 0 abnormal command completion flag L0102 turns on, the end processing and clearing of communication start condition M0000 are performed.</div></div>

RECV 0 (d, s, t)

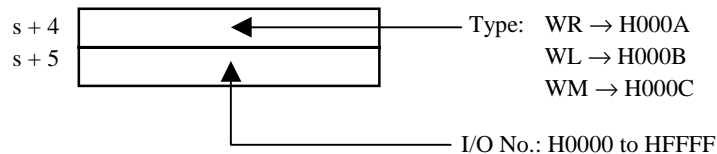
Item number		Transfer commands-5				Name		Telecommunication command † (TELECOMMUNICATION COMMAND)									
Ladder format				Condition code					Processing time (μs)						Remark		
TRNS 8 (d, s, t)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↑	●	●	●	●									
Command format				Number of steps					128	602	153	1,100					
TRNS 8 (d, s, t)				Condition			Steps										
				—			5										
Usable I/O				Bit				Word				Double word		Constant	Other		
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
d	Module loading location							○									
s	Head of parameter area								○						s uses up to s+10.		
t	Head of communication control bit					○									t uses up to t+13		
Function																	
<div><div>(1) This is a communication command for controlling the modem that is used by the CPU's ladder program.</div><div>(2) Set the WY to which an arbitrary I/O is assigned in d. (Since this is used as a dummy, it is possible to set open n points to a slot that does not actually exist in I/O assignments.)</div><div>(3) For s, set the head I/O number of the parameter area in which various communication parameters (control type, head and size of transmission data area, transmission code and transmission parameter) are specified.</div><div>(4) For t, set the head I/O number of the communication control bit area in which the start of communication, control bits for initial settings and the result as to whether or not the communication ended properly are stored.</div><div>(5) Description of area s</div><div><div><div><div>s</div><div>1] Return code</div></div><div><div>s + 1</div><div>2] System area</div><div>(Cannot be used by the user)</div></div><div><div>s + 3</div><div>3] Control type</div></div><div><div>s + 4</div><div>4] Head I/O of transmission data area</div></div><div><div>s + 6</div><div>5] Size of transmission data area</div></div><div><div>s + 7</div><div>6] Dial interval</div></div><div><div>s + 8</div><div>7] Non-response monitor time</div></div><div><div>s + 9</div><div>8] Modem-PLC transmission speed</div></div><div><div>s + 10</div><div>9] Transmission format</div></div></div><div><div><div></div><div>: User write-prohibited area</div></div><div><div></div><div>: User setting area</div></div></div><div><div>1] Return code:</div><div>The execution result of the TRNS 8 command is set in the lower 8 bits as follows: Normal completion → 0 Abnormal completion → ≠ 0</div></div><div><div>2] System area:</div><div>Used for system communication of the TRNS 8 command when the TRNS 8 command is executed. <u>This area cannot be used by the user.</u></div></div><div><div>3] Control type:</div><div>Specify the control type of the TRNS 8 command. 1: Dedicated/general switch request 2: General/dedicated switch request 3: TEL origination request 4: TEL disconnection request 5: Line connection check</div></div></div></div>																	

<sup>†</sup>: Only the EH-CPU448/308T/316T are supported.

TRNS 8 (d, s, t)

Function

- 4] Head I/O of the transmission data area:  
Set the command to be sent to the modem with the TRNS 8 command. Specify the initialization command if initialization is required when a dedicated/general switch request is made, the type and number of the head I/O of the area in which the originating telephone number is stored.



- 5] Transmission data area size:  
Specify the size of the transmission data area in units of words.
- 6] Dial interval:  
Set the dial wait time for the second and subsequent dialing.  
=0: 5 sec.  
≠0: Waits until the next dial with a time of x1s.
- 7] Non-response monitor time:  
Specify the timeout time after a command is issued to the modem.  
=0: 10 sec.  
≠0: Times out with a time of 1s.
- 8] Modem-PLC transmission speed:  
Specify the transmission speed between the modem and PLC.

Baud rate	Setting value
115.2 kbps	H0009
57.6 kbps	H0008
38.4 kbps	H0007
19.2 kbps	H0006
9600 bps	H0005
4800 bps	H0004
2400 bps	H0003
1200 bps	H0002
600 bps	H0001
300 bps	H0000

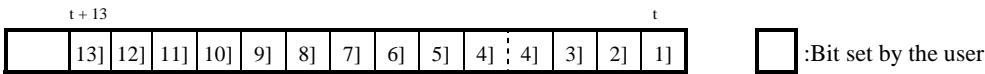
- 9] Transmission format:  
Specify the transmission format.

Transmission code	Set value
7-bit even parity, 2 stops	H0000
7-bit odd parity, 2 stops	H0001
7-bit even parity, 1 stop	H0002
7-bit odd parity, 1 stop	H0003
8-bit no parity, 2 stops	H0004
8-bit no parity, 1 stop	H0005
8-bit even parity, 1 stop	H0006
8-bit odd parity, 1 stop	H0007



Function

(6) Description of area t



- 1] Communication execution:  
This bit is set to “1” when the communication is performed using the TRNS 8 command. After communication is completed, the TRNS 8 command resets the area to “0.”
- 2] Normal completion:  
This bit is set to “1” when communication started by the TRNS 8 command ends normally. Also, the TRNS 8 command resets this bit to “0” when communication is commenced.
- 3] Abnormal completion:  
This bit is set to “1” when communication started by the TRNS 8 command ends abnormally. Also, the TRNS 8 command resets this bit to “0” when communication is started.
- 4] Being connected (2 bits):  
Sets the line status. When an originating call is being connected, “01” is set. When a incoming call is being connected, “10” is set. If nothing is connected, “00” is set. The TRNS 8 command resets this bit to “00” when communication is starts. This bit is set when communication is completed normally.
- 5] Dial busy:  
This bit is set to “1” when dial busy is detected after call origination.
- 6] Line busy:  
This bit is set to “1” when line busy is detected after call origination.
- 7] Received:  
This bit is set to “1” when a call is received when a switch request or originating request is made.
- 8] No response:  
This bit is set to “1” when there is no response after dedicated/general switching.
- 9] Parity error:  
This bit is set to “1” when a party error occurs.
- 10] Framing error:  
This bit is set to “1” when a framing error occurs.
- 11] Overrun error:  
This bit is set to “1” when an overrun error occurs.
- 12] Dedicated port being connected  
This bit is set to “1” when the dedicated port is being connected after a switch request is made.
- 13] Contension error:  
This bit is set to “1” when multiple TRANS 8 commands are started simultaneously by the user program, or when the TRANS 0 and RECV 0 commands are started simultaneously. This forces the communication to terminate.  
The TRNS 8 command resets 5] through 13] to “0” when the TRNS 8 command is started.

Function																																			
(7) Description of the transmission data area	<p>This area stores the data to be transmitted to the modem with the TRNS 8 command, and is used for the initialization command and call origination. Set the data to be transmitted according to the following format:</p> <div><div><p>1] When even number of bytes are transmitted</p><table><tr><th colspan="2">Number of bytes to be transmitted (N)</th></tr><tr><td>1st byte</td><td>2nd byte</td></tr><tr><td>3rd byte</td><td>4th byte</td></tr><tr><td>5th byte</td><td>6th byte</td></tr><tr><td>7th byte</td><td>8th byte</td></tr><tr><td colspan="2">:</td></tr><tr><td>N-1th byte</td><td>Nth byte</td></tr><tr><td></td><td></td></tr></table></div><div><p>2] When odd number of bytes are transmitted</p><table><tr><th colspan="2">Number of bytes to be transmitted (N)</th></tr><tr><td>1st byte</td><td>2nd byte</td></tr><tr><td>3rd byte</td><td>4th byte</td></tr><tr><td>5th byte</td><td>6th byte</td></tr><tr><td>7th byte</td><td>8th byte</td></tr><tr><td colspan="2">:</td></tr><tr><td>N-2th byte</td><td>N-1th byte</td></tr><tr><td>Nth byte</td><td>(Invalid data)</td></tr><tr><td></td><td></td></tr></table></div><div><p>Transmission data area size</p></div></div>	Number of bytes to be transmitted (N)		1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	:		N-1th byte	Nth byte			Number of bytes to be transmitted (N)		1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	:		N-2th byte	N-1th byte	Nth byte	(Invalid data)		
Number of bytes to be transmitted (N)																																			
1st byte	2nd byte																																		
3rd byte	4th byte																																		
5th byte	6th byte																																		
7th byte	8th byte																																		
:																																			
N-1th byte	Nth byte																																		
Number of bytes to be transmitted (N)																																			
1st byte	2nd byte																																		
3rd byte	4th byte																																		
5th byte	6th byte																																		
7th byte	8th byte																																		
:																																			
N-2th byte	N-1th byte																																		
Nth byte	(Invalid data)																																		
(i) When the initialization command is required during dedicated/general switch request	<p>Specify the initialization command excluding the head AT.</p> <p>(Example) Initialization command: To send ATE0Q0V0 &amp; CI &amp;SI to the modem</p> <table><tr><th colspan="2">H000C</th></tr><tr><td>H45 (E)</td><td>H30 (O)</td></tr><tr><td>H51 (Q)</td><td>H30 (O)</td></tr><tr><td>H56 (V)</td><td>H30 (O)</td></tr><tr><td>H26 (&amp;)</td><td>H43 (C)</td></tr><tr><td>H31 (1)</td><td>H26 (&amp;)</td></tr><tr><td>H53 (S)</td><td>H31 (1)</td></tr></table> <p>Set the following values when the modem is initialized*:</p> <table><tr><td>Result code:</td><td>Output</td></tr><tr><td>Display format of result code:</td><td>Numeric format</td></tr><tr><td>Echo back:</td><td>None</td></tr><tr><td>DR signal:</td><td>Always on</td></tr><tr><td>CD signal control:</td><td>Follows the carrier of the opposite modem</td></tr><tr><td>ER signal control:</td><td>Disconnects the line by switching from on to off</td></tr></table> <p>* The model may not operate normally if it is used with settings other than above. Be sure to set the model correctly by referring to the instruction manual of your modem.</p>	H000C		H45 (E)	H30 (O)	H51 (Q)	H30 (O)	H56 (V)	H30 (O)	H26 (&)	H43 (C)	H31 (1)	H26 (&)	H53 (S)	H31 (1)	Result code:	Output	Display format of result code:	Numeric format	Echo back:	None	DR signal:	Always on	CD signal control:	Follows the carrier of the opposite modem	ER signal control:	Disconnects the line by switching from on to off								
H000C																																			
H45 (E)	H30 (O)																																		
H51 (Q)	H30 (O)																																		
H56 (V)	H30 (O)																																		
H26 (&)	H43 (C)																																		
H31 (1)	H26 (&)																																		
H53 (S)	H31 (1)																																		
Result code:	Output																																		
Display format of result code:	Numeric format																																		
Echo back:	None																																		
DR signal:	Always on																																		
CD signal control:	Follows the carrier of the opposite modem																																		
ER signal control:	Disconnects the line by switching from on to off																																		
(ii) When the initialization command is not required during dedicated/general switch request	<p>Only AT can be sent by setting the transmission size to zero.</p> <table><tr><th colspan="2">H0000</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	H0000																																	
H0000																																			

Function

(iii) For call origination

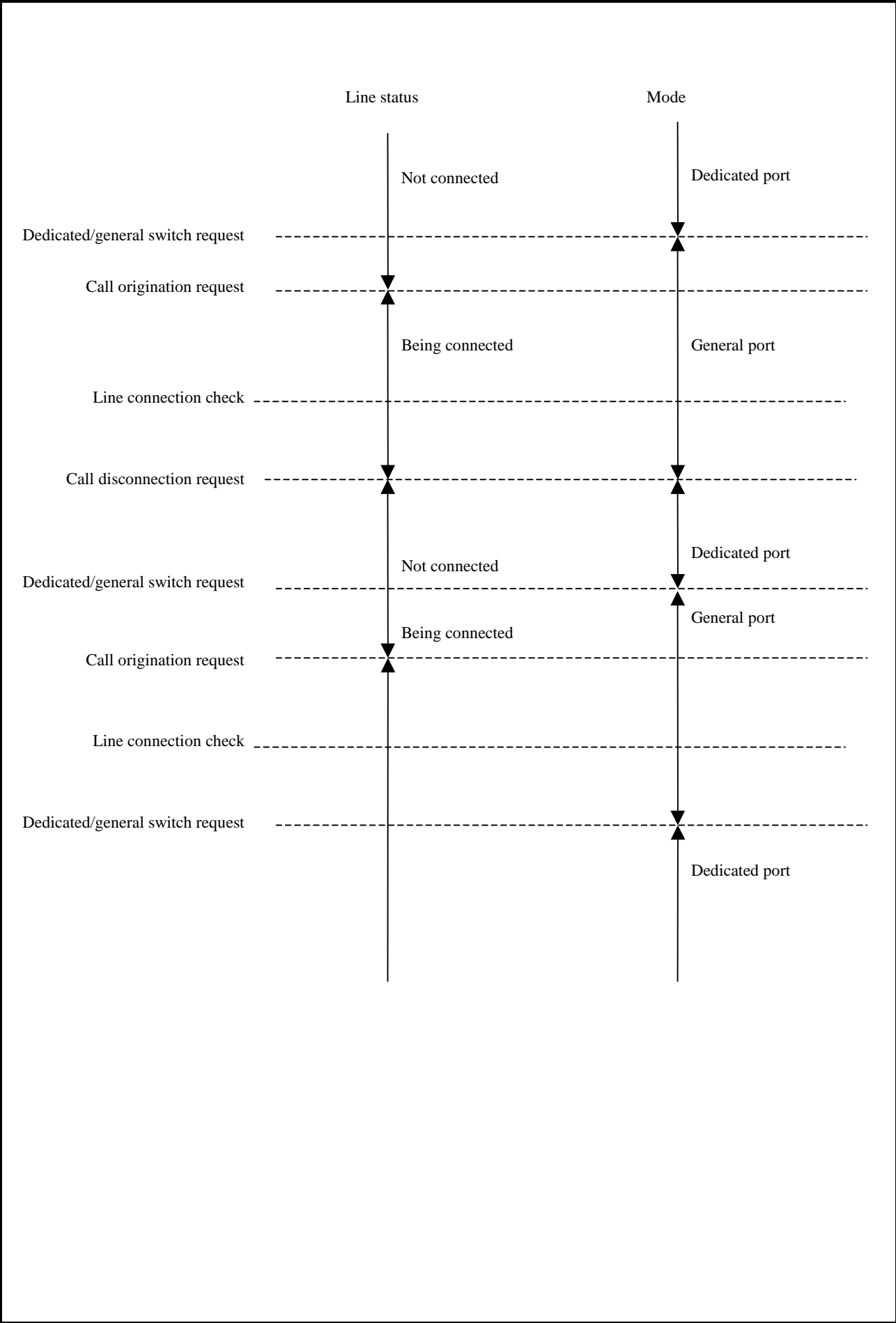
Specify the telephone numbers to be dialed for call origination. Multiple numbers may be specified by delimiting each number with a space (H20). If two consecutive spaces are entered, it is considered that no telephone numbers are present thereafter. If a space is entered at the beginning, no call origination will be performed.  
To redial the same telephone number, specify the same telephone number for the number of times to be called.  
To redial different telephone numbers, specify different telephone numbers.

(Example) To dial TEL 03-1111-2222 three times

H0020	
H30(0)	H33(3)
H31(1)	H31(1)
H31(1)	H31(1)
H32(2)	H32(2)
H32(2)	H32(2)
H20( )	H30(0)
H33(3)	H31(1)
H31(1)	H31(1)
H31(1)	H32(2)
H32(2)	H32(2)
H32(2)	H20( )
H30(0)	H33(3)
H31(1)	H31(1)
H31(1)	H31(1)
H32(2)	H32(2)
H32(2)	H32(2)

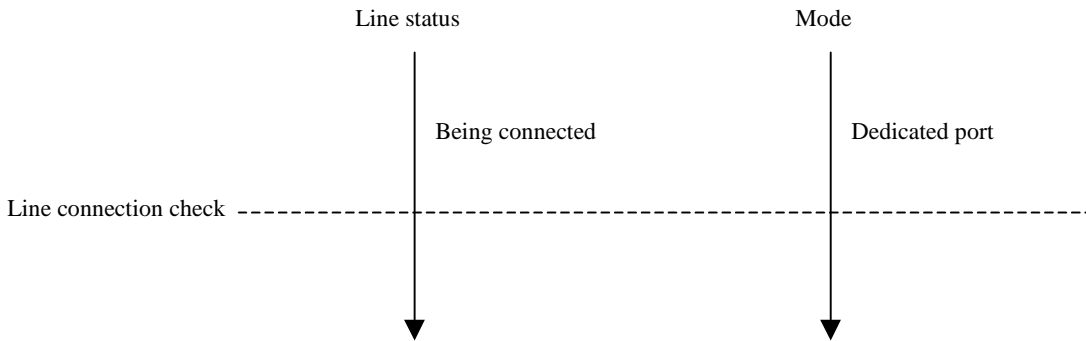
Notes

- Use this command so that s+10 and t+13 do not exceed the I/O range\*. If the I/O range is exceeded, DER is equal to “1” and communication will not be executed.  
\* For the I/O ranges, see the EH-CPU448 Performance Specifications Table on page 3.
- Control type
  - 1] Dedicated/general switch request  
Switches communication from the dedicated port communication to the general port communication. When the switching is completed normally, the general port is enabled. If an error occurs, the switching will not be performed. If the initialization command is required for the modem, the initialization command can be specified. If it is not required, set the transmission size to zero. This can be executed only when the line is being disconnected.
  - 2] General/dedicated switch request  
Switches communication from the general port communication to the dedicated port communication. If this switching is done while the line is being connected, the transmission speed and transmission format specified for the general port must match those for the dedicated port.
  - 3] Call origination request  
Performs a call origination to the specified telephone number.
  - 4] Call disconnection request  
Performs a call disconnection. Both the dedicated port and general port can be disconnected. When the disconnection is completed normally, the dedicated port is enabled.
  - 5] Line connection check  
Checks the line connection status.

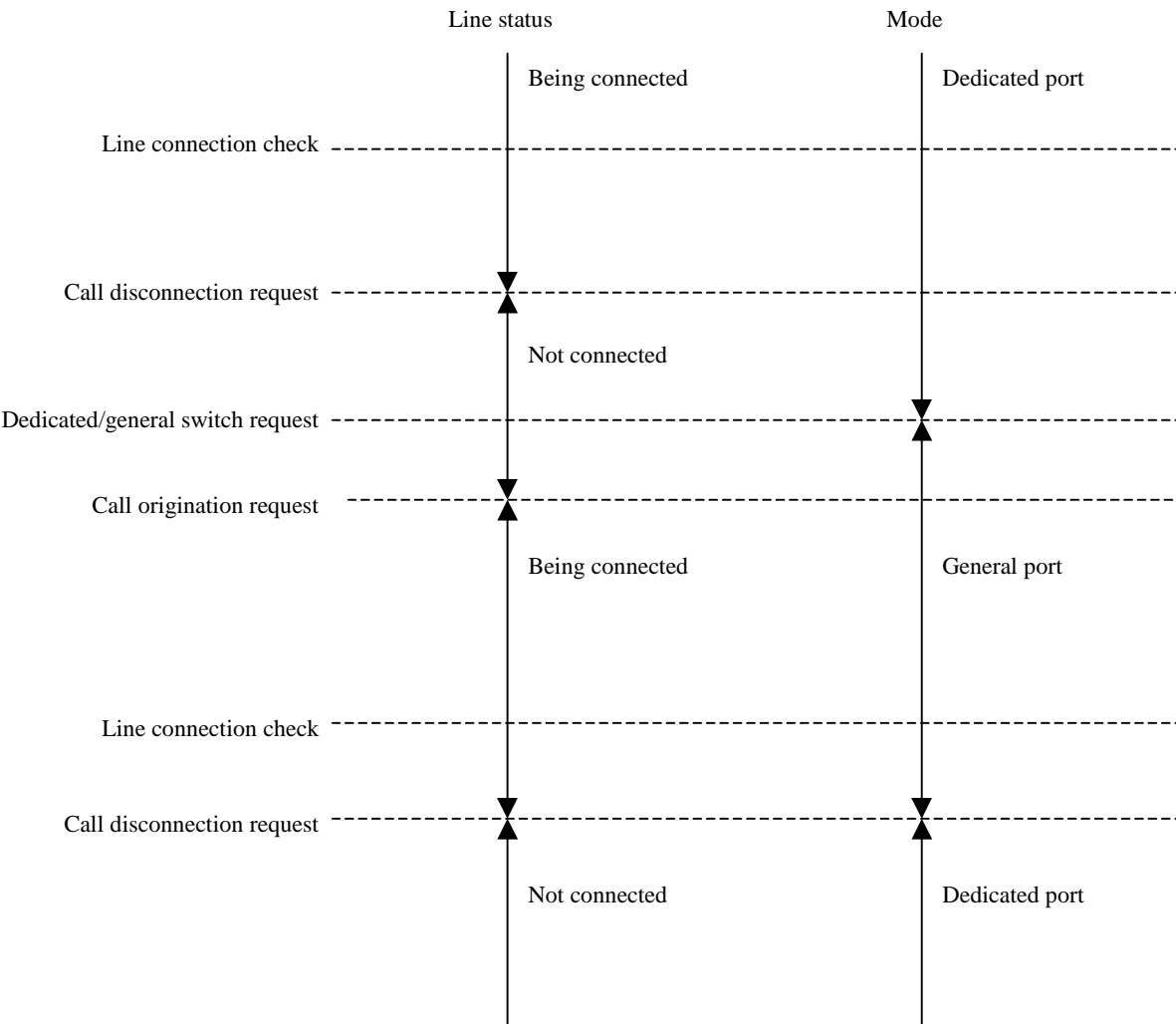


TRNS 8 (d, s, t)

Dedicated port being connected    Line check    Part 1

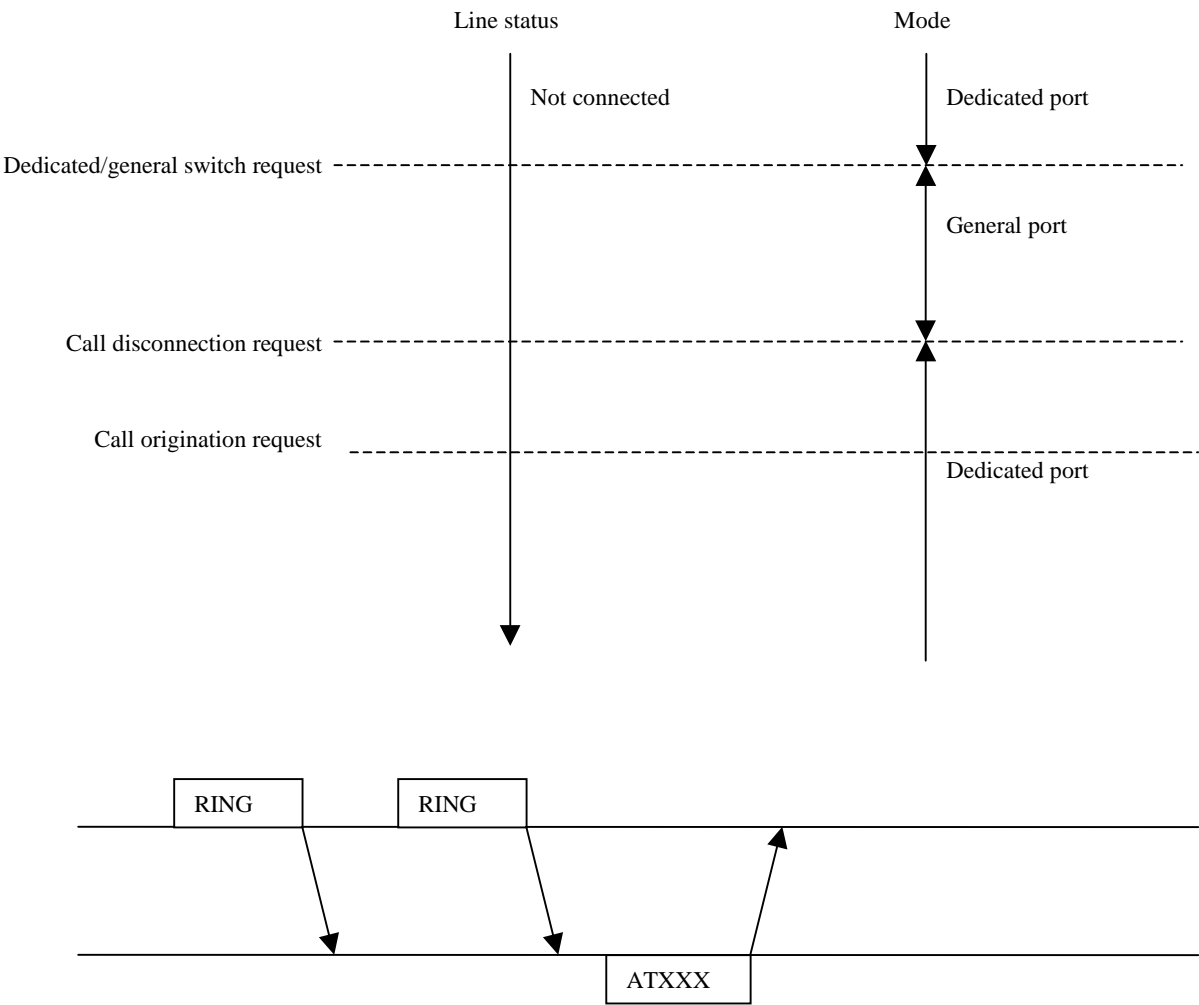


Dedicated port being connected    Line check    Part 2



TRANS 8 (d, s, t)

Dedicated port being connected    Call origination



Call termination (ring reception) check is not performed before the AT command is issued.  
It may result in either normal completion or abnormal completion (line busy, termination detected, no response). In case of abnormal completion, retry the operation.  
When changed from RUN to STOP:  
The port mode is set to the dedicated port.  
If a modem is connected using the general port, the line will be placed in the disconnected status.  
If the port is the dedicated port, no status change will occur.

## Error code

## TRNS 8 error code list

Types of errors: 1] Dedicated/general port switch request, 2] General/dedicated port switch request, 3] Call origination request, 4] Call disconnection request, 5] Line connection check

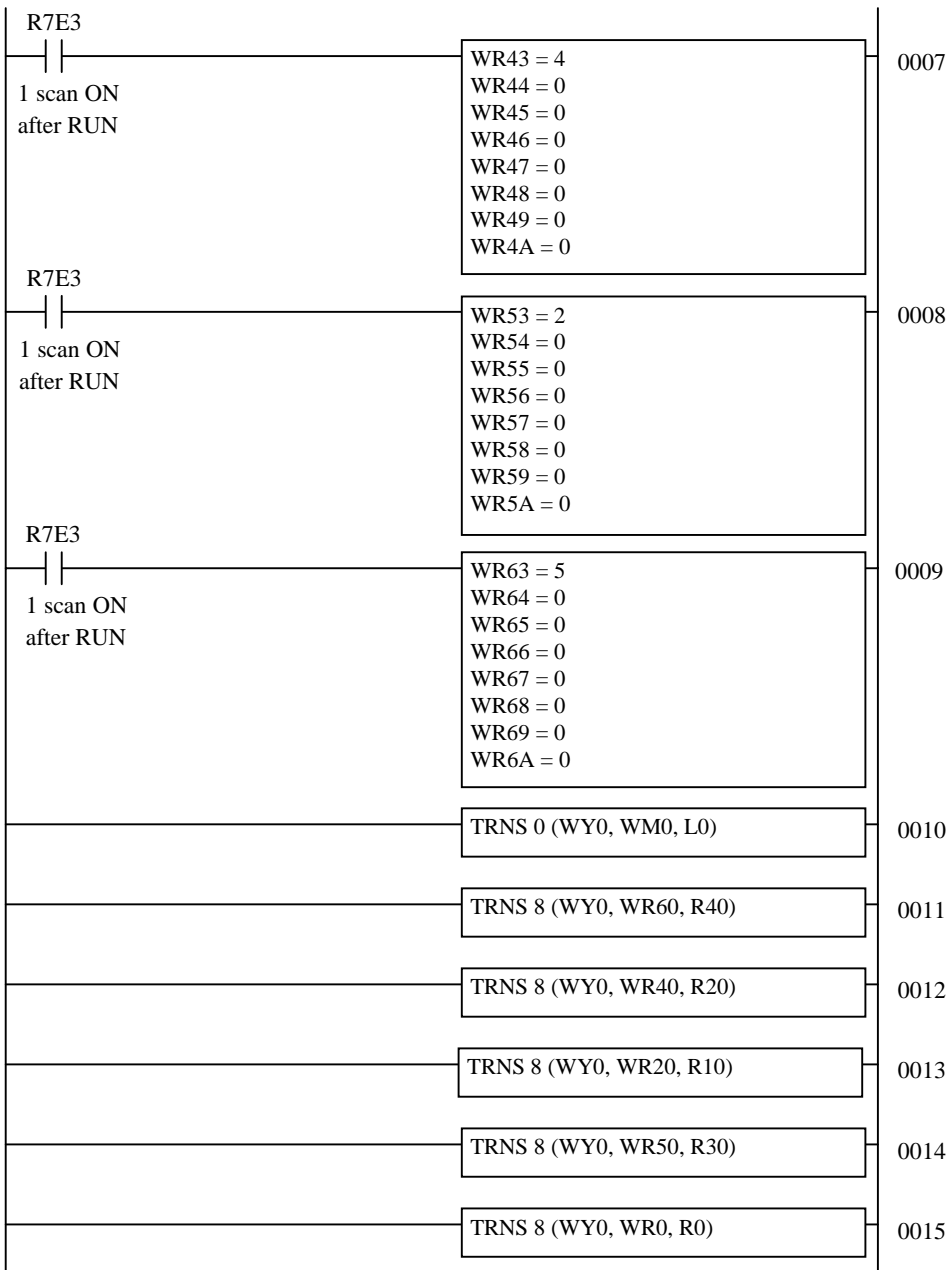
Return code	Error name	Description	Type of error
21h	Range check error	The s parameter and/or t parameter exceeded the I/O range.	1], 2], 3], 4], 5]
22h	Transmission area setting error	The starting address setting of the transmission area is incorrect.	1], 2]
23h	Transmission area range error	The transmission area exceeded the I/O range.	1], 2]
26h	Transmission data length error	The transmission data length is longer than the transmission area.	1], 2]
28h	Area overlap	The s parameter, t parameter and transmission area are overlapped.	1], 2], 3], 4], 5]
41h	Parity error	A parity error occurred during result reception.	1], 2]
42h	Framing error	A framing error occurred during result reception.	1], 2]
43h	Overrun error	An overrun error occurred during result reception.	1], 2]
44h	Contention error	More than one TRNS 8 command were started simultaneously. The TRNS 8 command was started with the TRNS 0 command simultaneously. The TRNS 8 command was started with the RECV 0 command simultaneously.	1], 2], 3], 4], 5]
45h	Parameter error	The setting values of the baud rate, transmission format and control type are incorrect.	1], when abnormal type
46h	Port specification error	The DIP switches are not set for modem connection.	1], 2], 3], 4], 5]
50h	Dial busy	Busy during call origination	2]
51h	Line busy	Line busy during call origination	2]
52h	Termination detected	When switching or during call origination	1], 2]
53h	No response	The no-response time has reached without the response of the AT command.	1]
54h	Dedicated port is being connected	Being connected to the dedicated port during switch request.	1]
55h	Line disconnection	No carrier is set during call origination.	2]
56h	Abnormal modem response	Response from the modem is abnormal.	1], 2]
57h	Abnormal port mode	The port mode was set to the dedicated port during origination.	2]
58h	Telephone number setting error	The telephone number set in the transmission data area started with a space. The number of data to be sent was zero during origination.	2]
59h	Cannot switch from general to dedicated port	Switching to the dedicated port did not complete normally.	5]

Program description		
<div>R7E3</div> <div>1 scan ON after RUN</div>	<div>WR3 = 1 WR4 = HA WR5 = H10 WR6 = 10 WR7 = 0 WR8 = 10 WR9 = 6 WRA = 2</div>	0001
<div>R7E3</div> <div>1 scan ON after RUN</div>	<div>WR10 = 15 WR11 = H4530 WR12 = H5130 WR13 = H5630 WR14 = H2643 WR15 = H3126 WR16 = H5330 WR17 = H2644 WR18 = H3200</div>	0002
<div>R7E3</div> <div>1 scan ON after RUN</div>	<div>WR23 = 3 WR24 = HA WR25 = H30 WR26 = 20 WR27 = 10 WR28 = 0 WR29 = 0 WR2A = 0</div>	0003
<div>R7E3</div> <div>1 scan ON after RUN</div>	<div>WR30 = 12 WR31 = H3220 WR32 = H3220 WR33 = H2020 WR34 = H3120 WR35 = H2020</div>	0004
<div>R7E3</div> <div>1 scan ON after RUN</div>	<div>WM3 = 0 WM4 = HC WM5 = H10 WM6 = 6 WM7 = HC WM8 = H20 WM9 = 10 WMA = 7 WMB = 0 WMC = 0 WMD = 6 WME = 2</div>	0005
<div>R7E3</div> <div>1 scan ON after RUN</div>	<div>WM10 = 10 WM11 = H3132 WM12 = H3334 WM13 = H3536 WM14 = H3738 WM15 = H3930 WM16 = H3132</div>	0006

TRNS 8 (d, s, t)



Program description



TRNS 8 (d, s, t)

Item number	Fun commands-1	Name		PID Initialization <sup>†</sup> (PID INITIALIZE)											
Ladder format		Condition code						Processing time (μs)						Remark	
FUN 0 (s) * (PIDIT (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	●									
Command format		Number of steps						1,661	3,154	7,389	12,572	4,421	8,493		
FUN 0 (s) * (PIDIT (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	PID control table							○						WR only	
Function															
<ul style="list-style-type: none"><li>The FUN 0 (s) initializes the area in which the initialization set data required for PID operation is stored.</li><li>The (s) in the FUN 0 (s) is used to specify the head number of WR of the PID management table.</li><li>If there is an error in the contents specified in the PID control table, an error code will be set in error code 0 of the PID control table and initialization will not be performed.</li><li>Once initialization is successfully completed (FUN 0 normal completion (“1”) in the PID management table), re-executing the FUN 0 will generate an error.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>															
Cautionary notes															
<ul style="list-style-type: none"><li>If difficulty arises when the area used by the PID operation is cleared upon operation start or recovering from a power failure, please specify the power failure memory.</li></ul>															

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-2	Name				PID operation control <sup>†</sup> (PID OPERATION CONTROL)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 1 (s) * (PIDOP (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	●									
Command format		Number of steps					83	140	197	429	131	216			
FUN 1 (s) * (PIDOP (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	PID control table							○						WR only	
Function															
<div><ul style="list-style-type: none"><li>The FUN 1 (s) determines the loop in which the operation is performed after reading the PID Execution flag from the bit table area of the loop and the PID Constant Change flag.</li><li>Set (s) in the FUN 1 (s) as the head number of the PID control table. If set differently, an error will be generated and an error code will be set to error codes 0 and 1 of the PID control table, resulting in the FUN 1 not being executed.</li><li>Program the FUN 1 (s) so that it is executed once during the 20 ms periodic scanning.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-3	Name		PID calculation process <sup>†</sup> (PID CALCULATION)											
Ladder format		Condition code						Processing time (μs)						Remark	
FUN 2 (s) * (PIDCL (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	●									
Command format		Number of steps						87	←	183	←	183	←		
FUN 2 (s) * (PIDCL (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Word table							○						WR only	
Function															
<div><ul style="list-style-type: none"><li>The sampling time set in the word table for each loop determines whether or not PID calculation is performed.</li><li>The FUN 2 (s) turns ON the PID Calculation In Progress flag of the loop that is being calculated.</li><li>Set all of the head number of WR of the word table for each PID loop of the FUN 2 (s).</li><li>The FUN 2 (s) will check for the output upper limit and low limit values, set value bit pattern, and range of the output value bit pattern for each loop. If an error is generated, the FUN 2 Error flag of the loop bit table will turn ON and an error code is set to error code 2 of the PID control table. The FUN 2 will be executed even if an error is generated.</li><li>Program the FUN 2 (s) so that it is executed during the 20 ms periodic scanning.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															

<sup>†</sup>: The EH-CPU104/208 are not supported.

## (1) PID control table (In the case of FUN 0 (WRxxxx))

## (a) Structure of PID management table (1)

Sets the header number of the WR used as the PID control table in s of FUN 0 (s). The PID control table is comprised of 2], 3], 4] and 5], and the size of the table increases by the number of loops 3]. Make sure that the maximum number of the WR is not exceeded. Otherwise, error code H0004 will be written in error code 0 2].

Address	Contents	Details	Remarks
xxxx	Error code 0 *1 (Read)	<ul style="list-style-type: none"> <li>Sets the error code generated by FUN 0 processing or some part of FUN 1 processing.</li> <li>If no error is present, the prior status is maintained.</li> </ul>	2]
xxxx + 1	Error code 1 *1 (Read)	<ul style="list-style-type: none"> <li>Sets the error code generated by FUN 1 processing.</li> <li>If no error is present, the prior status is maintained.</li> </ul>	
xxxx + 2	Error code 2 *1 (Read)	<ul style="list-style-type: none"> <li>Sets the error code generated by FUN 2 processing.</li> <li>If no error is present, the prior status is maintained.</li> </ul>	
xxxx + 3	FUN 0 Normal completion 1 (Read)	<ul style="list-style-type: none"> <li>Sets H0001 when FUN 0 (PID initialization) is executed normally.</li> <li>If an error is generated, the value will be H0000, and an error code will be set in error code 0.</li> </ul>	5]
xxxx + 4	Number of loops (Write) *2	<ul style="list-style-type: none"> <li>Sets the number of loops used in a range between 1 and 64.</li> <li>If the value is 0, H0002 is written in error code 0, and the PID will not be processed. (Even if the FUN 1 and FUN 2 are programmed, PID will not be processed.)</li> </ul>	3]
xxxx + 5	Head address of the WR of the word table for loop 1 (Write) *2	<ul style="list-style-type: none"> <li>48 words are used per loop for PID constant input and for PID internal calculations.</li> <li>If the maximum WR number is exceeded, error code XX05 will be written in error code 0.</li> </ul>	4]
xxxx + 6	Head address of the WR of the word table for loop 2 (Write) *2	<ul style="list-style-type: none"> <li>48 words are used per loop for PID constant input and for PID internal calculations.</li> <li>If the maximum WR number is exceeded, error code XX05 will be written in error code 0.</li> </ul>	
xxxx + 7	Head address of the WR of the word table for loop 3 (Write) *2	<ul style="list-style-type: none"> <li>48 words are used per loop for PID constant input and for PID internal calculations.</li> <li>If the maximum WR number is exceeded, error code XX05 will be written in error code 0.</li> </ul>	
• • •	• • •	• • •	
xxxx + 44	Head address of the WR of the word table for loop 64 (Write)*2	<ul style="list-style-type: none"> <li>48 words are used per loop for PID constant input and for PID internal calculations.</li> <li>If the maximum WR number is exceeded, error code XX05 will be written in error code 0.</li> </ul>	

\*1 Error codes are expressed as a four-digit hexadecimal value. For more information, see the Error Code Details.

\*2 The (Write) in the above table indicates the areas where the user enters data using a program. (It is also possible to read data.)

FUN 0 (s)  
FUN 1 (s)  
FUN 2 (s)

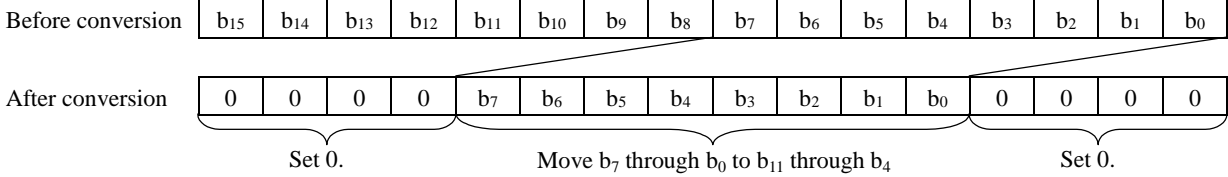
(b) Word table and bit table for each loop

(If the content of xxxx+5 in (a) is ADRIO (xxxx+5, yyyy))

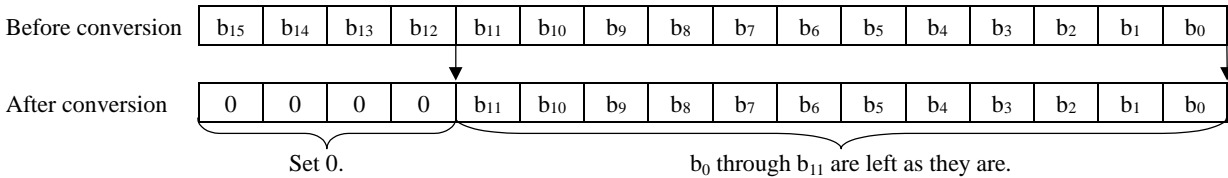
Address	Contents	Specifications	Notes	Remarks
yyyy	ADRIO (yyyy, zzzz) zzzz is the header number of the bit internal output.	Sets the header address of the bit table.	Uses 16 bits per loop. Set the actual address of the header number using the ADRIO command so the last suffix of the bit internal output is not exceeded.	11]
yyyy + 1	Sampling time TZ	When 1 to 200 ( $\times 20$ ms) analog I/O is installed in a basic base or extended base.	<ul style="list-style-type: none"> <li>Set a multiple of the minimum set value.</li> <li>The minimum set value is the value set to the number of loops 3].</li> </ul>	12]
yyyy + 2	Proportional gain KP	- 1,000 to +1,000	Corresponds to -10.00 to +10.00.	13]
yyyy + 3	Integral content Ti/TZ	1 to 32,767	Value is set to Ti/(Sampling time $\times$ 20 ms)	14]
yyyy + 4	Derivative constant TD/TZ	1 to 32,767	Value is set to Ti/(Sampling time $\times$ 20 ms)	15]
yyyy + 5	Derivative delay constant Tn/TZ	1 to 32,767	Value is set to Ti/(Sampling time $\times$ 20 ms)	16]
yyyy + 6	Output upper limit value UL	- 32,767 to 32,767	The following condition must be met. $LL \leq \text{INIT} \leq \text{UL}$	17]
yyyy + 7	Output low limit value LL	- 32,767 to 32,767		18]
yyyy + 8	Initial value INIT	- 32,767 to 32,767		19]
yyyy + 9	Set value I/O number (Write)	Set the actual address of the word number of the I/O for which the set value is set.		20]
yyyy + A	Measured Value I/O number (Write)	Set the actual address of the word number of the I/O for which the measured value is set.		21]
yyyy + B	Output value I/O Number (Write)	Set the actual address of the word number of the I/O that outputs the PID calculation results.		22]
yyyy + C	Set value bit pattern (Write)	Determine the method that is used to convert the set value to the 16-bit data in which the PID operation is performed. See *1 below and use a value between H0001 and H0004.		23]
yyyy + D	Measured value bit pattern (Write)	Determine the method that is used to convert the data read from the measured value I/O number 21] to the 16-bit data. (See the set value bit pattern 23].)		24]
yyyy + E	Output value bit pattern (Write)	<ul style="list-style-type: none"> <li>Write to the output value I/O number 22] after converting the results of the FUN 2 process or PID calculation according to the output value bit pattern 25].</li> <li>Use a value between H0001 and H0004 in *2 depending on the type of output I/O.</li> </ul>		25]
yyyy + F ↓ yyyy + 2F	PID calculation area (Cannot be used by the user)	Do not use this in user programs because this is used by FUN 0, FUN 1, and FUN 2 processing.		26]

\*1:

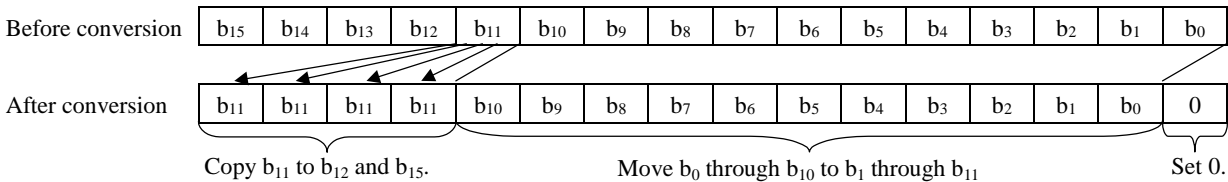
H0001: 8-bit → 16-bit



H0002: 12-bit unsigned → 16-bit



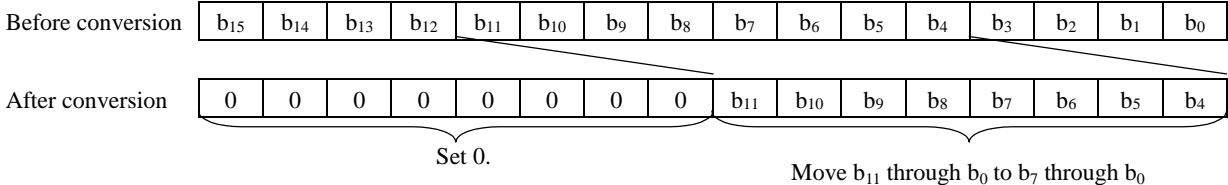
H0003: 12-bit signed → expand the sign to 16-bit



H0004: Do not convert

\*2 :

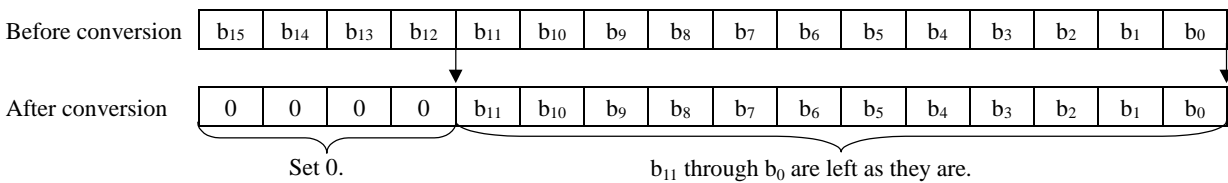
H0001: 16-bit → 8-bit



If values are H0FFF through H7FFF before conversion, the values are converted to H00FF.

If values are H8000 through HFFFF before conversion, the values are converted to H0000.

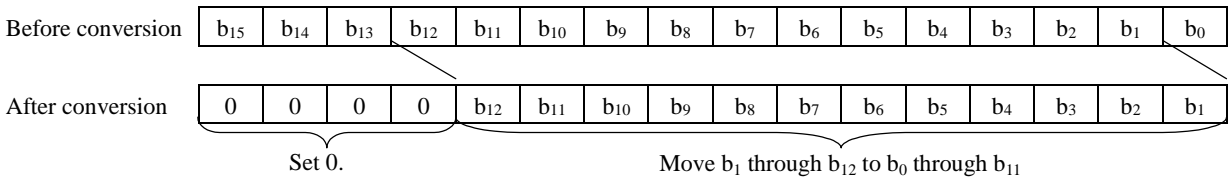
H0002: 16-bit → 12-bit



If values are H0FFF through H7FFF before conversion, the values are converted to H00FF.

If values are H8000 through HFFFF before conversion, the values are converted to H0000.

H0003: 16-bit signed → 12-bit signed



If values are H0FFF through H7FFF before conversion, the values are converted to H07FF.

If values are H8000 through HF000 before conversion, the values are converted to H0800.

H0004: Do not convert

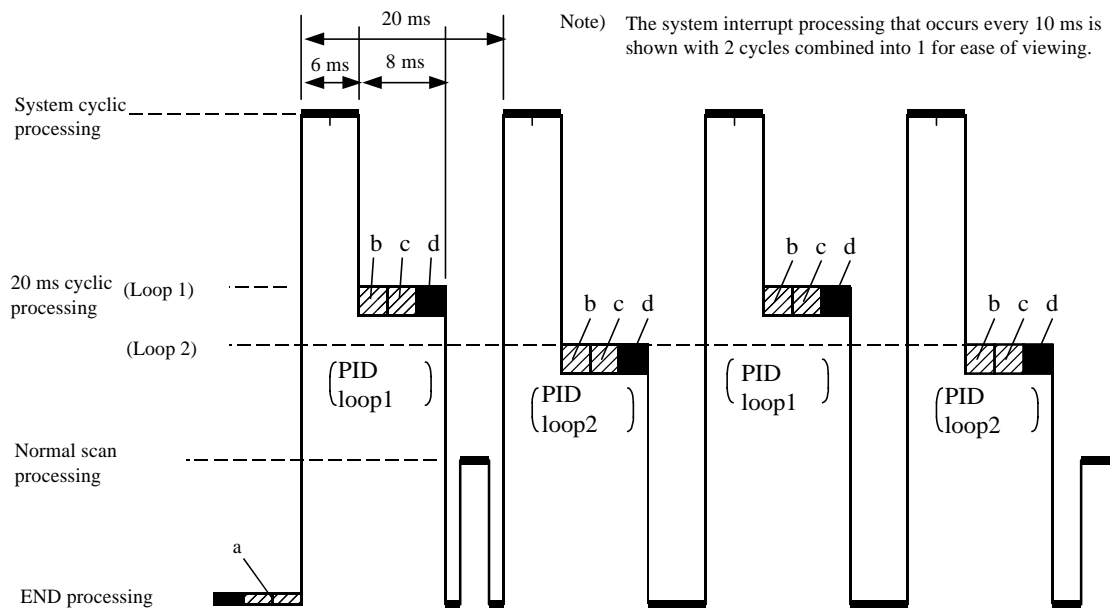
(c) Details of word tables used for each loop

Address	PID management table	Details	Remarks
zzzz	Execution flag (Write)	<ul style="list-style-type: none"> <li>When the Execution flag starts up (0 → 1), the PID constant at that time is checked and the PID calculation value is initialized. If successful, the PID RUN flag 58] is set to "1." If there is an error, the PID RUN flag 58] is set to "0" and PID calculation will not be performed.</li> <li>PID calculation is performed while the Execution flag = 1.</li> <li>When the Execution flag = 0, the PID calculation will end and the output will become "0."</li> </ul>	50]
zzzz + 1	Non-bumpless flag (Write)	0 : Perform Bumpless processing 1 : Perform non-bumpless processing	51]
zzzz + 2	PID constant change flag (Write)	<ul style="list-style-type: none"> <li>When the PID Constant Change flag is turned from OFF → ON, the PID constant that is used for the PID calculation is read again, and this value is used to perform calculations.</li> <li>After the PID constant change is complete, this flag must be turned OFF by the user.</li> <li>If there is an error in the PID constant (PID Constant OK = 0), the PID calculation value based on the previous PID constant will be used and the operation will continue.</li> </ul>	52]
zzzz + 3	S flag (Write)	When the S flag is set to "1", it reverts the output value to its initial value. It performs the following output depending on the relationship between Output Upper Limit Value 17], Output Lower Limit Value 18], and Initial Values 19]. Output Lower Limit Value 18] > Output Upper Limit Value 17] ....No output Output Lower Limit Value 18] ≤ Initial Value 19] ≤ Output Upper Limit Value 17] ..Outputs Initial Values 19] Output Lower Limit Value 18] ≤ Output Upper Limit Value 17] ≤ Initial Values 19] ... ≤ Outputs Output Upper Limit Value 17] Initial Values 19] ≤ Output Lower Limit Value 18] ≤ Output Upper Limit Value 17] ... Outputs Output Lower Limit Value 18] The S flag takes priority over the R Flag.	53]
zzzz + 4	R flag (Write)	When the R flag is set to "1", it clears the output value to 0.	54]
zzzz + 5	D-FREI flag (Write)	"0": Calculate PID without performing integrals or derivatives. "1": Calculate PID using integrals or derivatives.	55]
zzzz + 6	Unused		
zzzz + 7	Unused		
zzzz + 8	PID RUN flag (Read)	<ul style="list-style-type: none"> <li>When the FUN 1 detects the startup of the Execution flag 50], 12] through 16] and 20] through 22] will be checked for logical validity and the result will be set to the PID RUN flag 58].</li> <li>1 : Valid 0 : Invalid</li> <li>If the Execution flag 50] startup is detected by the FUN 1 when the PID RUN flag 58] = 1, PID RUN 58] becomes 0 and the PID process will end.</li> </ul>	58]
zzzz + 9	PID calculation in progress flag (Read)	<ul style="list-style-type: none"> <li>Sets the PID Calculation in Progress flag 59] in the loop in which the FUN 2 calculates the PID to "1," and sets all PID Calculation in Progress flags in other loops to "0."</li> </ul>	59]
zzzz + A	PID constant OK flag (Read)	<ul style="list-style-type: none"> <li>When the FUN 1 detects the startup of the PID Constant Change flag 52], the PID constants 12] through 16] will be checked for logical validity and the result will be set in the PID Constant OK Flag 60].</li> </ul>	60]
zzzz + B	Upper limit over flag (Read)	<ul style="list-style-type: none"> <li>If the PID output value calculated by the FUN 2 is greater than the output upper limit UL 17], the Upper Limit Over flag 61] will be set to "1."</li> </ul>	61]
zzzz + C	Lower limit over flag (Read)	<ul style="list-style-type: none"> <li>If the PID output value calculated by the FUN 2 is greater than the output lower limit LL 18], the Lower Limit Over flag 62] will be set to "1."</li> </ul>	62]
zzzz + D	FUN 2 error flag (Read)	When there is an error in the output upper limit value 17], output lower limit value 18], or in any of the bit patterns 23] through 25] during FUN 2 processing, the FUN 2 Error 63] will be set to "1." The cause of the error is set in error code 2 2]. PID calculation will still be executed even if an error is generated. If there is no error, the FUN 2 Error flag 63] = 0. Nothing will be set to error code 2 2].	63]
zzzz + E	Unused		
zzzz + F	Unused		



(2) PID operation execution format

(Example 1) Using two loops with both loops set as  $TZ = 2 (\times 20 \text{ ms})$



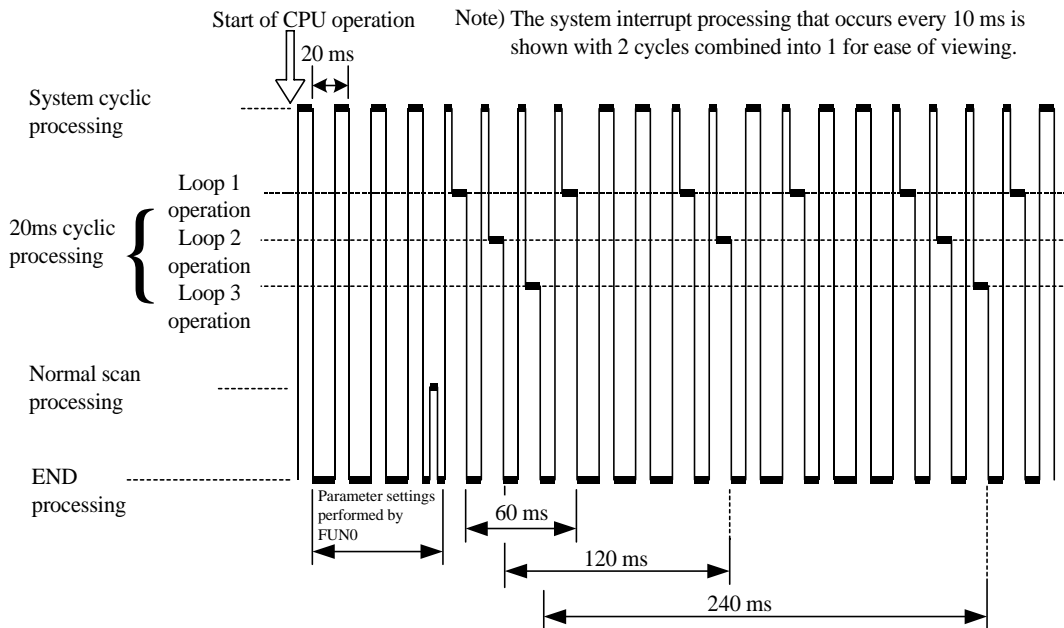
PID Operation Execution Control (2 loops)

(Example 2) Using three loops set as follows:

Loop1:  $TZ = 3 (\times 20 \text{ ms})$

Loop2:  $TZ = 6 (\times 20 \text{ ms})$

Loop3:  $TZ = 12 (\times 20 \text{ ms})$

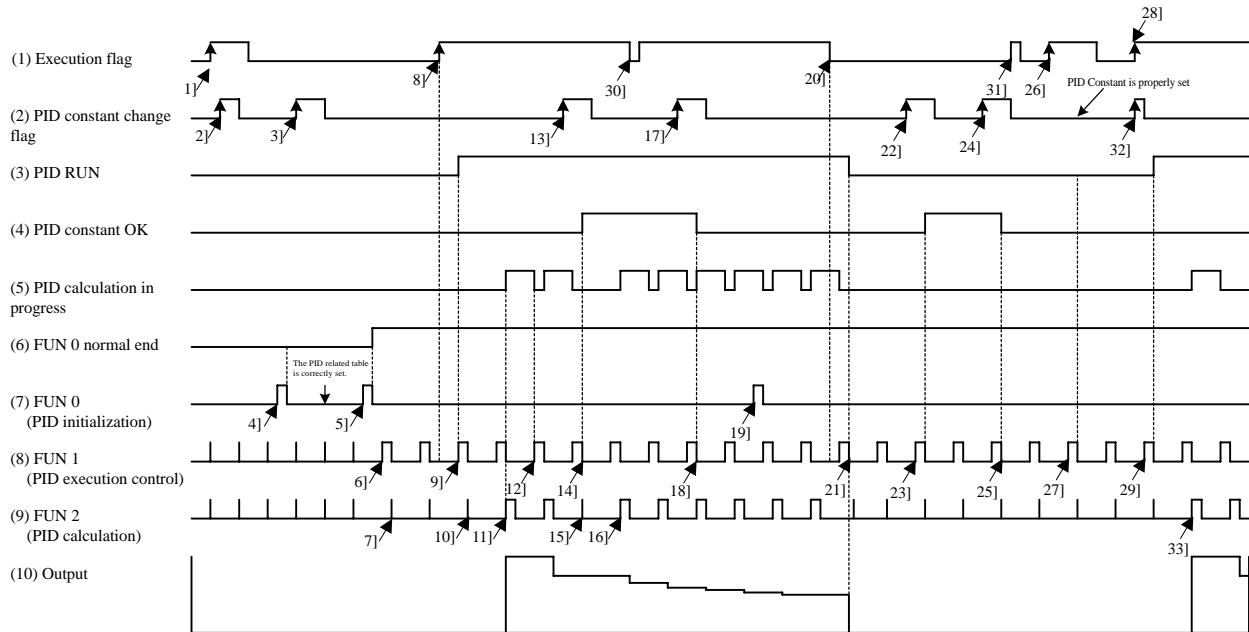


PID Operation Execution Control (3 loops)

## (3) PID operation timing chart

## (a) Timing chart example 1

The following timing chart shows the operation of the PID RUN flag, PID constant OK flag, PID calculation in progress flag, FUN 0, FUN 1, and FUN 2 when the execution flag and PID constant change flag is turned from ON to OFF in a single loop.



## Description of timing chart example 1

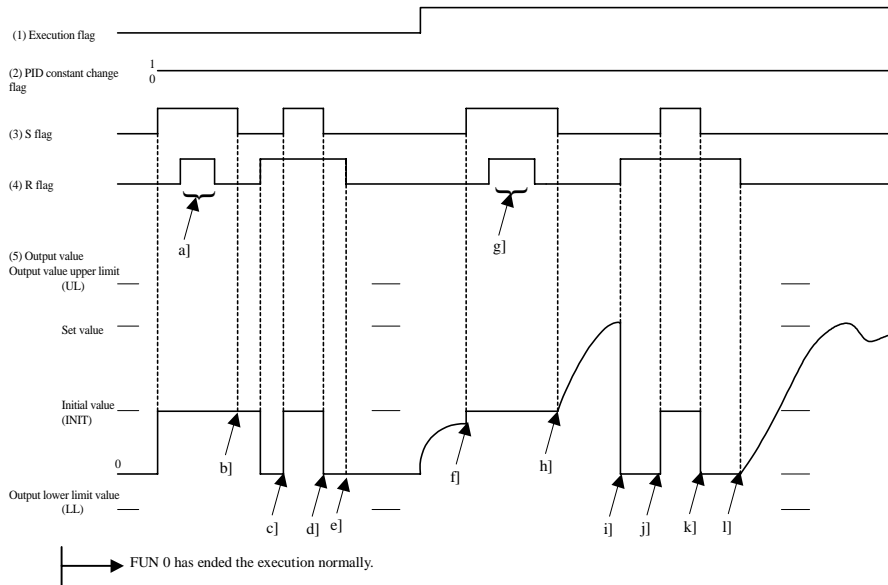
- 1] This is ignored since FUN 0 is not executed properly even when the execution flag, 2] and 3] of the PID constant change flag are turned on.
- 4] No process will be performed even if FUN 1 is executed because there was an error in the PID related table during FUN 0 processing.
- 5] 6] FUN 1 processing will be started because the FUN 0 processing ended normally. 7] FUN2 will not perform PID calculations because the execution flag is off.
- 8] 9] FUN 1 will detect turning on of the execution flag and will check the PID constant. Since it is normal, the PID constant will be calculated and the PIDRUN flag will be turned on.
- 10] The PID calculation of FUN 2 will not be performed on the first scan, so it will start with 11] FUN 2.
- 11] FUN 2 will turn the PID calculation in progress flag before calculating the PID. 12] FUN 1 will turn off the PID calculation in progress flag.
- 13] 14] FUN 1 checks the PID constant when the PID constant change flag is turned on. Since it is normal, the PID constant OK flag is turned on and the PID constant will be changed.
- 15] Since PID calculations are not performed in FUN 2, PID calculations will be performed from 16] FUN 2 according to the PID constant after it has been changed.
- 17] When the PID constant change flag was turned on, 18] FUN 1 checked the PID constant. An error was detected, so the PID constant OK flag is turned off. The PID constant flag will not be changed.
- 19] FUN 0 will be ignored when re-executed during PID operation.
- 20] Since 21] FUN 1 detected turning off of the execution flag, the PIDRUN flag will be turned off and the output will be set to 0.
- 21] Since 23] FUN 1 detected turning on of the PID constant change flag when the execution flag was off, the PID constant will be checked. Since it is valid, the PID constant will be changed and the PID constant OK flag will be turned on.
- 24] Since 25] FUN 1 detected turning on of the PID constant change flag when the execution flag was off, the PID constant will be checked. Since there was an error, the PID constant OK flag will be turned OFF.
- 26] 27] FUN 1 will detect turning on of the execution flag and check the PID constant. Since an error was detected, the PIDRUN flag will be turned off.
- 28] Since 29] FUN 1 detected turning on of both the execution flag and the 32] PID constant change flag simultaneously, turning on of the 32] PID constant change flag will be ignored. 29] FUN 1 checks the PID constant, and since it is normal, the PIDRUN flag will be turned on. PID calculation will be started from 33] FUN 2.
- 30] 31] If the execution flag turns from on to off in a timing such that the cyclic interrupt cannot detect it, it will be ignored.

(b) Timing chart example 2

The following is an operation timing chart in respect to the S flag and R flag (bumpless).

S flag....Sets the output value to the initial value.

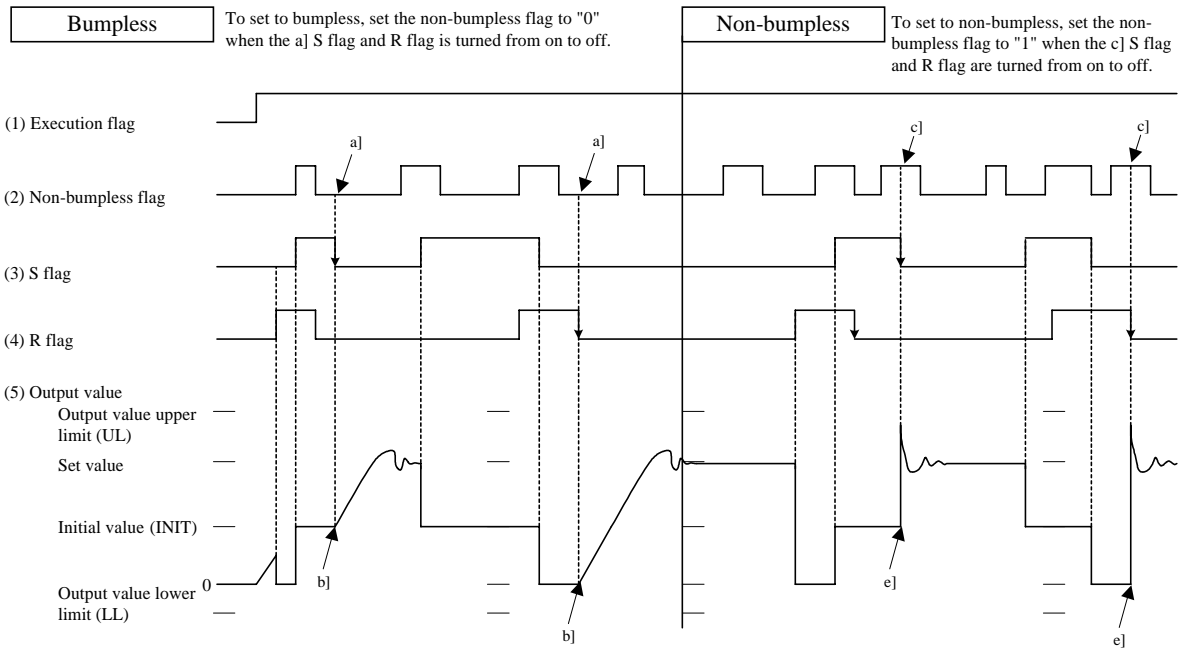
R flag....Sets the output value to 0.



- a) g] The output value is still INIT because the S flag takes priority.
- b) e] The output value is retained since the execution flag is off.
- c) j] The output value is set to INIT because the S flag takes priority.
- d) k] The output value will be 0 since the R flag is on when the S flag turns off.
- f] The output value will be INTT.
- h) l] The output value will continuously move toward the target value since the execution flag is on and bumpless.
- i] The output value will be 0.

(c) Timing chart example 3

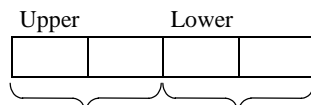
## Bumpless and non-bumpless



- |  |  |
|--|--|
| b) When the S flag and R flag turn from on to off, the output value will continuously change to move toward the set value. | e) When the S flag and R flag turn from on to off, the output value will abruptly change to move toward the set value. |
|--|--|

## (4) PID command error code details

- Error codes are shown using a 4-digit hexadecimal value.



Shows the loop number.

In the case of H00, it is an error that has no relation to loop numbers.

In the case of H01 through H04, there is an error in the loop shown in the loop number.

## (a) Error code 0

The error codes generated in FUN 0 processing and some parts of FUN 1 processing are set in error code 0.

If there is no error, the previous status will be maintained.

Error code	Contents and cause	Corrective action	Remarks
0001	The FUN 0 was executed again after the FUN 0 had been successfully completed.	Do not execute the FUN 0 after it has been executed successfully.	"FUN 0 normal completion 5]" maintains the previous value.
0002	The number of loops 3] is 0.	Set the number of loops 3] to a value between the range of 1 to 64.	
0003	The number of loops 3] exceeds 65.	Set the number of loops 3] to a value between the range of 1 to 64.	
0004	The PID control table exceeds the maximum number of WR.	Change the head of PID management table or the number of loops 3] so that the maximum number of WR is not exceeded.	The size of the PID management table will change. If the number of loops 3] exceeds the suffix of the I/O, "FUN 0 normal completion 5]" will maintain the previous value.
××05	The word table of loop ×× exceeds the maximum number of WR.	Set the number in the WR for the loop 4] again.	The size of the bit table is 16 bits per loop.
××06	The bit table of loop ×× exceeds the maximum number of R.	Set the bit number for R 11] again.	The size of the bit table is 16 bits per loop.
××07	The output upper limit value 17] in loop ×× is outside of range.	Set the output upper limit value 17] to a value between -32,767 and 32,767.	
××08	The output lower limit value 18] in loop ×× is outside of range.	Set the output lower limit value 18] to a value between -32,767 and 32,767.	
××09	The initial value 19] in loop ×× is outside of range.	Set the initial value 19] to a value between -32,767 and 32,767.	
××0A	There is an error in the size relationship between the output upper limit value 17], output lower limit value 18], and initial value 19].	Perform settings so that the output lower limit value 18] ( initial value 19] ( output upper limit value 17] is met.	
××0B	The set value bit pattern 23] in loop ×× is outside of range.	Set the set value bit pattern 23] to a value between 1 and 4.	
××0C	The measured value bit pattern 24] in loop ×× is outside of range.	Set the measured value bit pattern 24] to a value between 1 and 4.	
××0D	The output value bit pattern 25] in loop ×× is outside of range.	Set the output value bit pattern 25] to a value between 1 and 4.	
0020 (Note)	The FUN 1 is being executed when the FUN 0 is not successfully completed.	Do not run the FUN 1 until the FUN 0 is successfully executed.	Set to the error code 0 specified by the (S) in the FUN 1 (S).
0021 (Note)	The S in the FUN 1 (S) is different from the S in the FUN 0 (S) of the PID management table.	Set the same WR for the S in the FUN 1(S) and the S in the FUN 0 (S).	Set to the error code 0 specified by the (S) in the FUN 1 (S).

(Note) Error codes 0020 and 0021 will over-write the errors generated previously (0001 to XX0D). Therefore, execute the FUN 1 after verifying that the FUN 0 is successfully executed.

## (b) Error code 1

The error code generated in the FUN 1 process is set in error code 1. If there is no error, the previous condition is maintained.

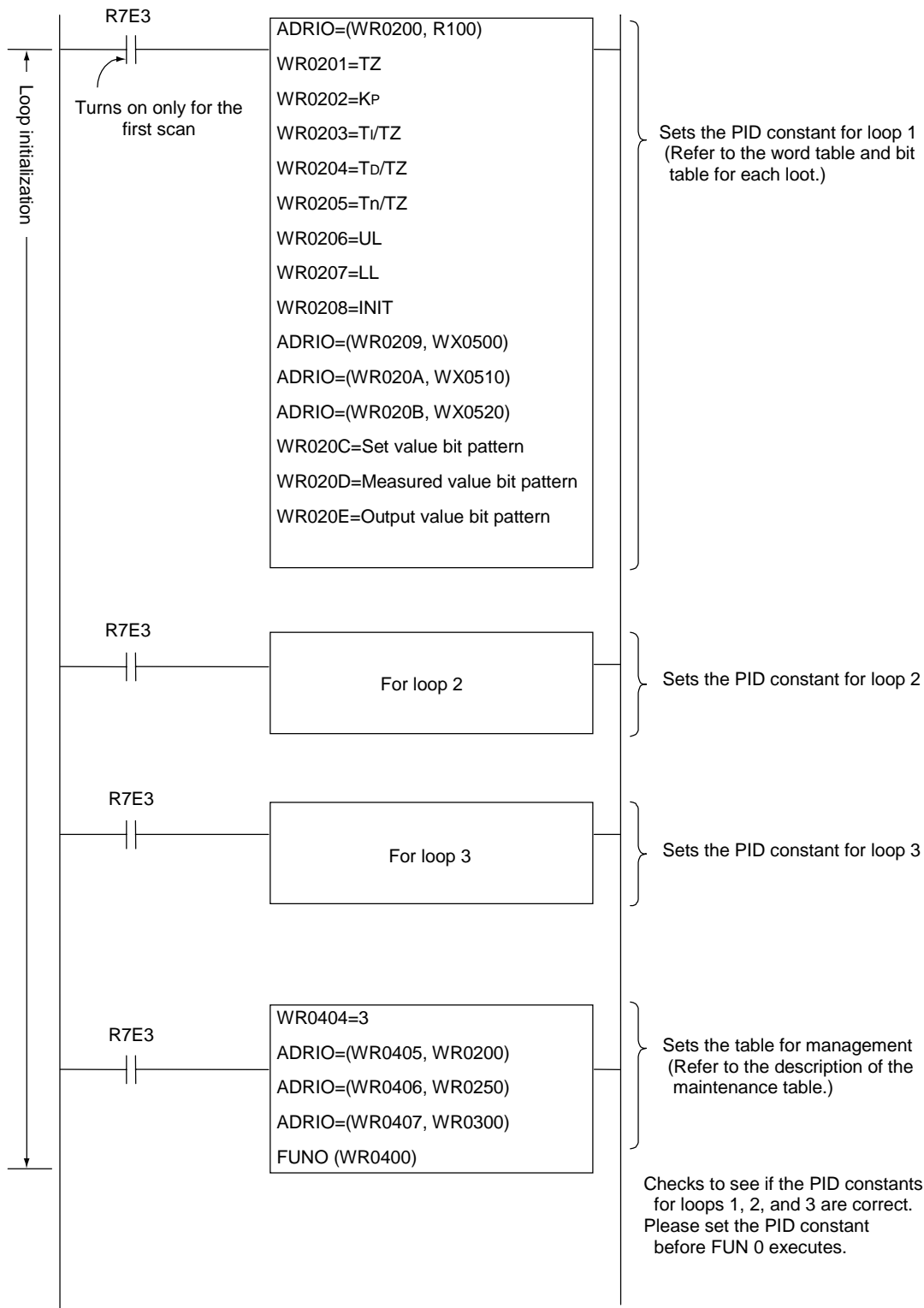
Error code	Contents and cause	Corrective action	Remarks
0020	The FUN 1 is being executed when the FUN 0 is not successfully completed.	Do not run the FUN 1 until the FUN 0 is successfully executed.	Set to the error code 0 specified by the (S) in the FUN 1 (S).
0021	The S in the FUN 1 (S) is different from the S in the FUN 0 (S) of the PID management table 1].	Set the same WR number for the S in the FUN 1(S) and the S in the FUN 0 (S).	Set to the error code 0 specified by the (S) in the FUN 1 (S).
xx22	There is an error in the set value I/O number 20] in loop xx.	Set the set value I/O number 20] using the ADRIO command.	These are errors that may be generated when the Execution flag starts up.
xx23	There is an error in the measured value I/O number 21] in loop xx.	Set the measured value I/O number 21] using the ADRIO command.	
xx24	There is an error in the output value I/O number 22] in loop xx.	Set the output value I/O number 22] using the ADRIO command.	
xx25	The sampling time 12] of loop xx is out of range.	Set the sampling time 12] to a value within the range of 1 to 200.	These are errors that may be generated when the Execution flag starts up or when the PID Constant Change flag starts up.
xx26	The sampling time 12] of loop xx is not a multiple of the number of loops 3].	Set the sampling time 12] so that it becomes a multiple of the number of loops 3].	
xx27	The proportional gain 13] of loop xx is out of range.	Set the proportional gain 13] to a value within the range of -1,000 to 1,000.	
xx28	The integral constant 14] of loop xx is out of range.	Set the integral constant 14] to a value within the range of 1 to 32,767.	
xx29	The derivative constant 15] of loop xx is out of range.	Set the derivative constant 15] to a value within the range of 1 to 32,767.	
xx2A	The derivative delay constant 16] of loop xx is out of range.	Set the derivative delay constant 16] to a value within the range of 1 to 32,767.	
xx30	There is an error in the size relationship between the output lower limit value 18] and output upper limit value 17] in loop xx.	Set the values so that the output lower limit value 18] $\leq$ output upper limit value 17] is satisfied.	There is a possibility that this error is generated when the S flag 53] is turned ON while the PID RUN flag 58] is OFF.
xx31	There is an error in the output value I/O number 22] in loop xx.	Set the output value I/O number 22] using the ADRIO command.	There is a possibility that these errors are generated when the S flag 53] or R flag 54] is turned on while the PID RUN flag 58] is OFF.
xx32	The output value bit pattern 25] in loop xx is outside of range.	Set the output value bit pattern 25] to a value between 1 and 4.	

## (c) Error code 2

Error code	Contents and cause	Corrective action	Remarks
0040			
xx41	The set value bit pattern 23] in loop xx is outside of range.	Set the set value bit pattern 23] to a value between 1 and 4.	When the bit pattern is outside of range, the process will continue based on "4. Do not convert."
xx42	The measured value bit pattern 24] in loop xx is outside of range.	Set the set value bit pattern 24] to a value between 1 and 4.	
xx43	The output value bit pattern 25] in loop xx is outside of range.	Set the output value bit pattern 25] to a value between 1 and 4.	
xx44	There is an error in the size relationship between the output lower limit value 18] and output upper limit value 17] in loop xx.	Set the values so that the output lower limit value 18] $\leq$ output upper limit value 17] is satisfied.	If there is a size relationship error, the process will continue but there will be no output.

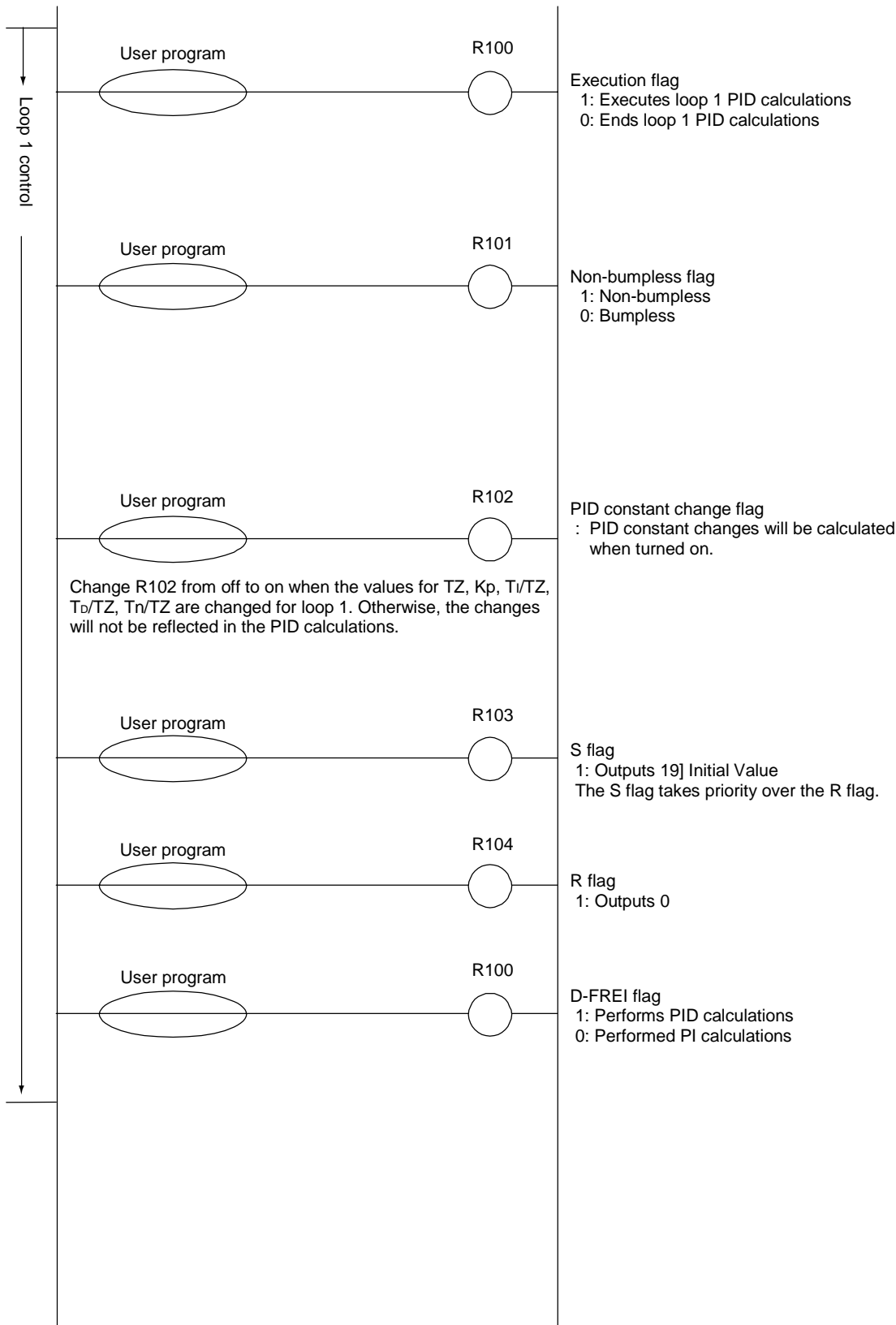
Program example

This program is an example comprised of three loops. This program also rewrites the PID constant every time the CPU starts a RUN process.



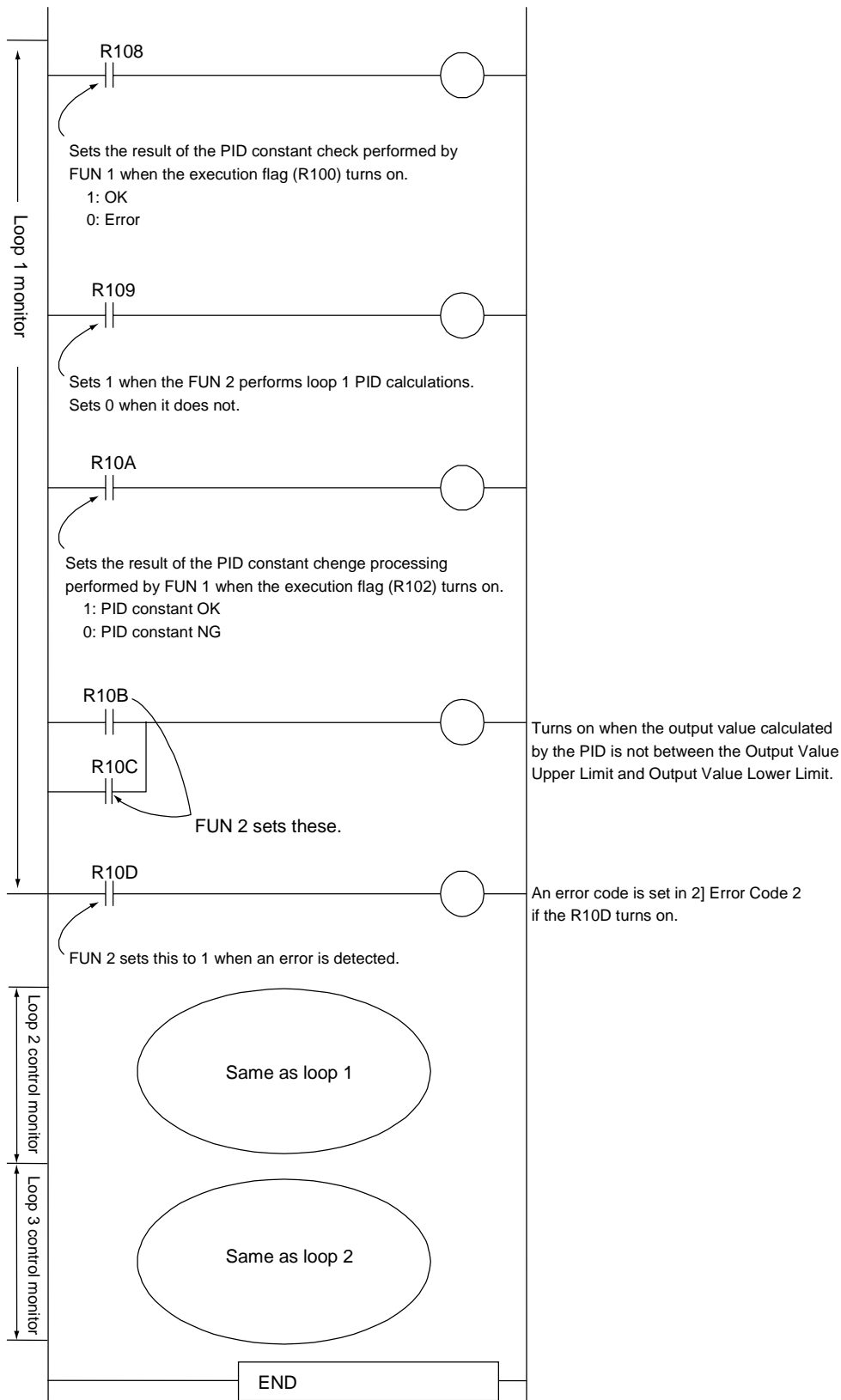
FUN 0 (\$)  
FUN 1 (\$)  
FUN 2 (\$)

Program example



FUN0(S)  
FUN1(S)  
FUN2(S)

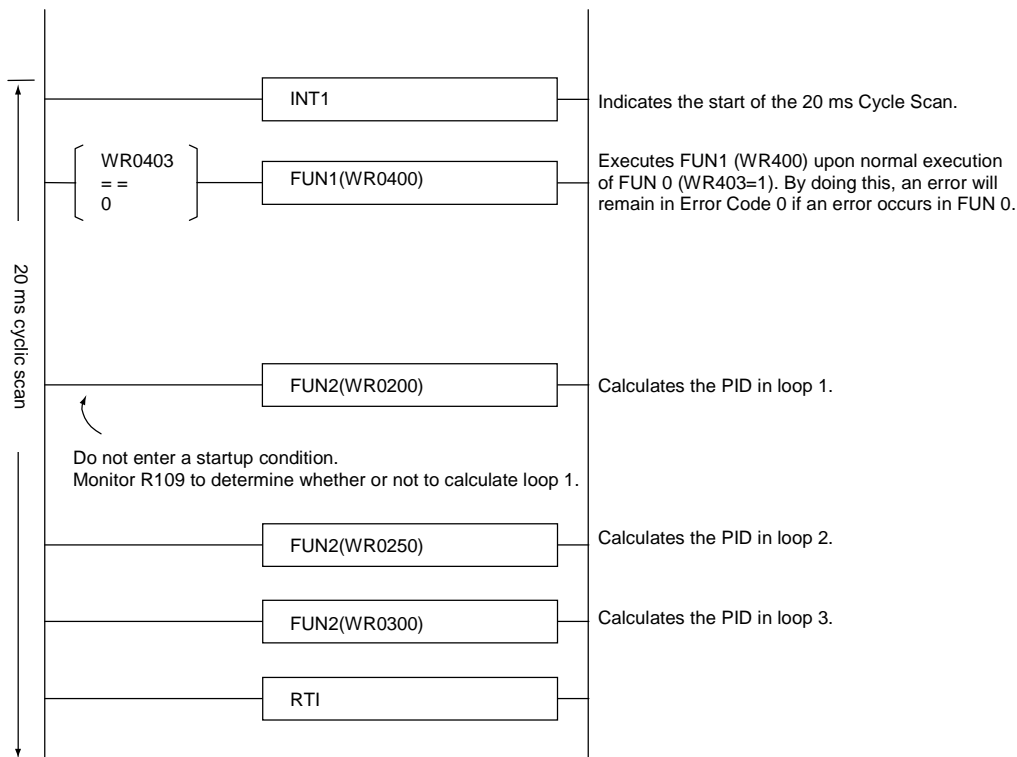
Program example



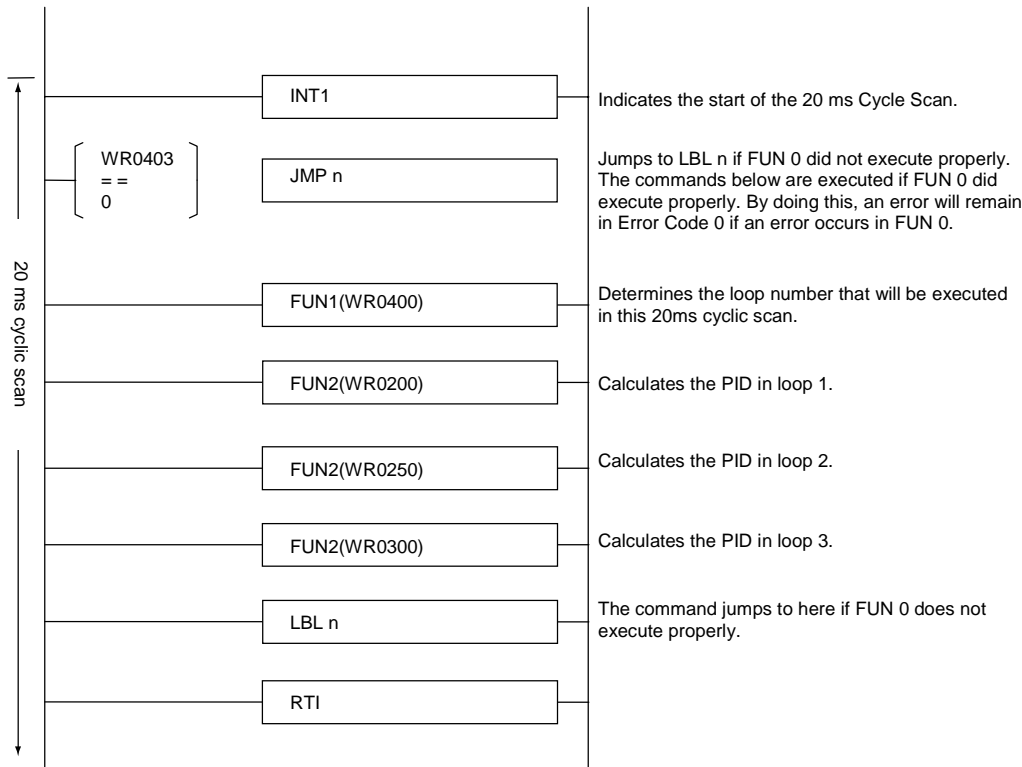
FUN 0 (S)  
FUN 1 (S)  
FUN 2 (S)



Program example



The program on this page can also be as shown below.

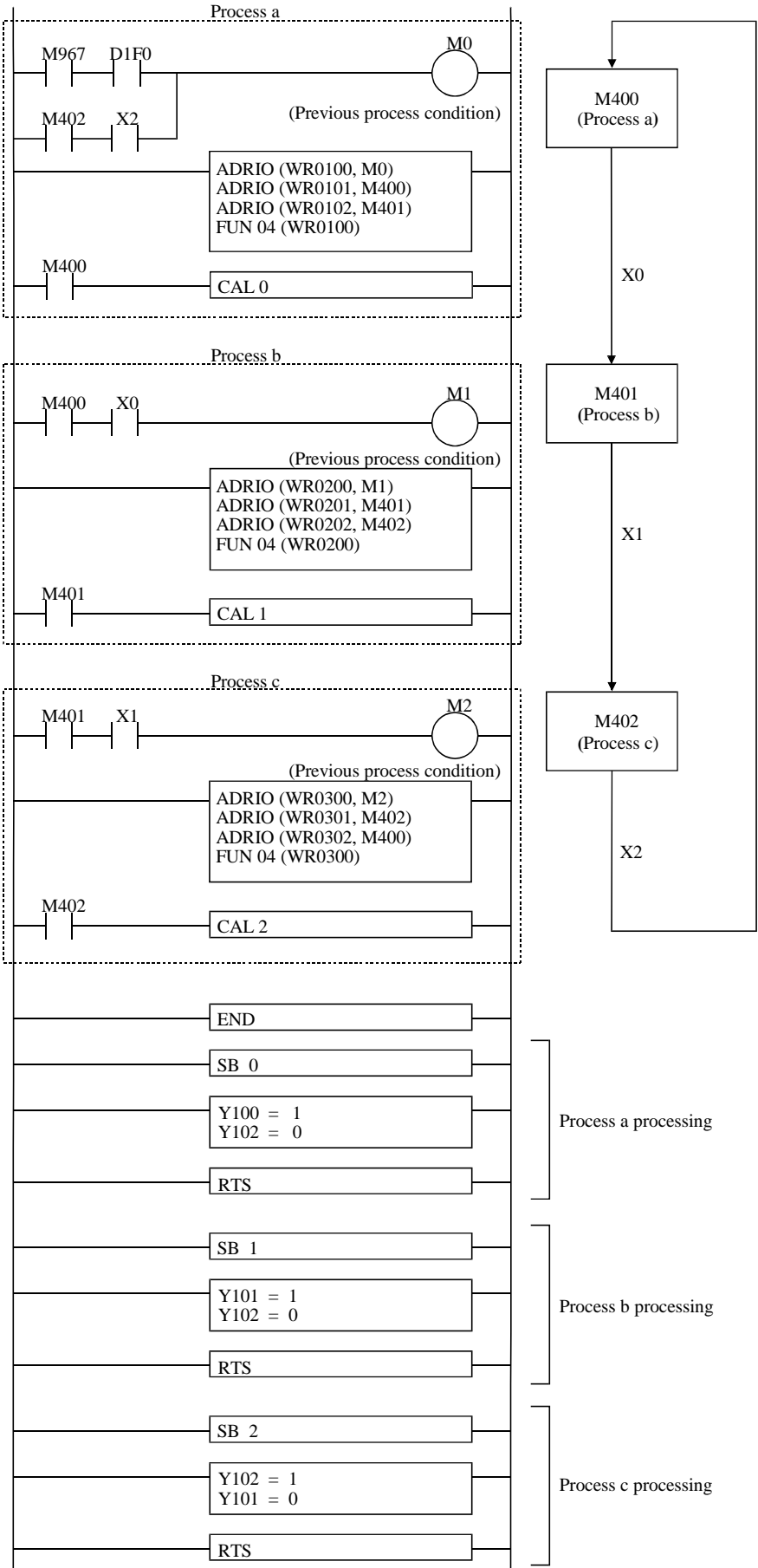


\* Please take note that INT2 is used for the EH-CPU448.

