HITACHI PROGRAMMABLE CONTROLLER

MICRO-EHV

USER'S MANUAL

DRAFT

NJI-591G(X)

○ Warranty period and coverage

The warranty period is the shorter period either 18 months from the data of manufacture or 12 months from the date of installation.
However within the warranty period, the warranty will be void if the fault is due to;

(1) Incorrect use as directed in this manual and the application manual.

(2) Malfunction or failure of external other devices than this unit.

(3) Attempted repair by unauthorized personnel.

(4) Natural disasters.

The warranty is for the PLC only, any damage caused to third party equipment by malfunction of the PLC is not covered by the warranty.

○ Repair

Any examination or repair after the warranty period is not covered. And within the warranty period any repair and examination which results in information showing the fault was caused by any of the items mentioned above, the repair and examination cost are not covered. If you have any questions regarding the warranty please contact wither your supplier or the local Hitachi Distributor. (Depending on failure part, examination might be impossible.)

○ 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

○ Reader of this manual

This manual is described for the following person.

- Person considering the introduction of PLC
- PLC system engineer
- Person handling PLC
- Manager after installing PLC

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.

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 classifies 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 blow:

: 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 a 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 (+) and (-) of the battery in reverse polarity. Do not recharge, disassemble, heat, place in fire, or short circuit the battery. There is a risk of explosion or fire.

PROHIBITED
• Do not attempt to disassemble, repair or modify any part of the PLC. Electric shock, malfunction or failure may result.

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

Revision History

No.	Description of Revision	Date of Revision	Manual number
1	The first edition	2021.08	NJI-591G(X)

MEMO

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Chapter 1 Introduction

Thank you for choosing Hitachi Programming Logic Controller (hereinafter referred to as PLC) MICRO-EHV Series. This manual describes the information you need to use various functions of the MICRO-EHV series. Before using MICRO-EHV, please read this manual carefully.

Also, refer to the related materials listed in Table 1.1.

Table 1.1 List of description materials

Item	Title of material	Manual number
MICRO-EHV hardware	MICRO-EHV HARDWARE MANUAL	NJI-589*(X)
MICRO-EHV programming	MICRO-EHV PROGRAMMING MANUAL	NJI-590*(X)
Programming software	Control Editor INSTRUCTION MANUAL	NJI-537*(X)

* The last digit of the manual number may change according to an updated version.

1.1 Terms used in this manual

Term	Description
MVH	MICRO-EHV High Function model basic unit
MVL	MICRO-EHV Standard model basic unit
this unit MICRO-EHV basic unit	MICRO-EHV basic unit (High Function or standard model)
Control Editor	Programming software for the MICRO-EHV/EH-150 EHV series
HMI	Human Machine Interface.
0x00, 0x00FF, H1234	A hexadecimal number is prefixed with 0x or H.
123,456, 65,535, 256	A decimal number is not prefixed.

1.2 Network configuration

You can configure various networks by combining various communication ports and option boards with this unit.