Item number	Fun commands-4	Name				Process stepping												
Ladder format		Condition code					Processing time (μs)						Remark					
FUN 4 (s) * (IFR (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
		↑	●	●	●	●												
Command format		Number of steps					208		←		370		←		398		←	
FUN 4 (s) * (IFR (s) )		Condition			Steps													
		—			3													
Usable I/O		Bit				Word				Double word			Constant	Other				
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
s	Argument							○						s uses up to s+3.				
														s+3 is used by the system.				
Function																		
s	Previous process condition I/O number																	
s+1	Process set I/O number																	
s+2	Next process (clear condition) I/O number																	
s+3	Used by the system																	
<ul style="list-style-type: none"><li>When the I/O designated by s (previous process) switches on, the s+1 (process set) switches on and the state is retained. (The previous process condition is triggered by edge.)</li><li>When the I/O designated by s+2 (next process) switches on, the s+1 (process set) is switched off. (The next process is triggered by level.)</li><li>When s (previous process) and s+2 (next process) are both on, the s+2 (next process) has the priority.</li><li>The user should designate output for each process, if necessary.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																		

FUN 4 (s)

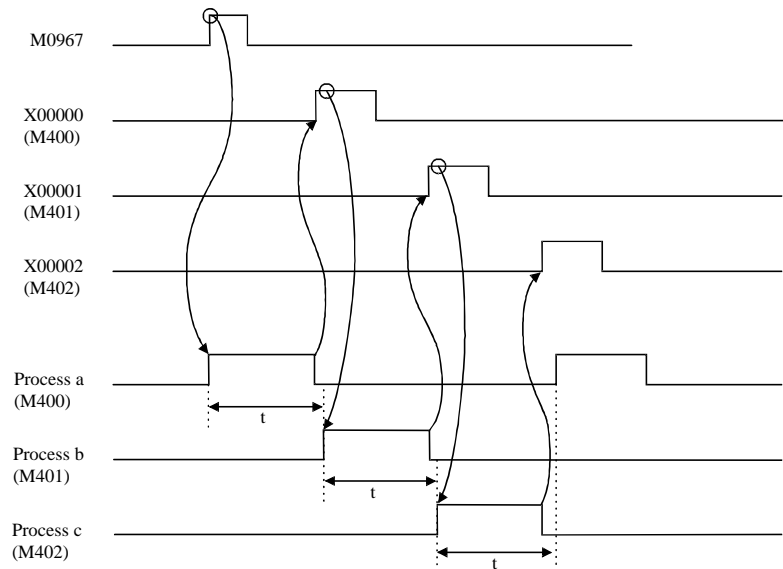
Program example



FUN 4 (s)

Cautionary notes

- Set the actual R, L and M address for the parameters s through s+2 using the ADRIO command.
- If the areas designated by s to s+2 overlap, if s+1, s+2 or s+3 falls out of range, DER will be equal to “1” and the command will not be processed.
- Do not designate the same I/O for arguments of different processes, since the action of the current process is levelled by the previous process.
- Each process requires at least one scan time.



t: One scan time is necessary

- In the program example described previously, the external I/O (X, Y) are used as switch signals of a process; thus, the time for performing I/O refresh (i.e., at least one scan period) is required for each process.

Item number		Fun commands-5		Name		SIN function (SIN FUNCTION)															
Ladder format				Condition code						Processing time (μs)						Remark					
FUN 10 (s) * (SIN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				↕	●	●	●	●													
Command format				Number of steps						39		←		87		←		105		←	
FUN 10 (s) * (SIN (s) )				Condition			Steps														
				—			3														
Usable I/O			Bit				Word				Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM								
s	Argument								○							s uses up to s+2.					
Function																					
<div><div><div><div>s+2</div><div>150150</div><div>Integer portion</div></div><div><div>s+1</div><div>0</div><div>Fractional portion</div></div></div><div>← SIN</div><div><div>s</div><div>150</div><div>0 to 360°</div></div></div> <div><ul style="list-style-type: none"><li>Calculates the SIN value using the unsigned binary value designated using s as the argument, and sets the integer and fractional portions of the result in s+2 and s+1, respectively.</li><li>The SIN value is indicated in a binary value, and negative values are indicated in two’s complements.</li><li>If the calculation is performed normally, DER is equal to “0.”</li><li>The fractional data is the value obtained by multiplying the actual value by 65,535.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>																					
Cautionary notes																					
<div><ul style="list-style-type: none"><li>The argument is given in degrees in the range <math>0 \leq s \leq 360</math>. Any other value will equal DER to “1” and the operation will not be performed.</li><li>If s+1 and s+2 exceed the maximum value for the I/O number, DER is equal to “1” and the operation will not be performed.</li></ul></div>																					
Program example																					
<div><div><div><div>X00100 DIF0</div><div><div>WR0100 = 40</div><div>FUN 10 (WR0100)</div></div></div></div><div><div>LD X00100</div><div>AND DIF0</div><div>[</div><div>WR0100 = 40</div><div>FUN 10 (WR0100)</div><div>]</div></div></div>																					
Program description																					
<div><ul style="list-style-type: none"><li>An angle of 40° is set in WR0100.</li><li>SIN operation is performed at the leading edge of X00100, and the fractional portion of the result is set in WR0101 and the whole number portion is set in WR0102 as binary values.</li></ul><p>Execution results: WR0102=H0000, WR0101=HA48E, WR0100=H0028</p></div>																					

Item number		Fun commands-6		Name		COS function (COS FUNCTION)														
Ladder format				Condition code					Processing time (μs)					Remark						
FUN 11 (s) * (COS (s))				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				↑	●	●	●	●												
Command format				Number of steps					40		←		89		←		108		←	
FUN 11 (s) * (COS (s))				Condition			Steps													
				—			3													
Usable I/O			Bit				Word				Double word			Constant	Other					
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
s	Argument								○							s uses up to s+2.				
Function																				
<div><div><div><div>s+2</div><div>15</div><div>Integer portion</div></div><div><div>s+1</div><div>0 15</div><div>Fractional portion</div></div></div><div>← COS</div><div><div>s</div><div>15 0</div><div>0 to 360°</div></div></div> <div><div><div><div>•</div><div>Calculates the COS value using the unsigned binary value designated by s as the argument, and sets the integer and fractional portions of the result in s+2 and s+1, respectively.</div></div><div><div>•</div><div>The COS value is indicated in a binary value, and negative values are indicated in two’s complements.</div></div><div><div>•</div><div>If the calculation is performed normally, DER is equal to “0.”</div></div><div><div>•</div><div>The fractional data is the value obtained by multiplying the actual value by 65,535.</div></div></div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div>																				
Cautionary notes																				
<div><div><div><div>•</div><div>The argument is given in degrees in the range 0 ≤ s ≤ 360. Any other value will equal DER to “1” and the operation will not be performed.</div></div><div><div>•</div><div>If s+1 and s+2 exceed the maximum value for the I/O number, DER is equal to “1” and the operation will not be performed.</div></div></div></div>																				
Program example																				
<div><div><div><div><div>X00101 DIF1</div><div><div>WR0110 = 110</div><div>FUN 11 (WR0110)</div></div></div></div><div><div>LD X00101</div><div>AND DIF1</div><div>[</div><div>WR0110 = 110</div><div>FUN 11 (WR0110)</div><div>]</div></div></div></div>																				
Program description																				
<div><div><div><div>•</div><div>An angle of 110° is set in WR0110.</div></div><div><div>•</div><div>COS operation is performed at the leading edge of X00101, and the fractional portion of the result is set in WR0111 and the whole number portion is set in WR0112 as binary values.</div></div></div><div>Execution results: WR0112=HFFFF, WR0111=HA871, WR0110=H006E</div></div>																				

Item number		Fun commands-7		Name		TAN function (TAN FUNCTION)										
Ladder format				Condition code					Processing time (μs)						Remark	
FUN 12 (s) * (TAN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
				↑	●	●	●	●								
Command format				Number of steps					40	←	88	←	109	←		
FUN 12 (s) * (TAN (s) )				Condition		Steps										
				—		3										
Usable I/O			Bit				Word			Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
s	Argument								○					s uses up to s+2.		
Function																
<div><div><div><div>s+2</div><div>150150</div><div>Integer portion</div></div><div><div>s+1</div><div>0</div><div>Fractional portion</div></div><div>← TAN</div><div><div>s</div><div>150</div><div>0 to 360°</div></div></div></div>																
<div><div><div><div><div>•</div><div>Calculates the TAN value using the unsigned binary value designated by s as the argument, and sets the integer and fractional portions of the result in s+2 and s+1, respectively.</div></div><div><div>•</div><div>The TAN value is indicated in a binary value, and negative values are indicated in two’s complements.</div></div><div><div>•</div><div>If the calculation is performed normally, DER is equal to “0.”</div></div><div><div>•</div><div>The fractional data is the value obtained by multiplying the actual value by 65,535.</div></div></div><div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div></div>																
Cautionary notes																
<div><div><div><div><div>•</div><div>The argument is given in degrees in the <math>0 \leq s \leq 360</math>. When s is equal to 90 or s is equal to 270, H7FFF and HFFFF are set for s+2 and s+1, respectively. If s falls outside the range, DER is equal to “1” and the operation will not be performed.</div></div><div><div>•</div><div>If s+1 and s+2 exceed the maximum value for the I/O number, DER is equal to “1” and the operation will not be performed.</div></div></div></div></div>																
Program example																
<div><div><div><div><div><div>X00102 DIF2</div><div><div>WR0105 = 45</div><div>FUN 12 (WR0105)</div></div></div></div></div></div><div><div>LD X00102</div><div>AND DIF2</div><div>[</div><div>WR0105 = 45</div><div>FUN 12 (WR0105)</div><div>]</div></div></div>																
Program description																
<div><div><div><div><div>•</div><div>An angle of 45° is set in WR0105.</div></div><div><div>•</div><div>TAN operation is performed at the leading edge of X00102, and the fractional portion of the result is set in WR0106 and the whole number portion is set in WR0107 as binary values.</div></div></div><div>Execution results: WR0107=H0001, WR0106=H0000, WR0105=H002D</div></div></div>																

Item number		Fun commands-8		Name		ARC SIN function (ARC SIN FUNCTION)									
Ladder format				Condition code					Processing time (μs)					Remark	
FUN 13 (s) * (ASIN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
				↑	●	●	●	●							
Command format				Number of steps					62 ← 123 ← 174 ←						
FUN 13 (s) * (ASIN (s) )				Condition			Steps								
				—			3								
Usable I/O			Bit				Word			Double word			Constant	Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
s	Argument (fractional portion)								○						s uses up to s+2.
s+1	Argument (integer portion)								○						
Function															
<div><div><div>15s+20</div><div>0 to 90, 180 to 270</div></div><div>← SIN<sup>-1</sup></div><div><div>15s+10</div><div>Integer portion</div></div><div><div>15s0</div><div>Fractional portion</div></div></div> <div><ul style="list-style-type: none"><li>Calculates the SIN<sup>-1</sup> value using the unsigned binary value designated by s (fractional portion) and s+1 (integer portion) as the argument, and outputs s+2.</li><li>The SIN<sup>-1</sup> value is described in degrees in the range of 0 to 90 and 180 to 270.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The fractional data is the value obtained by multiplying the actual value by 65,535.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															
Cautionary notes															
<div><ul style="list-style-type: none"><li>When the argument   s+1.s   &gt; 1, DER is equal to “1” and operation will not be performed.</li><li>When s+1 and s+2 exceed the maximum value for the I/O number, DER is equal to “1” and operation will not be performed.</li></ul></div>															
Program example															
<div><div><div><div>X00103 DIF3</div><div><div>DR0010 = H0000A48E</div><div>FUN 13 (WR0010)</div></div></div></div><div><pre>LD   X00103 AND  DIF3 [   DR0010 = H0000A48E   FUN 13 (WR0010) ]</pre></div></div>															
Program description															
<div><ul style="list-style-type: none"><li>Set data in DR0010 (WR0010, WR0011).</li><li>SIN<sup>-1</sup> operation is performs at the leading edge of X00103, and the result is set in WR0012 as a binary value. Execution results: WR0012=H0028, WR0011=H0000, WR0010=HA48E</li></ul></div>															



Item number		Fun commands-9		Name		ARC COS function (ARC COS FUNCTION)									
Ladder format				Condition code					Processing time (μs)					Remark	
FUN 14 (s) * (ACOS (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
				↕	●	●	●	●							
Command format				Number of steps					63 ← 125 ← 177 ←						
FUN 14 (s) * (ACOS (s) )				Condition			Steps								
				—			3								
Usable I/O			Bit				Word			Double word			Constant	Other	
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
s	Argument (fractional portion)								○						s uses up to s+2.
s+1	Argument (integer portion)								○						
Function															
<div><div><div>15</div><div>s+2</div><div>0</div><div>0 to 180°</div></div><div>← COS<sup>-1</sup></div><div><div><div>15</div><div>s+1</div><div>0</div><div>Integer portion</div></div><div><div>15</div><div>s</div><div>0</div><div>Fractional portion</div></div></div></div> <div><ul style="list-style-type: none"><li>Calculates the COS<sup>-1</sup> value using the unsigned binary value designated by s (fractional portion) and s+1 (integer portion) as the argument, and outputs s+2.</li><li>The COS<sup>-1</sup> value is described in degrees in the range of 0 to 180.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The fractional data is the value obtained by multiplying the actual value by 65,535.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															
Cautionary notes															
<div><ul style="list-style-type: none"><li>When the argument   s+1.s   &gt; 1, DER is equal to “1” and operation will not be performed.</li><li>When s+1 and s+2 exceed the maximum value for the I/O number, DER is equal to “1” and operation will not be performed.</li></ul></div>															
Program example															
<div><div><div><div>X00104 DIF4</div><div>DR0024 = HFFFA871 FUN 14 (WR0024)</div></div></div><div><div>LD X00104 AND DIF4 [ DR0024 = HFFFA871 FUN 14 (WR0024) ]</div></div></div>															
Program description															
<div><ul style="list-style-type: none"><li>Set data in DR0024 (WR0024, WR0025).</li><li>COS<sup>-1</sup> operation is performs at the leading edge of X00104, and the result is set in WR0026 as a binary value. Execution results: WR0026=H006E, WR0025=HFFFF, WR0024=HA871</li></ul></div>															

Item number		Fun commands-10		Name		ARC TAN function (ARC TAN FUNCTION)									
Ladder format				Condition code					Processing time (μs)					Remark	
FUN 15 (s) * (ATAN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
				↑	●	●	●	●							
Command format				Number of steps											
FUN 15 (s) * (ATAN (s) )				Condition			Steps		41	←	91	←	194	←	
				—			3								
Usable I/O			Bit				Word				Double word			Constant	Other
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
s	Argument (fractional portion)								○						s uses up to s+2.
s+1	Argument (integer portion)								○						
Function															
<div><div><div>15</div><div>s+2</div><div>0</div><div>0 to 180°</div></div><div>← TAN<sup>-1</sup></div><div><div>15</div><div>s+1</div><div>0</div><div>Integer portion</div></div><div><div>15</div><div>s</div><div>0</div><div>Fractional portion</div></div></div> <div><ul style="list-style-type: none"><li>Calculates the TAN<sup>-1</sup> value using the unsigned binary value designated by s (fractional portion) and s+1 (integer portion) as the argument, and outputs s+2.</li><li><u>The TAN<sup>-1</sup> value is described in degrees in the range of 0 to 90 and 180 to 270.</u></li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The fractional data is the value obtained by multiplying the actual value by 65,535.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															
Cautionary notes															
<div><ul style="list-style-type: none"><li>When s+1 and s+2 exceed the maximum value for the I/O number, DER is equal to “1” and operation will not be performed.</li></ul></div>															
Program example															
<div><div><div>X00105 DIF5</div><div></div><div>DR0030 = H00010000 FUN 15 (WR0030)</div></div><div><pre>LD    X00105 AND   DIF5 [ DR0030 = H00010000 FUN 15 (WR0030) ]</pre></div></div>															
Program description															
<div><ul style="list-style-type: none"><li>Set data in DR0030 (WR0030, WR0031).</li><li>TAN<sup>-1</sup> operation is performs at the leading edge of X00105, and the result is set in WR0032 as a binary value.</li></ul><p>Execution results: WR0032=H002D, WR0031=H0001, WR0030=H0000</p></div>															

Item number		Fun commands-11		Name		Conversion from 16-bit unsigned binary to decimal ASCII data † (BINARY TO DECIMAL ASCII)																								
Ladder format				Condition code					Processing time (μs)					Remark																
FUN 30 (s) * (BINDA (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																	
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																
				↕	●	●	●	●	140	←																				
Command format				Number of steps																										
FUN 30 (s) * (BINDA (s) )				Condition		Steps																								
				—		3																								
Usable I/O			Bit				Word									Double word			Constant	Other										
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																	
s	Argument (conversion data)							○						s uses up to s+3																
Function																														
<div><div><div>16-bit unsigned binary data</div><div>s<div>0 to 65535</div></div><div>10<sup>n</sup>: ASCII code in the 10<sup>n</sup> place</div></div><div><div>Decimal ASCII data</div><table><tr><td></td><td>15</td><td>87</td><td>0</td></tr><tr><td>s + 1</td><td>10<sup>4</sup></td><td></td><td>10<sup>3</sup></td></tr><tr><td>s + 2</td><td>10<sup>2</sup></td><td></td><td>10<sup>1</sup></td></tr><tr><td>s + 3</td><td>10<sup>0</sup></td><td></td><td>NULL</td></tr></table></div><div><div><div><div><div></div></div><div><div>X00300</div><div>DIF30</div></div></div><div><div>WR0000 = 12345</div><div>FUN 30 ( WR0000 )</div></div></div><div><div>LD X00300</div><div>AND DIF30</div><div>[</div><div>WR0000 = 12345</div><div>FUN 30 ( WR0000 )</div><div>]</div></div></div></div>																	15	87	0	s + 1	10 <sup>4</sup>		10 <sup>3</sup>	s + 2	10 <sup>2</sup>		10 <sup>1</sup>	s + 3	10 <sup>0</sup>	
	15	87	0																											
s + 1	10 <sup>4</sup>		10 <sup>3</sup>																											
s + 2	10 <sup>2</sup>		10 <sup>1</sup>																											
s + 3	10 <sup>0</sup>		NULL																											
Cautionary notes		<div><div><div></div><div>If s + 1 to s + 3 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</div></div></div>																												
Program example																														
Program description		<div><div><div><div></div><div>The binary data 12345 stored in WR0000 is converted to ASCII data.</div></div><div><div></div><div>The conversion result is stored in WR0001 to 3.</div></div></div><div>Execution results: WR0000=12345 (H3039), WR0001=H3132, WR0002=H3334, WR0003=H3500</div></div>																												

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-12	Name		Conversion from 32-bit signed binary to decimal ASCII data † (DOUBLE BINARY TO DECIMAL ASCII)																														
Ladder format		Condition code					Processing time (μs)						Remark																					
FUN 31 (s) * (DBINDA (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																							
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																						
		↑	●	●	●	●	199		←																									
Command format		Number of steps																																
FUN 31 (s) * (DBINDA (s) )		Condition			Steps																													
		—			3																													
Usable I/O		Bit				Word				Double word		Constant	Other																					
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM																				
s	Argument (lower)							○					-2,147,483,648 to																					
s	Argument (higher)							○					2,147,483,647																					
Function																																		
<div><div><div>32-bit signed binary data</div><div><div>s</div><div>Lower 16-bit</div></div><div><div>s + 1</div><div>Higher 16-bit</div></div></div><div><div>Signs</div><div>Plus: H20 (space)</div><div>Minus: H2D ("‑")</div><div>10<sup>n</sup>: ASCII code in the 10<sup>n</sup> place</div></div></div> <div><div>Decimal ASCII data</div><table><tr><td>15</td><td>87</td><td>0</td></tr><tr><td>s + 2</td><td>Sign</td><td>10<sup>9</sup></td></tr><tr><td>s + 3</td><td>10<sup>8</sup></td><td>10<sup>7</sup></td></tr><tr><td>s + 4</td><td>10<sup>6</sup></td><td>10<sup>5</sup></td></tr><tr><td>s + 5</td><td>10<sup>4</sup></td><td>10<sup>3</sup></td></tr><tr><td>s + 6</td><td>10<sup>2</sup></td><td>10<sup>1</sup></td></tr><tr><td>s + 7</td><td>10<sup>0</sup></td><td>NULL</td></tr></table></div> <div><div><div><div>The 32-bit signed binary data specified by arguments s (lower) and s + 1 (higher) is converted to 10-digit decimal ASCII code and the result is stored in s + 2 to s + 7.</div><div>If the sign is a plus, it is indicated by H20 (space), and by H2D ("‑") if it is a minus.</div><div>Leading zeros of the conversion result are suppressed and these digits are replaced by H20 (space).</div><div>The remaining digits after converting to ASCII are replaced by NULL, which indicates the end of a string.</div><div>If the operation is performed normally, DER is set to "0."</div></div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div>														15	87	0	s + 2	Sign	10 <sup>9</sup>	s + 3	10 <sup>8</sup>	10 <sup>7</sup>	s + 4	10 <sup>6</sup>	10 <sup>5</sup>	s + 5	10 <sup>4</sup>	10 <sup>3</sup>	s + 6	10 <sup>2</sup>	10 <sup>1</sup>	s + 7	10 <sup>0</sup>	NULL
15	87	0																																
s + 2	Sign	10 <sup>9</sup>																																
s + 3	10 <sup>8</sup>	10 <sup>7</sup>																																
s + 4	10 <sup>6</sup>	10 <sup>5</sup>																																
s + 5	10 <sup>4</sup>	10 <sup>3</sup>																																
s + 6	10 <sup>2</sup>	10 <sup>1</sup>																																
s + 7	10 <sup>0</sup>	NULL																																
Cautionary notes		<div><div><div>If s + 1 to s + 7 exceed the maximum I/O number, DER is set to "1" and no operation is performed.</div></div></div>																																
Program example		<div><div><div><div>X00301</div><div>DIF31</div></div><div><div>DR0010 = -1234567</div><div>FUN 31 ( WR0010 )</div></div></div><div><div>LD X00301</div><div>AND DIF31</div><div>[</div><div>DR0010 = -1234567</div><div>FUN 31 ( WR0010 )</div><div>]</div></div></div>																																
Program description		<div><div><div><div>The binary data -1234567 stored in WR0000 (WR0010, WR0011) is converted to ASCII data.</div><div>The conversion result is stored in WR0012 to WR0017.</div></div><div>Execution results: DR0010=-1234567 (HFFED2979), WR0012=H2020, WR0013=H2020, WR0014=H3132, WR0015=H3334, WR0016=H3536, WR0017=H3700</div></div></div>																																

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-13	Name	Conversion from 16-bit binary to hexadecimal ASCII data <sup>†</sup> (BINARY TO HEXA ASCII)											
Ladder format		Condition code					Processing time (μs)						Remark	
FUN 32 (s) * (BINHA (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
		↑	●	●	●	●	124 ←							
Command format		Number of steps												
FUN 32 (s) * (BINHA (s) )		Condition			Steps									
		—			3									
Usable I/O		Bit				Word				Double word		Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM
s	Argument (conversion data)							○						s uses up to s+3
Function														

- The 16-bit unsigned binary data specified by argument s is converted to 4-digit hexadecimal ASCII code and the result is stored in s + 1 to s + 3.
- Leading zeros of the conversion result are not suppressed.
- NULL after ASCII data indicates the end of a string.
- If the operation is performed normally, DER is set to “0.”

\* ( ) indicates the display when the LADDER EDITOR is used.

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number		Fun commands-14		Name		Conversion from 32-bit binary to hexadecimal ASCII data <sup>†</sup> (DOUBLE BINARY TO HEXA ASCII)																																	
Ladder format				Condition code					Processing time (μs)					Remark																									
FUN 33 (s) * (DBINHA (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																										
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																									
				↑	●	●	●	●	168	←																													
Command format				Number of steps																																			
FUN 33 (s) * (DBINHA (s) )				Condition			Steps																																
				—			3																																
Usable I/O		Bit				Word									Double word			Constant	Other																				
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																											
s	Argument (lower)							○						H00000000 to HFFFFFFF s uses up to s+6																									
s + 1	Argument (higher)							○																															
Function																																							
<div><div><div>32-bit unsigned binary data</div><div><div>s</div><div>Lower 16-bit</div></div><div><div>s + 1</div><div>Higher 16-bit</div></div></div><div><div>16<sup>n</sup>: ASCII code in the 16<sup>n</sup> place</div><div><div>Hexadecimal ASCII data</div><table><tr><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td>s + 2</td><td>16<sup>7</sup></td><td></td><td>16<sup>6</sup></td></tr><tr><td>s + 3</td><td>16<sup>5</sup></td><td></td><td>16<sup>4</sup></td></tr><tr><td>s + 4</td><td>16<sup>3</sup></td><td></td><td>16<sup>2</sup></td></tr><tr><td>s + 5</td><td>16<sup>1</sup></td><td></td><td>16<sup>0</sup></td></tr><tr><td>s + 6</td><td colspan="3">NULL</td></tr></table></div></div></div> <div><ul style="list-style-type: none"><li>The 32-bit signed binary data specified by arguments s (lower) and s + 1 (higher) is converted to an 8-digit hexadecimal ASCII code and the result is stored in s + 2 to s + 6.</li><li>Leading zeros of the conversion result are not suppressed.</li><li>NULL after ASCII data indicates the end of a string.</li><li>If the operation is performed normally, DER is set to “0.”</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>																15	8	7	0	s + 2	16 <sup>7</sup>		16 <sup>6</sup>	s + 3	16 <sup>5</sup>		16 <sup>4</sup>	s + 4	16 <sup>3</sup>		16 <sup>2</sup>	s + 5	16 <sup>1</sup>		16 <sup>0</sup>	s + 6	NULL		
15	8	7	0																																				
s + 2	16 <sup>7</sup>		16 <sup>6</sup>																																				
s + 3	16 <sup>5</sup>		16 <sup>4</sup>																																				
s + 4	16 <sup>3</sup>		16 <sup>2</sup>																																				
s + 5	16 <sup>1</sup>		16 <sup>0</sup>																																				
s + 6	NULL																																						
Cautionary notes		<ul style="list-style-type: none"><li>If s + 1 to s + 6 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</li></ul>																																					
Program example		<div><div><div>X00303 DIF33</div><div>DR0030 = H001289AB FUN 33 ( WR0030 )</div></div><div><div>LD X00303 AND DIF33 [ DR0030 = H001289AB FUN 33 ( WR0030 ) ]</div></div></div>																																					
Program description		<ul style="list-style-type: none"><li>The binary data H001289AB stored in DR0030 (WR0030, WR0031) is converted to ASCII data.</li><li>The conversion result is stored in WR0032 to WR0036.</li></ul> <p>Execution results: DR0030=H001289AB, WR0032=H3030, WR0033=H3132, WR0034=H3839, WR0035=H4142, WR0036=H0000</p>																																					

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-15	Name		Conversion from 16-bit BCD to decimal ASCII data <sup>†</sup> (BCD TO DECIMAL ASCII)																																							
Ladder format		Condition code					Processing time (μs)						Remark																														
FUN 34 (s) * (BCDDA (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																																
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																															
		↕	●	●	●	●	112	←																																			
Command format		Number of steps																																									
FUN 34 (s) * (BCDDA (s) )		Condition			Steps																																						
		—			3																																						
Usable I/O		Bit				Word				Double word			Constant	Other																													
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																															
s	Argument (conversion data)							○						s uses up to s+3																													
Function																																											
<div><div><div>16-bit BCD data</div><div><div>s</div><table><tr><td>15</td><td>12</td><td>11</td><td>7</td><td>4</td><td>3</td><td>0</td></tr><tr><td>10<sup>3</sup></td><td>10<sup>2</sup></td><td>10<sup>1</sup></td><td>10<sup>0</sup></td><td></td><td></td><td></td></tr></table></div><div>10<sup>n</sup>: BCD code in the 10<sup>n</sup> place</div></div><div><div>Decimal ASCII data</div><table><tr><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td>s + 1</td><td>10<sup>3</sup></td><td>10<sup>2</sup></td><td></td></tr><tr><td>s + 2</td><td>10<sup>1</sup></td><td>10<sup>0</sup></td><td></td></tr><tr><td>s + 3</td><td colspan="3">NULL</td></tr></table><div>10<sup>m</sup>: ASCII code in the 10<sup>m</sup> place</div></div></div> <div><ul style="list-style-type: none"><li>The 16-bit BCD data specified by argument s is converted to a 4-digit decimal ASCII code and the result is stored in s + 1 to s + 3.</li><li>Leading zeros of the conversion result are suppressed and these digits are replaced by H20 (space)</li><li>NULL after ASCII data indicates the end of a string.</li><li>If the operation is performed normally, DER is set to “0.”</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>														15	12	11	7	4	3	0	10 <sup>3</sup>	10 <sup>2</sup>	10 <sup>1</sup>	10 <sup>0</sup>				15	8	7	0	s + 1	10 <sup>3</sup>	10 <sup>2</sup>		s + 2	10 <sup>1</sup>	10 <sup>0</sup>		s + 3	NULL		
15	12	11	7	4	3	0																																					
10 <sup>3</sup>	10 <sup>2</sup>	10 <sup>1</sup>	10 <sup>0</sup>																																								
15	8	7	0																																								
s + 1	10 <sup>3</sup>	10 <sup>2</sup>																																									
s + 2	10 <sup>1</sup>	10 <sup>0</sup>																																									
s + 3	NULL																																										
Cautionary notes		<ul style="list-style-type: none"><li>If s is other than BCD data, DER is set to “1” and no operation is performed.</li><li>If s + 1 to s + 3 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</li></ul>																																									
Program example		<div><div><div>X00304 DIF34</div><div>WR0030 = H0123 FUN 34 ( WR0030 )</div></div><div><div>LD X00304 AND DIF34 [ WR0030 = H0123 FUN 34 ( WR0030 ) ]</div></div></div>																																									
Program description		<ul style="list-style-type: none"><li>The BCD data H0123 stored in WR0030 is converted to ASCII data.</li><li>The conversion result is stored in WR0031 to WR0033.</li></ul> <p>Execution results: WR0030=H0123, WR0031=H2031, WR0032=H3233, WR0033=H0000</p>																																									

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-16	Name		Conversion from 32-bit BCD to decimal ASCII data † (DOUBLE BCD TO DECIMAL ASCII)																																																																																					
Ladder format		Condition code					Processing time (μs)						Remark																																																																												
FUN 35 (s) * (DBCDDA (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																																																																														
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																																																													
		↕	●	●	●	●	171		←																																																																																
Command format		Number of steps																																																																																							
FUN 35 (s) * (DBCDDA (s) )		Condition			Steps																																																																																				
		—			3																																																																																				
Usable I/O		Bit				Word							Double word			Constant	Other																																																																								
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																																																																													
s	Argument (lower)							○						s is BCD data.																																																																											
s+1	Argument (higher)							○						s uses up to s+6																																																																											
Function																																																																																									
<div><div><div>32-bit BCD data</div><table><tr><td></td><td>15</td><td>12</td><td>11</td><td></td><td>7</td><td></td><td>4</td><td>3</td><td></td><td>0</td></tr><tr><td>s</td><td>10<sup>3</sup></td><td>10<sup>2</sup></td><td>10<sup>1</sup></td><td>10<sup>0</sup></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>s + 1</td><td>10<sup>7</sup></td><td>10<sup>6</sup></td><td>10<sup>5</sup></td><td>10<sup>4</sup></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table><div>10<sup>n</sup>: BCD code in the 10<sup>n</sup> place</div></div><div><div>Decimal ASCII data</div><table><tr><td></td><td>15</td><td></td><td>8</td><td>7</td><td></td><td>0</td></tr><tr><td>s + 2</td><td>10<sup>7</sup></td><td></td><td>10<sup>6</sup></td><td></td><td></td><td></td></tr><tr><td>s + 3</td><td>10<sup>5</sup></td><td></td><td>10<sup>4</sup></td><td></td><td></td><td></td></tr><tr><td>s + 4</td><td>10<sup>3</sup></td><td></td><td>10<sup>2</sup></td><td></td><td></td><td></td></tr><tr><td>s + 5</td><td>10<sup>1</sup></td><td></td><td>10<sup>0</sup></td><td></td><td></td><td></td></tr><tr><td>s + 6</td><td colspan="6">NULL</td></tr></table><div>10<sup>m</sup>: ASCII code in the 10<sup>m</sup> place</div></div><div><ul style="list-style-type: none"><li>The 32-bit BCD data specified by arguments s (lower) and s + 1 (higher) is converted to an 8-digit decimal ASCII code and the result is stored in s + 2 to s + 6.</li><li>Leading zeros of the conversion result are suppressed and these digits are replaced by H20 (space)</li><li>NULL after ASCII data indicates the end of a string.</li><li>If the operation is performed normally, DER is set to “0.”</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div></div>																15	12	11		7		4	3		0	s	10 <sup>3</sup>	10 <sup>2</sup>	10 <sup>1</sup>	10 <sup>0</sup>							s + 1	10 <sup>7</sup>	10 <sup>6</sup>	10 <sup>5</sup>	10 <sup>4</sup>								15		8	7		0	s + 2	10 <sup>7</sup>		10 <sup>6</sup>				s + 3	10 <sup>5</sup>		10 <sup>4</sup>				s + 4	10 <sup>3</sup>		10 <sup>2</sup>				s + 5	10 <sup>1</sup>		10 <sup>0</sup>				s + 6	NULL					
	15	12	11		7		4	3		0																																																																															
s	10 <sup>3</sup>	10 <sup>2</sup>	10 <sup>1</sup>	10 <sup>0</sup>																																																																																					
s + 1	10 <sup>7</sup>	10 <sup>6</sup>	10 <sup>5</sup>	10 <sup>4</sup>																																																																																					
	15		8	7		0																																																																																			
s + 2	10 <sup>7</sup>		10 <sup>6</sup>																																																																																						
s + 3	10 <sup>5</sup>		10 <sup>4</sup>																																																																																						
s + 4	10 <sup>3</sup>		10 <sup>2</sup>																																																																																						
s + 5	10 <sup>1</sup>		10 <sup>0</sup>																																																																																						
s + 6	NULL																																																																																								
Cautionary notes		<ul style="list-style-type: none"><li>If s, s + 1 is other than BCD data, DER is set to “1” and no operation is performed.</li><li>If s + 1 to s + 6 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</li></ul>																																																																																							
Program example		<div><div><div><div>X00305</div><div>DIF35</div></div><div>DR0040 = H00120567 FUN 35 ( WR0040 )</div></div><div><div>LD X00305 AND DIF35 [ DR0040 = H00120567 FUN 35 ( WR0040 ) ]</div></div></div>																																																																																							
Program description		<ul style="list-style-type: none"><li>The BCD data H00120567 stored in DR0040 (WR0040, WR0041) is converted to ASCII data.</li><li>The conversion result is stored in WR0042 to WR0046.</li></ul> <p>Execution results: DR0040=H00120567, WR0042=H2020, WR0043=H3132, WR0044=H3035, WR0045=H3637, WR0046=H0000</p>																																																																																							

<sup>†</sup>: Only the EH-CPU448 is supported.



Item number	Fun commands-17	Name		Conversion from 5-digit unsigned decimal ASCII to 16-bit binary data <sup>†</sup> (DECIMAL ASCII TO BINARY)										
Ladder format		Condition code					Processing time (μs)						Remark	
FUN 36 (s) * (DABIN (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
		↑	●	●	●	●	60	←						
Command format		Number of steps												
FUN 36 (s) * (DABIN (s) )		Condition			Steps									
		—			3									
Usable I/O		Bit				Word				Double word			Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
s	Argument (higher)							○						s to s + 2 will have combinations of H00, H20, and H 30 to H39. s uses up to s + 3
s+1	Argument (middle)							○						
s+2	Argument (lower)							○						
Function														
<div><div><div>Unsigned decimal ASCII data</div><div><div>s</div><div>10<sup>4</sup></div><div>10<sup>3</sup></div></div><div>s + 1</div><div>10<sup>2</sup></div><div>10<sup>1</sup></div><div>s + 2</div><div>10<sup>0</sup></div><div>H00</div></div><div>10<sup>n</sup>: ASCII code in the 10<sup>n</sup> place</div></div> <div><div>16-bit binary data</div><div>s + 3</div><div>0 to 65535</div></div>														
<div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div>WR0050 = H3132</div><div>WR0051 = H3334</div><div>WR0052 = H3500</div><div>FUN 36 ( WR0050 )</div></div></div><div><div>LD X00306</div><div>AND DIF36</div><div>[</div><div>WR0050 = H3132</div><div>WR0051 = H3334</div><div>WR0052 = H3500</div><div>FUN 36 ( WR0050 )</div><div>]</div></div></div>														
Program description														
<div><div><div><div></div><div></div><div></div><div></div><div></div></div><div></div></div><div><div>The ASCII data “1,” “2,” “3,” “4,” “5” stored in WR0050 to WR0052 is converted to binary data.</div><div>The conversion result is stored in WR0053.</div><div>Execution results: WR0050=H3132, WR0051=H3334, WR0052=H3500, WR0053=12345 (H3039)</div></div></div>														

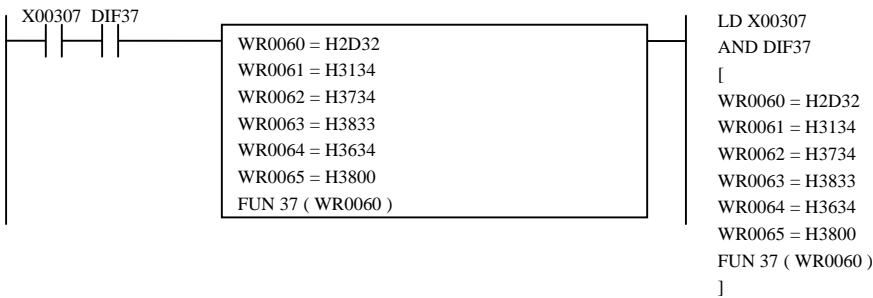
<sup>†</sup>: Only the EH-CPU448 is supported.



Cautionary notes

- If the sign is other than H20 and H2D, and other digits are other than H30 to H39 (0 to 9), DER is set to “1” and no operation is performed. However, this does not apply to H00 and H20 (NULL and space) of leading-zero-suppressed digits.
- If data is outside the range from –2,147,483,648 to 2,147,483,647, DER is set to “1” and no operation is performed.
- If s + 1 to s + 7 exceed the maximum I/O number, DER is set to “1” and no operation is performed.

Program example



Program description

- The ASCII data “-,” “2,” “1,” “4,” “7,” “4,” “8,” “3,” “6,” “4,” “8” stored in WR0060 to WR0065 is converted to binary data.
- The conversion result is stored in WR0067 (higher) and WR0066 (lower).

Execution results: WR0060=H2D32, WR0061=H3134, WR0062=H3734, WR0063=H3833, WR0064=H3634,  
WR0065=H3800, DR0060=-2147483648(H80000000)

Item number		Fun commands-19		Name		Conversion from 4-digit hexadecimal ASCII to 16-bit binary data † (HEXA ASCII TO BINARY)									
Ladder format				Condition code					Processing time (μs)						Remark
FUN 38 (s) * (HABIN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
				↑	●	●	●	●							
Command format				Number of steps					63	←					
FUN 38 (s) * (HABIN (s) )				Condition			Steps								
				—			3								
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument (higher ASCII)								○					Combination of H00, H20, H30 to H39 and H41 to 46	
s+1	Argument (lower ASCII)								○					s uses up to s + 2	
Function															
<div><div><div>Hexadecimal ASCII data</div><div><div><div>15870</div><div>s16<sup>3</sup>16<sup>2</sup></div><div>s + 116<sup>1</sup>16<sup>0</sup></div></div><div>16<sup>n</sup>: ASCII code in the 16<sup>n</sup> place</div></div><div><div>16-bit binary data</div><div><div>s + 2</div><div>H0 to HFFFF</div></div></div></div></div>															
<div><div><div><div><div><div></div><div></div><div></div><div></div></div><div>X00308 DIF38</div></div><div><div>WR0070 = H3132</div><div>WR0071 = H4142</div><div>FUN 38 ( WR0070 )</div></div></div><div><div>LD X00308</div><div>AND DIF38</div><div>[</div><div>WR0070 = H3132</div><div>WR0071 = H4142</div><div>FUN 38 ( WR0070 )</div><div>]</div></div></div></div>															
Cautionary notes		<div><div><div><div><div></div><div></div><div></div><div></div></div><div>If the 4-digit ASCII code stored in s to s + 1 is other than H30 to H39, H41 to H46 (0 to 9 and A to F), DER is set to “1” and no operation is performed. However, this does not apply to H00 and H20 (NULL and space) of leading-zero-suppressed digits.</div></div><div><div><div></div><div></div><div></div><div></div></div><div>If s + 1 to s + 2 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</div></div></div></div>													
Program example															
Program description		<div><div><div><div><div></div><div></div><div></div><div></div></div><div>The ASCII data “1,” “2,” “A,” “B” stored in WR0070, WR0071 is converted to binary data.</div></div><div><div><div></div><div></div><div></div><div></div></div><div>The conversion result is stored in WR0072.</div></div></div><div>Execution results: WR0070=H3132, WR0071=H4142, WR0072=H12AB</div></div>													

FUN 39 (s)

†: Only the EH-CPU448 is supported.

Item number		Fun commands-21		Name		Conversion from 4-digit decimal ASCII to 16-bit BCD data <sup>†</sup> (DECIMAL ASCII TO BCD)											
Ladder format				Condition code					Processing time (μs)					Remark			
FUN 40 (s) * (DABCD (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↕	●	●	●	●	64	←							
Command format				Number of steps													
FUN 40 (s) * (DABCD (s) )				Condition			Steps										
				—			3										
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument (ASCII data)								○						Combination of H00, H20 and H30 to H39 s uses up to s + 2		
s+1	Argument (ASCII data)								○								
Function																	
Decimal ASCII data				16-bit unsigned BCD data													
<div><div><div>s</div><div>10<sup>3</sup></div><div>10<sup>2</sup></div></div><div><div>s + 1</div><div>10<sup>1</sup></div><div>10<sup>0</sup></div></div></div>				<div><div>s + 2</div><div>10<sup>3</sup></div><div>10<sup>2</sup></div><div>10<sup>1</sup></div><div>10<sup>0</sup></div></div>													
10 <sup>m</sup> : ASCII code in the 10 <sup>m</sup> place				10 <sup>n</sup> : BCD code in the 10 <sup>n</sup> place													
<div><div><div><div><div>•</div><div>The 4-digit decimal ASCII data specified by arguments s to s + 1 is converted to 16-bit BCD data and the result is stored in s + 2.</div></div><div><div>•</div><div>Higher digit’s H00 and H20 (NULL and space) are processed as H30 (“0”). (Leading-zero-suppressed digit)</div></div><div><div>•</div><div>Arguments will be combinations of H30 to H39 (0 to 9).</div></div><div><div>•</div><div>If the operation is performed normally, DER is set to “0.”</div></div></div><div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div></div>																	
Cautionary notes				<div><div><div><div><div>•</div><div>If the 4-digit ASCII code stored in s to s + 1 is other than H30 to H39 (0 to 9), DER is set to “1” and no operation is performed. However, this does not apply to H00 and H20 (NULL and space) of leading-zero-suppressed digits.</div></div><div><div>•</div><div>If s + 1 to s + 2 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</div></div></div></div></div>													
Program example				<div><div><div><div><div><div>X00400</div><div>DIF40</div></div><div><div><div>WR0090 = H2020</div><div>WR0091 = H3031</div><div>FUN 40 ( WR0090 )</div></div></div></div><div><div><div>LD X00400</div><div>AND DIF40</div><div>[</div><div><div>WR0090 = H2020</div><div>WR0091 = H3031</div><div>FUN 40 ( WR0090 )</div></div><div>]</div></div></div></div></div></div>													
Program description				<div><div><div><div><div>•</div><div>The ASCII data “□” “□” “0,” “1,” stored in WR0090 and WR0091 is converted to 16-bit BCD data.</div></div><div><div>•</div><div>The conversion result is stored in WR0092. (“□”=H20)</div></div></div><div><div>Execution results: WR0090=H2020, WR0091=H3031, WR0092=H0001</div></div></div></div>													

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number		Fun commands-22		Name		Conversion from 8-digit decimal ASCII to 32-bit BCD data † (DOUBLE DECIMAL ASCII TO BCD)																																																													
Ladder format				Condition code					Processing time (μs)						Remark																																																				
FUN 41 (s) * (DDABCD (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left																																																						
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																																					
				↑	●	●	●	●	93	←																																																									
Command format				Number of steps																																																															
FUN 41 (s) * (DDABCD (s) )				Condition			Steps																																																												
				—			3																																																												
Usable I/O				Bit				Word				Double word		Constant	Other																																																				
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM																																																			
s	Argument (ASCII code)								○						Combination of H00, H20 and H30 to H39 s uses up to s + 5																																																				
~	~								~																																																										
s + 3	Argument (ASCII code)								○																																																										
Function																																																																			
<div><div><div>Decimal ASCII data</div><table><tr><td></td><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td>s</td><td>10<sup>7</sup></td><td></td><td></td><td>10<sup>6</sup></td></tr><tr><td>s + 1</td><td>10<sup>5</sup></td><td></td><td></td><td>10<sup>4</sup></td></tr><tr><td>s + 2</td><td>10<sup>3</sup></td><td></td><td></td><td>10<sup>2</sup></td></tr><tr><td>s + 3</td><td>10<sup>1</sup></td><td></td><td></td><td>10<sup>0</sup></td></tr></table></div><div><div>32-bit BCD data</div><table><tr><td></td><td>15</td><td>12</td><td>11</td><td>8</td><td>7</td><td>4</td><td>3</td><td>0</td></tr><tr><td>s + 4</td><td>10<sup>3</sup></td><td></td><td></td><td>10<sup>2</sup></td><td></td><td></td><td></td><td>10<sup>0</sup></td></tr><tr><td>s + 5</td><td>10<sup>7</sup></td><td></td><td></td><td>10<sup>6</sup></td><td></td><td></td><td></td><td>10<sup>4</sup></td></tr></table><div>10<sup>n</sup>: BCD code in the 10<sup>n</sup> place</div></div></div> <div>10<sup>m</sup>: ASCII code in the 10<sup>m</sup> place</div> <div><div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></div></div><div></div></div><div><div><div></div><div></div><div></d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<sup>7</sup>			10 <sup>6</sup>	s + 1	10 <sup>5</sup>			10 <sup>4</sup>	s + 2	10 <sup>3</sup>			10 <sup>2</sup>	s + 3	10 <sup>1</sup>			10 <sup>0</sup>		15	12	11	8	7	4	3	0	s + 4	10 <sup>3</sup>			10 <sup>2</sup>				10 <sup>0</sup>	s + 5	10 <sup>7</sup>			10 <sup>6</sup>				10 <sup>4</sup>
	15	8	7	0																																																															
s	10 <sup>7</sup>			10 <sup>6</sup>																																																															
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	15	12	11	8	7	4	3	0																																																											
s + 4	10 <sup>3</sup>			10 <sup>2</sup>				10 <sup>0</sup>																																																											
s + 5	10 <sup>7</sup>			10 <sup>6</sup>				10 <sup>4</sup>																																																											

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-23	Name		Conversion from hexadecimal binary to hexadecimal ASCII data † (BINARY TO ASCII)																																																																																										
Ladder format		Condition code					Processing time (μs)					Remark																																																																																		
FUN 42 (s) * (ASC (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		10 char. conv.																																																																																	
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																																																																		
		↑	●	●	●	●																																																																																								
Command format		Number of steps					119		←																																																																																					
FUN 42 (s) * (ASC (s) )		Condition			Steps																																																																																									
		—			3																																																																																									
Usable I/O		Bit				Word				Double word		Constant	Other																																																																																	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM																																																																																
s	No. of converted characters							○						s uses up to s+2																																																																																
s+1	Binary data head I/O No.							○						Actual address is set																																																																																
s+2	ASCII head I/O No. after conversion							○						Actual address is set																																																																																
Function																																																																																														
<div><div><div>s</div><div>No. of conversions n</div></div><div><div>s + 1</div><div>Binary data head a1</div></div><div><div>s + 2</div><div>ASCII data head a2</div></div></div> <div><div><div>Binary data table</div><table><tr><td>15</td><td>12</td><td>11</td><td>8</td><td>7</td><td>4</td><td>3</td><td>0</td></tr><tr><td colspan="2">d1</td><td colspan="2">d2</td><td colspan="2">d3</td><td colspan="2">d4</td></tr><tr><td colspan="8"></td></tr><tr><td colspan="2">dn-2</td><td colspan="2">dn-1</td><td colspan="2">dn</td><td colspan="2">dn + 1</td></tr></table></div><div><div>↓</div><div><div>ASCII data table</div><table><tr><td>15</td><td colspan="3">8</td><td>7</td><td colspan="3">0</td></tr><tr><td colspan="4">d1</td><td colspan="4">d2</td></tr><tr><td colspan="4">d3</td><td colspan="4">d4</td></tr><tr><td colspan="8"></td></tr><tr><td colspan="4">dn-2</td><td colspan="4">dn-1</td></tr><tr><td colspan="4">dn</td><td colspan="4">H20</td></tr></table></div></div></div> <div><ul style="list-style-type: none"><li>• The number of hexadecimal data characters specified by argument s is converted to hexadecimal ASCII codes beginning from the head I/O specified by argument s + 1, and the results are stored in addresses beginning from the head I/O specified by s + 2.</li><li>• If the number of characters is odd, the lower 8 bits of the data at the output destination will be H20 (space).</li><li>• Use the ADRIO command to set the actual addresses in the head I/Os of s + 1 and s + 2.</li><li>• If the operation is performed normally, DER is set to “0.”</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															15	12	11	8	7	4	3	0	d1		d2		d3		d4										dn-2		dn-1		dn		dn + 1		15	8			7	0			d1				d2				d3				d4												dn-2				dn-1				dn				H20			
15	12	11	8	7	4	3	0																																																																																							
d1		d2		d3		d4																																																																																								
dn-2		dn-1		dn		dn + 1																																																																																								
15	8			7	0																																																																																									
d1				d2																																																																																										
d3				d4																																																																																										
dn-2				dn-1																																																																																										
dn				H20																																																																																										

- The number of hexadecimal data characters specified by argument s is converted to hexadecimal ASCII codes beginning from the head I/O specified by argument s + 1, and the results are stored in addresses beginning from the head I/O specified by s + 2.
- If the number of characters is odd, the lower 8 bits of the data at the output destination will be H20 (space).
- Use the ADRIO command to set the actual addresses in the head I/Os of s + 1 and s + 2.
- If the operation is performed normally, DER is set to "0."
- \* ( ) indicates the display when the LADDER EDITOR is used.

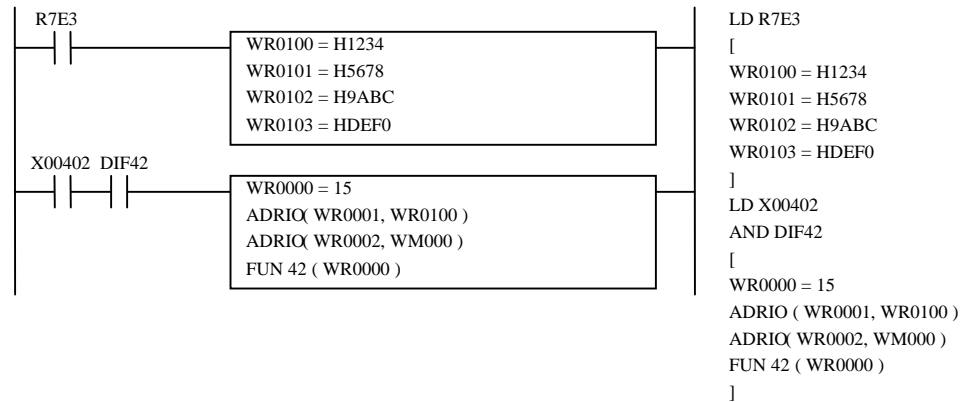
<sup>†</sup>: Only the EH-CPU448 is supported.



Cautionary notes

- The ADRIO command should be used to set the actual addresses in s + 1 and s + 2. If not, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by them overlap, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by s + 1 and s + 2 exceed the maximum I/O number, DER is set to “1” and no operation is performed.

Program example



Program description

- 1) The result is stored in the data table from WR0100 by special internal output R7E3 (single scan ON after RUN start).
- 2) At a rising edge of X00402, the hexadecimal binary data is converted to hexadecimal ASCII data, and the converted data is stored from WM000.

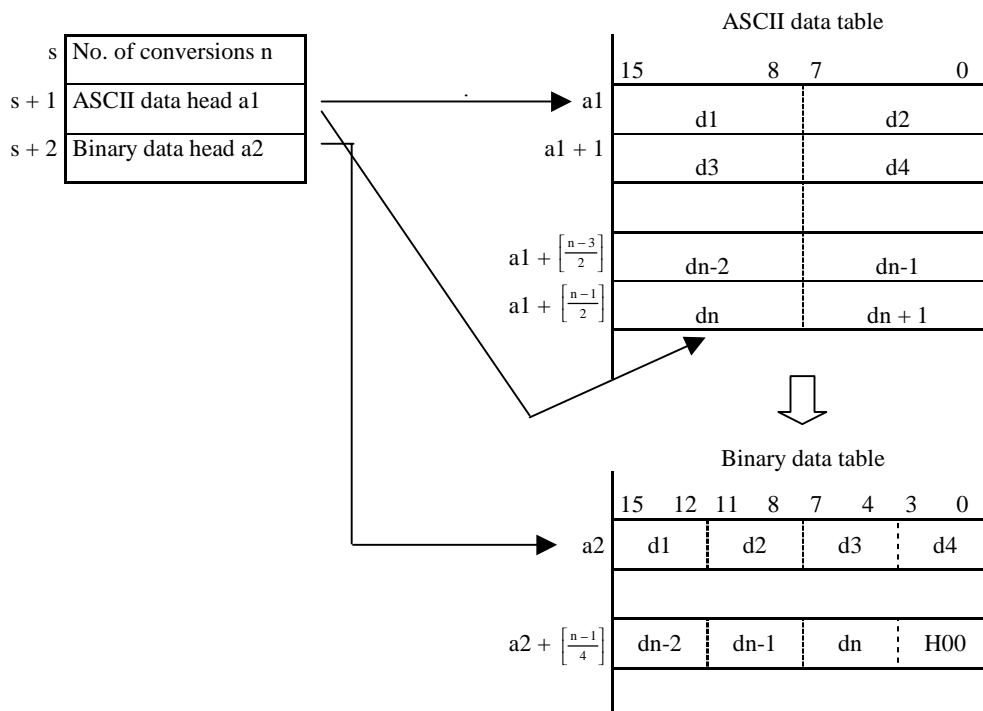
Execution results:

WR0100 = H1234	WM000=H3132, WM001=H3334
WR0101 = H5678	WM002=H3536, WM003=H3738
WR0102 = H9ABC	WM004=H3941, WM005=H4243
WR0103 = HDEF0	WM006=H4445, WM007=H4620 (“20” is a space.)

FUN 42 (s)

Item number	Fun commands-24	Name		Conversion from hexadecimal ASCII to hexadecimal binary data <sup>†</sup> (ASCII TO BINARY)										
Ladder format		Condition code					Processing time (μs)						Remark	
FUN 43 (s) * (HEX (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		10 char. conv.	
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
		↑	●	●	●	●								
Command format		Number of steps					191	←						
FUN 43 (s) * (HEX) (s) )		Condition			Steps									
		—			3									
Usable I/O		Bit				Word				Double word			Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
s	No. of converted characters							○						s uses up to s+2
s+1	ASCII head I/O No.							○						Actual address is set
s+2	Binary conversion data head I/O No.							○						Actual address is set

## Function



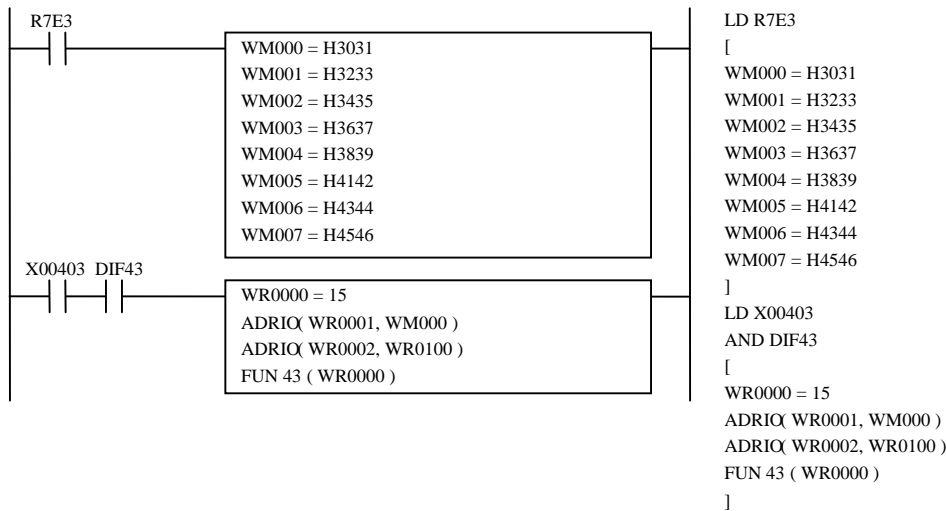
- The number of hexadecimal ASCII code characters specified by argument s is converted to binary data beginning from the head of the hexadecimal ASCII code specified by argument s + 1, and the results are stored in addresses beginning from the head I/O specified by s + 2.
- If the number of characters is odd, the lower 4 bits of the data at the output destination will be "0."
- Use the ADRIO command to store the actual addresses of the head I/Os at s + 1 and s + 2.
- Higher digit's H00 and H20 (NULL and space) are processed as H30 ("0"). (Leading-zero-suppressed digit)
- If the operation is performed normally, DER is set to "0."
- \* ( ) indicates the display when the LADDER EDITOR is used.

<sup>†</sup>: Only the EH-CPU448 is supported.

Cautionary notes

- The ADRIO command should be used to set the actual addresses in s + 1 and s + 2. If not, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by them overlap, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by s + 1 and s + 2 exceed the maximum I/O number, DER is set to “1” and no operation is performed.

Program example



Program description

- 1) The result is stored in the data table from WR0100 by special internal output R7E3 (single scan ON after RUN start).
- 2) At a rising edge of X00403, the hexadecimal ASCII data is converted to hexadecimal binary data, and the converted data is stored from WM0100.

Execution results: WM000=H3031, WM001=H3233  
WM002=H3435, WM003=H3637  
WM004=H3839, WM005=H4142  
WM006=H4344, WM007=H4546

➡

WR0100=H0123  
WR0101=H4567  
WR0102=H89AB  
WR0103=HCDE0

FUN 43 (s)

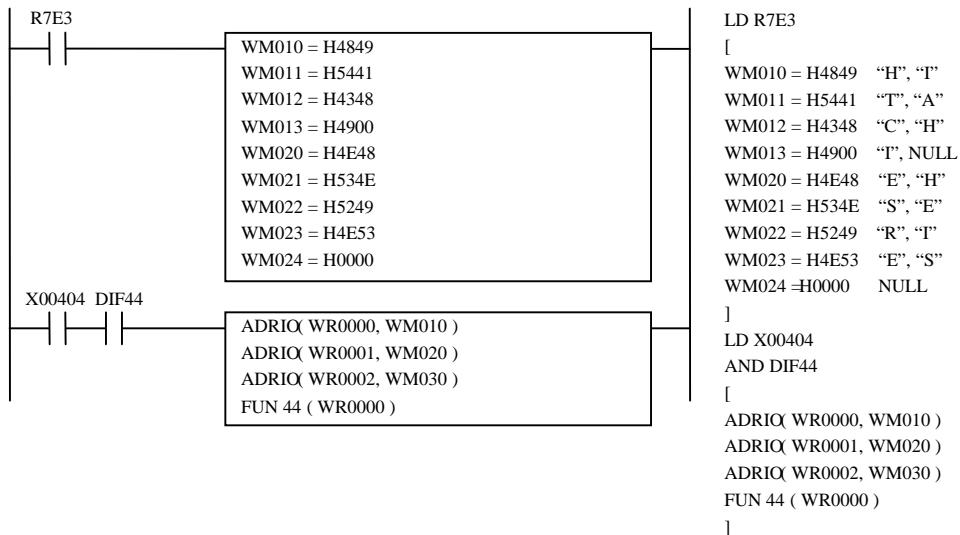
Item number	Fun commands-25	Name	Merge strings †										
Ladder format		Condition code					Processing time (μs)						Remark
FUN 44 (s) * (SADD (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		10 char. + 10 char. ↓ 20 char.
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
		↑	●	●	●	●	196		←		<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><di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<sup>†</sup>: Only the EH-CPU448 is supported.

Cautionary notes

- The ADRIO command should be used to set the actual addresses in s to s + 2. If not, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by them overlap, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by s + 1 and s + 2 exceed the maximum I/O number, DER is set to “1” and no operation is performed.

Program example



Program description

- 1) Sets the first character string from WM010 and the second character string from WM020 using special internal output R7E3 (single scan ON after RUN start).
- 2) At a rising edge of X00404, character strings are merged and output to WM030 and succeeding areas.

Execution results:

WM010=H4849	WM020=H4E48	WM030=H4849
WM011=H5441	WM021=H534E	WM031=H5441
WM012=H4348	WM022=H5249	WM032=H4348
WM013=H4900	WM023=H4E53	WM033=H494E
	WM024=H0000	WM034=H4853
		WM035=H4E52
		WM036=H494E
		WM037=H5300

FUN 44 (s)

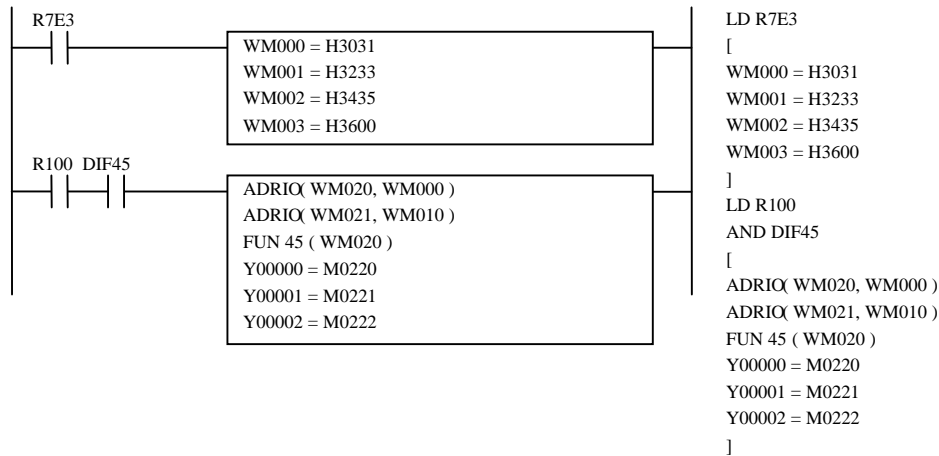
Item number	Fun commands-26	Name		Compare character strings †																										
Ladder format		Condition code					Processing time (μs)						Remark																	
FUN 45 (s) * (SCMP (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Comparison between 10 char. and 10 char.																	
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																		
		↑	●	●	●	●	157	←	/	/	/	/																		
Command format		Number of steps																												
FUN 45 (s) * (SCMP (s) )		Condition			Steps																									
		—			3																									
Usable I/O		Bit				Word				Double word			Constant	Other																
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																		
s	String 1 head I/O No.							○							Actual addresses are set in s to s + 1 s uses up to s + 2															
s+1	String 2 head I/O No.							○																						
Function																														
<div><div><div><div>s</div><div>String 1 head I/O No. a1</div></div><div><div>s + 1</div><div>String 2 head I/O No. a2</div></div></div><div><div>Character string 1</div><div><div>15870</div><div><div>d11</div><div>d12</div></div><div>⋮</div><div><div>d1n</div><div>NULL</div></div></div><div><div>Character string 2</div><div><div>15870</div><div><div>d21</div><div>d22</div></div><div>⋮</div><div><div>d2m</div><div>NULL</div></div></div></div><div>Comparison</div><div>↓</div><div>Result</div><div><div>15210</div><div><div>s + 2</div><div><div>F2</div><div>F1</div><div>F0</div></div></div></div><div><table><tr><td></td><td>F2</td><td>F1</td><td>F0</td></tr><tr><td>Unmatched number of characters</td><td>1</td><td>0</td><td>0</td></tr><tr><td>Unmatched character string</td><td>0</td><td>1</td><td>0</td></tr><tr><td>Matched character string</td><td>0</td><td>0</td><td>1</td></tr></table></div></div></div>																F2	F1	F0	Unmatched number of characters	1	0	0	Unmatched character string	0	1	0	Matched character string	0	0	1
	F2	F1	F0																											
Unmatched number of characters	1	0	0																											
Unmatched character string	0	1	0																											
Matched character string	0	0	1																											
<div><ul style="list-style-type: none"><li>The character string that begins from the head I/O specified by argument s and the character string that begins from the head I/O specified by argument s + 1 are compared, and the result is stored in s + 2.</li><li>The character strings to be compared end before a NULL (H00).</li><li>The numbers of characters in the strings are compared first. If the numbers do not match, bit 2 is set to “1.” If the numbers of characters match, the strings themselves are compared. If they do not match, bit 1 is set to “1.” If both the numbers of characters and strings match, bit 0 is set to “1.”</li><li>Use the ADRIO command to set the actual addresses in the head I/Os of s and s + 1.</li><li>If the operation is performed normally, DER is set to “0.”</li></ul><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div>																														

<sup>†</sup>: Only the EH-CPU448 is supported.

Cautionary notes

- The ADRIO command should be used to set the actual addresses in s and s + 1. If not, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by them overlap, DER is set to “1” and no operation is performed.
- If s to s + 2 and the areas specified by s and s + 1 exceed the maximum I/O number, DER is set to “1” and no operation is performed.

Program example



Program description

- 1) The compared data is stored in WM000 and succeeding areas by special internal output R7E3 (single scan ON after RUN start).
- 2) At a rising edge of R100, the data beginning from WM000 and the data beginning from WM010 are compared.
- 3) Depending on the comparison result, Y00000 to Y00002 turn on.

FUN 45 (s)

Item number	Fun commands-27	Name		Conversion from word units to byte units <sup>†</sup> (CONVERSION WORDS TO BYTES)									
Ladder format		Condition code					Processing time (μs)					Remark	
FUN 46 (s) * (WTOB (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		5 words to 10 bytes (word)
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
		↑	●	●	●	●	115 ←		/		/		
Command format		Number of steps											
FUN 46 (s) * (WTOB (s) )		Condition			Steps								
		—			3								
Usable I/O		Bit				Word				Double word		Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY		
s	Word data head I/O No.							○					Actual addresses are set in s and s + 1  s uses up to s + 2
s+1	Byte conversion data head I/O No.							○					
s+2	No. of converted bytes							○					
Function		<div><div><div><div><div>s</div><div>Word-unit data head I/O No. a1</div></div><div><div>s + 1</div><div>Converted byte-unit data head I/O No. a2</div></div><div><div>s + 2</div><div>No. n of converted bytes</div></div></div><div><div><div>Word unit data</div><div><div><div>15870</div><div>d1d2</div><div>⋮</div><div>dn dn + 1</div></div><div><div>Byte unit data</div><div><div><div>15870</div><div>00n d1</div><div>00n d2</div><div>⋮</div><div>00n dn-1</div><div>00n dn</div></div></div></div><div><div>→</div><div>a1</div><div>→</div><div>a2</div><div>→</div><div>a2 + 1</div><div>→</div><div>a2 + n-2</div><div>→</div><div>a2 + n-1</div><div>→</div><div>n</div></div></div></div></div><div><ul style="list-style-type: none"><li>The word character string data of the head I/O specified by argument s is divided into byte units for the number of bytes specified by argument s + 2, and the result is stored in the head I/O area specified by s + 1.</li><li>Use the ADRIO command to set the actual addresses in the head I/Os of s to s + 1.</li><li>The higher byte of the divided data is set to H00.</li><li>If the operation is performed normally, DER is set to “0.”</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div></div></div>											
Cautionary notes		<ul style="list-style-type: none"><li>The ADRIO command should be used to set the actual addresses in s and s + 1. If not, DER is set to “1” and no operation is performed.</li><li>If s to s + 2 and the areas specified by them overlap, DER is set to “1” and no operation is performed.</li><li>If s to s + 2 and the areas specified by s and s + 1 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</li></ul>											

<sup>†</sup>: Only the EH-CPU448 is supported.



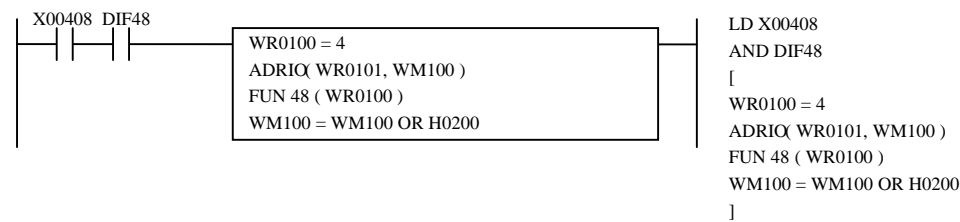
Item number	Fun commands-28	Name	Conversion from byte units to word units <sup>†</sup> (CONVERSION BYTES TO WORDS)										
Ladder format		Condition code					Processing time (μs)					Remark	
FUN 47 (s) * (BTOW (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3***		Other than left	10 bytes (word) to 5 words	
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave		Max
		↑	●	●	●	●	109	←					
Command format		Number of steps											
FUN 47 (s) * (BTOW (s) )		Condition			Steps								
		—			3								
Usable I/O		Bit				Word						Double word	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM	
s	Byte-unit data head I/O No.							○					Actual addresses are set in s and s + 1  s uses up to s + 2
s+1	Word-unit data head I/O No.							○					
s+2	No. of converted bytes							○					
Function		<div><div><div>Byte unit data</div><div><div><div><div>s</div><div>Byte-unit data head I/O No. a1</div></div><div><div>s + 1</div><div>Converted word-unit data head I/O No. a2</div></div><div><div>s + 2</div><div>No. n of converted bytes</div></div></div><div><div>a1</div><div>a1 + 1</div><div>a1 + n - 2</div><div>a1 + n - 1</div></div><div><div>15</div><div>8</div><div>7</div><div>0</div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div>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<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-29	Name	Byte right shift <sup>†</sup> (BYTE RIGHT SHIFT)																																																																																				
Ladder format		Condition code					Processing time (μs)						Remark																																																																										
FUN 48 (s) * (BSHR (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		Shift 10 char. by 1 byte																																																																										
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max																																																																											
		↑	●	●	●	●	81		←																																																																														
Command format		Number of steps																																																																																					
FUN 48 (s) * (BSHR (s) )		Condition			Steps		81		←																																																																														
		—			3																																																																																		
Usable I/O		Bit				Word				Double word			Constant	Other																																																																									
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM																																																																											
s	No. of shifted bytes							○						Address is set in s + 1. s uses up to s + 1.																																																																									
s+1	Shift data head I/O No.							○																																																																															
Function																																																																																							
<div><div><div><div>s</div><div>No. n of shifted bytes</div></div><div><div>s + 1</div><div>Shift data head I/O No. a</div></div></div><div><div><div>Before shift</div><div><table><tr><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td colspan="2">d1</td><td colspan="2">d2</td></tr><tr><td colspan="4">⋮</td></tr><tr><td colspan="2">dn-1</td><td colspan="2">dn</td></tr><tr><td colspan="2">dn + 1</td><td colspan="2">dn + 2</td></tr></table></div><div><div>After shift</div><div><table><tr><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td colspan="2">H00</td><td colspan="2">d1</td></tr><tr><td colspan="4">⋮</td></tr><tr><td colspan="2">dn-2</td><td colspan="2">dn-1</td></tr><tr><td colspan="2">dn</td><td colspan="2">dn + 2</td></tr></table></div></div><div><div>For even bytes</div><div>Not updated</div></div></div><div><div><div>Before conversion</div><div><table><tr><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td colspan="2">d1</td><td colspan="2">d2</td></tr><tr><td colspan="4">⋮</td></tr><tr><td colspan="2">dn</td><td colspan="2">dn + 1</td></tr></table></div><div><div>After conversion</div><div><table><tr><td>15</td><td>8</td><td>7</td><td>0</td></tr><tr><td colspan="2">H00</td><td colspan="2">d1</td></tr><tr><td colspan="4">⋮</td></tr><tr><td colspan="2">dn-1</td><td colspan="2">dn</td></tr></table></div></div><div><div>For odd bytes</div></div></div></div></div></div>																15	8	7	0	d1		d2		⋮				dn-1		dn		dn + 1		dn + 2		15	8	7	0	H00		d1		⋮				dn-2		dn-1		dn		dn + 2		15	8	7	0	d1		d2		⋮				dn		dn + 1		15	8	7	0	H00		d1		⋮				dn-1		dn	
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dn-1		dn																																																																																					
<div><div><div><div><div>• The data given by the number of bytes specified by argument s is shifted one byte to the right, beginning from the head I/O specified by argument s + 1.</div><div>• An H00 is inserted in an area that became empty after the shift. Note that the data after the specified number of bytes is lost by the shift operation.</div><div>• Use the ADRIO command to set the actual addresses in the head I/Os of s + 1.</div><div>• If the operation is performed normally, DER is set to “0.”</div></div><div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div></div></div>																																																																																							
Cautionary notes																																																																																							
<div><div><div><div>• The ADRIO command should be used to set the actual addresses in s + 1. If not, DER is set to “1” and no operation is performed.</div><div>• If s and s + 1 and the areas specified by them overlap, DER is set to “1” and no operation is performed.</div><div>• If s + 1 and the areas specified by s and s + 1 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</div></div></div></div>																																																																																							

<sup>†</sup>: Only the EH-CPU448 is supported.

Program example



Program description

Four bytes of transmission data is stored in WM100 and succeeding areas. Communication control code H02 (STX) is added to the head of this data.  
Execution results:

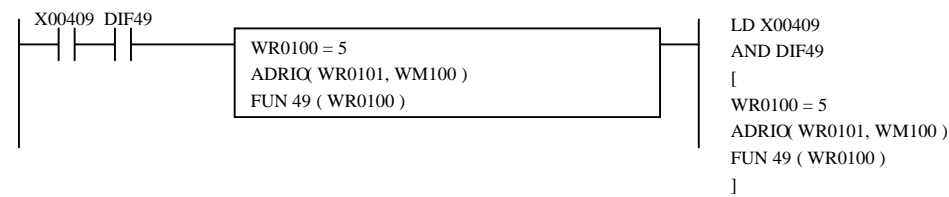
WM100	"T"	"E"			WM100	H02	"T"		
WM101	"X"	"T"			WM101	"E"	"X"		
WM102					WM102	"T"			

FUN 48 (s)

Item number	Fun commands-30	Name				Byte left shift † (BYTE LEFT SHIFT)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 49 (s) * (BSHL (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		10 char.		
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↕	●	●	●	●	85		←		<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div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<sup>†</sup>: Only the EH-CPU448 is supported.

Program example



Program description

Five bytes of data with control code is stored in WM100 and succeeding areas. The control code is deleted from this data so that it becomes a data string containing only data.  
Execution results:

WM100	H02	"T"		WM100	"T"	"E"
WM101	"E"	"X"		WM101	"X"	"T"
WM102	"T"			WM102	H00	

Item number	Fun commands-31	Name		Binary square root <sup>†</sup> (BINARY SQUAREROOT)										
Ladder format		Condition code					Processing time (μs)						Remark	
FUN 60 (s) * (BSQR (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
		↕	●	●	●	●								
Command format		Number of steps					453 ←							
FUN 60 (s) * (BSQR (s) )		Condition			Steps									
		—			3									
Usable I/O		Bit				Word				Double word			Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
s	Argument (lower)							○						
s+2	Argument (higher)							○						s uses up to s+2
Function														
<div><div><div>150</div><div>Square root</div><div>s + 2</div></div><div>←</div><div><div>3216150</div><div>HigherLower</div><div>s + 1s</div></div></div>														
<ul style="list-style-type: none"><li>• The square root of the 32-bit binary value specified by arguments s (lower) and s + 1 (higher) is calculated and stored in s + 2.</li><li>• If the operation is performed normally, DER is set to “0.”</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>														
Cautionary notes														
<ul style="list-style-type: none"><li>• If s + 1 to s + 2 exceed the maximum I/O number, DER is set to “1” and no operation is performed.</li></ul>														
Program example														
<div><div><div>X00600DIF60</div><div>DR0100 = H12345678 FUN 60 ( WR0100 )</div></div><div><div>LD X00600 AND DIF60 [ WR0000 = H12345678 FUN 60 ( WR0100 ) ]</div></div></div>														
Program description														
<ul style="list-style-type: none"><li>• Stores the 32-bit binary value H12345678 in WR0100 and WR0101.</li><li>• The conversion result is stored in WR0102.</li></ul> <p>Execution results: DR0100=H12345678, WR0102=H4444(17476)</p>														

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number		Fun commands-32		Name		Dynamic scan pulse command <sup>†</sup> (PULSE GENERATING FUNCTION)										
Ladder format				Condition code					Processing time (μs)					Remark		
FUN 61 (s) * (PGEN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
				↑	●	●	●	●	73	←						
Command format					Number of steps											
FUN 61 (s) * (PGEN (s) )					Condition			Steps								
					—			3								
Usable I/O		Bit				Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
s	No. of ON scan pulse							○								
s+1	No. of OFF scan pulse							○								
s+2	Pulse output I/O				○									Actual address is set		
s+3	System area													Cannot be used by the user		
s+4																

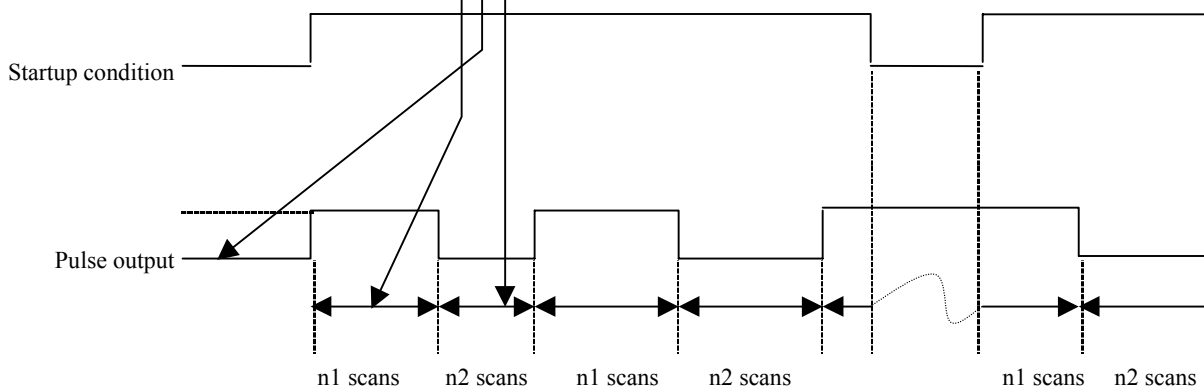
## Function

Table

s	n1 of ON scan pulse
s + 1	n2 of OFF scan pulse
s + 2	Pulse output I/O No. a
s + 3	ON scan progress value
s + 4	OFF scan progress value

Relationship between number of scans and pulse activation

Number of scans		Pulse activation
n1	n2	
n1 = 0	n2 = 0	Pulse output turns OFF.
	n2 ≥ 1	
n1 ≥ 1	n2 = 0	Pulse output turns ON.
	n2 ≥ 1	Pulse output turns ON for n1 scans and turns OFF for n2 scans.



- The following operation is repeated: Turns ON the bit internal output specified by argument s + 2 for the number of scans specified by argument s and turns it OFF for the number of scans specified by argument s + 1.
- If this command is executed several times within one scan, the internal bit output turns ON and OFF according to the number of executions.
- If both s and s + 1 are 0, the output stays OFF.
- If the startup condition turns OFF, the output as well as the progress values in s + 3 and s + 4 are retained.
- Both s + 3 and s + 4 should be cleared at initialization; otherwise the pulse width of the first cycle may change.
- Use the ADRIO command to store an actual address in the pulse output I/O. ADRIO (s + 2, bit internal output)
- If the operation is performed normally, DER is set to "0."

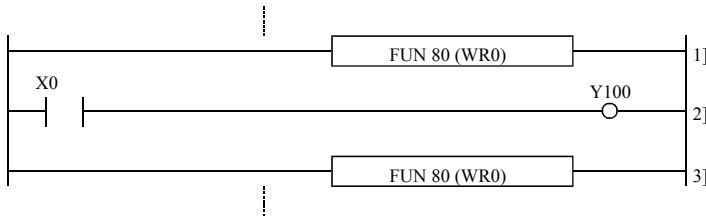
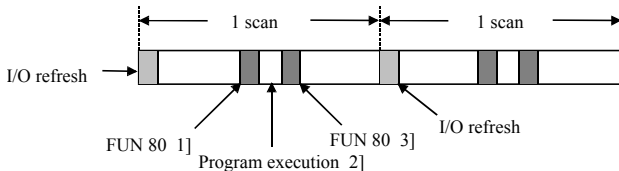
\* ( ) indicates the display when the LADDER EDITOR is used.

<sup>†</sup>: Only the EH-CPU448 is supported.

Cautionary notes

- The pulse activation may at most be delayed by one scan in relation to the pulse output startup condition. Note that if the startup condition changes from ON to OFF then to ON, the pulse width of that part may change by  $\pm$  one scan.
- Use the ADRIO command to store an actual address in the pulse output I/O of  $s + 2$ . If not, an error will occur and no operation will be performed
- If  $s + 1$  to  $s + 4$  and the areas specified by  $s + 2$  exceed the maximum I/O number, DER is set to “1” and no operation is performed.



Item number	Fun commands-33	Name				I/O refresh (All points)										
Ladder format		Condition code								Processing time (μs)						Remark
FUN 80 (s)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left					
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max				
		↕	●	●	●	●										
Command format		Number of steps								69	←	156	←	162	←	
FUN 80 (s)		Condition				Steps										
		—				3										
Usable I/O		Bit				Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
s	Argument (dummy)							○								
Function																
		<ul style="list-style-type: none"><li>This command performs I/O refresh of all data in the external I/Os (including link area) in the middle of a scan.</li></ul>														
Cautionary notes																
		<ul style="list-style-type: none"><li>This command performs I/O refresh of all external I/Os (including link area). If refresh of certain area is to be performed, use FUN81 or FUN82.</li><li>If the argument s exceeds the maximum I/O number, DER is equal to “1” and the command will not be processed.</li><li>Assign argument s as a one-word dummy. The I/O specified by argument s (WR, WL, WM) will not be affected.</li></ul>														
Program example																
																
Program description																
																

FUN 80 (s)

Item number		Fun commands-34		Name		I/O refresh (Input/output designation)											
Ladder format				Condition code						Processing time (μs)						Remark	
FUN 81 (s)				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↕	●	●	●	●									
Command format				Number of steps						44	←	94	←	104	←		
FUN 81 (s)				Condition			Steps										
				—			3										
Usable I/O			Bit				Word				Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
s	Type								○								
Function																	
s	Input type		H00: Input refresh (including remote) H01: Output refresh (including remote) H02: Link refresh  • Depending on the I/O type of the area specified by s, refresh is performed with respect to I/O modules only, output modules only or link area only. • Refresh is performed by each slot assignment according to the I/O assignment. • If the refresh processing is completed normally, DER is set to “0.”														
Cautionary notes																	
		• If the I/O type is other than H00, H01 or H02, DER is equal to “1” and the command will not be processed. • If the argument s exceeds the maximum I/O number, DER is set to “1” and the command will not be processed.															
Program example																	
		<div><div><div>R000</div><div>DIF0</div></div><div><div>WR0004 = 0</div><div>FUN 81 (WR0004 )</div></div></div> <div><div><div>R001</div><div>DIF1</div></div><div><div>WR0004 = 1</div><div>FUN 81 (WR0004 )</div></div></div>										<div>LD R000 AND DIF0 [ WR0004 = 0 FUN 81 (WR0004) ] LD R001 AND DIF1 [ WR0004 = 1 FUN 81 (WR0004) ]</div>					
Program description																	
		• Upon rising of R000, the input module is refreshed. • Upon rising of R001, the output module is refreshed.															

FUN 81 (s)

Item number	Fun commands-35	Name				I/O Refresh (Any slot)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 82 (s)		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↕	●	●	●	●									
Command format		Number of steps					80	←	142	←	201	←			
FUN 82 (s)		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word		Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
s	Number of points							○							
s+1 and beyond	Slot location number							○					Designate the slot location.		
Function															
		<div><div><div>s</div><div>Number of points to be refreshed</div></div><div><div>s+1</div><div>Refresh slot location number</div></div><div><div>s+2</div><div>Refresh slot location number</div></div><div><div>:</div><div>:</div></div><div><div>:</div><div>:</div></div><div><div>s+n</div><div>Refresh slot location number</div></div></div> <div><div>n ≤ 64</div><div>Refresh slot location number is designated by unit and slot number.</div></div>													
		<div><div><div><div><div>R000</div><div>DIF0</div></div><div></div><div><div>WR0000 = H0002</div><div>WR0001 = H0000</div><div>WR0002 = H0012</div><div>FUN 82 (WR0000)</div></div></div></div><div><div>LD R000</div><div>AND DIF0</div><div>[</div><div>WR0000 = H0002</div><div>WR0001 = H0000</div><div>WR0002 = H0012</div><div>FUN 82 (WR0000)</div><div>]</div></div></div>													
Program description		<div><div><div><div><div></div><div>Upon rising of R000, the two slots designated after WR0001 (unit 0, slot 0) and (unit 1, slot 2) are refreshed.</div></div></div></div></div>													

FUN 82 (s)

Cautionary notes

- Set the unit number (0 to 1) and slot number (0 to 7) after s+1. Setting any other value will equal DER to “1” and that slot will not be processed.
- If there is no I/O assignment to the designated slot, DER is equal to “1” and that slot will not be processed.
- If the number of s+n points exceeds the maximum I/O number, DER is equal to “1” and no processing is performed.
- If the number of points exceeds 64, DER is set to 1 and the points exceeding 64 will not be processed (refresh will be performed for up to 64 points).

Slot location number

The slot locations are designated using the unit number and slot number.

The unit number and slot number are set as follows in one word units:

b15	b12	b7	b3	b0
0 to 0	0 to 0	Unit number	Slot number	

Name	Floating-point operation (FUN100 to FUN118) cautionary notes
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The following describes some points of caution related to all the FUN commands (FUN100 to FUN 118) for performing floating-point operation. Data for the floating-point commands uses single-precision floating points conforming to IEEE754. The internal representation of IEEE754's single-precision floating-point numbers is explained below.

- Internal representation format of floating point

Single-precision floating-point numbers are expressed as 32-bit data in the following format.

Contents	Sign bit (S)	Exponent part (E)	Mantissa part (M)
Bit number	b <sub>31</sub>	b <sub>30</sub> b <sub>23</sub>	b <sub>22</sub> b <sub>0</sub>

The 32-bit data in the above table corresponds to internal outputs in the following manner. Examples of representation of internal output I/O numbers when WR100, WR101, and DR100 are used are shown in parentheses..

Word	Upper word (WR101)	Lower word (WR100)
Bit number	b <sub>15</sub> b <sub>0</sub>	b <sub>15</sub> b <sub>0</sub>
Double word	Double word (DR100)	
Bit number	b <sub>31</sub>	b <sub>0</sub>

(1) Sign Bit

Sign bit (S)	Contents
0	Real number
1	Negative number

(2) Exponent Part

Exponent part (E)	Two's exponential value (E')
FF	Indicates overflow value.
FE	127
↓	↓
80	1
7F	0
7E	-1
↓	↓
01	-126
00	Treated as 0.

(3) Mantissa Part

Mantissa part (M)	The value of mantissa part (M')
7FFFFFFF	(1.11 ... 11) <sub>2</sub>
7FFFFFFE	(1.11 ... 10) <sub>2</sub>
↓	↓
1	(1.00 ... 01) <sub>2</sub>
0	(1.00 ... 00) <sub>2</sub>

1 in the integer portion of M' in the above table does not appear in the format.

(4) Mathematical Expression

The floating-point number (F) can be expressed with the following formula using the sign bit (S), exponent part (E), and mantissa part (M) listed above.

$$(F) = (-1)^S \times (1 + M \times 2^{-23}) \times 2^{E-7FH} = (-1)^S \times M' \times 2^{E'}$$

- Range that can be expressed by floating-point numbers

Hexadecimal Expression		Floating Point Expression	Remark
Higher word	Lower word		
H7F7F	HFFFF	+3.402823 ... × 10 <sup>38</sup>	Maximum value
H0080	H0000	+1.175494 ... × 10 <sup>-38</sup>	The minimum absolute value of a positive number
↓	↓	↓	The value in this range is treated as 0.
H8080	H0000	-1.175494 ... × 10 <sup>-38</sup>	The minimum absolute value of a negative number
HFF7F	HFFF	-3.402823 ... × 10 <sup>38</sup>	Minimum value

- Example of setting in interval outputs

Interval output		Sign bit	Exponent part	Mantissa part	Floating point
Higher word	Lower word				
H3F80	H0000	0	7F	0	(1.00 ... 00) <sub>2</sub> × 2 <sup>7FH-7FH</sup> = 1.0
H4128	H0000	0	82	28	(1.0101000 ... 0) <sub>2</sub> × 2 <sup>82H-7FH</sup> = 10.5
HBF00	H0000	1	7E	0	(-1) × (1.00 ... 00) <sub>2</sub> × 2 <sup>7EH-7FH</sup> = -0.5
H3F00	H0000	0	7E	0	(1.00 ... 00) <sub>2</sub> × 2 <sup>7EH-7FH</sup> = 0.5

Item number	Fun commands-36	Name				Floating Point Operation † (Real to Integer (Word) Conversion)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 100 (s) * (INTW (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					57	←	104	←	107	←			
FUN 100 (s) * (INTW (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+2	
Function															
<div><div><div>15</div><div>s+2</div><div>0</div></div><div>Integer portion</div></div> <div>← INTW</div> <div><div><div>15</div><div>s+1</div><div>0</div></div><div>Real number portion</div></div> <div><div><div>15</div><div>s</div><div>0</div></div><div>Real number portion</div></div> <ul style="list-style-type: none"><li>Converts the real number specified by arguments s and s+1 to integer word data, then sets the result in s+2.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>															
Cautionary notes															
<ul style="list-style-type: none"><li>When the resulting integer value of the conversion of the real number specified in s and s+1 falls outside the range of −32,768 to 32,767, DER is set to "1" and s+2 does not change.</li><li>If s to s+2 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul>															
Program example															
<div><div><div>X00200</div><div>└─┴─┘</div></div><div>DR0100 = H46FFFE00 FUN100 (WR0100)</div></div> <div>LD X00200 [ DR0100 = H46FFFE00 FUN 100 (WR0100) ]</div>															
Program description															
<ul style="list-style-type: none"><li>At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is converted to an integer and the result is set in WR0102.</li></ul> <p>Internal output setting : WR0101 = H46FF, WR0100 = HFE00</p> <p>Operation result : WR0102 = H7FFF</p>															

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number		Fun commands-37		Name		Floating Point Operation † (Real to Integer (Double Word) Conversion)														
Ladder format				Condition code					Processing time (μs)						Remark					
FUN 101 (s) * (INTD (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				↑	●	●	●	●												
Command format				Number of steps					69		←		119		←		123		←	
FUN 101 (s) * (INTD (s) )				Condition			Steps													
				—			3													
Usable I/O				Bit				Word				Double word			Constant	Other				
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
s	Argument								○							s uses up to s+3				
Function																				
<div><div><div>s+3</div><div>15</div><div>0</div><div>Integer portion</div></div><div><div>s+2</div><div>15</div><div>0</div><div>Integer portion</div></div><div>← INTD</div><div><div>s+1</div><div>15</div><div>0</div><div>Real number portion</div></div><div><div>s</div><div>15</div><div>0</div><div>Real number portion</div></div></div>																				
<div><div>• Converts the real number specified by arguments s and s+1 to double word data, then sets the result in s+2 and s+3.</div><div>• If the calculation is completed normally, DER is equal to “0.”</div><div>• The floating point format conforms to IEEE754.</div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div>																				
Cautionary notes																				
<div><div>• When the resulting integer value of the conversion of the real number specified in s and s+1 falls outside the range of -2,147,483,648 to 2,147,483,647, DER is set to "1," and s+2 and s+3 do not change.</div><div>• If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</div></div>																				
Program example																				
<div><div><div>X00200</div><div><div>DR0100 = H4EFFFFFF</div><div>FUN101 (WR0100)</div></div></div><div><div>LD X00200</div><div>[</div><div>DR0100 = H4EFFFFFF</div><div>FUN 101 (WR0100)</div><div>]</div></div></div>																				
Program description																				
<div><div>• At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is converted to an integer and the result is set in DR0102 (WR0102, WR0103).</div><div>Internal output setting : WR0101 = H4EFF, WR0100 = HFFFF</div><div>Operation result : WR0103 = H7FFF, WR0102 = HFF80</div></div>																				

† : The EH-CPU104/208 are not supported.

Item number	Fun commands-38	Name		Floating Point Operation <sup>†</sup> (Integer (Word) to Real Number Conversion)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 102 (s) * (FLOAT (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					42	←	89	←	93	←			
FUN 102 (s) * (FLOAT (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+2	
Function															
<div><div><div><div>15</div><div>s+2</div><div>0</div></div><div><div>15</div><div>s+1</div><div>0</div></div></div><div><div>15</div><div>s</div><div>0</div></div></div> <div><div>Real number portion</div><div>Real number portion</div><div>← FLOAT</div><div>Integer portion</div></div> <div><ul style="list-style-type: none"><li>Converts the integer word data s to a real number, then sets the result in s+1 and s+2.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															
Cautionary notes															
<div><ul style="list-style-type: none"><li>An integer value in the range of −32,768 to 32,767 can be set for s and s+1.</li><li>If s to s+2 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul></div>															
Program example															
<div><div>X00200</div><div><div>WR0100 = H7FFF</div><div>FUN102 (WR0100)</div></div></div>		<div><div>LD X00200</div><div>[</div><div>DR0100 = H7FFF</div><div>FUN 102 (WR0100)</div><div>]</div></div>													
Program description															
<div><ul style="list-style-type: none"><li>At a rising edge of X0200, the integer specified in WR0100 is converted to a real number and the result is set in DR0101 (WR0101, WR0102).</li></ul><div>Internal output setting : WR0100 = H7FFF</div><div>Operation result : WR0102 = H46FF, WR0101 = HFE00</div></div>															

<sup>†</sup> : The EH-CPU104/208 are not supported.



Item number		Fun commands-39		Name		Floating Point Operation † (Integer (Double Word) to Real Number Conversion)											
Ladder format				Condition code						Processing time (μs)						Remark	
FUN 103 (s) * (FLOATD (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
				↑	●	●	●	●									
Command format				Number of steps						47	←	96	←	99	←		
FUN 103 (s) * (FLOATD (s) )				Condition			Steps										
				—			3										
Usable I/O				Bit				Word				Double word			Constant	Other	
				X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument								○						s uses up to s+3		
Function																	
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FLOATD</div><div><div>15s+1015s0</div><div>Integer portionInteger portion</div></div></div> <ul style="list-style-type: none"><li>Converts the integer double word data s and s+1 to a real number, then sets the result s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>An integer value in the range of −2,147,483,648 to 2,147,483,647 can be set for s and s+1.</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul>																	
Program example																	
<div><div><div>X00200</div><div>DR0100 = H00020001 FUN103 (WR0100)</div></div><div></div><div><div>LD X00200</div><div>[</div><div>DR0100 = H00020001</div><div>FUN 103 (WR0100)</div><div>]</div></div></div>																	
Program description																	
<ul style="list-style-type: none"><li>At a rising edge of X0200, the integer specified in DR0100 (WR0100, WR0101) is converted to a real number and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting: WR0101 = H0002, WR0100 = H0001</p> <p>Operation result: WR0103 = H4800, WR0102 = H0040</p>																	

<sup>†</sup>: The EH-CPU104/208 are not supported.

FUN 103 (s)

Item number	Fun commands-40	Name		Floating Point Operation <sup>†</sup> (Addition)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 104 (s) * (FADD (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					70	←	122	←	125	←			
FUN 104 (s) * (FADD (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word		Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
s	Argument							○					s uses up to s+5		
Function															
<div><div><div>15s+5015s+40</div><div>Real number portionReal number portion</div></div><div>← FADD</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div><div>+</div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div></div>															
<div><div><div><div>• Adds the real number (s+2, s+3) to the real number (s, s+1), then sets the result in (s+4, s+5).</div><div>• If the calculation is completed normally, DER is equal to “0.”</div><div>• The floating point format conforms to IEEE754.</div></div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div>															
Cautionary notes															
<div><div><div><div>• When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</div><div>• If s to s+5 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</div></div></div></div>															
Program example															
<div><div><div>X00200DIF0</div><div><div></div><div></div><div></div></div><div>DR0100 = H42C90000 DE0102 = H43488000 FUN104 (WR0100)</div></div></div>		<div><div>LDX00200</div><div>ANDDIF0</div><div>[</div><div>DR0100 = H42C90000</div><div>DR0102 = H43488000</div><div>FUN 104 (WR0100)</div><div>]</div></div>													
Program description															
<div><div><div><div>• At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is added to the real number specified in DR0102 (WR0102, WR0103), and the result is set in DR0104 (WR0104, WR0105).</div></div><div>Internal output setting :<div>WR0101 = H42C9, WR0100 = H0000</div><div>WR0103 = H4348, WR0102 = H8000</div></div><div>Operation result :<div>WR0105 = H4396, WR0104 = H8000</div></div></div></div>															

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-41	Name		Floating Point Operation † (Subtraction)											
Ladder format		Condition code						Processing time (μs)						Remark	
FUN 105 (s) * (FSUB (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps						70	←	121	←	125	←		
FUN 105 (s) * (FSUB (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+5	
Function															
<div><div><div><div>15</div><div>s+5</div><div>0</div></div><div><div>15</div><div>s+4</div><div>0</div></div></div><div>Real number portion</div><div>Real number portion</div></div> <div>← FSUB</div> <div><div><div><div>15</div><div>s+1</div><div>0</div></div><div><div>15</div><div>s</div><div>0</div></div></div><div>Real number portion</div><div>Real number portion</div></div> <div>—</div> <div><div><div><div>15</div><div>s+3</div><div>0</div></div><div><div>15</div><div>s+2</div><div>0</div></div></div><div>Real number portion</div><div>Real number portion</div></div>															
<div><div><div><div><div>•</div><div>Subtracts the real number (s+2, s+3) from the real number (s, s+1), then sets the result in (s+4, s+5).</div></div><div><div>•</div><div>If the calculation is completed normally, DER is equal to “0.”</div></div><div><div>•</div><div>The floating point format conforms to IEEE754.</div></div></div><div><div><div>•</div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div></div></div>															
Cautionary notes															
<div><div><div><div><div>•</div><div>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</div></div><div><div>•</div><div>If s to s+5 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</div></div></div></div></div>															
Program example															
<div><div><div><div><div><div>X00200</div><div>DIF0</div></div><div><div></div><div></div><div></div></div></div><div><div>DR0100 = H43488000</div><div>DE0102 = H42C90000</div><div>FUN105 (WR0100)</div></div></div><div><div>LD X00200</div><div>AND DIF0</div><div>[</div><div>DR0100 = H43488000</div><div>DR0102 = H42C90000</div><div>FUN 105 (WR0100)</div><div>]</div></div></div></div>															
Program description															
<div><div><div><div><div>•</div><div>At a rising edge of X0200, the real number specified in DR0102 (WR0102, WR0103) is subtracted from the real number specified in DR0100 (WR0100, WR0101), and the result is set in DR0104 (WR0104, WR0105).</div></div><div><div>Internal output setting :</div><div>WR0101 = H4348, WR0100 = H8000</div><div>WR0103 = H42C9, WR0102 = H0000</div><div>Operation result :</div><div>WR0105 = H42C8, WR0104 = H0000</div></div></div></div></div>															

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-42	Name		Floating Point Operation <sup>†</sup> (Multiplication)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 106 (s) * (FMUL (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					69	←	121	←	125	←			
FUN 106 (s) * (FMUL (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+5	
Function															
<div><div><div><div>15s+5015s+40</div><div>Real number portionReal number portion</div></div><div>← FMUL</div><div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div><div>×</div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div></div></div></div>															
<div><div><div><div><div>• Multiplies the real number (s, s+1) with the real number (s+2, s+3), then sets the result in (s+4, s+5).</div><div>• If the calculation is completed normally, DER is equal to “0.”</div><div>• The floating point format conforms to IEEE754.</div></div><div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div></div></div>															
Cautionary notes															
<div><div><div><div><div>• When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</div><div>• If s to s+5 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</div></div></div></div></div>															
Program example															
<div><div><div><div>X00200DIF0</div><div><div></div><div></div><div></div></div></div><div><div>DR0100 = H43488000</div><div>DE0102 = H42C90000</div><div>FUN106 (WR0100)</div></div></div></div>		<div><div>LDX00200</div><div>ANDDIF0</div><div>[</div><div>DR0100 = H43488000</div><div>DR0102 = H42C90000</div><div>FUN 106 (WR0100)</div><div>]</div></div>													
Program description															
<div><div><div><div><div>• At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is multiplied by the real number specified in DR0102 (WR0102, WR0103), and the result is set in DR0104 (WR0104, WR0105).</div></div></div><div><div>Internal output setting :</div><div>WR0101 = H4348, WR0100 = H8000</div><div>WR0103 = H42C9, WR0102 = H0000</div></div><div><div>Operation result :</div><div>WR0105 = H469D, WR0104 = H6C80</div></div></div></div>															

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-43	Name				Floating Point Operation † (Division)											
Ladder format		Condition code					Processing time (μs)						Remark				
FUN 107 (s) * (FDIV (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
		↕	●	●	●	●											
Command format		Number of steps					119	←	171	←	174	←					
FUN 107 (s) * (FDIV (s) )		Condition			Steps												
		—			3												
Usable I/O		Bit				Word				Double word			Constant	Other			
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
s	Argument							○						s uses up to s+5			
Function																	
		<div><div><div>15s+5015s+40</div><div>Real number portionReal number portion</div></div><div>← FDIV</div><div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div><div>/</div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div></div></div> <ul style="list-style-type: none"><li>Divides real number (s, s+1) by real number (s+2, s+3), then sets the result in (s+4, s+5).</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>															
Cautionary notes																	
		<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+5 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul>															
Program example																	
		<div><div><div>X00200DIF0</div><div></div></div><div></div><div>DR0100 = H43488000 DE0102 = H42C88000 FUN107 (WR0100)</div></div> <div>LD X00200 AND DIF0 [ DR0100 = H43488000 DR0102 = H42C88000 FUN 107 (WR0100) ]</div>															
Program description																	
		<ul style="list-style-type: none"><li>At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is divided by the real number specified in DR0102 (WR0102, WR0103), and the result is set in DR0104 (WR0104, WR0105).</li></ul> <p>Internal output setting : WR0101 = H4348, WR0100 = H8000 WR0103 = H42C8, WR0102 = H8000</p> <p>Operation result : WR0105 = H4000, WR0104 = H0000</p>															

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-44	Name				Floating Point Operation <sup>†</sup> (Angle to Radian Conversion)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 108 (s) * (FRAD (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					63	←	114	←	117	←			
FUN 108 (s) * (FRAD (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+3	
Function															
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FRAD</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <div>degrees × <math>\frac{\pi}{180}</math> = radian</div> <div><ul style="list-style-type: none"><li>Converts the angle units of the real number value specified in s and s+1 as the arguments to radian units, the sets the result the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul></div> <div>* ( ) indicates the display when the LADDER EDITOR is used.</div>															
Cautionary notes		<div><ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul></div>													
Program example		<div><div><div>X00200</div><div>DR0100 = H42C80000 FUN108 (WR0100)</div></div><div>LD X00200 [ DR0100 = H42C80000 FUN 108 (WR0100) ]</div></div>													
Program description		<div><ul style="list-style-type: none"><li>At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is converted to a radian and the result is set in DR0102 (WR0102, WR0103).</li></ul></div> <div>Internal output setting : WR0101 = H42C8, WR0100 = H0000</div> <div>Operation result : WR0103 = H3FDF, WR0102 = H66F3</div>													

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-45	Name		Floating Point Operation † (Radian to Angle Conversion)											
Ladder format		Condition code						Processing time (μs)						Remark	
FUN 109 (s) * (FDEG (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↕	●	●	●	●									
Command format		Number of steps						63 ← 114 ← 117 ←							
FUN 109 (s) * (FDEG (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+3	
Function															
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FDEG</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <div><math display="block">\text{radian} \times \frac{180}{\pi} = \text{degrees}</math></div> <div><ul style="list-style-type: none"><li>Converts the radian units of the real number value specified in s and s+1 as the arguments to angle units, then sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															
Cautionary notes		<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul>													
Program example		<div><div><div>X00200DIF0</div><div></div><div>DR0100 = H3FDF66F3 FUN109 (WR0100)</div></div><div><pre>LD X00200 AND DIF0 [ DR0100 = H3FDF66F3 FUN 109 (WR0100) ]</pre></div></div>													
Program description		<ul style="list-style-type: none"><li>At a rising edge of X0200, the real number specified in DR0100 (WR0100, WR0101) is converted to an angle and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting : WR0101 = H3FDF, WR0100 = H66F3</p> <p>Operation result : WR0103 = H42C8, WR0102 = H0000</p>													

† : The EH-CPU104/208 are not supported.

Item number	Fun commands-46	Name		Floating Point Operation <sup>†</sup> (SIN)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 110 (s) * (FSIN (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					281	←	354	←	358	←			
FUN 110 (s) * (FSIN (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+3	
Function															
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FSIN</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <div><ul style="list-style-type: none"><li>Calculates the sine value of the real number value in radian units specified in s and s+1 as the arguments, then sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>															
Cautionary notes															
<div><ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li><li>When the value of s, s+1 is greater than 1.414847550405688000e+16, the sine value cannot be calculated, thus DER is set to "1."</li><li>When the value of s, s+1 is greater than 2.981568260000000000e+08, a result is obtained but the accuracy decreases, so DER is set to "1."</li></ul></div>															
Program example															
<div><div><div><div>X00200DIF0</div><div></div></div><div></div><div><div>DR0100 = H3F060A92</div><div>FUN110 (WR0100)</div></div></div><div><div>LDX00200</div><div>ANDDIF0</div><div>[</div><div>DR0100 = H3F060A92</div><div>FUN110 (WR0100)</div><div>]</div></div></div>															
Program description															
<div><ul style="list-style-type: none"><li>At a rising edge of X0200, the SIN of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</li></ul><div>Internal output setting :WR0101 = H3F06, WR0100 = H0A92</div><div>Operation result :WR0103 = H3F00, WR0102 = H0000</div></div>															

<sup>†</sup>: The EH-CPU104/208 are not supported.



Item number	Fun commands-47	Name		Floating Point Operation <sup>†</sup> (COS)														
Ladder format		Condition code					Processing time (μs)						Remark					
FUN 111 (s) * (FCOS (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
		↑	●	●	●	●												
Command format		Number of steps					303		←		380		←		383		←	
FUN 111 (s) * (FCOS (s) )		Condition			Steps													
		—			3													
Usable I/O		Bit				Word				Double word			Constant	Other				
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
s	Argument							○							s uses up to s+3			
Function																		
		<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FCOS</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div>																
		<div><div><div><div>• Calculates the cosine value of the real number value in radian units specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</div><div>• If the calculation is completed normally, DER is equal to “0.”</div><div>• The floating point format conforms to IEEE754.</div><div>• * ( ) indicates the display when the LADDER EDITOR is used.</div></div></div></div>																
Cautionary notes																		
		<div><div><div><div>• When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</div><div>• If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</div><div>• When the value of s, s+1 is greater than 1.414847550405688000e+16, the cosine value cannot be calculated and DER is set to "1."</div><div>• When the value of s, s+1 is greater than 2.981568260000000000e+08, a result is obtained but the accuracy decreases, so DER is set to "1."</div></div></div></div>																
Program example																		
		<div><div><div><div>X00200DIF0</div><div></div></div><div></div><div>DR0100 = H3F060A92 FUN111 (WR0100)</div></div><div><div>LD X00200 AND DIF0 [ DR0100 = H3F060A92 FUN 111 (WR0100) ]</div></div></div>																
Program description																		
		<div><div><div><div>• At a rising edge of X0200, the cosine value of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</div></div></div><div><div>Internal output setting : WR0101 = H3F06, WR0100 = H0A92</div><div>Operation result : WR0103 = H3F5D, WR0102 = HB3D7</div></div></div>																

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-48	Name				Floating Point Operation <sup>†</sup> (TAN)											
Ladder format		Condition code					Processing time (μs)						Remark				
FUN 112 (s) * (FTAN (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
		↑	●	●	●	●											
Command format		Number of steps					343	←	414	←	417	←					
FUN 112 (s) * (FTAN (s) )		Condition			Steps												
		—			3												
Usable I/O		Bit				Word				Double word			Constant	Other			
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
s	Argument							○						s uses up to s+3			
Function																	
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FTAN</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <ul style="list-style-type: none"><li>Calculates the tangent value of the real number value in radian units specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																	
Cautionary notes																	
<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li><li>When the value of s, s+1 is greater than 1.414847550405688000e+16/2, the tangent value cannot be calculated and DER is set to "1."</li><li>When the value of s, s+1 is greater than 2.981568260000000000e+08/2, a result is obtained but the accuracy decreases, so DER is set to "1."</li></ul>																	
Program example																	
<div><div><div>X00200DIF0</div><div></div><div>DR0100 = H3F060A92 FUN112 (WR0100)</div></div><div><pre>LD    X00200 AND DIF0 [   DR0100 = H3F060A92   FUN 112 (WR0100) ]</pre></div></div>																	
Program description																	
<ul style="list-style-type: none"><li>At a rising edge of X0200, the tangent value of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting :   WR0101 = H3F06, WR0100 = H0A92</p> <p>Operation result :         WR0103 = H3F13, WR0102 = HCD3A</p>																	

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-49	Name				Floating Point Operation <sup>†</sup> (ARC SIN)											
Ladder format		Condition code								Processing time (μs)						Remark	
FUN 113 (s) * (FASIN (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
		↑	●	●	●	●											
Command format		Number of steps								200 ← 275 ← 278 ←							
FUN 113 (s) * (FASIN (s) )		Condition				Steps											
		—				3											
Usable I/O		Bit				Word				Double word			Constant	Other			
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
s	Argument							○						s uses up to s+3			
Function																	
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FASIN</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <ul style="list-style-type: none"><li>Calculates the SIN<sup>-1</sup> value of the real number value in radian units specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																	
Cautionary notes		<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li><li>When the value of s, s+1 is greater than 1, DER is set to "1."</li></ul>															
Program example		<div><div><div>X00200DIF0</div><div>DR0100 = H3F800000 FUN113 (WR0100)</div></div><div>LD X00200 AND DIF0 [ DR0100 = H3F800000 FUN 113 (WR0100) ]</div></div>															
Program description		<ul style="list-style-type: none"><li>At a rising edge of X0200, the SIN<sup>-1</sup> value of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting : WR0101 = H3F80, WR0100 = H0000</p> <p>Operation result : WR0103 = H3FC9, WR0102 = H0FDB</p>															

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-50	Name		Floating Point Operation <sup>†</sup> (ARC COS)											
Ladder format		Condition code						Processing time (μs)						Remark	
FUN 114 (s) * (FACOS (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps						191	←	266	←	269	←		
FUN 114 (s) * (FACOS (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+3	
Function															
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FACOS</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <ul style="list-style-type: none"><li>Calculates the COS<sup>-1</sup> value of the real number value in radian units specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>															
Cautionary notes															
<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li><li>When the value of s, s+1 is greater than 1, DER is set to "1."</li></ul>															
Program example															
<div><div><div>X00200DIF0</div><div></div><div></div></div><div>DR0100 = H3F800000 FUN114 (WR0100)</div></div>		<div>LDX00200 ANDDIF0 [ DR0100 = H3F800000 FUN 114 (WR0100) ]</div>													
Program description															
<ul style="list-style-type: none"><li>At a rising edge of X0200, the COS<sup>-1</sup> value of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting : WR0101 = H3F80, WR0100 = H0000</p> <p>Operation result : WR0103 = H0000, WR0102 = H0000</p>															

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number		Fun commands-51		Name		Floating Point Operation <sup>†</sup> (ARC TAN)														
Ladder format				Condition code					Processing time (μs)					Remark						
FUN 115 (s) * (FATAN (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				↑	●	●	●	●												
Command format				Number of steps					394		←		463		←		466		←	
FUN 115 (s) * (FATAN (s) )				Condition			Steps													
				—			3													
Usable I/O			Bit				Word			Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY					DR, DL, DM			
s	Argument								○						s uses up to s+3					
Function																				
<div><div><div>15</div><div>s+3</div><div>0</div><div>15</div><div>s+2</div><div>0</div></div><div>Real number portion</div></div> <div>← FATAN</div> <div><div><div>15</div><div>s+1</div><div>0</div><div>15</div><div>s</div><div>0</div></div><div>Real number portion</div></div> <div>Real number portion</div> <div><ul style="list-style-type: none"><li>Calculates the TAN<sup>-1</sup> value of the real number value in radian units specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul><p>* ( ) indicates the display when the LADDER EDITOR is used.</p></div>																				
Cautionary notes																				
<div><ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li></ul></div>																				
Program example																				
<div><div><div><div>X00200</div><div>DIF0</div></div><div><div>DR0100 = HC0000000</div><div>FUN115 (WR0100)</div></div></div><div><div>LD X00200</div><div>AND DIF0</div><div>[</div><div>DR0100 = HC0000000</div><div>FUN 115 (WR0100)</div><div>]</div></div></div>																				
Program description																				
<div><ul style="list-style-type: none"><li>At a rising edge of X0200, the TAN<sup>-1</sup> value of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</li></ul><p>Internal output setting : WR0101 = HC000, WR0100 = H0000</p><p>Operation result : WR0103 = HBF8D, WR0102 = HB70D</p></div>																				

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-52	Name		Floating Point Operation <sup>†</sup> (Square Root)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 116 (s) * (FSQR (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					481	←	553	←	556	←			
FUN 116 (s) * (FSQR (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○						s uses up to s+3	
Function															
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FSQR</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <div><div><div>• Calculates the square root using the real number value specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</div><div>• If the calculation is completed normally, DER is equal to “0.”</div><div>• The floating point format conforms to IEEE754.</div><div>* ( ) indicates the display when the LADDER EDITOR is used.</div></div></div>															
Cautionary notes															
<div><div><div>• When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</div><div>• If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</div><div>• When the value of s, s+1 is lower than 0, the value cannot be calculated and DER is set to "1."</div></div></div>															
Program example															
<div><div><div>X00200DIF0</div><div>DR0100 = H40000000 FUN116 (WR0100)</div></div></div>		<div><div>LDX00200 ANDDIF0 [ DR0100 = H40000000 FUN 116 (WR0100) ]</div></div>													
Program description															
<div><div><div>• At a rising edge of X0200, the square root of the real number specified in DR0100 (WR0100, WR0101) is calculated and the result is set in DR0102 (WR0102, WR0103).</div><div>Internal output setting :WR0101 = H4000, WR0100 = H0000</div><div>Operation result :WR0103 = H3FB5, WR0102 = H04F3</div></div></div>															

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-53	Name		Floating Point Operation <sup>†</sup> (Exponent)														
Ladder format		Condition code					Processing time (μs)						Remark					
FUN 117 (s) * (FEXP (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
		↑	●	●	●	●												
Command format		Number of steps					329		←		395		←		399		←	
FUN 117 (s) * (FEXP (s) )		Condition			Steps													
		—			3													
Usable I/O		Bit				Word				Double word			Constant	Other				
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
s	Argument							○							s uses up to s+3			
Function																		
<div><div><div>15s+3015s+20</div><div>Real number portionReal number portion</div></div><div>← FEXP</div><div><div>15s+1015s0</div><div>Real number portionReal number portion</div></div></div> <ul style="list-style-type: none"><li>Performs an exponent operation using the real number value specified in s and s+1 as the arguments, the sets the result in s+2 and s+3.</li><li>An exponent operation is performed using 2.71828 as the base (e).</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																		
Cautionary notes																		
<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li><li>Calculation cannot be performed when the value of s, s+1 is lower than −7.0839639e+02. In this case, DER is set to "1."</li></ul>																		
Program example																		
<div><div><div>X00200DIF0</div><div></div><div>DR0100 = H40000000 FUN117 (WR0100)</div></div><div><pre>LD X00200 AND DIF0 [ DR0100 = H40000000 FUN 117 (WR0100) ]</pre></div></div>																		
Program description																		
<ul style="list-style-type: none"><li>At a rising edge of X0200, an exponent operation of the real number specified in DR0100 (WR0100, WR0101) is performed and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting : WR0101 = H4000, WR0100 = H0000</p> <p>Operation result : WR0103 = H40EC, WR0102 = H7326</p>																		

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-54	Name				Floating Point Operation † (Natural Logarithm)												
Ladder format		Condition code					Processing time (μs)						Remark					
FUN 118 (s) * (FLOG (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
		↑	●	●	●	●												
Command format		Number of steps					187		←		254		←		257		←	
FUN 118 (s) * (FLOG (s) )		Condition			Steps													
		—			3													
Usable I/O		Bit				Word				Double word			Constant	Other				
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM						
s	Argument							○						s uses up to s+3				
Function																		
		<div><div><div>15</div><div>s+3</div><div>0</div><div>15</div><div>s+2</div><div>0</div></div><div>Real number portion</div><div>Real number portion</div></div> <div>← FLOG</div> <div><div><div>15</div><div>s+1</div><div>0</div><div>15</div><div>s</div><div>0</div></div><div>Real number portion</div><div>Real number portion</div></div> <ul style="list-style-type: none"><li>Performs a logarithm operation for the real number value specified by arguments s and s+1 using the natural logarithm (e) as the base, then sets the result in s+2 and s+3.</li><li>If the calculation is completed normally, DER is equal to “0.”</li><li>The floating point format conforms to IEEE754.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																
Cautionary notes																		
		<ul style="list-style-type: none"><li>When the operation result is not within the range of −1e+37 to 1e+37, DER is set to "1."</li><li>If s to s+3 exceeds the maximum value of the I/O number, DER is set to "1" and no operation is performed.</li><li>Calculation cannot be performed when the value of s, s+1 is lower than or equal to 0. In this case, DER is set to "1."</li></ul>																
Program example																		
		<div><div><div>X00200</div><div>DIF0</div></div><div>DR0100 = H3F000000 FUN118 (WR0100)</div></div> <div>LD X00200 AND DIF0 [ DR0100 = H3F000000 FUN 118 (WR0100) ]</div>																
Program description																		
		<ul style="list-style-type: none"><li>At a rising edge of X0200, the logarithm operation of the real number specified in DR0100 (WR0100, WR0101) is performed and the result is set in DR0102 (WR0102, WR0103).</li></ul> <p>Internal output setting : WR0101 = H3F00, WR0100 = H0000</p> <p>Operation result : WR0103 = HBF31, WR0102 = H7218</p>																

† : The EH-CPU104/208 are not supported.



Item number	Fun commands-55	Name				Index setting <sup>†</sup> (argument d)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 120 (s) * (INDXD (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	●									
Command format		Number of steps					18	←							
FUN 120 (s) * (INDXD (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DN, DM			
s	Index I/O No.							○							
Function															
		<ul style="list-style-type: none"><li>Sets the argument used as an index in respect to argument d of the MOV and COPY commands.</li></ul>													
Cautionary notes															
		<ul style="list-style-type: none"><li>The I/O value specified in the Index Area will be initialized to “0.”</li><li>Index qualification will be performed to both the MOV and COPY commands.</li><li>This does not check for duplicate index numbers.</li></ul>													
Program example															
		<div><div><div>X00200</div><div>┌───┐</div><div>FUN 120 (WR0100)</div></div><div>X00200</div><div>┌───┐</div><div>COPY(WR0200, H2020, 255) FUN 123 (WR0100)</div></div> <div>Sets the WR0100 as an index in respect to argument d.</div> <div>Performs copy processing after the index (WR0100) is added in respect to argument d of the COPY command (WR0200). After the COPY command is executed, the index will be updated (+1) (FUN 123).</div>													

<sup>†</sup>: Only the EH-CPU448 is supported.

FUN 120 (s)

Item number	Fun commands-56	Name				Index setting <sup>†</sup> (argument s)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 121 (s) * (INDXS (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		●	●	●	●	●									
Command format		Number of steps					18	←							
FUN 121 (s) * (INDXS (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DN, DM			
s	Index I/O No.							○							
Function															
		<ul style="list-style-type: none"><li>Sets the argument used as an index in respect to argument s of the MOV and COPY commands.</li></ul>													
Cautionary notes															
		<ul style="list-style-type: none"><li>The I/O value specified in the Index Area will be initialized to “0.”</li><li>Index qualification will be performed to both the MOV and COPY commands.</li><li>This does not check for duplicate index numbers.</li></ul>													
Program example															
		<div><div><div>X00200</div><div> </div><div> </div><div>FUN 120 (WR0100) FUN 121 (WR0101)</div></div><div><div>X00200</div><div>↗</div><div>↘</div><div>COPY(WR0200, WM100, 255) FUN 123 (WR0100) FUN 123 (WR0101)</div></div></div> <div><div>Sets WR0100 as an index in respect to argument d and sets WR0101 as an index in respect to argument s.</div><div>Adds an index (WR0100) in respect to argument d (WR0200) of the COPY command. Then adds an index (WR0101) in respect to argument s (WM100). After the COPY command is executed, the index will be updated (+1) (FUN 123).</div></div>													

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number		Fun commands-57		Name		Index cancel <sup>†</sup>										
Ladder format				Condition code					Processing time (μs)						Remark	
FUN 122 (s) * (INDXC (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
				↑	●	●	●	●								
Command format				Number of steps					18	←						
FUN 122 (s) * (INDXC (s) )				Condition			Steps									
				—			3									
Usable I/O			Bit				Word			Double word			Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DN, DM	
s	Index I/O No.								○							
Function																
				<ul style="list-style-type: none"><li>• Cancels the index specification that is set for argument d or s of the MOV and COPY commands.</li><li>• Sets the I/O number specified by FUN 120 or FUN 121 to s.</li></ul>												
Cautionary notes																
				<ul style="list-style-type: none"><li>• Cancels the index specification for argument d or s in respect to both the MOV and COPY commands.</li><li>• If the I/O number set in s is not specified as an index, DER will be equal to “1” and no processing will be performed.</li></ul>												
Program example																
<div><div><div>X00200</div><div><div></div><div></div></div></div><div>FUN 122 (WR0100)</div><div>Cancels the index specification with which WR0100 is set as an index.</div></div>																

<sup>†</sup>: Only the EH-CPU448 is supported.

FUN 122 (s)

Item number	Fun commands-58	Name				Increment † (INC)										
Ladder format		Condition code								Processing time (μs)						Remark
FUN 123 (s) * (INC (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left					
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max				
		●	●	●	●	●										
Command format		Number of steps								29	←	74	←	77	←	
FUN 123 (s) * (INC (s) )		Condition				Steps										
		—				3										
Usable I/O		Bit				Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM				
s	Argument							O								
Function																
		<ul style="list-style-type: none"><li>• Increments the word I/O specified in WR, WL, WM by 1 (+1).</li><li>* ( ) indicates the display when the LADDER EDITOR is used.</li></ul>														
Cautionary notes																
		<ul style="list-style-type: none"><li>• When FFFFH is increased by 1 (+1), the result will be 0000H.</li></ul>														
Program example																
		<div><div><div>X00200</div><div>DIF0</div><div></div><div>WR0100 = H0000</div></div><div><div>X00200</div><div>DIF1</div><div></div><div>FUN 123 (WR0100)</div></div></div> <div><div>LD X00200</div><div>AND DIF0</div><div>[</div><div>WR0100 = H0000</div><div>]</div><div>LD X00200</div><div>AND DIF1</div><div>[</div><div>FUN 123 (WR0100)</div><div>]</div></div>														
Program description																
		<ul style="list-style-type: none"><li>• At a rising edge of X0200, the WR0100 is incremented by 1 (+1).</li></ul> <div>Internal output setting : WR0100 = H0000</div> <div>Operation result : WR0100 = H0001</div>														

Item number		Fun commands-59		Name		Double Word Increment <sup>†</sup> (INCD)															
Ladder format				Condition code						Processing time (μs)						Remark					
FUN 124 (s) * (INCD (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				↑	●	●	●	●													
Command format				Number of steps						42		←		91		←		94		←	
FUN 124 (s) * (INCD (s) )				Condition			Steps														
				—			3														
Usable I/O			Bit				Word				Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM								
s	Argument									○						s uses up to s+1					
Function																					
<ul style="list-style-type: none"><li>Replaces the specified I/O in WR, WL or WM with the double word I/O in DR, DL or DM, and increments the double word I/O by 1 (+1).</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																					
Cautionary notes																					
<ul style="list-style-type: none"><li>When the area specified by s exceeds the maximum value of I/O number, DER is set to "1" and no operation is performed.</li><li>When FFFFFFFFH is increased by 1 (+1), the result will be 00000000H.</li></ul>																					
Program example																					
<div><div><div>X00200</div><div>DIF0</div><div>DR0100 = H00000000</div></div><div><div>X00200</div><div>DIF1</div><div>FUN 124 (WR0100)</div></div></div>										<pre>LD X00200 AND DIF0 [ DR0100 = H00000000 ]  LD X00200 AND DIF1 [ FUN 124 (WR0100) ]</pre>											
Program description																					
<ul style="list-style-type: none"><li>At a rising edge of X0200, the DR0100 is incremented by 1 (+1).</li></ul> <p>Internal output setting : DR0100 = H00000000</p> <p>Operation result : DR0100 = H00000001</p>																					

<sup>†</sup> : The EH-CPU104/208 are not supported.

Item number	Fun commands-60	Name				Decrement <sup>†</sup> (DEC)											
Ladder format		Condition code					Processing time (μs)						Remark				
FUN 125 (s) * (DEC (s))		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left						
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max					
		●	●	●	●	●											
Command format		Number of steps					30	←	73	←	77	←					
FUN 125 (s) * (DEC (s))		Condition			Steps												
		—			3												
Usable I/O		Bit				Word				Double word			Constant	Other			
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM					
s	Argument							○									
Function																	
		<ul style="list-style-type: none"><li>Decrements the word I/O specified in WR, WL or WM by 1 (−1).</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>															
Cautionary notes																	
		<ul style="list-style-type: none"><li>When 0000H is decreased by 1 (−1), the result will be FFFFH.</li></ul>															
Program example																	
		<div><div><div>X00200DIF0</div><div>— — —</div><div>WR0100 = HFFFF</div></div><div><div>X00200DIF1</div><div>— — —</div><div>FUN 125 (WR0100)</div></div></div> <div><pre>LD X00200 AND DIF0 [   WR0100 = HFFFF ]  LD X00200 AND DIF1 [   FUN 125 (WR0100) ]</pre></div>															
Program description																	
		<ul style="list-style-type: none"><li>At a rising edge of X0200, the WR0100 is decremented by 1 (−1).</li></ul> <p>Internal output setting : WR0100 = HFFFF</p> <p>Operation result : WR0100 = HFFFE</p>															

<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number		Fun commands-61		Name		Double Word Decrement † (DECD)															
Ladder format				Condition code						Processing time (μs)						Remark					
FUN 126 (s) * (DECD (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
				↑	●	●	●	●													
Command format				Number of steps						41		←		91		←		94		←	
FUN 126 (s) * (DECD (s) )				Condition			Steps														
				—			3														
Usable I/O			Bit				Word				Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM								
s	Argument									○							s uses up to s+1				
Function																					
<ul style="list-style-type: none"><li>Replaces the specified I/O in WR, WL or WM with the double word I/O in DR, DL or DM, and decrements the double word I/O by 1 (–1).</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p>																					
Cautionary notes																					
<ul style="list-style-type: none"><li>When the area specified by s exceeds the maximum value of I/O number, DER is set to "1" and no operation is performed.</li><li>When 00000000H is decreased by 1 (–1), the result will be FFFFFFFFH.</li></ul>																					
Program example																					
<div><div><div>X00200</div><div>DIF0</div><div>DR0100 = HFFFFFFF</div></div><div><div>X00200</div><div>DIF1</div><div>FUN 126 (WR0100)</div></div></div>				<div>LD X00200 AND DIF0 [ WR0100 = HFFFFFFF ]  LD X00200 AND DIF1 [ FUN 126 (WR0100) ]</div>																	
Program description																					
<ul style="list-style-type: none"><li>At a rising edge of X0200, the DR0100 is decremented by 1 (–1).</li></ul> <p>Internal output setting : DR0100 = HFFFFFFF</p> <p>Operation result : DR0100 = HFFFFFFFE</p>																					

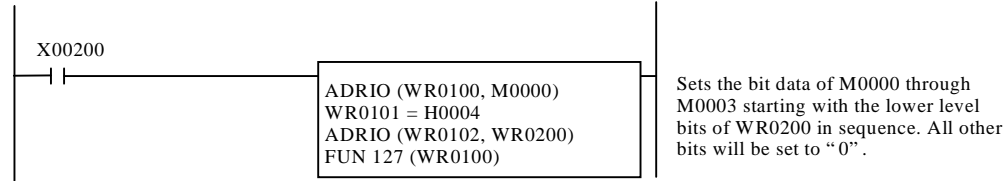
<sup>†</sup>: The EH-CPU104/208 are not supported.

Item number	Fun commands-62	Name	Expand bit data to word data †										
Ladder format		Condition code					Processing time (μs)						Remark
FUN 127 (s) * (BITTOW (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
		↑	●	●	●	●	139	←					
Command format		Number of steps											
FUN 127 (s) * (BITTOW (s) )		Condition			Steps								
		—			3								
Usable I/O		Bit				Word				Double word		Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY		
s	Bit header I/O No.							○					Specify with actual address (Note)
s+1	No. of bits							○					0 to 16
s+2	Word I/O No.							○					Specify with actual address (Note)
Function													
<div><div><div><div>s</div><div>Bit header I/O No.</div></div><div><div>s+1</div><div>No. of bits</div></div><div><div>s+2</div><div>Word I/O No.</div></div></div><div><div><div><div>b15</div><div>~</div><div>b4</div><div>b3</div><div>b2</div><div>b1</div><div>b0</div></div><div><div>0</div><div>~</div><div>0</div><div>d</div><div>c</div><div>b</div><div>a</div></div></div><div><div><div><div>a</div><div>b</div><div>c</div><div>d</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div></div><div><div><div><d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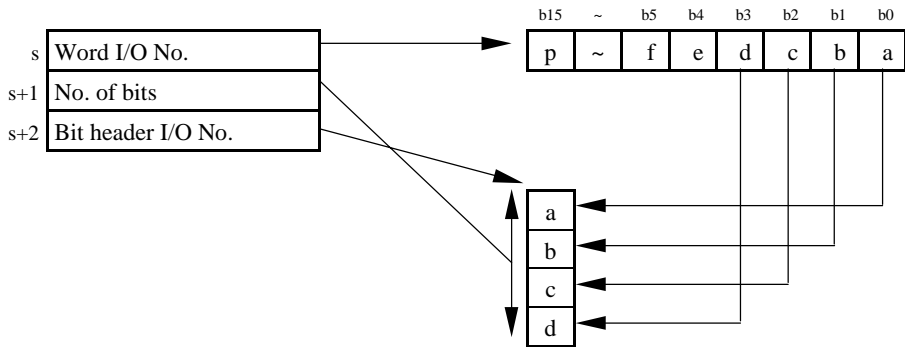
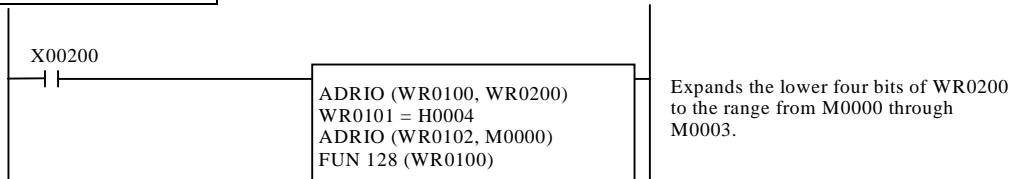
<sup>†</sup>: Only the EH-CPU448 is supported.



Program example



FUN 127 (s)

Item number	Fun commands-63	Name		Compress word data to bit data †									
Ladder format		Condition code					Processing time (μs)					Remark	
FUN 128 (s) * (WTOBIT (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left		
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max	
		↑	●	●	●	●	145	←					
Command format		Number of steps											
FUN 128 (s) * (WTOBIT (s) )		Condition			Steps		145	←					
		—			3								
Usable I/O		Bit				Word				Double word		Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY		
s	Word I/O No.							○					Specify with actual address (Note)
s+1	No. of bits							○					0 to 16
s+2	Bit header I/O No.							○					Specify with actual address (Note)
Function													
<div>• Sets the specified number of bits (s + 1), from the lowest bit of the I/O (s) specified by the word I/O number, in the area starting with the specified header I/O number (s + 2).</div> <div></div>													
Cautionary notes													
<div>• Set the actual I/O addresses using the ADRIO command for the s and s + 2 parameters. If the actual addresses are not specified, DER will be equal to “1” and no processing will be performed.</div> <div>• If s through s + 2 or the areas specified by them overlap, DER will be equal to “1” and no processing will be performed.</div> <div>• If s through s + 2 exceed the maximum value of the I/O number, DER will be equal to “1” and no processing will be performed..</div> <div>• If the areas specified by s through s + 2 exceed the maximum I/O number, the data will be expanded within the specified area range, but DER will be equal to “1”.</div> <div>• If the number of bits (s + 1) exceeds 16, DER will be equal to “1” and no processing will be performed.</div> <div>• If the number of bits (s + 1) is 0, no processing will be performed. DER will be equal to “1”.</div>													
Program example													
<div></div>													

<sup>†</sup>: Only the EH-CPU448 is supported.

Item number	Fun commands-64	Name	Extended X/Y area read/write command <sup>†</sup> (XY AREA READ/WRITE COMMAND)											
Ladder format		Condition code					Processing time (μs)						Remark	
FUN 200 (s) * (XYR/W (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left			
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max		
		↑	●	●	●	●	65	337						
Command format		Number of steps												
FUN 200 (s) * (XYR/W (s) )		Condition			Steps									
		—			3									
Usable I/O		Bit				Word			Double word				Constant	Other
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM		
s	Header of parameter area							○					s uses up to s+7	
Function														
<div><ul style="list-style-type: none"><li>• This command reads and writes data between the CPU and a module using the extended X and Y areas.</li><li>• The maximum read and write data sizes are determined by the number of module's I/O assignment points. For details on using this command, refer to the applicable module manual.</li><li>• By specifying the control type, the read/write method by performing or not performing handshaking with the module can be selected. However, in order to use the read/write method by performing handshaking, the module side must support handshaking. For more details, refer to the applicable module manual.</li><li>• s sets the head I/O number of the parameter area that sets various data read/write parameters.</li></ul><div>* The values displayed inside parenthesis ( ) show the display when LADDER EDITOR is used.</div></div>														
<div><div><div>Extended X area</div><div>Extended Y area</div></div><div>WR, WL, and WM areas</div><div><div>Read</div><div>Read</div><div>Write</div></div></div>														

<sup>†</sup> : Only the EH-CPU448 is supported.

Description of S parameter area

s+0	1] Error code
s+1	2] System area
s+2	(not available to user)
s+3	3] Control type
s+4	4] Header of target area
s+5	5] Read/write control bit I/O No.
s+6	6] Transfer source (destination) header I/O No.
s+7	7] Size

- [1] Error code:  
The result of FUN 200 command execution is set.  
Normal end → = 0  
Abnormal end → ≠ 0
- [2] System area:  
This is used by the system processes of the FUN 200 command when the FUN 200 command is executed. This area cannot be used by the user.
- [3] Control type  
Specifies the control type.  
H0001: Read request from the X area (with handshaking)  
H0002: Read request from the X area (without handshaking)  
H0003: Write request to the Y area (with handshaking)  
H0004: Forced write request to the Y area (without handshaking)  
H0005: Forced read request from the Y area (without handshaking)
- [4] Header of target area:

b15	b11	b7	b0
Unit No.	Slot No.	Word location	

- Sets the unit number (0 to 7)  
Sets the slot number (0 to 7)  
Sets the word location (from 0) \*1
- [5] Read/write control bit I/O number:  
Sets the actual addresses of R, L, and M in the read/write control bit I/O number using the ADRIO command.
- [6] Transfer source (destination) header I/O number:  
Sets the actual addresses of WR, WL, and WM in the transfer source (destination) header I/O number using the ADRIO command.
- [7] Size:  
Sets the size to be read or written (from 1) in word units. \*1

Description of read/write control bit table

+0	1] Execute flag
+1	2] Normal end flag
+2	3] Abnormal end flag

\* Description of borders

User setting area
User write prohibited area

- 1] Execution flag:  
Set to "1" using a user program when performing read or write operation using the FUN 200 command. When the read or write operation is complete, the FUN 200 command resets this to "0".
- 2] Normal end flag:  
Set to "1" when read or write operation by the FUN 200 command is normally completed. When read or write operation is started, the FUN 200 command resets this to "0".
- 3] Abnormal end flag:  
Set to "1" when read or write operation by the FUN 200 command is abnormally completed. When read or write operation is started, the FUN 200 command resets this to "0".

\*1 The ranges in which the word location and size can be specified will differ depending on assignment. The equation for calculating the ranges of the word location and size is as follows.  
Size = 3Fh – Number of input points – Number of output points

(Example) If assignment is 4W/4W,  
3Fh – 4 – 4 = 37h  
The word location range is 00h through 36h.  
The size range is 0001h through 0037h.

Cautionary notes

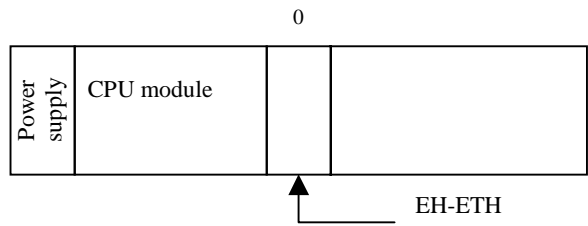
- When an error is generated, an error code is set, DER will be equal to “1,” and no processing will be performed.
- If the specified size is 0, the process will end normally with performing anything.
- Execute using only normal scan without entering any startup conditions.

For more information on the error codes that can be set, see the Error Code Details.

Program example

In this program example, a program performs information settings on the Ethernet module (EH-ETH) by writing to the Y area. After the information is set normally, the program reads the information settings of the Ethernet module (EH-ETH) by reading the X area.

(1) EH-ETH installation



The EH-ETH is installed in the “0” slot of the basic base. Therefore, the I/O assignment of the EH-ETH will be WX0000, WY0001.

(2) Internal output assignments

A sample program will be created using the assignments shown below. Change the I/O number, etc. according to the application in an actual usage.

I/O	NO.	Usage
WR	0000 to 0007	FUN 200 command (Y area writing) Parameter area (S to S + 7)
M	0000 to 0002	FUN 200 command (Y area writing) Control bit table
WM	100 to 117	Transfer source data area (24 words)
WR	0010 to 0017	FUN 200 command (X area reading) Parameter area (S to S + 7)
M	0010 to 0012	FUN 200 command (X area reading) Control bit table
WM	120 to 137	Transfer source data area (24 words)
R	100 101	Execution request (FUN 200 execution Y area writing) Execution request (FUN 200 execution X area reading)

## Program example

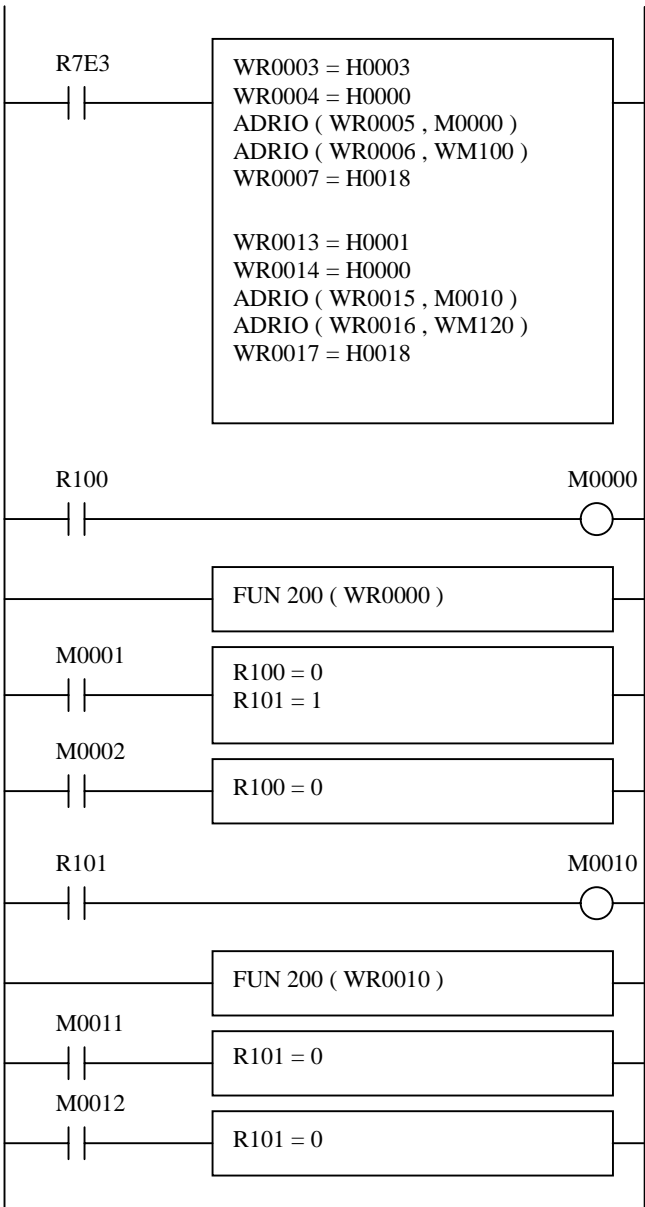
## (3) Data passed from the CPU to the EH-ETH

Using the following program example, the data to be set in the transfer source data area that will be passed from the CPU to the EH-ETH is described.

For more details, see the EH-ETH manual.

I/O NO.	Data	Description	Remark
WM100	HC000	Higher IP address	192.000
WM101	H0000	Lower IP address	000.000
WM102	HFFFF	Higher subnet mask address	255.255
WM103	HFF00	Lower subnet mask address	255.000
WM104	HC000	Higher IP address for sending and receiving tests	192.000
WM105	H00FF	Lower IP address for sending and receiving tests	000.255
WM106	H0FA0	Port number for sending and receiving tests	4000
WM107	H0000	Higher gateway address 1	000.000
WM108	H0000	Lower gateway address 1	000.000
WM109	H0000	Higher gateway address 2	000.000
WM10A	H0000	Lower gateway address 2	000.000
WM10B	H0000	Higher gateway address 3	000.000
WM10C	H0000	Lower gateway address 3	000.000
WM10D	H0000	Higher gateway address 4	000.000
WM10E	H0000	Lower gateway address 4	000.000
WM10F	H0BBC	Task code 1 port number	3004
WM110	H0001	Task code 1 communication protocol	TCP/IP
WM111	H0BBD	Task code 2 port number	3005
WM112	H0001	Task code 2 communication protocol	TCP/IP
WM113	H0BBE	Task code 3 port number	3006
WM114	H0001	Task code 3 communication protocol	TCP/IP
WM115	H0BBF	Task code 4 port number	3007
WM116	H0001	Task code 4 communication protocol	TCP/IP
WM117	H0000	Task code timeout	No timeout check

Program example



Perform parameter area initialization settings with 1 scan execution on.  
Write request to the Y area  
Set M0000 in the read control bit I/O number from unit number 0, slot number 0, word location word 0.  
Set WM100 in the transfer source header I/O number.  
Set the read size to 24 words.

Read request from the X area  
Set M0010 in the read control bit I/O number from unit number 0, slot number 0, word location word 0.  
Set WM120 in the transfer source header I/O number.  
Set the read size to 24 words.

Start reading when the execution flag M0000 turns on  
Contact point R100 turns off when the normal end flag M0001 turns on.  
Contact point R101 turns on when the normal end flag M0001 turns on.  
Contact point R100 turns off when the abnormal end flag M0002 turns on.

After writing to the Y area is completed normally, start reading from the X area.

Start reading when the execution flag M0010 turns on.

Contact point R101 turns on when the normal end flag M0011 turns on.

Contact point R101 turns off when the abnormal end flag M0012 turns on.

FUN 200 (s)

Item number	Fun commands-65	Name				Status control read/write command † (SC AREA READ/WRITE COMMAND)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 201 (s) * (SCR/W (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●	66	338							
Command format		Number of steps													
FUN 201 (s) * (SCR/W (s) )		Condition			Steps		66	338							
		—			3										
Usable I/O			Bit				Word			Double word		Constant	Other		
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX			DY	DR, DL, DM
s	Header of parameter area								○					s uses up to s+7	
Function															
<ul style="list-style-type: none"><li>• This command reads and writes data between the CPU and a module using the status control area.</li><li>• The maximum read and write data sizes are different depending on the module. For details on using this command, refer to the applicable module manual.</li><li>• By specifying the control type, the read/write method by performing or not performing handshaking with the module can be selected. However, in order to use the read/write method by performing handshaking, the module side must support handshaking. For more details, refer to the applicable module manual.</li><li>• s sets the head I/O number of the parameter area that sets various data read/write parameters.</li><li>* The values displayed inside parenthesis ( ) show the display when LADDER EDITOR is used.</li></ul>															
<div><div><div>Status area</div><div>Control area</div></div><div><div>WR, WL, and WM areas</div></div><div><div>Read</div><div>Write</div></div></div>															

†: Only the EH-CPU448 is supported.



Description of S parameter area

s+0	1] Error code
s+1	2] System area
s+2	(not available to user)
s+3	3] Control type
s+4	4] Header of target area
s+5	5] Read/write control bit I/O No.
s+6	6] Transfer source (destination) header I/O No.
s+7	7] Size

- [1] Error code:  
The result of FUN 201 command execution is set.  
Normal end → = 0  
Abnormal end → ≠ 0
- [2] System area:  
This is used by the system processes of the FUN 201 command when the FUN 201 command is executed. This area cannot be used by the user.
- [3] Control type  
Specifies the control type.  
H0001: Read request from the status area (with handshaking)  
H0002: Read request from the status area (without handshaking)  
H0003: Write request to the control area (with handshaking)  
H0004: Forced write request to the control area (without handshaking)  
H0005: Forced read request from the control area (without handshaking)  
HA55A: Software reset
- [4] Header of target area:

b15	b11	b7	b0
Unit No.	Slot No.	Word location	

- Sets the unit number (0 to 7)  
Sets the slot number (0 to 7)  
Sets the word location (from 0) \*1
- [5] Read/write control bit I/O number:  
Sets the actual addresses of R, L, and M in the read/write control bit I/O number using the ADRIO command.
- [6] Transfer source (destination) header I/O number:  
Sets the actual addresses of WR, WL, and WM in the transfer source (destination) header I/O number using the ADRIO command.
- [7] Size:  
Sets the size to be read or written (from 1) in word units. \*1

Description of read/write control bit table

+0	1] Execute flag
+1	2] Normal end flag
+2	3] Abnormal end flag

\* Description of borders

User setting area
User write prohibited area

- 1] Execution flag:  
Set to "1" using a user program when performing read or write operation using the FUN 201 command. When the read or write operation is complete, the FUN 201 command resets this to "0".
- 2] Normal end flag:  
Set to "1" when read or write operation by the FUN 201 command is normally completed. When read or write operation is started, the FUN 201 command resets this to "0".
- 3] Abnormal end flag:  
Set to "1" when read or write operation by the FUN 201 command is abnormally completed. When read or write operation is started, the FUN 201 command resets this to "0".
- \*1
- When performing read or write operation by controlling handshaking (when the control type is H001 or H003)  
The ranges that can be specified for the word location and size are different for each module. Refer to the applicable module manual.
  - When performing forced read or forced write operation  
The word location range will be 00h to 3Dh.  
The size range will be 0001h to 003Eh.

Cautionary notes

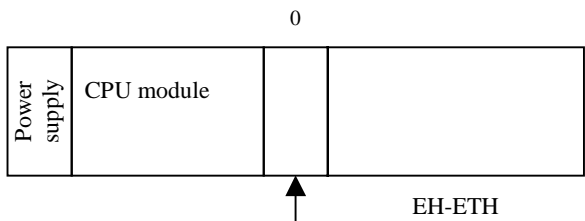
- When an error is generated, an error code is set, DER will be equal to “1,” and no processing will be performed.
- If the specified size is 0, the process will end normally with performing anything.
- Execute using only normal scan without entering any startup conditions.

For more information on the error codes that can be set, see the Error Code Details.

Program example

The following is an example of a program that sets the transmission information of the Ethernet module (EH-ETH) by writing to the control area. Another example of a program that reads the communication status and error information of the Ethernet module (EH-ETH) by reading the status area is also shown.

(1) EH-ETH installation



The EH-ETH is installed in the “0” slot of the basic base.  
Therefore, the I/O assignment of the EH-ETH will be  
WX0000, WY0001.

(2) Internal output assignments

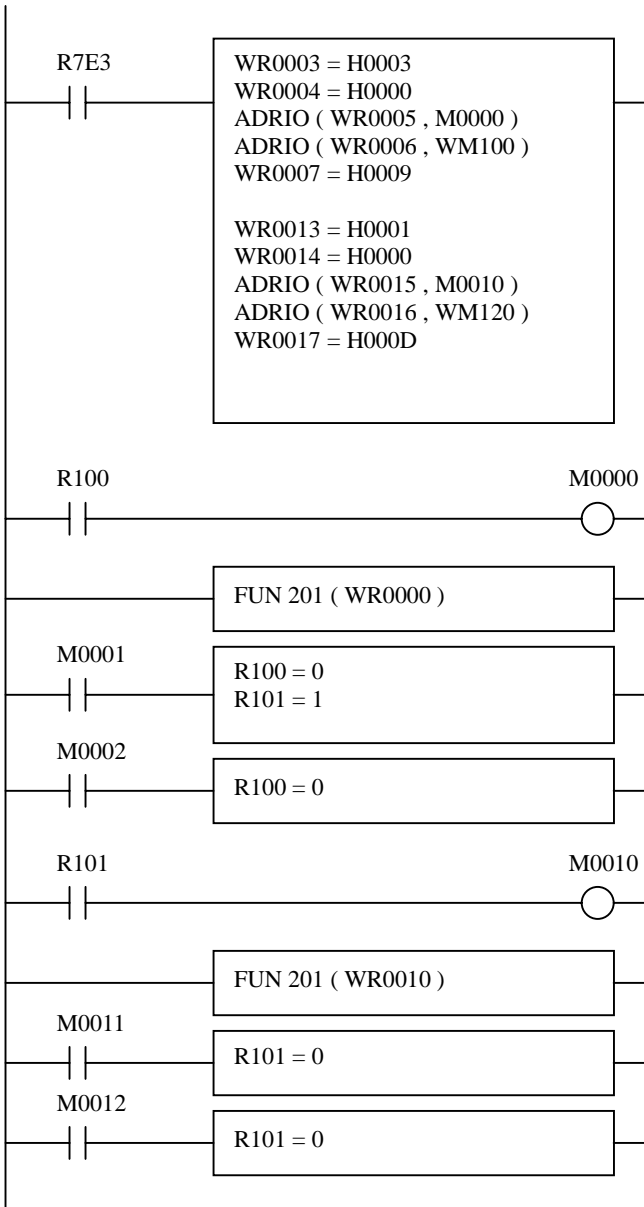
A sample program will be created using the assignments shown below. Change the I/O number, etc. according to the application in an actual usage.

I/O	NO.	Usage
WR	0000 to 0007	FUN 201 command (control area writing) Parameter area (S to S + 7)
M	0000 to 0002	FUN 201 command (control area writing) Control bit table
WM	100 to 108	Transfer source data area (9 words)
WR	0010 to 0017	FUN 201 command (status area reading) Parameter area (S to S + 7)
M	0010 to 0012	FUN 201 command (status area reading) Control bit table
WM	120 to 12D	Transfer source data area (13 words)
R	100 101	Execution request (FUN 201 execution control area writing) Execution request (FUN 201 execution status area reading)

Program example

(3) Data passed from the CPU to the EH-ETH  
Using the following program example, the data to be set in the transfer source data area that will be passed from the CPU to the EH-ETH is described.  
For more details, see the EH-ETH manual.

I/O NO.	Data	Description	Remark
WM100	H000F	Module control register	
WM101	H0000	Connection open/close request	
WM102	H003F	Dedicated transmission control	
WM103	H003F	Automatic transmission control	
WM104	H003F	Dedicated reception control	
WM105	H003F	Automatic reception control	
WM106	H3F3F	Error clear 1 control	
WM107	H3F3F	Error clear 2 control	
WM108	H3F3F	Error clear 3 control	



Perform parameter area initialization settings with 1 scan execution on.

Write request to the control area  
Set M0000 in the read control bit I/O number from unit number 0, slot number 0, word location word 0.  
Set WM100 in the transfer source header I/O number.  
Set the read size to 9 words.

Read request from the status area  
Set M0010 in the read control bit I/O number from unit number 0, slot number 0, word location word 0.  
Set WM120 in the transfer source header I/O number.  
Set the read size to 13 words.

Start reading when the execution flag M0000 turns on

Contact point R100 turns off when the normal end flag M0001 turns on.

Contact point R101 turns on when the normal end flag M0001 turns on.

Contact point R100 turns off when the abnormal end flag M0002 turns on.

After writing to the control area is completed normally, start reading from the status area.

Start reading when the execution flag M0010 turns on.

Contact point R101 turns on when the normal end flag M0011 turns on.

Contact point R101 turns off when the abnormal end flag M0012 turns on.

## Error code details

## FUN200/FUN201 command error code list

Return code	Name	Description	Corrective action
0000	Normal end	Read/write operation ended normally.	
0002	S parameter area range error	Argument s has exceeded the maximum word I/O number.	Change the header I/O number of argument s.
0004	Control bit table range error	The control bit table has exceeded the maximum bit I/O number.	Change the bit header I/O number of the control bit table.
0006	Control type setting error	The control type setting is incorrect.	Set the correct value for the control type.
0008	Target area header setting error	The header setting of the target area is incorrect.	Set the unit number within a range of 0 to 7, set the slot number within a range of 0 to 7, and set the word location within the proper range.
000A	Target area range error*1	The target area header word location + size – 1 has exceeded the last word location.	Set the target area within the correct range.
000C	Transfer source (destination) header I/O number range error	The transfer source (destination) header I/O number has exceeded the maximum word I/O number.	Change the transfer source (destination) header word I/O number.
000D	Transfer source (destination) area range error*1	The transfer source (destination) header I/O + size – 1 has exceeded the maximum word I/O number.	Change the transfer source (destination) area within the correct range.
000E	Overlap error	The area for argument s and the area specified by argument s overlap.	Perform settings so the area for argument s and the area specified by argument s do not overlap.
0010	No assignment	There is no assignment in the specified unit and slot.	Perform assignment.
0020	Installation error	A module that supports handshaking is not installed.	Change the control type to forced read operation or forced write operation.
0022	Non-existent read or write area	There is no area in which read or write operation can be performed while controlling handshaking.	Change the control type to forced read operation or forced write operation.
0030	Timeout*2	No response from the module.	Check the attachment to the CPU basic base and restart. Or exchange the module.
0040	Conflict error	Read or write operation was simultaneously attempted to the same target area, or the module was reset while reading or writing.	Do not startup simultaneously or change the target area.

\*1 An error will be generated, but the read/write processing will be performed within the specified range.

\*2 A timeout will be generated if a response is not received within 100 ms after handshake is controlled and read/write operation is started.

A timeout will be generated if a response is not received within 5 s after software reset is started.

Item number	Fun commands-66	Name		Data logging initialization setting <sup>†</sup> (LOG INITIALIZE)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 210 (s) * (LOGIT (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					1,728	3,121	10,087	19,550	6,163	11,663			
FUN 210 (s) * (LOGIT (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Data logging management table							○							
Function															
		<ul style="list-style-type: none"><li>Initializes the data logging function (common area).</li><li>The initialization settings will be used to check and initialize the parameters for log data write and log data clear processes.</li><li>Always perform the initialization setting once during operation.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used. For the details of the data logging management table, see “Management table details.” For the error codes that are set, see “Error code details.”</p>													
Cautionary notes															
		<ul style="list-style-type: none"><li>If an error is generated, an error code will be set to <u>the error code in the data logging management table</u>, and DER will be set to “1.” In this case, initialization setting will not be performed.</li><li>An error will be generated if initialization is performed again after the initialization setting has already been performed once (initialization of the data logging management table has been successfully completed).</li><li>An error will be generated if the argument S (data logging management table) exceeds the maximum value for the I/O number.</li><li>An error will be generated if there is an error in the verification process of items that have been specified for initialization in (S+3).</li></ul>													

<sup>†</sup>: The EH-CPU104/208 are not supported.

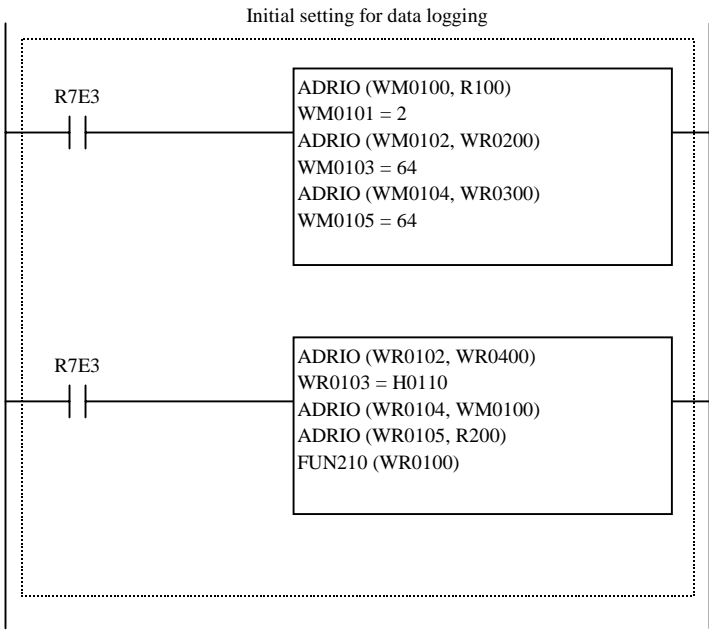
Program example

The following shows a sample program that performs initial settings for data logging.  
This program initializes the log write parameter table and log clear parameter bit table.

(1) Assigning internal outputs

This sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

I/O	No.	Usage	Remarks
WR	0100 to 0105	FUN 210 command Data logging management table (s to s+5)	See the data logging management table
WR	0400 to 0404	Log information table	See the log information table
WM	0100 to 0105	Log write parameter table	See the log write parameter table
R	0100 to 0103	Log write control bit table	See the log write control bit table
WR	0200 to 023F	Log data group 1	This I/O content is logged
WR	0300 to 033F	Log data group 2	This I/O content is logged
R	0200 to 0202	Log clear parameter bit table	See the log clear parameter bit table



Setting of actual address for log information table.  
Initialization of log write parameter table and log clear  
parameter bit table.  
Setting of actual address for log write parameter table.  
Setting of actual address for log clear parameter bit table.  
Execution of initial setting for data logging.

Program example

1. This program performs the initial settings of the log information table, log write table and log clear parameter bit table when a single scan execution (R7E3) is on.

Management table  
overview

See “Management table details” for detailed description.

(a) Logging management table (6 words)

s + 0	1) Error codes
s + 1	2) Initialization result
s + 2	3) Logging information table I/O number
s + 3	4) Initialization specification
s + 4	5) Log write parameter I/O number
s + 5	6) Log clear parameter I/O number

(b) Logging information table (5 words)

+ 0	Number of logs allowed (Lower)
+ 1	Number of logs allowed (Upper)
+ 2	Log size (words/log)
+ 3	Number of logs (Lower)
+ 4	Number of logs (Upper)

Exists when initialization specification (S+3) for log write is enabled.

(c) Log write parameter table (2 + MAX (128 \*2) words)

+ 0	Log write control bit I/O Number
+ 1	Number of log groups (n) MAX 128
+ 2	Log groups 1 head I/O number
+ 3	Log groups 1 size
+ 4	Log groups 2 head I/O number
+ 5	Log groups 2 size
	—
	—
+ (n + 2) + 0	Log groups n head I/O number
+ (n + 2) + 1	Log groups n size

(d) Log write control bit table (4 bits)

+ 0	EXECUTE flag
+ 1	RUN flag
+ 2	WRITE flag
+ 3	ABNORMAL COMPLETION flag

MAX  
(128 \*2) words

Exists when initialization specification (S+3) for log clear is enabled.

(e) Log clear parameter bit table (3 bits)

+ 0	EXECUTE flag
+ 1	RUN flag
+ 2	ABNORMAL COMPLETION flag

\* Description of cells

Area set by the user
Area where the user cannot write

FUN 210 (s)

Management table details

(a) Explanation of data logging management table (1/2)

1] Data logging management table

S	Error code	2]
S + 1	Initialization result	3]
S + 2	Logging information table I/O number	4]
S + 3	Initialization specifications	5]
S + 4	Log write parameter I/O number	6]
S + 5	Log clear parameter I/O number	7]

1] Data logging management table

1. Set in the FUN 210 (S) the word head I/O number used as the data logging management table.
2. The data logging management table consists of 2) through 7) and the size is 6 words. Make sure the maximum value for the word head I/O number is not exceeded.  
If the maximum value is exceeded, H0002 will be set to the error code.

2] Error code (Read)

Sets the error code generated in the FUN 210 process.

3] Initialization result (Read/Common area)

Sets the initialization result, and whether or not execution is allowed.

15	8	7	0
d	c	b	a

- (b0 to b3) Whether or not re-initialization is allowed is set.  
0 : Allowed  
Other than 0 : Not allowed
- (b4 to b7) Whether or not execution of the FUN 211 (Log Data Write) is allowed is set.  
0 : Not allowed  
Other than 0 : Allowed
- (b8 to b11) Whether or not execution of the FUN 212 (Log Data Clear) is allowed is set.  
0 : Not allowed  
Other than 0 : Allowed
- (b12 to b15) Whether or not execution of the FUN 213 (Log Data Read) is allowed is set.  
0 : Not allowed  
Other than 0 : Allowed

\* If recovery is not possible by use of commands, b0 to b3 will become other than 0 and b4 to b15 will become 0.

4] Logging information table I/O number (Write/Common area)

Sets the word head I/O number that stores the current logging information data.

See “(b) Explanation of logging information word table.”

5] Initialization specifications (Write)

Sets the parameter table used.

15	8	7	0
d	c	b	a

- (b0 to b3) Open (Unused)
- (b4 to b7) Initialization of log write parameter table  
0 : Not initialized  
Other than 0 : Initialized
- (b8 to b11) Initialization of log clear parameter table  
Other than 0 : Initialized
- (b12 to b15) Open (Unused)



Management table  
details

- (a) Explanation of data logging management table (2/2)
- 6] Log write parameter I/O number (Write)  
Sets the word head I/O number used in the FUN 211 (Log Data Write) process.  
When the write Function is not used, set H0000 as a dummy argument.  
See “(c) Explanation of log write parameter word table.”
- 7] Log clear parameter I/O number (Write)  
Sets the bit head I/O number of the parameter used in the FUN 212 (Log Data Clear) process.  
When the clear function is not used, set H0000 as a dummy argument.  
See “(e) Explanation of log clear parameter bit tables.”

Management table  
details

(b) Explanation of log information word table

1] Log information word table

+ 0	Number of logs allowed	: lower (R)	2]
+ 1	Number of logs allowed	: upper (R)	
+ 2	Log size (words/log)	(R)	3]
+ 3	Number of logs	: lower (R)	4]
+ 4	Number of logs	: upper (R)	

(R) Read word

1] Log information word table

1. Set the actual address (WR, WL, WM) of the word head I/O number that is used as the table into the data logging management table 4) using the ADRIO command.
2. The table consists of 2) through 4), and the size is 5 words. Make sure the maximum value for the word I/O number is not exceeded. If the maximum value is exceeded, H0003 will be set to the error code in the data logging management table.

2] Number of logs allowed

1. Indicates the number of logs currently allowed.
2. The value calculated by the formula shown below is set.  

$$\text{Number of logs allowed} = 384 \text{ k } (393216) \text{ words} \div 3) \text{ Log size}$$
 (\*) Round off below the decimal point.

3] Log size (words/log)

Indicates the number of words (Total number of words of respective log groups) per data groups written for a single log.

4] Number of logs

The number of logs that have been written at present is set. The number does not include the log whose data is currently being written. The count is increased by 1 when all data for that log has been written.

Management table details

(c) Explanation of log write parameter word table

1] Log write parameter word table

+ 0	Log write control bit I/O number	2)
+ 1	Log groups quantity (n)	3)
+ 2	Log groups 1 head I/O number	4)
+ 3	Log groups 1 size	
+ 4	Log groups 2 head I/O number	
+ 5	Log groups 2 size	
•	•	
•	•	
+ (n × 2) + 0	Log groups n head I/O number	
+ (n × 2) + 1	Log groups n size	

1] Log write parameter word table

1. Set the actual address (WR, WL, WM) of the word head I/O number that is used as the table into the data log management table 6) using the ADRIO command.
2. The table consists of 2) through 4), and the size increases depending on the log groups quantity 3). Make sure the maximum value for the word head I/O number is not exceeded. If the maximum value is exceeded, H0005 will be set to the error code in the data logging management table.

2] Log write control bit I/O number

Set the bit I/O number used in FUN 211 control.  
See (d), "Explanation of log write control bit table."

3] Log groups quantity

Set the number of logging groups in the range between 1 and 128.  
If the specified value exceeds the allowable range, H0004 will be set to the error code in the data logging management table. If this error occurs, data logging will not be performed.

4] Log selection

Select the elements that comprise a single logging.

1. Head I/O number 1 to n ... Set each number using the ADRIO command by making sure the maximum value for the word head I/O number (WR, WL, WM, WX), from which the data will be logged, is not exceeded.
2. Size ..... Set the range for the number of words logged from the word head I/O number.
3. If the maximum I/O number is exceeded, Hxx08 will be set to the error code in the data logging management table. If this error occurs, data logging will not be performed.
4. If the specified size is not between 1 and 128, H0007 will be set to the error code in the data logging management table. If this error occurs, data logging will not be performed.
5. The total size (number of words) of the selected data items must be in the range between 1 and 128 words. If the above range is exceeded, H0009 will be set to the error code in the data logging management table. If this error occurs, data logging will not be performed.

Management table details

(d) Explanation of log write control bit table

1] Log write control bit table

+ 0	EXECUTE flag	(W)	2)
+ 1	RUN flag	(R)	3)
+ 2	WRITE flag	(R)	4)
+ 3	ABNORMAL COMPLETION flag	(R)	5)

(W) Set and read bit

(R) Read bit

1] Log write control bit table

1. Set the actual address (R, L, M) of the bit head I/O number that is used as the table into the log write parameter table 2) using the ADRIO command.
2. The table consists of 2) through 5), and the size is 4 bits. Make sure the maximum value for the bit I/O number is not exceeded. If the maximum value is exceeded, H0006 will be set to the error code in the data logging management table.

2] EXECUTE flag

1. When the EXECUTE flag rises (0 → 1), the system waits for the start of data logging.
2. If the execution ready state is achieved normally, the RUN flag 3) becomes 1. If there is an error, the RUN flag 3) becomes 0.
3. Logging is performed while the EXECUTE flag is 1.

3] RUN flag

1. When the FUN 211 detects the rise of the EXECUTE flag 2), it checks if execution is allowed and sets the result.  
1 : Check result is normal. Data logging is started.  
0 : Check result is abnormal. Data logging is not performed. The EXECUTE flag 2) becomes 0 and the cause of error is set to the FUN 211 (log data write) error code.
2. When the FUN 211 detects the fall of the EXECUTE flag 2) while the RUN flag is 1, and if the WRITE flag 4) is 1 (data is being written), the RUN flag will become 0 when the write is completed and the data logging will end.

4] WRITE flag

This flag indicates whether or not the data that has been stored temporarily via the FUN 211 is currently being written.  
1 : Data write is being executed.  
0 : Data write is yet to be executed.

5] ABNORMAL COMPLETION flag

This flag indicates whether or not the FUN 211 (data logging write) has been executed normally.  
1 : Abnormal completion. The cause of error is set to the FUN 211 (log data write) error code.  
0 : Normal completion. Indicates a state where no error has been generated.

Management table details

(e) Explanation of log clear parameter bit table

1] Log clear parameter bit table

+ 0	EXECUTE flag	(W)	2)
+ 1	RUN flag	(R)	3)
+ 2	ABNORMAL COMPLETION flag	(R)	4)

(W) Set and read bit

(R) Read bit

1] Log clear parameter bit table

1. Set the actual address (R, L, M) of the bit head I/O number that is used as the table into the data log management table 7) using the ADRIO command.
2. The table consists of 2) through 4), and the size is 3 bits. Make sure the maximum value for the bit I/O number is not exceeded. If the maximum value is exceeded, H000A will be set to the error code in the data logging management table.

2] EXECUTE flag

1. When the EXECUTE flag rises (0 → 1), the system waits for the start of log data clear.
2. If the execution ready state is achieved normally, the RUN flag 3) becomes 1. If there is an error, the RUN flag 3) becomes 0.

3] RUN flag

1. When the FUN 212 detects the rise of the EXECUTE flag 2), it checks if execution is allowed and sets the result.  
1 : Check result is normal. Log data clear is started.  
0 : Check result is abnormal. Log data clear is not performed. The EXECUTE flag 2) becomes 0 and the cause of error is set to the FUN 212 (log data clear) error code.
2. When the clear is completed, both the RUN flag and EXECUTE flag 2) become 0. If the FUN 212 detects the fall of the EXECUTE flag 2) while the RUN flag is 1 (data is being cleared), the RUN flag will become 0 when the clear is completed and the log data clear will end.

4] ABNORMAL COMPLETION flag

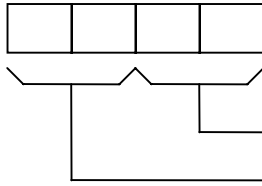
This flag indicates whether or not the FUN 212 (log data clear) has been executed normally.

- 1 : Abnormal completion. The cause of error is set to the FUN 212 (log data clear) error code.  
0 : Normal completion. Indicates a state where no error has been generated.

## Error code details

## (a) Explanation of log function error code

Each error code is expressed as a four-digit hexadecimal number.



The last 2 digits indicate the cause of error.

These digits indicate the log groups number.

If H00, it indicates that this error is not related to the log groups number.

If between H01 and H80, it indicates that there is an error regarding the log groups number.

In the error code list, the error codes in which the first 2 digits are indicated by ×× have a log groups number between H01 and H80 in place of ××. Numbers in brackets and ○ used in the table below indicate the corresponding numbers in “Management table details.”

Error code	Check point/output destination				Description and cause	Corrective action
	Initial	Write	Clear	Read		
0001	○	×	×	×	The FUN 210 was executed again after its re-initialization had become disabled.	Modify the program so that the FUN 210 will not be executed after its initialization is completed.
0002	○	○ *3	○ *3	○	The argument S exceeds the maximum value for the word I/O number.	Change the head I/O number of the argument S.
0003	○	×	×	×	The log information table (a) 4) exceeds the maximum value for the word I/O number.	Change the head word I/O number (a) 4).
0004	○ *1	×	×	×	The log groups quantity (c) 3) exceeds the range between 1 and 128.	Set the log groups quantity (c) 3) in the range between 1 and 128.
0005	○ *1	×	×	×	The log write parameter table (a) 6) exceeds the maximum value for the word I/O number.	Change the head word I/O number (a) 6)/ log groups quantity (c) 3).
0006	○ *1	×	×	×	The log write control bit table (c) 2) exceeds the maximum value for the bit I/O number.	Change the head bit I/O number (c) 2).
××07	○ *1	×	×	×	Groups size (c) 4) number ×× exceeds the range between 1 and 128.	Set the groups size (c) 4) corresponding to ×× in the range between 1 and 128.
××08	○ *1	×	×	×	Logging groups (c) 4) number XX exceeds the maximum value for the word I/O number.	Change the head word I/O number (c) 4)/ groups size (c) 4) corresponding to XX.
0009	○ *1	×	×	×	The total size of the log groups exceeds the range between 1 and 128.	Set the total size of the log groups so it falls in the range between 1 and 128.
000A	○ *2	×	×	×	The log clear parameter table (a) 7) exceeds the maximum value for the bit I/O number.	Change the head bit I/O number (a) 7).
000B	×	○	○	○	A FUN was executed although its execution was not allowed ( 3) initialization result was “execution not allowed”).	Execute the FUN after confirming that the initialization result has become “execution allowed.”
000C	×	×	×	○	The specified file address does not exist.	Set the file address between H0000 and HFFFF (lower) or H0000 and H0005 (upper).
000D	×	×	×	○	The acquisition source area exceeds the maximum value for the word I/O number.	Change the head I/O number or size of the acquisition source.
000E	○	×	×	○	The area of the argument S and the area specified by the argument S are overlapping.	Set the area of the argument S so it does not overlap with the area specified by the argument S.
000F	×	×	×	○	There is no log data in the specified file address.	Calculate the value of file address again by referring to the log information table (a) 4).
0010	○	○	×	×	The size of the single log that was previously written to the memory board is different from the total size of the log groups.	Modify the program according to the previous log size. Or, execute the FUN 212 command to clear the data, then execute again.
0011	×	×	×	○	The read size exceeds 128.	Set the read size in the range between 1 and 128.

Error code details

Error code	Check point/output destination				Description and cause	Corrective action
	Initial	Write	Clear	Read		
0012	×	○	×	×	The log data area became full and no new log data could be added.	To recover this error, read the current data using the FUN 213 command, then clear the data using the FUN 212 command. When the data has been cleared, execute again.
0020	○	○	○	○	No memory board is installed, or the memory board does not support the logging function.	Set a memory board that supports the logging function.
0021	×	○	○	×	Operation was attempted in the write-prohibited mode.	Change the dip switch setting to the write-enable mode.
0022	○	○	○	×	Hardware error was detected in the memory board.	The memory board may be damaged. Replace the memory board.
0023	○	○	×	×	The previous logging has failed.	To recover this error, execute the FUN 212 command to clear the data, then execute again.
0024	×	○	○	○	Operation was attempted in a mode other than the data logging mode.	Change the dip switch setting to the data logging mode.

- \* Initial: FUN 210 (initial setting)
- Write: FUN 211 (write)
- Clear: FUN 212 (clear)
- Read: FUN 213 (read)
- \*1: When the initialization of log write is specified.
- \*2: When the initialization of log clear is specified.
- \*3: Cannot be output.

Item number	Fun commands-67	Name		Log data write † (LOG WRITE)											
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 211 (s) * (LOGWRT (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					645	1,188	1,025	1,587	973	1,535			
FUN 211 (s) * (LOGWRT (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit			Word				Double word			Constant	Other		
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY			DR, DL, DM	
s	Error code							O							
Function															
		<ul style="list-style-type: none"><li>This command is used to log (i.e., write to the memory board) the items specified by the FUN 210 (initial setting for data logging).</li><li>* ( ) indicates the display when the LADDER EDITOR is used.</li><li>For the data logging management table, see “Management table details.”</li><li>For the error codes to be set, see “Error code details.”</li></ul>													
Cautionary notes															
		<ul style="list-style-type: none"><li>If an error occurs, an error code is set and DER becomes equal to “1.” If this happens, the log data write will not be performed.</li><li>If this command is executed when <u>the initialization result in the data logging management table</u> corresponding to the FUN 210 (initial setting for data logging ) is “execution not allowed,” an error will occur.</li><li>An error will occur if the argument S exceeds the maximum value for the I/O number.</li><li>Do not set a startup condition for this command. Execute it during normal scans only.</li><li>An error will occur if the dip switch setting on the memory board specifies write prohibited or any mode other than the data logging mode.</li><li>If the memory board is currently in use for other processing, DER becomes equal to “0” and R7F7 becomes equal to “1.” If this happens, the processing will not be performed.</li></ul>													

<sup>†</sup>: The EH-CPU104/208 are not supported.



## Program example

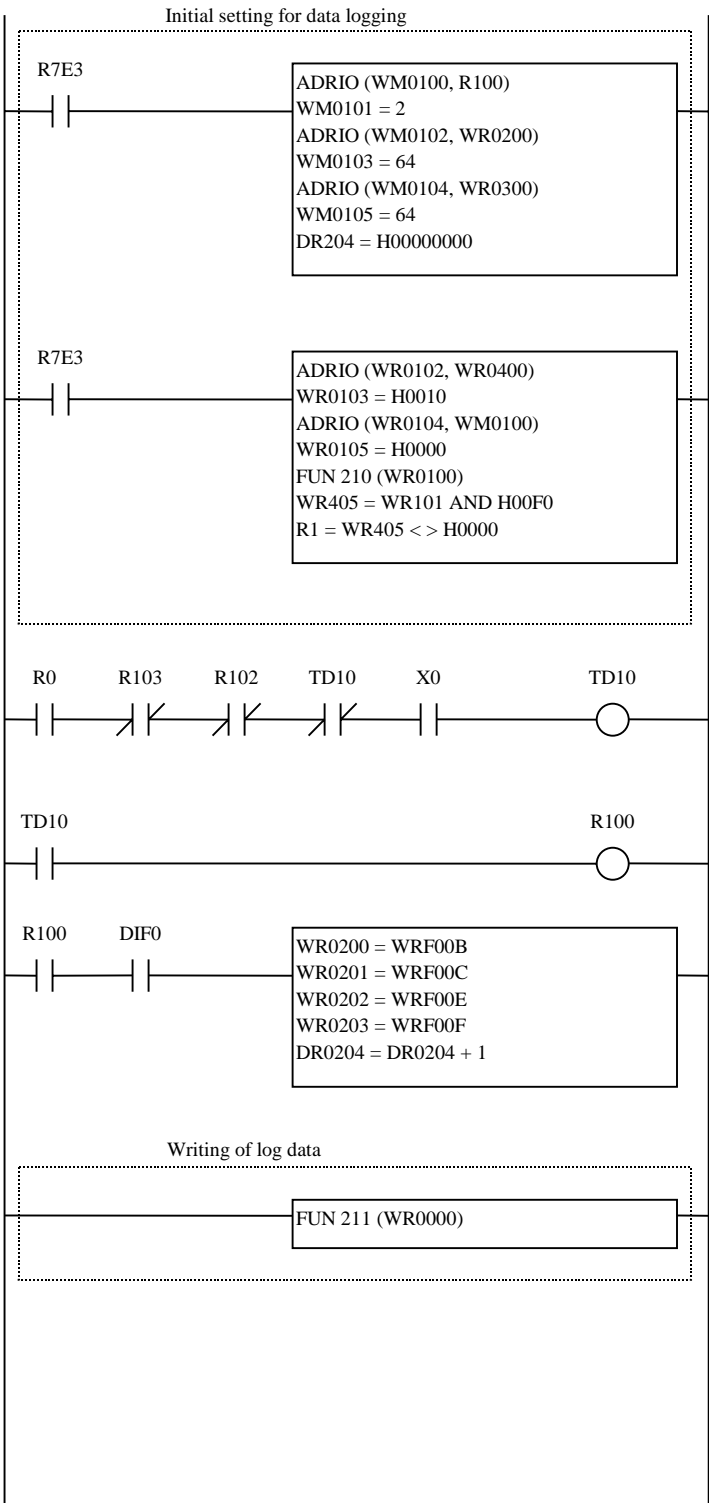
The following shows a sample program that writes into the logging area a total of 128 words including WR200 through WR23F (64 words) and WR300 through WR33F (64 words) at intervals of 10 minutes after ON of X00000 (the start bit), together with date data (year/month, day/hour, minute/second) and sequence number.

## (1) Assigning internal outputs

The sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

I/O	No.	Usage	Remarks
WR	0100 to 0105	FUN 210 command Data logging management table (s to S+5)	See the data logging management table
WR	0400 to 0404	Log information table	See the log information table
WM	100 to 105	Log write parameter table	See the log write parameter table
R	100 to 103	Log write control bit table	See the log write control bit table
WR	0200 to 023F	Log data groups 1	This data is logged
WR	0300 to 033F	Log data groups 2	This data is logged
DR	0204	Sequence number	Increments by 1 after each logging
WR	0405	Save area for initialization result	Only the result of the FUN 211 is set
R	0	Save bit for initialization result	If ON, it indicates normal completion (execution allowed)
X	0	Log start bit	Logging interval (10 minutes) monitoring start bit
TD	10	10 minute monitoring timer	Turns on when 10 minutes have elapsed
WR	0000	FUN 211 command error code (s)	The error code that has been generated as a result of the log data write is set

Program example



Create a write parameter in WM0100 that logs 128 words (64 words from WR200 and 64 words from WR300) upon turning ON of single scan execution. Clears the sequence number to 0.

Specify initial setting so that the specified item (WM0100) is logged in WR0100 upon turning ON of single scan execution. Sets the initialization result in R000 after the initial setting.

1S 600 (Turns ON when 10 minutes have elapsed)  
The progress value is updated while the start bit is ON but only when both the initial setting and logging have been completed normally.

Logging is started when TD10 is turned ON (when 10 minutes have elapsed).

Date data (year/month, day/hour, minute/second) and sequence number are appended to the head of log data (WR200 to WR205) when the logging execution flag is turned ON (R100 OFF → ON).

Executes the logging.

Item number	Fun commands-68	Name		Log data clear <sup>†</sup> (LOG CLEAR)											
Ladder format		Condition code						Processing time (μs)						Remark	
FUN 212 (s) * (LOGCLR (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps													
FUN 212 (s) * (LOGCLR (s) )		Condition			Steps			163	164	238	443	391	←		
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Error code							○							
Function															
		<ul style="list-style-type: none"><li>This command is used to forcibly erase (clear) the logged data in the memory board.</li></ul> <p>* ( ) indicates the display when the LADDER EDITOR is used.</p> <p>For the data logging management table, see “Management table details.”</p> <p>For the error codes to be set, see “Error code details.”</p>													
Cautionary notes															
		<ul style="list-style-type: none"><li>If an error occurs, an error code is set and DER becomes equal to “1”. If this happens, the log data clear will not be performed.</li><li>If this command is executed when <u>the initialization result in the data logging management table</u> corresponding to the FUN 210 (initial setting for data logging) is “execution not allowed,” an error will occur.</li><li>An error will occur if the argument S exceeds the maximum value for the I/O number.</li><li>Do not set a startup condition for this command. Execute it during normal scans only.</li><li>An error will occur if the dip switch setting on the memory board specifies write prohibited or any mode other than the data logging mode.</li><li>If the memory board is currently in use for other processing, DER becomes equal to “0” and R7F7 becomes equal to “1.” If this happens, the processing will not be performed.</li></ul>													

<sup>†</sup>: The EH-CPU104/208 are not supported.

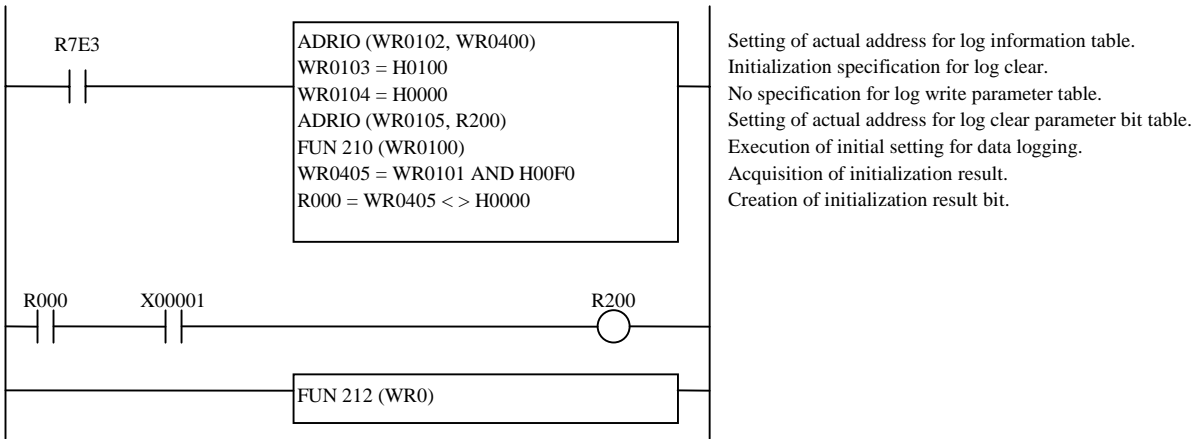
Program example

The following shows a sample program that performs initial setting for logging area clear and then clears the logging area.