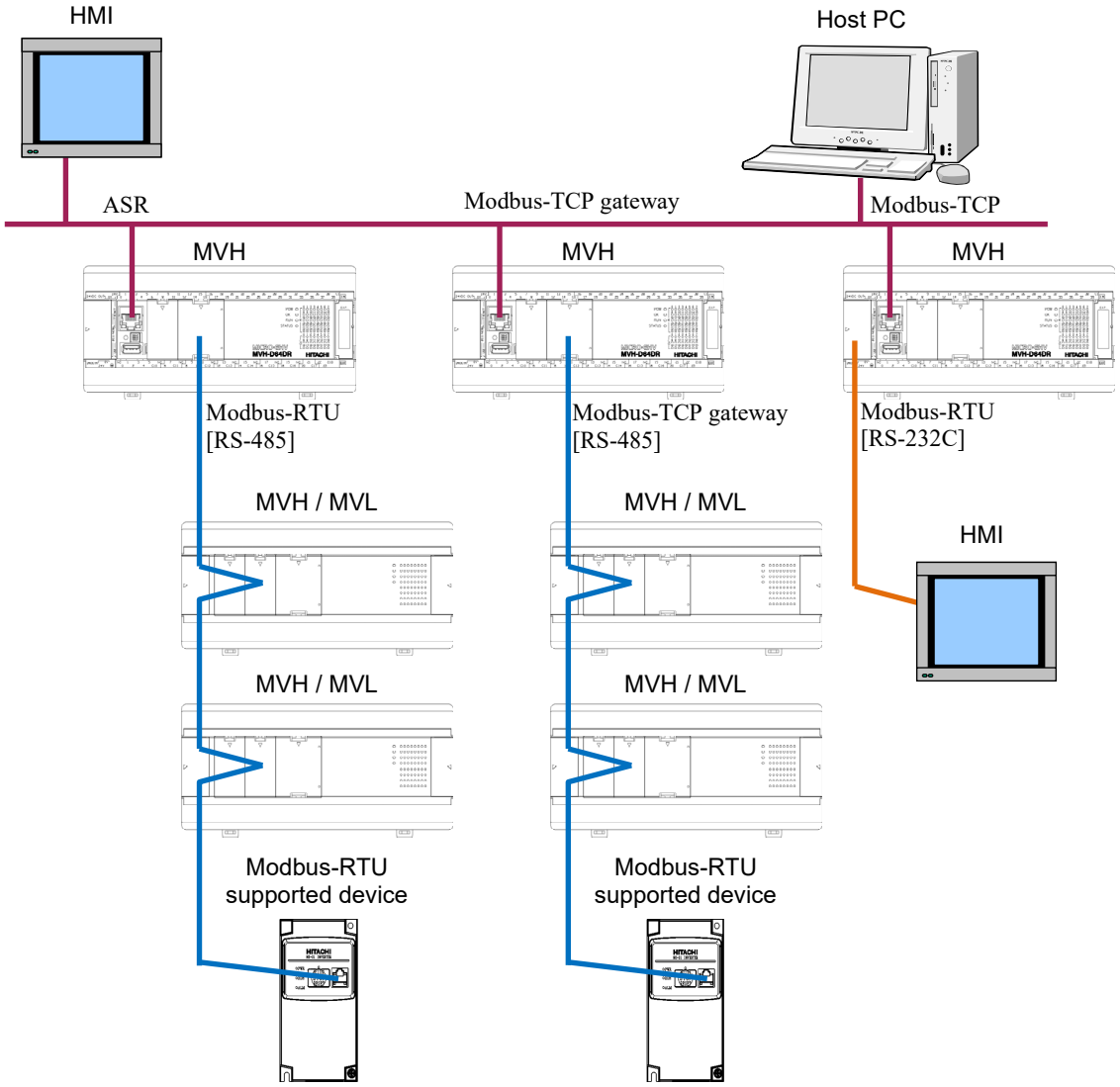

Figure 1.1 MICRO-EHV network configuration

1.3 Basic unit communication port

MVL is equipped with a USB port for programming and a serial communication port. MVH is equipped with an Ethernet port in addition to a USB port for programming and a serial communication port. You can also implement an option board to add a serial communication port to both MVH and MVL.

You can connect a personal computer with any communication port to create programs and monitor the status by using the programming software (hereinafter referred to as Control Editor).