(1) Assigning internal outputs

The sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

I/O	No.	Usage	Remarks
WR	0100 to 0105	FUN 210 command Data logging management table (s to S+5)	See the data logging management table
WR	0400 to 0404	Log information table	See the log information table
R	200 to 202	Log clear parameter bit table	See the log clear parameter bit table
WR	0405	Save area for initialization result	Only the result of the FUN 212 is set
R	000	Save bit for initialization result	If ON, it indicates normal completion (execution allowed)
X	00001	Clear start bit	Logging clear start bit
WR	0000	FUN 212 command error code (s)	The error code that has been generated as a result of the log data clear is set



Program description

The log area is cleared when X00001 (the clear start bit) is turned ON after the initial setting for log area clear has been executed upon turning ON of single scan execution (R7E3) and completed normally.

Item number	Fun commands-69	Name				Log data read <sup>†</sup> (LOG READ)									
Ladder format		Condition code					Processing time (μs)						Remark		
FUN 213 (s) * (LOGRED (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left				
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max			
		↑	●	●	●	●									
Command format		Number of steps					268	357	547	633	560	645			
FUN 213 (s) * (LOGRED (s) )		Condition			Steps										
		—			3										
Usable I/O		Bit				Word				Double word			Constant	Other	
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM			
s	Argument							○							
Function															

The logged data in the memory board is transferred to the specified I/O number area by the amount of data corresponding to the number of words being specified by the source log data address (word position from the head of log data).

s

Error code

s + 1

Source log data address (lower)

s + 2

Source log data address (upper)

s + 3

Destination head I/O number

s + 4

Size (1 to 128 words)

The range of log data address is shown below.

Lower address : 0 to FFFFH

Upper address : 0 to 0005H

Log data (memory board)

Transfer area

- The valid maximum log data address is calculated by the formula shown below :  
(Log size in the log information table × Number of logs) – 1
- When the log data read is completed normally, DER becomes equal to “0.”
- If the specified size is 0, nothing will be done and the process will complete normally.
- For the S+3 parameter, set the actual address (WR, WL, WM) using the ADRIO command.

\* ( ) indicates the display when the LADDER EDITOR is used.

For the data logging management table, see “Management table details.”

For the error codes to be set, see “Error code details.”

- The valid maximum log data address is calculated by the formula shown below :  
(Log size in the log information table × Number of logs) – 1
- When the log data read is completed normally, DER becomes equal to “0.”
- If the specified size is 0, nothing will be done and the process will complete normally.
- For the S+3 parameter, set the actual address (WR, WL, WM) using the ADRIO command.

\* ( ) indicates the display when the LADDER EDITOR is used.

For the data logging management table, see “Management table details.”

For the error codes to be set, see “Error code details.”

<sup>†</sup>: The EH-CPU104/208 are not supported.

Cautionary notes

- If an error occurs, an error code is set and DER becomes equal to “1”. If this happens, the log data read will not be performed.
- If this command is executed when the initialization result in the data logging management table corresponding to the FUN 210 (initial setting for data logging ) is “execution not allowed,” an error will occur.
- An error will occur if the specified log data address does not exist.
- If the specified log data does not exist, an error will occur after the read.
- An error will occur if the area specified by the argument S or S+3 exceeds the maximum value for the I/O number.
- An error will occur if the area specified by the argument S and the one specified by S+3 overlap.
- An error will occur if the dip switch setting on the memory board specifies any mode other than the data logging mode.
- If the memory board is currently in use for other processing, DER becomes equal to “0” and R7F7 becomes equal to “1.” If this happens, the processing will not be performed.

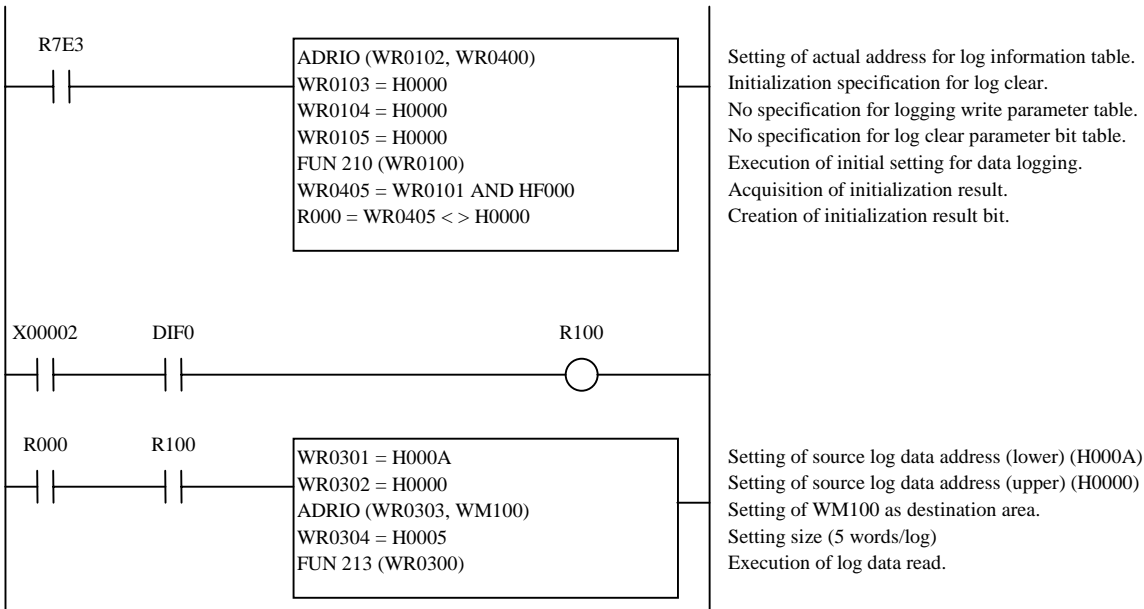
Program example

The following shows a sample program that performs initial setting for log data read and then reads the logged data.

(1) Assigning internal outputs

The sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

I/O	No.	Usage	Remarks
WR	0100 to 0105	FUN 210 command Data logging management table (s to S+5)	See the data logging management table
WR	0400 to 0404	Data logging information table	See the log information table
WR	0405	Save area for initialization result	Only the result of the FUN 213 is set
R	000	Save bit for initialization result	If ON, it indicates normal completion (execution allowed)
X	00002	Read start bit	Logging read start bit
WR	0300 to 0304	FUN 213 command parameter area (s to S+4)	
WM	0100 to 0104	Log data transfer area	The data that has been read is set

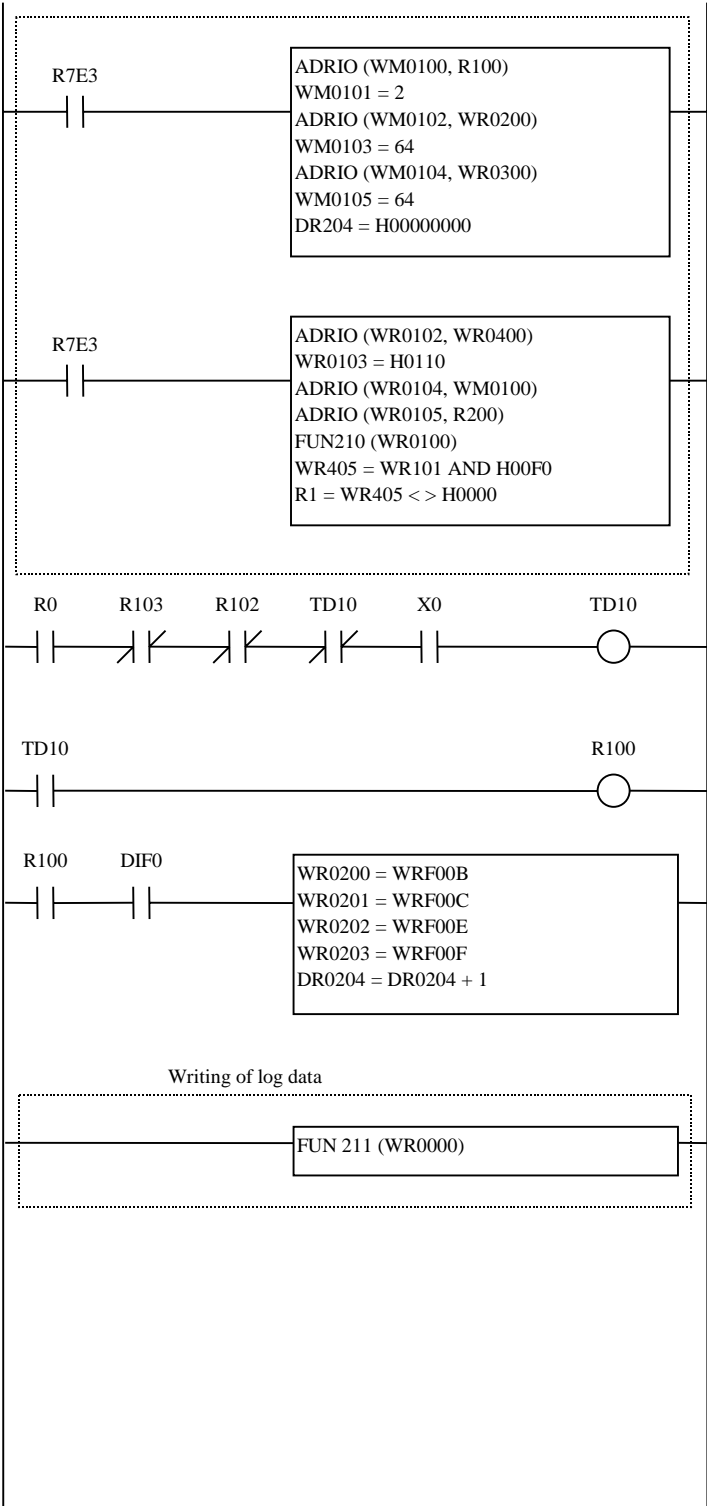


Program description

Of the three logs of data that have been written, with each log consisting of 5 words, the content of the third log (in the memory board) is transferred to the destination (WM100) by the amount of data specified for a single log (5 words), with X00002 (the read start bit) ON.

Program example

The following shows an example of a program that starts logging at every 10 minutes after X0 turns ON, reads the first and last log data when X0 is OFF, and then clears the log data.



Setting of actual address for logging information table  
Initializes the log write parameter table and log clear parameter table.  
Log write parameter table not specified  
Log clear parameter bit table not specified  
Data logging initialization setting executed

Specify initial setting so that the specified item (WM0100) is logged/cleared in WR0100 upon turning ON of single scan execution.  
Sets the initialization result in R000 after the initial setting.

1S 600 (Turns ON when 10 minutes have elapsed)  
The progress value is updated while the start bit is ON but only when both the initial setting and logging have been completed normally.

Logging is started when the TD10 (10 min has elapsed) is ON.

Date data (year/month, day/hour, minute/second) and sequence number are appended to the head of log data (WR200 to WR205) when the logging execution flag is turned ON (R100 OFF → ON).

FUN 213 (s)

R7E3

WR0405 = WR0101 AND H0F00  
R1 = WR0405 <> H0000

Clear the logging data

FUN 212 (WR0600)

R200 DFN1

DR0204 = 00000000

R7E3

WR0405 = WR0101 AND HF000  
R2 = WR0405 <> H0000

R2 X0 DFN0 R300

R102 R101 R300 DIF1

DR0701 = H00000000  
ADRIO (WR0703, WM200)  
WR0704 = WR0402  
FUN 213 (WR0700)  
DR0010 = DR0402 AND HFFFF  
DR0701 = DR0403 - 1  
DR0701 = DR0701 \* DR0010  
ADRIO (WR0703, WM300)  
WR0704 = WR0402  
FUN 213 (WR0700)  
R200 = R1

5. Setting of WM300 as destination area  
Setting size (128 words/log)  
Execution of log data read (last log item).  
Execution of log clear.



Item number	Fun commands-70	Name				BOX comment (BOX COMMENT)													
Ladder format		Condition code						Processing time (μs)						Remark					
FUN 254 (s) * (BOXC (s) )		R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left								
		DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max							
		●	●	●	●	●													
Command format		Number of steps						0.15		←		14.4		←		20		←	
FUN 254 (s) * (BOXC (s) )		Condition			Steps														
		—			3														
Usable I/O		Bit				Word				Double word			Constant	Other					
		X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY	DR, DL, DM							
s	Argument (dummy constant)							○											
Function																			
<div><ul style="list-style-type: none"><li>This command does not perform any operations. It is used to print comments on the right side of the calculation box in conjunction with the LADDER EDITOR.</li><li>A comment can contain a maximum of 32 characters.</li><li>* ( ) indicates the display when the LADDER EDITOR is used.</li></ul></div>																			

Item number		Fun commands-71		Name		Memo comment (MEMO COMMENT)														
Ladder format				Condition code					Processing time (μs)					Remark						
FUN 255 (s) * (MEMC (s) )				R7F4	R7F3	R7F2	R7F1	R7F0	EH-CPU448		EH-CPU3**		Other than left							
				DER	ERR	SD	V	C	Ave	Max	Ave	Max	Ave	Max						
				●	●	●	●	●												
Command format				Number of steps					0.15		←		14.4		←		20		←	
FUN 255 (s) * (MEMC (s) )				Condition			Steps													
				—			3													
Usable I/O			Bit				Word			Double word			Constant	Other						
			X	Y	R, L, M	TD, SS, WDT, MS, TMR, CU, RCU, CT	WX	WY	WR, WL, WM	TC	DX	DY					DR, DL, DM			
s	Argument (dummy constant)								○											
Function																				
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# Chapter 6 I/O Specifications

Classification of I/O that can be used with the EH-150 as well as the I/O points are indicated in Table 6.1.

Table 6.1 Usable I/O classification and points

Item	Function	Symbol	Size	Name	EH-CPU104	EH-CPU208	EH-CPU308	EH-CPU316	EH-CPU448					
					Number of points	Number of points	Number of points	Number of points	Number of points					
1	External I/O	External I/O	X	B	Bit external input	512 bits (At the time 64 points I/O module is used)	1024 bits (At the time 64 points I/O module is used)							
			Y	B	Bit external output									
			WX	W	Word external input									
			WY	W	Word external output									
			DX	D	Double word external input									
			DY	D	Double word external output									
	Remote I/O	X	B	Bit remote external input	2,048 bits									
		Y	B	Bit remote external output										
		WX	W	Word remote external input	128 words									
		WY	W	Word remote external output										
		DX	D	Double word remote external input										
		DY	D	Double word remote external output										
2	CPU link area	L	B	Bit link area 1	16,384 bits									
		WL	W	Word link area 1										
		DL	D	Double word link area 1	1,024 words									
		L	B	Bit link area 2										
		WL	W	Word link area 2										
		DL	D	Double word link area 2										
3	Internal output	Bit	R	B	Bit internal output	1,984 bits								
			R	B	Bit special internal output									
		Word	WR	W	Word internal output	4,096 words	8,192 words	17,408 words	22,528 words	50,176 words				
			DR	D	Double word internal output									
			WR	W	Word special internal output						512 words			
			DR	D	Double word special internal output									
		Common use of bit / word	M	B	Bit internal output	16,384 bits								
			WM	W	Word internal output									
			DM	D	Double word internal output									
4	Others	Edge detection	DIF	B	Rise edge	512 points								
			DFN	B	Fall edge									
		Master control	MCS	B	Master control set	50 points								
			MCR	B	Master control reset									
		Timer, Counter	TD	B	On delay timer	Not available					2,048 bits			
			TM	B	Expanded on delay timer									
			SS	B	Single-shot timer	Timer 256 points (0.01 s timer has only 0 to 63) * The same No. cannot be used to timer, counter. * TM is available with only EH-CPU448. Counter 512 points (The same area as the timer is used in the range up to 256 points) * The same No. cannot be used to timer, counter.								
			WDT	B	Watchdog timer									
			MS	B	Monostable timer									
			TMR	B	Accumulative timer									
			CU	B	Up counter									
			RCU	B	Ring counter									
			CTU	B	Up-down counter up input									
			CTD	B	Up-down counter down input									
			CT	B	Up-down counter down output									
			CL	B	Progress value clear									
			TC	W	Timer counter progress value									

## 6.1 External I/O

When operation start is performed for the EH-150, the user program is executed (scanned) after the input refresh processing (receiving external input data) is performed. Operations are performed according to the contents of the user program, and the next input refresh processing and output refresh processing (operation results are reflected in the external output) are performed. After that, the next user program is executed (scanned). This series of operations is continually repeated until operation is stopped or until something occurs where operation can no longer continue. When operation is stopped or if something occurs so that operation can no longer continue, the CPU performs an output refresh with all output data as off data and stops operation, regardless of the execution status for the user program. Diagram outlining this series of operations is indicated in Figure 6.1 below.

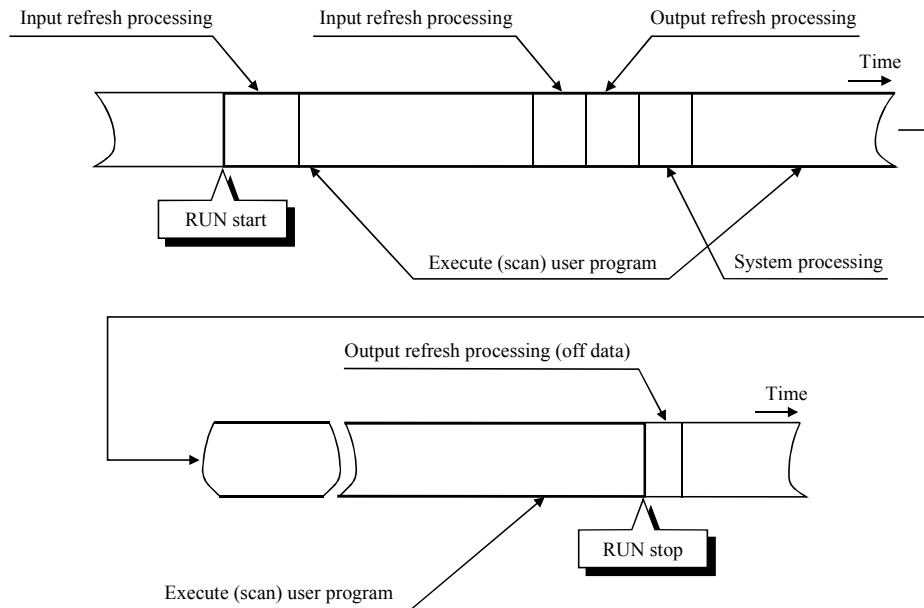


Figure 6.1 Overview of user program execution and refresh processing

The user programs are executed in order, usually from the program at the beginning of the scan area to the end of the program or until the END command. After that, I/O data is refreshed prior to the execution of the next user program. As shown above, external I/O data is updated in group in the refresh processing after the user program is executed. If it is necessary to update (refresh) the I/O data while the user program is being executed, use the refresh command. When designing the system, take into account the above refresh operation from when the input data is received and operated on until output data is obtained.

The next section explains the assignment of external I/O. The external I/O numbers for the EH-150 system are expressed with the following rules.

Table 6.2 List of external I/O classification and data type

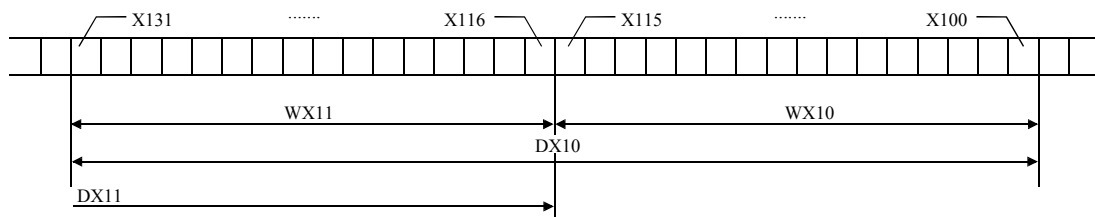
Classification	I/O classification	Data type	Remarks
X	External input	Bit type	Corresponds to the signal of each terminal block.
WX		Word type (16-bit)	Data in the range 0 to 15 is batch processed. 16-bit synchronicity guaranteed.
DX		Double word type (32-bit)	Two word data are batch expressed. 32-bit synchronicity is not guaranteed.
Y	External output	Bit type	Corresponds to the signal of each terminal block.
WY		Word type (16-bit)	Data in the range 0 to 15 is batch processed. 16-bit synchronicity guaranteed.
DY		Double word type (32-bit)	Two word data are batch expressed. 32-bit synchronicity is not guaranteed.

Table 6.3 List of I/O number rules for external I/O

Data type	Numbering rule	Example
Bit type (basic/expansion)		X0 Y100 X00010 Y1005
Word type		WX0 WY10 WX110 WY3
Double word type		DX0 DY10 DX100

The external I/O word type is a collection of 16 points, and double word type is a collection of 32 points of the relevant bit type.

(Example) Relationship between DX10, WX10 and X100 to X115 is,



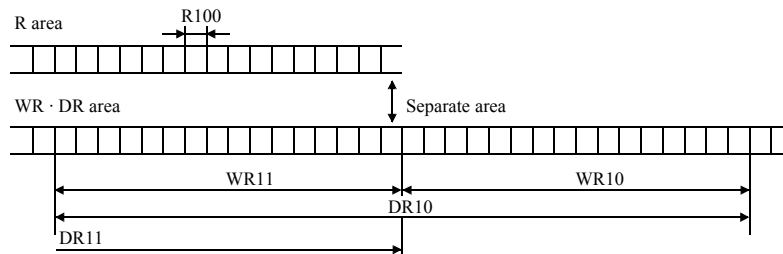
## 6.2 Internal Output

Memory in the CPU module is available as the area for internal outputs. There are three areas: bit dedicated area (R), word dedicated area (WR), and bit/word common area (M/WM).

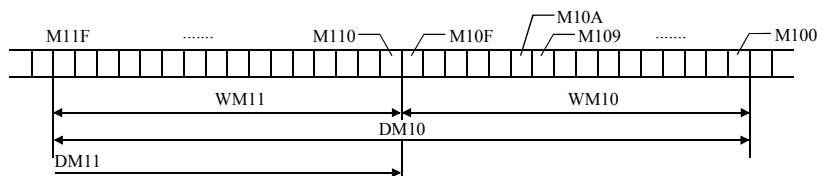
Table 6.4 List of I/O number rules for external I/O

Data type	Numbering rule	Example
Bit dedicated type	<p>R <span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <p>Normal area H000 to H7BF Special area H7C0 to H7FF Both are expressed by hexadecimal</p>	R0 R105 R23C R7E7
Word dedicated type	<p>&lt;Word&gt;</p> <p>WR<span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <p>Normal area H0000 to Special area HF000 to Both are expressed by hexadecimal</p>	WR0 WR11 WR1234 WRF004
	<p>&lt;Double word&gt;</p> <p>DR<span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <p>Normal area H0000 to Special area HF000 to Both are expressed by hexadecimals. Expresses WR for 2 words in continuatio</p>	DR0 DR11 DR1234 DRF004
Bit/word common type	<p>&lt;Bit&gt;</p> <p>M <span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <p>H0000 to</p>	M0 M11 M1234
	<p>&lt;Word&gt;</p> <p>WM<span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <p>H000 to</p> <p>M120F ..... M1200</p> <p>WM120</p>	WM0 WM11 WM123
	<p>&lt;Double word&gt;</p> <p>DM<span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <p>H0000 to Expressed by hexadecimals. Expresses DM for 2 words in continuatio</p>	DM0 DM11 DM234

- Internal output R and WR, DR are completely separate areas. Bit-based operations cannot be performed in WR. (Example) Relationship between R100 and WR10, DR10



- Since internal output M, WM and DM share the same area, bit-based operations are allowed. (Example) Relationship between M100 and WM10, DM10



# Chapter 7 User Program

## 7.1 Memory Capacity

The specifications for the user program in EH-150 are given in Table 7.1.

Table 7.1 User program specifications

No.	Item		EH-CPU104	EH-CPU208	EH-CPU308	EH-CPU316	EH-CPU448
1	Program capacity		4 k steps	8 k steps	8 k steps	16 k steps	48 k steps
2	Command size		32 bits/1 step				
3	Memory specification	SRAM	Backup is possible by installing the battery				
		FLASH	Backup is possible by using FLASH memory				
4	Programming language		H-series ladder/command language				
5	Program creation		Created with H-series programming device				
6	Program modification	During STOP	Can be done as desired by using the programming device.				
		During RUN	Can be done by using the modification during RUN operation (except control commands). Control commands can be changed with special operations. *1 (When a change is made during RUN, control operation stops while the program is being modified.).				
7	Program protection		The program cannot be changed unless with a WRITE occupancy. (Occupancy is automatically controlled by the programming device).				
8	Password		A password can be set using the programming device (the program cannot be displayed when setting the password. The program can be downloaded to the programming device).				
9	Check function		A sum check function for the program is always running. An address check with the I/O assignment table is done at the time RUN begins.				
10	Program name		The program name is set using the programming device and is stored together with the program.				

\*1: Refer to the peripheral device manual for details.

Note:

- Comment data that has been created with peripheral device is not stored in the CPU.
- Save the user program to a separate floppy disk or other media, in case a mishap should occur.

## 7.2 Programming Method

The following methods are allowed for creating the user program.

Table 7.2 Programming methods

No.	Programming device used	Operation concept	Remarks
1	Personal computer software (LADDER EDITOR, etc.)	[For off-line / on-line operation] The I/O assignment table created, program to be created is input, and transferred to the EH-150 CPU.	<ul style="list-style-type: none"> <li>• When each EH-150 module is loaded to the base unit, the I/O assignment information can be read.</li> <li>• Initialize the EH-150 CPU when using it for the first time after it is unpacked or when a battery error occurs.</li> </ul>
2	Dedicated programming console (GPCL01H, etc.)	[For direct operation] As the programs are input one by one, the program input to the CPU is directly written to the CPU, each time.	
3	Portable graphic programmer (PGM-GPH) (Do not use an option box.)	As the programs are input one by one, the program input to the CPU is directly written to the CPU, each time.	
4	Ccommand language programmer (PGM-CHH)		

The system configuration and procedure for creating a user program when using personal computer software are indicated below. It is necessary to take note that cables, etc. differ depending on the personal computer and the software used.

Table 7.3 System configuration when using a personal computer

No.	Personal computer software used	DOS/V PC	PC9800 series personal computer
1	LADDER EDITOR (Windows® version)	 DOS/V PC (Windows®95/NT)	 PC9800 series personal computer (Windows®95/NT)
		Specify H-302. Specify EH-150 after version 2.0.	
		Specify RAM-04H (4 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-16H (16 k memory).	
		Specify RAM-48H (48 k memory).	
2	LADDER EDITOR (DOS version)	 DOS/V PC (MS-DOS®)	 PC9800 series personal computer (MS-DOS®)
		Specify H-302.	
		Specify RAM-04H (4 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-16H (16 k memory).	
		Specify RAM-48H (48 k memory).	
3	LADDER EDITOR (Windows® version)	 DOS/V PC (Windows®95/NT)	 PC9800 series personal computer (Windows®95/NT)
		Specify H-302. Specify EH-150 after version 2.0.	
		Specify RAM-04H (4 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-16H (16 k memory).	
		Specify RAM-48H (48 k memory).	
4	LADDER EDITOR (DOS version)	 DOS/V PC (MS-DOS®)	 PC9800 series personal computer (MS-DOS®)
		Specify H-302.	
		Specify RAM-04H (4 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-08H (8 k memory).	
		Specify RAM-16H (16 k memory).	
		Specify RAM-48H (48 k memory).	

\* Restart the power supply after the mode setting switch has been adjusted. The settings that are made while the power is on will not be effective until the power is restarted.

Note: Refer to the manual that comes with each software on how to install the software (LADDER EDITOR).

Table 7.4 List of procedures for creating a program

Item	Create new program	Modify	Test operation, adjustment	
	Off-line	Off-line	On-line	On-direct
Operation procedure summary				
Circumstance	When creating a new program	When modifying a program	When transferring a program to the CPU for the first time	When modifying a program during test operation
Point	A program can be created without having the actual EH-150.	When using a program that was used in another H-series, specify H-302 as the CPU type.	When performing CPU error check, make sure the I/O assignment matches the loaded module. (The match can be forced using the loading read function).	Match the personal computer and the contents of CPU memory to enter the on-direct mode. Afterwards, the modification will be reflected in both the computer memory and CPU memory.

\*1: For LADDER EDITOR for DOS version and LADDER EDITOR 1.xx for Windows ®.  
Specify EH-150 after LADDER EDITOR 2.xx for Windows ®.

Table 7.5 System configuration when using the programmer

Item	Portable graphic programmer (PGM-GPH)	Ccommand language programmer (PGM-CHH)
System configuration		
Cable (EH-150 side)	EH-RS05	EH-RS05
Cable (programmer side)	PGCB02H	PGCB02H

Note: 1. Do not use the option box (model: PGMIF1H) for the portable graphic programmer. Because of the large current consumption, the EH-150 system may go down.  
Also, use a cable of 2 m (6.56 ft.) in length (model: PGCB02H) on the programmer side to connect a programmer. If a 5 m (16.4 ft.) cable (model: PGCB05H) is used, the programmer operation may become unstable.

2. The programmer can only be connected to serial port 2. For more information on setting modes, see Table 10.6.



With the EH-150, the user program is controlled in ladder units and as shown with Figure 7.1, 1 ladder can describe 9 contacts (a-type contact or b-type contact) and 7 coils.

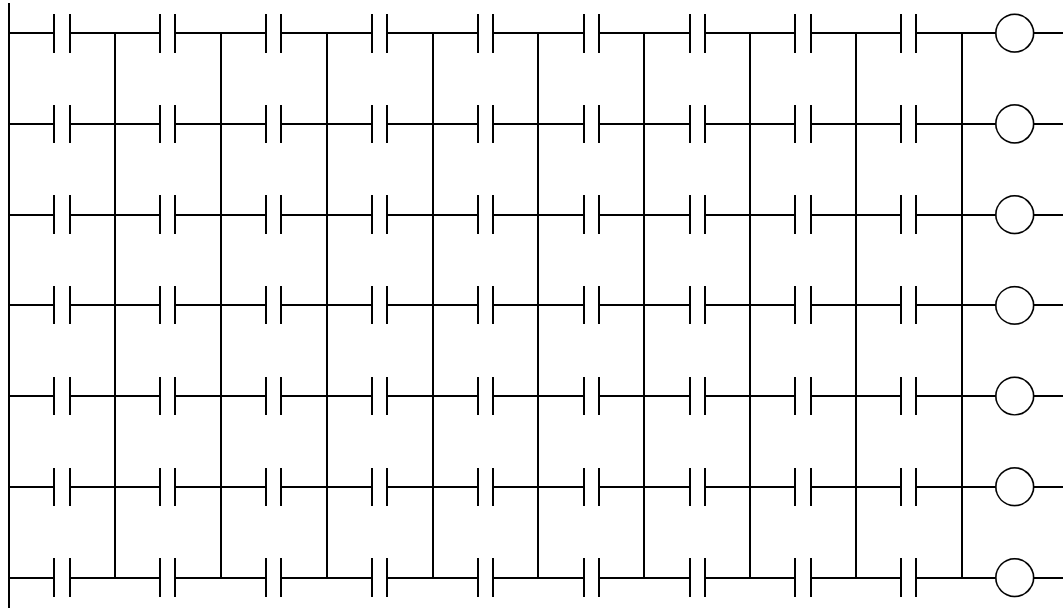


Figure 7.1 Size of one ladder

Or, one relational box can be described using the width of 3 contacts. The relational box can be thought of as an a-type contact that turns on when the conditions in the box are satisfied (Figure 7.2).

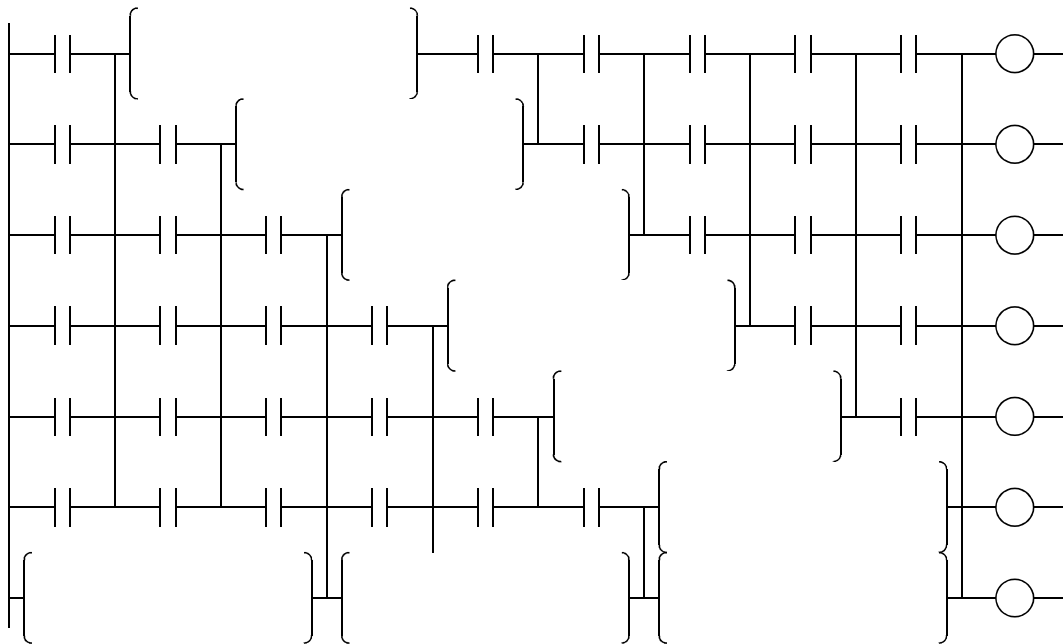


Figure 7.2 Using a relational box

In addition, if return symbols are used, a ladder containing up to 57 contacts and one coil can be input within seven lines. (Figure 7.3)

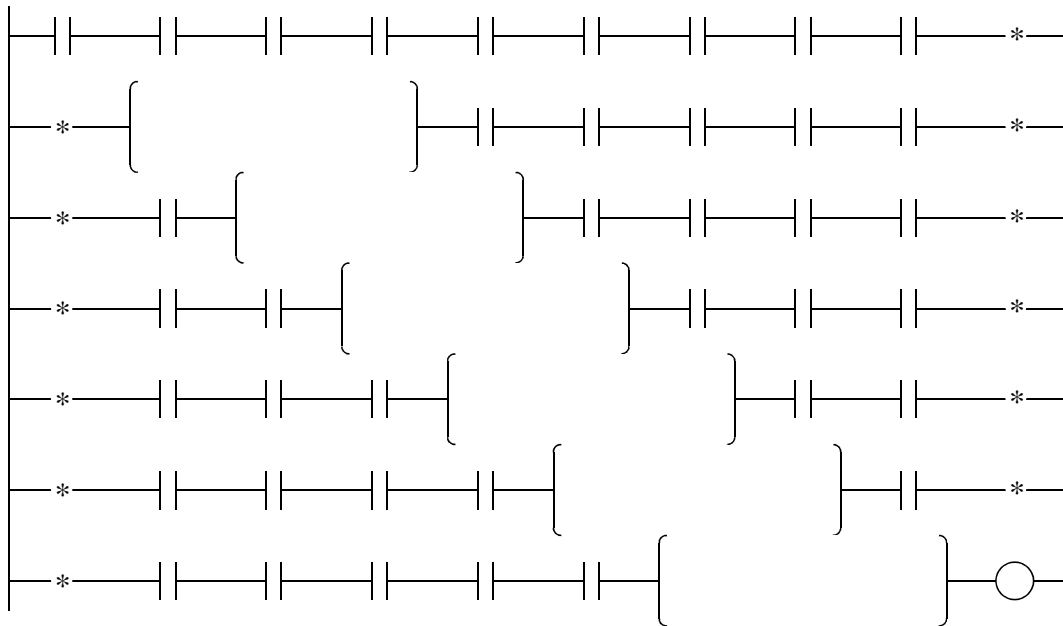
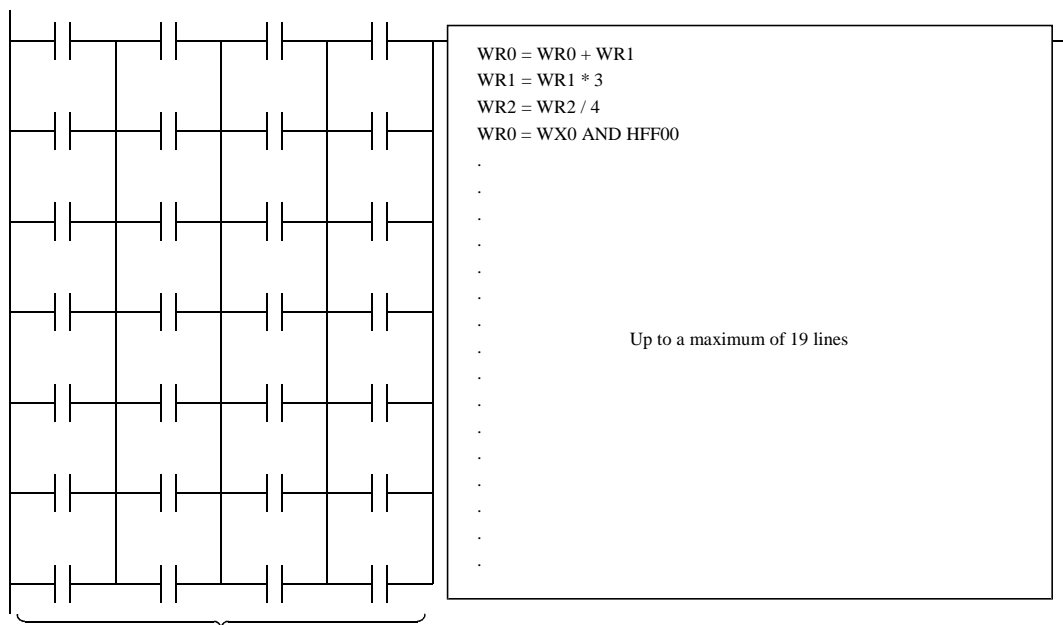


Figure 7.3 Example of using return symbols

A processing box can be placed in the coil position. Processing commands, application commands, control commands, transfer command and FUN commands can be described in a processing box. A maximum of 19 commands can be described in one processing box. The processing box is executed when the condition in the contact section that is connected directly before it, is satisfied and not executed if the condition is unsatisfied.

Refer to “Chapter 5 Command Specifications” for details on each command.



A maximum of 4 contacts can be described in one line

Figure 7.4 Using a processing box

Note: For the LADDER EDITOR for Windows®, the processing box can be displayed in 1 contact point width, so a ladder of 9 contact and 1 processing box can be input.

For details, refer to the user's manual for the LADDER EDITOR for Windows®.



# Chapter 8 Operating and Stopping EH-150

The EH-150 can switch its operation status and stop status through various types of operations. This feature is shown in Figure 8.1.

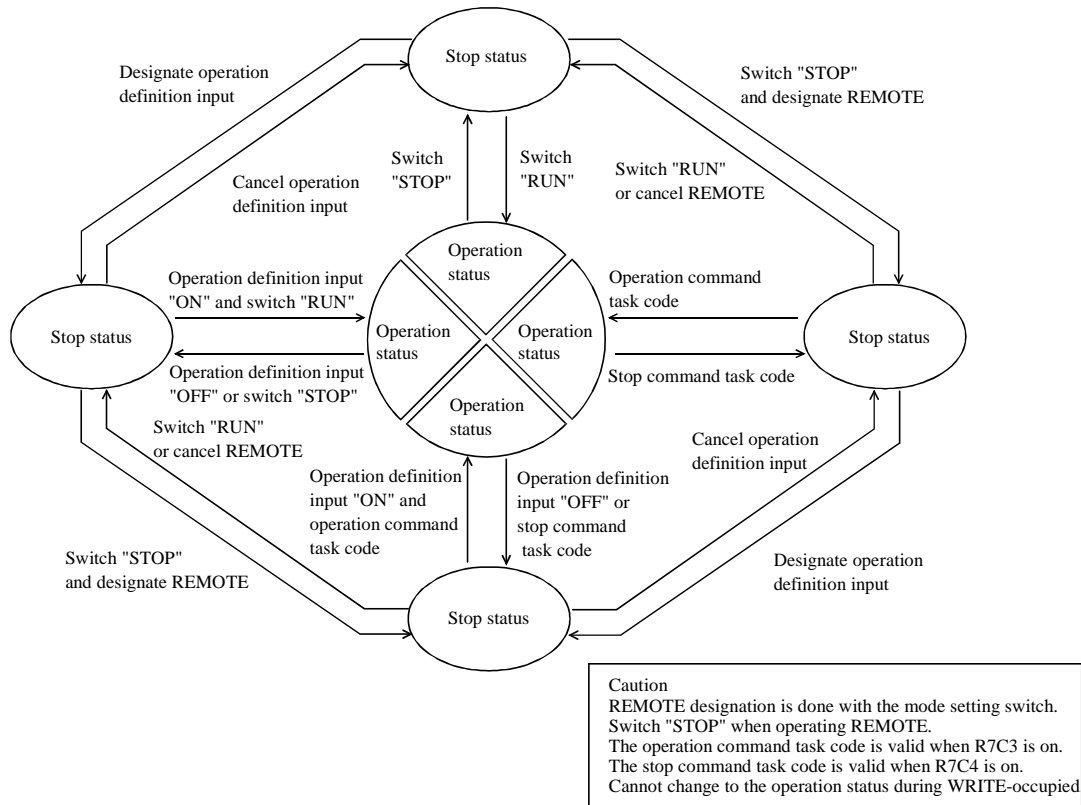


Figure 8.1 Diagram of status transition between operation and stop

The EH-150 can be operated or stopped under the conditions as shown in Figure 8.1. If an error is detected during operation or stop, output is shut off, an error is displayed and the EH-150 stops. Error includes serious failure, medium failure, minor failure and warning. The operation status for each failure is shown in Table 8.1.

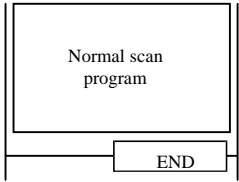
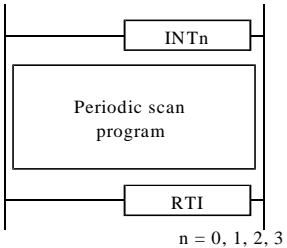
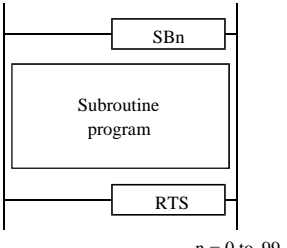
Table 8.1 Description of each failure and operation status

Classification	Description	Run/Stop
Serious failure	This indicates there is a serious, unrecoverable error, such as power failure, microcomputer error, system ROM error, system RAM error, system bus error, etc.	Stop
Medium failure	This indicates there is an error such as data memory abnormal, system program abnormal, user memory abnormal, user memory size error, grammatical assemble error, etc., which will cause a malfunction if operation is continued.	Stop
Minor failure	These are errors such as I/O information verify error, remote abnormal, overload error, excessively assigned I/O points. The operation can continue when there is a continue operation setting in the user program.	Stop (continued operation is possible if specified)
Warning	These are abnormal such as a transfer error, where it is possible to continue the operation.	Operation continues

## 8.1 RUN Start

When the EH-150 switches to operation status, the user program is executed in sequence from the head. The user program consists of a normal scan program and periodic scan program. In addition to these programs, there is a subroutine area defined as a subroutine.

Table 8.2 Program classification

No.	Program classification	Description	Expression
1	Normal scan program	This is the program that is normally executed. When the program has been executed to the END command, execution starts again from the head. Overload error monitoring is performed according to the overload check time set by the user. Monitoring is from the top of the program until the END command. If it is designated to continue during overload, the operation continues.	
2	Periodic scan program	This program is executed periodically at intervals of 5 ms, 10 ms, 20 ms, or 40 ms. INT0: every 10 ms [every 5 ms] INT1: every 20 ms [every 10 ms] INT2: every 40 ms [every 20 ms] INT3: [every 40 ms] Intervals shown in [ ] are for the EH-CPU448. Each execution cycle time becomes the overload error monitoring time. If it is specified to continue during overload, the operation is terminated in the middle.	
3	Subroutine	This is a program called out by the CALL command.	

### 8.1.1 Scan operation

Each program is executed in the order of the priority shown in Figure 8.2. Each program is executed while monitoring the execution time of each program area. If the monitored time exceeds the prescribed time, this causes an overload error and operation stops. When continued operation has been specified, operation continues.

The timing for scan execution is shown in Figure 8.2. System processing is performed at set periods (every 5 ms), followed by communication system processing. The maximum execution time of communication system processing \*1 equals the duration of time until the next periodic system processing is started. If the communication system processing ends before the maximum execution time is up, execution of scan processing is started upon completion of the communication system processing. When the next periodic processing is performed, scanning is performed until the next periodic processing is performed.

\*1: Communication system processing is executed every 10 ms.

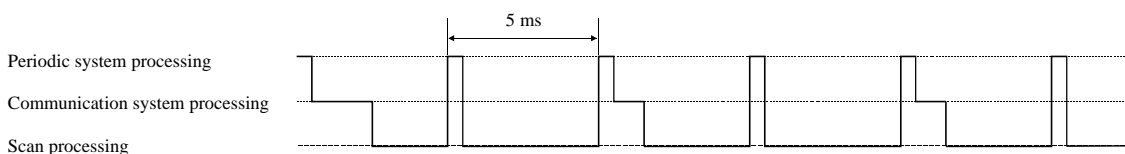


Figure 8.2 Relationship between system processing and scanning

As shown in Figure 8.3, scan processing is done while periodic scanning is performed. Periodic scanning is processed at the point when switching to normal scan. Periodic scans are performed at intervals of every 5 ms, 10 ms, 20 ms, or 40 ms. (5 ms periodic scan is supported only for the EH-CPU448.) In terms of priority of execution, 5 ms scans have the highest priority. Use the refresh command when you wish to perform data processing for the external I/O (X,Y) during the periodic scan.

Update of timer progress value is performed as part of system processing. (For the EH-CPU448, it is performed when each timer command is executed.)

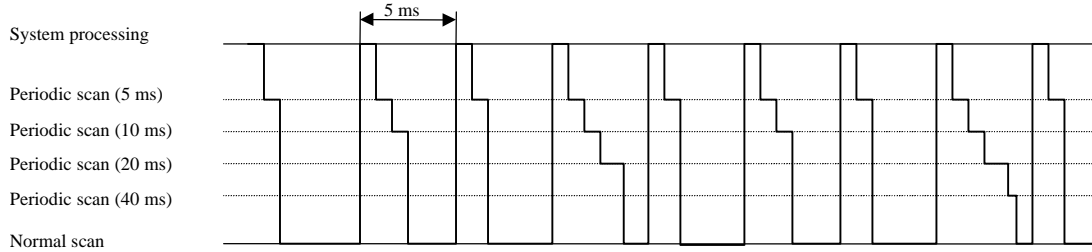


Figure 8.3 Scan execution timing

### 8.1.2 Setting System Processing Time (EH-CPU448)

The EH-CPU448 can set any system processing time in the range from 3 to 9 ms. It is thus possible to select the optimal system processing time according to the purpose of control.

#### (1) Operation and application

Figure 8.4 shows the scan operation when the system processing time is set to 3 ms. In this figure, the system operation time corresponds to “periodical system processing” + “communication system processing,” thus it is possible to set this parameter.

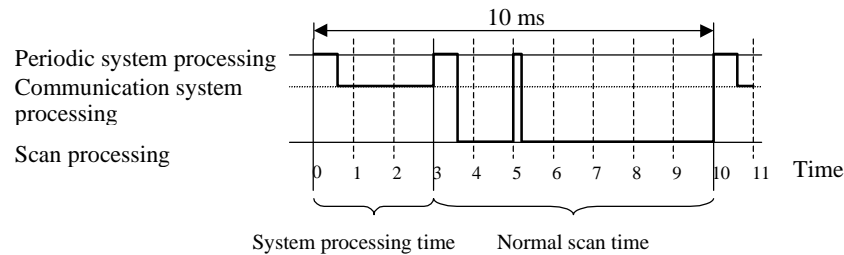


Figure 8.4 Scan operation when the system processing time is set to 3 ms

Because the scan processing time for executing user programs can be made longer, the operation processing efficiency per unit time can be improved.

#### (2) Setup method

Set the system processing time in special internal output WRF038.

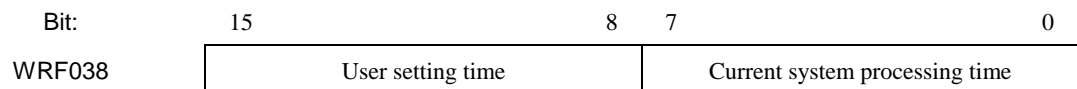


Figure 8.5 Special internal output for setting the system processing time

Enter a value from 3 to 9 in 1-digit BCD format representing the user setting time. If a value outside this range is selected, the system sets the system processing time to 3. Furthermore, the processing time of the system currently in operation, which is set in the lower eight bits of the current system processing time field, can be checked by monitoring WRF038 with a peripheral unit.

Example: In order to set the system processing time to 3 ms, enter H0300 in WRF038.

If H10 is set as the user setting time, the system operates with a system processing time of 3 ms. When WRF038 is monitored, a value of H1003 is displayed.

This setting becomes valid immediately after setting.

#### (3) Precautions

The 5 ms periodical scan (INT0), which is supported only by the EH-CPU448, should be used under the following condition:

Scan time of 5 ms periodical scan + system processing time (the value set in WRF038) < 5 ms

If this condition is not met, the system processing time will become different from the set value because the execution of the 5 ms periodical scan has higher priority (hence the system processing time is shortened).

Moreover, if the 5 ms periodical scan is used, there will be a periodical scan congestion error when the scan time reaches around 3 ms. In this case, the system processing time is fixed at approximately 2 ms.

### 8.1.3 Setting System Processing Time (EH-CPU308/316)

The system processing time of the EH-CPU308/316\* can be fixed at 5 ms. By fixing the system processing time, the normal scan time will not fluctuate and it is executed for 5 ms in 5 ms cycles.

\* The EH-CPU308/316 of ROM Version 03 or earlier do not support this function.

#### (1) Operation and application

Figure 8.6 shows the scan operation when the system processing time is fixed. In this figure, the system operation time corresponds to “periodical system processing” + “communication system processing,” thus it is possible to set this parameter.

Conventionally, the operation shifts to normal scan processing when the system processing is finished. If, however, the system processing time is fixed, the normal scan does not start until 5 ms have elapsed, even if the system processing is finished.

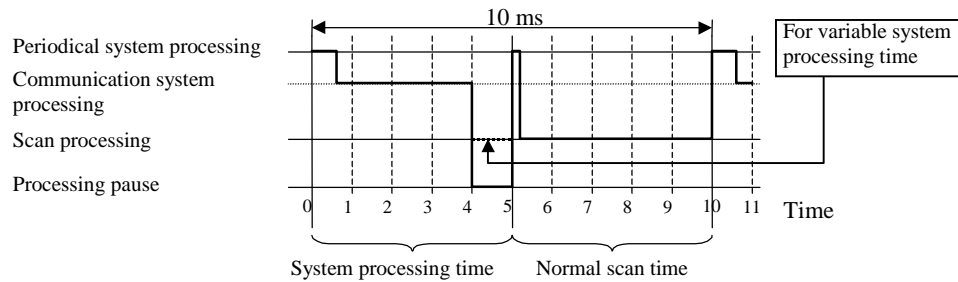


Figure 8.6 System processing time (fixed at 5 ms)

The scan processing time for executing user programs can be fixed. Use this function if it is not desirable to allow the normal scan time to fluctuate.

#### (2) Setup method

Set the system processing time in special internal output WRF038.

Bit:	15	8	7	0
WRF038	User setting time			Current operation status

Figure 8.7 Special internal output for setting the system processing time

Enter H\*5 as the user setting time. When the setting is completed, H05 is set in the current operation status field. If a value other than H\*5 is set in the user setting time field, the setting value is stored in the user setting time field but H00 is stored in the current operation status field, and the system processing time becomes variable as usual.

Example: In order to fix the system processing time, enter H0500 in WRF038. If WRF038 is monitored at this point, it can be observed that H0505 is set.

If a value other than H\*5, e.g. H0300, is set as the system processing time, the system processing time becomes variable and the value that can be monitored in WRF038 is H0300.

This setting becomes valid immediately after setting.

### 8.1.4 Normal Scan

#### (1) Definition and operation

The normal scan refers to the calculations and execution of the ladder/instruction language program (excluding interrupt programs) until the END scan processing caused by the END instruction or the execution of programs written in Pro-H. The time required for one scan, from the beginning of a normal scan program to the END scan processing, is called the normal scan time.

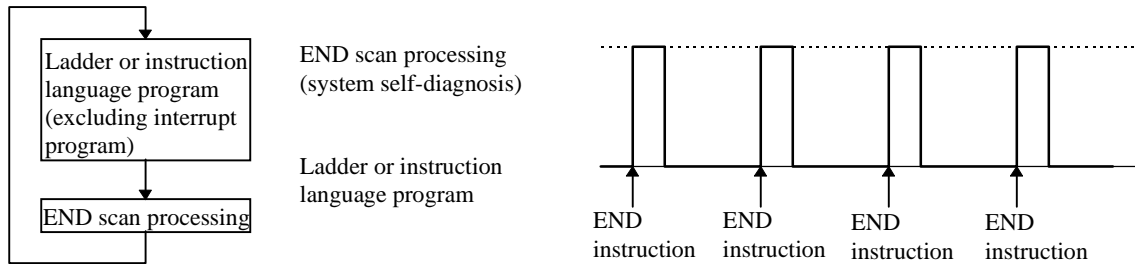


Figure 8.8 Operation of normal scan

#### (2) Causes of congestion errors at normal scan

Congestion errors may occur at normal scan because of the following two possible reasons. In particular when using a periodical scan program together, care must be taken to create the program in such a way that the total scan time does not exceed the congestion check time.

##### (a) When only a normal scan program is used

The scan time exceeded the congestion check time because the time required for one scan was too long.

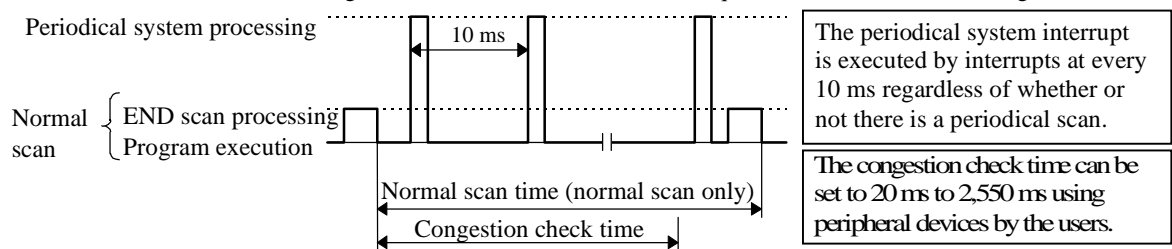


Figure 8.9 Congestion error at normal scan (a)

##### (b) When both a normal scan program and a periodical scan program are used

The congestion check time was exceeded because the periodical scan program was executed and the normal scan time became longer. (Figure 8.10 shows an example of operation by CPUs other than the EH-CPU448.)

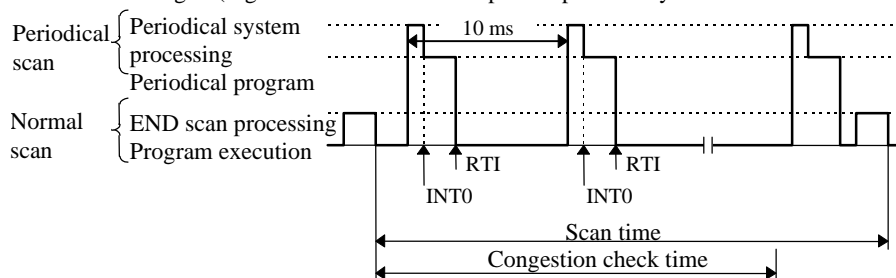


Figure 8.10 Congestion error at normal scan (b)

#### (3) Continuation of operation after a congestion error occurred

When the special internal output R7C0, which specifies whether the operation should continue after a congestion error occurred, is turned on, the normal scan executes the scan until the end regardless of the congestion check time, and after executing the END scan processing, executes the normal scan from the beginning again.

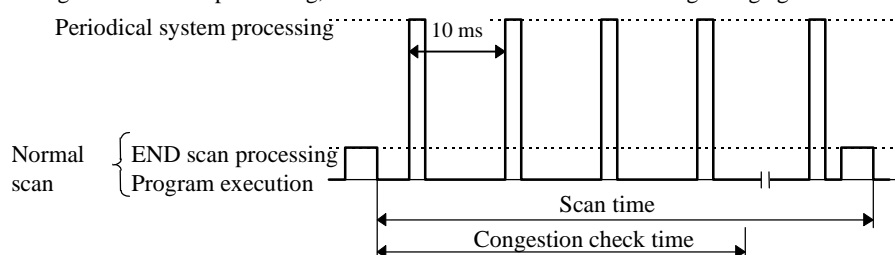


Figure 8.11 Operation when operation continuation at congestion error is set

However, note that this setting does not stop the execution of the scan when a congestion error occurred even when an infinite loop is formed within the normal scan by the JMP instruction.



### 8.1.5 Periodical Scan (Other than the EH-CPU448)

#### (1) Definition and operation

This scan executes operations of interrupt programs (periodical scan programs) while the CPU is operating with a cycle time specified by the user (10 ms, 20 ms or 40 ms). For the EH-CPU448, a 5 ms periodical scan has newly been added. The details about the periodical scan of the EH-CPU448 are explained in Section 8.1.6. This section explains about CPUs other than the EH-CPU448.

Enter the periodical scan program to be executed between instructions INT0 and RT1 if it should be started up with a 10 ms cycle time, and between INT1 and RT1 if it should be started up with a 20 ms cycle time.

The periodical system processing is executed every 10 ms regardless of whether or not there is a periodical scan program.

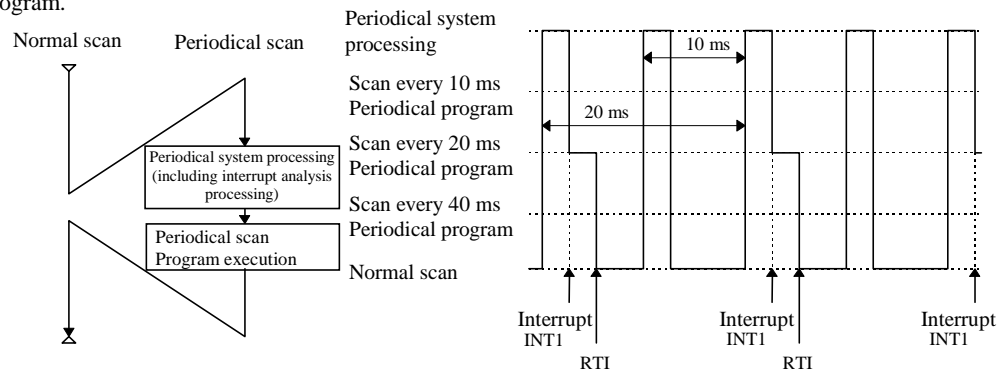


Figure 8.12 Operation of periodical scan (in case of INT1)

#### (2) Causes of congestion errors at periodical scan

If there are periodical scans at every 10 ms as well as scans at every 20 ms or 40 ms, a congestion error occurs and the scan is stopped if the periodical scan at 10 ms is started up again before all the periodical scans are completed (i.e., the periodical system processing at INT0 to INT2 does not end within 10 ms).

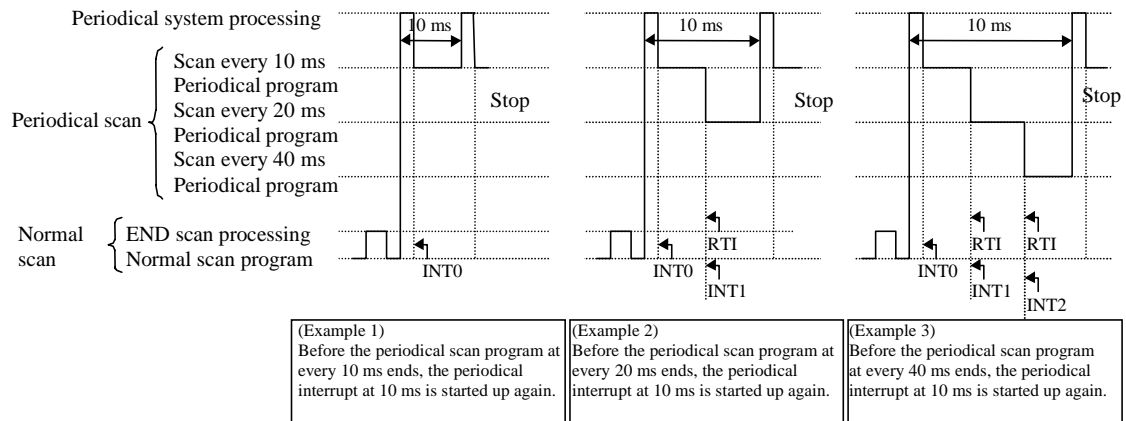


Figure 8.13 Congestion error at periodical scan (10 ms)

Similarly, when executing with a periodical scan at every 20 ms or with a combination of periodical scans at every 20 ms and 40 ms, a congestion error occurs if the periodical scan at 20 ms is started up again before all the periodical scans are completed (i.e., the periodical system processing at INT1 to INT2 does not end within 20 ms). Finally, when using a periodical scan at every 40 ms, a congestion error occurs if the periodical scan at 40 ms is started up again before all the periodical scans are completed (i.e., the periodical system processing at INT2 does not end within 40 ms).

## (3) Continuation of operation after a congestion error

If a congestion error occurs when the special internal output bit R7C1, which specifies whether the operation should continue after a congestion error, is turned on, the execution of the periodical scan is stopped and the periodical scan is executed from the beginning again. If the operation continuation specification for the normal scan is Off when this happens, the scan stops as a congestion error at a normal scan. If the operation continuation specification for the normal scan is On, only the periodical scan continues to be executed in the event of a periodical congestion error. Care must be taken because the normal scan is not executed under this condition.

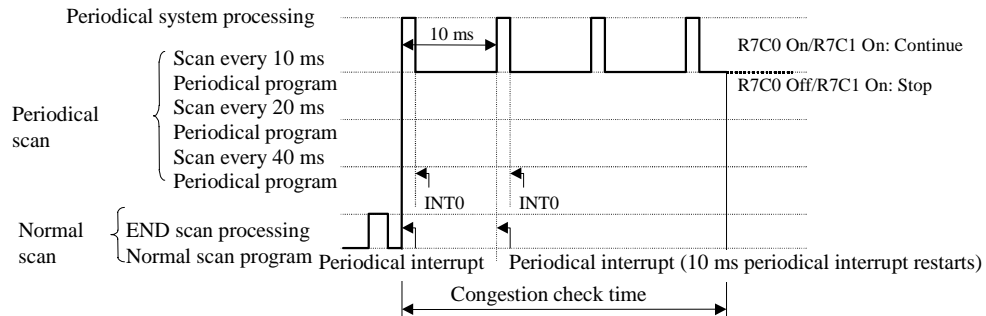


Figure 8.14 Operation when operation continuation at congestion error is set

### 8.1.6 Periodical Scan (EH-CPU448)

## (1) Definition and operation

In addition to the conventional periodical scan, a “5 ms periodical scan” is now available in the EH-CPU448. The basic operations, such as normal operation and operations at congestion errors, are the same as the operations available at the periodic scan described in Section 8.1.5. However, the EH-CPU448 uses “INT0,” which is the interrupt label for the 10 ms periodical scan in CPUs other than the EH-CPU448, as the interrupt label for the 5 ms periodical scan and increases the following label numbers one by one. Please be careful when you use this function. The following table lists the interrupt labels and startup cycles of the EH-CPU448.

Table 8.3 Interrupt labels and startup cycles of the EH-CPU448

No.	Interrupt label	Startup cycle	
		EH-CPU448	Other than EH-CPU448
1	INT0	Every 5 ms	Every 10 ms
2	INT1	Every 10 ms	Every 20 ms
3	INT2	Every 20 ms	Every 40 ms
4	INT3	Every 40 ms	-

## (2) Causes of congestion errors at periodical scan

In the same way as in CPUs other than the EH-CPU448, a congestion error occurs when the execution time of the periodic scan exceeds the minimum cycle (time) of periodical program steps used in the program.

Example 1) If all the interrupt labels, INT0 to INT3, are used

Since the minimum cycle of the periodical scans being used is 5 ms, a congestion error occurs if the total scan time of each periodical scan exceeds 5 ms.

Example 2) When INT2 and INT3 are used

Since the minimum cycle of the periodical scans being used is 20 ms, a congestion error occurs if the total scan time of each periodical scan exceeds 20 ms.

## (3) Continuation of operation after the occurrence of a congestion error

In the same way as in CPUs other than the EH-CPU448, the special internal output bit R7C1, which specifies whether the operation should continue after a congestion error has occurred, can be turned on. In this case, if a periodical scan congestion error occurs, the execution of the periodical scan is suspended and executed from the beginning again.

## (4) Cautions when using 5 ms periodical scan

The congestion check time for the 5 ms periodical scan is approximately 3 ms. A congestion error occurs if the total scan time of each periodical scan and system periodical scan exceeds 3 ms.

## 8.2 Online Change in RUN

The user program can be modified during operation while retaining the output status as is. This is called the "online change in RUN" function. Modifying the user program requires programming software specifically for this or a programmer. Refer to the individual manuals on how to do this.

Online change in RUN cannot be done in the following situations. Perform this operation after completing the conditions.

Table 8.4 Conditions for performing online change in RUN

No	Conditions under which online change in RUN cannot be done	Specific situation	How to satisfy the conditions
1	When READ-occupying	Other programming device is connected.	Change other programming devices to off-line.
2		When a personal computer or panel, etc. is connected and monitoring is being done.	Change the personal computer or panel to off-line. (When monitoring, it is convenient to use the occupancy unnecessary task code.)
3	END command is not executed.	A program that runs in an endless loop is being executed.	Correct the program so that it does not run in an endless loop.
4	Trying to modify a program that contains control commands.	Doing an online change in RUN for a ladder containing a control command may cause operation to stop depending on the type of the program modification error.	An explanation of how to do an online change in RUN for a ladder that contains a control command is given in the programming software manual.
5	A password has been set.	A program protected by a password cannot be modified.	Perform the revision after having the system supervisor remove the password.

(When the CPU is stopped, the modification is executed without displaying a message confirming online change in RUN.)

### 8.2.1 Cautionary Items for Changing Programs in RUN

The system operation of EH-CPU448 is slightly different from those of EH-CPU104/208/308/316. The following describes cautionary items for changing programs in RUN when using EH-CPU448.

#### (1) Updating the timer elapsed value

The timer elapsed value of EH-CPU448 is calculated by comparing with the previous elapsed value when the timer coil command is executed. The execution of a user program halts temporarily when it is changed in RUN. Therefore, the timer elapsed value will not be updated when the CPU is in the HALT state.

Reference: The timer elapsed values of EH-CPU104/208/308/316 are updated periodically. Therefore, these timer elapsed values are updated even in the HALT state.

#### (2) Transferring changed programs to the FLASH memory

EH-CPU448 loads the programs that have been changed in RUN to the FLASH memory after the change in RUN display on the peripheral unit goes off. If the CPU power is turned off while a changed program is being transferred to the FLASH memory, that program may be damaged.

To prevent this, the special internal output R7EF which indicates that programs are being transferred to the FLASH memory (turns on while programs are being transferred to the FLASH memory) has been added. Before turning off the CPU power, be sure that this special internal output R7EF is off, or wait for about two minutes after the change in RUN operation.

The EH-150 operation when the user program is changed in RUN is shown below.

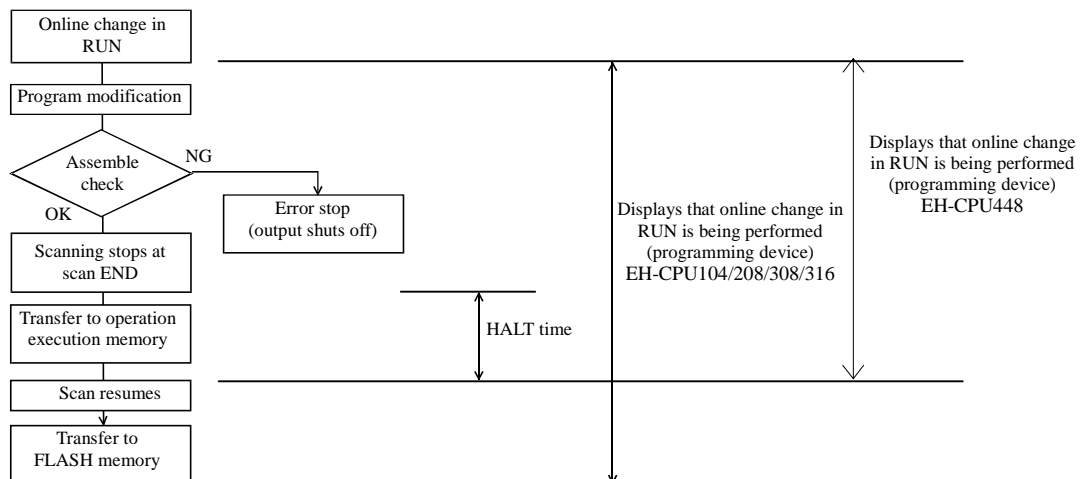


Figure 8.15 Internal processing for an online change in RUN

### 8.2.2 HALT time

When performing online change in RUN, the program to be written to the CPU is checked if there are no errors, then the CPU is halted temporarily (RUN → HALT).

The program of the modified area is written to the CPU while it is halted, and the CPU is set to operate (HALT → RUN) again.

At this time, the approximate time the CPU is halted will be obtained in the equation below (it is not necessarily the maximum value).

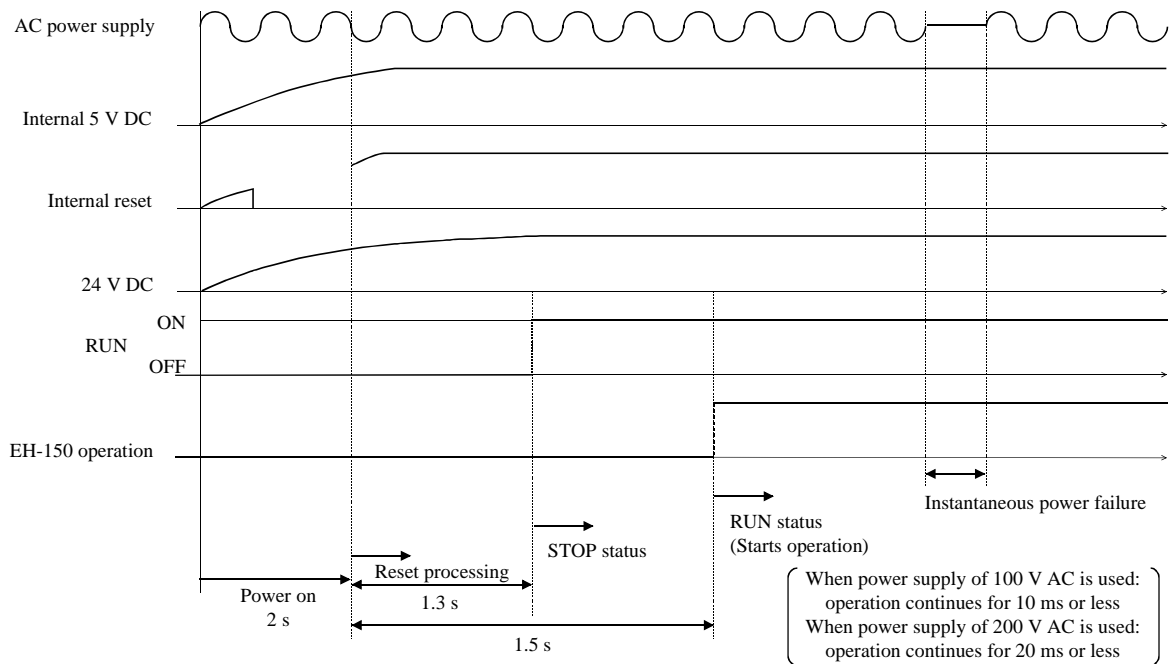
$$\begin{aligned}\text{HALT time (ms)} &= 45 \times \text{Program capacity (ks)} + 20 \text{ (EH-CPU104/208)} \\ &= 38 \times \text{Program capacity (ks)} + 10 \text{ (EH-CPU308/316)} \\ &= 29 \times \text{Program capacity (ks)} + 60 \text{ (EH-CPU448)}\end{aligned}$$

An example of a calculation of the HALT time using the above equation is shown below.

Program capacity (ks)	HALT time (ms)				
	EH-CPU104	EH-CPU208	EH-CPU308	EH-CPU316	EH-CPU448
4	200		162		176
8	-	380	314		292
16	-	-	-	618	524
48	-	-	-	-	1,452

### 8.3 Instantaneous Power Failure

What happens when the power supply to the EH-150 shuts off, is shown below.



#### (1) Powering on

The EH-150 starts operations after a maximum of 3.5 seconds have elapsed after power-up. If the power for input module is not completely started when the operation is commenced, the input that is supposed to be on will be received as OFF and operation proceeds, so make sure that the power for I/O module is completely started before operation is commenced.

**Note:** When expanding the unit using the EH-CPU208/308/316/448, turn on the power supply of the expansion side, or turn on the power for the basic side and expansion side simultaneously. If the basic side is powered up first, an error will occur.

#### (2) Instantaneous power failure actions

##### (a) When 100 V AC is supplied

Operation is continued during instantaneous power failures that last less than 10 ms.

##### (b) When 200 V AC is supplied

Operation is continued during instantaneous power failure that last less than 20 ms.

**Note:** Make arrangements so that the power for input module is supplied while the CPU continues its operation. If the power is not supplied, the CPU will perform operation assuming the input data as OFF. Exercise caution especially when performing operation that changes the contents of the power failure memory using input signals, since the contents of the power failure memory might be altered unintentionally due to an instantaneous power failure.

## 8.4 Operation Parameter

The settings of "parameters," which are required to perform tasks such as creating programs, transferring programs to the CPU, are performed. The setting contents are explained below.

Item	Function	Description	When to use the function												
1	Password	<ul style="list-style-type: none"><li>○ Register a password to a program in the four-digit hexadecimal format. The program with a password will not allow program operation nor changes unless the correct password is entered, so please exercise caution. <u>Caution: The user will not be able to reset the password when it is forgotten, so exercise sufficient caution when using a password.</u> Password is not set at the time of shipment.</li></ul>	Use when protecting the confidentiality of the program.												
2	CPU type	<ul style="list-style-type: none"><li>○ Set the CPU name used to perform programming. For EH-150, set to the following: Set H-302 with the EH-150. However, set EH-150 with the LADDER EDITOR (Windows ® version) Ver 2.0 or later.</li></ul>	Always perform these settings when programming.												
3	Memory assignment	<ul style="list-style-type: none"><li>○ Set the memory capacity. For EH-150, set to the following:<table border="1"><tr><td>CPU</td><td>EH-CPU104</td><td>EH-CPU208/308</td><td>EH-CPU316</td></tr><tr><td>Memory type</td><td>RAM-04H</td><td>RAM-08H</td><td>RAM-16H</td></tr></table> <table border="1"><tr><td>CPU</td><td>EH-CPU448</td></tr><tr><td>Memory type</td><td>RAM-48H</td></tr></table></li></ul>	CPU	EH-CPU104	EH-CPU208/308	EH-CPU316	Memory type	RAM-04H	RAM-08H	RAM-16H	CPU	EH-CPU448	Memory type	RAM-48H	Always perform these settings when programming.
CPU	EH-CPU104	EH-CPU208/308	EH-CPU316												
Memory type	RAM-04H	RAM-08H	RAM-16H												
CPU	EH-CPU448														
Memory type	RAM-48H														
4	Operation parameters	<ul style="list-style-type: none"><li>○ Operation control Perform these settings when controlling the operation and stopping using a specific I/O. If this is not set, operation will commence automatically when the RUN switch is set to "RUN."</li><li>○ Overload check time Set this when you wish to stop the CPU operation when the set maximum processing time for a normal scan is exceeded. When the setting is not made, this is automatically set to initial value 100 ms.</li><li>○ Operation mode at abnormal occurrence Set this when you wish to continue the CPU operation when the error generated by the CPU is minor. However, do not use this when not debugging.</li></ul>	Set according to the user's operation purposes.												
5	I/O assignment	<ul style="list-style-type: none"><li>○ This sets the I/O assignment information of the CPU. It is recommended to use the EH-150's convenient I/O assignment copy function.</li></ul>	Always perform these settings when programming.												
6	Program name	Set the program name using a maximum of 16 kana or alphanumeric characters. The set program names can be written into the CPU along with the program, which will make the program verification and maintenance works easier.	Set this when easy program verification and maintenance are desired.												
7	Power failure memory	This sets the range in which the data in a specified area in the CPU is to be stored upon CPU power off or when commencing RUN. Settings for R, WR, WM, TD, DIF, DFN are possible.	Set this when there is data you wish to maintain when operation is stopped.  The special internal output data is unconditionally saved for power failure by I/O number.												

## 8.5 Test Operation

### (1) Verification of interlock

Verify the performance of the interlock in preparation for unexpected accidents.

Create ladders such as an emergency stop ladder, protective ladder and interlock ladder outside the program controller. With regard to the relay output module, however, do not control the relay drive power supply to interlock with external loads.

### (2) Operation without load

Before actually operating the loads in the system, test the program only and verify its operation.

Always perform this if there is any possibility of damaging the other party's equipment due to unexpected occurrences caused by program errors or other problems.

### (3) Operation using actual loads

Supply power to the external input and external output to verify the actions.

# Chapter 9 PLC Installation, Loading, Wiring

## 9.1 Installation

### (1) Installation location and environment

- (a) When installing the EH-150, use the module within the [3.3 general specification] environment.
- (b) Mount the PLC onto a metal plate.
- (c) Install the PLC in a suitable enclosure such as a cabinet that opens with a key, tool, etc.

### (2) Installing the base unit

#### (a) Precautions when installing the base unit

- 1] When installing the base unit, fix it securely with screws in 4 places (M4, length 20 mm (0.79 in.) or more) or DIN rail.
- 2] To keep the unit within the ambient temperature range when using,
  - a) Allow ample space for air circulation. (50 mm (1.97 in.) or more at top and bottom, 10 mm (0.39 in.) or more to the left and right)
  - b) Avoid installing the unit directly above equipment that generates a lot of heat (heater, transformer, large-capacity resistance, etc.)
  - c) When the ambient temperature reaches more than 55 °C, install a fan or cooler to lower the temperature to below 55 °C.
- 3] Avoid mounting inside a panel where high-voltage equipment is installed.
- 4] Install 200 mm (7.87 in.) or more away from high-voltage lines or power lines.
- 5] Avoid upside down, vertical or horizontal mounting.

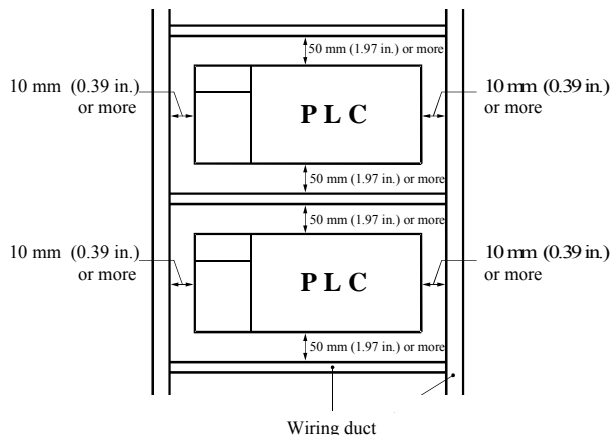


Figure 9.1 Amount of installation

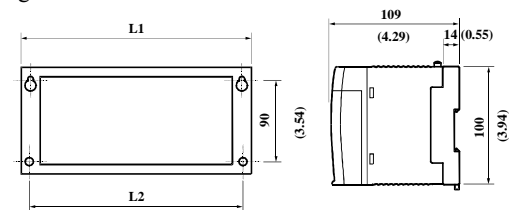


Figure 9.2 External dimensions

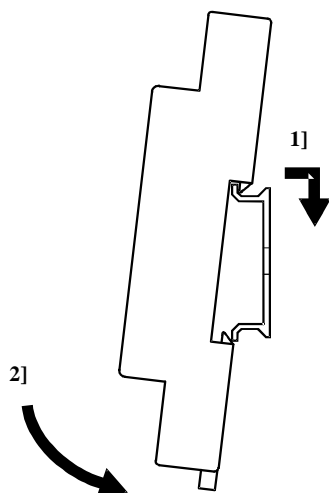
Dimensional table

Base	L1 (Outer dimensions)	L2 (Mounted dimensions)
3 slots	222.5 (8.76)	207 (8.15)
5 slots	282.5 (11.12)	267 (10.51)
8 slots	372.5 (14.67)	357 (14.06)

Unit: mm (in.)

#### (b) Mounting to a DIN rail

##### Attaching to a DIN rail

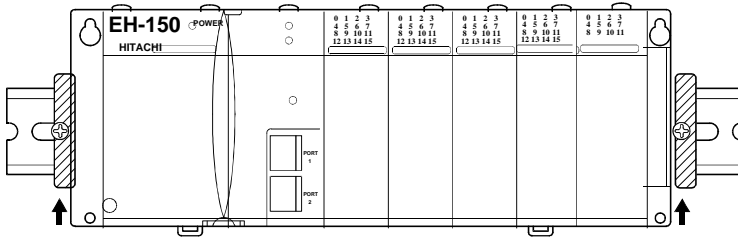


- 1] Hook the claw fixed at the bottom of the base unit, to the DIN rail.
- 2] Press the base unit into the DIN rail until it clicks.

Note: After installation, check to make sure the base unit is securely fixed.

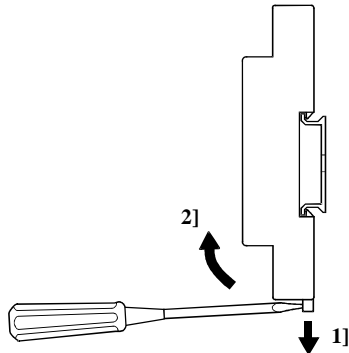


### Fixing the unit



Secure the unit by installing DIN rail fixing brackets from both sides. (The product may go out of place if not secured with the fixing brackets.)

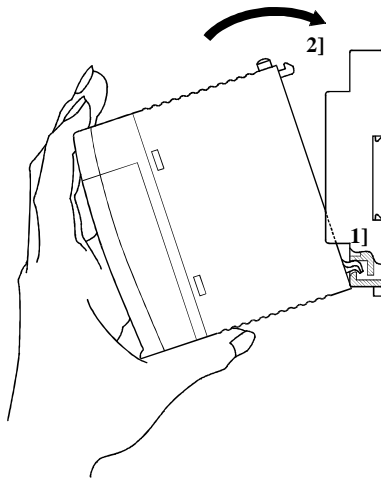
### Removing the unit from the DIN rail



- 1] While lowering the DIN rail fixing mounting lever toward the bottom, raise the base upward to remove.

## 9.2 Loading the Module

### (1) Installing



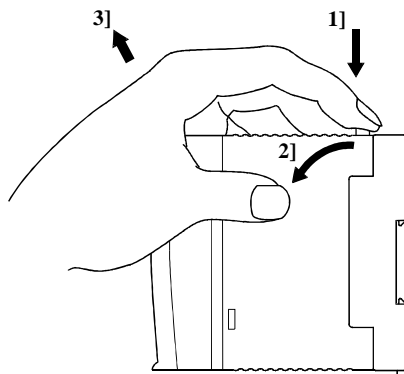
- 1] Hook the claw at the lower section of the module to the hole in the base.
- 2] Press in the upper side of the module until it clicks.

Note 1: After loading the module, check to make sure it does not come out.

Note 2: Load the power module at the leftmost side of the base unit.

Note 3: Load the CPU module and I/O controller to the left of the power module.

### (2) Removing



- 1] Push in the lock button.
- 2] With the lock button pushed in, pull the top of the module toward the front.
- 3] Raise it toward the top and pull it out.

Note: For the power module, pull it out while pushing down the two lock buttons.

## 9.3 Wiring

### (1) Separation of the power system

For the power supply, there is power for the EH-150 PLC unit/power for the I/O signals/power for general equipment. These power supplies should be wired from separate systems as much as possible.

When these power supplies are supplied from one main power source, separate the wiring with a transformer or similar device, so that each power supply is a separate system.

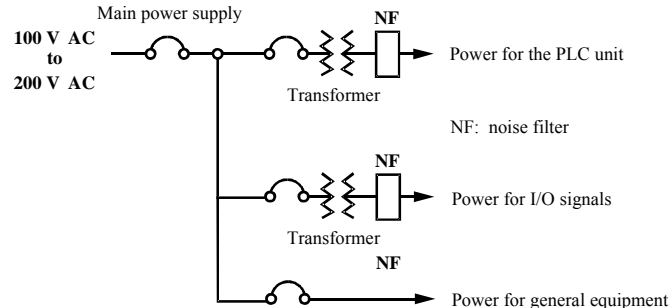


Figure 9.3 Example of power system diagram

### (2) Regarding fail safe

#### 1] Construct an interlock circuit outside the PLC.

When the PLC power supply is turned on or off, the lag time and difference in startup time between the PLC unit power and the external power (particularly DC power supply) for the PLC I/O module signals, may temporarily cause the I/O not to operate normally.

Do not control the power for the EH-YR12 relays to have it perform an interlock with the external load, etc. The relays may turn on even when power is not being supplied by an aluminum electrolytic condenser inside the module to drive the relays.

Also, it is plausible that a fault in the external power supply or a failure in the PLC unit will lead to abnormal actions. To prevent such actions from causing abnormal operation of the entire system, and from the viewpoint of creating a fail-safe mechanism, construct ladders such as an emergency stop circuit, the protect circuit, and the interlock circuit, for the sections that lead to a mechanical breakdown or accident from abnormal operation outside the PLC.

#### 2] Install a lightning arrester

To prevent damage to equipment as a result of being struck by lightning, it is recommended that a lightning arrester be set up for each PLC power supply ladder.

The EH-150 detects power failures from a voltage drop of the internal 5 V DC power supply. For this reason, when the load in the unit's internal 5 V DC is light, the 5 V DC is retained for a long time and operations may continue for more than 100 ms. Therefore, when using the AC input module, an off delay timer for coordinating with the internal 5 V DC is necessary since the AC input signal turns off more quickly than the internal 5 V DC.

### (3) Wiring to the power module

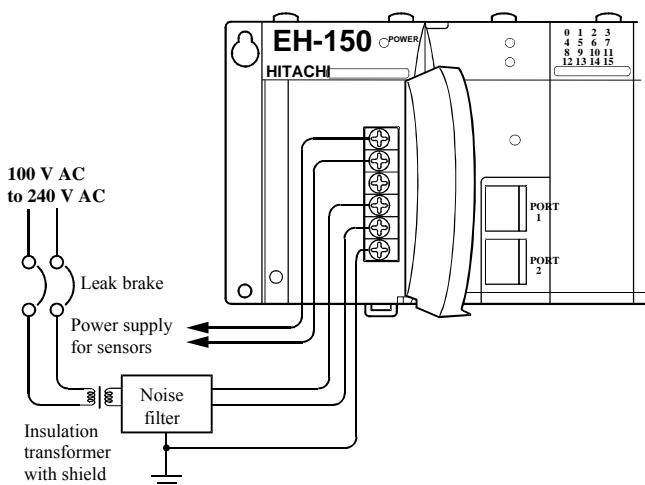
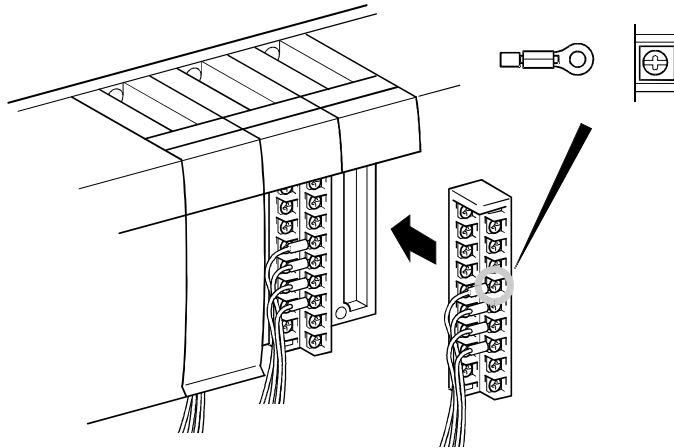


Figure 9.4 Wiring power diagram

- (a) For power supply wiring, use a cable of 2 mm<sup>2</sup> (0.0031 in.) or more to prevent a voltage drop from occurring.
- (b) The function ground terminal (FE terminal) should use cable of 2 mm<sup>2</sup> (0.0031 in.<sup>2</sup>) or more and Class D grounding (100 Ω or less). The appropriate distance for ground cable is within 20 m (65.62 ft.).
  - 1] Shared with instrumentation panel, relay panel grounding
  - 2] Avoid joint grounding with equipment that can generate noise such as high-frequency heating furnace, large power panel (several kW or more), thyristor exchanger, electric welders, etc.
  - 3] Be sure to connect a noise filter (NF) to the power cable.
- (c) The terminal screw is an M3. When wiring, tighten screws within a torque range of 0.49 to 0.78 N·m.
- (d) Use the same power supply system for the basic and expansion units.

(4) Wiring cable for I/O signals



Screws for all terminals are M3.

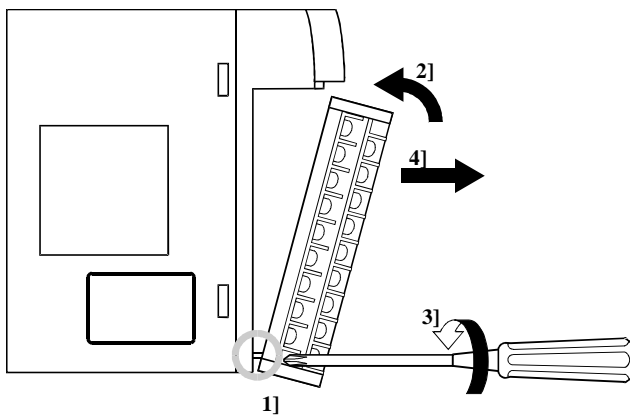
Tighten within a torque range of 0.49 to 0.78 N·m. When using a crimp terminal, use one with an outer diameter of 6 mm (0.24 in.) or less.

Use only up to two crimp terminals in the same terminal. Avoid clamping down more than three at the same time.

Use a cable thickness of maximum 0.75 mm<sup>2</sup> (0.0011 in<sup>2</sup>). (Use a 0.5 mm<sup>2</sup> (0.00075 in<sup>2</sup>) cable when adding two crimp terminals in the same terminal).

Note: When corresponding to CE marking EMC command is necessary, use shielded cable for the relay output module.

Attaching the terminal block



- 1] Align the tip of the terminal block mounting screws to the screw section of the I/O cover insertion fittings.
- 2] Push in the top of the terminal block until the I/O cover claw section locks with a click.
- 3] While holding down the upper part of the terminal block, tighten the terminal block mounting screws.
- 4] Pull on the top of the terminal block to make sure that it is locked and cannot come out.

Note: If the terminal block is removed, always reinstall it following the instructions above.

(5) Input wiring for the input module

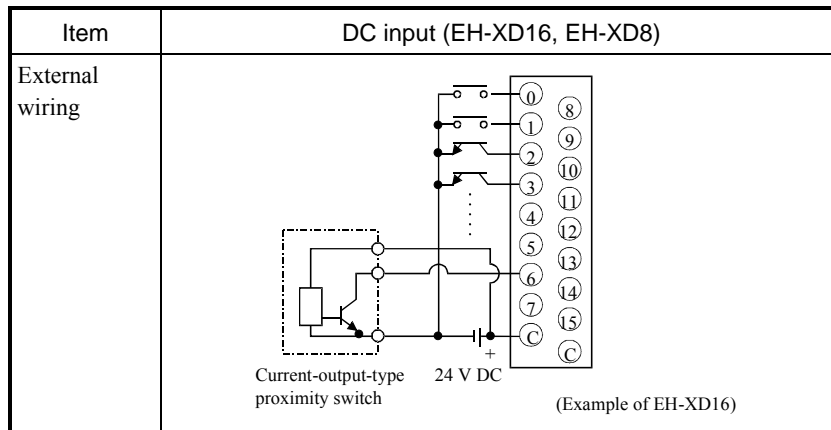
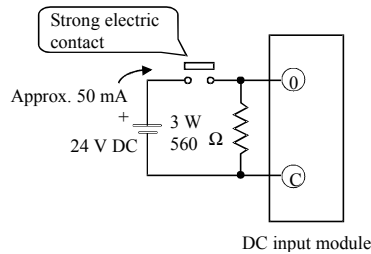


Figure 9.5 Input wiring

(a) DC input module

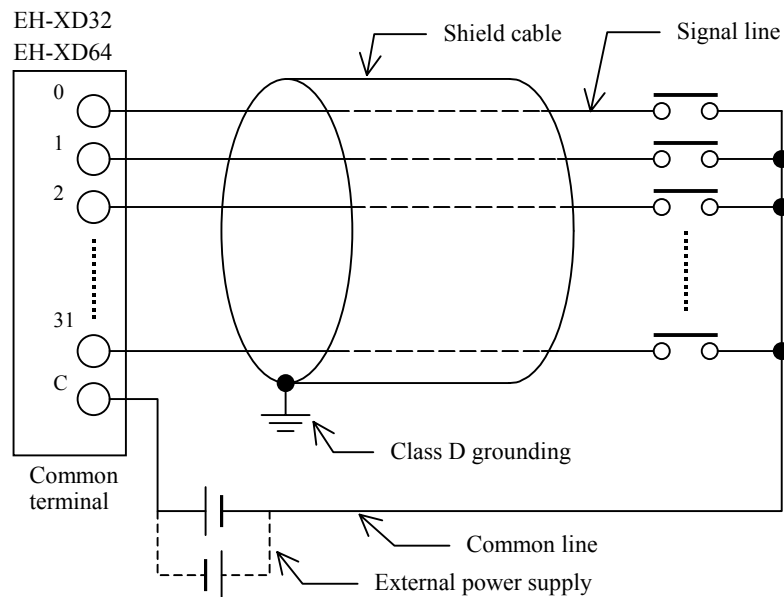
- 1] When all input terminals (X0, X1, ...) and the common terminal (C) are loaded with 24 V DC, inputs change to ON, and approximately 6.9 mA of current in the case of the EH-XD8, and approximately 4mA in the case of the EH-XD16, flow to the external input contacts.
- 2] For sensors such as a proximity switch or photoelectric switch, current output type (transistor open collector) can be directly connected. For voltage-output-type sensors, connect them to the input terminal after first going through the transistor.
- 3] Measures to prevent faulty contact in a strong electric contact



The current that flows to a contact when external contacts are closed is approximately 6.9 mA for the EH-XD8, and approximately 4 mA for the EH-XD16. If the use of a strong electric contact cannot be avoided, add resistance as shown in the diagram at left and supply sufficient current to the contact to prevent a faulty contact.

- 4] Limit the wiring length within 30 m (98.43 ft.).

(b) Wiring for the 32-point/64-point input module EH-XD32, EH-X64 (Based on CE marking)



Cautionary notes

- 1] Wire only the signal line through the shielded cable, and provide class D grounding on the shielded cable side.
- 2] Do not wire the common line through the shielded cable. Be sure to wire it independently and separately from the power line, I/O lines or power supply line.
- 3] The supply line to the external power supply should be wired as close as possible to the common terminal of the input module.

(6) Output wiring for the output module

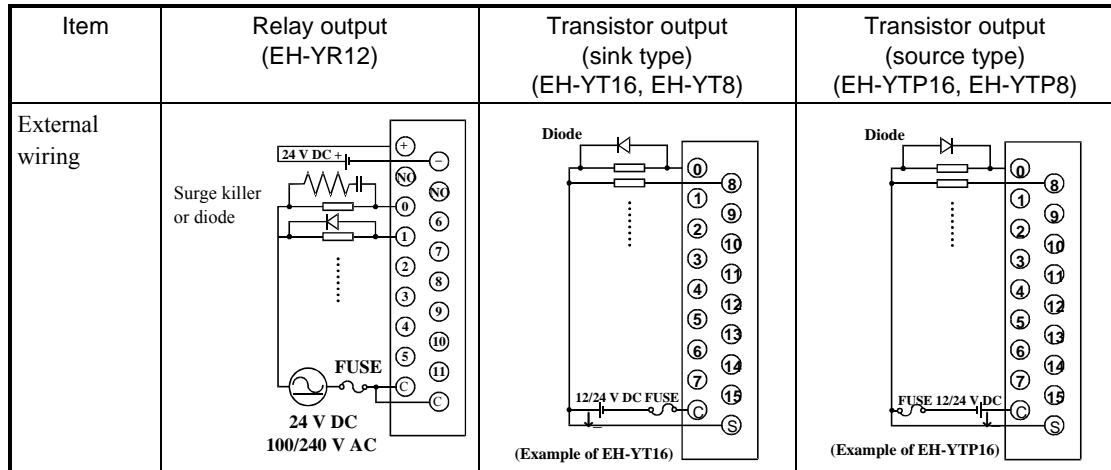
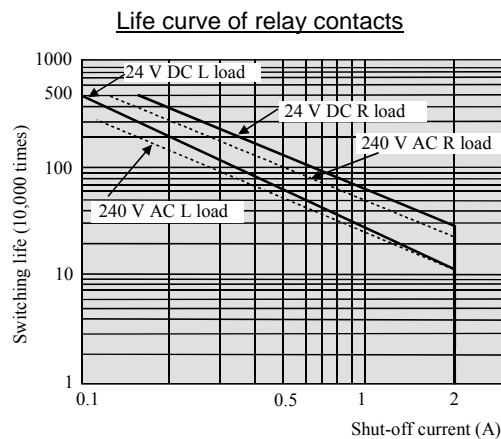


Figure 9.6 Output wiring

(a) Wiring for the relay output module

1] Life of relay contacts



Life of the contact is also in squared reverse proportion to the current, so be aware that interrupting rush current or directly driving the condenser load will drastically reduce the life of the relay.

When switching is done with high frequency, use a transistor output module.

2] Surge killer

For inductive load, connect a surge killer (condenser 0.1  $\mu$ F, + resistance of around 100  $\Omega$ ) in parallel to the load. Also, for DC load, connect a flywheel diode.

3] Fuse

A fuse is not built into this module. Install a 6 A fuse in the common to prevent the external wiring from burning out.

4] Power supply for driving the relays

If a 24 V DC power supply is connected to drive the relays, take care with respect to the polarity when connecting. There is a risk that the internal circuit will be damaged if the wiring is done incorrectly. Also, do not perform an interlock, etc. to the external load with the power supply for driving the relays.

(b) Wiring for the transistor output module

5] Flywheel diode

For inductive load, connect a flywheel diode in parallel.

6] S and C terminals

Always connect an S terminal and C (common) terminal. If the module is used without connecting these terminals, the internal flywheel diode does not function and there is a risk that the module will malfunction or breakdown.

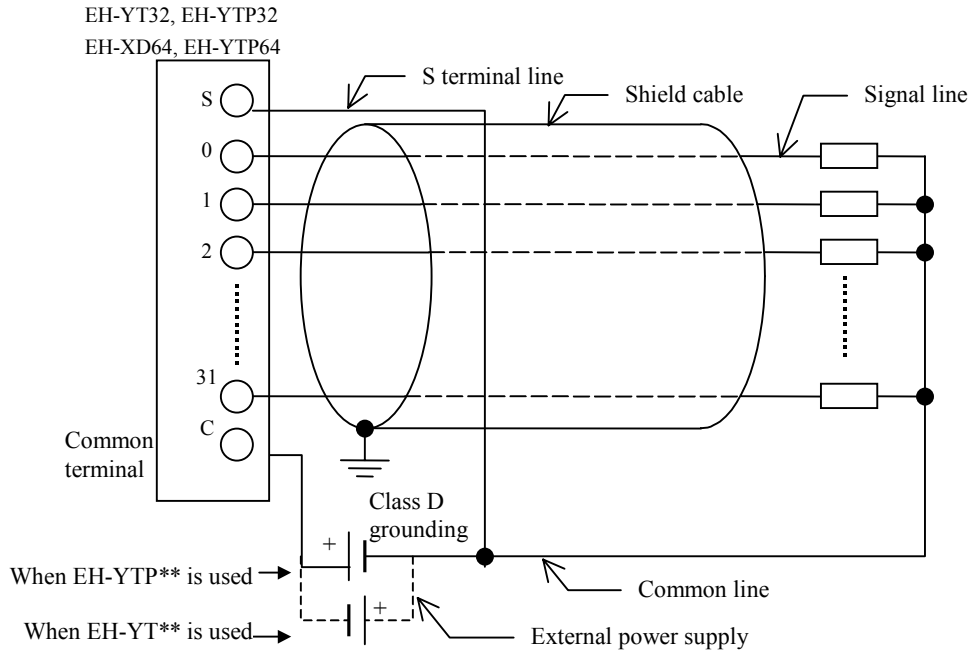
7] Fuse

A fuse is inserted in the common to prevent the external wiring from burning out, but this does not protect transistor elements. Therefore, when the external load is shorted, these elements are destroyed, so exercise caution. If the external load shorts, please contact us for repair.

Also, if the fuse blows, there will be no output even if the LED lights up. (The fuse out lamp for the module at this time as well as a CPU module error will not be displayed.)

Note: If the fuse is melted or blown, do not supply power to the module after changing the fuse without eliminating the source of the problem. Damage escalation, smoke, etc., may otherwise result.

(c) Wiring for the 32-point/64 point output module EH-YT32/YTP32, EH-YT64/YTP64 (Based on CE marking)



Cautionary notes

- 1] Wire only the signal line through the shielded cable, and provide class D grounding on the shielded cable side.
- 2] Do not wire the common line or S terminal line through the shielded cable. Be sure to wire them independently and separately from the power line, I/O lines or power supply line.
- 3] The supply line to the external power supply should be wired as close as possible to the common terminal of the output module.

(7) Analog module I/O wiring

- Do not apply excess voltage to the analog input module beyond the rated input voltage. Similarly, do not subject the module to current that exceeds the rated input current. Connecting the analog input module to a power supply other than the specified types may cause damage to the product or burning of its internal components.
- For unused channels of the analog input module, short the input terminals before use.
- For unused channels of the analog output module (unused current output channel, 2 to 3 channels), short the outputs before use.
- When wiring the external lines of the analog module, route them through the shielded cables while separating them from other power lines or signal lines subject to differential voltage. Shielded cables must be grounded on one side. However, whether it is more effective to ground on one side or leave both sides open, depends on the noise environment condition in the actual use. Provide appropriate grounding based on the noise environment.
- Use separate piping for the AC power supply line and the signal/data lines.
- Wire the signal lines and data lines as close as possible to the grounded surface of the cabinet or a metal bar.

## (8) Wiring to the module terminal

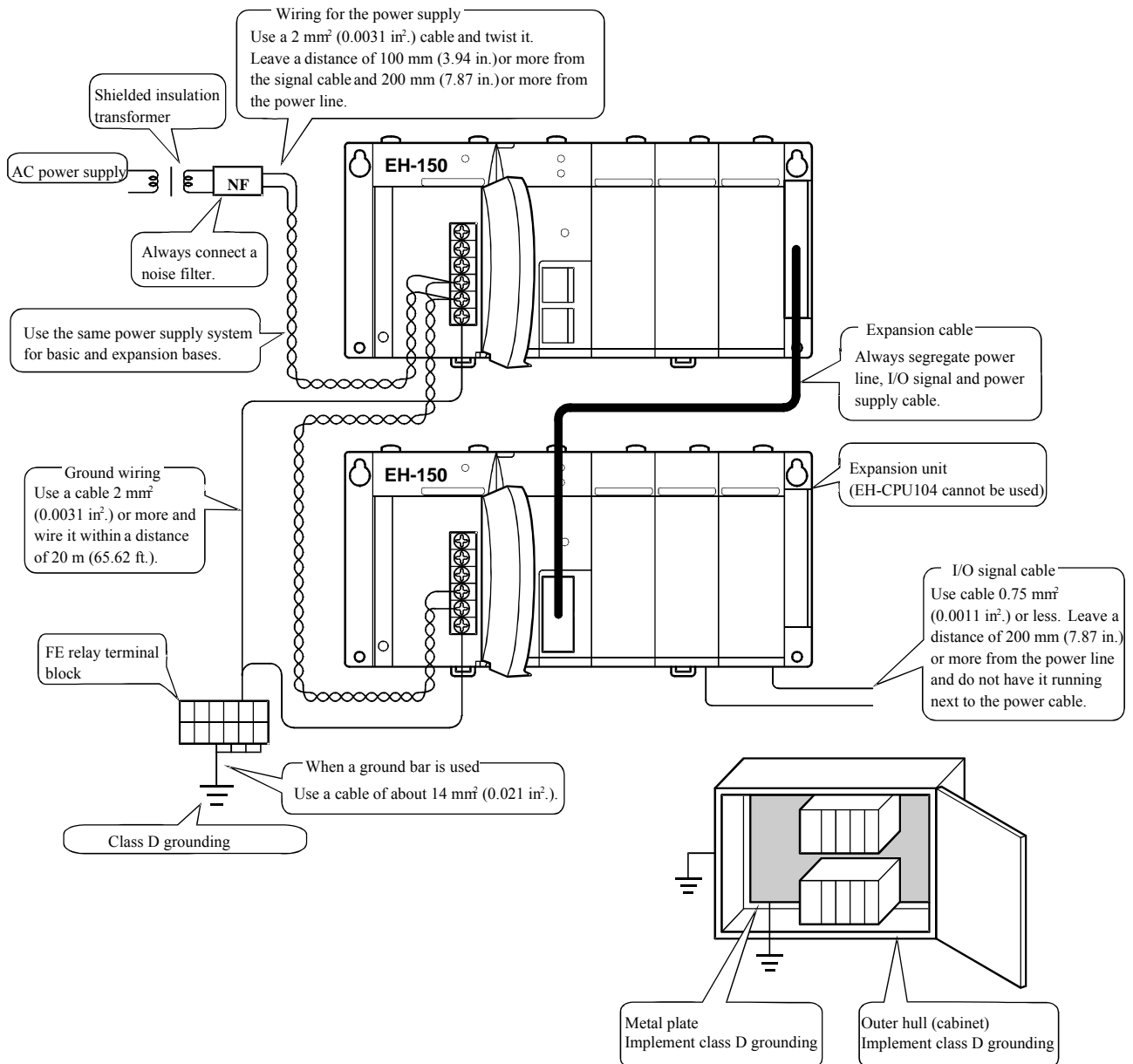


Figure 9.7 Example of wiring

# Chapter 10 Communication Specifications

## 10.1 Features

The EH-150 has two communication ports.

Port 1 can be used as a dedicated port or it can be switched to a general-purpose port to perform communication using the user program. Also, it comes with a modem control function (not supported by the EH-CPU104), which allows communication from a distant location by setting up a modem in Port 1.

With the EH-CPU448, 1:N communication using a task code with station number and communication by the transmission control procedure 2 can be performed at the dedicated port of the port 1.

Port 2 can be used as a dedicated port.

### 10.1.1 Communication port functions

Table 10.1 Communication port specifications

	Port specification	Interface	Connection mode	Communication protocol	Connected device
Port 1	Dedicated	RS-232C	1 : 1	Transmission control procedure 1, transmission control procedure 2 <sup>*1</sup>	Programming device, monitor
				Modem control (AT command) transmission control procedure 1, transmission control procedure 2 <sup>*1</sup>	Modem
		RS-422 <sup>*1</sup>	1 : 1	Transmission control procedure 1, transmission control procedure 2	Programming device, monitor
			1 : N	Transmission control procedure 1 with station No. Transmission control procedure 2 with station No.	
		RS-485 <sup>*1</sup>	1 : 1	Transmission control procedure 1, transmission control procedure 2	Programming device, monitor
			1 : N	Transmission control procedure 1 with station No. Transmission control procedure 2 with station No.	
	General	RS-232C	1 : 1	TRNS command control (no procedure)	Communications equipment such as personal computer
		RS-422 <sup>*2</sup>	1 : 1, 1 : N		
		RS-485 <sup>*2</sup>	1 : 1, 1 : N		
Port 2	Dedicated	RS-232C	1 : 1	Transmission control procedure 1	Programming device, monitor

\*1 Only the EH-CPU448 is supported.

\*2 Only the EH-CPU308/316 and EH-CPU448 are supported.

### 10.1.2 Port 1 setup method

Set the mode setting switch according to your application, then set the special internal output values based on the user setting values listed below. For more details on the mode setting switch, see page 4-6. For the meaning of the port setting bits, see the descriptions of the special internal outputs WRF036 and WRF037.

#### (1) General port setup

When data is transmitted and received using the TRNS 0 and RECV 0 commands in a user program, set the interface according to the method shown below. After the set value has been changed by the user, when the system receives the set value change, the system sets the following system set values in special internal outputs, and switches the interface. If user set values other than specified below are set, the system will not accept those settings. Be sure to verify the safety of the unit to be connected before the setting is changed.



Table 10.2 General port settings of port 1

Mode SW		WRF036		Contents of setting	
2	5	User set value	System set value	Interface	Control procedure
OFF	OFF	H0003	H0002	RS-232C	Non-procedure (use TRNS 0 and RECV 0 commands)
		H0005	H0004	RS-422	
		H0009	H0008	RS-485	

## (2) Dedicated port mode setup

When a modem is used, perform the following setup:

Table 10.3 Modem settings of port 1

Mode SW		WRF037			Contents of setting	
2	5	User set value	System set value *1	Value displayed after power restart	Interface	Control procedure
OFF	OFF	H8000	H0000	H0000	RS-232C	Transmission control procedure 1
		HC000	H4000	H4000		Transmission control procedure 2

## (3) Dedicated port setup

If the port 1 is used as a dedicated port, perform the following setup.

By performing this setup, communication via RS-232C, RS-422 and RS-485 interfaces, as well as communication via transmission control procedures 1 and 2, 1:1 and 1:N dedicated port communication with station number can be performed. Any change to the setting of the dedicated port 1 becomes valid when the power is turned on next time.

Table 10.4 shows the set values to change the setting at the time of delivery (WRF037=H0000).

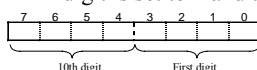
Table 10.4 Dedicated port settings of port 1

Mode SW		WRF037			Contents of setting	
2	5	User set value	System set value *1	Value displayed after power restart	Interface	Control procedure
-	ON	H8000	H0000	H0000	RS-232C	Transmission control procedure 1
		HC000	H4000	H4000		Transmission control procedure 2
		H8100	H0100	H0500	RS-422	Transmission control procedure 1
		HC100	H4100	H4500		Transmission control procedure 2
		HA1**	H21**	H25**		Transmission control procedure 1 with station No.
		HE1**	H61**	H65**		Transmission control procedure 2 with station No.
		H8200	H0200	H0A00	RS-485	Transmission control procedure 1
		HC200	H4200	H4A00		Transmission control procedure 2
		HA2**	H22**	H2A**		Transmission control procedure 1 with station No.
		HE2**	H62**	H6A**		Transmission control procedure 2 with station No.

\*\* 1: Denotes a station number in 1:N communication. Set\*2 a 2-digit BCD value from 00 to 31. If a value outside this range is specified as a station number, the specified value will be displayed, but the system will operate using a BCD value of 31.

\*1 The current interface status is displayed by b11 and b10 of WRF037. Because of this, different values may be displayed as system set values depending on the setting of the previous operation. For the content of each bit, see the description of the special internal output WRF037.

\*2 If station number H1A is specified, for example, in the figure below, note that the system treats it as if the second digit is set to 1 and the first digit is set to HA (10).



## 10.2 Dedicated Port

The designations for port 1 when set as a dedicated port, and port 2 (fixed to dedicated port) are shown in table 10.5. Port 1 can be switched to a generic-use port.

When setting a general-purpose port or a modem connection to port 1, refer to those specifications respectively.

In the dedicated port, a CPU program can be created or monitored from the programming device connected. Also, a monitoring system which uses a monitor available on the market can be constructed. Moreover, a variety of systems can be constructed by connecting a personal computer and creating software.

Adjust the connecting cables setup and setting switches to the purpose for which they are to be used and check these carefully beforehand.

Table 10.5 Specifications for a dedicated port

Item	Specification				
Transmission speed	4,800 bps, 9,600 bps, 19,200 bps, 38,400 bps (except for EH-CPU 104) Change the speed using the setting switch.				
	Port 1			Port 2 *1	
	SW3	SW4	Transmission speed setting	SW6	Transmission speed setting
	ON	ON	4,800 bps	ON	PHL = Low: 9,600 bps PHL = High: 38,400 bps
	OFF	ON	9,600 bps		
	ON	OFF	19,200 bps	OFF	PHL = Low: 4,800 bps PHL = High: 19,200 bps
	OFF	OFF	38,400 bps		
Interface*2	Conforms to RS-232C		RS-422	RS-485	Conforms to RS-232C
Max cable length	15 m		500 m	500 m	15 m
Connection mode (max connected units)	1 : 1		1 : N (32 units)	1 : N (32 units)	
Communication system	Half duplex				
Synchronization system	Start-stop synchronization				
Startup system	One-sided startup using the host side command				
Transmission system	Serial transmission (bit serial transmission)				
Transmission code	ASCII				
Transmission code configuration	ASCII: 7-bit data, 1 start, 1 stop, even number parity				
Transmission code outgoing sequence	Sent out from the lowest bit in character units				
Error control	Vertical parity check, sum check, overrun check, framing check				
Transmission unit	Message unit (variable length)				
Maximum message length	503 bytes*3 (including control characters)				
Control procedure	H-series dedicated procedure (high protocol) Standard procedure 1 (transmission control procedure 1), simplified procedure (transmission control procedure 2)*2				
Connector used	CPU side: TM5RJ3-88 8-pin modular connector (Hirose) Partner side: Comparable to TM10P-88P (Hirose)				

\*1 When the port selector switch is set to programmer connection, the PHL signal may be set to HIGH. However, +12 V DC is output from the connector pin 5 of port 2 simultaneously, so exercise caution.

\*2 The communication interfaces of RS-422 and RS-485 and transmission control procedure 2 are supported only by the EH-CPU448.

\*3 When H series' dedicated procedure with station number is used in the EH-CPU448, the maximum message length will be 505 bytes (including control character).

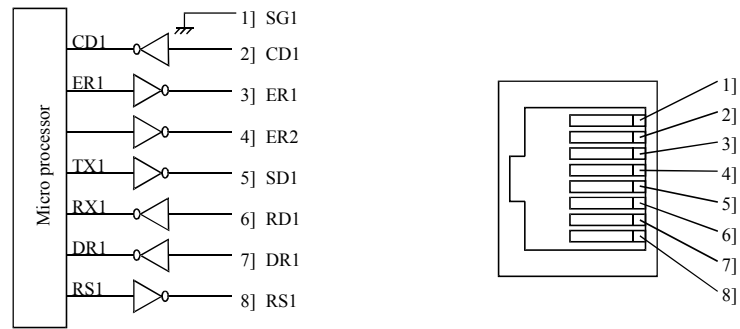


Figure 10.1 Ladder diagram and pin numbers for port 1

Table 10.6 List of port 1 signals

Pin No.	Signal abbreviation	Direction		Meaning
		CPU	Host	
1]	SG1	←→	←→	Ground for signal
2]	CD1	←	←	Notification signal during carrier received
3]	ER1	→	→	Communication enabled signal When this signal is high level, communication is possible.
4]	ER2	→	→	Outputs High
5]	SD1	→	→	Data sent by the CPU
6]	RD1	←	←	Data received by the CPU
7]	DR1	←	←	Peripheral units connected signal When this signal is high level, indicates that dedicated peripherals are connected.
8]	RS1	→	→	Transmission request signal When this signal is high level, indicates that the CPU can receive data.

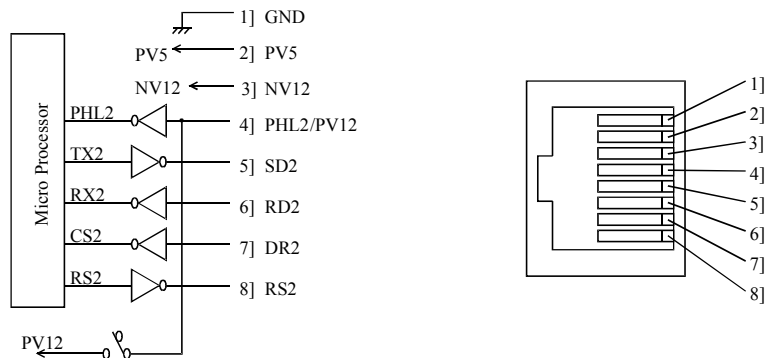


Figure 10.2 Ladder diagram and pin numbers for port 2

Table 10.7 List of port 2 signals

Pin No.	Signal abbreviation	Direction		Meaning
		CPU	Host	
1]	SG2	←→	←→	Signal ground
2]	PV5	←	←	5 V DC is supplied.
3]	NV12	→	→	-12 V DC is supplied.
4]	PHL2 / PV12	←	→	Peripheral units connected signal/+12 V DC output. Indicates that a dedicated peripheral is connected. (when the switching switch is off). 12 V DC is supplied. (when the switching switch is on).
5]	SD2	→	→	Data sent by the CPU
6]	RD2	←	←	Data received by the CPU
7]	DR2	←	←	Receive enabled signal When this signal is high level, indicates that connected devices can receive data.
8]	RS2	→	→	Transmission request signal When this signal is high level, indicates that the CPU can receive data.

## 10.3 General-Purpose Port

Port 1 can be used as a general-purpose port. When Port 1 is designated as a general-purpose port, the send and receive operations are controlled by the user program. The specifications for a general-purpose port are given in Table 10.8 below. When the settings are made for a dedicated port or modem connection, refer to their specifications respectively. When a general-purpose port is designated, communication operations are controlled from the user program (use the TRNS0, RECV0 commands). In this case, communication procedures can be created as desired according to the devices that are connected. Also, by connecting a modem and setting up original communication commands, communication can be performed via the modem. (In this case, since ER signals cannot be controlled, it is necessary to perform line disconnection using a command or use other I/O and connect a cable for control).

Adjust the connecting cables setup and setting switches to the purpose for which they are to be used and check these carefully beforehand. Refer to P4-6 for setting switch.

Table 10.8 Specifications for a general-purpose port

Item	Specification		
Transmission speed	300, 600, 1,200, 2,400, 4,800, 9,600, 19,200 bps		
Communication system	Half duplex		
Synchronization system	Start-stop synchronization		
Startup system	One-sided startup using the host side command		
Transmission system	Serial transmission (bit serial transmission)		
Transmission code	User defined		
Transmission code configuration	User setting: (1 start, 7 or 8 bit data, NON or EVEN or ODD parity, 1 or 2 stop)		
Transmission code outgoing sequence	Sent out from the lowest bit in character units		
Error control	Vertical parity check, overrun check, framing check		
Transmission unit	Message unit (variable length)		
Maximum message length	256 bytes (including control characters)		
Interface *	Conforms to RS-232C	RS-422	RS-485
Maximum cable length	15 m (49.2 ft.)	500 m (1640.5 ft.)	500 m (1640.5 ft.)
Connection mode (max connected units)	1 : 1	1 : N (32 units)	1 : N (32 units)
Control procedure	No procedure		
Control code	User defined		
Connector used	CPU side: TM5RJ3-88 8-pin modular connector (Hirose) Partner side: Comparable to TM10P-88P (Hirose)		

\* Only RS-232C can be used with the EH-CPU 104/208.

TRNS0, RECV0 commands specifications

Transmission speed set value (For other specification details, refer to the item in the list of instructions.)

Baud rate	Set value
19,200 bps	H0006
9,600 bps	H0005
4,800 bps	H0004
2,400 bps	H0003
1,200 bps	H0002
600 bps	H0001
300 bps	H0000

### 10.3.1 RS-232C interface

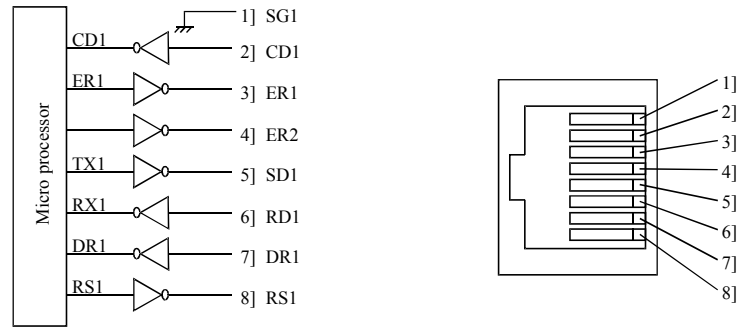


Figure 10.3 Ladder diagram and pin numbers

Table 10.9 List of port 1 signals

Pin No.	Signal abbreviation	Direction		Meaning
		CPU	Host	
1]	SG1	←	←	Ground for signal
2]	CD1	←	←	Notification signal during carrier received
3]	ER1	→	→	Transmission enabled signal When this signal is high level, communication is possible.
4]	ER2	→	→	Outputs High.
5]	SD1	→	→	Data sent by the CPU
6]	RD1	←	←	Data received by the CPU
7]	DR1	←	←	Reception request signal When this signal is high level, indicates that dedicated the host can send data. Connect it to RTS signal on the host.
8]	RS1	→	→	Transmission request signal When this signal is high level, indicates that the CPU can receive data. Connect it to CTS on the host.

### 10.3.2 RS-422/485 interface

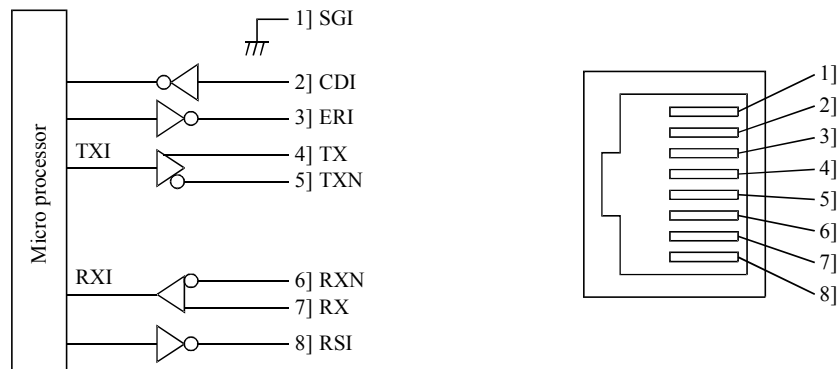


Figure 10.4 Ladder diagram and pin numbers

Table 10.10 List of port 1 signal

Pin No.	Signal abbreviation	Direction		Meaning
		CPU	Host	
1]	SG1	←	→	Signal ground
2]	CD1	←	←	Not used. Do not connect.
3]	ER1	→	→	Not used. Do not connect.
4]	TX	→	→	Data sent by the CPU +
5]	TXN	→	→	Data sent by the CPU –
6]	RXN	←	←	Data received by the CPU –
7]	RX	←	←	Data received by the CPU +
8]	RS1	→	→	Not used. Do not connect.

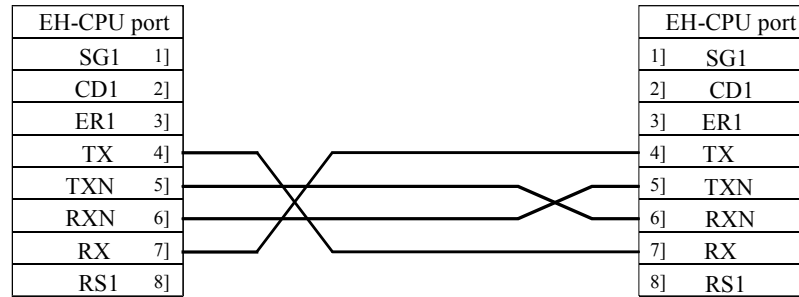


Figure 10.5 RS-422 signal connection diagram

If used as RS-485 interface, connect pin numbers 3] and 4], and 3] and 5], externally.

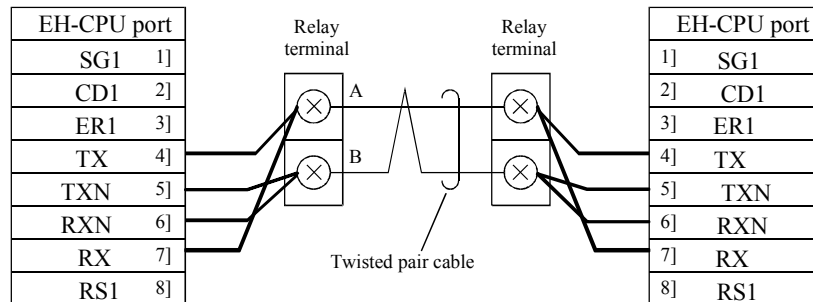


Figure 10.6 RS-485 signal connection diagram

### 10.3.3 1: N communication (RS-485)

#### (1) Precautions

When performing 1 to N communication using RS-485, do so in polling/selecting mode. When creating a ladder program, observe the following precautions.

- 1] Perform communication by making sure the master station and slave station are using the same start code.
- 2] At the master station, send a request by specifying the station number of the slave station.
- 3] At the slave station, send a response only when the request received from the master station is addressed to the own station. Set the station so that it will reset the mode and wait for the next request in the event it received a request addressed to other station.
- 4] At the master station, send a new request after at least 20 ms ( $t_p$  in figure below) has elapsed from the time it completed receiving the last response from the slave station.
- 5] At the slave station, send a response after at least 20 ms ( $t_s$  in figure below) has elapsed from the time it completed receiving the request from the master station.

Figure 10.7 shows an example of 1 to N transmission sequence. This example shows a sequence in which the master station sends a series of requests to slave stations 1 to 3, with each slave station sending a response to the received request.

In Figure 10.7, a plateau expressed in solid line indicates that the station received a transmission addressed to the own station. Similarly, a plateau expressed in dotted line indicates that the station received a transmission addressed to other station.

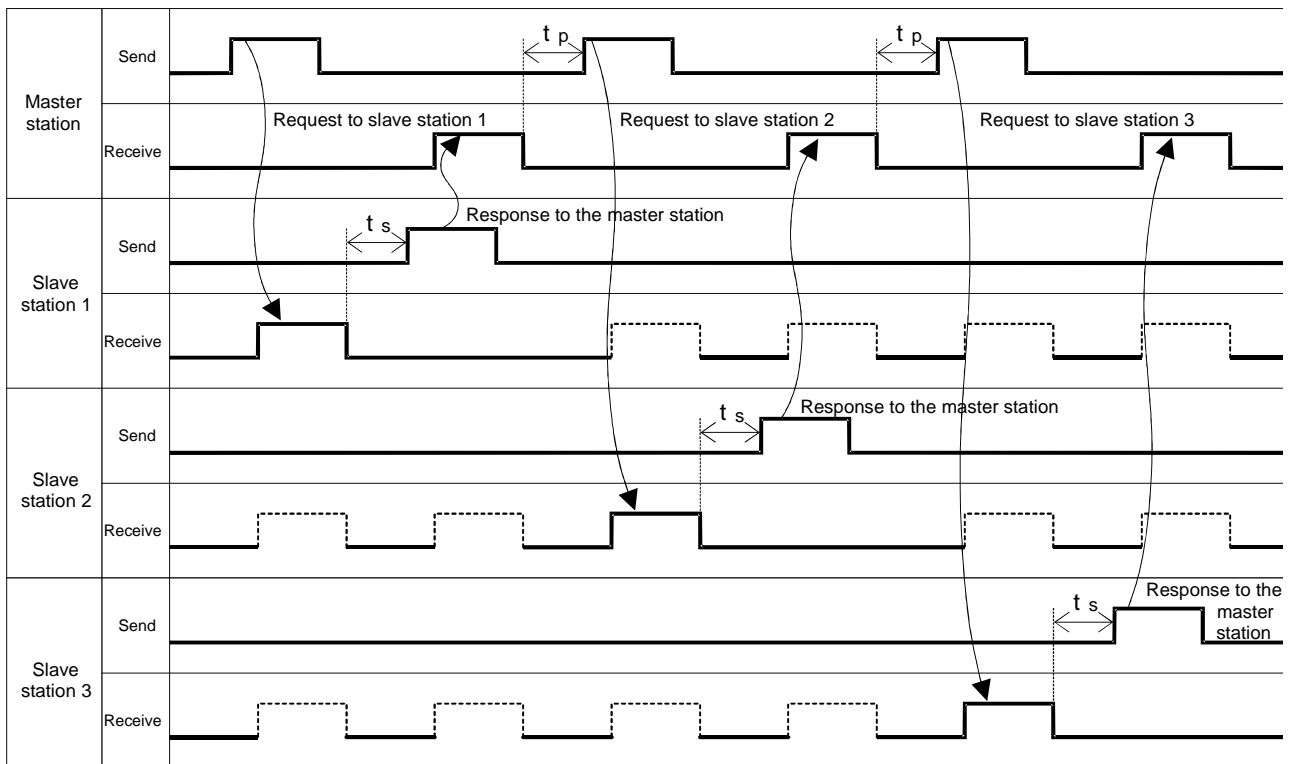


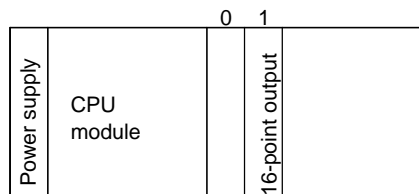
Figure 10.7 1:N transmission and reception sequence

## (2) Sample Program

The following shows a sample program that performs communication between one master station and three slave stations using RS-485.

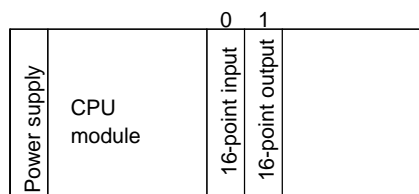
## 1] Mounting the module

## (a) Master station side



Mount the 16-point output module in slot "1" of the basic base.

## (b) Slave station side



Mount the 16-point input module in slot "0" of the basic base and mount the 16-point output module in slot "1" of the basic base.

## 2] Assigning internal outputs

The sample program is created using the following assignments. In actual cases, change the I/O numbers and other items according to the application.

## (a) Assigning internal outputs on the master station side

I/O	No.	Usage
WM	100 to 10E	TRNS 0 instruction Parameter area (s to s+14)
R	000 to 00B	TRNS 0 instruction Communication control bit area (t to t+11)
	100	Transmission data setting completion flag
WR	0000 to 001F	Transmission data area (32-word)
	0100 to 011F	Reception data area (32-word)
	4000	Station number of target slave station
	4001	Number of slave stations
WL	001 to 003	Reception data storage area

## (b) Assigning internal outputs on the slave station side

I/O	No.	Usage
WM	0000 to 000E	RECV 0 instruction Parameter area (s to s+14)
	200 to 21F	Transmission data area (32-word)
	300 to 31F	Reception data area (32-word)
WR	0000 to 000E	TRNS 0 instruction Parameter area (s to s+14)
	0200 to 021F	Transmission data area (32-word)
	0300 to 031F	Reception data area (32-word)
	4000	Station number of communicating slave station
	4001	Own station number
WL	001 to 003	Reception data storage area

## 3] Transmission format

The following shows the formats that are used when transmitting data between the master station and slave station.

## (a) Request format from the master station to slave station (a maximum of 3 bytes)

Start code	Slave station number	End code
02H	1 to 3	0DH

## (b) Response format from the slave station to master station (a maximum of 5 bytes)

Start code	Own station number	Data		End code
02H	1 to 3	Any *	Any *	0DH

\*: Any data can be set except for the end code (0DH). The slave station number is set in this sample program.

## 4] Reception result on the master station side

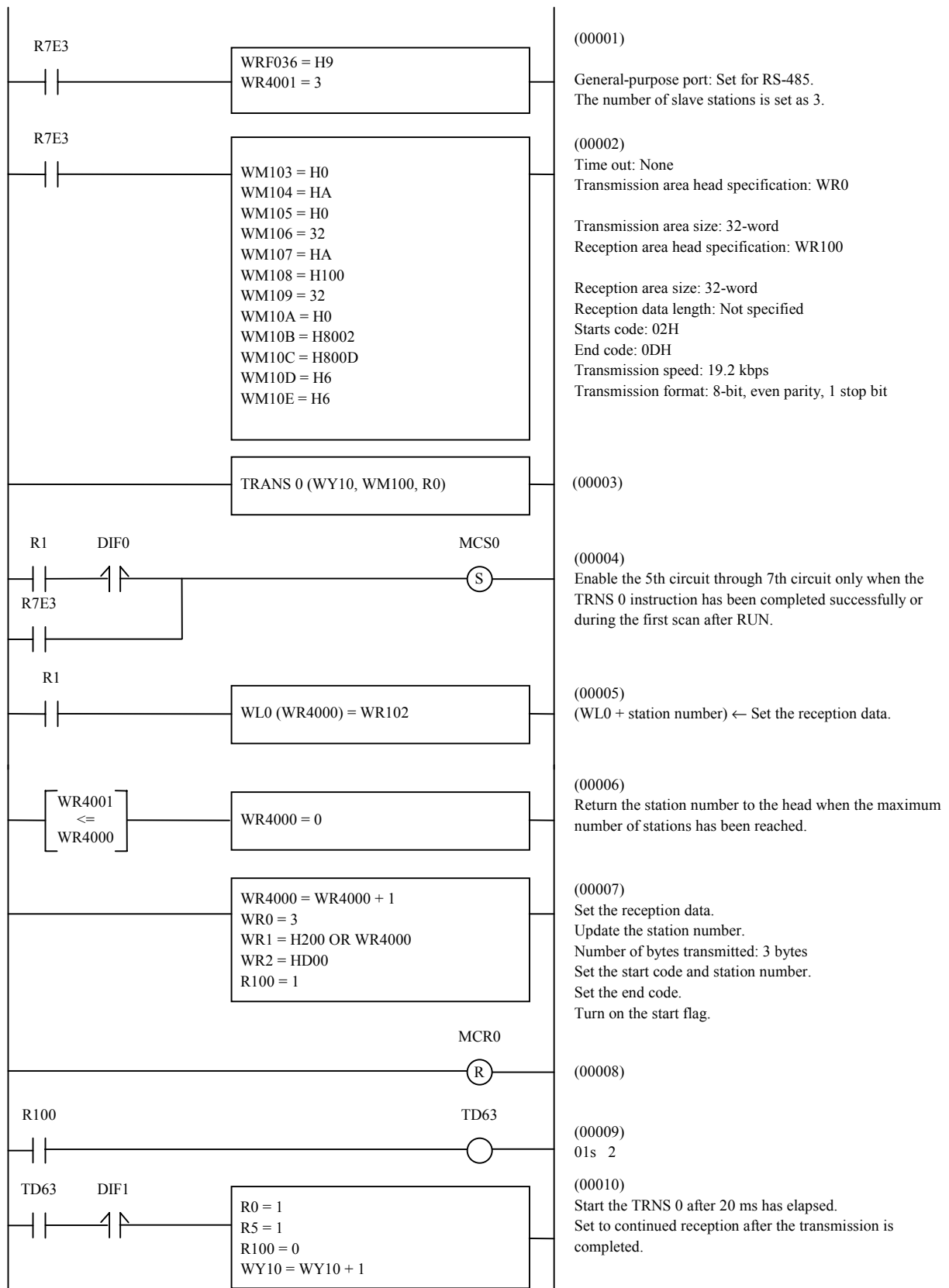
When the transmissions between slave stations 1 to 3 have completed successfully, the corresponding data are set in the WL area of the master station as shown below. In this sample program, the slave stations set their own station number as part of the data.

Address	Set value	Contents
WL0001	0001H	The data received from slave station 1.
WL0002	0002H	The data received from slave station 2.
WL0003	0003H	The data received from slave station 3.

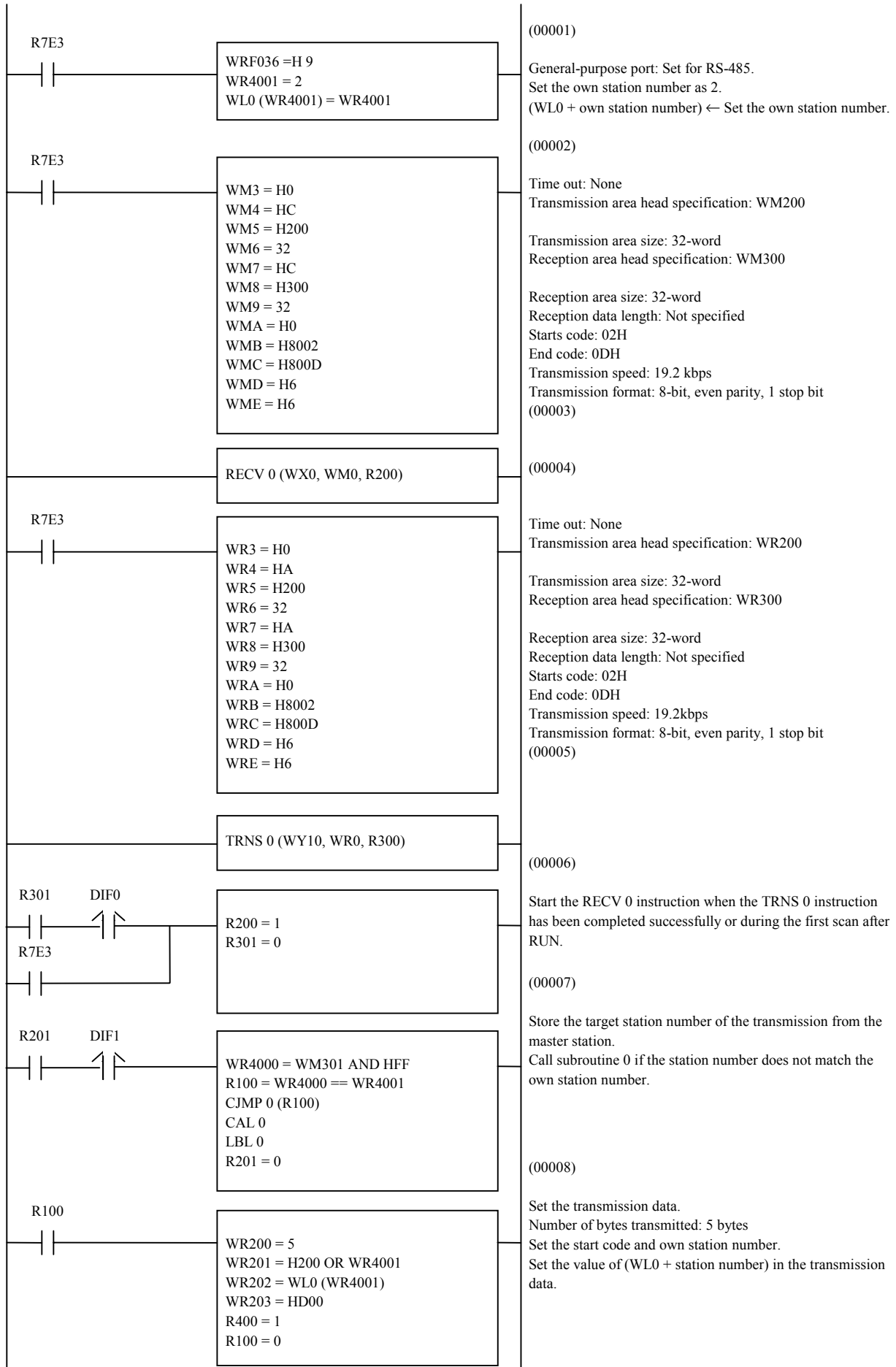


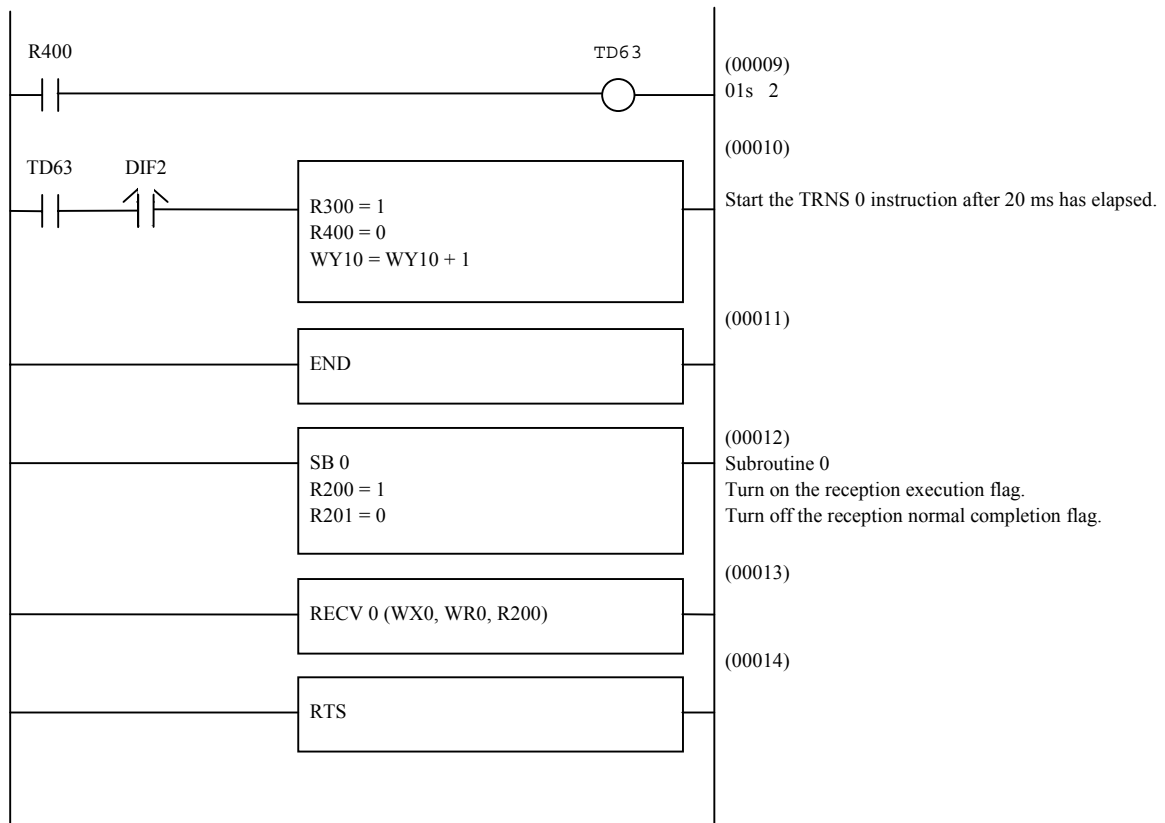
## 5] Program

(a) Program on the master station side (with three slave stations)



## (b) Program on the slave station side (slave station number 2)





## 10.4 Modem Control Function

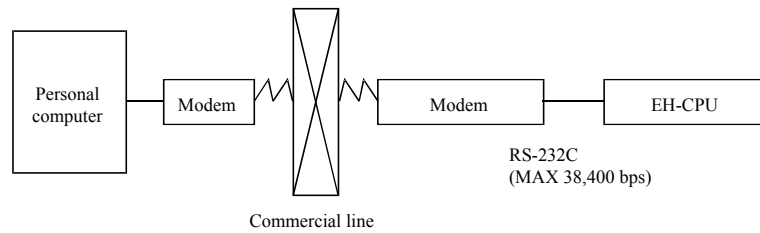
EH-CPU208/308/316/448 is equipped with a modem control function. The modem control function can be controlled using task codes.

To use this function, the mode setting switch must be set. For setting switches, refer to P4-6.

\* EH-CPU104 does not have this function.

Connecting the two operating modems may be difficult if there is a large difference between them in communication speeds. Match to eliminate any difference in communication speeds.

### 10.4.1 Configuration



### 10.4.2 Connection specifications

Item	Specification
Transmission speed	2,400 bps, 4,800 bps, 9,600 bps, 19,200 bps, 38,400 bps * Communication speed between the modem and PLC depends on the setting for the special internal output WRF01A.
Communication system	Full duplex (communication program is half-duplex control)
Synchronization system	Start-stop synchronization
Transmission system	Serial transmission (bit serial transmission)
Transmission code	ASCII code
Transmission code configuration	
Transmission code outgoing sequence	Sent out from the lowest bit ( $2^0$ ) in character units
Error detection	Vertical parity check, overrun check, framing check
Interface	Conforms to RS-232C
Control procedure	H-series dedicated procedure (high protocol)
Startup system	One-sided startup using the host side command

Table 10.11 List of port 1 signals when a modem is connected

Pin No.	Signal abbreviation	Direction		Meaning
		CPU	Modem	
1]	SG1	←	—	Signal ground
2]	CD1	←	—	Carrier receive in-progress notification signal Connected to CD in the modem.
3]	ER1	—	→	Communication enabled signal of the terminal
4]	ER2	—	→	Unused
5]	SD1	—	→	Data sent by the CPU Connected to SD in the modem.
6]	RD1	←	—	Data received by the CPU Connected to RD in the modem.
7]	DR1	←	—	Communication enabled signal of the modem Connected to DR in the modem.
8]	RS1	—	→	Transmission request signal Connected to RS in the modem.

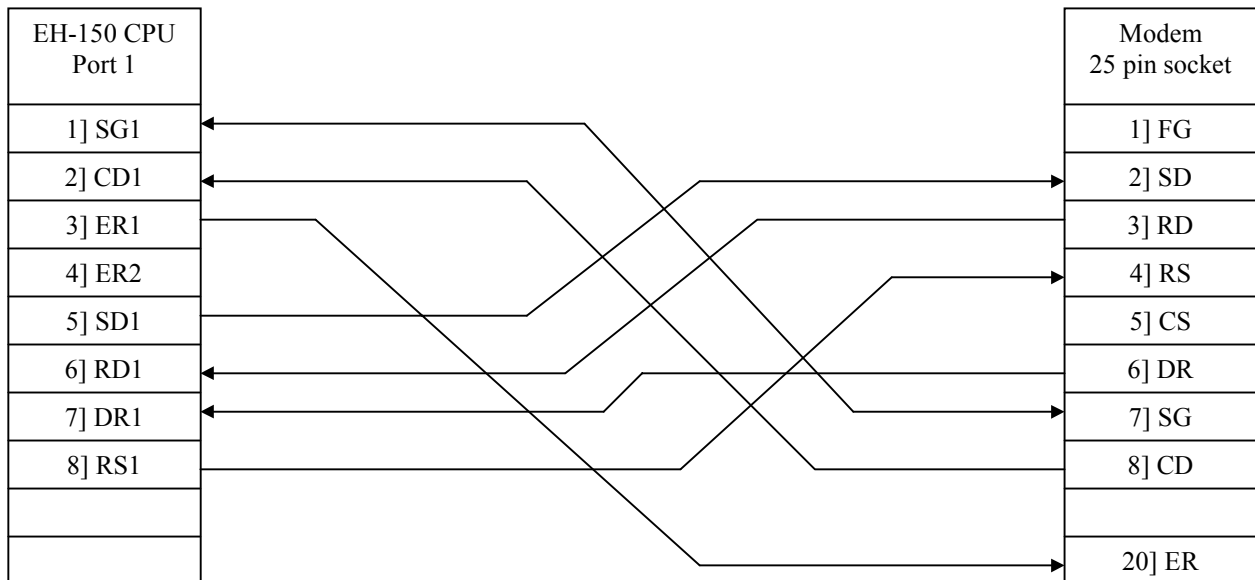


Figure 10.8 Cable connection between a modem (25 pin socket) and port 1

### 10.4.3 Additional task codes

The existing task codes are supported, and ladder disconnection processing is supported as an additional function. The specification is the same as the current post communication (destination processing, ladder disconnection processing), except for the NCU control.

Line disconnection task code

Line disconnection request

H1C
-----

Response (normal response only)

H00	H1C
-----	-----

### 10.4.4 AT commands

In AT commands, an instruction sent to the modem from the host is called a "command" and the character string in response to the "command" returned to the host from the modem is called a "result code".

AT commands always begin with the character string "AT" and a return code is input at the end of the command. However, A/ is excluded. The command that follows after the "AT" can have multiple inputs in a single line.

#### (1) Format

##### 1] AT command format

A	T	command parameter command parameter . . . .	CR	LF
---	---	---	----	----

##### 2] Result code format

CR	LF	result code (word)	CR	LF
Result code (number)		CR	LF	

#### (2) List of commands (extract)

##### 1] AT commands

Command	Function overview		Example
AT	Automatically recognizes data format		—
A/	Re-executes the response directly preceding		—
ATDmm	Dial		ATD12345678
ATHn	Line ON/OFF	0: On hook (disconnect) 1: Off hook	ATH0 ATH1
ATPn	Pulse setting	0, 1: 10 pps 2: 20 pps	ATP0, ATP1 ATP2
ATT	Tone setting		ATT
ATSn = X	Sets S register value		ATS0 = 0
ATVn	Result code display format	0: Number 1: Word	ATV0 ATV1
AT&Cn	CD signal control	0: Always on 1: Depends on the carrier of counter-party modem	AT&C0 AT&C1
AT&Dn	ER signal control	0: Always on 2: Turning from on to off during communication disconnects line 3: Turning from on to off resets the software	AT&D0 AT&D2 AT&D3
AT&Sn	DR signal	0: Always on 1: Depends on sequence 2: Depends on CD signal	AT&S0 AT&S1 AT&S2
AT&Rn	RI (CI) signal control	0: Turns on from calling start until communication begins 1: Turns on from calling start until communication ends 2: Turns on/off in synchronization with the call signal	AT&R0 AT&R1 AT&R2

##### 2] S register

S register	Set value	Function
S0	0 no automatic reception 1 to 255	Setting for automatic reception/reception ring count
S2	0 to 127 (43 [+])	Escape code setting
S3	0 to 127 (13 [CR])	CR code setting
S4	0 to 127 (10 [LF])	LF code setting

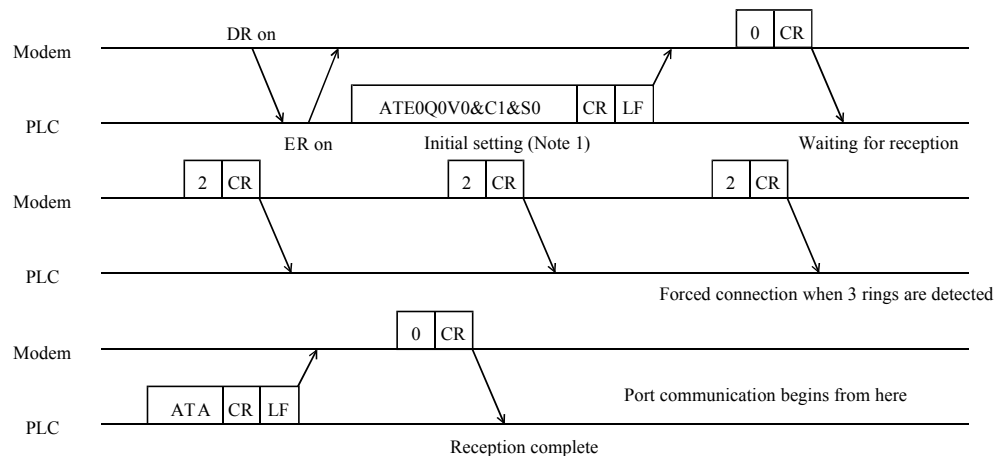
## 3] Result codes

Number format	Word format	Meaning
0	OK	Normal execution
1	CONNECT	Connection complete
2	RING	Reception detected
3	NO CARRIER	Line disconnected
4	ERROR	Command error
5	CONNECT 1200	1,200 bps connection
6	NO DIAL TONE	Cannot hear dial tone
7	BUSY	Busy signal detected
8	NO ANSWER	No tone heard
10	CONNECT 2400	2,400 bps connection
11	CONNECT 4800	4,800 bps connection
12	CONNECT 9600	9,600 bps connection
13	CONNECT 14400	14,400 bps connection

## (3) Sequence

An example of a communication sequence using the Omron-made modem ME3314A is given below.

## (a) Reception sequence



- 1] The PLC generates the AT command that performs the initial setting of the modem.
- 2] If initial setting is OK, the modem returns "0."
- 3] When the PLC is in reception wait status and detects the result code "2" three times, it connects the modem.

## (b) Disconnect sequence



The PLC disconnects the line when the result code "3" is returned.

Note 1: Since the modem initial setup sets only minimal items from the PLC side, connect a personal computer and perform necessary settings before making the connection. (Set the DR signal to always on.)

## 10.5 Port and Peripheral Unit Connection



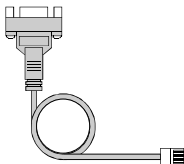
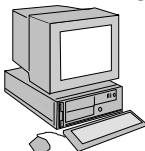

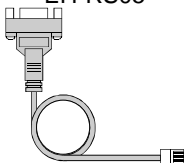
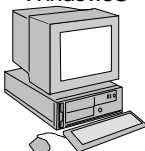

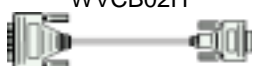
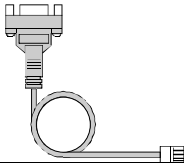

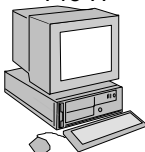

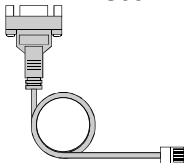

Tables 10.12 and 10.13 show the settings of the mode setting switches and the connecting cables to connect a peripheral unit to ports 1 and 2 of the EH-150, respectively.

Table 10.12 Settings of the mode setting switches for connecting peripheral units

Condition		A	B	C	D	E	F
PORT	SW	Windows® LADDER EDITOR (DOS/V)	Windows® LADDER EDITOR (PC98)	DOS LADDER EDITOR (PC98)	DOS LADDER EDITOR (AT compatible)	LADDER EDITOR For GPCL / HILDRL	Programmer (PGM-GPH) (PGM-CHH)
1	8	OFF	OFF	OFF	OFF	Cannot connect	Cannot connect
	7	OFF	OFF	OFF	OFF		
	6	—	—	—	—		
	5	ON	ON	ON	ON		
	4	OFF	OFF	ON	ON		
	3	ON	ON	ON	ON		
	2	—	—	—	—		
	1	OFF	OFF	OFF	OFF		
	Toggle	—	—	—	—		
2	8	OFF	OFF	OFF	OFF	OFF	OFF
	7	OFF	OFF	OFF	OFF	OFF	OFF
	6	OFF	OFF	OFF	OFF	OFF	OFF
	5	—	—	—	—	—	—
	4	—	—	—	—	—	—
	3	—	—	—	—	—	—
	2	—	—	—	—	—	—
	1	OFF	OFF	OFF	OFF	OFF	OFF
	Toggle	ON	ON	OFF	OFF	OFF	ON
Software type		HLW-PC3	HLW-PC3	HL-PC3	HL-AT3E	HL-GPCL/HILDRL	(Built-in programmer)
Cable type		WVCB02H + EH-RS05	WPCB02H + EH-RS05	PCCB02H + EH-RS05	EH-VCB02	GPCB02H + EH-RS05	PGCB02H + EH-RS05
		EH-VCB02					



Table 10.13 Peripheral unit connection configuration

Peripheral unit	Cable	
GPCL01H (LADDER EDITOR, HI-Ladder) 	GPCB02H 	EH-RS05 
LADDER EDITOR 	PCCB02H 	EH-RS05 
LADDER EDITOR for Windows® 	WPCB02H  WVCB02H 	EH-RS05 
	EH-VCB02 	
Pro-H 	WVCB02H 	EH-RS05 
	EH-VCB02 	

## 10.6 Connection method for RS-422/485 communication

Communication can be performed with an interface of RS-422/485 at the port 1 of the EH-150. Using the H series' dedicated control procedure (high protocol) or general port commands (TRNS 0 and RECV 0), communication of 1:N stations can be performed. Figures 10.8 and 10.9 show examples when a connection is made for 1:N stations at the port 1. Note that, for the connection for communication in 1:1 mode, only the first EH-150 in these figures is connected.

### (1) In case of RS-422

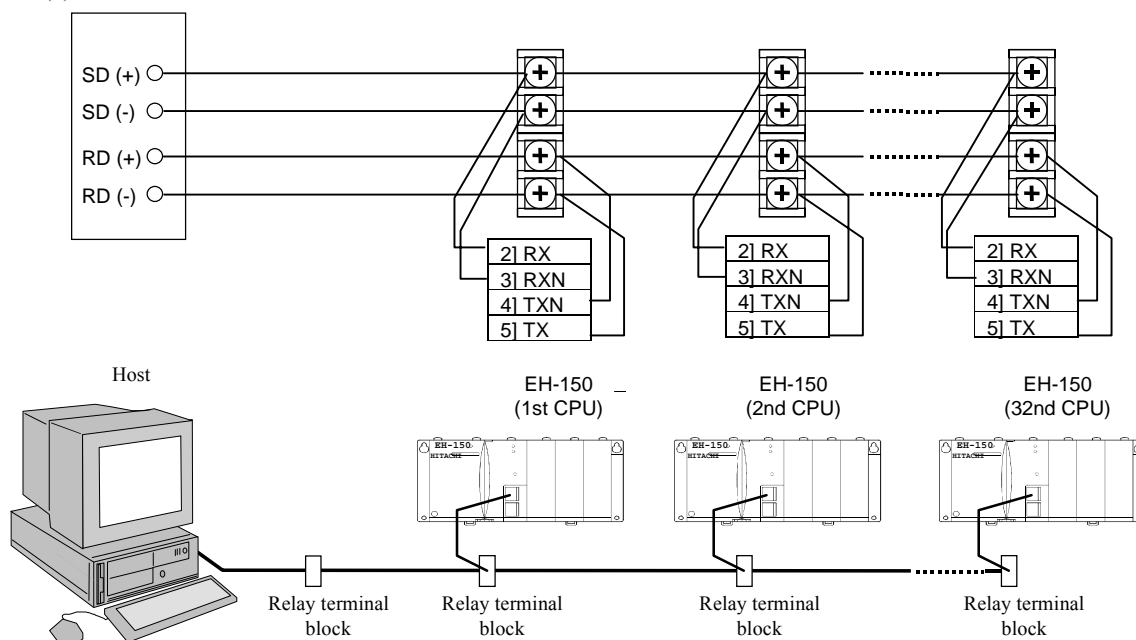


Figure 10.9 Connection for 1:n station communication by RS-422

### (2) In case of RS-485

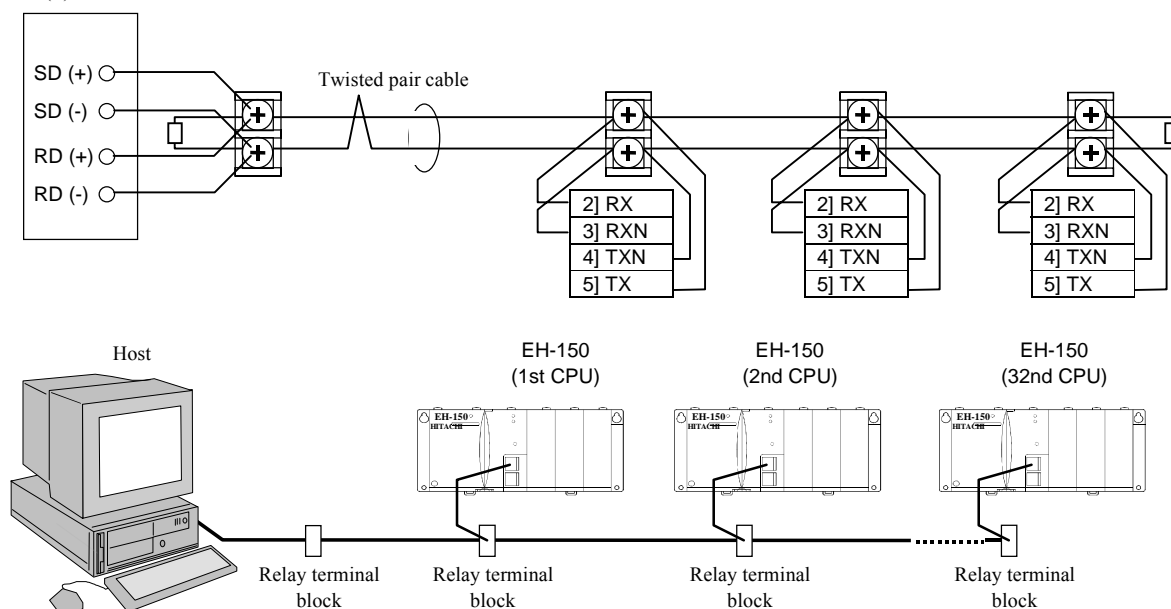


Figure 10.10 Connection for 1:n station communication by RS-485



# Chapter 11 Real Time Clock Function · Memory Board Function

## 11.1 Real Time Clock Function

The EH-CPU208/308/316/448 includes a function that manages the time and date of PLC data. The clock function can be operated with either special internal output or a task code.

Clock data is retained by battery power. Note that the battery is not connected when the module is shipped. When using the clock function, connect the battery and set the clock data.

However, this function is not available for the EH-CPU104.

### 11.1.1 Operation using a special internal output

#### (1) Reading clock data

By turning the read request (R7F8) on, the clock data at the time of the request is stored in the read value area (WRF01B to WRF01F).

#### (2) Clock data setting

The clock data setting is done by first set the data to store in the set value area (WRF01B to WRF01F), and then turning on the setting request (R7F9). At this time, if there is an error in the set value, the setting data error (R7FB) turns on. When the setting request (R7F9) turns off and the setting data error (R7FB) is off, setting is complete.

#### (3) Clock data $\pm 30$ seconds adjustment

By turning on the  $\pm 30$  second adjustment request (R7FA), the seconds value will be set as follows depending on the value at this time.

- When the digit for seconds is 00 to 29: the digit becomes 00
- When the digit for seconds is 30 to 59: the time becomes +1 minute and the digit for seconds becomes 00.

#### (4) Defining special internal output

- Operation bit

Item	I/O number	Name	Function
1	R7F8	Calendar · clock read request	Reads the current value.
2	R7F9	Calendar · clock set request	Sets the contents set in the setting area, in RTC.
3	R7FA	Clock $\pm 30$ second adjustment request	Changes the digit for seconds in RTC to 0.
4	R7FB	Calendar · clock set data error	This turns on when the set data has an error.

- Current value display area: Current time of the clock is always displayed (all in BCD data)

Item	I/O number	Name	Description
1	WRF00B	Year	Displays 4 digit year.
2	WRF00C	Month/day	Displays month and day data.
3	WRF00D	Day of the week	Displays day of the week data.
4	WRF00E	Hour	Displays hour (24-hour format) data.
5	WRF00F	Seconds	Displays seconds data.

- Read value/set value area: Value read from the clock is displayed or set value is stored (all in BCD data)

Item	I/O number	Name	Description
1	WRF01B	Year	Displays or stores 4 digit year.
2	WRF01C	Month/day	Displays or stores month and day data.
3	WRF01D	Day of the week	Displays or stores day of the week data.
4	WRF01E	Hour	Displays or stores hour (24-hour format) data.
5	WRF01F	Seconds	Displays or stores seconds data.

Note 1: Day of the week data is as follows (3 upper digits are always 000):

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

Note 2: Upper 2 digits of seconds data is always 00.

### 11.1.2 Operation using task codes

The following can be performed with the clock setting and reading task codes.

- Read clock data
- Set clock data
- Clock data  $\pm 30$  seconds adjustment

Refer to the task code list (Appendix 3) for more detail on task codes.

## 11.2 Memory Board Function

The EH-CPU308/316/448 have the program transfer function for transferring and comparing programs between the CPU and either the EH-MEMP or EH-MEMD memory board, and the data logging function via the FUN command from user programs using the EH-MEMD memory board. Table 11.1 shows the DIP switch settings of the EH-MEMP and EH-MEMD memory boards for switching to each mode.

\* The EH-CPU104/208 do not support the memory board function.

Table 11.1 Operation modes settings with dip switch of memory board

Function	SW4	SW3	SW2	SW1	Operation details	Remarks
Program transfer					Starts up in the normal operating mode (Invalid memory board)	
				ON	From memory board to CPU (Program transfer)	
			ON		From CPU to memory board (Program transfer)	
			ON	ON	Between memory board and CPU (Check program)	
		ON			Starts up in the normal operating mode (Invalid memory board)	*
		ON		ON	From memory board to CPU (Program transfer)	*
		ON	ON		Dip switch setting error	*
Data logging		ON	ON	ON	Between memory board and CPU (Check program)	*
	ON		Invalid		Starts up in the normal mode (Data logging command can be executed)	
	ON	ON	Invalid		Starts up in the normal mode (Data logging command can be executed)	*

\*: If the SW3 is ON, writing to the memory board is prohibited.

In the case of program transfer mode, the dip switch setting becomes effective only after turning on the power. In the case of data logging mode, SW3 becomes effective in real time. (However, if the setting is changed while a command is being executed, the new setting becomes effective upon execution of the next command.)

### 11.2.1 Program transfer function

The EH-CPU308/316/448 have the program transfer function for transferring and comparing programs between the CPU and either the EH-MEMP or EH-MEMD memory board by setting the DIP switches of the memory board in advance and turning on the power. Since the CPU starts up in a special mode, the CPU will not switch to the RUN mode in this case. Table 11.2 shows the operation modes that can be executed between each CPU model and the EH-MEMP/EH-MEMD memory board. As shown in Table 11.2, the maximum program size that can be transferred to the EH-MEMD memory board is 16 k steps. Thus, to transfer a program of larger than 16 k steps and a maximum of 48 k steps in the EH-CPU448, use the EH-MEMP memory board.

Table 11.2 Sizes of programs that can be transferred to each CPU

CPU model	Program transfer size	Memory board → CPU		Memory board ← CPU		Memory board = CPU	
		EH-MEMP	EH-MEMD	EH-MEMP	EH-MEMD	EH-MEMP	EH-MEMD
EH-CPU308	8 k steps or less	○	○	○	○	○	○
	Over 8 k steps	×	×	—	—	×	×
EH-CPU316	16 k steps or less	○	○	○	○	○	○
	Over 16 k steps	×	×	—	—	×	×
EH-CPU448	16 k steps or less	○	○	○	○	○	○
	Over 16 k steps and 48 k steps or less	○	—	○	—	○	—

○: Executable; ×: Not executable because of error; —: This event does not occur

Table 11.3 shows the LED displays when an error occurs during the execution of the program transfer function.

Table 11.3 CPU LED indications in the program transfer mode

Operation mode	Memory board → CPU		Memory board ← CPU		Memory board = CPU	
	RUN	ERR	RUN	ERR	RUN	ERR
Dip switch setting error	—	—	●	◐	—	—
Sum error in memory board	●	○	—	—	●	○
Sum error in CPU memory	—	—	◐	○	◐	○
Memory size error	◐ *1	◐ *1	—	—	—	—
Transfer and checking in progress	◐	●	◐	●	◐	●
FLASH error (inside memory board) *4	—	—	○	◐	—	—
Unmatched check result	●	◐	●	◐	●	◐
Normal completion	○→●	●	○→●	●	○→●	●

○: ON ●: OFF ◐: Flashing (1 s ON, 1 s OFF) ◑: Flashing (500 ms ON, 500 ms OFF)

◒: Flashing (250 ms ON, 250 ms OFF) ○→●: 3 s OFF after ON

\*1: RUN and LED of ERR flash at the same time

\*2: Erase error and write error of FLASH

## 11.2.2 Logging Function

The EH-CPU 308/316/448 provides the function for log data using the EH-MEMD.

\* This function cannot be used with the EH-MEMP.

### (1) Log commands

There are four types of log commands, as shown below.

FUN 210 (s) * (LOGIT (s))	Initial setting for data logging
FUN 211 (s) * (LOGWRT (s))	Log data write
FUN 212 (s) * (LOGCLR (s))	Log data clear
FUN 213 (s) * (LOGRED (s))	Log data read

\* ( ) indicates the display when the LADDER EDITOR is used.

### (2) Overview of logging function

The logging function is used to transfer a group of specified data groups (word internal output/external input) to the log data area (memory board) as a single log, or read a group of data stored in the log data area.

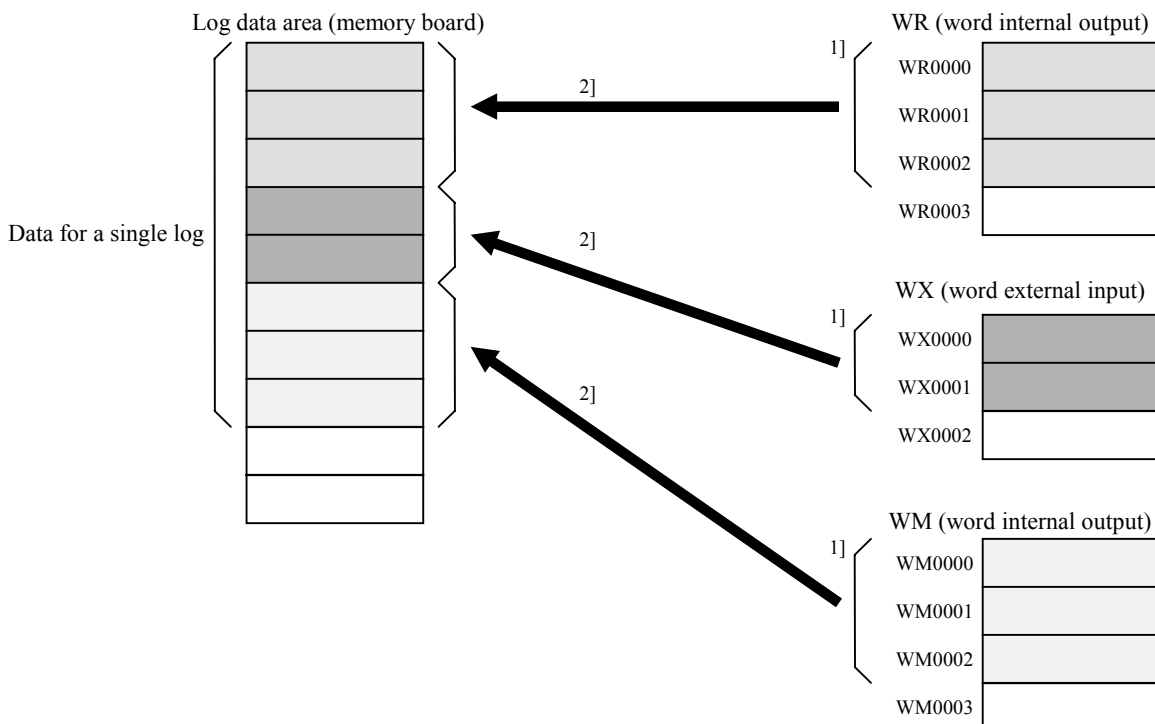
Use example:

#### 1] FUN 210 (Initial setting for data logging)

Sets a total of 8 words from three groups of the log data including WR0000 through WR0002 (3 words), WX0000 and WX0001 (2 words), and WM0000 through WM0002 (3 words), as a data for a single log.

#### 2] FUN 211 (log data write)

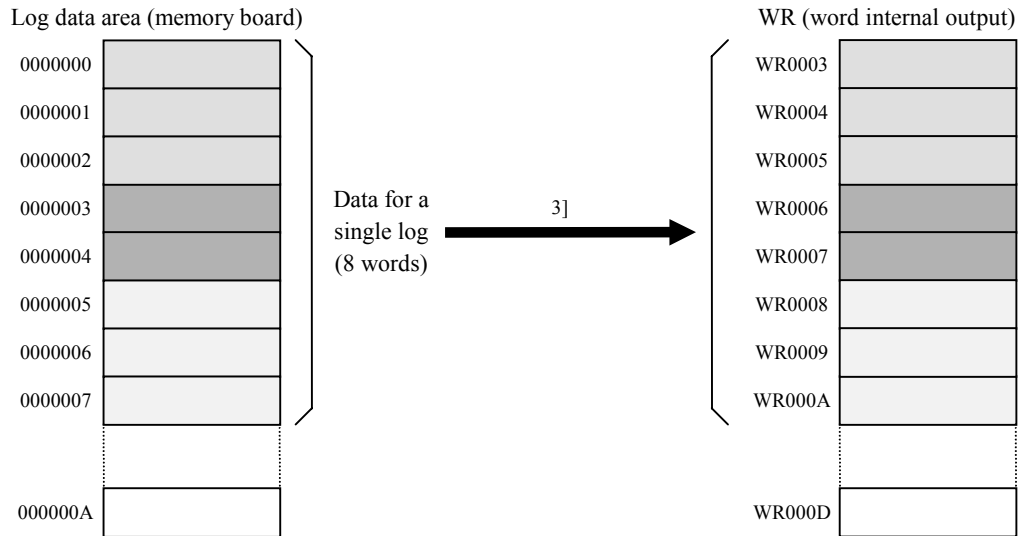
Writes to the log data area (memory board) the log data for a single log specified in the initial setting in 1].





## 3] FUN 213 (log data read)

Reads to the specified destination after WR0003 the contents of the log data area written in 2] by the amount of data for a single log (8 words) starting from the head of the log data area.



## 4] FUN 212 (log data clear)

Clears the contents of the log data area in the memory board.

## (3) Applicable log area

The table below shows the I/O areas that can be used for logging and their allowable ranges.

	Symbol	Allowable range		
		EH-CPU308	EH-CPU316	EH-CPU448
Word external input	WX	16 words		Cannot be used
CPU link area 1	WL	WL0 to WL3FF		
CPU link area 2	WL	WL1000 to WL13FF		
Word internal output	WR	WR0 to WR43FF	WR0 to WR57FF	WR0 to WRC3FF
	WM	WM0 to WM3FFF		

\* If an area outside the corresponding range is specified, the DER (R7F4) bit is turned ON and the processing will not be performed.

## (4) Log data size and write interval

- Size of log data area  
384 K (393,216) words
- Size of log data  
Data between 1 and 128 words can be specified for a single log.
- Write interval  
The table below shows the number of words in a single log and the corresponding logging interval.

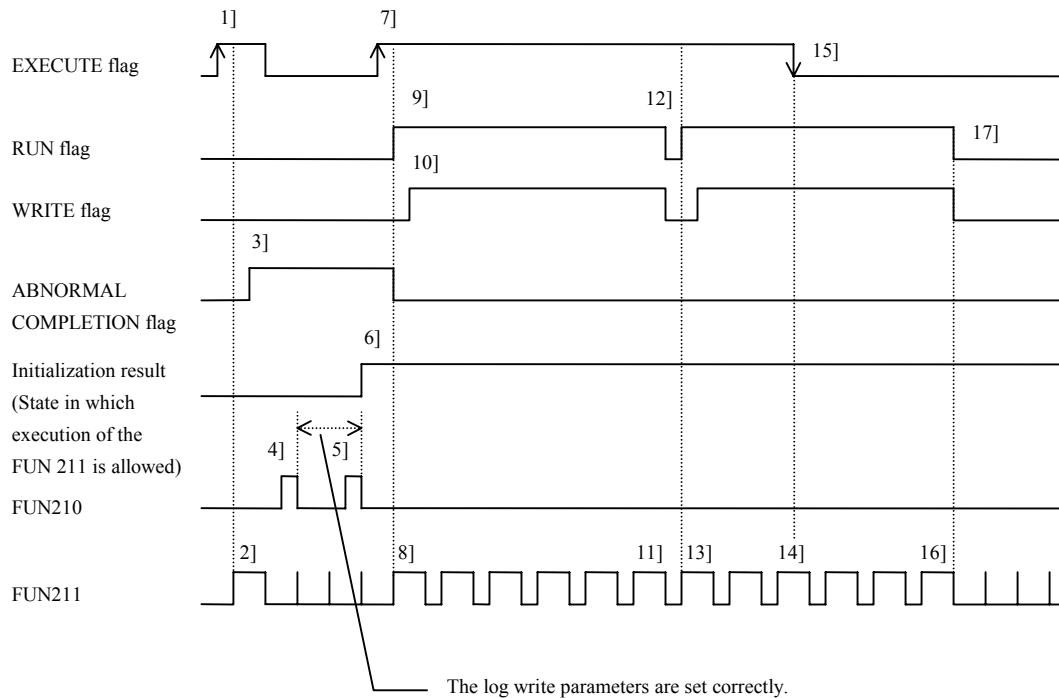
	Minimum	Intermediate	Maximum
Log data size (words/log)	1 word per log	n words per log	128 words per log
Minimum write interval (ms)	Approx. 10 ms	Approx. (5n + 5) ms	Approx. 645 ms

\* In the above table, n indicates an integer between 1 and 128.

No new data can be logged in between the write intervals (ms) shown above.

## (5) Log write (FUN 211) time chart

The diagram below shows the relationship between the log write control bit table (EXECUTE flag, RUN flag, WRITE flag, ABNORMAL COMPLETION flag) and the execution of the FUN 211 (log write).



The EXECUTE flag rises 1]. However, since the initialization result indicates that execution of the FUN 211 is not allowed, the FUN 211 turns on 2] the ABNORMAL COMPLETION flag 3].

A log write parameter error is found during the processing of the FUN 210 4]. As a result, the initialization result does not indicate that execution of the FUN 211 is allowed.

The write parameters are correctly set 5]. As a result, the initialization result indicates that execution of the FUN 211 is allowed 6].

The FUN 211 detects 8] the rise of the EXECUTE flag 7] and checks if the execution is allowed. Since the check result is normal, the RUN flag is turned on 9] and the log data is stored temporarily. When all data has been stored, the WRITE flag is turned on 10] and the log data is written to the memory board (starting of write).

When the writing of data for the first log is completed 11], the RUN flag and WRITE flag are turned off 12].

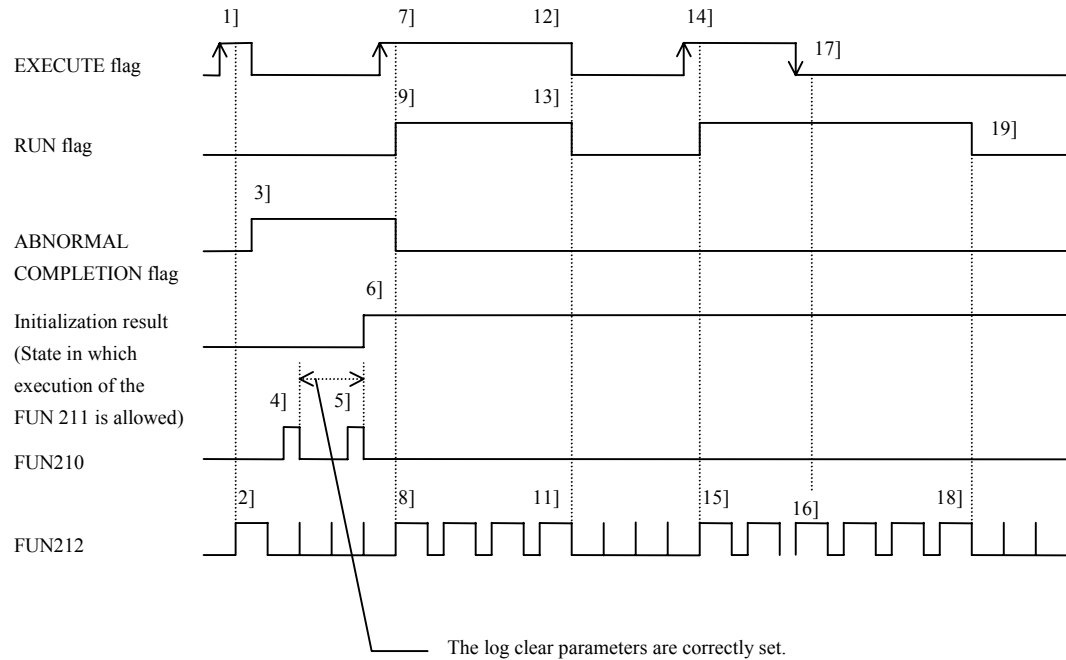
Since the EXECUTE flag is still on, writing of the second log is started 13].

The FUN 211 detects 14] the fall of the EXECUTE flag 15]. However, the processing continues since the writing of data for the second log is not completed yet.

When the writing of data for the second log is completed 16], the RUN flag and WRITE flag are turned off 17].

## (6) Log clear (FUN 212) time chart

The diagram below shows the relationship between the log clear parameter bit table (EXECUTE flag, RUN flag, ABNORMAL COMPLETION flag) and the execution of the FUN 211 (log clear).



The EXECUTE flag rises 1]. However, since the initialization result indicates that execution of the FUN 211 is not allowed, the FUN 211 turns on 2] the ABNORMAL COMPLETION flag 3].

A log clear parameter error is found during the processing of the FUN 210 4]. As a result, the initialization result does not indicate that execution of the FUN 211 is allowed.

The log clear parameters are correctly set 5]. As a result, the initialization result indicates that execution of the FUN 211 is allowed 6].

The FUN 212 detects 8] the rise of the EXECUTE flag 7] and checks if the execution is allowed. Since the check result is normal, the RUN flag is turned on 9] and the log data is cleared.

When the log data clear is completed 11], the EXECUTE flag 12] and the RUN flag 13] are turned off.

The FUN 212 detects 15] the rise of the EXECUTE flag 14] and starts the second data clear.

The FUN 212 detects 16] the fall of the EXECUTE flag 17]. However, since the second data clear is not completed yet, the processing continues.

When the second data clear is completed, the FUN 212 turns off 18] the RUN flag 19].

## (7) Log error details

When started in the logging mode, the system checks the log data upon power ON. If the system detects an error during the check, it sets to the special internal output R7FE or WRF07F an applicable error code from among the following error codes, and then executes the program shown below. At the same time, the CPU error code “A0” is set to the special internal output WRF000. The table below shows the description of each error.

CPU error code	Special internal output		Error code	Description of error
A0	R7FE = 1	WRF07F	H0001	Different memory board from the one previously installed
			H0002 to H0009	Invalid log data
			H00FF	Memory board cannot be accessed

## (8) Corrective actions to be taken upon detection of log error

When the system detects any of the log errors described in (7), take appropriate actions as shown below.

When H0001 occurred:

Reinstall the memory board previously installed, and restart the system.

If a new memory board is installed, clear the log data using the log data clear command (FUN 212).

When any of the errors between H0002 and H0009 occurred:

Clear the log data using the log data clear command (FUN 212), and then restart the system.

When H00FF occurred:

Check if the memory board is properly installed, and then restart the system. If the error persists, there may be a hardware error in the memory board.



# Chapter 12 Error Code List

## 12.1 Error Codes








The table below indicates the self-diagnostic error codes. (Refer to Chapter 15 Troubleshooting for corrective action.) Error codes are output as a hexadecimal to the special internal output WRF000. (This special internal output is saved during a power failure, and is retained even when the cause of the error disappears. Also, when more than one error is generated, the one that is classified with the greatest severity is stored.)