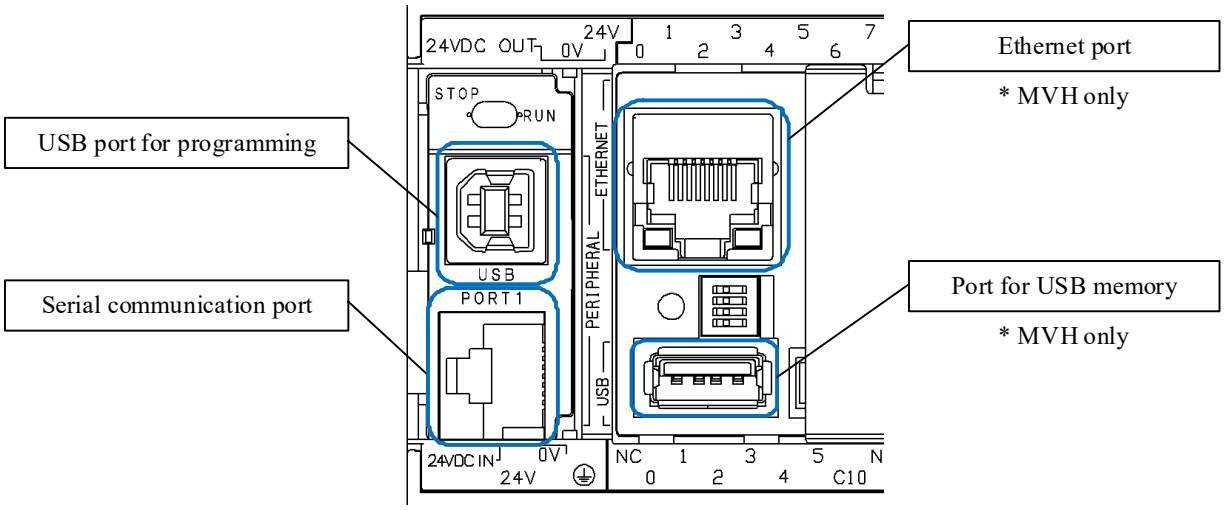

Figure 1.2 MICRO-EHV communication port

Caution

(1) If an Ethernet communication cable is connected to a serial communication port, the Serial communication port of MVH or **the external equipment connected to the Serial communication port may be damaged**.

(2) In a high speed 100BASE-TX connection (100 Mbps), a communication error may occur under influence of the installation environment, the cable length, or noises, resulting that the link with a network HUB may not be established or it may easily break.

In such a case, please reconstruct the network system using the following solutions:

(a) Use the TCP/IP communication protocol to communicate another equipment, and increase the number of times to retry if necessary.

(b) Replace the network HUB with a 10 Mbps product or change the setting to use the data communication rate of 10 Mbps.

(3) If the Control Editor has an online connection via USB, it may generate a communication error in a noisy environment. If a communication error is generated in a noisy environment, the serial communication port or the Ethernet port should be used for online connection.

(4) For stable communication, do not place a communication cable close to other wiring, nor put a power line or other wiring and the communication cable in the same duct.

Table 1.2 shows available functions on each communication port.

Table 1.2 MICRO-EHV communication ports and functions

No	Function \ Port		Serial communication port	USB port	Ethernet port	Option board RS-485
(1)	Dedicated procedure communication (Task code)		✓	✓	✓	✓
(2)	ASR communication		-	-	✓	-
(3)	Modbus-TCP	Gateway	-	-	✓	-
(4)		Slave	-	-	✓	-
(5)	NTP time acquisition communication		-	-	✓	-
(6)	General-purpose communication		✓	-	-	✓
(7)	Modbus-RTU	Master	-	-	-	✓
(8)		Slave	-	-	-	✓

(1) Dedicated procedure communication (Task code)

The Hitachi PLC implements dedicated communication procedures. The communication using these procedures is called a task code communication.

Advantages of the task code communication include:

1. It has the single master/multi slave style communication method as with the Modbus protocol.
2. It is unnecessary to create a ladder program for the task code communication on the PLC side.
3. It can be used for the USB, serial, and Ethernet transmission channels.
4. It is supported by major general-purpose HMI manufacturers including us.

The Control Editor communicates with this unit by using this task code communication. This enables the Control Editor to have an online connection via the USB, Ethernet, and serial ports.

The built-in serial communication port is compliant with the electric characteristics of RS-232C. It can be connected with only one communication equipment when using the task code communication.

The option boards provide RS-485-compliant communication ports. If the RS-485-compliant type option board is used, one master communication equipment can communicate with multiple MICRO-EHV basic units using the task code communication.

The Ethernet port has four logical ports for the task code communication, enabling concurrent communications with up to four equipment.