Note: LED example

○ : ON    ● : OFF    ◐ : Flashing (1 s ON, 1 s OFF)    ◑ : Flashing (500 ms ON, 500 ms OFF)    ◒ : Flashing (250 ms ON, 250 ms OFF)

Error code	Error name [detection timing]	Classifi- cation	Nature of error	RUN LED	ERR LED	Ope- ration	Related special internal output	
							Bit	Word
11	System ROM error [when power turns on]	Serious failure	The system ROM has a sum error or cannot be read	●	○	Stops	R7DB	—
12	System RAM error [when power turns on]	Serious failure	System RAM cannot be read and written properly	●	○	Stops	R7DB	—
13	Micro computer error [always checking]	Serious failure	Address error interrupt, undefined command interrupt occurred in the micro computer	●	○	Stops	R7C8	—
15	System bus time out error [when bus is accessed]	Serious failure	Micro computer detects a system bus time out	●	○	Stops	R7D8	—
16	System program abnormal [always checking]	Serious failure	System program in FLASH memory has a sum error	●	○	Stops	R7C8	—
—	Power off Power error [always checking]	Serious failure	No power supply from the power module	●	●	Stops	—	—
—	Microcomputer overload error [Constantly checked]	Serious failure	The watchdog timer detected a microcomputer overload because the microcomputer did not operate according to program (the microcomputer is not functioning correctly).	—*1	○	Stops	—	—
23	Undefined command [check during operation]	Medium failure	Error is detected when an attempt is made to execute a user program command that cannot be decoded (undefined) command	◐	○	Stops	R7C9	—
27	Data memory error [when power ON, at initialization]	Medium failure	Data memory cannot be read/written properly.	●	○	Stops	—	—
31	User memory abnormal [when power turns on, when RUN starts, when parameters are changed, at initialization]	Medium failure	A sum error is detected in user memory or RUNNING memory	◐	○	Stops	R7CA	—
33	User memory size error [when RUN starts]	Medium failure	User program capacity set by the parameter is larger than actual user memory capacity	◐	○	Stops	R7CC	—
34	Grammar/assemble error [when RUN starts, online change in RUN]	Medium failure	There is a grammar error in the user program	◑	○	Stops	R7D4	WRF001
41	I/O information verify error [always checking]	Minor failure	I/O assignment information and actual loading of module do not match	◑	○	Stops *2	R7CD	WRF002
43	Remote abnormal [always checking]	Minor failure	<ul style="list-style-type: none"> <li>I/O assignment verify mismatch occurs in the remote slave station module</li> <li>Communication error occurs between the remote master station module and CPU</li> <li>There is an error in the remote master station module, and transmission to the slave station has stopped</li> </ul>	◑	○	Stops *2	R7D0	WRF006 WRF080 to WRF0DF
44	Overload error (Normal scan) [during operation]	Minor failure	Execution time for normal scan exceeded the overload check time set by the parameter	◑	○	Stops *2	R7D1	—

Error code	Error name [detection timing]	Classification	Nature of error	RUN LED	ERR LED	Operation	Related special internal output	
							Bit	Word
45	Overload error (periodic scan) [periodic processing]	Minor failure	Execution time for periodic scan exceeded the execution period			Stops *2	R7D2	—
47	I/O assignment points over [when power turns on, when RUN starts, during RUN, when parameters changed]	Minor failure	Number of CPU assignment slots exceeds 16 slots (EH-CPU208/308/316/448) Number of CPU assignment slots exceeds 8 slots (EH-CPU104)			Stops *2	R7D6	—
51	I/O module abnormal [always checking]	Warning	• High function module, communication module faults out	— *1		Runs	R7D5	WRF005 WRF080 to WRF0DF
52	I/O transmission error [when high function module is transmitting, when transfer command is being executed]	Warning	• Error occurs during high function module transmission • TRNS, RECV command parameter error	— *1		Runs	—	—
53	I/O inappropriate assignment [check during operation]	Warning	Assignment of communication module is incorrect	— *1		Runs	—	—
54	Communication module abnormal [always checking]	Warning	Communication module hardware abnormal	— *1		Runs	R7D7	WRF004
55	Communication module transmission error [when a peripheral device is connected to the communication module]	Warning	Error occurred during transmission to the communication module	— *1		Runs	R7D7	WRF004
57	Communication module I/O assignment over [always checking]	Warning	The number of communication module assignments exceeds the maximum	— *1		Runs	R7DD	—
58	Communication module I/O verify error [always checking]	Warning	• Mismatch between communication module assignment information and module loading • Communication module hardware error	— *1		Runs	R7CE	WRF003
59	Link module abnormal [always checking]	Warning	• Link module hardware abnormal • Link parameter abnormal	— *1		Runs	R7DE	WRF007 WRF0E0 to WRF19F
61	Port 2 transmission error (parity) [when transmitting]	Warning	Parity error detected during transmission	— *1		Runs	—	—
62	Port 2 transmission error (framing/overflow) [when transmitting]	Warning	Framing error or overrun error detected during transmission	— *1		Runs	—	—
63	Port 2 transmission error (time out) [when transmitting]	Warning	Time out error detected during transmission	— *1		Runs	—	—
64	Port 2 transmission error (protocol error) [when transmitting]	Warning	Protocol (transmission procedure) error detected during transmission	— *1		Runs	—	—
65	Port 2 transmission error (BCC error) [when transmitting]	Warning	Sum error detected during transmission	— *1		Runs	—	—
67	Port 1 transmission error (parity) [when transmitting]	Warning	Parity error detected during transmission	— *1		Runs	—	—
68	Port 1 transmission error (framing/overflow) [when transmitting]	Warning	Framing error or overrun error detected during transmission	— *1		Runs	—	—
69	Port 1 transmission error (time out) [when transmitting]	Warning	Time out error detected during transmission	— *1		Runs	—	—

Error code	Error name [detection timing]	Classifi- cation	Nature of error	RUN LED	ERR LED	Ope- ration	Related special internal output	
							Bit	Word
6A	Port 1 transmission error (protocol error) [when transmitting]	Warning	Protocol (transmission procedure) error detected during transmission	— *1		Runs	—	—
6B	Port 1 transmission error (BCC error) [when transmitting]	Warning	Sum error detected during transmission	— *1		Runs	—	—
71	Battery error [always checking]	Warning	<ul style="list-style-type: none"> <li>Battery voltage dropped below specified value</li> <li>Battery not installed</li> </ul>	— *1		Runs	R7D9	—
94	Port 1 No modem response (when modem is connected)	Warning	There is no response from the modem connected to the port.	— *1		Runs	—	—
95	Port 1 Dial busy (when modem is connected)	Warning	The modem of the opposite party is communicating with another terminal or not ready for communication.	— *1		Runs	—	—
96	Port 1 CS ON time out (when modem is connected)	Warning	The CS signal of the modem connected to the port does not turn on within the designated time.	— *1		Runs	—	—
A0	Data logging error	Warning	Detected an error in the memory board or log data.	— *1		Runs	R7FE	WRF07F

\*1: Condition prior to error occurrence is restored. (If operation was in progress, the RUN LED turns ON; if operation was stopped, the RUN LED turns off)

\*2: Depending on the run parameter setting, operation can continue even when an abnormal occurs.

#### How to clear the error code

Set 1 in the special internal output R7EC to clear the error code from the PLC.

Pressing the reset switch for the power failure memory protection (R.CL) on the front of the CPU while the CPU is stopped also clears the error code.

However, if the reset switch for the power failure memory protection is pressed, all the power failure memory area is cleared with 0, so exercise caution.



## 12.2 Grammar and Assemble Error Codes

Descriptions of the grammar/assemble error codes are given below. The error codes are output as a hexadecimal to the internal output WRF001.

Error code	Error item	Description of error	Corrective action
H0001	Double definition of LBL	There are 2 or more LBL commands with the same number in the program	Limit the LBL command that has 2 or more of the same number to 1.
H0002	Double definition of FOR	There are 2 or more FOR commands with the same number in the program	Limit the FOR command that has 2 or more of the same number to 1.
H0003	Double definition of NEXT	There are 2 or more NEXT commands with the same number in the program	Limit the NEXT command that has 2 or more of the same number to 1.
H0004	Double definition of SB	There are 2 or more SB commands with the same number in the program	Limit the SB command that has 2 or more of the same number to 1.
H0005	Double definition of INT	There are 2 or more INT commands with the same number in the program	Limit the INT command that has 2 or more of the same number to 1.
H0010	END undefined	There is no END command prior to the INT, SB commands	Define the END command before the INT or SB command.
H0011	RTS undefined	There is no RTS command corresponding to the SB command	Define the RTS command after the SB command.
H0012	RTI undefined	There is no RTI command corresponding to the INT command	Define the RTI command after the INT command.
H0013	SB undefined	There is no SB command corresponding to the RTS command	Define the SB command before the RTS command.
H0014	INT undefined	There is no INT command corresponding to the RTI command	Define the INT command before the RTI command.
H0020	RTS area error	There is an RTS command in the normal scan area or periodic scan program area	Define the RTS command within the subroutine area.
H0021	RTI area error	There is an RTI command in the normal scan area or subroutine program area	Define the RTI command within the interrupt scan area.
H0022	END area error	There is an END command in the periodic scan area or subroutine program area	Define the END command at the end of the normal scan area.
H0023	CEND area error	There is a CEND command in the periodic scan area or subroutine program area	Define the CEND command within the normal scan area.
H0030	RTS start condition error	There is a start condition in the processing box that contains an RTS command	Delete the startup condition of the processing box.
H0031	RTI start condition error	There is a start condition in the processing box that contains an RTI command	Delete the startup condition of the processing box.
H0032	END start condition error	There is a start condition in the processing box that contains an END command	Delete the startup condition of the processing box.

## 12.3 Operation Error Codes

If an error occurs when a control command is executed, “1” is set in the operation error (ERR) special internal output “R7F3” and an error code indicating the nature of the error is set in WRF015.

To do a zero clear of the operation error, execute “R7F3=0” using forced setting from the program or peripheral device.

To do a zero clear of the error code, execute “WRF015=0” using forced setting from the program or peripheral device.

Error code	Error name	Description of error	Originating command
H0013	SB undefined	SBn command corresponding to the command number n in the CALn command is not programmed	CAL
H0015	LBL undefined	LBLn command corresponding to the command number n in the JMPn, CJMPn commands is not programmed	JMP CJMP RSRV
H0016	FOR undefined	FORn command corresponding to the command number n in the NEXTn command is not programmed	NEXT
H0017	NEXT undefined	NEXTn command corresponding to the command number n in the FORn command is not programmed	FOR
H0040	LBL area error	LBLn command corresponding to the command number n in the JMPn, CJMPn commands is not programmed in the same program area	JMP CJMP RSRV
H0041	CAL nesting overflow	There are more than 6 levels of subroutine nesting	CAL
H0042	CAL undefined	RTS command was executed without executing a CAL command	RTS
H0043	FOR to NEXT error	There is a NEXTn with the same command number n prior to the FORn command	FOR
H0044	NEXT area error	There is no NEXTn command with the same command number n as the FORn command, in the same program area	FOR
H0045	FOR to NEXT nesting overflow	The FORn and NEXTn commands are not nested	FOR
H0046	FOR nesting overflow	There are more than 6 nesting levels of FOR to NEXT	FOR NEXT



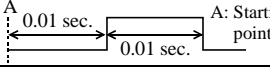
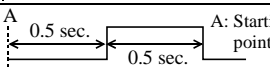
# Chapter 13 Special Internal Outputs

The EH-150 has a special internal output area for performing status display and various other settings. The special internal output area is always kept as power failure memory.

## 13.1 Bit Special Internal Output Area

Definitions of the bit special internal output area (R7C0 to R7FF) are given below.

No.	Name	Meaning	Description	Setting condition	Resetting condition
R7C0	Continue when overload error occurs (normal scan)	0: Stop running when overload error occurs 1: Continue running when overload error occurs	Designates continue/stop running when a normal scan overload error occurs	Turned on by the user	Turned off by the user or turned off even when power failure memory is cleared
R7C1	Continue when overload error occurs (periodic scan)	0: Stop running when overload error occurs 1: Continue running when overload error occurs	Designates continue/stop running when a periodic-scan overload error occurs		
R7C2	Continue when overload error occurs (interrupt scan)	0: Stop running when overload error occurs 1: Continue running when overload error occurs	Designates continue/stop running when an interrupt-scan overload error occurs		
R7C3	REMOTE RUN allowed	0: RUN prohibited 1: RUN allowed	Designates whether operation based on the task code is allowed		
R7C4	REMOTE STOP allowed	0: STOP prohibited 1: STOP allowed	Designates whether stop based on the task code is allowed		
R7C5	Undefined	Do not use.			
R7C6	Undefined	Do not use.			
R7C7	Modification during RUN allowed	0: Modification during RUN prohibited 1: Modification during RUN allowed	Designates whether online change in RUN is allowed in the user program	Turned on by the user	Turned off by the user or turned off even when power failure memory is cleared
R7C8	Serious failure flag	0: No serious failure 1: Serious failure	Indicates whether there is an abnormal in the system	Turned on by the system	
R7C9	Microcomputer abnormal	0: Normal 1: Abnormal	Indicates whether there is an abnormal in the microcomputer		
R7CA	User memory abnormal	0: Normal 1: Abnormal	Indicates whether there is an abnormal in the user memory		
R7CB	Undefined	Do not use.			
R7CC	Memory size over	0: Normal 1: Abnormal	Indicates whether the capacity set by the parameter exceeds loaded memory capacity	Turned on by the system	Turned off by the user or turned off even when power failure memory is cleared
R7CD	I/O verify mismatch	0: Normal 1: Unmatched	Indicates whether I/O assignment and loading are matched (Mismatched information output to WRF002)		
R7CE	Communication module assignment verify mismatch	0: Normal 1: Unmatched	Indicates whether I/O assignment and loading are matched (Mismatched information output to WRF003)		
R7CF	Undefined	Do not use.			
R7D0	Remote abnormal	0: Normal 1: Abnormal	Indicates whether the remote module is normal (Abnormal slot number display to WRF006, detailed information output to WRF080 to WRF0DF)	Turned on by the system	Turned off by the user or turned off even when power failure
R7D1	Overload error (normal scan)	0: Normal 1: Scan time over	Indicates whether the scan execution time has exceeded the designated time		
R7D2	Overload error (periodic scan)	0: Normal 1: Scan time over	Indicates whether the periodic scan was completed within cycle time		
R7D3	Undefined	Do not use.		Turned on by the system	Turned off by the user or turned off even when power failure
R7D4	Grammar/assemble error	0: Normal 1: Error	Indicates whether there is a grammar error in the user program (Detailed information output to WRF001)		
R7D5	I/O module abnormal	0: Normal 1: Abnormal	Indicates whether there is an abnormal in the I/O module (Abnormal slot number output to WRF005)		

No.	Name	Meaning	Description	Setting condition	Resetting condition
R7D6	Number of I/O assignment points over	0: Normal 1: I/O assignment points over	Indicates whether the number of I/O assigned points has exceeded the maximum number	Turned on by the system	off even when power failure memory is cleared
R7D7	Communication module abnormal	0: Normal 1: Abnormal	Indicates whether there is an abnormal in the communication module (Abnormal slot number output to WRF004)		
R7D8	System bus abnormal	0: Normal 1: Abnormal	Indicates whether there is an abnormal when the system bus is accessed		
R7D9	Battery error	0: Normal 1: Abnormal	Indicates whether battery voltage is low		Turned off by the system *
R7DA	Undefined	Do not use.			
R7DB	Self-diagnostic error	0: Normal 1: Error	Indicates whether there is a self-diagnostic error (Detailed information output to WRF000)	Turned on by the system	Turned off by the user or turned off even when power failure memory is cleared
R7DC	Undefined	Do not use.			
R7DD	Communication module assignment over	0: Normal 1: Error	Indicates whether the communication module assignment exceeds the maximum value	Turned on by the system	Turned off by the user or turned off when the power failure memory is cleared
R7DE	Link module abnormal	0: Normal 1: Abnormal	Indicates whether there is an abnormal in the link module (Abnormal slot number displayed in WRF007, detailed information output to WRF0E0 to WRF19F)		
R7DF	Undefined	Do not use.			
R7E0	Operation switch position (STOP)	0: When RUN switch position is other than STOP, or when RUN switch position is STOP and setting switch position is REMOTE 1: When RUN switch position is STOP and setting switch position is other than REMOTE	One of these is on	Turned on by the system	Turned off by the system
R7E1	Operation switch position (REMOTE)	0: When RUN switch position is other than STOP, or when RUN switch position is STOP and setting switch position is REMOTE 1: When RUN switch position is STOP and setting switch position is other than REMOTE			
R7E2	Operation switch position (RUN)	0: RUN switch position is other than RUN 1: RUN switch position is RUN			
R7E3	1 scan ON after RUN	0: From the second scan after RUN 1: 1 scan after RUN	ON  OFF A		
R7E4	Always ON	0: Non-status of 0 1: Always	Always outputs 1 regardless of CPU status		OFF not possible
R7E5	0.02 second clock	0: 0.01 seconds 1: 0.01 seconds	ON  OFF A		Turned off by the system
R7E6	0.1 second clock	0: 0.05 seconds 1: 0.05 seconds	ON  OFF A		
R7E7	1.0 second clock	0: 0.5 seconds 1: 0.5 seconds	ON  OFF A		
R7E8	Occupied flag	0: Unoccupied 1: Occupied	Indicates occupancy status from the peripheral device		
R7E9	RUN prohibited	0: Operation allowed 1: Operation prohibited	Indicates whether it is operation prohibited status		

\* Battery error (R7D9) will turn off when the error factor is gone by exchanging the batteries, etc.

No.	Name	Meaning	Description	Setting condition	Resetting condition
R7EA	Executing an online change in RUN	0: Not being executed 1: Being executed	Indicates whether operation is temporarily stopped (output hold) due to online change in RUN	Turned on by the system	Turned off by the system
R7EB	Undefined	Do not use.			
R7EC	Clear error special internal output	Clear with 1	Clears error special internal outputs (WRF000 to F00A, R7C8 to 7DE)	Turned on by the user	Turned off by the system
R7ED	Undefined	Do not use.			
R7EE	Battery error display	0: Upon error, ERR lamp flashes 1: Upon error, ERR lamp turns off	Indicates whether or not the ERR lamp is used to notify battery errors	Turned on by the user	Turned off by the user or turned off even when power failure memory is cleared
R7EF	Backup memory writing execution flag (EH-CPU448 only)	0: Write complete 1: Write in progress	Indicates whether or not data is being written to the backup memory.	Turned on by the system	Turned off by the system
R7F0	Carry flag (C)	0: No carry 1: Carry	Indicates whether there is a carryover from the operation result		
R7F1	Overflow flag (V)	0: No overflow 1: Overflow	Indicates whether there is overflow in the operation result		
R7F2	Shift data (SD)	0: Shift data "0" 1: Shift data "1"	Designates the shift data used in shift commands, etc.	Turned on by the user	Turned off by the user
R7F3	Operation error (ERR)	0: Normal 1: Error	Indicates whether there is an operation error when operation is executed	Turned on by the system	Turned off by the system
R7F4	Data error (DER)	0: Normal 1: Error	Indicates whether there is a data error when operation is executed		
R7F5	Undefined	Do not use.			
R7F6	Scan time base value specification (EH-CPU448)	0: 10 ms 1: 1 ms	Specifies the time base of the scan time display (WRF010-WRF012).	Turned on by the user	Turned off by the user
	Undefined (EH-CPU104/208/308/316))	Do not use.			
R7F7	Memory board busy	0: Standby 1: Busy	Indicates whether the memory board that was accessed during the execution of the FUN command (FUN 211 through FUN 213) is currently in use for other processing	Turned on by the system	Turned off by the system
R7F8	Calendar, clock read request Undefined for the EH-CPU104	1: Read	Read present value of calendar, clock and set in WRF01B to WRF01F	Turned on by the user	Turned off by the system
R7F9	Calendar, clock setting request Undefined for the EH-CPU104	1: Set	Set the data set in WRF01B to WRF01F in the calendar, clock		
R7FA	Clock $\pm 30$ second adjustment request Undefined for the EH-CPU104	1: Request adjustment	When second data is 0 to 29, it becomes 0 seconds and when it is 30 to 59, +1 minute is added and second data becomes 0		
R7FB	Calendar, clock set data error Undefined for the EH-CPU104	0: Normal 1: Error	Indicates whether there is an error in calendar, clock set data	Turned on by the system	
R7FC to R7FD	Undefined	Do not use.			
R7FE	Data logging error	0: Normal 1: Error	Indicates whether or not there is an error in the memory board or log data	Turned on by the system	Turned off by the user or turned off even when power failure memory is cleared
R7FF	Undefined	Do not use.			

## 13.2 Word Special Internal Output Area

Definitions of the word special internal output area (WRF000 to WRF1FF) are given below.

No.	Name	Storage data	Description	Setting condition	Resetting condition
WRF000	Self diagnosis error code	Error code (2 digit hexadecimal, upper 2 digits are 00)	Stores the error number deleted in the CPU as a binary code	Set by the system	Cleared by the user
WRF001 (R7D4)	Grammar/assemble error details	Grammar/assemble error code (4 digit hexadecimal)	Error code for user program grammar/assemble error is stored		
WRF002 (R7CD)	I/O verify mismatch details	Mismatched slot number *1	<div>15121187430</div> <div>0a b0</div> <div>a: Unit number (0 to 1)</div> <div>b: Slot number (0 to 7)</div>		
WRF003 (R7CE)	Communication module I/O verify mismatch details	Mismatched module slot number *1	Mismatched slot number is stored (lower 4 bits: 0 to 7, upper bit 0)		
WRF004 (R7D7)	Communication module abnormal slot number	Slot number of the communication module with abnormal *1	Abnormal slot number (lower 4 bits: 0 to 7, upper bit 0)		
WRF005 (R7D5)	I/O module abnormal slot number	Slot number of the I/O module with abnormal *1	<div>15121187430</div> <div>0a b0</div> <div>a: Unit number (0 to 1)</div> <div>b: Slot number (0 to 7)</div>		
WRF006 (R7D0)	Remote I/O master station module abnormal slot number	Slot number of the module with abnormal *1			
WRF007 (R7DE)	Link module abnormal slot number	Slot number of the module with abnormal *1			
WRF008	Undefined	Do not use.			
WRF009	Undefined	Do not use.			
WRF00A	Undefined	Do not use.			
WRF00B	Calendar and clock present value (4 digit BCD)	Year	Always displays the 4 digit year	Set by the system	Always displayed
WRF00C		Month/day	Month/day data always displayed		
WRF00D		Day of the week	Day of the week data always displayed (Sunday: 0000 to Saturday: 0006)		
WRF00E		Hour/minute	Hour/minute data always displayed (24-hour system)		
WRF00F		Seconds	Seconds data always displayed (Lower 2 digits, upper 2 digits are 00)		
WRF010	Scan time (maximum value)	Maximum execution time for a normal scan	Maximum execution time for a normal scan is stored in 10 ms units *2	Set by the system	Cleared by the system (when RUN starts)
WRF011	Scan time (present value)	Present value of execution time for a normal scan	Present value of execution time for a normal scan is stored in 10 ms units *2		
WRF012	Scan time (minimum value)	Minimum execution time for a normal scan	Minimum execution time for a normal scan is stored in 10 ms units (the first scan after RUN is HFFFF)		
WRF013	CPU status	<div>151110876543210</div> <div>Unuseda b c d e f g h i</div> <div>a: CPU type (011), c: Unused, e: Unused, g: Unused, I: CPU operation (1-RUN, 0-STOP)</div> <div>b: Battery error (1-error, 0-no error), d: Unused, f: Error (1-error, 0-no error), h: Halt (1-executing, 0-not executing),</div>		Set by the system	Always displayed

\*1 When checking to see which slot is currently in error, turn off the respective bit special internal output (the number within ( ) of the number column) once, or turn on R7EC once.

\*2 For the EH-CPU448, the unit changes to 1 ms when R7F6 is turned on.

No.	Name	Storage data	Description	Setting condition	Resetting condition
WRF014	Word internal output capacity	Number of words for word internal output (WR)	EH-CPU104: H1000, EH-CPU208: H2000, EH-CPU308: H4400, EH-CPU316: H5800 EH-CPU448: HC400	Set by the system	Always displayed
WRF015	Operation error code	Operation error code	Operation error code is stored (4 digit hexadecimal)		Cleared by the user
WRF016	Division remainder register (lower)	Remainder data when division command executed	For a double word operation: WRF017 (upper), WRF016 (lower)		Cleared by the system
WRF017	Division remainder register (upper)		For a word operation: WRF016 only		
WRF018	Communication module startup flag	<div><div>159876543210</div><div><div>Unused</div><div>a</div><div>b</div><div>c</div><div>d</div><div>e</div><div>f</div><div>g</div><div>h</div><div>i</div></div></div> <div>Bit number corresponds to the slot number 1-startup complete 0-startup incomplete</div>			
WRF019	Undefined	Do not use.			
WRF01A	Baud rate set value between CPU and modem	<div><div>156543210</div><div><div>Unused</div><div>a</div><div>b</div><div>c</div><div>d</div><div>e</div><div>f</div></div></div> <div>a-57,600 bps      b-38,400 bps      c-19,200 bps d-9,600 bps      e-4,800 bps      f-2,400 bps The corresponding bit is set to 1. The lower bit takes priority. If all bits are 0, it is 2,400 bps.</div>		Set by the user	Cleared by the user
WRF01B	Read and set values for calendar and clock (4 digit BCD) Undefined for the EH-CPU104	Year	Stores the 4 digit year value that is read or sets the set value	Set by the system or by the user	Cleared by the user
WRF01C		Month/day	Stores the read month/day value or sets the set value		
WRF01D		Day of the week data (Sunday: 0000 to Saturday: 0006)	Stores the read day of the week data or sets the set value		
WRF01E		Hour/minute (24-hour system)	Stores the read hour/minute value or sets the set value		
WRF01F		Seconds	Stores the read second value or sets the set value		
WRF020 to F021	Communication module status (slot 0)	Status data	<div><div>15870</div><div><div>Status 1</div><div>Status 2</div><div>Status 3</div><div>Status 4</div></div></div> <div>Refer to communication module specifications for details</div>	Set by the system	Cleared by the system
WRF022 to F023	Communication module status (slot 1)	Status data			
WRF024 to F025	Communication module status (slot 2)	Status data			
WRF026 to F027	Communication module status (slot 3)	Status data			
WRF028 to F029	Communication module status (slot 4)	Status data			
WRF02A to F02B	Communication module status (slot 5)	Status data			
WRF02C to F02D	Communication module status (slot 6)	Status data			
WRF02E to F02F	Communication module status (slot 7)	Status data			
WRF030 to F031	Communication module status (slot 8)	Status data			
WRF032 to F035	Undefined	Do not use.			



No.	Name	Meaning	Description	Setting condition	Resetting condition																																							
WRF036	Selection of communication port 1	<div>15<span style="float:right">0</span></div> <table><tr><td colspan="4">Unused</td><td>a</td><td>b</td><td>c</td><td>d</td></tr></table> <div>a-RS-485<span style="margin-left: 100px;">b-RS-422</span><span style="margin-left: 100px;">c-RS-232C</span></div> <div>d-switching monitoring flag</div> <div>The user turns to 1 the bits corresponding to the port to be selected (a to c) and the switching monitoring flag (d).</div> <div>The system resets d when the switching of ports is completed.</div> <table><tr><td></td><td>Value set by the user</td><td>Display after port switching</td></tr><tr><td>RS-232C</td><td>H0003</td><td>H0002</td></tr><tr><td>RS-422</td><td>H0005</td><td>H0004</td></tr><tr><td>RS-485</td><td>H0009</td><td>H0008</td></tr></table>		Unused				a	b	c	d		Value set by the user	Display after port switching	RS-232C	H0003	H0002	RS-422	H0005	H0004	RS-485	H0009	H0008																					
Unused				a	b	c	d																																					
	Value set by the user	Display after port switching																																										
RS-232C	H0003	H0002																																										
RS-422	H0005	H0004																																										
RS-485	H0009	H0008																																										
WRF037	Setting of port 1 communication function (EH-CPU448 only)	<div>15 14 13 12 11 10 9 8 7<span style="float:right">0</span></div> <table><tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>Station No.</td></tr></table> <div>a: Setting bit 1 - Set This bit is set to 0 by the system after setting is complete.</div> <div>b: Transmission control procedure 0 - Transmission control procedure 1 1 - Transmission control procedure 2</div> <div>c: Station number presence 0 - No station number 1 - Station number present</div> <div>d: Not used</div> <div>e, f: Communication interface status display (set by the system)</div> <table><tr><td>e</td><td>f</td><td>Interface</td></tr><tr><td>0</td><td>0</td><td>RS-232C</td></tr><tr><td>0</td><td>1</td><td>RS-422</td></tr><tr><td>1</td><td>0</td><td>RS-485</td></tr><tr><td>1</td><td>1</td><td>(This will not be displayed.)</td></tr></table> <div>g, h: Communication interface setting (set by the user)</div> <table><tr><td>g</td><td>h</td><td>Interface</td></tr><tr><td>0</td><td>0</td><td>RS-232C</td></tr><tr><td>0</td><td>1</td><td>RS-422</td></tr><tr><td>1</td><td>0</td><td>RS-485</td></tr><tr><td>1</td><td>1</td><td>No setting change will be performed.</td></tr></table> <div>Station number 0 to 31 in 2-digit BCD. If the station number exceeds this range, the system will set 31.</div> <div>For more details, see Chapter 10, "Communication Specifications."</div>		a	b	c	d	e	f	g	h	Station No.	e	f	Interface	0	0	RS-232C	0	1	RS-422	1	0	RS-485	1	1	(This will not be displayed.)	g	h	Interface	0	0	RS-232C	0	1	RS-422	1	0	RS-485	1	1	No setting change will be performed.	Set by the system or by the user	Cleared by the user
a	b	c	d	e	f	g	h	Station No.																																				
e	f	Interface																																										
0	0	RS-232C																																										
0	1	RS-422																																										
1	0	RS-485																																										
1	1	(This will not be displayed.)																																										
g	h	Interface																																										
0	0	RS-232C																																										
0	1	RS-422																																										
1	0	RS-485																																										
1	1	No setting change will be performed.																																										
WRF038	Setting of system processing time (EH-CPU448)	<div>15<span style="float:right">8 7<span style="float:right">0</span></span></div> <table><tr><td>User setting time</td><td>Current operating condition</td></tr></table> <div>User setting time: 3 to 9 in 1-digit BCD. If the user setting time exceeds this range, the system will set 3.</div> <div>Current system processing time: The system sets the processing time of the system currently in operation.</div> <div>This setting becomes effective immediately after it is set.</div> <div>For more details, see Chapter 8, "Operating and Stopping EH-150."</div>		User setting time	Current operating condition																																							
User setting time	Current operating condition																																											
	Setting of system processing time (EH-CPU308/316 of ROM Ver. 04 or later)	<div>15<span style="float:right">8 7<span style="float:right">0</span></span></div> <table><tr><td>User setting time</td><td>Current operating condition</td></tr></table> <div>User setting time: 5 in BCD. If a value other than 5 is specified, the system processing time will vary.</div> <div>Current operating time: 00 - System processing time varies. 05 - System processing time is fixed at 5 ms.</div> <div>*The current operating condition section is set by the system.</div> <div>This setting becomes effective immediately after it is set.</div> <div>For more details, see Chapter 8, "Operating and Stopping EH-150."</div>		User setting time	Current operating condition																																							
User setting time	Current operating condition																																											
	Undefined (EH-CPU104/208)	Do not use.																																										

No.	Name	Meaning	Description	Setting condition	Resetting condition																					
WRF039 to F03B	Undefined	Do not use.																								
WRF03C	Modem time out (port 1)	H80**: Time out monitoring is performed for ** seconds. (The timer is set again upon reception of STX, ENQ or NAK.)		Set by the user	Cleared by the user																					
WRF03D to F03F	Undefined	Do not use.																								
WRF040 to F042	Occupied member registration area 1	<div>Occupied port number</div> <div><div><div>15870</div><table><tr><td>a</td><td>Fixed to 0</td></tr><tr><td>b</td><td>c</td></tr><tr><td>d</td><td>e</td></tr></table></div><div>a: 0- Not occupied, 1 - Read-occupied, 2 - Write-occupied b: Loop number                      c: Unit number d: Module number                  e: Port number (*) (*) When dedicated port: Port 1 is H02 and port 2 is H01.</div></div>		a	Fixed to 0	b	c	d	e	Set by the system	Cleared by the system															
a	Fixed to 0																									
b	c																									
d	e																									
WRF043 to F045	Occupied member registration area 2																									
WRF046 to F048	Occupied member registration area 3																									
WRF049 to F04B	Occupied member registration area 4																									
WRF04C to F04F	Undefined	Do not use.																								
WRF050	System use area	System ROM version information																								
WRF051	System use area	System FLASH ROM version information																								
WRF052 to F07D	Undefined	Do not use.																								
WRF07E	Link area clear mode selection (EH-CPU308/316 of ROM Ver. 04 or later, EH-CPU448)	<div><div>When a mode to clear a link area is selected, the specified link area will be cleared to 0 when the CPU status changes from RUN to STOP.</div><div><table><tr><td>0</td><td>b</td><td>a</td></tr></table><div>a: 1 = Link area 1 mode switch request (this is set to 0 by the system when mode switch is complete.) b: Link area 1: 0 = Do not clear; 1 = Clear c: 1 = Link area 2 mode switch request (this is set to 0 by the system when mode switch is complete.) d: Link area 2: 0 = Do not clear; 1 = Clear</div></div><div><table><tr><td></td><td>Selection mode</td><td>User set value</td><td>Display after mode switch</td></tr><tr><td rowspan="2">Link 1</td><td>Clear</td><td>H0003</td><td>H00*2</td></tr><tr><td>Do not clear</td><td>H0001</td><td>H00*1</td></tr><tr><td rowspan="2">Link 2</td><td>Clear</td><td>H0030</td><td>H002*</td></tr><tr><td>Do not clear</td><td>H0010</td><td>H000*</td></tr></table><div>*: Retains the status before switching.</div></div></div>		0	b	a		Selection mode	User set value	Display after mode switch	Link 1	Clear	H0003	H00*2	Do not clear	H0001	H00*1	Link 2	Clear	H0030	H002*	Do not clear	H0010	H000*	Set by the system or by the user	Always displayed
0	b	a																								
	Selection mode	User set value	Display after mode switch																							
Link 1	Clear	H0003	H00*2																							
	Do not clear	H0001	H00*1																							
Link 2	Clear	H0030	H002*																							
	Do not clear	H0010	H000*																							
	Undefined (EH-CPU104/208)																									
WRF07F	Log error code	Log error code	Stores the log error code. For details, see the data logging specifications.	Set by the system	Cleared by the user																					
WRF080 to F097	Remote master 1 error flag	Remote error information (refer to separate sheet for details)		Set by the system	Cleared by the system																					
WRF098 to F0AF	Remote master 2 error flag																									
WRF0B0 to F0C7	Remote master 3 error flag																									
WRF0C8 to F0DF	Remote master 4 error flag																									
WRF0E0 to F13F	Link 1 error flag	Link information (refer to separate sheet for details)																								
WRF140 to F19F	Link 2 error flag																									

## 13.3 Remote Error Flag Area

Details of the remote error flag error are given below.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Slave station participation flag	a																+ 00
Slave station error flag	b																+ 01
Master station error detail information	c	d	e	f	g	h	i	j	Number of times transmission errors *1								+ 02
Slave station No. 0 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 03
Slave station No. 1 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 04
Slave station No. 2 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 05
Slave station No. 3 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 06
Slave station No. 4 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 07
Slave station No. 5 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 08
Slave station No. 6 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 09
Slave station No. 7 detail information	k	l	m	n	o	p	q	r	Number of times transmission errors *2								+ 0A
Slave station No. 8 detail information	Undefined																+ 0B
Slave station No. 9 detail information	Undefined																+ 0C
Slave station No. 10 detail information	Undefined																+ 0D
Slave station No. 11 detail information	Undefined																+ 0E
Slave station No. 12 detail information	Undefined																+ 0F
Slave station No. 13 detail information	Undefined																+ 10
Slave station No. 14 detail information	Undefined																+ 11
Slave station No. 15 detail information	Undefined																+ 12
I/O verify mismatch slot No.	0									Slave station No.				Slot No.			+ 13
I/O error slot No.	0									Slave station No.				Slot No.			+ 14
Refresh time (maximum)	(unit: ms)																+ 15
Refresh time (minimum)	(unit: ms)																+ 16
Refresh time (present)	(unit: ms)																+ 17

- a: Bit number corresponds to the slave station number (1: participating, 0: non-participating)  
b: Bit number corresponds to the slave station number (1: error, 0: no error)  
c: Time out error (1: error, 0: no error)      k: Same as c  
d: Frame error (1: error, 0: no error)      l: Same as d  
e: System bus error (1: error, 0: no error)      m: Undefined  
f: Slave station I/O error (1: error, 0: no error)      n: Same as f  
g: Duplicate station number (1: error, 0: no error)      o: Same as g  
h: Slave station connection mismatch (1: error, 0: no error)      p: Same as h  
i: I/O information mismatch (1: error, 0: no error)      q: Same as i  
j: Remote points error (1: error, 0: no error)      r: Undefined

\*1 "Number of times transmission error" is a cumulative total of the number of c or d error occurrences.

\*2 "Number of times transmission error" is a cumulative total of the number of k or l error occurrences.

## 13.4 Link Error Flag Area

Details of the link error flag area are given below.

																15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Local station error information		Undefined		a	b	c	d	e	f	Undefined		Disconnected station number						+ 00														
		15	to													0	+ 01															
Link participation flag (g)		31	to													16	+ 02															
		47	to													32	+ 03															
		63	to													48	+ 04															
Link operation status flag (h)		15	to													0	+ 05															
		31	to													16	+ 06															
		47	to													32	+ 07															
		63	to													48	+ 08															
CPU status flag (i)		3				2				1				0				+ 09														
		:															:															
		:															:															
		63				62				61				60				+ 18														
Error status flag (j) *1		15	to													0	+ 19															
		31	to													16	+ 1A															
		47	to													32	+ 1B															
		63	to													48	+ 1C															
Station 0 to 63 Error detail information		k	l	m	Undefined					Number of times transmission errors *2						+ 1D																
		:															:															
		:															:															
		k	l	m	Undefined					Number of times transmission errors *2						+ 5C																
Refresh time (maximum)		(Unit: ms)															+ 5D															
Refresh time (minimum)		(Unit: ms)															+ 5E															
Refresh time (present)		(Unit: ms)															+ 5F															

- a: System bus error (1-error, 0-no error)      b: Undefined  
 c: Area error (1-error, 0-no error)      d: Duplicate area error (1-error, 0-no error)  
 e: Station number error (1-error, 0-no error)      f: Transmission path disconnected (1-error, 0-no error)  
 g: Number indicates the station number (1-participation, 0-non-participation)  
 h: Number indicates the station number (1-operating, 0-stopped)  
 i: Number indicates the station number (of the 4 bits, 1] 1-CPU error, 0-normal 2] Undefined 3] 1-HALT status, 0-other than HALT status 4] 1-running, 0-stopped)

1]	2]	3]	4]
----	----	----	----

- j: Number indicates the station number (1-error, 0-no error)      k: Time out error (1-error, 0-no error)  
 l: Frame error (1-error, 0-no error)      m: Abnormal between CPU and link (1-abnormal, 0-normal)

\*1 “Error status flag” is set to 1 when one of the k, l and m errors is generated in “Error detail information.” k, l and m generate error when an error is detected while the peripheral device is communicating with the CPU of other station.

\*2 “Number of times transmission errors” is a cumulative total of the number of k or l error occurrences.



# Chapter 14 Troubleshooting

## 14.1 Error Indication and Countermeasure Procedures

The indication locations of errors detected by individual equipment in the EH-150 system are shown in Figure 14.1. When errors occur, remedy the errors using the error code list.

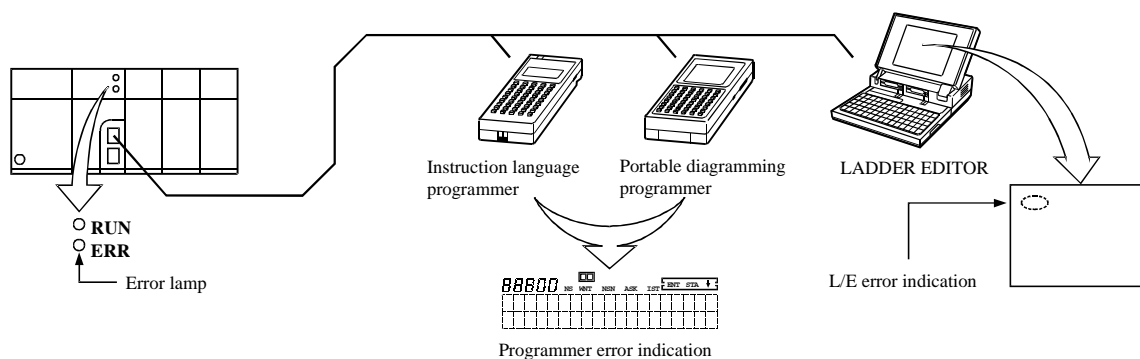


Figure 14.1 Error indication of EH-150

### (1) Error indication

#### (a) CPU module error indication

The CPU module will perform self-diagnostic tests using the microcomputer, and when there is an error the contents are indicated in the combination of the ERR and RUN lamps located in the front of the CPU module being lit/flashing/unlit. For Chapter 12 error codes and countermeasures, refer to the self-diagnosis error code list.

#### (b) Programmer error indication

Error codes encountered during program device operation, such as duplicate definition error, undefined error, operation error, program over, etc., will be displayed on the programming device. For detailed error codes, refer to the error code list in the programming device manual.

#### (c) GPCL error display

The error detected by the CPU during the GPCL operation is displayed at the bottom left of the screen.

ON LINE PROGRAMMING			
***** CPU STATUS *****		***** PC STATUS *****	
CPU TYPE	: H-300	CPU TYPE	: H-300
STATUS	: STOP	MEMORY CAPA	: 0192 [S]
MEMORY TYPE	: RAM	FLOW	: 0 [S]
CAPA	: 0192 [S]	LADDER	: 7552 [S]
DATA	: 2048 [W]	DATA	: 2048 [W]
BATTERY	: OK	MEMORY STATUS	: NOT
CONTROL	: NO	CASSETTE TYPE	: [S]
PREV.	: 10 [*10mSEC]	PRINT PORT	: CENTRO
CPU PORT	: HOME	BUZZER PORT	: FON
CPU STATUS	: STOP [MODE]	SELECT NO.7	
CPU ONLINE	: H-300	SYSTEM INITIALIZE	
CPU PORT	: HOME	PORT SET	
CPU CONNECT ERROR		PROGRAMMING	
		UTILITY	

Error display

If the cable is disconnected or the power to the master unit is turned off during the GPCL operation, "CPU CONNECTION ERROR" is displayed to indicate a connection error.

For the details of error codes, see the list of error codes in the GPCL manual.

#### (d) Setting in the special internal output

An error code is set in the special internal output area (such as WRF000). The smaller the error code value, the more serious the error is. When two or more errors occur, the smaller number is set. For example, if "71" (battery error) and "31" (user memory error) occur simultaneously, "31" is set. If the levels are the same, the cause code generated last will be displayed.

The clearing of error special internal output is performed by setting the special internal output R7EC to 1. The R7EC can be set to 1 either by connecting the programming device or by including a subprogram that sets the R7EC using external input within the program. (If turning R7EC on by the program, always set it on after the error cause has been verified. However, if R7EC is turned on by a program that would generate a watchdog error, the system may clear the error cause and rerun after detecting a watchdog error.)

Note: Error codes are set in hexadecimal values. Verify error codes by setting the monitor to hexadecimal display.

The range of the special internal output that is cleared when R7EC is set to 1 is shown below.

No.	Bit special internal output	No.	Word special internal output
R7C8	Serious failure flag	WRF000	Self-diagnostic error code
9	Operation microcomputer abnormal	1	Grammar/assemble error details
A	User memory abnormal	2	I/O verify mismatch details
B	I/O bus abnormal	3	Communication module I/O verify mismatch details
C	Memory size over	4	Communication module abnormal slot number
D	I/O verify mismatch	5	I/O module abnormal slot number
E	Communication module assignment verify mismatch	6	Remote I/O master station module abnormal slot number
R7CF	(Undefined)		
R7D0	Remote abnormal	7	Link module abnormal slot number
1	Overload error (normal scan)	8	(Undefined)
2	Overload error (periodical scan)	9	(Undefined)
3	Overload error (interrupt scan)	WRF00A	(Undefined)
4	Grammar/assemble error		
5	I/O module abnormal		
6	I/O assignment point over		
7	Communication module abnormal		
8	System bus error		
9	Battery error		
A	(Undefined)		
B	Self-diagnostic error		
C	(Undefined)		
D	Communication module assignment over		
R7DE	Link module abnormal		

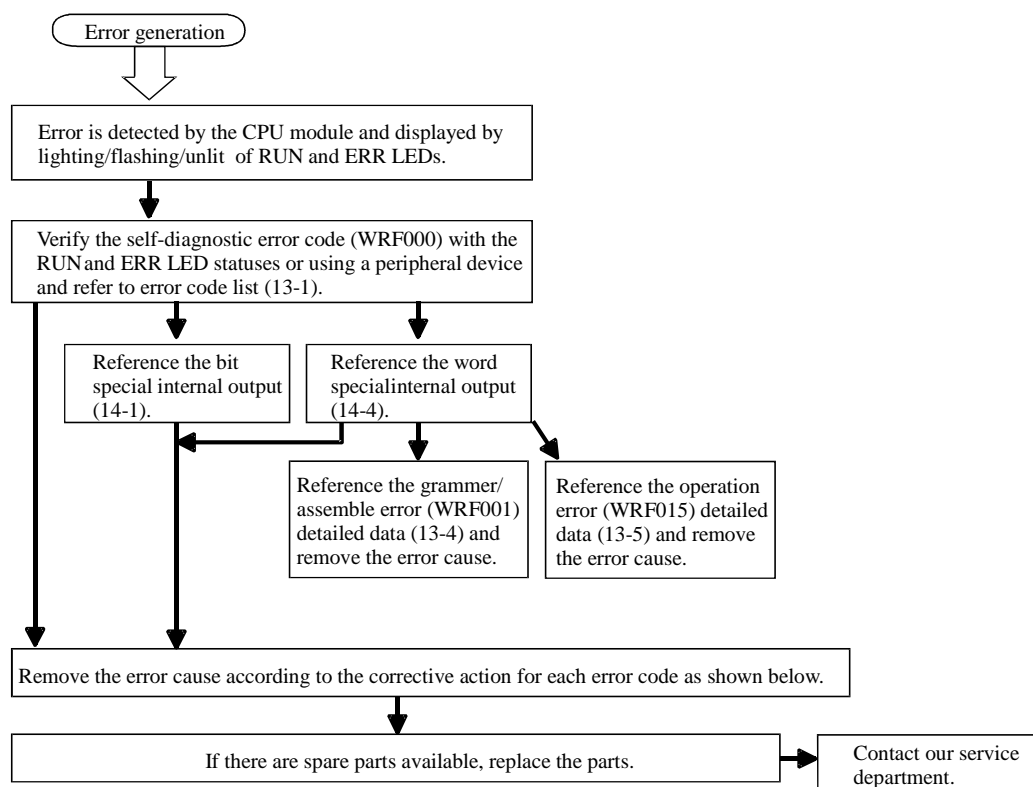
When all of the special internal output data cannot be cleared for program execution reasons, refer to the self-diagnostic error code list and clear only the respective error flags by using forced set of the programmer or peripheral device.

#### Caution

If the internal output for a self-diagnostic error R7DB (WRF000) is used as a system error for the stop condition of CPU RUN, the R7DB may be turned on even with an error of the warning level (battery error, etc.), causing the CPU to stop. Therefore, do not use the internal output of the self-diagnostic error as a condition for stopping the CPU.

## (2) Corrective actions when errors are generated

The process flow when an error is generated is shown below.



Error code	Error name	Corrective action
11	System ROM error	Re-inspect the fixation of the CPU module to the basic base unit and restart the power supply. If the same error occurs, it is a hardware error in the CPU module, so replace the CPU module with a spare. Make sure that there are no machines, etc. that generate excessive noise.
12	System RAM error	
13	Microcomputer error	
15	System bus timeout error	
16	System program error	
23	Undefined command	
27	Data memory error	
—	Power shut-off, power supply error	Check the basic and extended power supply voltage.
31	User memory error	The contents of the user program is destroyed. Perform initialization and transfer the program again. This is displayed when the machine is stored with a worn-out battery or without battery for a long period of time.
33	User memory size error	This may be displayed when the contents of the memory within the CPU module is unstable. If the same error is generated after initialization, replace the CPU module with a new one.
34	Grammar/assemble error	There is a grammar or assemble error in the user program. Verify the program and I/O assignment.
41	I/O information verification error	Check the I/O assignment. Check each I/O module, I/O controller fixation and expansion cable connection.
43	Remote error	Perform module settings, reset, etc. according to the error code of the malfunctioning remote module.
44	Overload error (normal scan)	Change the program so that the scan time of the user program is shorter or change the watchdog check time.
45	Overload error (periodic scan)	Change the program so that the periodic interrupt program execution time is shorter.
47	I/O assignment point over	Perform I/O assignment so that the maximum I/O points of the CPU module are not exceeded.



Error code	Error name	Corrective action
51	I/O module abnormal	Check for errors in I/O modules and replace the malfunctioning module.
52	I/O transmission error	Reset the power supply for the high-function module. Set the TRNS, RECV parameters correctly.
53	I/O invalid interrupt	Check to see if the links and remote modules are assigned properly in the I/O assignment.
54	Communication module abnormal	Perform error recovery procedures according to the error code of the malfunctioning communication module.
55	Communication module transmission error	
57	Communication module I/O over assignment	Perform assignment so that the maximum number of communication module assignments is not exceeded.
58	Communication module I/O information verify error	Change the parameters or properly install the communication function module.
59	Link module abnormal	Perform error recovery procedures according to the error code of the malfunctioning link module.
61	Port 2 transmission error (parity)	Check the connection of the connector cable. Check the settings such as the transmission speed. Check to see if there are any sources of noise near the cable.
62	Port 2 transmission error (framing/overflow)	
63	Port 2 transmission error (time out)	Check the connection of the connector cable. Check to see if there are any sources of noise near the cable. Verify the protocol designations, evaluate the host computer processing and correct any errors.
64	Port 2 transmission error (protocol error)	
65	Port 2 transmission error (BCC error)	
67	Port 1 transmission error (parity)	Check the connection of the connector cable. Check the settings such as the transmission speed. Check to see if there are any sources of noise near the cable.
68	Port 1 transmission error (framing/overflow)	
69	Port 1 transmission error (timeout)	Check the connection of the connector cable. Check to see if there are any sources of noise near the cable. Verify the protocol designations, evaluate the host computer processing and correct any errors.
6A	Port 1 transmission error (protocol error)	
6B	Port 1 transmission error (BCC error)	
71	Battery error	Replace the battery with a new one. Verify the connection of the battery connector.



Perform the following procedures to erase the error display.

(a) When CPU is stopped

Turn the CPU RUN switch to "STOP," then to "RUN" again.

If the cause of the error has been corrected, the ERR lamp turns off. However, the error information remains in the error special internal output, which stores the CPU error types and details. (This makes it possible to analyze the error after recovery.) To reset the error information, perform the procedures shown in (b) or press the reset switch for the power failure memory protection (R.CL SW).

(b) When the CPU is still running

1] Clear the ERR lamp only.

Set "1" in the special internal output, R7EB.

2] Clear the ERR lamp display and error special internal output.

Set "1" in the special internal output, R7EC.

## 14.2 Checklist when Abnormal Occur

If an error is generated in the EH-150 system, check the following items. If there are no problems in the following items, contact our service department.

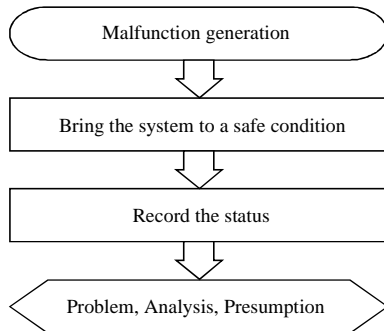
- (a) Power supply related items
  - Is the power voltage correct? (85 to 264 V AC)
  - Are there any warps in the power supply waveform?
  - Are there any excessive noises in the power supply?
  - Is power supplied for all basic and expansion modules?
  - Is the capacity of the power supply module greater than the total of module consumption current?
- (b) CPU related items
  - Are the initial settings (CPU initialization, I/O assignment, parameter settings, etc.) proper?
  - Are there any error codes that are output to the special internal output?
  - Is the RUN switch in the proper location?
  - Are batteries mounted properly? Is the battery life still remaining?
  - Are the CPU connectors properly connected to the base connectors?
- (c) Input module related items
  - Is the input voltage within the specifications for the module?
  - Is there any noise or chattering in the input?
  - Do the I/O assignment numbers in the program match?
  - Is the wiring done properly?
- (d) Output module related items
  - Do the module and the load power supply type (DC/AC) match?
  - Do the load voltage and current match the module specifications?
  - Is there any noise or chattering in the output waveform?
  - Is the wiring done properly?
  - Do the I/O assignment numbers in the program match?
  - Are there any unintentional overlaps in the output numbers?
- (e) Wiring related items
  - Is the FE terminal of the power supply module grounded using class-3 dedicated grounding?
  - Is the wiring between the expansions mixed up with other wires?
  - Are the power supply wiring and I/O cables separated?
  - Are there any foreign substances in the connector of each module?

### Caution

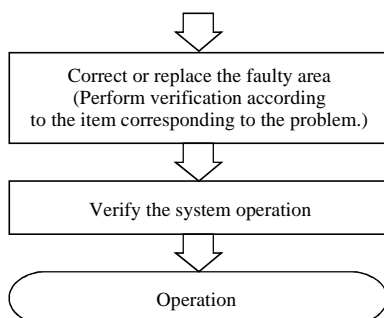
- (a) Be sure to replace the modules with the power supply turned off.
- (b) When returning the module for repair, please notify us of the malfunctioning effects in as much detail as possible (including error codes, malfunctioning output bit number, will not turn on or off, etc.).
- (c) The tools and devices necessary for troubleshooting are roughly as follows:  
Phillips/flathead drivers, digital MultiMate, tester, oscilloscope (necessary depending on the case) etc.

### 14.3 Procedures to Solve Abnormals

The processing flow when a malfunction has occurred is as follows:

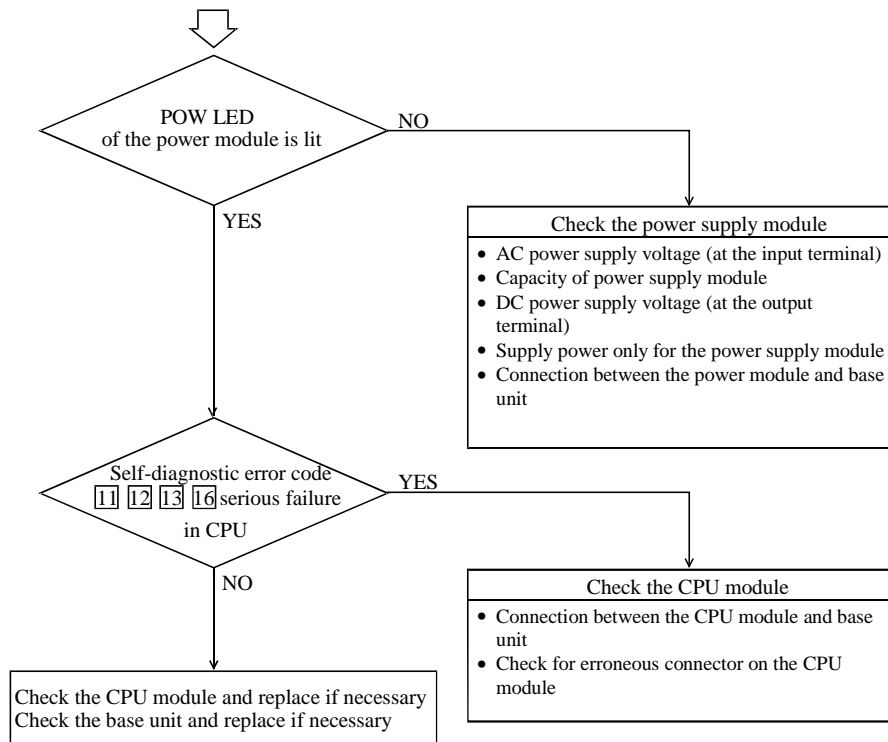


Major problems	Verification points	Typical causes of the problem	Reference item
PLC will not start	Power LED, CPU error code	Power supply abnormal, power shut off, power supply capacity shortage, module connector error, serious CPU failure	(a)
Will not operate (will not RUN)	CPU error code, CPU LED, Internal output of error	I/O assignment abnormal, incorrect parameter settings, incorrect user program, syntax error, drive conditions not met, write-occupied status	(b)
Operation stopped (RUN stopped)	Power LED, CPU LED, CPU error code	Power supply abnormal, expansion power supply abnormal/shut off, CPU abnormal, memory abnormal, communication module abnormal, base abnormal	(c)
Wrong input at input module or input module will not input (abnormal operation)	CPU LED, I/O LED Monitoring by peripheral devices	User program timings, input power supply, bad connection, input module abnormal, I/O inductive noise	(d)
Wrong output from output module or output module will not output (abnormal operation)	CPU LED, I/O LED, Monitoring by peripheral devices, Forced set	User programming, bad connection, output module abnormal, I/O inductive noise	(e)
Peripheral device abnormal	CPU error code, CPU, peripheral devices	Serious CPU failure, peripheral device abnormal, peripheral drive setting error, cable abnormal	(f)



(a) PLC will not start

The CPU ERR LED does not turn off even when power is started, nor peripheral devices cannot be connected on-line.

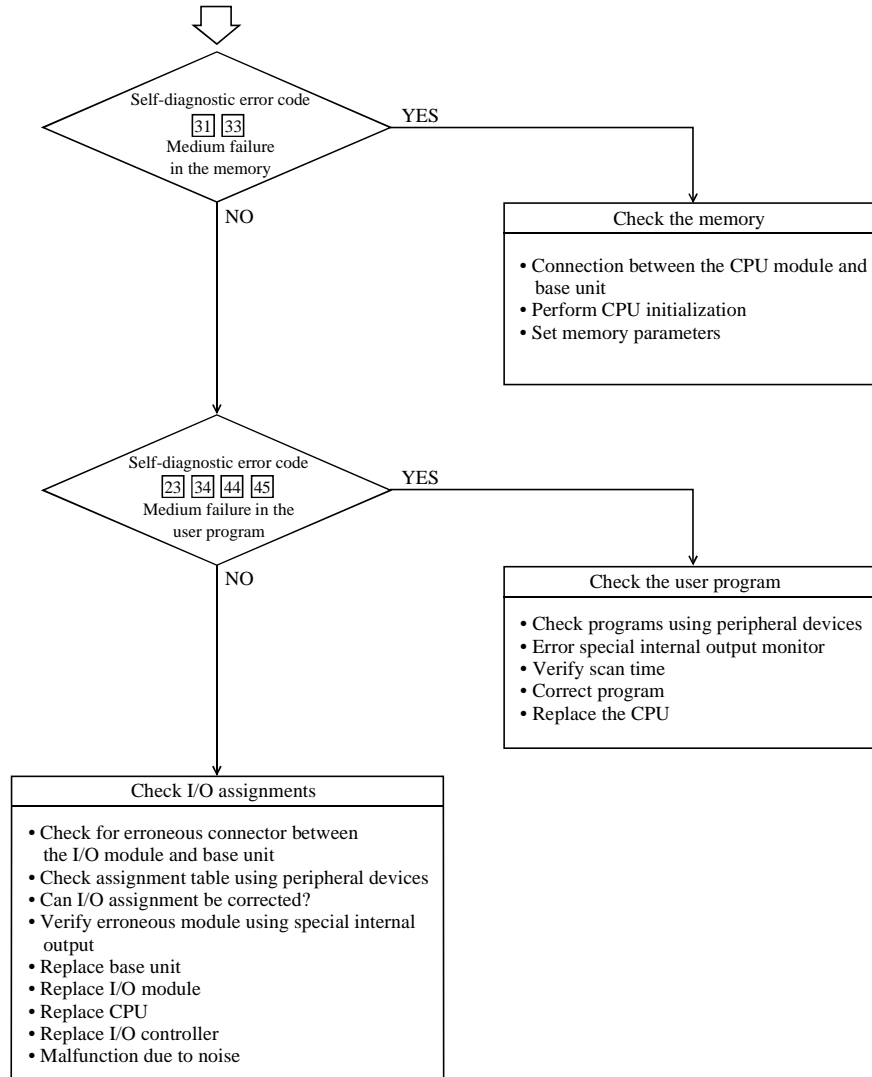


(b) Will not operate (will not run)

Even if the PLC operation conditions are met, the CPU does not operate (the RUN LED does not turn on) and remains stopped. However, the peripheral devices go on-line.

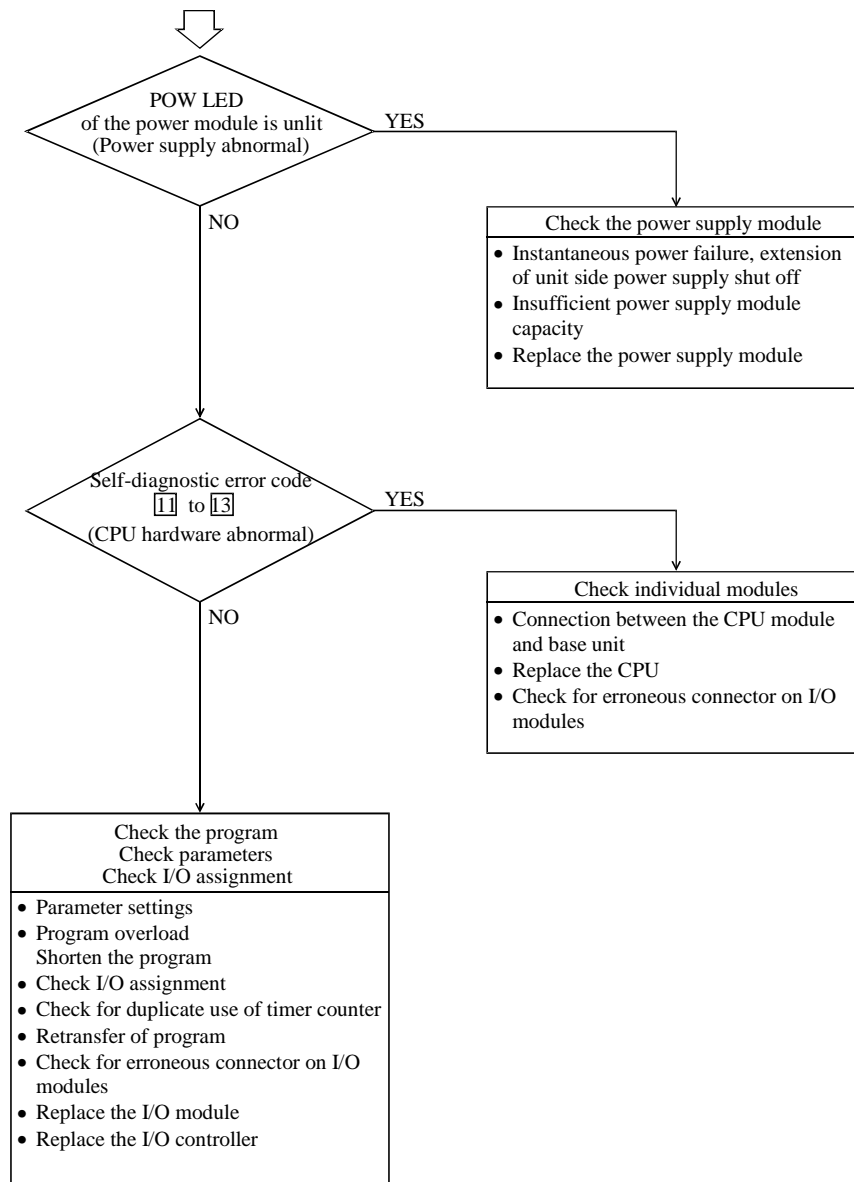
### Caution

If the CPU is WRITE-occupied, the CPU will not run even if the RUN switch is switched from “STOP” to “RUN.” The CPU starts running by pressing the GRS key after peripheral devices are connected.



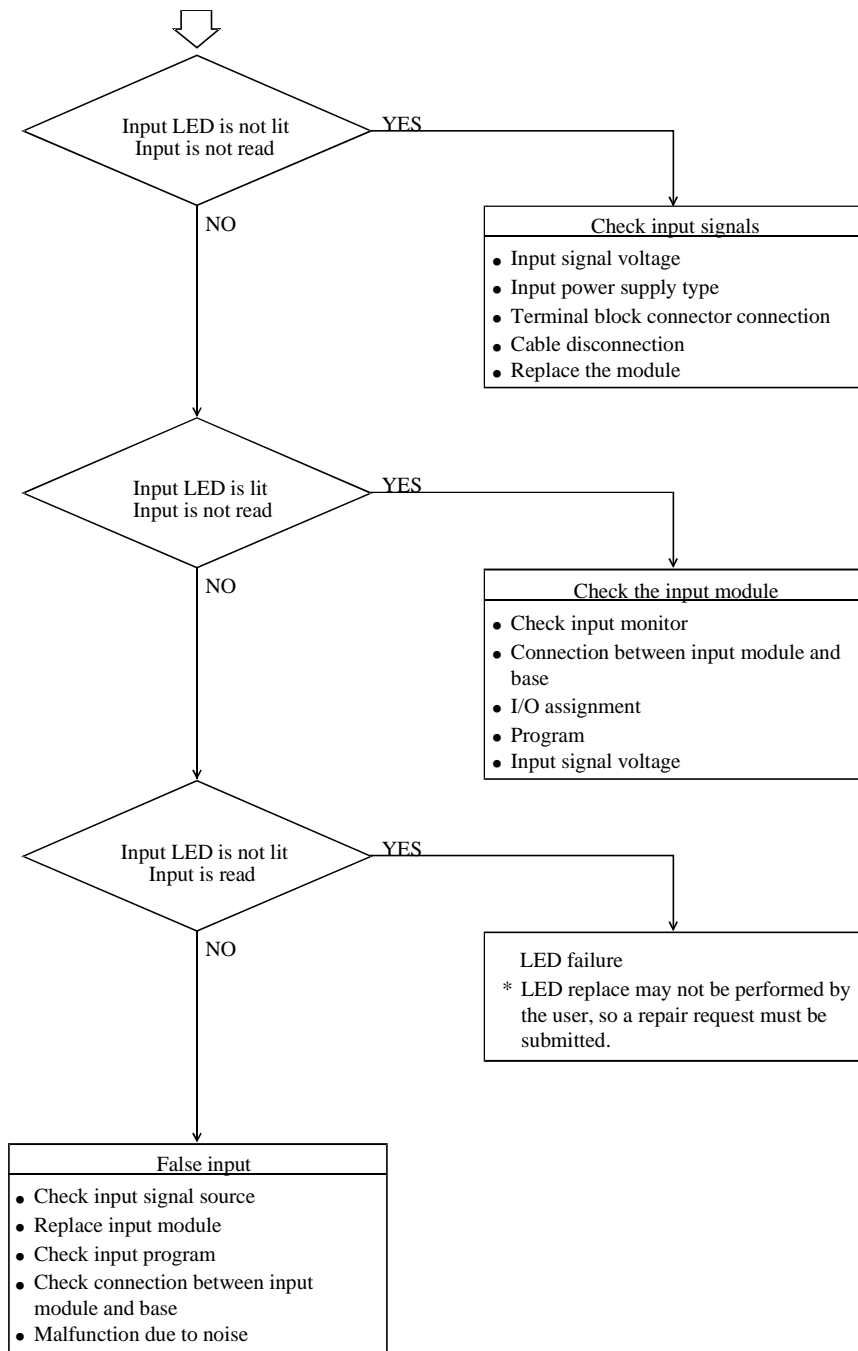
(c) Operation stopped (RUN stopped)

[ During normal operation, the CPU suddenly stops (the RUN LED turns off). ]

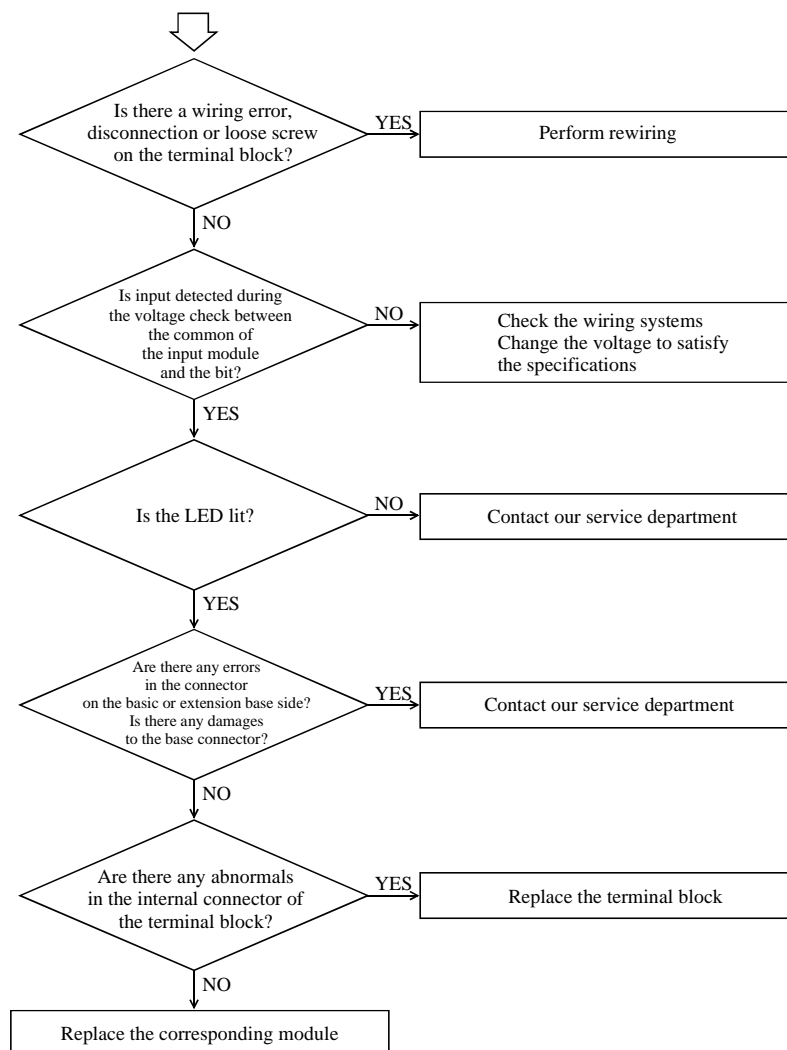


(d) Wrong input at input module or input module will not input (abnormal operation)

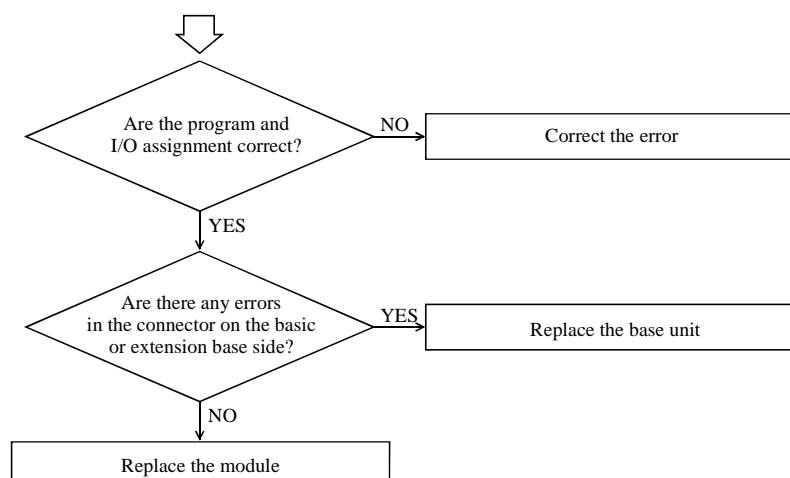
[ The CPU runs, but the input data is not correct. ]



[ Data can not be input. ]



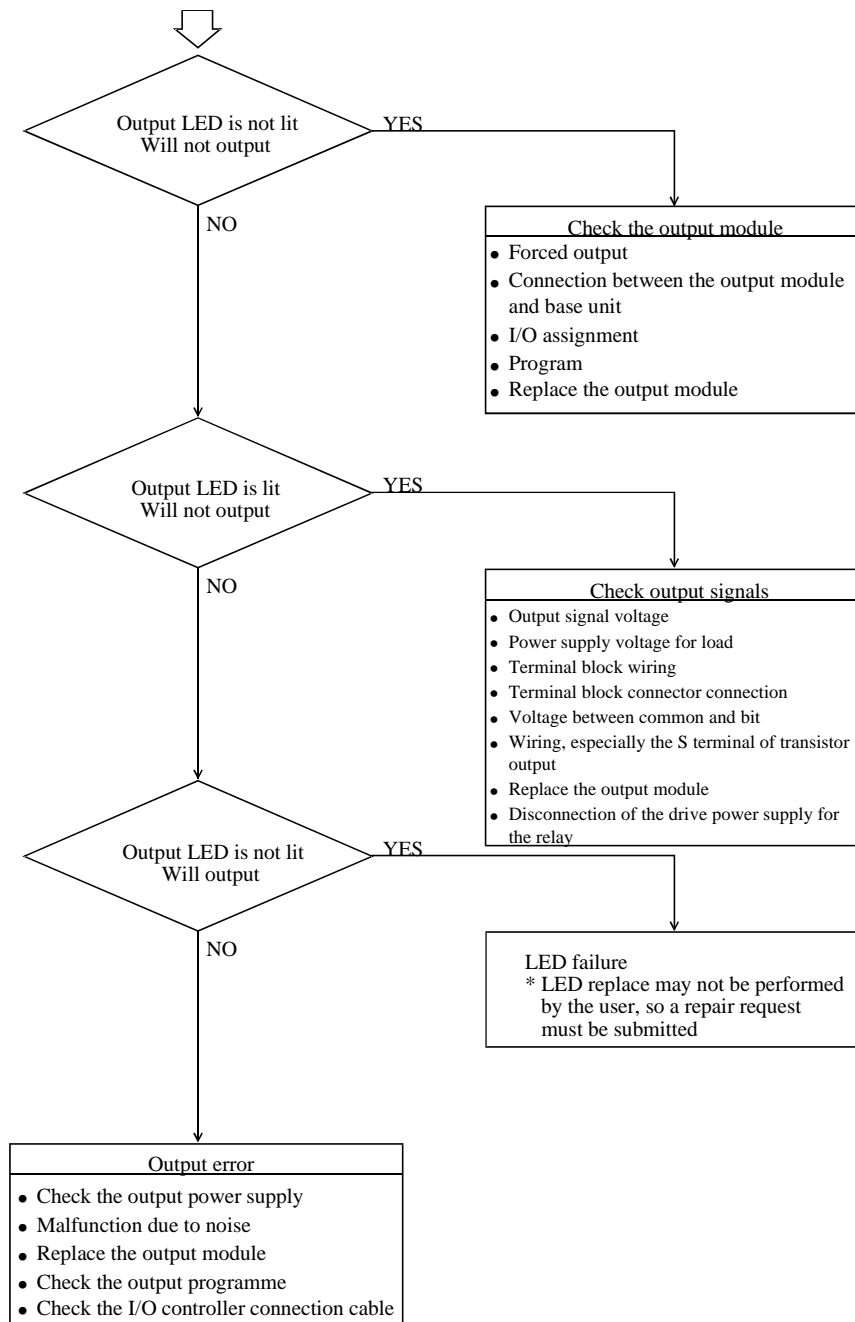
[ I/O assignment error is generated, but data is read. ]



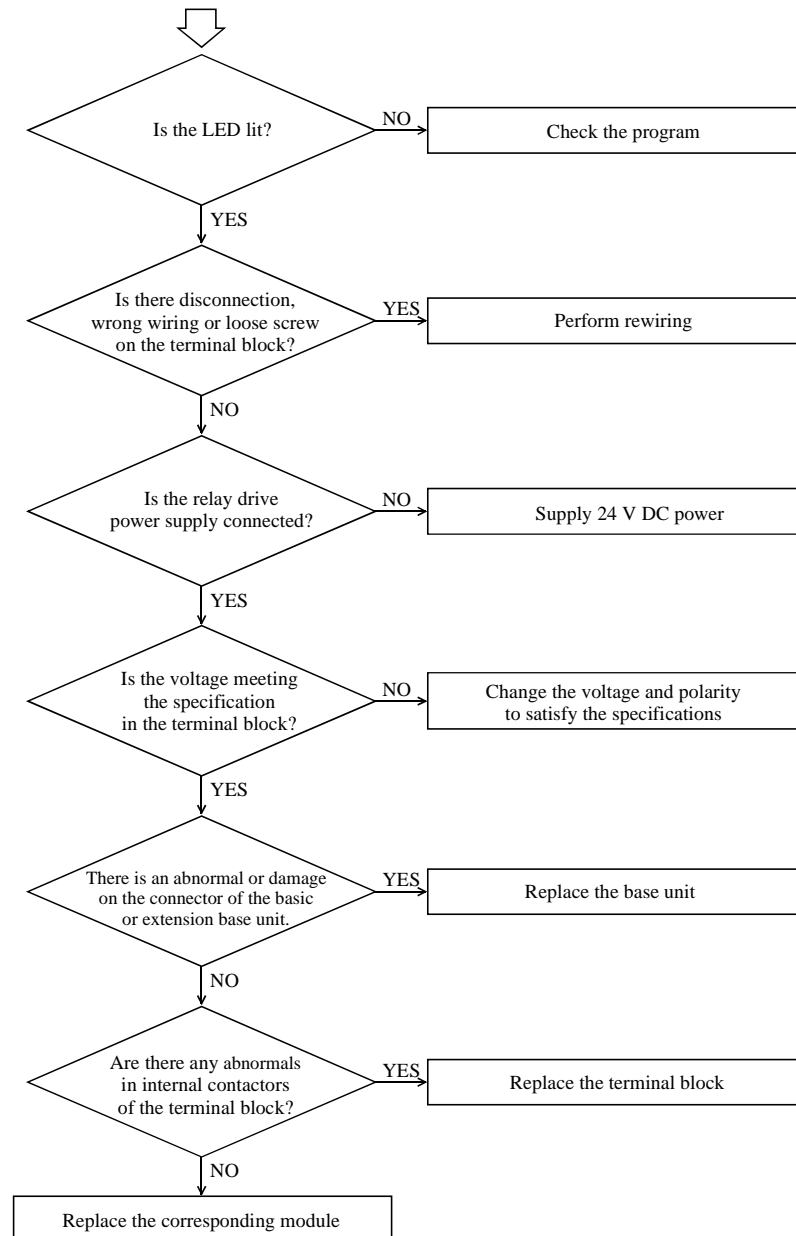


(e) Wrong output from output module or output module will not output (abnormal operation)

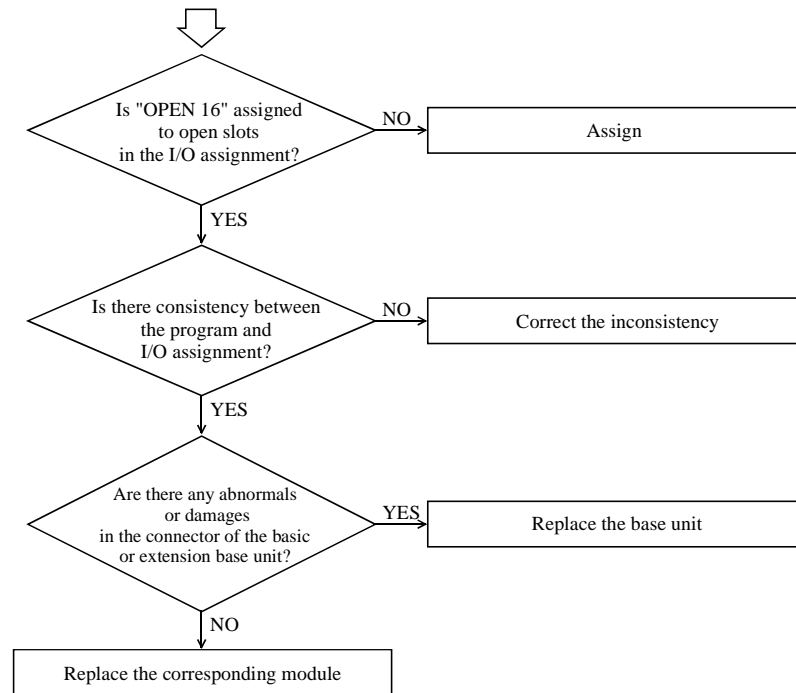
[ The CPU operates, but output signals are not correct. ]



[ The CPU operates, but output signals are not detected. ]

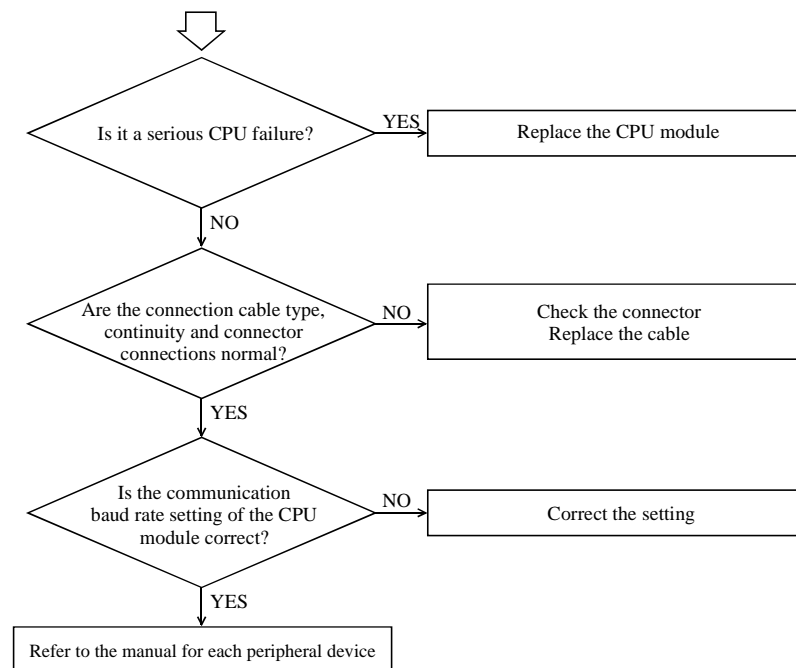


[ I/O assignment error is generated, but output is normal. ]



(f) Peripheral devices abnormal

[ Peripheral devices cannot be connected. ]



# Chapter 15 Operation Examples

To understand the basic operation of the EH-150, this chapter explains samples of operations such as inputting simple programs and verifying operations.

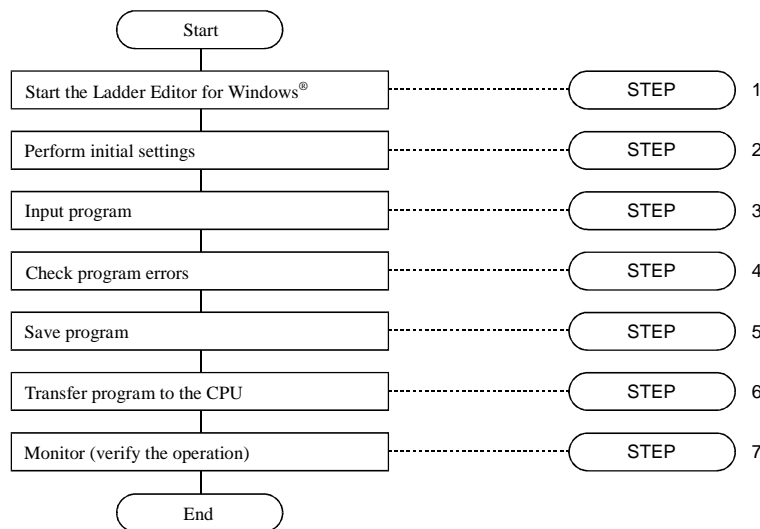
The following programming devices can be used:

	Peripheral device name	Form
1	Portable graphic programmer	PGM-GPH
	ROM pack for portable graphic programmer	PGMPK2H
2	Command language programmer	PGM-CHH
3	H series ladder diagram command language software Ladder Editor	HL-PC3 HL-AT3E
	H series ladder diagram command language software Ladder Editor for Windows® version	HLW-PC3 HLW-PC3E

\* The graphic input unit (model name: GPCL01H) can be used. However, the PGMIF1H cannot be used.

## (1) Operation verification procedures

An operation is verified according to the following procedures:



A personal computer and Ladder Editor for Windows® are used as the peripheral devices in the example. For details, refer to the user's manual for each peripheral device.

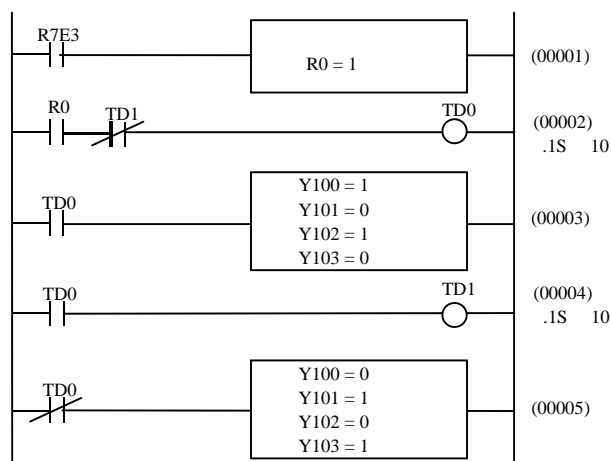
## (2) Detailed operation example

The following explains an operation example using the module and sample program from step 1.

Power supply	CPU	Slot 0	Slot 1	Slot 2
--------------	-----	--------	--------	--------

Power supply: EH-PSA  
 Basic base: EH-BS3  
 CPU: EH-CPU448  
 Slot 0: EH-XD64(64-point input)  
 Slot 1: EH-YT32(32-point output)  
 Slot 2: EH-DUM(dummy)

Operation of program  
 Turn Y100 and Y102 on and  
 Y101 and Y103 off and vice  
 versa, alternating at one second  
 intervals.



## STEP 1 Starting the Ladder Editor for Windows®

### 1. Start the personal computer.

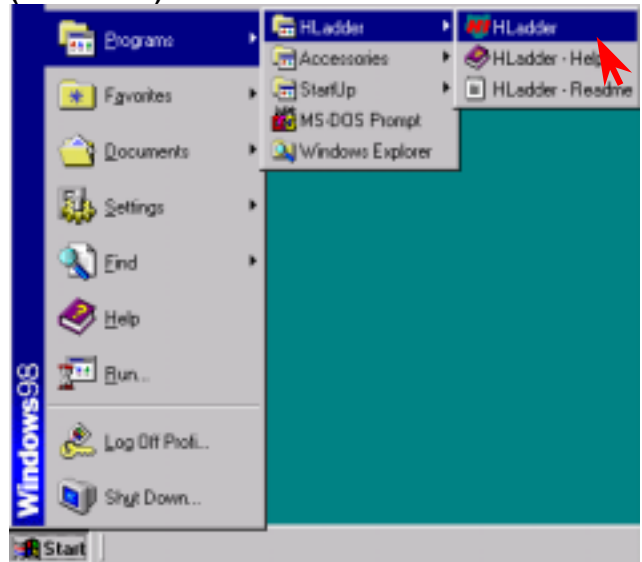
Start the personal computer.

### 2. Start the Ladder Editor for Windows® system (GRS screen).

From the Start menu of Windows®, click  
[Program] → [HLadder] → [HLadder].

As Ladder Editor for Windows® is started, the GRS screen is displayed.

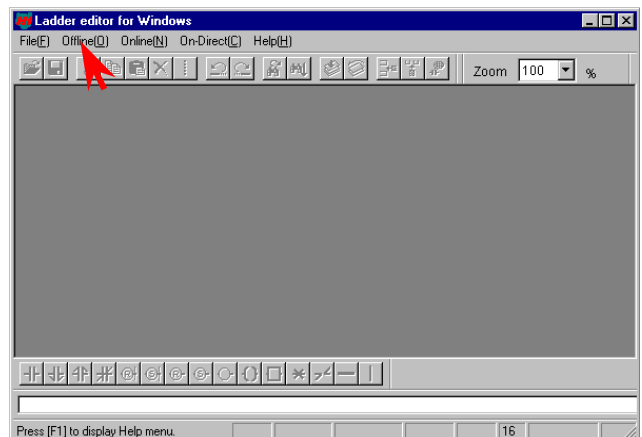
Startup



### 3. Switching to Offline mode.

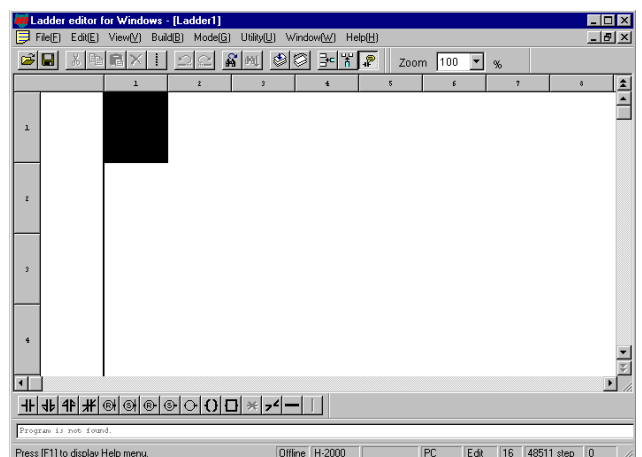
Click [Offline] in the Menu bar.

GRS screen



The Read/Edit screen is displayed.

Mode switching



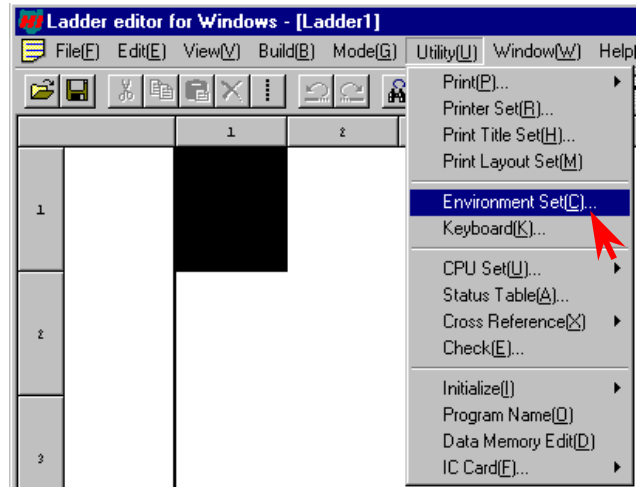
## STEP 2 Initialization

Settings for the CPU type, memory type and I/O assignment are performed.

### 1. Setting the CPU type

Click **[Utility]** → **[Environment Settings]** in the Menu bar.

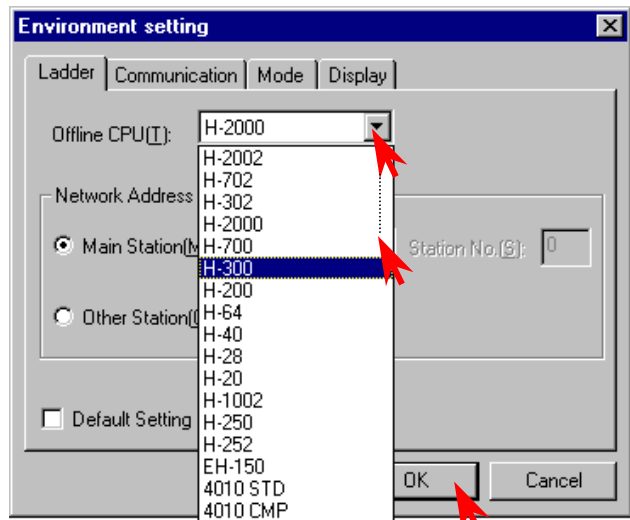
Pull-down menu



The Environment Setting dialogue box is displayed. Specify the CPU type from the Ladder tag.

- Click the ▼ of the Offline CPU field to show the available CPU types in the pull-down display. Select the CPU type.
- Click the **[OK]** button.

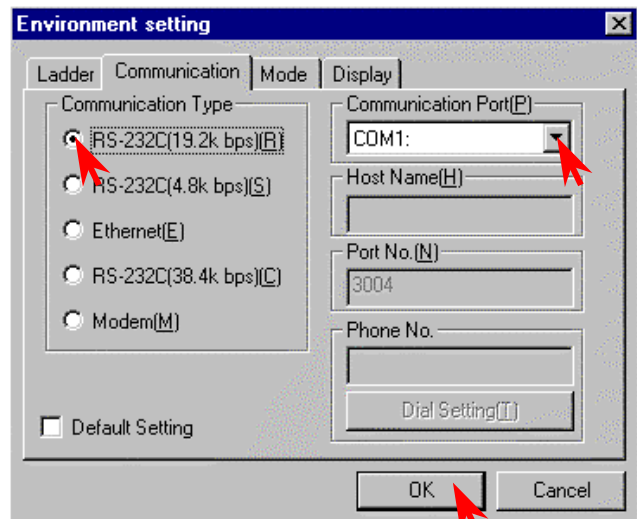
Pull-down display of CPU types



Specify the transmission speed from the Communication tag.

- Select the transmission speed set with the DIP switches of the EH-150 main unit (in case of 10-point type CPU, the transmission speed is fixed at 4800bps).
- Specify the communication port.
- Click the **[OK]** button.

Pull-down display of CPU types



For the CPU type, select "EH-150." (However, if LADDER EDITOR for Windows® of earlier than Ver. 2.0, HL-PC3, or GPCL01H is used, select "H-302.")

\* If the EH-CPU448 is used, select "H-302." (If "EH-150" is selected, 48K steps cannot be specified for the memory type.)

## 2. Setting the memory type

Click **[Utility] → [CPU Setting] → [CPU Information]** in the Menu bar.

Pull-down menu

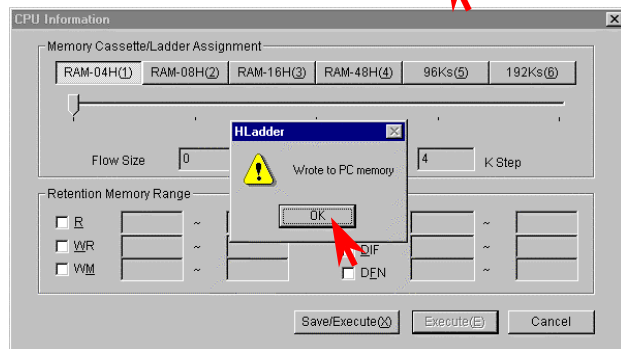
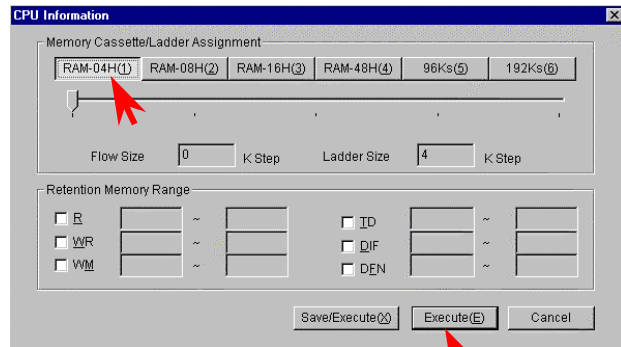
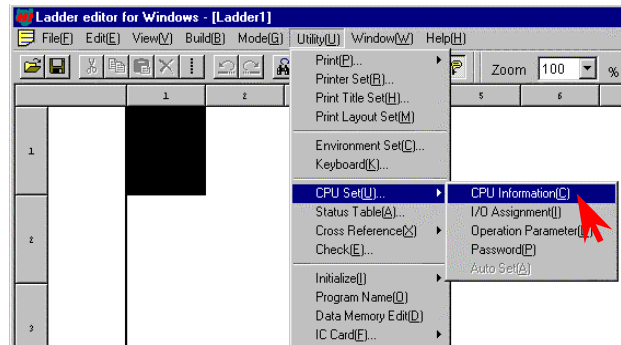
The CPU Information dialogue box is displayed.