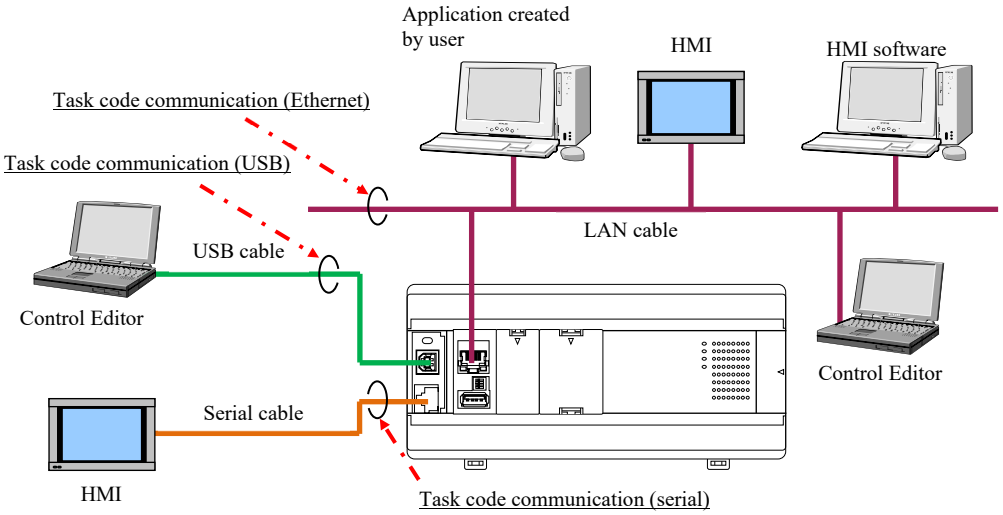

Figure 1.3 Task code communication

(2) ASR communication

The ASR communication function can be used on the Ethernet port. This unit has six logical ports for the ASR communication function (hereinafter referred to as ASR logical ports). You can transmit/receive message data to/from an upper host just by configuring certain settings from the Control Editor.

You can select TCP/IP or UDP/IP for the protocol, and Event or Cyclic sending for the data transmission timing. Data reception is processed by the system automatically. The communication method can be specified for each of the concurrently used six logical ports.

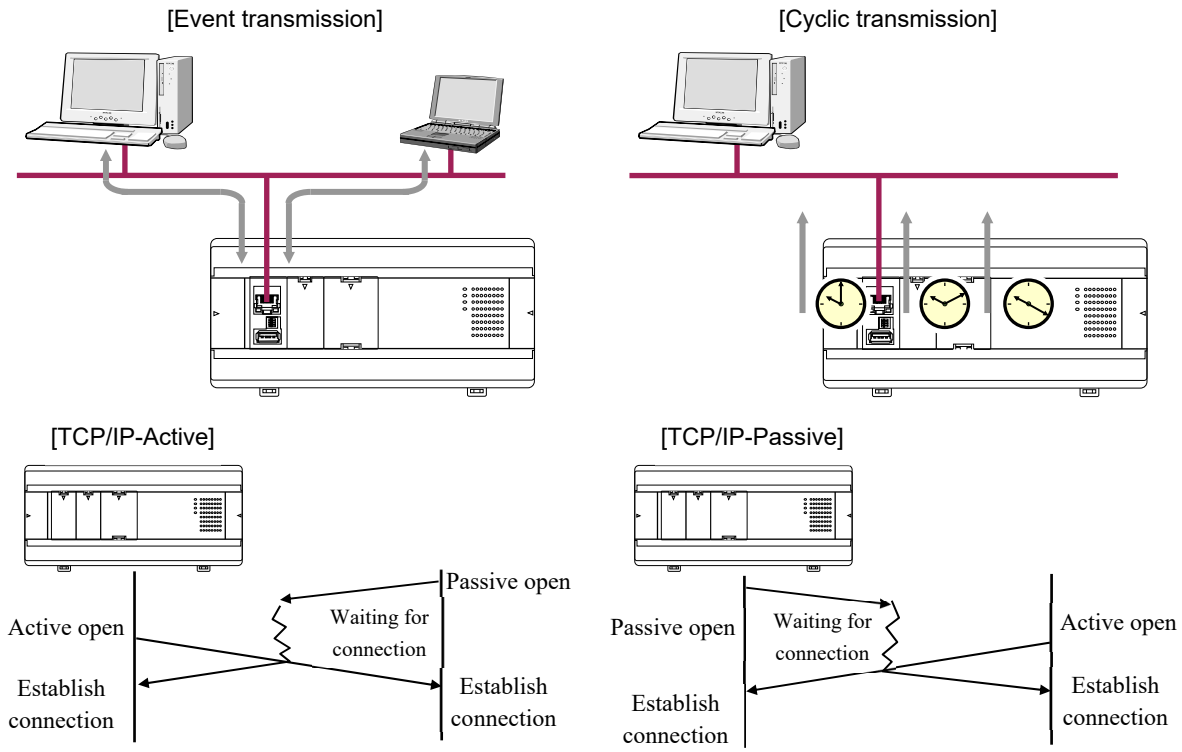

Figure 1.4 Ethernet communication port for ASR communication

(3)(4) Modbus-TCP (gateway/slave)

The Modbus-TCP gateway and slave functions can be used on the Ethernet port of MVH.

The gateway communication function receives messages for the slave on the Ethernet port and transmits them to the slave equipment via the option board.