- Click the Memory Cassette/Ladder Assign button and select the memory cassette size.
- Click **[Execute]** or the **[Memory/Execute]** button.

CPU Information dialogue box

- Click the **[OK]** button in the confirmation dialogue box.

Select the memory cassette size according to the CPU model by referring to Section 7.2. If the EH-CPU448 is used, select “H-302” for the CPU type. **[Execute]**: Save to the PC memory **[Memory/Execute]**: Save to the PC memory and Window registry.



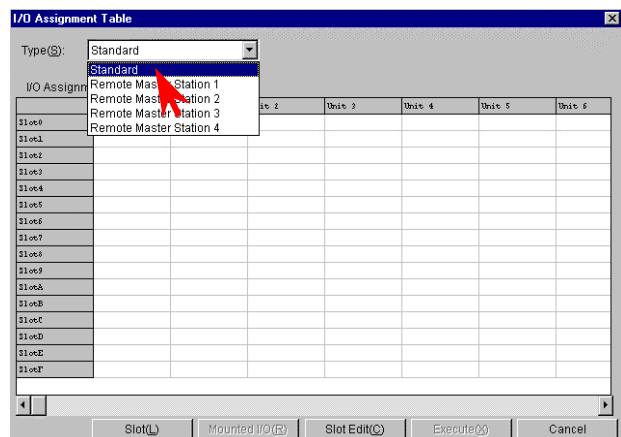
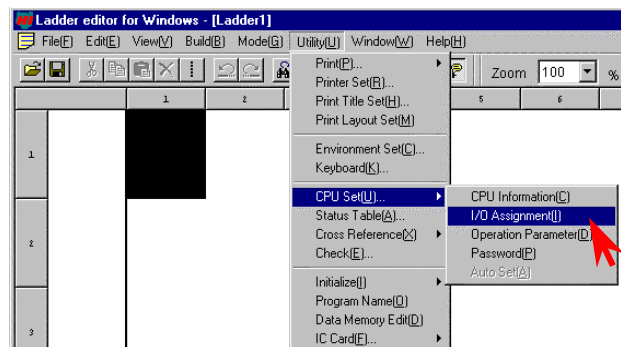
## 3. Assigning I/O

Click **[Utility] → [CPU Setting] → [I/O Assign]** in the Menu bar.

Pull-down menu

The I/O Assign List dialogue box is displayed. Click the ▼ of the Types field and select **[Standard]** from the pull-down display.

I/O Assign List dialogue box



There are two setting methods for the subsequent procedures.

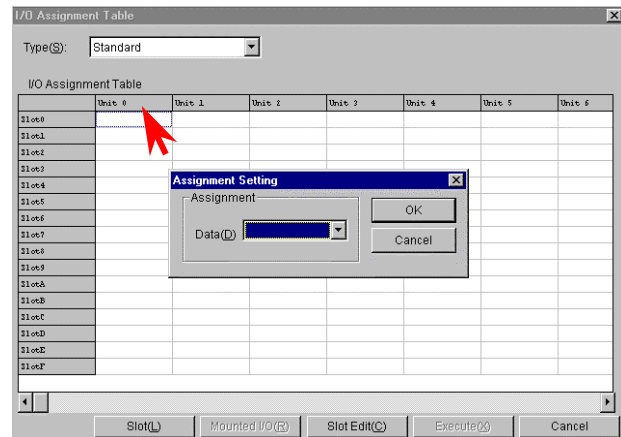
- From the I/O Assign List
- From the I/O Assign List → Slot Setting Status

[Setting from the I/O Assign List]

- 1] Double-click the cell for the unit number and slot number to be set.

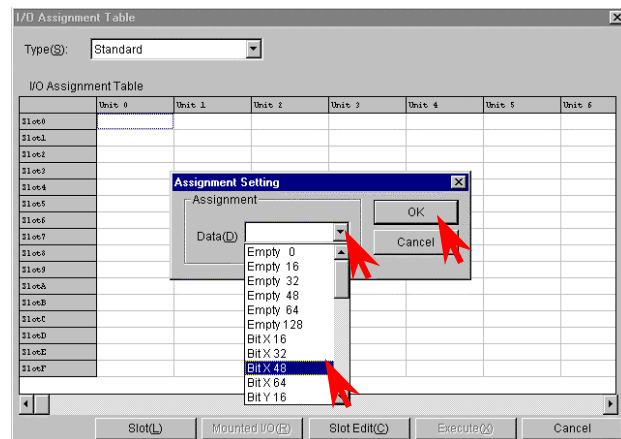
The Assignment Setting dialogue box is displayed.

The Assignment Setting dialogue box.



- 2] Click the ▼ of the data and select I/O type from the pull-down display.
  - 3] Click the [OK] button to close the Assignment Setting dialogue box.
- I/O type is set to the specified cell.

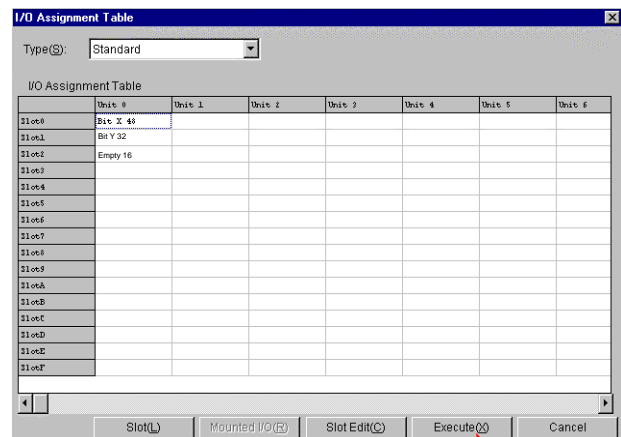
Setting of I/O type



In the same way, repeat steps 1] to 3] to assign Y32 and 16 vacant points to Slot 1 and 2 respectively.

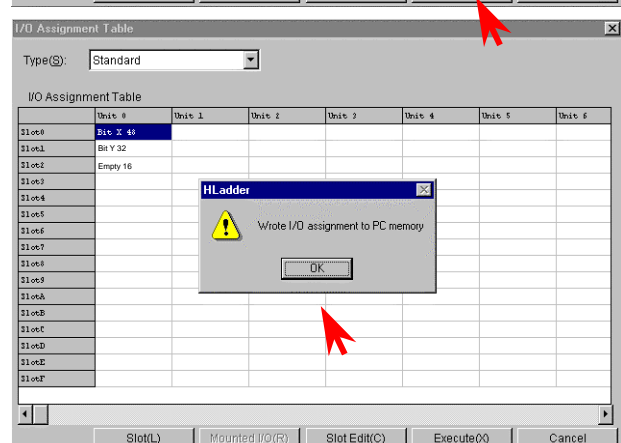
If a wrong value has been entered, the slot is left blank by assigning [Vacant 0] and is treated as though nothing is assigned to it.

- 4] Click the [Execute] button.
- The information assigned to the PC memory is written.



- 5] Click the [OK] button in the confirmation dialogue box to close the I/O Assignment List dialogue box.

Confirmation dialogue box



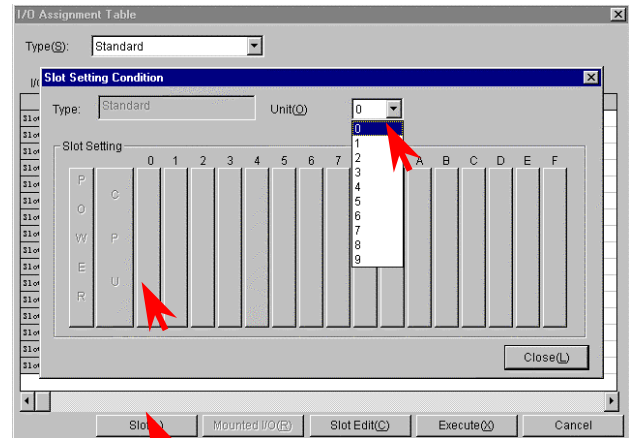


[Setting from the Slot Setting Status]

Click the **[Slot]** button to display the Slot Setting Status dialogue box.

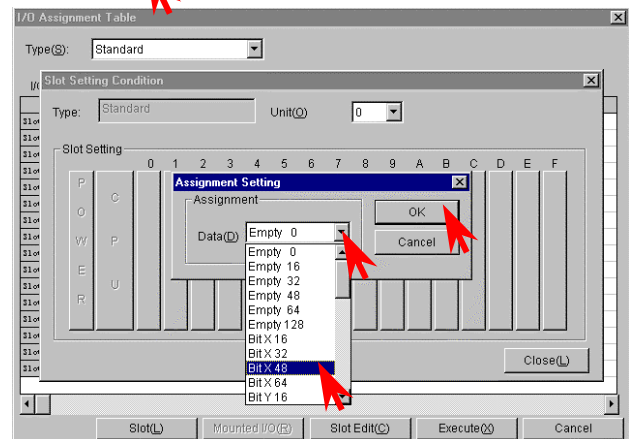
- 1] Click the ▼ of the unit and select the unit number from the pull-down display.
- 2] Click the button of the slot number to be set.

Slot Setting Status dialogue box.



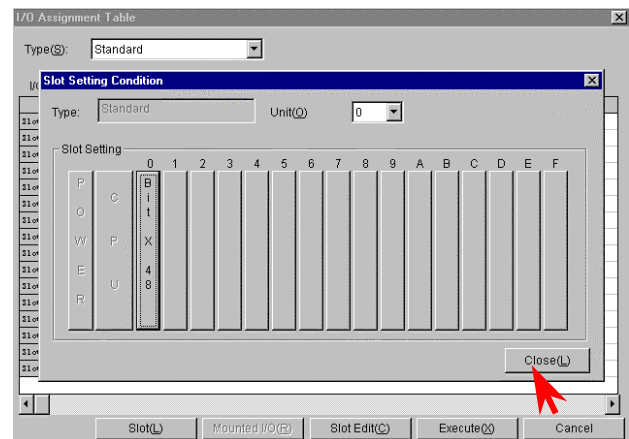
- 3] Click the ▼ of the data and select the I/O type from the pull-down display.
  - 4] Click the **[OK]** button and close the Assignment Setting dialogue box.
- I/O type is set to the specified slot no.

Specification of I/O type



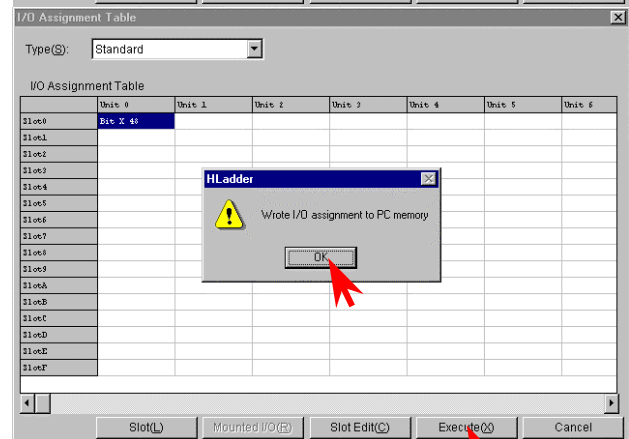
In the same way, repeat the steps 1] and 2] to 4] to set other unit and slot numbers in order to perform I/O assignment according to the unit to be used. In this example, Y32 and 16 vacant points are assigned to slots 1 and 2 respectively.

- 5] Click the **[Close]** button to close the Slot Setting Status dialogue box. Enter the I/O assignment set in the Slot Setting Status into the I/O Assignment List.



- 6] Click the **[Execute]** button to write the assigned information to the PC memory.
- 7] Click the **[OK]** button in the confirmation dialogue box to close the I/O Assignment List dialogue box.

Confirmation dialogue box



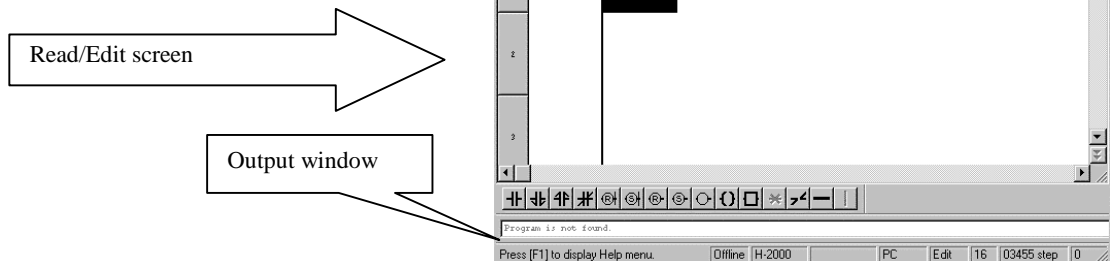
For online mode, it is possible to read the I/O mounted on the CPU by the "Mount" button. For details, refer to the "Reading Mounted I/O" of the programming device.

## STEP 3 Program input

### 1. Input a program.

At first, the output window displays “there is no program” in the bottom left of the Read/Edit screen.

The cursor ■, which indicates the program input position, is placed at the top left of the screen.



[Input procedure of ladder program]

Repeat steps 1] to 4] to proceed with symbol input. The usual operations found in other Windows applications, such as cut, copy, paste, and move, can be performed on already input symbols.

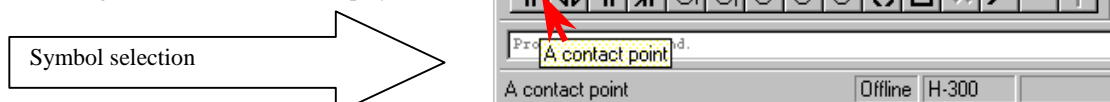
- 1] Specify the input position. (Move the cursor ■ by clicking the mouse or the arrow keys.)
- 2] Click symbols in the Symbol bar.



- 3] Input the desired function (I/O, comparison expression, arithmetic expression) in the dialogue box for the symbol displayed.
- 4] Click the **[OK]** button in the dialogue box.

[Example of entering a contact]

- 1] Begin from the cursor position at the top.
  - 2] Click the symbol for contact A.
- The dialogue box for contacts is displayed.



- 3] Enter “R7E3” as the I/O No. in the Input field. (I/O No. (half-width alpha-numeric input) can be entered by the keyboard only, or by selecting the initial letter(s) from the pull-down menu of ▼ and by typing the rest.) Enter a proper comment.



- 4] Click the **[OK]** button.
- The dialogue closes.

When the dialogue box closes, the symbol is displayed in the Read/Edit screen and the cursor shifts.

Display of symbol

The comment is displayed under the symbol.

[Example of entering a Processing Box]

- 1) The specification of the input position can be omitted when entering symbols into the same ladder as the contact above.
- 2) Click the symbol for Processing Box.

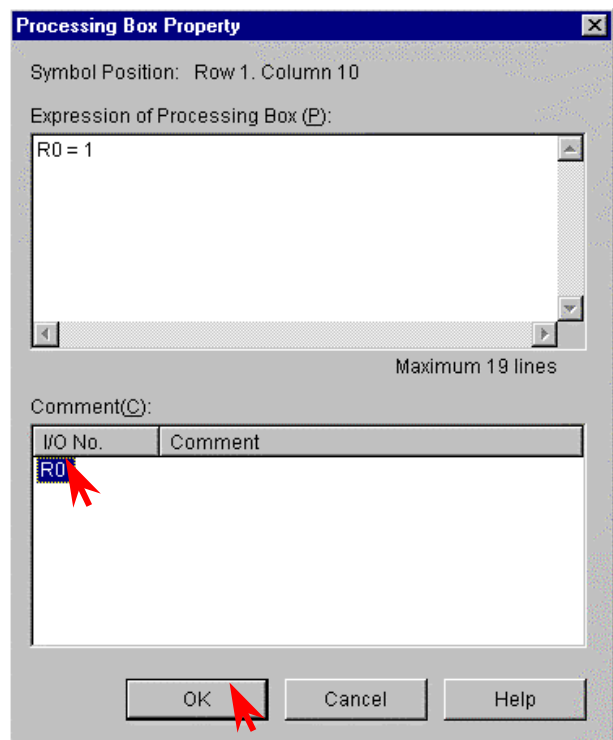
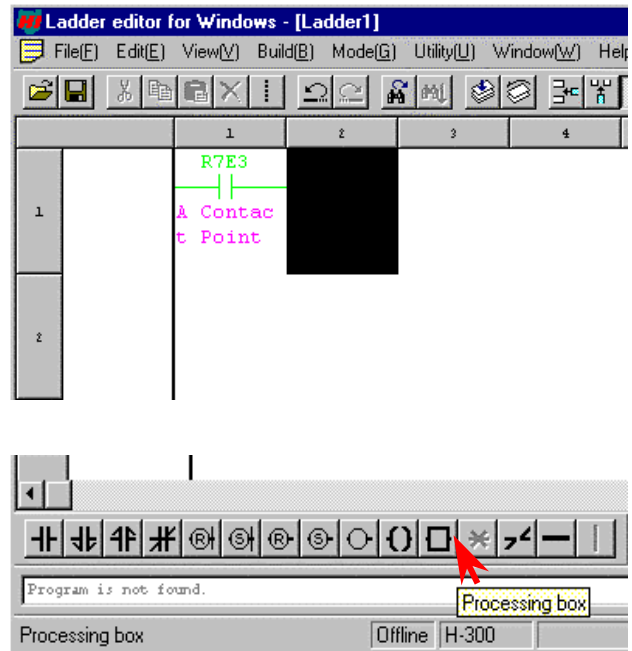
Symbol selection

The cursor moves to the far-right portion of the screen automatically.  
The dialogue box for the processing box symbol is displayed.

- 3) Input arithmetic expressions in the Expression in Processing Box text field.  
Multiple lines (a maximum of 19) can be input by including line breaks

Processing Box properties

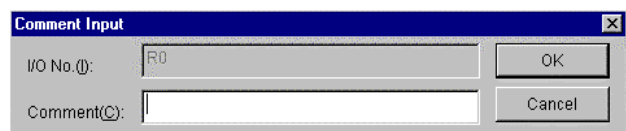
The comment for the I/O No. written to the Processing Box is displayed by clicking the Comment column.  
If there are no comments, only the I/O No. is displayed.



Always enter a space before and after “=”.

- The Comment Input dialogue box is displayed by double-clicking the I/O No. displayed in the Comment column.
- Input a comment and click the **[OK]** button.

Comment Input dialogue box



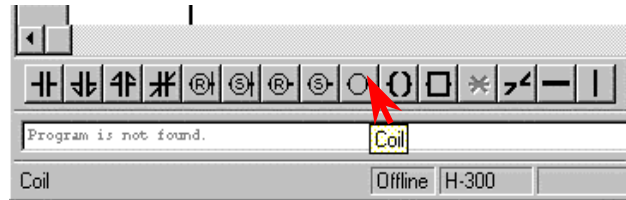
- 4) Click the **[OK]** button in the Processing Box.

The input of the horizontal line symbol, which connects between symbols, may be omitted. (Symbols are connected by horizontal lines by the automatic wiring function at ladder write.)

[Example of entering a timer]

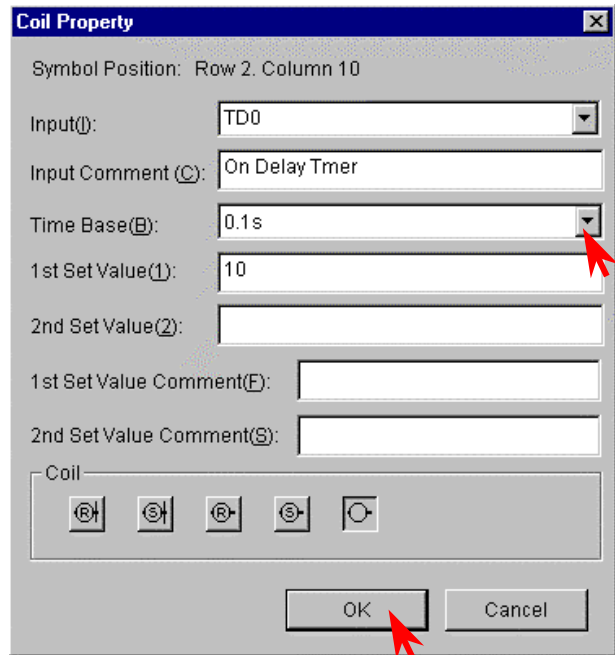
- 1) Specify the input position, or omit the specification if entering it in the same ladder.
  - 2) Click the symbol for coil.
- When the specification of the input position is omitted, the cursor automatically moves to the far-right portion of the screen.

Symbol selection



- 3) Input I/O No., time base, and the first setting value.

Coil property



The following initials of various I/O numbers can be selected from the pull-down display of the Input field:

R, L, M, Y, TD, SS, WDT, MS, TMR, CU, RCU, CTU, CTD, CL

Input values in the necessary items, such as the time base, the first setting value, and second setting value, according to the I/O No.

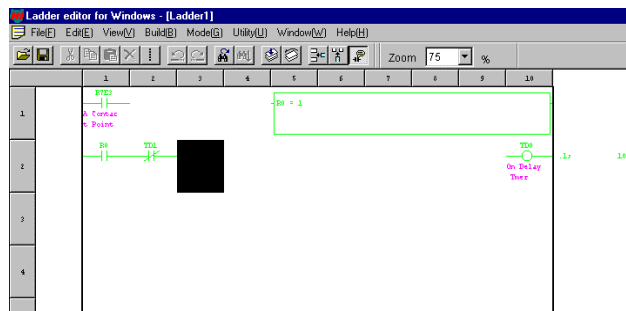
(Example) Coil

It is only necessary to enter values in the Input and Comment items.

- 4) Click the **[OK]** button to display the symbol at the cursor at the far-right portion of the ladder.

Symbols whose input positions for coils, arithmetic expressions, etc. are determined are automatically flushed to the right.

Display of symbols

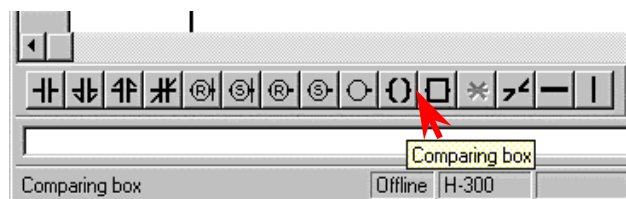


After displaying the coil, the cursor moves to the top of the next ladder.

[Example of entering a Comparison Box]

- 1) Specify the input position
- 2) Click the symbol for Comparison Box.

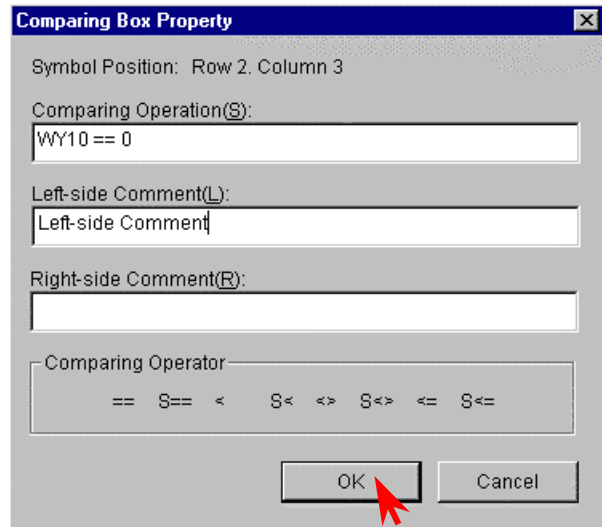
Symbol selection



- 3] Input comparison expression and comment.
- 4] Click the **[OK]** button.

Comparison Box property

The comment input is valid only for I/O numbers. In this example, entering a comment for the value on the right side of the expression will not generate a comment.



The dialog box titled "Comparing Box Property" has the following fields and options:

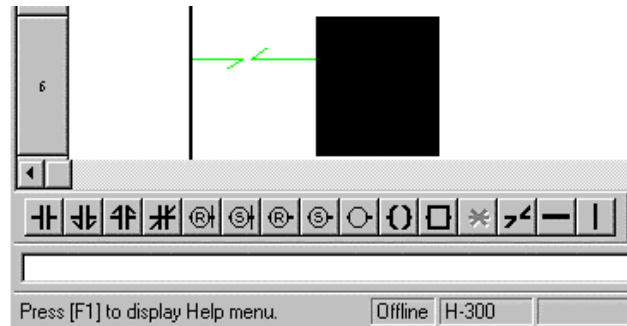
- Symbol Position: Row 2, Column 3
- Comparing Operation(S): WY10 == 0
- Left-side Comment(L): Left-side Comment
- Right-side Comment(R):
- Comparing Operator: A row of buttons including ==, S==, <, S<, <>, S<>, <=, and S<=.
- Buttons: OK and Cancel.

Always enter a space between an I/O number and comparison operator (in this case, between "WY10" and "=", as well as between a comparison operator and comparison data ("=" and "0").

[Example of entering a Knot]

- 1] Specify the input position.
  - 2] Click the symbol for Knot.
- The symbol is displayed and the cursor moves to the right.

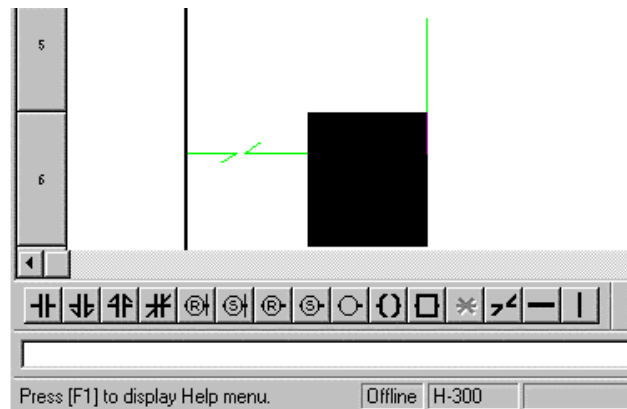
Display of symbols



[Example of entering a Vertical Line]

- 1] Specify the input position.
  - 2] Click the symbol for Vertical Line.
- The symbol is displayed on the right side of the cursor. The cursor does not move.


Display of symbol



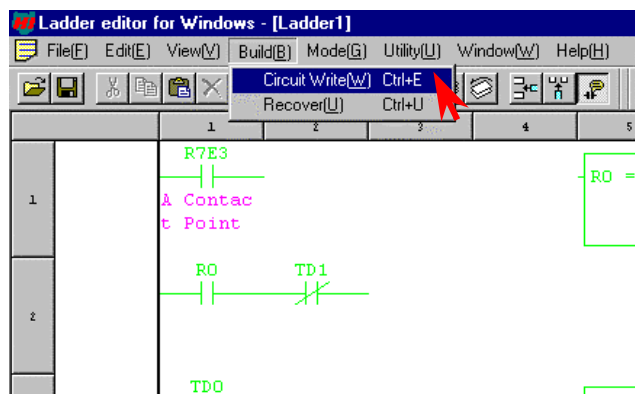
In case of the Horizontal Line symbol, the cursor does move to the right after displaying the symbol, in the same way as in the Knot symbol.

## 2. Writing to the program memory

Perform a "ladder write" operation by either of the following methods in order to write the ladder to the program memory.

- 1] Click **[Build] → [Ladder write]** in the Menu bar.
- 2] Click the **[ladder write]** icon  in the tool bar.

Ladder write operation

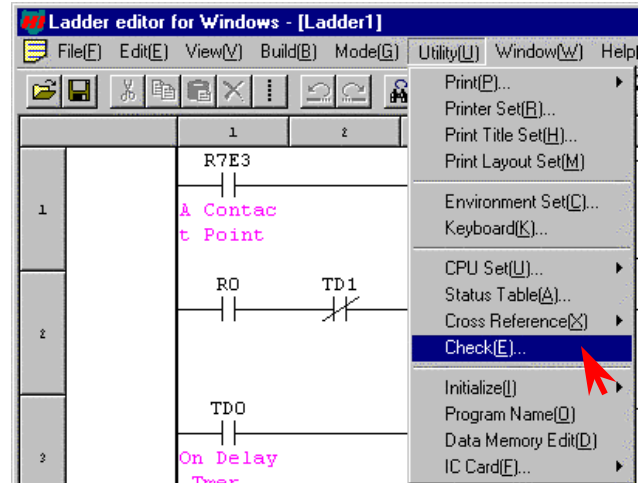


## STEP 4 Checking program errors

Check to see if the program in the memory is correct.

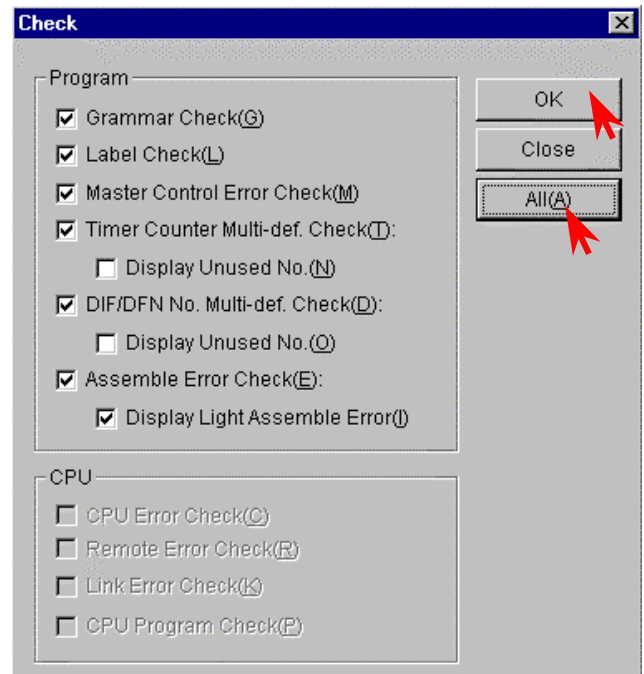
Click **[Utility] → [Check]** in the Menu bar.  
The Check dialogue box is displayed.

Pull-down menu



- Click the **[All items]** or the individual check column to specify the items to be checked.
  - Click the **[Execute]** button.
- The Check Result dialogue box is displayed.

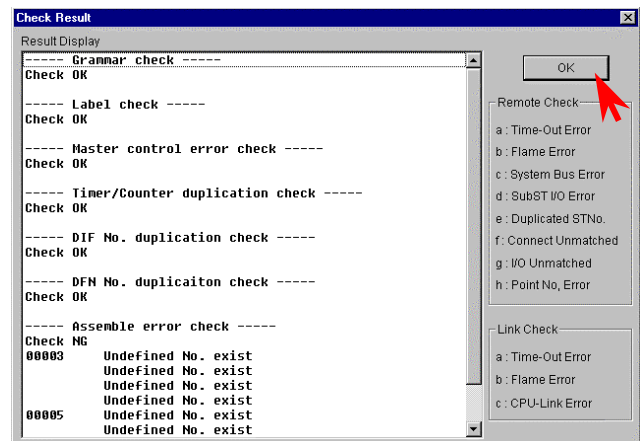
Check dialogue box



The checking of the CPU can be specified at online mode.

- Click the **[OK]** button.
- The Check Result dialogue box closes.

Check Result dialogue box



(Note)


For example, if the I/O assignment of bit Y32 is missing for unit 1, WY10 of the sample is treated as undefined; the error is displayed as in the figure to the right.

If there are any errors, correct the errors of the program before check the program again.


## STEP 5 Saving the program

Save the program and comment that has been created to a floppy disk.

Click **[File] → [Record]** in the Menu bar, the

Record icon , or **[File] → [Batch Record]**.  
The dialogue for Record or Batch Record is displayed.

Pull-down menu.

Record : Specify the file type and save.  
Batch Record: Saves a program and all the comment files.

Record dialogue box:

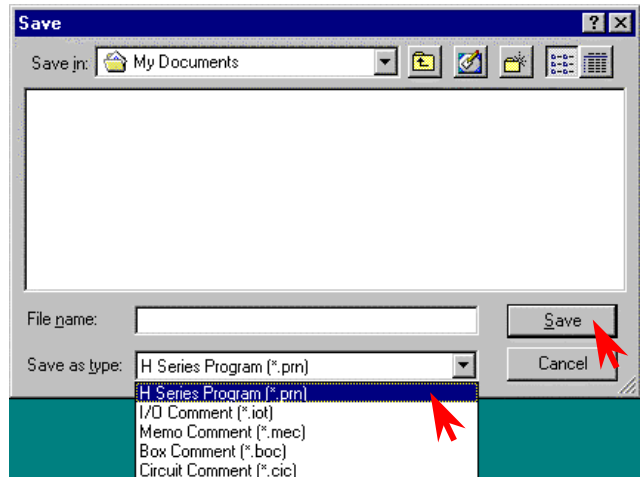
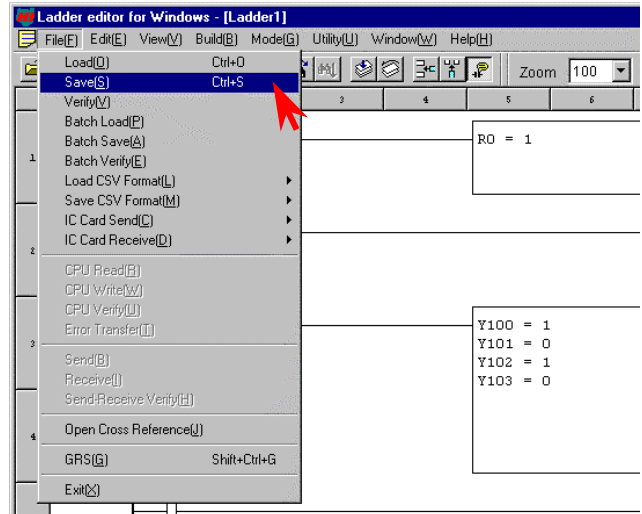
Specify the directory to save in, file name, and file type.

Batch Record dialogue box:

Specify the place to save and file name.

Click the **[Save]** button to save.

Record dialogue box

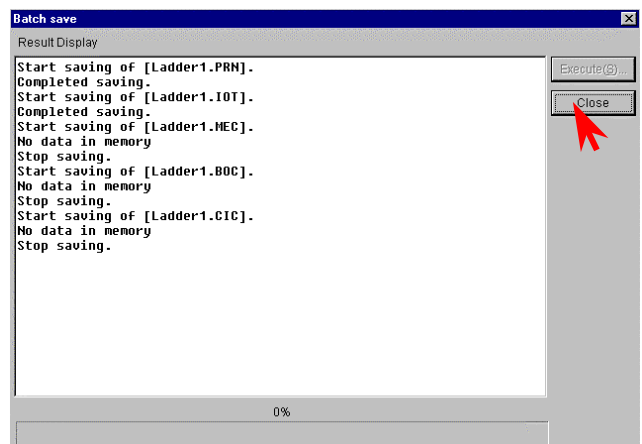


File name extensions are not necessary to input.

Record and Batch Record display the results of the save operations for one file and five files respectively.

The figure to the left shows an example of a result display for the Batch Record.

Batch Record Result dialogue box.





## STEP 6 Program transfer to CPU


Write the program that has been input, to the CPU. However, verify the following:

- The CPU and the personal computer connection cable are properly connected.
- The CPU power is on.
- CPU mode switch is set to “STOP.”

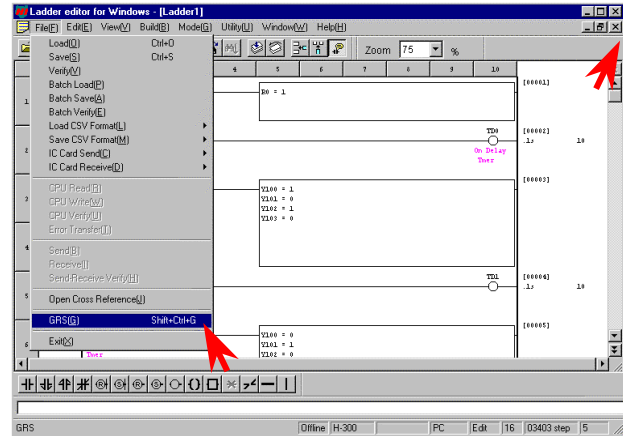
### 1. Switching to online mode.

Move to the GRS screen from the offline mode.

This can be done in two ways.

- 1] Click **[File]** → **[GRS]** in the Menu bar.
- 2] Click  (lower button) on the upper right of the screen.

GRS screen



In the GRS screen, click the **[Online]** item in the Menu bar.

The Read/Edit screen of the online mode is displayed.

GRS screen

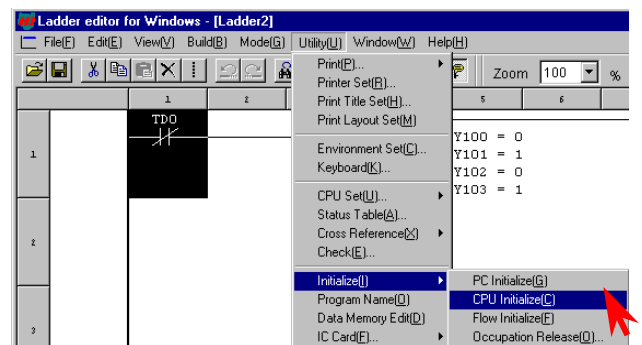


Note) Verify again that the DIP switches are set to the transmission speed selected in the Environment Setting in step 2. (For 10-point type, it is fixed to 4,800 bps.)

### 2. Initializing the CPU

Click **[Utility]** → **[Initialize]** → **[CPU initialize]** in the Menu bar.

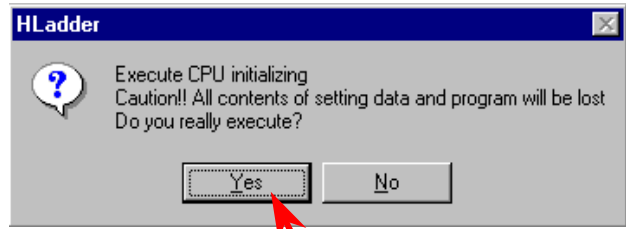
Pull-down menu



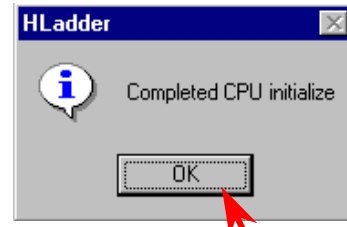
Note) Please note that programs etc. in the personal computer will be erased if [PC initialize] is selected.



The Confirmation dialogue box is displayed; click the **[Yes]** button and start the CPU initialization.



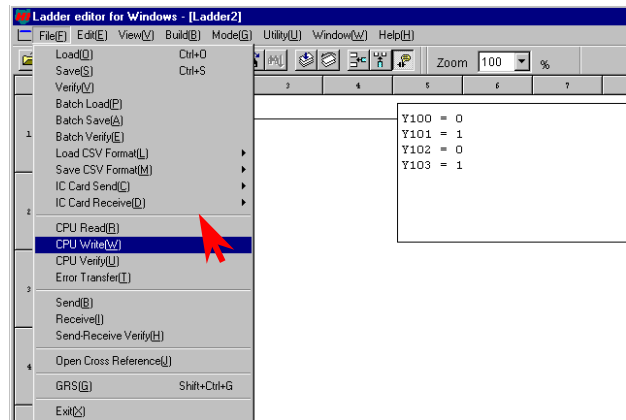
The Exit dialogue box is displayed; click the **[OK]** button to close the dialogue.



### 3. Transferring to the CPU

Click **[File] → [CPU write]** in the Menu bar.

Pull-down menu

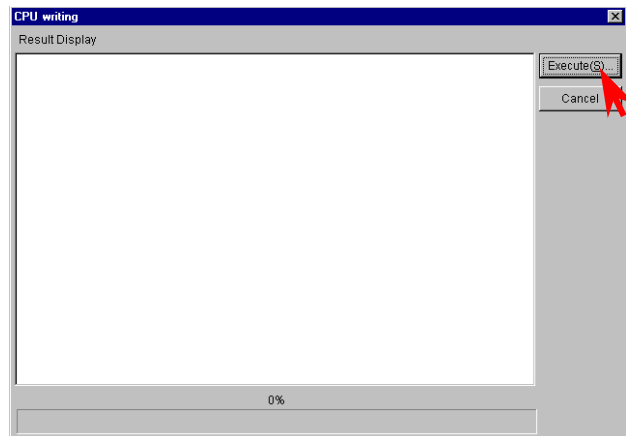


Program transfer

CPU Read: PC (personal computer) ← CPU  
CPU Write: PC (personal computer) → CPU

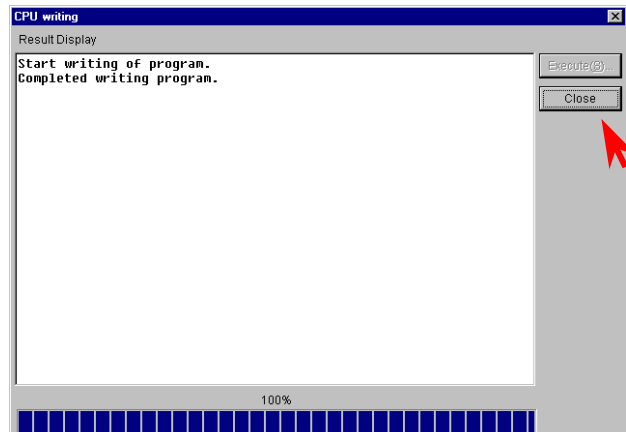
The CPU Write dialogue box is displayed.  
Click the **[Execute]** button.

CPU write dialogue box



When the writing is completed, the result is displayed.  
Click the **[Close]** button to close the dialogue box.

Display of write result.



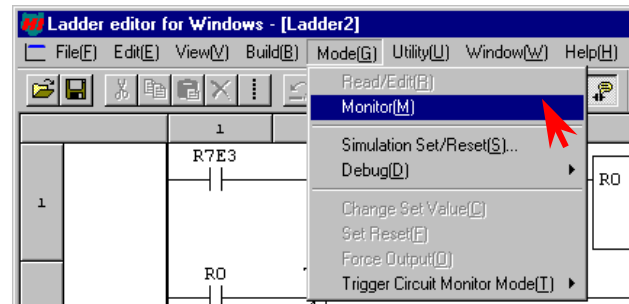
## STEP 7 Monitoring (verifying the operation)

Monitor the program execution status in the CPU.

[Ladder monitor]

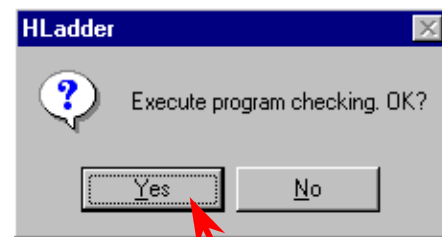
Click **[Mode] → [Monitor]** in the Menu bar.

Pull-down menu



The Confirmation dialogue box for the program match check between PC and the CPU is displayed. Click the **[Yes]** button.

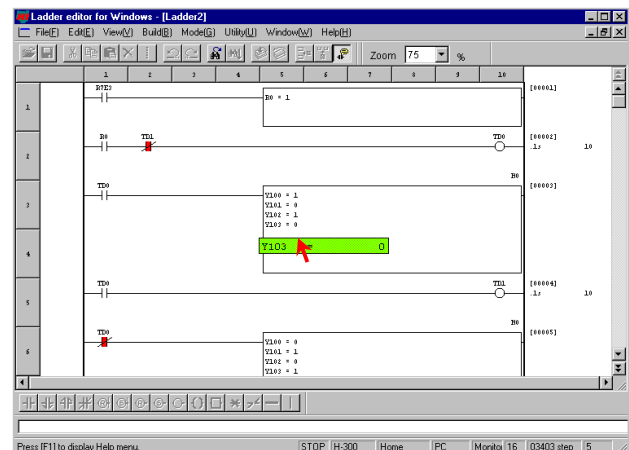
Match check



Set the CPU's RUN switch to "RUN" to begin the CPU operation.

The on/off status of the contact, timer, and current counter value are displayed.

Display of ladder monitor



To monitor and display the current value and progress value, select comparison expression, arithmetic box, and coil (timer, counter, etc.) with the mouse arrow.

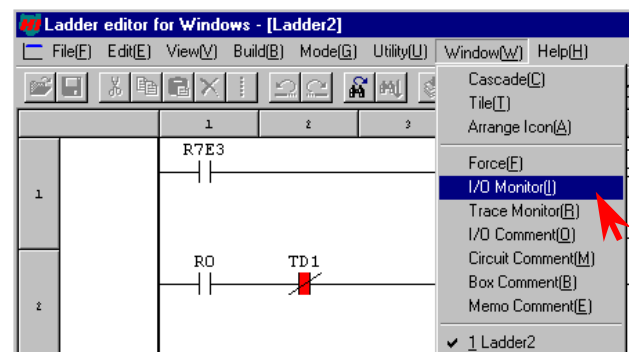
[I/O monitor]

The I/O monitor can be operated while in monitor mode.

Click **[Window] → [I/O Monitor]** in the Menu bar.


The I/O Monitor dialogue box is displayed.

Pull-down menu

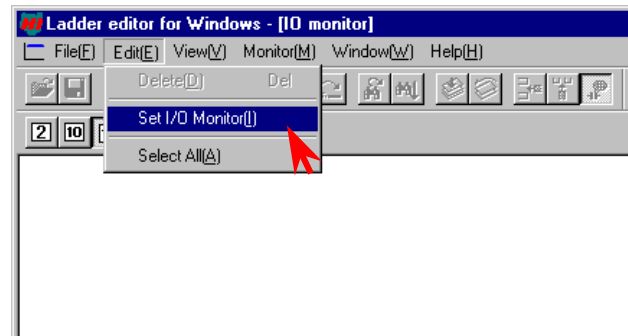


The I/O Monitor dialogue box is displayed on the Read/Edit screen at its maximum size.

The I/O monitor can be specified in the following two ways.

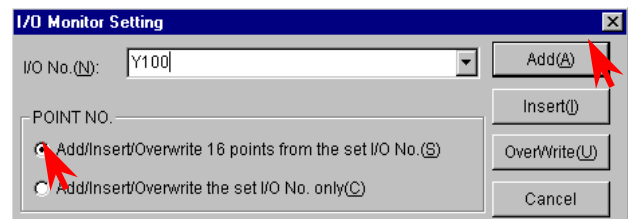
- 1) Click **[Edit] → [I/O monitor setting]** in the Menu bar.
- 2) Click the  icon in the Symbol bar.

I/O Monitor dialogue box



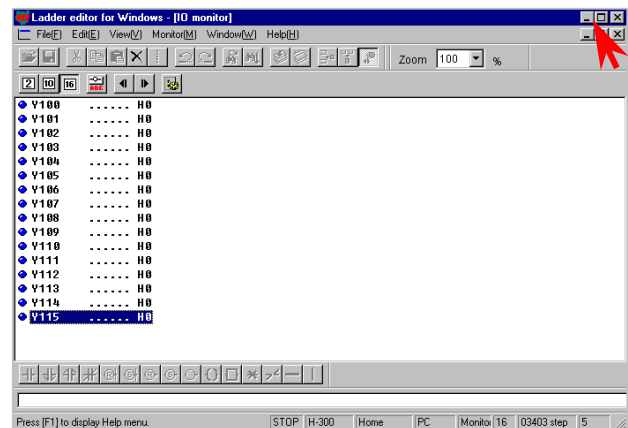
- Enter the starting I/O No.
- Click the number of points to be monitored.
- Click on either the **[Add]**, **[Insert]**, or **[Overwrite]** buttons.

I/O Monitor Setting dialogue box.




Monitor and display 16 points from Y100.

I/O monitor



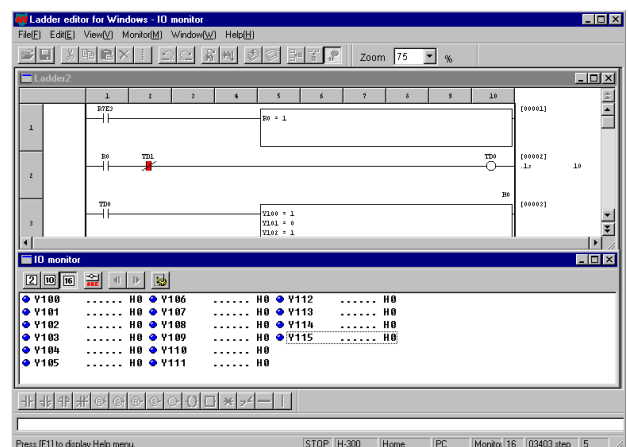
The I/O monitor can display up to 64 I/O points (up to 64 including words/double-words).

Click the I/O No. being I/O monitored and click **[Edit] → [Delete]** to delete it from the monitor.

The display size of the I/O Monitor dialogue box can be changed by clicking .

Both the ladder monitor in the Read/Edit screen and the I/O Monitor can be displayed by making their display sizes smaller to check the operation.

Display of ladder and I/O monitor



# Chapter 16 Daily and Periodic Inspection

In order to use the EH-150 functions in the most desirable condition and maintain the system to operate normally, it is essential to conduct daily and periodic inspections.

## (1) Daily inspection

Verify the following items while the system is running.

Table 16.1 Items for daily inspection

Item	LED display	Inspection method	Normal status	Main cause of error
Power module display	POW	Visual check	Lit	Power supply error, etc.
CPU module display *1	RUN	Visual check	Lit (running)	When unlit: Microcomputer malfunction, memory error, etc. When flashing: Grammar error, watchdog error, etc.
	ERR	Visual check	Unlit	When lit: Microcomputer malfunction, memory error, etc. When flashing: Battery error *2

\*1 The EH-150 indicates the error contents using the combination of lit/flashing/unlit status of ERR and RUN lamps. For details, refer to the Chapter 13 that shows the error code list.

\*2 If the power supply for the basic module is left turned off without replacing the battery over one week after the ERR lamp has flashed, the memory contents may be destroyed. Exercise caution when the system power is turned off for a long period of time, since this error might not be detected and the memory contents may have already been destroyed.

## (2) Periodic inspection

Turn off the power for the external I/O ladder and check the following items once every six months.

Table 16.2 Items for periodic inspection

Part	Item	Check criteria	Remarks
Programming device to CPU	Check operation of programming device	All switches and display lamps work normally.	
Power supply	Check for voltage fluctuations	85 to 264 V AC	Tester
I/O module	Output relay life	Electrical life 200,000 times Mechanical life 10 million times	Refer to the relay contact life curve (Chapter 9).
	LED	Turns on/off correctly	
	External power voltage	Within the specification for each I/O module	Refer to the I/O module specifications(Chapter 4).
Battery (Lithium battery)	Check voltage, life	ERR lamp flashes Within 2 years after replacement	
Installation and connecting areas	(1) All modules are securely fixed (2) All connectors fit snugly (3) All screws are tight (4) All cables are normal	No defects	Tighten Check insertion Tighten Visual check
Ambient environment	(1) Temperature (2) Humidity (3) Other	0 to 55 °C 20 to 90 % RH (no condensation) No dust, foreign matter, vibration	Visual check
Spare parts	Check number of parts, storage condition	No defects	Visual check
Program	Check program contents	Compare the contents of the latest program saved and CPU contents, and make sure they are the same	Check both master and backup.

## (3) Life of the power module

Numbers of electrolytic condensers are used in the power module. Electrolytic condensers have a lifetime and it is believed that the life is reduced by half when the ambient temperature rise 10 °C.

When stocking spare parts, the standard for consideration is that the power module has a life of approximately 5 years when used at the rated ambient temperature (30 °C). Also, to lengthen the life of the module, consider the air circulation around the module and ambient temperature when installing it.

## (4) Life of the battery

- The length of the battery life is expressed as the total time during which the power supply for the basic unit is off.
- The battery life can be determined by checking for the flashing of the ERR lamp.
- The battery life is also displayed in the bit special internal output “R7D9.”  
An example of a ladder using “R7D9” is shown below.

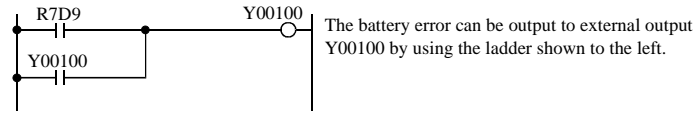


Figure 16.1 Battery error detection ladder

- The self-diagnostic error code “71” indicates that the battery is not loaded or that it has reached its life.

Use the reference table below to determine the remaining life of battery.

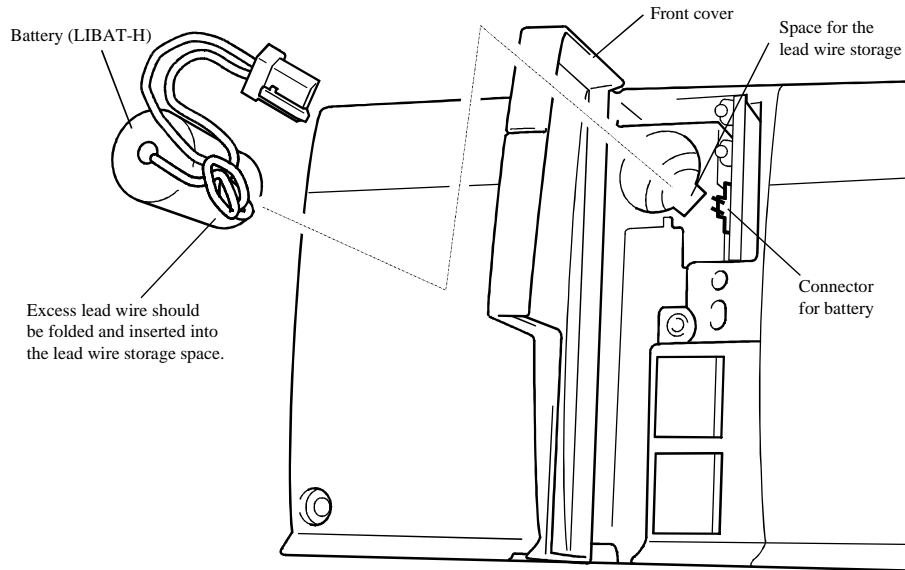
As a guideline, replace the battery every two years even when the total power failure time is less than the guaranteed value shown in the table.

Battery life (Total power failure time) [Hr]	
Guaranteed value (MIN) *1	Actual value (MAX) *2
2,000	32,000

\*1 The guaranteed value indicates the total power failure time at the ambient temperature of 55°C.

\*2 The actual value indicates the total power failure time at the ambient temperature of 25°C.

## (5) How to replace the battery



- 1] Prepare a new battery (LIBAT-H).
- 2] Confirm that the newest program is saved on floppy disks. If it is not saved, always save a backup of the program on floppy disks for safety purposes.
- 3] Replace the battery while the power supply to the basic base is turned on.
- 4] Remove the old lithium battery from the battery case, and remove the connector on the battery side.
- 5] Insert the connector on the battery side to the CPU module connector.  
Insert it so that the red lead is  $\oplus$ , and the black lead is  $\ominus$ .
- 6] Fold the excess lead and store it in the lead storage space.  
(If excess lead is not dressed properly, the wire may be severed by the front cover.)
- \* When exchanging while the basic base unit power turned off, perform steps 4], 5] and 6], in less than one minute.

**Precautions when handling the battery**

Be careful when replacing the battery, since false replacement may cause the battery to explode. Use LIBAT-H for new batteries.

Batteries that have been replaced should be individually placed in a suitable plastic bag (to prevent shorting) and a disposal company should be requested to dispose of them.

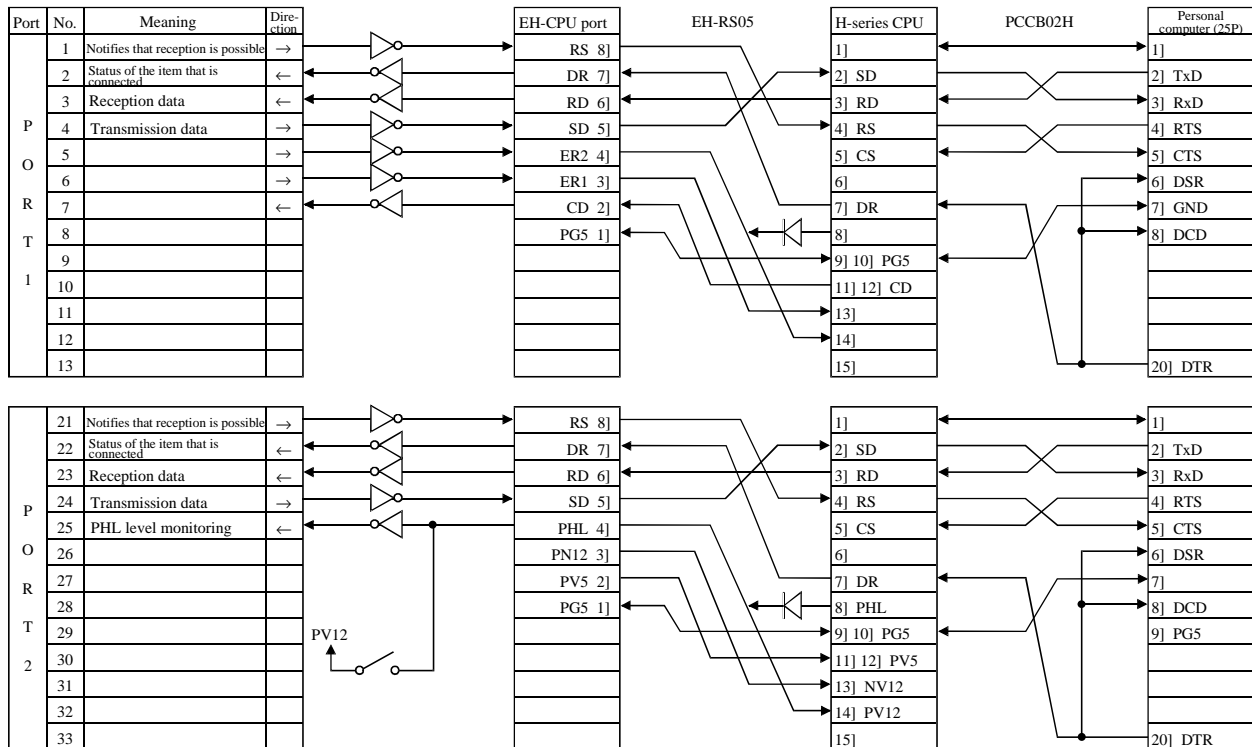
At this time, do not short the batteries, throw them in the fire, dismantle them, exert external force, expose them to water, charge them or cut the lead wires since doing so leads to the risk that the batteries will ignite, explosion or burn up.



# Appendix 1 Cable Connection Diagram

EH-150 port and cable connection [when using LADDER EDITOR for PC9801 (HL-PC3)]

<Cable: EH-RS05 + PCCB02H>

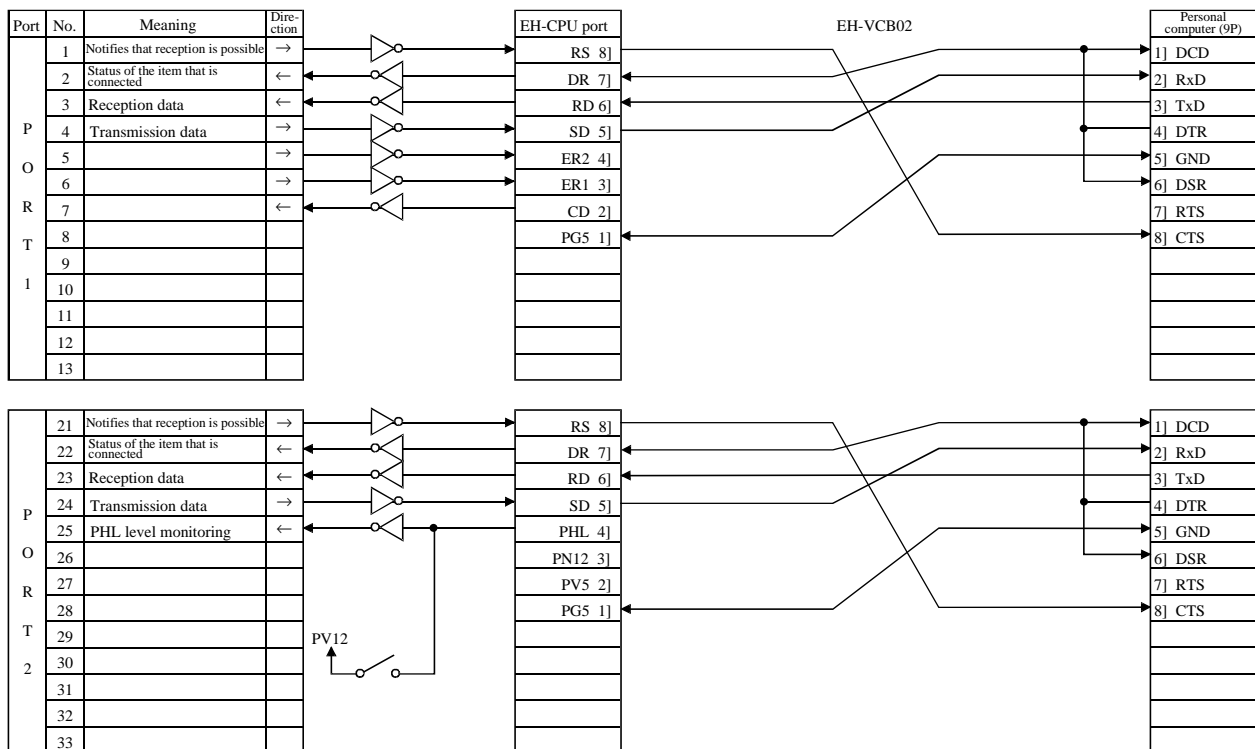


\*The pin numbers ([1] to [8]) of the EH-CPU port have been changed beginning with this manual (NJI-281B(X)). For the correspondence between pin numbers and connectors, see the figure in Chapter 10, "Communication Specifications" of this manual.



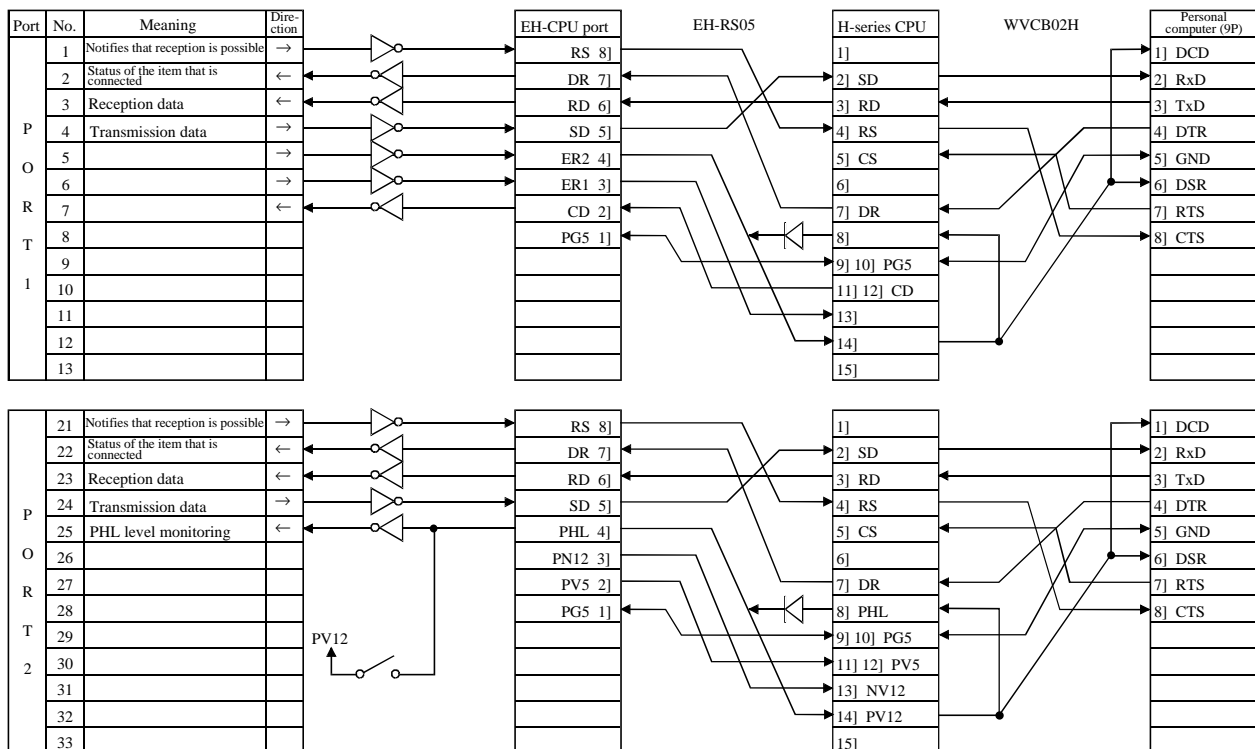
## EH-150 port and cable connection [when using LADDER EDITOR (HL-AT3E) for AT compatibles]

&lt;Cable: EH-VCB02&gt;



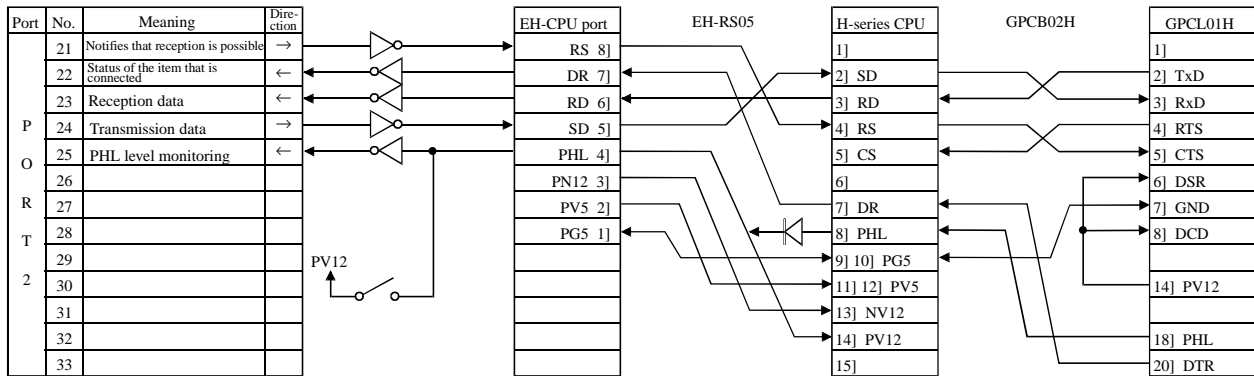
## EH-150 port and cable connection [when using LADDER EDITOR Windows® for AT compatibles]

&lt;Cable: EH-RS05 + WVCB02H (for Windows®)&gt;

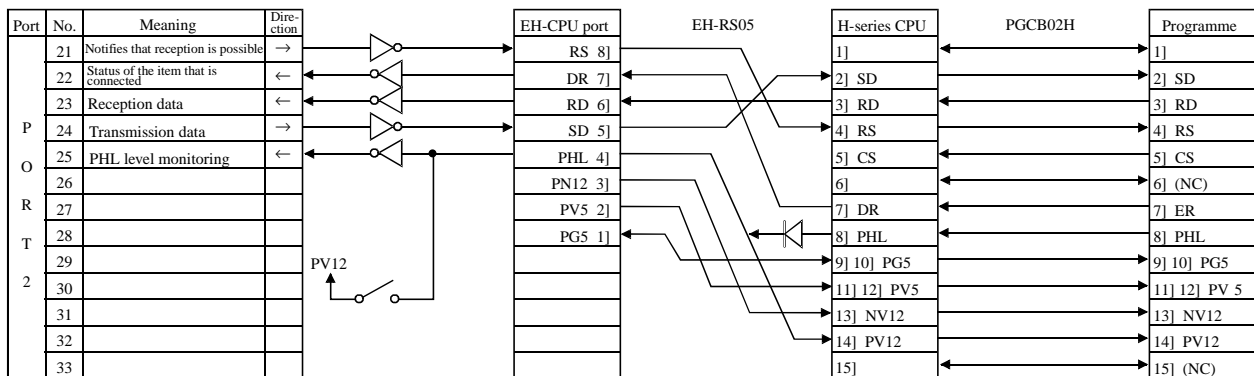


\*The pin numbers ([1] to [8]) of the EH-CPU port have been changed beginning with this manual (NJI-281B(X)). For the correspondence between pin numbers and connectors, see the figure in Chapter 10, "Communication Specifications" of this manual.

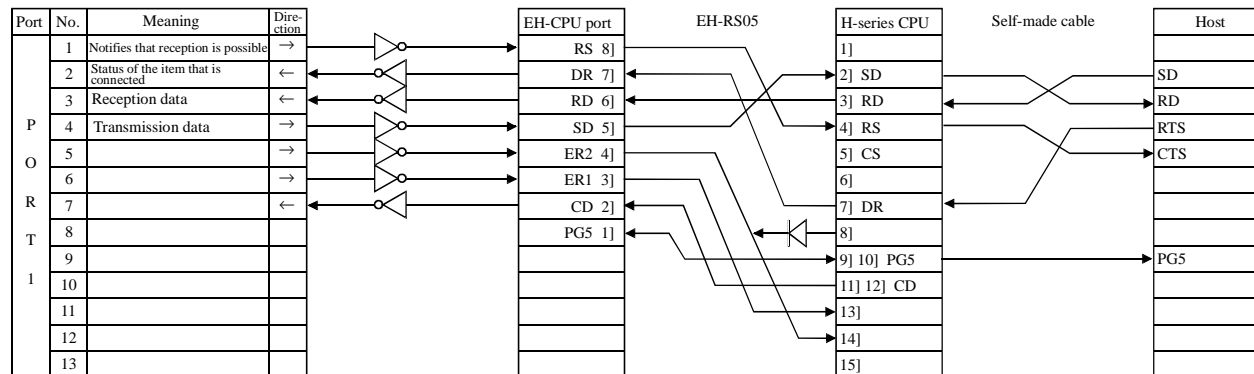
## EH-150 port and cable connection [when using GPCL01H] &lt;Cable: EH-RS05 + GPCB02H&gt;



## EH-150 port and cable connection [when using a programmer] &lt;Cable: EH-RS05 + PGCB02H&gt;



## EH-150 port and cable connection [when using the host] &lt;Cable: EH-RS05 + Self-made cable&gt;



\*The pin numbers ([1] to [8]) of the EH-CPU port have been changed beginning with this manual (NJI-281B(X)). For the correspondence between pin numbers and connectors, see the figure in Chapter 10, "Communication Specifications" of this manual.

# Appendix 2 H-series Command Support Comparison Chart

[Basic commands and sequence commands]

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H-4010
1	LD	Logical operation start	○	○	○	○	○	○	○	○
2	LDI	Logical negation operation start	○	○	○	○	○	○	○	○
3	AND	Contact series connection	○	○	○	○	○	○	○	○
4	ANI	Contact series connection	○	○	○	○	○	○	○	○
5	OR	Contact parallel connection	○	○	○	○	○	○	○	○
6	ORI	Contact parallel connection	○	○	○	○	○	○	○	○
7	NOT	Negation	○	○	○	○	○	○	○	○
8	AND DIF	Rising edge detection	○	○	○	○	○	○	○	○
9	OR DIF	Rising edge detection	○	○	○	○	○	○	○	○
10	AND DFN	Falling edge detection	○	○	○	○	○	○	○	○
11	OR DFN	Falling edge detection	○	○	○	○	○	○	○	○
12	OUT	I/O output	○	○	○	○	○	○	○	○
13	SET	Set I/O output	○	○	○	○	○	○	○	○
14	RES	Reset I/O output	○	○	○	○	○	○	○	○
15	MCS	Set master control	○	○	○	○	○	○	○	○
16	MCR	Reset master control	○	○	○	○	○	○	○	○
17	MPS	Save operation result	○	○	○	○	○	○	○	○
18	MRD	Read operation result	○	○	○	○	○	○	○	○
19	MPP	Clear operation result	○	○	○	○	○	○	○	○
20	ANB	Logical block series connection	○	○	○	○	○	○	○	○
21	ORB	Logical block parallel connection	○	○	○	○	○	○	○	○
22	[ ]	Processing box start and end	○	○	○	○	○	○	○	○
23	( )	Relational box start and end	○	○	○	○	○	○	○	○

\* ○: Supported ×: Not supported

[Basic commands and timer/counter]

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H-4010
1	OUT TD	On delay timer	○	○	○	○	○	○	○	○
2	OUT TM	Extended on delay timer	●	×	×	×	×	×	×	×
3	OUT SS	Single shot	○	○	○	○	○	○	○	○
4	OUT MS	Mono stable timer	○	×	×	○	○	○	○	○
5	OUT TMR	Integral timer	○	×	×	○	○	○	○	○
6	OUT WDT	Watchdog timer	○	×	×	○	○	○	○	○
7	OUT CU	Counter	○	○	○	○	○	○	○	○
8	OUT RCU	Ring counter	○	×	×	○	○	○	○	○
9	OUT CTU	Up and down of up counter	○	○	○	○	○	○	○	○
10	OUT CTD	Up and down of down counter	○	○	○	○	○	○	○	○
11	OUT CL	Counter clear	○	○	○	○	○	○	○	○

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ◎: The EH-CPU 308, 316 and 448 are supported.

[Basic commands and relational box]

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
1	LD(s1 == s2)	= Relational box	○	○	○	○	○	○	○	○
2	AND(s1 == s2)	= Relational box	○	○	○	○	○	○	○	○
3	OR(s1 == s2)	= Relational box	○	○	○	○	○	○	○	○
4	LD(s1 S== s2)	Signed = Relational box	○	×	×	○	○	○	○	○
5	AND(s1 S== s2)	Signed = Relational box	○	×	×	○	○	○	○	○
6	OR(s1 S== s2)	Signed = Relational box	○	×	×	○	○	○	○	○
7	LD(s1 <> s2)	<> Relational box	○	○	○	○	○	○	○	○
8	AND(s1 <> s2)	<> Relational box	○	○	○	○	○	○	○	○
9	OR(s1 <> s2)	<> Relational box	○	○	○	○	○	○	○	○
10	LD(s1 S<> s2)	Signed <> Relational box	○	×	×	○	○	○	○	○
11	AND(s1 S<> s2)	Signed <> Relational box	○	×	×	○	○	○	○	○
12	OR(s1 S<> s2)	Signed <> Relational box	○	×	×	○	○	○	○	○
13	LD(s1 < s2)	< Relational box	○	○	○	○	○	○	○	○
14	AND(s1 < s2)	< Relational box	○	○	○	○	○	○	○	○
15	OR(s1 < s2)	< Relational box	○	○	○	○	○	○	○	○
16	LD(s1 S< s2)	Signed < Relational box	○	×	×	○	○	○	○	○
17	AND(s1 S< s2)	Signed < Relational box	○	×	×	○	○	○	○	○
18	OR(s1 S< s2)	Signed < Relational box	○	×	×	○	○	○	○	○
19	LD(s1 <= s2)	<= Relational box	○	○	○	○	○	○	○	○
20	AND(s1 <= s2)	<= Relational box	○	○	○	○	○	○	○	○
21	OR(s1 <= s2)	<= Relational box	○	○	○	○	○	○	○	○
22	LD(s1 S<= s2)	Signed <= Relational box	○	×	×	○	○	○	○	○
23	AND(s1 S<= s2)	Signed <= Relational box	○	×	×	○	○	○	○	○
24	OR(s1 S<= s2)	Signed <= Relational box	○	×	×	○	○	○	○	○

\* ○: Supported ×: Not supported

## [Arithmetic commands]

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
1	d = s	Substitution statement	○	○	○	○	○	○	○	○
2	d = s1 + s2	Binary addition	○	○	○	○	○	○	○	○
3	d = s1 B+ s2	BCD addition	○	○	○	○	○	○	○	○
4	d = s - s2	Binary subtraction	○	○	○	○	○	○	○	○
5	d = s1 B- s2	BCD subtraction	○	○	○	○	○	○	○	○
6	d = s1 × s2	Binary multiplication	○	○	○	○	○	○	○	○
7	d = s1 B× s2	BCD multiplication	○	○	○	○	○	○	○	○
8	d = s1 S× s2	Signed binary multiplication	○	×	×	○	○	○	○	○
9	d = s1 / s2	Binary division	○	○	○	○	○	○	○	○
10	d = s1 B/ s2	BCD division	○	○	○	○	○	○	○	○
11	d = s1 S/ s2	Signed binary division	○	×	×	○	○	○	○	○
12	d = s1 OR s2	Logical OR	○	○	○	○	○	○	○	○
13	d = s1 AND s2	Logical AND	○	○	○	○	○	○	○	○
14	d = s1 XOR s2	Exclusive OR	○	○	○	○	○	○	○	○
15	d = s1 == s2	= Relational expression	○	○	○	○	○	○	○	○
16	d = s1 S== s2	Signed = Relational expression	○	×	×	○	○	○	○	○
17	d = s1 <> s2	≠ Relational expression	○	○	○	○	○	○	○	○
18	d = s1 S<> s2	Signed ≠ Relational expression	○	×	×	○	○	○	○	○
19	d = s1 < s2	< Relational expression	○	○	○	○	○	○	○	○
20	d = s1 S< s2	Signed < Relational expression	○	×	×	○	○	○	○	○
21	d = s1 <= s2	<= Relational expression	○	○	○	○	○	○	○	○
22	d = s1 S<= s2	Signed <= Relational expression	○	×	×	○	○	○	○	○

\* ○: Supported ×: Not supported

## [Application commands] (1/2)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
1	BSET (d, n)	Bit set	○	○	○	○	○	○	○	○
2	BRES (d, n)	Bit reset	○	○	○	○	○	○	○	○
3	BTS (d, n)	Bit test	○	○	○	○	○	○	○	○
4	SHR (d, n)	Shift right	○	○	○	○	○	○	○	○
5	SHL (d, n)	Shift left	○	○	○	○	○	○	○	○
6	ROR (d, n)	Rotate right	○	○	○	○	○	○	○	○
7	ROL (d, n)	Rotate left	○	○	○	○	○	○	○	○
8	LSR (d, n)	Logical shift right	○	○	○	○	○	○	○	○
9	LSL (d, n)	Logical shift left	○	○	○	○	○	○	○	○
10	BSR (d, n)	BCD shift right	○	○	○	○	○	○	○	○
11	BSL (d, n)	BCD shift left	○	○	○	○	○	○	○	○
12	WSHR (d, n)	Batch shift right	○	×	×	○	○	○	○	○
13	WSHL (d, n)	Batch shift left	○	×	×	○	○	○	○	○
14	WBSR (d, n)	Batch BCD shift right	○	×	×	○	○	○	○	○
15	WBSL (d, n)	Batch BCD shift left	○	×	×	○	○	○	○	○
16	MOV (d, s, n)	Block transfer	○	×	×	○	○	○	○	○
17	COPY (d, s, n)	Copy	○	×	×	○	○	○	○	○

\* ○: Supported ×: Not supported

## [Application commands] (2/2)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
18	XCG (d, d2, n)	Block exchange	○	×	×	○	○	○	○	○
19	NOT (d)	Reverse	○	○	○	○	○	○	○	○
20	NEG (d)	Two's complement	○	○	○	○	○	○	○	○
21	ABS (d, s)	Absolute value	○	○	○	○	○	○	○	○
22	SGET (d, s)	Sign addition	○	×	×	○	○	○	○	○
23	EXT (d, s)	Sign expansion	○	×	×	○	○	○	○	○
24	BCD (d, s)	Binary → BCD conversion	○	○	○	○	○	○	○	○
25	BIN (d, s)	BCD → Binary conversion	○	○	○	○	○	○	○	○
26	DECO (d, s, n)	Decode	○	○	○	○	○	○	○	○
27	ENCO (d, s, n)	Encode	○	○	○	○	○	○	○	○
28	SEG (d, s)	7 segment decode	○	×	×	○	○	○	○	○
29	SQR (d, s)	Square root	○	×	×	○	○	○	○	○
30	BCU (d, s)	Bit count	○	○	○	○	○	○	○	○
31	SWAP (d)	Swap	○	○	○	○	○	○	○	○
32	FIFIT (P, n)	FIFO initialization	○	×	×	○	○	○	○	○
33	FIFWR (P, s)	FIFO write	○	×	×	○	○	○	○	○
34	FIFRD (P, d)	FIFO read	○	×	×	○	○	○	○	○
35	UNIT (d, s, n)	Unit	○	○	○	○	○	○	○	○
36	DIST (d, s, n)	Distribute	○	○	○	○	○	○	○	○
37	ADRIO (d, s)	I/O address conversion	○	×	×	×	○	○	○	○

\* ○: Supported ×: Not supported

## [Control commands]

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
1	END	Normal scan end	○	○	○	○	○	○	○	○
2	CEND (s)	Scan conditional end	○	○	○	○	○	○	○	○
3	JMP n	Unconditional jump	○	○	○	○	○	○	○	○
4	CJMP n (s)	Conditional jump	○	○	○	○	○	○	○	○
5	RSRV n	Reserve	×	×	×	×	×	○	○	○
6	FREE	Reserve cancel	×	×	×	×	×	○	○	○
7	LBL n	Label	○	○	○	○	○	○	○	○
8	FOR n (s)	FOR	○	×	×	○	○	○	○	○
9	NEXT n	NEXT	○	×	×	○	○	○	○	○
10	CAL n	Call subroutine	○	○	○	○	○	○	○	○
11	SB n	Start subroutine program	○	○	○	○	○	○	○	○
12	RTS	RETURN SUBROUTINE	○	○	○	○	○	○	○	○
13	START n	Start BASIC task	×	×	×	×	×	○	○	○
14	INT n	Start interrupt scan program	○	○	○	○	○	○	○	○
15	RTI	RETURN INTERRUPT	○	○	○	○	○	○	○	○

\* ○: Supported ×: Not supported

## [High-function module transfer commands]

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
1	TRNS 0 (d, s, t)	General-purpose port transmission command	○	×	×	×	×	×	○	○
2	RECV 0 (d, s, t)	General-purpose port receiving command	○	×	×	×	×	×	○	○
3	TRNS 1 (d, s, t)	Data communication command for SIO, CLOCK	×	×	×	×	○	×	○	○
4	QTRNS1 (d, s, t)	High data communication command for SIO, CLOCK	×	×	×	×	×	×	○	○
5	TRNS 2 (d, s, t)	Data communication command for ASCII	×	×	×	×	×	×	○	○
6	QTRNS2 (d, s, t)	High data communication command for ASCII	×	×	×	×	×	×	○	○
7	TRNS 3 (d, s, t)	Data transmission command for POSIT-H	×	×	×	×	×	×	○	○
8	QTRNS3 (d, s, t)	High data transmission command for POSIT-H	×	×	×	×	×	×	○	○
9	RECV 3 (d, s, t)	Data receiving command for POSIT-H	×	×	×	×	×	×	○	○
10	TRNS 4 (d, s, t)	Data communication command for POSIT-2H, POSITA2H	×	×	×	×	○	×	○	○
11	QTRNS 4 (d, s, t)	High data communication command for POSIT-2H, POSITA2H	×	×	×	×	×	×	○	○
12	TRNS 5 (d, s, t)	Data communication command for XCU-001H	×	×	×	×	×	×	○	○
13	TRNS 6 (d, s, t)	Data communication command for XCU-232H	×	×	×	×	×	×	○	○
14	TRNS 7 (d, s, t)	ID reader transmission command	●	×	×	×	×	×	×	×
15	RECV 7 (d, s, t)	ID reader reception command	●	×	×	×	×	×	×	×
16	TRNS 8 (d, s, t)	Telecommunication command	●	×	×	×	×	×	×	×

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ◎: The EH-CPU308, 316 and 448 are supported.

## [FUN commands] (1/5)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
1	FUN 0 (s) (PIDIT (s))	PID operation initialization	◎	×	×	×	○	×	○	○
2	FUN 1 (s) (PIDOP (s))	PID operation execution control	◎	×	×	×	○	×	○	○
3	FUN 2 (s) (PIDCL (s))	PID operation execution	◎	×	×	×	○	×	○	○
4	FUN 4 (s) (IFR (s))	Process stepping	○	×	×	×	×	×	×	○
5	FUN 10 (s) (SIN (s))	SIN function	○	×	×	×	○	×	○	○
6	FUN 11 (s) (COS (s))	COS function	○	×	×	×	○	×	○	○
7	FUN 12 (s) (TAN (s))	TAN function	○	×	×	×	○	×	○	○
8	FUN 13 (s) (ASIN (s))	ARC SIN function	○	×	×	×	○	×	○	○
9	FUN 14 (s) (ACOS (s))	ARC COS function	○	×	×	×	○	×	○	○
10	FUN 15 (s) (ATAN (s))	ARC TAN function	○	×	×	×	○	×	○	○
11	FUN 20 (s) (DSRCH (s))	Data search	×	×	×	×	○	×	○	○
12	FUN 21 (s) (TSRCH (s))	Table search	×	×	×	×	○	×	○	○

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ◎: The EH-CPU308, 316 and 448 are supported.

[FUN commands] (2/5)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
13	FUN 30 (s) (BINDA (s))	Binary → decimal ASCII conversion (16 bit)	●	×	×	×	○	×	○	○
14	FUN 31 (s) (DBINDA (s))	Binary → decimal ASCII conversion (32 bit)	●	×	×	×	○	×	○	○
15	FUN 32 (s) (BINHA (s))	Binary → hexadecimal ASCII conversion (16 bit)	●	×	×	×	○	×	○	○
16	FUN 33 (s) (DBINHA (s))	Binary → hexadecimal ASCII conversion (32 bit)	●	×	×	×	○	×	○	○
17	FUN 34 (s) (BCDDA (s))	BCD → decimal ASCII conversion (16 bit)	●	×	×	×	○	×	○	○
18	FUN 35 (s) (DBCDDA (s))	BCD → decimal ASCII conversion (32 bit)	●	×	×	×	○	×	○	○
19	FUN 36 (s) (DABIN (s))	Without signed 5 digit Decimal ASCII conversion → binary conversion	●	×	×	×	○	×	○	○
20	FUN 37 (s) (DDABIN (s))	Signed 10 digit Decimal ASCII conversion → binary conversion	●	×	×	×	○	×	○	○
21	FUN 38 (s) (HABIN (s))	4 digit hexadecimal ASCII → binary conversion	●	×	×	×	○	×	○	○
22	FUN 39 (s) (DHABIN (s))	8 digit hexadecimal ASCII → binary conversion	●	×	×	×	○	×	○	○
23	FUN 40 (s) (DABCD (s))	4 digit decimal ASCII → BCD conversion	●	×	×	×	○	×	○	○
24	FUN 41 (s) (DDABCD (s))	8 digit decimal ASCII → BCD conversion	●	×	×	×	○	×	○	○
25	FUN 42 (s) (ASC (s))	Hexadecimal binary → ASCII conversion (digit designation)	●	×	×	×	○	×	○	○
26	FUN 43 (s) (HEX (s))	Hexadecimal ASCII → binary conversion (digit designation)	●	×	×	×	○	×	○	○
27	FUN 44 (s) (ASDD (s))	Character unit	●	×	×	×	○	×	○	○
28	FUN 45 (s) (SCMP (s))	Character relational	●	×	×	×	○	×	○	○
29	FUN 46 (s) (WTOB (s))	Word → byte conversion	●	×	×	×	○	×	○	○
30	FUN 47 (s) (WTOW (s))	Byte → word conversion	●	×	×	×	○	×	○	○
31	FUN 48 (s) (BSHR (s))	Byte unit right shift	●	×	×	×	○	×	○	○
32	FUN 49 (s) (BSHL (s))	Byte unit left shift	●	×	×	×	○	×	○	○
33	FUN 50 (s) (TRSET (s))	Sampling trace set	×	×	×	×	○	×	○	○
34	FUN 51 (s) (TRACE (s))	Sampling trace execution	×	×	×	×	○	×	○	○
35	FUN 52 (s) (TRRES (s))	Sampling trace reset	×	×	×	×	○	×	○	○
36	FUN 60 (s) (BSQR (s))	Binary square	●	×	×	×	○	×	○	○
37	FUN 61 (s) (PGEN (s))	Dynamic scan pulse	●	×	×	×	○	×	○	○
38	FUN 70 (s)	High-speed counter mode set	×	○	×	×	×	×	×	×
39	FUN 71 (s)	High-speed counter process value read	×	○	×	×	×	×	×	×

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ◎: The EH-CPU308, 316 and 448 are supported.



[FUN commands] (3/5)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
40	FUN 72 (s)	High-speed counter process value write	×	○	×	×	×	×	×	×
41	FUN 73 (s)	High-speed counter set value read	×	○	×	×	×	×	×	×
42	FUN 74 (s)	High-speed counter set value write	×	○	×	×	×	×	×	×
43	FUN 80 (ALREF)	I/O refresh (All points)	○	×	×	×	○	×	×	○
44	FUN 81 (IOREF)	I/O refresh (Input/output designation)	○	×	×	×	○	×	×	○
45	FUN 82 (SLREF)	I/O refresh (Any slot)	○	×	×	×	○	×	×	○
46	FUN 90 (ETDIT)	Expansion timer initial setting	×	×	×	×	×	×	×	○
47	FUN 91 (ETD)	Expansion timer execution	×	×	×	×	×	×	×	○
48	FUN 92 (ECUIT)	Expansion counter/up-down counter initial setting	×	×	×	×	×	×	×	×
49	FUN 93 (ECU)	Expansion counter execution	×	×	×	×	×	×	×	×
50	FUN 94 (ECTU)	Expansion up-down counter up execution	×	×	×	×	×	×	×	×
51	FUN 95 (ECTD)	Expansion up-down counter down execution	×	×	×	×	×	×	×	×
52	FUN 96 (ECL)	Expansion counter clear	×	×	×	×	×	×	×	×
53	FUN 97 (WNRED)	Expansion link area read	×	×	×	×	×	×	×	○
54	FUN 98 (WNWRT)	Expansion link area write	×	×	×	×	×	×	×	○
55	FUN 100 (INT)	Flow decimal point operation (real number → integral number (word) conversion)	⊙	×	×	×	×	×	×	○
56	FUN 101 (INTD)	Flow decimal point operation (real number → integral number (double word) conversion)	⊙	×	×	×	×	×	×	○
57	FUN 102 (FLOAT)	Flow decimal point operation (integral number (word) → real number conversion)	⊙	×	×	×	×	×	×	○
58	FUN 103 (FLOATD)	Flow decimal point operation (integral number (double word) → real number conversion)	⊙	×	×	×	×	×	×	○
59	FUN 104 (FADD)	Flow decimal point operation (addition)	⊙	×	×	×	×	×	×	○
60	FUN 105 (FSUB)	Flow decimal point operation (subtraction)	⊙	×	×	×	×	×	×	○
61	FUN 106 (FMUL)	Flow decimal point operation (multiplication)	⊙	×	×	×	×	×	×	○
62	FUN 107 (FDIV)	Flow decimal point operation (division)	⊙	×	×	×	×	×	×	○
63	FUN 108 (FRAD)	Flow decimal point operation (angle → radian conversion)	⊙	×	×	×	×	×	×	○
64	FUN 109 (FDEG)	Flow decimal point operation (radian → angle conversion)	⊙	×	×	×	×	×	×	○
65	FUN 110 (FSIN)	Flow decimal point operation (SIN)	⊙	×	×	×	×	×	×	○
66	FUN 111 (FCOS)	Flow decimal point operation (COS)	⊙	×	×	×	×	×	×	○

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ⊙: The EH-CPU308, 316 and 448 are supported.

[FUN commands] (4/5)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
67	FUN 112 (FTAN)	Flow decimal point operation (TAN)	⊙	×	×	×	×	×	×	○
68	FUN 113 (FASIN)	Flow decimal point operation (ARC SIN)	⊙	×	×	×	×	×	×	○
69	FUN 114 (FACOS)	Flow decimal point operation (ARC COS)	⊙	×	×	×	×	×	×	○
70	FUN 115 (FATAN)	Flow decimal point operation (ARC TAN)	⊙	×	×	×	×	×	×	○
71	FUN 116 (FSQR)	Flow decimal point operation (square)	⊙	×	×	×	×	×	×	○
72	FUN 117 (FEXP)	Flow decimal point operation (characteristic)	⊙	×	×	×	×	×	×	○
73	FUN 118 (FLOG)	Flow decimal point operation (napierian logarithm)	⊙	×	×	×	×	×	×	○
74	FUN 120 (INDXD)	Index setting (argument d)	●	×	×	×	×	×	×	○
75	FUN 121 (INDXS)	Index setting (argument s)	●	×	×	×	×	×	×	○
76	FUN 122 (INDXC)	Index cancel	●	×	×	×	×	×	×	○
77	FUN 123 (INC)	Increment (INC)	⊙	×	×	×	×	×	×	○
78	FUN 124 (INCD)	Double word increment (DINC)	⊙	×	×	×	×	×	×	○
79	FUN 125 (DEC)	Decrement (DEC)	⊙	×	×	×	×	×	×	○
80	FUN 126 (DECD)	Double word decrement (DECD)	⊙	×	×	×	×	×	×	○
81	FUN 127 (BITTOW)	Expansion of bit data to word data	●	×	×	×	×	×	×	○
82	FUN 128 (WTOBIT)	Expansion of word data to bit data	●	×	×	×	×	×	×	○
83	FUN133 (FIBMOV)	File memory block transfer	×	×	×	×	×	×	×	○
84	FUN134 (FIBCHG)	File memory block exchange	×	×	×	×	×	×	×	○
85	FUN135 (FIWRED)	File memory word unit read	×	×	×	×	×	×	×	○
86	FUN136 (FIWWRT)	File memory word unit write	×	×	×	×	×	×	×	○
87	FUN200 (XYR/W)	X, Y area read/write command	●	×	×	×	×	×	×	×
88	FUN201 (SCR/W)	Status control area read/write command	●	×	×	×	×	×	×	×
89	FUN 210 (s) (LOGIT (s))	Initial setting for data logging	⊙	×	×	×	×	×	×	×
90	FUN 211 (s) (LOGWRT (s))	Log data write	⊙	×	×	×	×	×	×	×
91	FUN 212 (s) (LOGCLR (s))	Log data clear	⊙	×	×	×	×	×	×	×

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ⊙: The EH-CPU308, 316 and 448 are supported.

[FUN commands] (5/5)

No.	Command format	Command name	EH-150	H-64 to H-20	H-200	H-250	H-252	H-2000 H-700 H-300	H-2002 H-1002 H-702 H-302	H4010
92	FUN 213 (s) (LOGRED (s))	Log data read	⊙	×	×	×	×	×	×	×
93	FUN 254 (s) (BOXC (s))	BOX comment	○	○	○	○	○	○	○	○
94	FUN 255 (s) (MEMC (s))	Memo comment	○	○	○	○	○	○	○	○

\* ○: Supported ×: Not supported ●: The EH-CPU448 is supported. ⊙: The EH-CPU308, 316 and 448 are supported.

# Appendix 3 Task Code Specifications

The EH-150 communicates with the host by issuing task codes. This chapter explains the details of each task code.

(1) Task code function details

This section explains the details of each task code function and response command function.  
Each task code is explained using the format shown below:

Task code Response task code	Task code number	Task code description	Classification	Response, CPU control, memory read, memory write or I/O control
Function				
Execution condition	<div>Shows the task code execution conditions.</div> <div>Details are described on the next page.</div>			
Format	<div>Format of the request task code</div> <div>and</div> <div>Format of the response task code</div>			
Description				
Example				

## How to read the execution condition table

The table indicates the CPU status in which the task code is executable and the memory occupancy status.  
For the details of the CPU status, refer to CPU status read of task code H10.

## 1] Execution condition example 1

CPU status					
STOP	RUN	HALT	ERROR		
×	×	×	×	READ occupancy	Occupancy status
○	×	×	○	WRITE occupancy	

○ : Executable

× : Not-executable

In example 1, the task code can only be executed when the CPU is in the STOP or ERROR status and the memory is WRITE-occupied.

## 2] Execution condition example 2

CPU status					
STOP	RUN	HALT	ERROR		
○	○	○	○	READ occupancy	Occupancy status
○	○	○	○	WRITE occupancy	

In example 2, the task code is executable if the CPU is occupied.

Task code list

No.	Classification	Task code number	Description	Remarks
1	Response	00	Normal execution	
		01	Task code error	
		02	Warning	
		03	Not-executable	
		05	BUSY	
		08	Network error	
2	CPU control	10	CPU status read	
		11	CPU run / stop designation	
		16	CPU occupancy/cancel	
		17	Forced release of occupancy	
		18	Calendar time clock set/read	
		1C	Line disconnection when a modem is connected.	Refer to 10.4
3	Memory write	20	Clear all	
		23	Program transfer with address designation	
		26	Write memory assignment	
		27	Parameter modification completion	
		28	Timer/counter set value modification	
4	Memory read	31	Program read with address designation	
		33	Final ladder search	
		35	Read memory assignment	
5	I/O control	40	Monitoring with I/O number designation (N continuous points)	
		42	Forced set/reset with I/O number designation (N continuous points)	
		44	Monitoring with I/O number designation (N random points)	
		45	Forced set/reset with I/O number designation (N random points)	
11	I/O control (not occupied)	A0	Monitoring with I/O number designation (N continuous points)	
		A2	Forced set/reset with I/O number designation (N continuous points)	
		A4	Monitoring with I/O number designation (N random points)	
		A5	Forced set/reset with I/O number designation (N random points)	

Response task code	H00	Normal execution	Classification	Response			
Function							
Indicates that the requested task code has been executed normally.							
Format							
<table><tr><td>H00</td><td>(a)</td><td>(b)</td></tr></table>					H00	(a)	(b)
H00	(a)	(b)					
<p>(a) Executed task code</p> <p>(b) Execution result data</p> <p>Refer to the description of each task code for details.</p>							

Response task code	H01	Task code error	Classification	Response																		
Function																						
Indicates that there is an error in the task code requested for execution. (Task code undefined, parameter error, etc.)																						
Format																						
<table><tr><td>H01</td><td>(a)</td><td>(b)</td></tr></table>			H01	(a)	(b)	(a) Task code requested for execution (b) Return code																
H01	(a)	(b)																				
Description																						
Return code details are shown below:																						
<table><tr><td>Return code</td><td>Description</td></tr><tr><td>H01</td><td>Task code is undefined.</td></tr><tr><td>H02</td><td>Function selection code is undefined.</td></tr><tr><td>H04</td><td>Abnormal address</td></tr><tr><td>H05</td><td>Abnormal step number or word number</td></tr><tr><td>H06</td><td>Abnormal I/O code</td></tr><tr><td>H07</td><td>Abnormal I/O number</td></tr><tr><td>H09</td><td>Write was attempted more than the memory capacity.</td></tr><tr><td>H0A</td><td>Insufficient memory size</td></tr></table>					Return code	Description	H01	Task code is undefined.	H02	Function selection code is undefined.	H04	Abnormal address	H05	Abnormal step number or word number	H06	Abnormal I/O code	H07	Abnormal I/O number	H09	Write was attempted more than the memory capacity.	H0A	Insufficient memory size
Return code	Description																					
H01	Task code is undefined.																					
H02	Function selection code is undefined.																					
H04	Abnormal address																					
H05	Abnormal step number or word number																					
H06	Abnormal I/O code																					
H07	Abnormal I/O number																					
H09	Write was attempted more than the memory capacity.																					
H0A	Insufficient memory size																					

Response task code	H02	Warning	Classification	Response			
Function							
Indicates that the local terminal does not occupy the CPU during monitoring.							
Format							
<table><tr><td>H02</td><td>(a)</td><td>(b)</td></tr></table>					H02	(a)	(b)
H02	(a)	(b)					
<p>(a) Task code requested for execution</p> <p>(b) Execution result data</p> <p>Refer to the description of each task code for details.</p>							

Response task code	H03	Not-executable	Classification	Response																														
Function																																		
Indicates that the requested task code cannot be executed.																																		
Format																																		
<table><tr><td>H03</td><td>(a)</td><td>(b)</td></tr></table>	H03	(a)	(b)	<div>(a) Task code requested for execution</div> <div>(b) Return code</div>																														
H03	(a)	(b)																																
Description																																		
Return code details are shown below:																																		
<table><tr><th>Return code</th><th>Description</th></tr><tr><td>H01</td><td>This is ROM memory.</td></tr><tr><td>H02</td><td>Does not match parameter area.</td></tr><tr><td>H03</td><td>Occupancy code does not match (READ-occupied).</td></tr><tr><td>H04</td><td>Occupancy code does not match (WRITE-occupied).</td></tr><tr><td>H05</td><td>Another station is in the process of debugging.</td></tr><tr><td>H06</td><td>Already READ-occupied in four stations.</td></tr><tr><td>H07</td><td>Local station does not occupy CPU.</td></tr><tr><td>H08</td><td>Another station is occupying CPU.</td></tr><tr><td>H0A</td><td>RAM memory error.</td></tr><tr><td>H0B</td><td>CPU is running.</td></tr><tr><td>H0C</td><td>Operation error.</td></tr><tr><td>H0D</td><td>Program does not exist.</td></tr><tr><td>H0E</td><td>Task code combination error.</td></tr><tr><td>H0F</td><td>Program is illogical.</td></tr></table>					Return code	Description	H01	This is ROM memory.	H02	Does not match parameter area.	H03	Occupancy code does not match (READ-occupied).	H04	Occupancy code does not match (WRITE-occupied).	H05	Another station is in the process of debugging.	H06	Already READ-occupied in four stations.	H07	Local station does not occupy CPU.	H08	Another station is occupying CPU.	H0A	RAM memory error.	H0B	CPU is running.	H0C	Operation error.	H0D	Program does not exist.	H0E	Task code combination error.	H0F	Program is illogical.
Return code	Description																																	
H01	This is ROM memory.																																	
H02	Does not match parameter area.																																	
H03	Occupancy code does not match (READ-occupied).																																	
H04	Occupancy code does not match (WRITE-occupied).																																	
H05	Another station is in the process of debugging.																																	
H06	Already READ-occupied in four stations.																																	
H07	Local station does not occupy CPU.																																	
H08	Another station is occupying CPU.																																	
H0A	RAM memory error.																																	
H0B	CPU is running.																																	
H0C	Operation error.																																	
H0D	Program does not exist.																																	
H0E	Task code combination error.																																	
H0F	Program is illogical.																																	



Response task code	H05	BUSY		Classification	Response
Function					
Indicates that the requested task code was not executed because another task code was being executed. (Note) Create a program so that transmission is retried from a request task code when BUSY is returned.					
Format					
<div><div><div>H05</div><div>(a)</div></div><div>(a) Task code that requested the execution</div></div>					

Response task code	H08	Network error	Classification	Response					
Function									
Indicates that a communication error has occurred.									
Format									
<table><tr><td>H08</td><td>(a)</td><td colspan="3">(b)</td></tr></table>					H08	(a)	(b)		
H08	(a)	(b)							
<p>(a) Task code requested for execution</p> <p>(b) The network address that detected the error</p>									
Description									
Indicates that there was a communication error or the designated destination address does not exist.									

Task code	H10	CPU status read			Classification	CPU control																												
Function																																		
Reads the CPU status, memory-load status and software version. This task code can also be executed when the CPU is not occupied.																																		
Execution condition																																		
<table><tr><th colspan="4">CPU status</th><td></td><td></td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th><td></td><td></td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td><td rowspan="3">Occupancy status</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>							CPU status						STOP	RUN	HALT	ERROR			○	○	○	○	READ occupancy	Occupancy status	○	○	○	○	WRITE occupancy	○	○	○	○	Not occupied
CPU status																																		
STOP	RUN	HALT	ERROR																															
○	○	○	○	READ occupancy	Occupancy status																													
○	○	○	○	WRITE occupancy																														
○	○	○	○	Not occupied																														
Format																																		
<div>Request</div> <table><tr><td>H10</td><td>(a)</td></tr></table> <div>(a) Function selection (subcommand)</div> <div>1] H00: Reads CPU status.</div> <div>2] H01: Reads memory status.</div> <div>3] H02: Reads system software version.</div> <div>4] H03: Reads error code.</div> <div>5] H04: Reads CPU name.</div> <div>Response</div> <div>1] Read CPU status (subcommand H00)</div> <table><tr><td>(a)</td><td>H10</td><td>(b)</td><td>(c)</td></tr></table> <div>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div> <div>(b) The read CPU status</div> <div>(c) User program version (H00 to HFF) This value is counted up only when memory writing has occurred and the WRITE occupancy is canceled (indicating the number of times WRITE occupancy has occurred). This value is H00 upon power-up.</div> <div>2] Read memory status (subcommand H01)</div> <table><tr><td>(a)</td><td>H10</td><td>(b)</td><td>(c)</td><td>(d)</td></tr></table> <div>(a) Response task code (H00 when executed normally)</div> <div>(b) Memory type</div> <div>(c) User memory capacity (number of steps)</div> <div>(d) Data memory capacity (number of words)</div>							H10	(a)	(a)	H10	(b)	(c)	(a)	H10	(b)	(c)	(d)																	
H10	(a)																																	
(a)	H10	(b)	(c)																															
(a)	H10	(b)	(c)	(d)																														

3] Read system software version (subcommand H02)

(a)	H10	(b)	

- (a) Response task code (H00 when executed normally)
- (b) Version (4 digit BCD)  
This is the version of the system software (ROM) for CPU.

4] Read error code (subcommand H03)

(a)	H10	(b)	

- (a) Response task code (H00 when executed normally)
- (b) CPU error code (2 digit hexadecimal)  
This is the same code as the contents of special internal output WRF000.

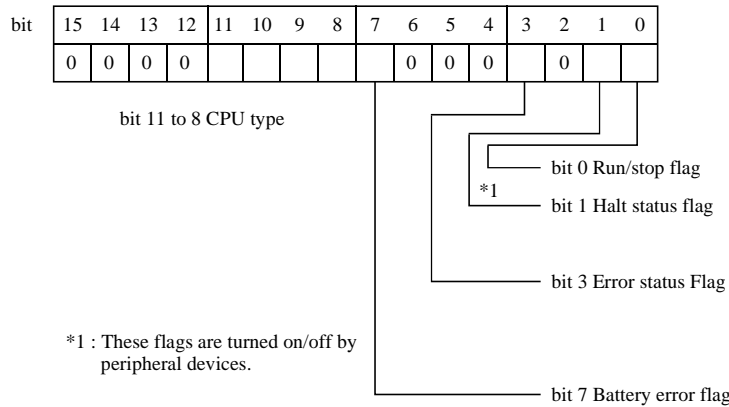
5] Read CPU name (subcommand H04)

(a)	H10	(b)	

- (a) Response task code (H00 when executed normally)
- (b) CPU name (16 ASCII-code characters)  
If it is less than 16 characters, Null (H20) are added until 16 characters are reached.

## Description

## 1] CPU status (4 digits) b area details (response to the subcommand "H00")



bit11 to 8 CPU type flag

0011: EH-CPU104/208/308/316/448

bit 0 Run/stop flag

Displays the run/stop status of CPU.

"1": Run / "0": Stop

bit 1 Halt status flag

Displays whether or not the CPU is halted.

"1": Halted / "0": Not halted

bit 2 Unused ("0")

bit 3 Error status flag

Displays whether or not the CPU is in the error status.

"1": Error / "0": Normal

When this flag is 1, error details may be determined by reading the CPU error code (refer to (4)).

bit 4 Unused ("0")

bit 5 Unused ("0")

bit 6 Unused ("0")

bit 7 Battery error flag

Displays whether or not the CPU backup battery is normal.

"1": Battery is not installed or voltage is low. / "0": Battery normal

## 2] Memory status (response to the subcommand H01)

Item	Description	Description	Remarks
Memory type	H00	Memory error	
	H02	RAM memory	
User memory capacity	H0010	4 k Steps	EH-CPU104
	H0020	8 k Steps	EH-CPU208/308
	H0040	16 k Steps	EH-CPU316
	H00C0	48 k Steps	EH-CPU448
Data memory capacity	H004C	4 kW	EH-CPU104
	H005C	8 kW	EH-CPU208
	H0080	17 kW	EH-CPU308
	H0094	22 kW	EH-CPU316
	H0100	49 kW	EH-CPU448

Description	
3] System software version (response to the subcommand H02) The software version of the system software installed in the EH-150.	
4] Error code (response to the subcommand H03) The same code as the error code output in special internal output WRF000 (self-diagnostic error code) can be read	
5] CPU name (response to the subcommand H04) EH-CPU104/208/308/316/448 ..... H-302	

Example	
---------	--

Function selection (subcommand): H00

Request

1	0	0	0
---	---	---	---

Response

0	0	1	0	0	3	0	1	0	1
---	---	---	---	---	---	---	---	---	---

CPU status  
EH-CPU104/208/308/316/448 running

User program  
version = H01

Function selection (subcommand): H01

Request

1	0	0	1
---	---	---	---

Response

0	0	1	0	0	2	0	0	2	0	0	0	4	C
---	---	---	---	---	---	---	---	---	---	---	---	---	---

RAM memory

User memory  
capacity: 8 k Steps

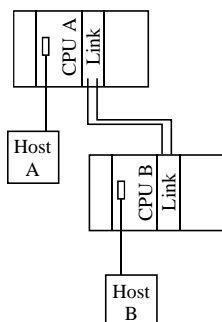
Data memory  
capacity: 4 kW

Task code	H11	CPU run/stop designation	Classification	CPU control																
Function																				
Controls the run/stop of the CPU from the host. It will end normally, even if a run designation while running and stop designation while stopped are made.																				
Execution condition																				
The following conditions must be met: 1] The RUN switch is set to STOP, and the number 1 DIP switch is on. 2] The CPU status is not ERROR. 3] In the case of function selection and stop designation, the special internal output R7C4 is on. 4] In the case of function selection and run designation, the special internal output R7C3 is on and R7E9 is off. In addition, if the run control input is set using parameters, the contact is on.  Note: If the CPU is WRITE-occupied by another station, a “not-executable” response will be made. (If the CPU is WRITE-occupied by the local station, execution is possible.)																				
Format																				
<div>Request<div><table><tr><td>H11</td><td>(a)</td></tr></table></div><div>(a) Function selection (subcommand)<div>1] H00: Stop designation 2] H01: Run designation</div></div></div> <div>Response<div><table><tr><td>(a)</td><td>H11</td></tr></table></div><div>a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div></div>					H11	(a)	(a)	H11												
H11	(a)																			
(a)	H11																			
Description																				
<div>1] STOP (subcommand H00) The CPU operation is stopped. If a stop designation is sent when the CPU is stopped, a normal response task code results. If the CPU sends a stop designation during error, the error status can be canceled. However, the error codes H10 to H2F cannot be canceled.</div> <div>2] RUN (subcommand H01) Runs the CPU. If a run designation is sent when the CPU is already running, a normal response task code results.</div>																				
Example																				
<div><div>Stop designation</div><div>Request<div><table><tr><td>1</td><td>1</td><td>0</td><td>0</td></tr></table></div><div>Response<div><table><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr></table></div></div></div><div><div>Run designation</div><div>Request<div><table><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr></table></div><div>Response<div><table><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr></table></div></div></div></div></div>					1	1	0	0	0	0	1	1	1	1	0	1	0	0	1	1
1	1	0	0																	
0	0	1	1																	
1	1	0	1																	
0	0	1	1																	

Task code	H16	CPU occupancy/cancel				Classification	CPU control																																																																					
Function																																																																												
Declares that the user memory will be accessed. The user memory cannot be accessed by the host unless the CPU is occupied using this task code. Also, depending on the function selection, it performs the same processing as the parameter modification completion processing (task code H27).																																																																												
Execution condition																																																																												
<table><tr><td colspan="2" rowspan="2"></td><td colspan="4">CPU status</td><td colspan="2" rowspan="2"></td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td></tr><tr><td rowspan="12">Function selection sub-command</td><td rowspan="2">H01</td><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td><td rowspan="12">Occupancy status</td></tr><tr><td>×</td><td>×</td><td>×</td><td>×</td><td>WRITE occupancy</td></tr><tr><td rowspan="2">H02</td><td>×</td><td>×</td><td>×</td><td>×</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td rowspan="2">H05</td><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td rowspan="2">H06</td><td>○*1</td><td>○*1</td><td>○*1</td><td>○*1</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td rowspan="2">H00</td><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr></table>										CPU status						STOP	RUN	HALT	ERROR	Function selection sub-command	H01	○	○	○	○	READ occupancy	Occupancy status	×	×	×	×	WRITE occupancy	H02	×	×	×	×	READ occupancy	○	○	○	○	WRITE occupancy	H05	○	○	○	○	READ occupancy	○	○	○	○	WRITE occupancy	H06	○*1	○*1	○*1	○*1	READ occupancy	○	○	○	○	WRITE occupancy	H00	○	○	○	○	READ occupancy	○	○	○	○	WRITE occupancy
		CPU status																																																																										
		STOP	RUN	HALT	ERROR																																																																							
Function selection sub-command	H01	○	○	○	○	READ occupancy	Occupancy status																																																																					
		×	×	×	×	WRITE occupancy																																																																						
	H02	×	×	×	×	READ occupancy																																																																						
		○	○	○	○	WRITE occupancy																																																																						
	H05	○	○	○	○	READ occupancy																																																																						
		○	○	○	○	WRITE occupancy																																																																						
	H06	○*1	○*1	○*1	○*1	READ occupancy																																																																						
		○	○	○	○	WRITE occupancy																																																																						
	H00	○	○	○	○	READ occupancy																																																																						
		○	○	○	○	WRITE occupancy																																																																						
	*1: It cannot be executed while the CPU is READ-occupied by another station.																																																																											
	Format																																																																											
<div>Request<div><table><tr><td>H16</td><td>(a)</td></tr></table></div><div>(a) Function selection (subcommand)<div><div>1] H01: READ occupancy</div><div>2] H02: WRITE occupancy</div><div>3] H05: Modifies the local station occupancy mode from WRITE occupancy to READ occupancy.</div><div>4] H06: Modifies the local station occupancy mode from READ occupancy to WRITE occupancy.</div><div>5] H00: Cancels the local station occupancy.</div></div></div></div> <div>Response<div><table><tr><td>(a)</td><td>H16</td><td>(b)</td></tr></table></div><div>(a) Response task code (H00 when executed normally)<div>For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div></div><div>(b) User program version (H00 to HFF)</div></div>								H16	(a)	(a)	H16	(b)																																																																
H16	(a)																																																																											
(a)	H16	(b)																																																																										

## Description

- 1] READ occupancy (subcommand H01)  
This command is used when the local station is not occupying the CPU if performing tasks such as reading the user program, monitoring and setting the data memory or the I/O.
- 2] WRITE occupancy (subcommand H02)  
This command is used when writing the user program if the local station is not WRITE-occupying the CPU. This command cannot be used when another station is occupying the CPU.
- 3] Occupancy mode modification (modification from WRITE occupancy to READ occupancy) (subcommand H05)  
Modifies the CPU occupancy mode of the local station to the READ occupancy.  
This command cannot be executed when the local station is not occupying the CPU.  
When modifying from WRITE occupancy to READ occupancy, the parameter modification completion processing is performed.
- 4] Occupancy mode modification(modification from READ occupancy to WRITE occupancy) (subcommand H06)  
Modifies the CPU occupancy mode of the local station to WRITE occupancy.  
This command cannot be executed when the local station is not occupying the CPU.  
This command cannot be executed when another station is occupying the CPU.
- 5] Occupancy cancel (subcommand H00)  
Cancels the local station CPU occupancy.  
When canceling the WRITE occupancy, the parameter modification completion processing is performed.

Execution conditions in the occupancy status

CPU occupancy status	Function selection (subcommand)				
	H01	H02	H05	H06	H00
No occupancy	○	○	×	×	○
Local station is WRITE-occupying	×	○	○	○	○
Another station is WRITE-occupying	×	×	×	×	○
Only the local station is READ-occupying	○	×	○	○	○
Local and other stations are READ-occupying	○	×	○	×	○
Only another station is READ-occupying	○	×	×	×	○
Four other stations are READ-occupying	×	×	×	×	○

From the viewpoint of host A, host A is the local station and host B is the other station.  
From the viewpoint of host B, host B is the local station and host A is the other station.



Task code	H17	Forced cancel of occupancy	Classification	CPU control																												
Function																																
<p>Forces the cancel of CPU occupancy. This command is used in situations such as when another programming device has gone down due to an error while occupying the user memory of the CPU (function selection H00).</p> <p>When connecting the host to the CPU and occupying it for the first time, use function selection H01 so the local occupancy status is canceled forcibly.</p> <p>This task code can also be executed when the CPU is not occupied.</p>																																
Execution condition																																
<table><tr><th colspan="4">CPU status</th><td></td><td></td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th><td></td><td></td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td><td rowspan="3">Occupancy status</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>					CPU status						STOP	RUN	HALT	ERROR			○	○	○	○	READ occupancy	Occupancy status	○	○	○	○	WRITE occupancy	○	○	○	○	Not occupied
CPU status																																
STOP	RUN	HALT	ERROR																													
○	○	○	○	READ occupancy	Occupancy status																											
○	○	○	○	WRITE occupancy																												
○	○	○	○	Not occupied																												
Format																																
<p>Request</p> <table><tr><td>H17</td><td>(a)</td></tr></table> <p>(a) Function selection (subcommand)</p> <p>1] H00: Forced cancel of all occupancy</p> <p>2] H01: Forced cancel of local station occupancy</p> <p>Response</p> <table><tr><td>(a)</td><td>H17</td></tr></table> <p>(a) Response task code (H00 when executed normally)</p> <p>For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</p>					H17	(a)	(a)	H17																								
H17	(a)																															
(a)	H17																															
Description																																
<p>With forced cancel, if there are modification in the parameter area, the same processing as parameter modification completion processing is performed (refer to the task code H27) as well as the canceling of memory occupancy.</p> <p>1] Forced cancel of all occupancy (subcommand H00)</p> <p>All occupancy is canceled unconditionally, so when this command has been executed the peripheral that is reading the user memory, for example, will not be able to perform reading. Therefore, verify the registered peripherals by monitoring the occupancy table (WRF040 to WRF04B) when executing this command.</p> <p>Member registration area</p> <table><tr><td><table><tr><td>A</td></tr><tr><td>B</td></tr><tr><td></td></tr><tr><td></td></tr></table></td><td><table><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table></td><td><div>READ request</div><div>Not-executable error</div></td></tr><tr><td>READ-occupied by the peripherals A and B</td><td>All peripheral registrations are canceled</td><td>Even if peripheral A or B issues a READ request, a not-executable error is sent because the occupancy is already being forcibly canceled.</td></tr></table>					<table><tr><td>A</td></tr><tr><td>B</td></tr><tr><td></td></tr><tr><td></td></tr></table>	A	B			<table><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table>					<div>READ request</div> <div>Not-executable error</div>	READ-occupied by the peripherals A and B	All peripheral registrations are canceled	Even if peripheral A or B issues a READ request, a not-executable error is sent because the occupancy is already being forcibly canceled.														
<table><tr><td>A</td></tr><tr><td>B</td></tr><tr><td></td></tr><tr><td></td></tr></table>	A	B			<table><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table>					<div>READ request</div> <div>Not-executable error</div>																						
A																																
B																																
READ-occupied by the peripherals A and B	All peripheral registrations are canceled	Even if peripheral A or B issues a READ request, a not-executable error is sent because the occupancy is already being forcibly canceled.																														

Description																	
<div>2] Forced cancel of local station occupancy (subcommand H01) Cancels the occupancy of the local station. The occupancy of other stations are maintained.</div> <div><div><table><tr><td>A</td></tr><tr><td>B</td></tr><tr><td>C</td></tr><tr><td></td></tr></table><div></div><table><tr><td>A</td></tr><tr><td>C</td></tr><tr><td></td></tr><tr><td></td></tr></table></div><div>READ-occupied by peripherals A, B, and C</div><div>The occupancy by the local station (B) is forcibly canceled.</div></div>		A	B	C		A	C										
A																	
B																	
C																	
A																	
C																	
Example																	
<div><div><div>Function selection H00</div><div>Request<table><tr><td>1</td><td>7</td><td>0</td><td>0</td></tr></table><div></div><table><tr><td>0</td><td>0</td><td>1</td><td>7</td></tr></table></div><div>Response</div></div><div><div>Function selection H01</div><div>Request<table><tr><td>1</td><td>7</td><td>0</td><td>1</td></tr></table><div></div><table><tr><td>0</td><td>0</td><td>1</td><td>7</td></tr></table></div><div>Response</div></div></div>		1	7	0	0	0	0	1	7	1	7	0	1	0	0	1	7
1	7	0	0														
0	0	1	7														
1	7	0	1														
0	0	1	7														

Task code	H18	Calendar clock set/read			Classification	CPU control											
Function																	
Sets data to or reads data from the internal calendar clock of the CPU module.																	
Execution condition																	
When EH-CPU104 is used, the execution not-possible (H03) response task code will be returned as this task code becomes invalid.																	
Request																	
<table><tr><td>H18</td><td>(a)</td><td>(b)</td><td>(c)</td><td>(d)</td><td>(e)</td><td>(f)</td><td>(g)</td><td>(h)</td></tr></table> <div>(b) to (h) are added when the function selection is H01.</div>									H18	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
H18	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)									
<div>(a) Function selection (subcommand)</div> <div>1] H00: Read calendar clock</div> <div>2] H01: Set calendar clock</div> <div>3] H02: 30 second adjustment (Less than 30 seconds → 0 second, 30 seconds or more → +1 minute and 0 second)</div> <div>(b) Year (4 digits in BCD)</div> <div>(c) Month (H01 to H12 in BCD)</div> <div>(d) Day (H01 to H31 in BCD)</div> <div>(e) Week (H00: Sunday, H01: Monday, H02: Tuesday, H03: Wednesday, H04: Thursday, H05: Friday, H06: Saturday)</div> <div>(f) Time (H00 to H23 in BDC)</div> <div>(g) Minutes (H00 to H59 in BDC)</div> <div>(h) Seconds (H00 to H59 in BDC)</div>																	
Response																	
<table><tr><td>(a)</td><td>H18</td><td>(b)</td><td>(c)</td><td>(d)</td><td>(e)</td><td>(f)</td><td>(g)</td><td>(h)</td></tr></table> <div>*1 : Added as response data only when the function selection is H00.</div>									(a)	H18	(b)	(c)	(d)	(e)	(f)	(g)	(h)
(a)	H18	(b)	(c)	(d)	(e)	(f)	(g)	(h)									
<div>(a) Response task code (H00 when executed normally)</div> <div>For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div> <div>*1: The contents of (b) to (h) are the same as the request task code.</div>																	
Description																	
<div>1] Read calendar clock (subcommand H00)</div> <div>Reads the calendar time data in the CPU module.</div> <div>2] Set calendar clock (subcommand H01)</div> <div>Sets the calendar time data in the CPU module.</div> <div>3] 30 second adjustment (subcommand H02)</div> <div>Performs second adjustment of the calendar time in the CPU module.</div> <div>0 to 29 seconds → 00 second</div> <div>30 to 59 seconds → + 1 minute and 00 second</div>																	

Example

Function selection (subcommand): H00

Request

1	8	0	0
---	---	---	---

Response

0	0	1	8	1	9	9	1	0	3	2	1	0	4	0	8	0	5	3	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Normal execution      1991      March 21      Thursday      8 o'clock 5 minutes 30 seconds

Function selection (subcommand): H01

Request

1	8	0	1	1	9	9	1	0	4	2	0	0	6	1	6	5	0	3	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1991      April 20      Saturday      16 o'clock 50 minutes 30 seconds

Response

0	0	1	8
---	---	---	---

Normal execution

Task code	H20	Clear all	Classification	Memory write																				
Function																								
Clear the designated area in the user memory.																								
Execution condition																								
<table><tr><td colspan="4">CPU status</td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td><td rowspan="2">READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><td>×</td><td>×</td><td>×</td><td>×</td></tr><tr><td>○</td><td>×</td><td>×</td><td>○</td><td>WRITE occupancy</td><td></td></tr></table>					CPU status				STOP	RUN	HALT	ERROR	READ occupancy	Occupancy status	×	×	×	×	○	×	×	○	WRITE occupancy	
CPU status																								
STOP	RUN	HALT	ERROR	READ occupancy	Occupancy status																			
×	×	×	×																					
○	×	×	○	WRITE occupancy																				
Format																								
<div>Request</div> <table><tr><td>H20</td><td>(a)</td></tr></table> <div>(a) Function selection (subcommand)</div> <div>1] H00: Initialization of all user memory area</div> <div>2] H01: Initialization of the HI-FLOW area *1</div> <div>3] H02: Initialization of the HI-LADDER area</div> <div>4] H03: Zero clear of all user memory area</div> <div>*1: EH-150 does not support HI-FLOW.</div>					H20	(a)																		
H20	(a)																							
<div>Response</div> <table><tr><td>(a)</td><td>H20</td></tr></table> <div>(a) Response task code (H00 when executed normally)</div> <div>For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div>					(a)	H20																		
(a)	H20																							
Description	<div>(1) The composition of user memory</div> <div>The user memory has the composition as shown in the diagram to the right. Parameter area (A) stores the I/O assignment, memory assignment and other information, while parameter area (B) stores the timer information, etc.</div> <table><tr><td colspan="2">User memory</td></tr><tr><td>Parameter area (A)</td><td rowspan="2">} Parameter area</td></tr><tr><td>Parameter area (B)</td></tr><tr><td>HI-FLOW area</td><td></td></tr><tr><td>HI-LADDER area</td><td></td></tr></table> <div>(2) Description of each function</div> <div>1] Initialization of all user memory areas (subcommand H00)</div> <div>Initializes all of parameter areas (A) and (B), the HI-FLOW area and the HI-LADDER area. If this command is executed, memory are assigned as follows. Also, the I/O assignment is erased.</div> <table><tr><td colspan="2">Assignment capacity</td></tr><tr><td>Parameter area ((A), (B) total)</td><td>: H0280</td></tr><tr><td>HI-FLOW area</td><td>: H0000</td></tr><tr><td>HI-LADDER area</td><td>: Load capacity *2 – H0280</td></tr></table> <div>*2 : Determine the load capacity from H10 “CPU status 2] user memory capacity”.</div>				User memory		Parameter area (A)	} Parameter area	Parameter area (B)	HI-FLOW area		HI-LADDER area		Assignment capacity		Parameter area ((A), (B) total)	: H0280	HI-FLOW area	: H0000	HI-LADDER area	: Load capacity *2 – H0280			
User memory																								
Parameter area (A)	} Parameter area																							
Parameter area (B)																								
HI-FLOW area																								
HI-LADDER area																								
Assignment capacity																								
Parameter area ((A), (B) total)	: H0280																							
HI-FLOW area	: H0000																							
HI-LADDER area	: Load capacity *2 – H0280																							

Description	
	<p>When the subcommand H00 is executed using the task code H20 via the COMM, remote or link module, the I/O assignment of the module will be erased and the communication with the CPU cannot be performed. In such a case, connect a programming device to the CPU and perform the I/O assignment operation. Note that the WRITE-occupancy release operation is necessary when connecting a programming device.</p> <p>2] Initialization of the HI-FLOW area (subcommand H01) Only the HI-FLOW area is initialized. (EH-150 does not support HI-FLOW.)</p> <p>3] Initialization of the HI-LADDER area (subcommand H02) Only the HI-LADDER area is initialized.</p> <p>4] Zero clear of all user memory areas (subcommand H03) Writes zero to all areas equivalent to the load capacity of the memory.</p> <p>When the subcommand H00 or H03 is executed using task code H20, always execute the task code H27, parameter modification completion, when the write processing is completed with respect to each user-memory area.</p>

Task code	H23	Program transfer with address designation	Classification	Memory write																							
Function																											
Writes the designated number of program steps to the user memory, starting with the designated address. * For EH-150 CPU, the operation of HI-FLOW programs cannot be performed, while the programs can be transferred.																											
Execution condition																											
<table><tr><th colspan="4">CPU status</th><td></td><td></td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th><td></td><td></td></tr><tr><td>×</td><td>×</td><td>×</td><td>×</td><td>READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><td>○</td><td>×</td><td>×</td><td>○</td><td>WRITE occupancy</td></tr></table>					CPU status						STOP	RUN	HALT	ERROR			×	×	×	×	READ occupancy	Occupancy status	○	×	×	○	WRITE occupancy
CPU status																											
STOP	RUN	HALT	ERROR																								
×	×	×	×	READ occupancy	Occupancy status																						
○	×	×	○	WRITE occupancy																							
Format																											
Request																											
<table><tr><td>H23</td><td>(a)</td><td>(b)</td><td>(c)</td><td>(d)</td><td></td></tr></table>					H23	(a)	(b)	(c)	(d)																		
H23	(a)	(b)	(c)	(d)																							
<p>(a) Memory area designation (subcommand)</p> <p>1] H00: Parameter area (A)</p> <p>2] H01: HI-FLOW area *1</p> <p>3] H02: HI-LADDER area</p> <p>4] H03: Parameter area (B)</p> <p>(b) User memory address (absolute address)</p> <p>(c) Number of steps to be written (H01 to H3C; maximum 60 steps)</p> <p>(d) Write data (1 step is equivalent to 4 bytes.)</p> <p>*1: EH-150 does not support HI-FLOW.</p>																											
Response																											
<table><tr><td>(a)</td><td>H23</td></tr></table>					(a)	H23																					
(a)	H23																										
<p>(a) Response task code (H00 when executed normally)</p> <p>For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</p>																											

Description	
<p>(1) The configuration of use memory</p> <p>The configuration and address of the user memory are shown in the diagram to the right.</p>	<div><p>User memory</p><div><div><div>H0003 →</div><div>H0160 →</div><div>H0280 →</div><div>A →</div></div><div><div>Parameter area (A)</div><div>Parameter area (B)</div><div>HI-FLOW area</div><div>HI-LADDER area</div></div><div><div>}</div><div>}</div></div><div><div>Parameter area</div><div>n steps</div></div></div><div><math display="block">A = H0280 + n \text{ steps}</math></div><p>Note: Obtain the HI-LADDER area head address using the following equation: Head address = (H0280) + (HI-FLOW area capacity) Obtain the HI-FLOW area capacity using the task code H35 “read memory assignment”.</p></div>
<p>(2) Description of each function</p> <p>1] Parameter area (A) (subcommand H00) Writes the designated data *1 in parameter area (A).</p> <p>Note: After executing this command, always execute the task code H27, parameter change completion, when the memory write processing is completed.</p> <p>2] HI-FLOW area (subcommand H01) Writes the designated program *1 to the HI-FLOW area.</p> <p>Note: EH-150 does not support HI-FLOW.</p> <p>3] HI-LADDER area (subcommand H02) Writes the designated program *1 to the HI-LADDER area.</p> <p>4] Parameter area (B) (subcommand H03) Write the designated program *1 to parameter area (B). The maximum capacity per write is 60 steps.</p> <p>*1: For the designated data and program, use the data and program read using task code H31 “read program with address designation.” If an invalid data or program is written, the CPU module may stop due to an error.</p>	

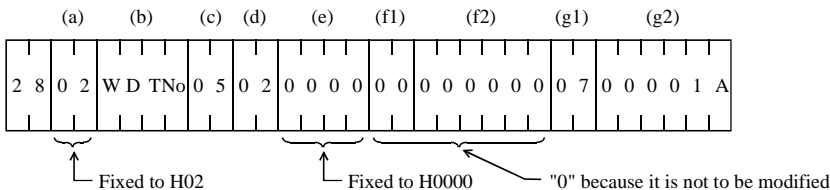


Task code	H26	Write memory assignment	Classification	Memory write																					
Function																									
Writes the memory assignment information.																									
Execution condition																									
<table><tr><th colspan="4">CPU status</th></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th><td></td><td></td></tr><tr><td>×</td><td>×</td><td>×</td><td>×</td><td>READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><td>○</td><td>×</td><td>×</td><td>○</td><td>WRITE occupancy</td></tr></table>					CPU status				STOP	RUN	HALT	ERROR			×	×	×	×	READ occupancy	Occupancy status	○	×	×	○	WRITE occupancy
CPU status																									
STOP	RUN	HALT	ERROR																						
×	×	×	×	READ occupancy	Occupancy status																				
○	×	×	○	WRITE occupancy																					
Format																									
Request																									
<table><tr><td>H26</td><td>H00 (a)</td><td>H 0 0 0 0 0 2 8 0 (b)</td><td>(c)</td><td></td></tr></table> <table><tr><td>(d)</td></tr></table>					H26	H00 (a)	H 0 0 0 0 0 2 8 0 (b)	(c)		(d)															
H26	H00 (a)	H 0 0 0 0 0 2 8 0 (b)	(c)																						
(d)																									
<p>(a) Subcommand (fixed to H00)</p> <p>(b) Memory capacity of the parameter area (fixed to H00000280)</p> <p>(c) Memory capacity of the HI-FLOW area (designated in 8 digit hexadecimal) *1</p> <p>(d) Memory capacity of the HI-LADDER area (designated in 8 digit hexadecimal)</p> <p>*1: EH-150 does not support HI-FLOW.</p>																									
Response																									
<table><tr><td>(a)</td><td>H26</td></tr></table> <p>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</p>					(a)	H26																			
(a)	H26																								
Description																									
Request																									
<table><tr><td>H26</td><td>H00</td><td>Parameter area memory capacity</td><td>HI-FLOW user memory capacity</td><td>HI-LADDER user memory capacity</td></tr></table>					H26	H00	Parameter area memory capacity	HI-FLOW user memory capacity	HI-LADDER user memory capacity																
H26	H00	Parameter area memory capacity	HI-FLOW user memory capacity	HI-LADDER user memory capacity																					
Memory assignment table																									
<table><tr><td>Parameter area memory capacity</td><td>←</td></tr><tr><td>HI-FLOW user memory capacity</td><td>←</td></tr><tr><td>HI-LADDER user memory capacity</td><td>←</td></tr></table>					Parameter area memory capacity	←	HI-FLOW user memory capacity	←	HI-LADDER user memory capacity	←															
Parameter area memory capacity	←																								
HI-FLOW user memory capacity	←																								
HI-LADDER user memory capacity	←																								
After this task code is executed, always execute task code H27 “parameter modification completion”, when the memory write processing is complete.																									

Task code	H27	Parameter modification completion	Classification	Memory write																							
Function																											
Notifies the CPU that the parameter area data has been modified.																											
Execution condition																											
<table><tr><th colspan="4">CPU status</th><td></td><td></td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th><td></td><td></td></tr><tr><td>×</td><td>×</td><td>×</td><td>×</td><td>READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><td>○</td><td>×</td><td>×</td><td>○</td><td>WRITE occupancy</td></tr></table>					CPU status						STOP	RUN	HALT	ERROR			×	×	×	×	READ occupancy	Occupancy status	○	×	×	○	WRITE occupancy
CPU status																											
STOP	RUN	HALT	ERROR																								
×	×	×	×	READ occupancy	Occupancy status																						
○	×	×	○	WRITE occupancy																							
Format																											
<div>Request<div><div>H27</div></div></div> <div>Response<div><div>(a)H27</div></div><div>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div></div>																											
Description	<div><div>(1) Conducts I/O assignment based on the parameter information stored in parameter area (A) of the user memory so that the I/O and communication actions are performed according to the new I/O assignment.</div><div>(2) When the initialization of all user memory areas, zero clear, change in parameter area (A), or the writing of memory assignment is performed, always execute this task code when the memory write processing is completed.</div><div>(3) If the I/O assignment of each communication module is erased, or if the slots are changed after this task code has been executed, communication between the CPU and the connected host cannot be performed. In such cases, connect the programming device to the CPU and perform the necessary operations such as I/O assignment to recover.</div></div>																										

Task code	H28	Timer/counter set value modification	Classification	Memory write																								
Function																												
Modifies the set value for the HI-LADDER program timer or counter.																												
Execution condition																												
1] CPU status																												
<table><tr><td colspan="4">CPU status</td><td></td><td></td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td><td></td><td></td></tr><tr><td>×</td><td>×</td><td>×</td><td>×</td><td>READ occupancy</td><td>Occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td><td>status</td></tr></table>					CPU status						STOP	RUN	HALT	ERROR			×	×	×	×	READ occupancy	Occupancy	○	○	○	○	WRITE occupancy	status
CPU status																												
STOP	RUN	HALT	ERROR																									
×	×	×	×	READ occupancy	Occupancy																							
○	○	○	○	WRITE occupancy	status																							
2] The special internal output R7C7, which allows modifies while running, is on.																												
3] Normal scan time is less than 3 seconds while running.																												
4] In the case of ERROR, it is not in the severe error status. While a modification is performed in a status other than STOP or ERROR, the special internal output R7EA (modify in progress while running) will turn on.																												
Format																												
Request																												
<table><tr><td>H28</td><td>H02 (a)</td><td>(b)</td><td>(c)</td><td>(d)</td><td>(e)</td><td>(f1)</td><td>(f2)</td><td>(g1)</td><td>(g2)</td></tr></table>					H28	H02 (a)	(b)	(c)	(d)	(e)	(f1)	(f2)	(g1)	(g2)														
H28	H02 (a)	(b)	(c)	(d)	(e)	(f1)	(f2)	(g1)	(g2)																			
(a) Subcommand : H02 (fixed)																												
(b) Timer counter number : H0000 to H01FF (0 to 511)																												
(c) Change code : H00 Modify not performed.																												
H01 Modify time base only.																												
H02 Modify set value number 1 only.																												
H03 Modify time base and set value number 1.																												
H04 Modify set value number 2 only (WDT command).																												
H05 Modify time base and set value number 2 (WDT command).																												
H06 Modify set values number 1 and number2 (WDT command).																												
H07 Modify time base, set value number1 and set value number 2 (WDT command).																												
Note : When not making modification, set 0 in all digits.																												

(Example) When "H05" (change time base and set value number 2) is set as the modification code, set "0" for the I/O code (f1) and the I/O number (f2) of the set value number1, which is not to be modified.



- (d) Time base
- H00: Counter
  - H01: 0.01 second timer
  - H02: 0.1 second timer
  - H03: 1 second timer

The counter can be specified when the timer counter number is H0000 to H01FF (0 to 511).  
 The 0.01 second timer can be specified when the timer counter number is H0000 to H003F (0 to 63).  
 The 0.1 and 1 second timers can be specified when the timer counter number is H0000 to H00FF (0 to 255).

- (e) Address H0000 (must be fixed to H0000)

- (f1) Set value number 1 I/O code  
 (f2) Set value number 1 I/O number  
 (g1) Set value number 2 I/O code  
 (g2) Set value number 2 I/O number

Type	I/O code	I/O number
Constant	H07	H000000 to H00FFFF
WX	H08	H000000 to H004FF9
WY	H09	H000000 to H004FF9
WR	H0A	H000000 to H001FFF *1
WL	H0B	H000000 to H0003FF
		H001000 to H0013FF
WM	H0C	H000000 to H0003FF

Response

(a)	H28
-----	-----

- (a) Response task code (H00 when executed normally)

\*1: The WR area will vary depending on the CPU type.

EH-CPU104: to WRFFF      EH-CPU308: to WR43FF      EH-CPU448: to WRC3FF  
 EH-CPU208: to WR1FFF      EH-CPU316: to WR57FF

#### Description

Modifies the timer counter set value within the ladder program. While the CPU is running, the set values are modified without stopping the scan when the normal scan END command is executed.

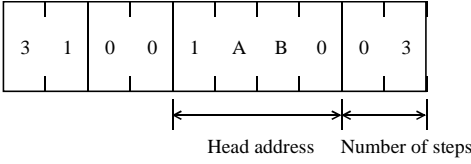
Note : When an address other than H0000 is designated, the settings will be modified if an error with the return code H04 (address error) or H0F (program not logical) occurs or if the timer is written to the designated address in the user program area, so take caution.

Task code	H31	Program read with address designation	Classification	Memory read																			
Function																							
Reads the designated number of program steps, starting with the designated address.																							
Execution condition																							
<table><tr><th colspan="4">CPU status</th></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr></table>					CPU status				STOP	RUN	HALT	ERROR	○	○	○	○	READ occupancy	Occupancy status	○	○	○	○	WRITE occupancy
CPU status																							
STOP	RUN	HALT	ERROR																				
○	○	○	○	READ occupancy	Occupancy status																		
○	○	○	○	WRITE occupancy																			
Format																							
Request																							
<table><tr><td>H31</td><td>H00 (a)</td><td>(b)</td><td>(c)</td></tr></table>					H31	H00 (a)	(b)	(c)															
H31	H00 (a)	(b)	(c)																				
(a) Dummy (must be fixed to H00)																							
(b) Head address (absolute address in the CPU module)																							
(c) Number of steps (H01 to H3C, 60 steps maximum)																							
Response																							
<table><tr><td>(a)</td><td>H31</td><td>(b)</td><td>(b)</td></tr></table> <div><div>1st step</div><div>Nth step</div></div>					(a)	H31	(b)	(b)															
(a)	H31	(b)	(b)																				
(a) Response task code (H00)																							
For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.																							
(b) Program contents																							
Description																							
Request																							
<table><tr><td>H31</td><td>H00</td><td>Head address</td><td>Number of steps</td></tr></table>					H31	H00	Head address	Number of steps															
H31	H00	Head address	Number of steps																				
<div><div>Number of steps</div><div>User memory</div><div>Response</div><div><table><tr><td>H00</td><td>H31</td><td>1st step</td><td>2nd step</td><td>3rd step</td></tr></table></div></div>					H00	H31	1st step	2nd step	3rd step														
H00	H31	1st step	2nd step	3rd step																			

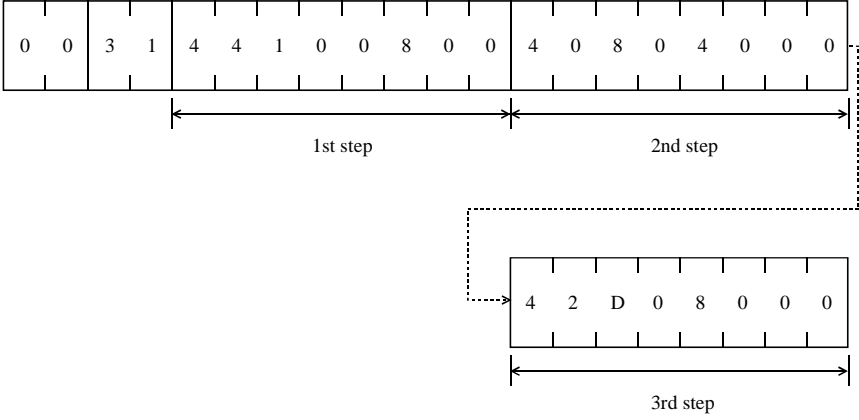
Example

Reads three steps, starting with address H1AB0.

Request



Response



Task code	H33	Final ladder search	Classification	Memory read																				
Function																								
Returns the circuit number, head address and the number of steps of the final circuit. (HI-LADDER only)																								
Execution condition																								
<table><tr><td colspan="4">CPU status</td><td rowspan="2">READ occupancy</td><td rowspan="3">Occupancy status</td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr></table>					CPU status				READ occupancy	Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	WRITE occupancy	○	○	○	○	
CPU status				READ occupancy	Occupancy status																			
STOP	RUN	HALT	ERROR																					
○	○	○	○	WRITE occupancy																				
○	○	○	○																					
Format																								
<p>Request</p> <table><tr><td>H33</td></tr></table> <p>Response</p> <table><tr><td>(a)</td><td>H33</td><td>(b)</td><td>(c)</td><td>(d)</td></tr></table> <p>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</p> <p>(b) Circuit number (4 digit hexadecimal)</p> <p>(c) Head address (4 digit hexadecimal)</p> <p>(d) Number of steps (4 digit hexadecimal)</p> <p>Note : When there is no program</p> <p>(b) Circuit number = H0000</p> <p>(c) Head address = H0000</p> <p>(d) Number of steps = H0000</p>					H33	(a)	H33	(b)	(c)	(d)														
H33																								
(a)	H33	(b)	(c)	(d)																				

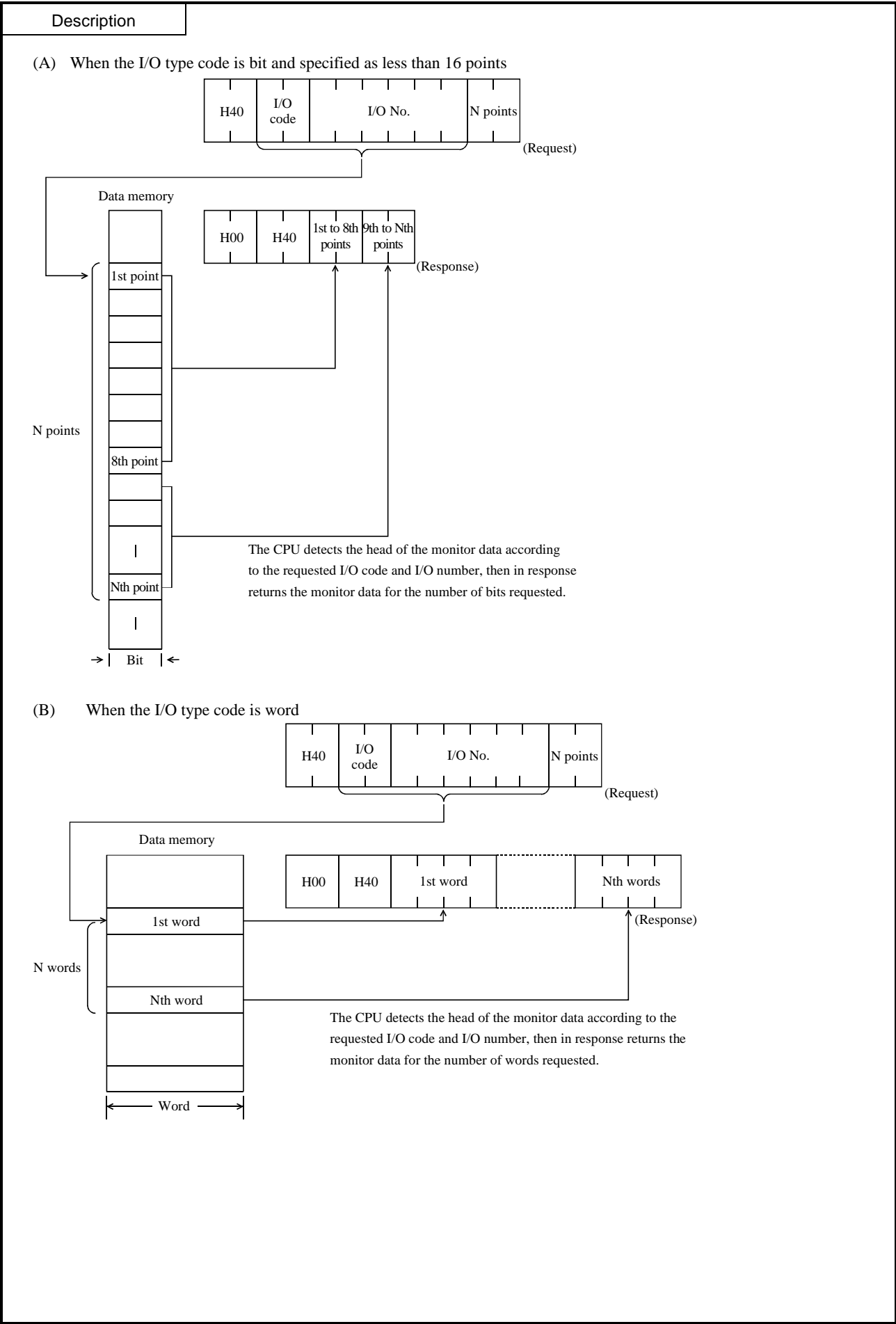
Description	
<div><div>User memory</div><div><div><div>Circuit number 1</div><div>Final circuit</div></div><div><div>H33</div><div><div>H00H33Circuit number of the final circuitHead addressNumber of steps</div><div>Number of steps</div></div></div></div></div>	
Example	
<p>Assume the final circuit number as 100 (H64), the head address as H1C80 and the number of steps as 10 (H0A).</p> <p>Request</p> <div><div>33</div></div> <p>Response</p> <div><div><div>003300641C80000A</div><div>Circuit numberHead addressNumber of steps</div></div></div>	



Task code	H35	Read memory assignment		Classification	Memory read																						
Function																											
Reads the assigned memory capacity data.																											
Execution condition																											
<table><tr><td colspan="4">CPU status</td><td rowspan="2">READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td><td></td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr></table>						CPU status				READ occupancy	Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	WRITE occupancy		○	○	○	○		
CPU status				READ occupancy	Occupancy status																						
STOP	RUN	HALT	ERROR																								
○	○	○	○	WRITE occupancy																							
○	○	○	○																								
Format																											
Request																											
<table><tr><td>H35</td><td>H00</td></tr></table>						H35	H00																				
H35	H00																										
Response																											
<table><tr><td>(a)</td><td>H35</td><td>(b)</td><td>(c)</td></tr></table> <div><div>(d)</div></div>						(a)	H35	(b)	(c)																		
(a)	H35	(b)	(c)																								
<div>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div> <div>(b) Parameter area memory capacity (H00000280 fixed)</div> <div>(c) HI-FLOW user program memory capacity (8 digit hexadecimal) *</div> <div>(d) HI-LADDER use program memory capacity (8 digit hexadecimal)</div> <div>* EH-150 does not support HI-FLOW.</div>																											

Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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I/O codes chart

I/O code	Symbol
H00	X
H01	Y
H02	R
H03	L
H04	M
H05	Timer, counter
H06	CL
H07	(Unused)
H08	WX
H09	WY
H0A	WR
H0B	WL
H0C	WM
H0D	TC
H0E	DIF
H0F	DFN

I/O number decimal/hexadecimal conversion chart

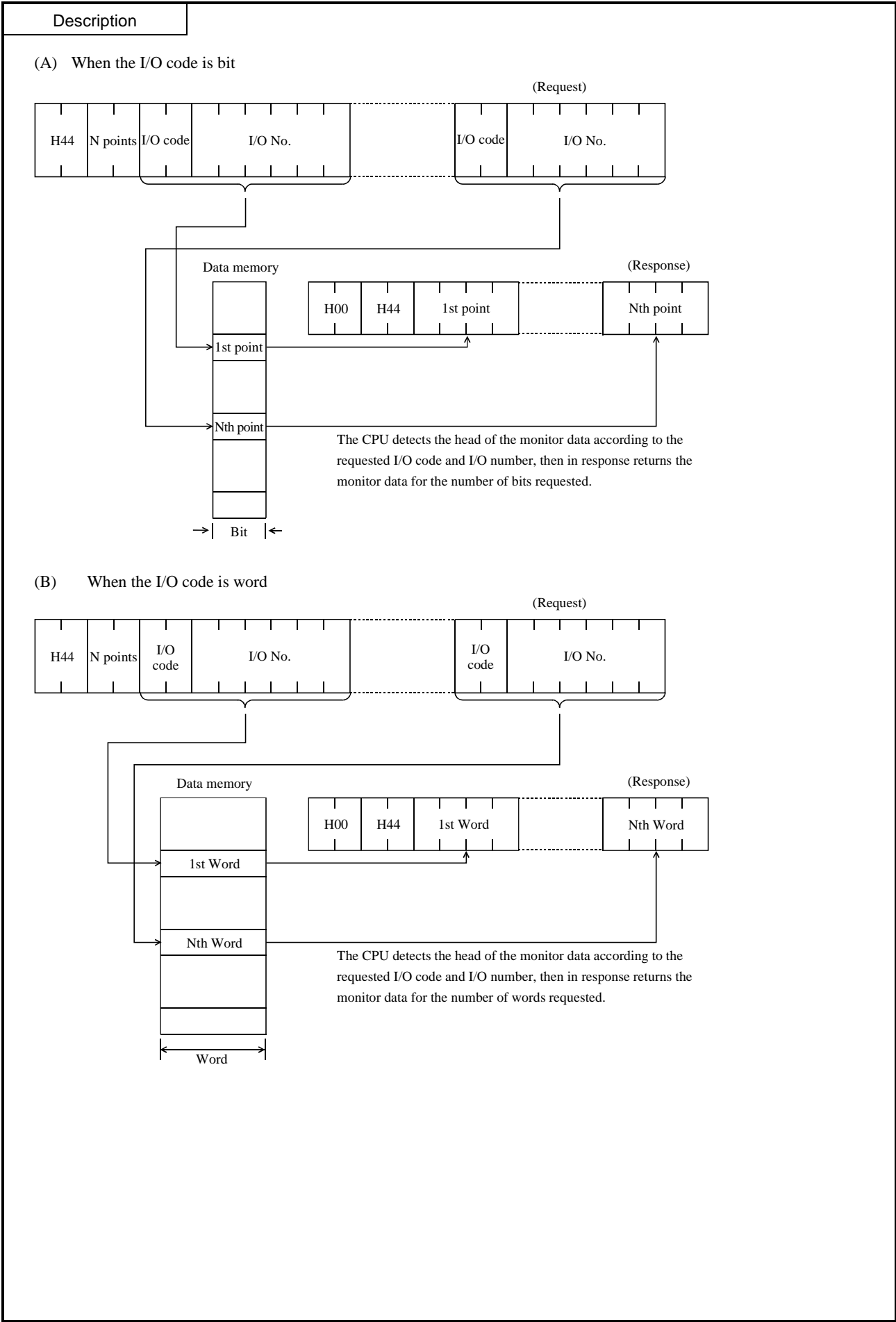
Symbol	I/O code	I/O number	
		Decimal (partially hexadecimal)	Hexadecimal
X	H00	00000 to 4FF95	H000000 to H4FF5F
Y	H01	00000 to 4FF95	H000000 to H4FF5F
Timer, counter	H05	0 to 511	H000000 to H0001FF
CL	H06	0 to 511	H000000 to H0001FF
WX	H08	0000 to 4FF9	H000000 to H004FF9
WY	H09	0000 to 4FF9	H000000 to H004FF9
TC	H0D	0 to 511	H000000 to H0001FF
DIF	H0E	0 to 511	H000000 to H0001FF
DFN	H0F	0 to 511	H000000 to H0001FF

Note :

1. In the decimal expression of X and Y, the lower two digits are decimal and the upper three digits are hexadecimal. Perform conversion from decimal to hexadecimal with respect to the lowest two digits.  
(Example) 4FF90 → 4FF5A
2. In the decimal expression of WX, WY, the lowest digit is decimal and the upper three digits are hexadecimal.

Task code	H42	Forced set/reset with I/O number designation (N continuous points)	Classification	I/O control																						
Function	Forcibly sets and resets the designated data in N continuous points (words) of data area, starting with the designated I/O.																									
Execution condition	<table><tr><th colspan="4">CPU status</th><td rowspan="2">READ occupancy</td><td rowspan="2">Occupancy status</td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td><td></td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr></table>				CPU status				READ occupancy	Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	WRITE occupancy		○	○	○	○		
CPU status				READ occupancy	Occupancy status																					
STOP	RUN	HALT	ERROR																							
○	○	○	○	WRITE occupancy																						
○	○	○	○																							
Format	<p>Request</p> <table><tr><td>H42</td><td>(a)</td><td>(b)</td><td>(c)</td><td>(d)</td></tr></table> <div><div>(a) I/O code</div><div>(b) I/O number</div><div>(c) Number of bits H01 to HC8 (1 to 200) Number of words H01 to H64 (1 to 100)</div><div>*1: Refer to the task code H40</div><div>(d) Set/reset data</div></div> <div><div>(d) Set/reset data</div><div>(Bit data)</div><div><div>Number of points/8</div><div><div>bit7</div><div>0</div></div><div><div>1st point</div><div>2nd point</div><div></div><div></div><div></div><div></div><div></div><div>8th point</div></div><div>Binary image (H00 to HFF)</div></div><div><div>(Word data)</div><div><div>Word number value</div><div><div>H</div><div>L</div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div>1st word</div><div>Nth word</div></div><div>Binary image (H0000 to HFFFF)</div></div></div><p>Response</p><table><tr><td>(a)</td><td>H42</td></tr></table><div><div>(a) Response task code (H00 when executed normally)</div><div>For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter.</div><div>* The EH-150 returns “H00” (normal execution) even for I/Os that are out of range.</div></div></div>				H42	(a)	(b)	(c)	(d)	(a)	H42															
H42	(a)	(b)	(c)	(d)																						
(a)	H42																									

Task code	H44	Monitoring with I/O number designation (N random points)	Classification	I/O control																						
Function	Reads the monitor data by designating N random points (words) of I/O numbers.  * This task code can also be executed when the CPU is not occupied. However, the response task code will be “H02” (local station is not occupying the CPU).  * The I/O data of EH-150 outside the range returns all off (0).																									
Execution condition	<table><tr><th colspan="4">CPU status</th><td rowspan="4">Occupancy status</td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>				CPU status				Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	○	○	○	○	○	○	○	○	Not occupied
CPU status				Occupancy status																						
STOP	RUN	HALT	ERROR																							
○	○	○	○																							
○	○	○	○																							
○	○	○	○	Not occupied																						
Format	<p>Request</p> <div><div>1st point (word)</div><div><table><tr><td>H44</td><td>(a)</td><td>(b)</td><td>(c)</td></tr></table></div><div>Nth point (word)</div><div><table><tr><td>(b)</td><td>(c)</td></tr></table></div></div> <p>(a) Number of bits/number of words H01 to H3F (1 to 60) (b) I/O code (c) I/O number</p> <p>Refer to the task code H40.</p> <p>Response</p> <div><div>Monitor data (1st point, 1st word)</div><div><table><tr><td>(a)</td><td>H44</td><td>(b)</td></tr></table></div><div>Monitor data (Nth point, Nth word)</div><div><table><tr><td>(b)</td></tr></table></div></div> <p>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter. (b) Monitor data (refer to below for details)</p> <p>(Bit data)</p> <div><table><tr><td>0</td><td>0</td><td>0</td></tr></table><p>← “0” or “1”</p><p>1 point</p></div> <p>(Word data)</p> <div><table><tr><td></td></tr></table><p>← H0000 to HFFFF</p><p>1 word</p></div>				H44	(a)	(b)	(c)	(b)	(c)	(a)	H44	(b)	(b)	0	0	0									
H44	(a)	(b)	(c)																							
(b)	(c)																									
(a)	H44	(b)																								
(b)																										
0	0	0																								



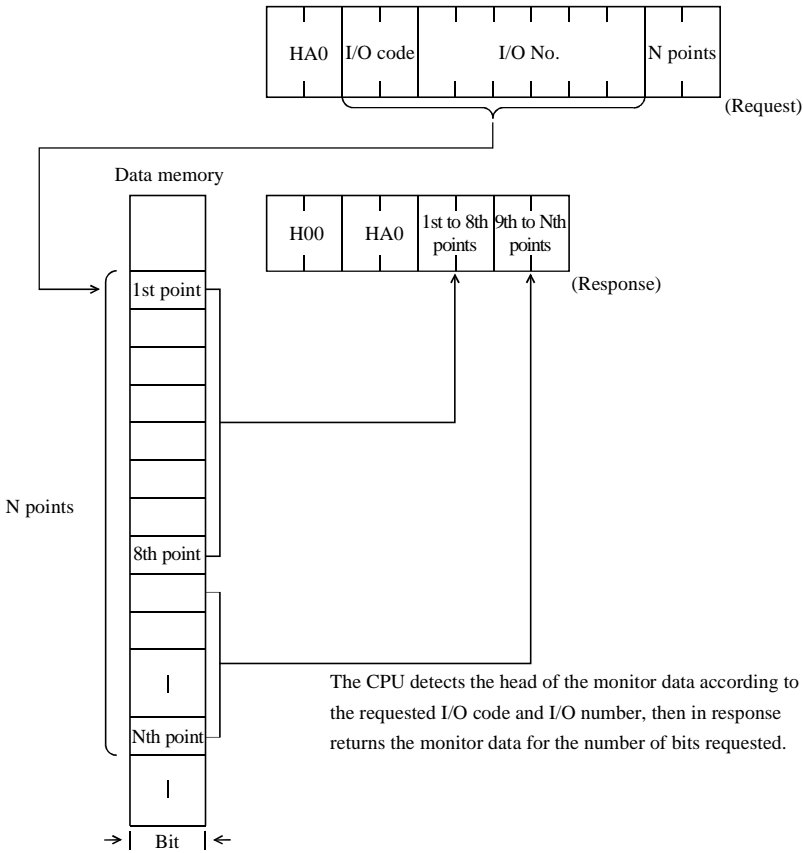


Task code	H45	Forced set/reset with I/O number designation (N random points)	Classification	I/O control																			
Function	Designates N points (words) of I/O numbers randomly, and forcibly sets the designated data or resets the data area.																						
Execution condition	<table><tr><th colspan="4">CPU status</th><td rowspan="2">Occupancy status</td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr></table>				CPU status				Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	READ occupancy	○	○	○	○	WRITE occupancy
CPU status				Occupancy status																			
STOP	RUN	HALT	ERROR																				
○	○	○	○	READ occupancy																			
○	○	○	○	WRITE occupancy																			
Format	<p>Request</p> <div><table><tr><td>H45</td><td>(a)</td><td>(b)</td><td>(c)</td><td>(d)</td></tr></table><p>1st point, 1st word</p></div> <div><p>(a) Number of bits/number of words H01 to H28 (1 to 40) (b) I/O code (c) I/O number (d) Data</p><p>Refer to the task code H40.</p><div><table><tr><td>(b)</td><td>(c)</td><td>(d)</td></tr></table><p>Nth point, Nth word</p></div></div> <p>(Bit data)</p> <div><table><tr><td>0</td><td>0</td><td>0</td></tr></table><p>"0" or "1"</p></div> <p>(Word data)</p> <div><table><tr><td></td><td></td><td></td></tr></table><p>H0000 to HFFFF</p></div> <p>Response</p> <div><table><tr><td>(a)</td><td>H45</td></tr></table><p>(a) Response task code For task codes other than the normal task codes, refer to the "response list by task code" at the end of this chapter.</p><p>* The EH-150 returns "H00" (normal execution) even for I/Os that are out of range.</p></div>				H45	(a)	(b)	(c)	(d)	(b)	(c)	(d)	0	0	0				(a)	H45			
H45	(a)	(b)	(c)	(d)																			
(b)	(c)	(d)																					
0	0	0																					
(a)	H45																						

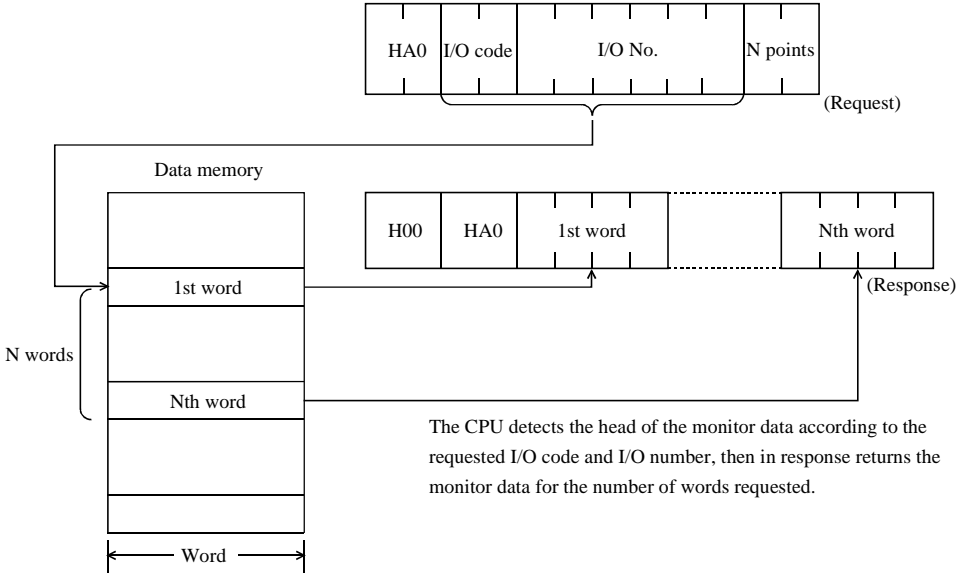
Task code	HA0	Monitoring with I/O number designation (N continuous points)	Classification	I/O control																															
Function	Reads N continuous points (words) of monitor data, starting with the designated I/O number. * This task code can also be executed when the CPU is not occupied. * The I/O data of EH-150 outside the range returns all off (0).																																		
Execution condition	<table><tr><th colspan="4">CPU status</th><td></td><td></td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th><td></td><td></td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td><td rowspan="3">Occupancy status</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>				CPU status						STOP	RUN	HALT	ERROR			○	○	○	○	READ occupancy	Occupancy status	○	○	○	○	WRITE occupancy	○	○	○	○	Not occupied			
CPU status																																			
STOP	RUN	HALT	ERROR																																
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○	○	○	○	WRITE occupancy																															
○	○	○	○	Not occupied																															
Format	<div>Request</div> <table><tr><td>HA0</td><td>(a)</td><td>(b)</td><td>(c)</td></tr></table> <div>(a) I/O code (b) I/O number (c) Number of bits H01 to HF0 (1 to 240) Number of words H01 to H78 (1 to 120)</div> <div>Response</div> <table><tr><td>(a)</td><td>HA0</td><td>(b)</td></tr></table> <div>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter. (b) Monitor data</div> <div>(b) Monitor data</div> <div>(Bit data)</div> <div><div>Number of points/8</div><table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table><div>bit7 → 0</div><table><tr><td>1st point</td><td>2nd point</td><td></td><td></td><td></td><td></td><td></td><td>8th point</td></tr></table><div>Binary image (H00 to HFF)</div></div> <div>When the number of monitor points is less than 8 points, the open bits are set to 0 (H00 to HFF).</div> <div>(Word data)</div> <div><div>Number of words</div><table><tr><td>H</td><td>L</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table><div>1 wordNth word</div><div>Binary image (H0000 to HFFFF)</div></div>				HA0	(a)	(b)	(c)	(a)	HA0	(b)									1st point	2nd point						8th point	H	L						
HA0	(a)	(b)	(c)																																
(a)	HA0	(b)																																	
1st point	2nd point						8th point																												
H	L																																		

Description

(A) When the I/O type code is bit and specified as less than 16 points.

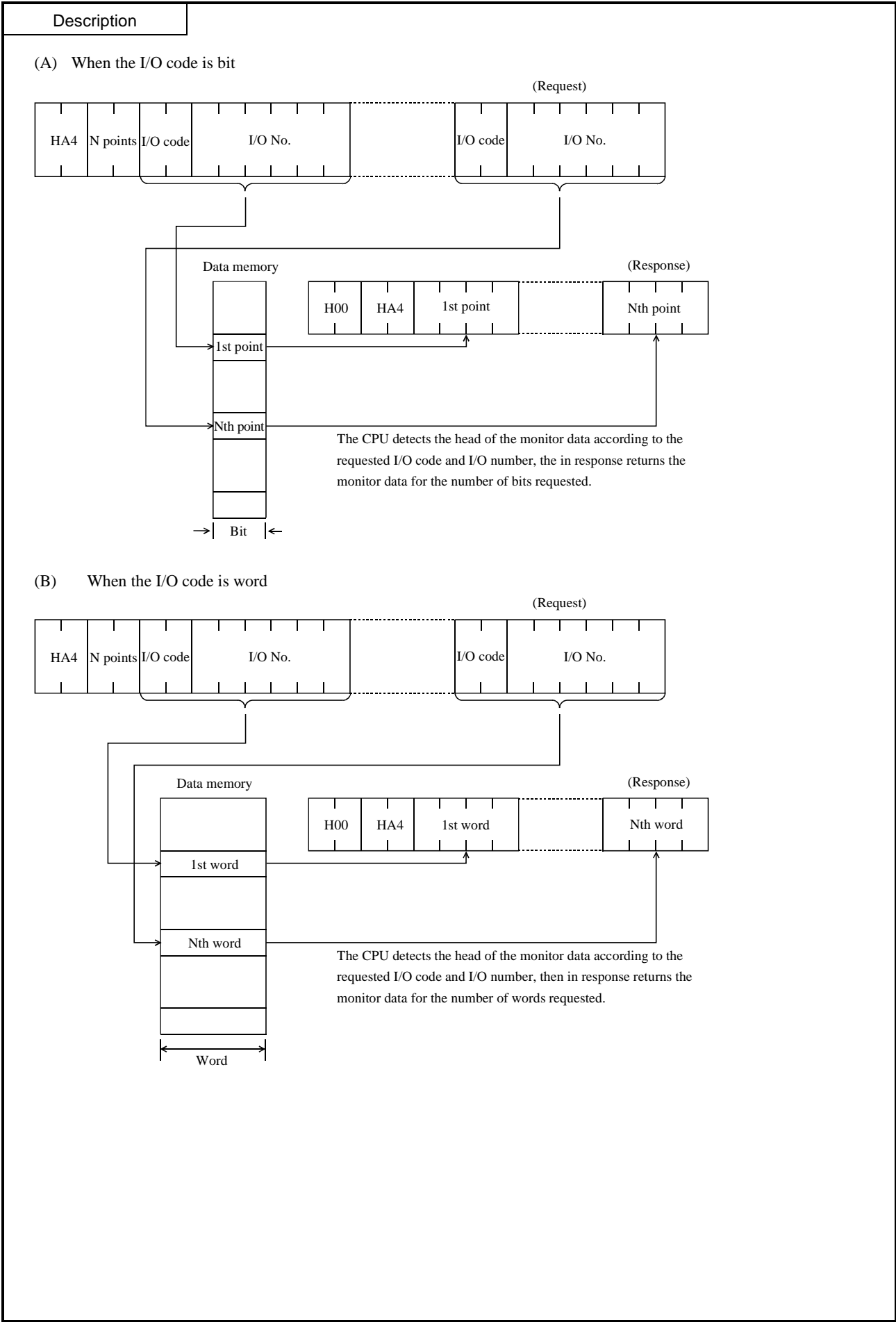


(B) When the I/O type code is word



Task code	HA2	Forced set/reset with I/O number designation (N continuous points)	Classification	I/O control																																
Function	Forcibly sets and resets the designated data in N continuous points (words) of data area, starting with the specified I/O. * This task code can also be executed when the CPU is not occupied.																																			
Execution condition	<table><tr><th colspan="4">CPU status</th><td rowspan="4">Occupancy status</td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>				CPU status				Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	○	○	○	○	○	○	○	○	READ occupancy	○	○	○	○	WRITE occupancy	○	○	○	○	Not occupied
CPU status				Occupancy status																																
STOP	RUN	HALT	ERROR																																	
○	○	○	○																																	
○	○	○	○																																	
○	○	○	○	READ occupancy																																
○	○	○	○	WRITE occupancy																																
○	○	○	○	Not occupied																																
Format	<div>Request</div> <table><tr><td>HA2</td><td>(a)</td><td>(b)</td><td>(c)</td><td>(d)</td></tr></table> <div>(a) I/O code (b) I/O number (c) Number of bits H01 to HC8 (1 to 200) Number of words H01 to H64 (1 to 100) (d) Set/reset data</div> <div>(d) Set/reset data (Bit data)</div> <div><div>Number of points/8</div><div><div>bit7</div><div>0</div></div><div>1st point2nd point8th point</div><div>Binary image (H00 to HFF)</div></div> <div>(Word data)</div> <div><div>Word number value</div><div>1st wordNth word</div><div>Binary image (H0000 to HFFFF)</div></div> <div>Response</div> <table><tr><td>(a)</td><td>HA2</td></tr></table> <div>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter. * The EH-150 returns “H00” (normal execution) even for I/Os that are out of range.</div>				HA2	(a)	(b)	(c)	(d)	(a)	HA2																									
HA2	(a)	(b)	(c)	(d)																																
(a)	HA2																																			

Task code	HA4	Monitoring with I/O number designation (N random points)	Classification	I/O control																								
Function	Reads the monitor data by designating N random points (words) of I/O numbers. * This task code can also be executed when the CPU is not occupied. * The I/O data of EH-150 outside the range returns all off (0).																											
Execution condition	<table><tr><th colspan="4">CPU status</th><td rowspan="4">Occupancy status</td></tr><tr><th>STOP</th><th>RUN</th><th>HALT</th><th>ERROR</th></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>				CPU status				Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	READ occupancy	○	○	○	○	WRITE occupancy	○	○	○	○	Not occupied
CPU status				Occupancy status																								
STOP	RUN	HALT	ERROR																									
○	○	○	○		READ occupancy																							
○	○	○	○		WRITE occupancy																							
○	○	○	○	Not occupied																								
Format	<p>Request</p> <div><div>1st point (word)</div><div>Nth point (word)</div><div><table><tr><td>HA4</td><td>(a)</td><td>(b)</td><td>(c)</td><td>...</td><td>(b)</td><td>(c)</td></tr></table></div></div> <p>(a) Number of bits/number of words H01 to H3F (1 to 60) (b) I/O code (c) I/O number</p> <p>Refer to the task code H40.</p> <p>Response</p> <div><div>Monitor data (1st point, 1st word)</div><div>Monitor data (Nth point, Nth word)</div><div><table><tr><td>(a)</td><td>HA4</td><td>(b)</td><td>...</td><td>(b)</td></tr></table></div></div> <p>(a) Response task code (H00 when executed normally) For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter. (b) Monitor data (refer to below for details)</p> <p>(Bit data)</p> <div><table><tr><td>0</td><td>0</td><td>0</td></tr></table><p>← "0" or "1"</p><p>1 point</p></div> <p>(Word data)</p> <div><table><tr><td></td><td></td><td></td></tr></table><p>← H0000 to HFFFF</p><p>1 word</p></div>				HA4	(a)	(b)	(c)	...	(b)	(c)	(a)	HA4	(b)	...	(b)	0	0	0									
HA4	(a)	(b)	(c)	...	(b)	(c)																						
(a)	HA4	(b)	...	(b)																								
0	0	0																										



Task code	HA5	Forced set/reset with I/O number designation (N random points)	Classification	I/O control																																
Function	Designates N points (words) of I/O numbers randomly, and forcibly sets the designated data or resets the data area. * This task code can also be executed when the CPU is not occupied.																																			
Execution condition	<table><tr><th colspan="4">CPU status</th><td rowspan="4">Occupancy status</td></tr><tr><td>STOP</td><td>RUN</td><td>HALT</td><td>ERROR</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>READ occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>WRITE occupancy</td></tr><tr><td>○</td><td>○</td><td>○</td><td>○</td><td>Not occupied</td></tr></table>				CPU status				Occupancy status	STOP	RUN	HALT	ERROR	○	○	○	○	○	○	○	○	○	○	○	○	READ occupancy	○	○	○	○	WRITE occupancy	○	○	○	○	Not occupied
CPU status				Occupancy status																																
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○	○	○	○	WRITE occupancy																																
○	○	○	○	Not occupied																																
Format	<p>Request</p> <div><div><div>HA5</div><div>(a)</div><div>(b)</div><div>(c)</div><div>(d)</div></div><div>1st point, 1st word</div></div> <div><div>(a) Number of bits/number of words H01 to H28 (1 to 40)</div><div>(b) I/O code</div><div>(c) I/O number</div><div>(d) Data</div></div> <div>Refer to the task code H40.</div> <div><div>(b)</div><div>(c)</div><div>(d)</div></div> <div>Nth point, Nth word</div> <p>(Bit data)</p> <div><div>0 0 0</div><div>"0" or "1"</div></div> <p>(Word data)</p> <div><div></div><div>H0000 to HFFFF</div></div> <p>Response</p> <div><div>(a)</div><div>HA5</div></div> <div>(a) Response task code For task codes other than the normal task codes, refer to the “response list by task code” at the end of this chapter. * The EH-150 returns “H00” (normal execution) even for I/Os that are out of range.</div>																																			

Task code response list

Task code	Subcommand		Response task code		Return code		Error cause
		Code		Code		Code	
H10	Status	H00	Normal execution	H00			
	Memory status	H01	Normal execution	H00			
	Software version	H02	Normal execution	H00			
	CPU error code	H03	Normal execution	H00			
	Call CPU name	H04	Normal execution	H00			
	Undefined	H05 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
	None		Abnormal task code	H01	Abnormal number of steps/words	H05	Only the task code is input.
H11	Stop designation	H00	Normal execution	H00			
			Not-executable	H03	Operation error	H0C	Setting is not in remote status. Remote STOP is not enabled.
	Run designation	H01	Normal execution	H00			
			Not-executable	H03	Operation error	H0C	Setting is not in remote status. CPU is in error status. WRITE-occupied by other station. Remote RUN is not enabled. User-set run condition is not satisfied.
					Combination error	H0E	A RUN-prohibited task code has already been executed and the CPU is in RUN-prohibited state.
	Undefined	H02 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
	None		Abnormal task code	H01	Abnormal number of steps/words	H05	Only the task code is input.
H16	Cancel occupancy	H00	Normal execution	H00			
	READ occupancy	H01	Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H04	Local station is WRITE-occupying CPU.
					READ occupancy maximum exceeded	H06	Already READ-occupied by the other four stations.
					Occupied by another station	H08	Another station is WRITE-occupying CPU.
	WRITE occupancy	H02	Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU.
					Occupied by another station	H08	CPU is occupied by another station.
	Occupancy mode modification (WRITE → READ)	H05	Normal execution	H00			
			Not-executable	H03	Not occupied	H07	Local station is not occupying the CPU.
	Occupancy mode modification (READ → WRITE)	H06	Normal execution	H00			
			Not-executable	H03	Not occupied	H07	Local station is not occupying the CPU.
					Occupied by another station	H08	CPU is occupying by another station.
	Undefined	H03, H04, H07 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
	None		Abnormal task code	H01	Abnormal number of steps/words	H05	Only the task code is input.
H17	Forced cancel of all peripherals	H00	Normal completion	H00			
	Forced cancel of local station	H01	Normal completion	H00			
	Undefined	H02 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
	None		Abnormal task code	H01	Abnormal number of steps/words	H05	Only the task code is input.
H18	Reading the calendar clock	H00	Normal execution	H00			
			Not-executable	H03	RTC cannot be accessed	H10	Abnormal RTC, or not mounting
	Setting the calendar clock	H01	Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	Parameter length is too short.



Task code	Subcommand		Response task code		Return code		Error cause
		Code		Code		Code	
H18	Setting the calendar clock	H01	Not-executable	H03	Operation error	H0C	Abnormal set value
					RTC cannot be accessed	H10	Abnormal RTC, or not mounting
	30 second adjustment	H02	Normal execution	H00			
			Not-executable	H03	RTC cannot be accessed	H10	Abnormal RTC, or not mounting
	Undefined	H03 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
H1C			Normal execution	H00			
H20	Initialize all user memory area	H00	Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					RAM error	H0A	READ/WRITE check results did not match
					CPU is running	H0B	CPU is running
	Initialize HI-FLOW area	H01	Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running and “modify during RUN” mode is not set
	Initialize HI-LADDER area	H02	Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running and “modify during RUN” mode is not set
	Zero clear all user memory area	H03	Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running
	Undefined	H04 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
H23	Write to parameter area (A)	H00	Normal execution	H00			
			Abnormal task code	H01	Abnormal address	H04	Transfer address is outside the specified range of parameter area (A)
					Abnormal number of steps/words	H05	Number of transfer steps are outside the specified range
					Memory over	H09	“Address + number of steps” exceeds the parameter area
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running
	Write to HI-FLOW area	H01	Normal execution	H00			
			Abnormal task code	H01	Abnormal address	H04	Transfer address is outside the designated range of HI-FLOW area
					Abnormal number of steps/words	H05	Number of transfer steps are outside the designated range
					Memory over	H09	“Address + number of steps” exceeds the flow area
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running
	Write to HI-LADDER area	H02	Normal execution	H00			
			Abnormal task code	H01	Abnormal address	H04	Transfer address is outside the designated range of HI-LADDER area
					Abnormal number of steps/words	H05	Number of transfer steps are outside the designated range
					Memory over	H09	“Address + number of steps” exceeds the ladder area

Task code	Subcommand		Response task code		Return code		Error cause
		Code		Code		Code	
H23	Write to HI-LADDER area	H02	Not-executable	H03	ROM memory	H01	Program memory is ROM
					Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running and “modify during RUN” mode is not set
	Write to parameter area (B)	H03	Normal execution	H00			
			Abnormal task code	H01	Abnormal address	H04	Transfer address is outside the designated range of parameter area (B)
					Abnormal number of steps/words	H05	Number of transfer steps are outside the designated range
					Memory over	H09	“Address + number of steps” exceeds the parameter area
			Not-executable	H03	Occupancy code mismatch	H03	Local station is READ-occupying CPU
					Not occupied	H07	Local station is not occupying CPU
					CPU is running	H0B	CPU is running and “modify during RUN” mode is not set
	Undefined	H04 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
	None		Abnormal task code	H01	Abnormal number of steps/words	H05	Only the task code is input.
H26	Memory assignment	H00 (Fixed)	Normal execution	H00			
			Abnormal task code	H01	Memory size over	H0A	Memory assignment total has exceeded the physical memory capacity.
			Not-executable	H03	Occupancy code mismatch	H03	READ-occupied by local station.
					Not occupied	H07	Local station is not occupying CPU.
					CPU is running	H0B	CPU is running and “modify during RUN” mode is not set.
	Undefined	H01 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
	None		Abnormal task code	H01	Abnormal number of steps/words	H05	Task code input-parameter length is too short.
H27	End of parameter change		Normal execution	H00			
			Not-executable	H03	Occupancy code mismatch	H03	READ-occupying by local station.
					Not occupied	H07	Local station is not occupying CPU.
					CPU is running	H0B	CPU is running and “modify during RUN” mode is not set.
H28	Change set value of timer counter	H02 (Fixed)	Normal execution	H00			
			Abnormal task code	H01	Undefined subcommand	H02	Subcommand is other than 02H. Modification code is 08H or above.
					Abnormal address	H04	Address is abnormal.
					Abnormal number of steps/words	H05	Task code input-parameter length is too short.
					Abnormal I/O code	H06	I/O code is abnormal. Time base is H04 or above.
					Abnormal I/O number	H07	I/O number is abnormal. Timer counter number is 512 or above. The 1st set value of watchdog (constant) is greater than or equal to the 2nd set value (constant). 0.01 second, 0.1 second or 1.0 second was set as the time base when timer counter number was 256 or above. 0.01 second was set as the time base when timer counter number was 64 or above.
			Not-executable	H03	Inconsistent parameter	H02	The timer of the timer-counter number is used by HI-FLOW.
					Occupancy code mismatch	H03	READ-occupying by local station
					Not occupied	H07	Not occupied by local station.

Task code	Subcommand		Response task code		Return code		Error cause
		Code		Code		Code	
H28	Change set value of timer counter	H02 (Fixed)	Not-executable	H03	Not-occupied	H07	Local station is not occupying CPU.
					Operation error	H0C	R7C7 is off CPU severe error Scan time is more than 3 seconds
					No program	H0D	No program
					Inconsistent program	H0F	0.01 second, 0.1 second or 1.0 second was set as the time base for a counter. A counter is designated as the time base for a timer. Modification of second set value was specified as the modification code when other than WDT. Timer is not programmed in the designated user address.
H31	Read address designation program	H00 (Fixed)	Normal execution	H00			
			Abnormal task code	H01	Abnormal address	H04	Designated address exceeds the capacity of installed memory.
					Abnormal number of steps	H05	Number of read steps is outside the range of 1 to 60.
		Undefined	H01 to HFF	Not occupied	H03	Not occupied	H07
			Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
H33	None		Normal execution	H00			
			Not-executable	H03	Not-occupied	H07	Local station is not occupying CPU.
H35	Read memory assignment	H00	Normal execution	H00			
			Not-executable	H03	Not-occupied	H07	Local station is not occupying CPU.
	Reserved subcommand	H02 H04	Do not use.				
	Undefined	H01, H03, H05 to HFF	Abnormal task code	H01	Undefined subcommand	H02	Undefined subcommand is set.
H40	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined or is an I/O that cannot be forced to be set.
					Abnormal I/O No.	H07	The requested I/O type code is undefined or is an I/O that cannot be monitored.
			Warning	H02			Local station is not occupying CPU.
H42	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined.
					Abnormal I/O No.	H07	The requested I/O No. is outside the designated range.
			Not-executable	H03	Not occupied	H07	Local station is not occupying CPU.
H44	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined or is an I/O that cannot be forced to be set.
					Abnormal I/O No.	H07	The requested I/O type code is undefined.
			Warning	H02			Local station is not occupying CPU.
H45	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined or is an I/O that cannot be forced to be set.
					Abnormal I/O No.	H07	The requested I/O No. is outside the designated range.
			Not-executable	H03	Not occupied	H07	Local station is not occupying CPU.

Task code	Subcommand		Response task code		Return code		Error cause
		Code		Code		Code	
HA0	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined.
					Abnormal I/O No.	H07	The requested I/O No. is outside the designated range.
HA2	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined or is an I/O that cannot be forced to be set.
					Abnormal I/O No.	H07	The requested I/O No. is outside the designated range.
HA4	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words	H05	The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined.
					Abnormal I/O No.	H07	The requested I/O No. is outside the designated range.
HA5	None		Normal execution	H00			
			Abnormal task code	H01	Abnormal number of steps/words		The requested number of points is outside the designated range.
					Abnormal I/O code	H06	The requested I/O type code is undefined or is an I/O that cannot be forced to be set.
					Abnormal I/O No.	H07	The requested I/O No. is outside the designated range.

**MEMO**

[illegible]

**HITACHI**