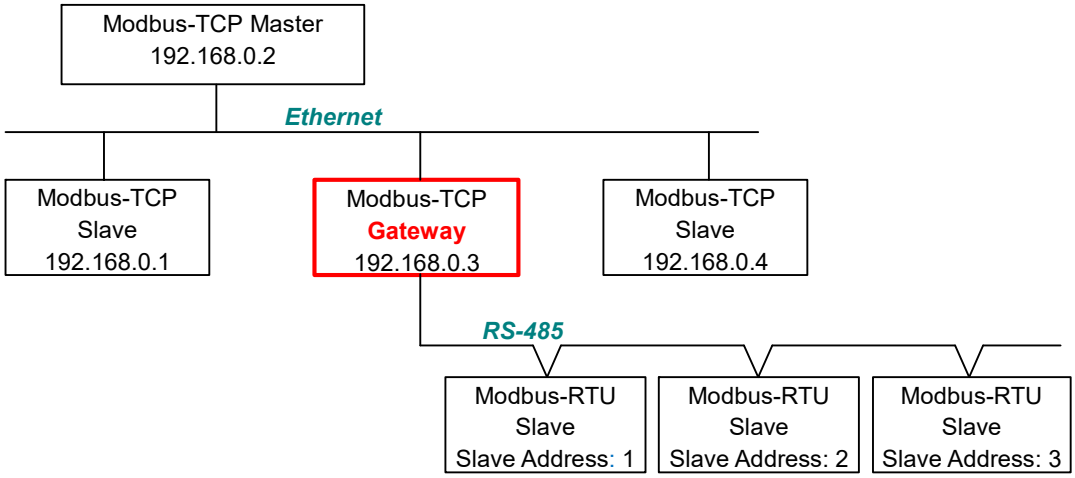

Figure 1.5 Example of system configuration with Modbus-TCP gateway function enabled

(5) NTP time acquisition communication

This communication function acquires the time information from NTP (Network Time Protocol) server or SNTP (Simple Network Time Protocol) server on the network. It is available on MVH equipped with the Ethernet port. When it acquires time information, it automatically corrects the time information controlled by MVH.

You can set the time acquisition interval in hours and minutes. Also, you can use a user program to control when to acquire the time information.

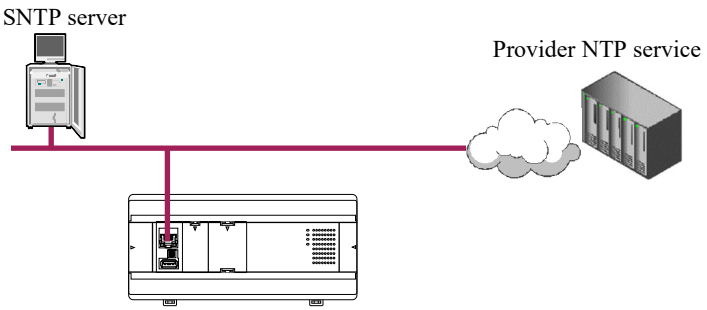

Figure 1.6 NTP time acquisition

(6) General-purpose communication

You can use the serial communication port and the RS-232C/RS-485 option board to exchange data with various commercial communication equipment using a general-purpose non-procedural communication. To use a general-purpose non-procedural communication, you need to program the communication processing using the dedicated TRNS0/RECV0 commands based on the specification of an equipment to communicate with.

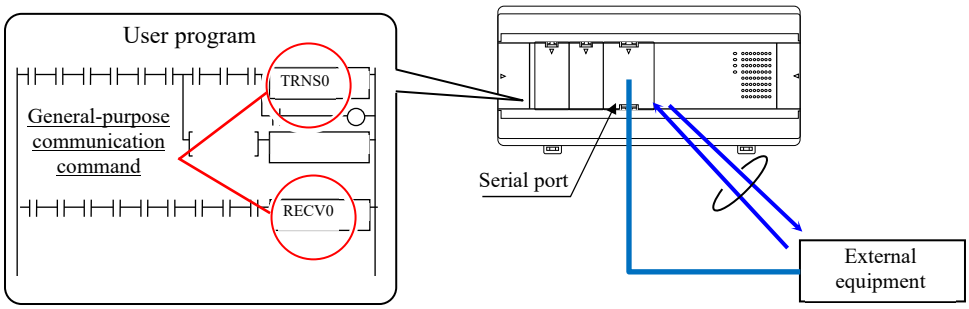

Figure 1.7 General-purpose serial communication on option board

(7)(8) Modbus-RTU (master/slave)

You can use the RS-232C/RS-485 option board with this unit to enable the Modbus-RTU communication.

You can use the Modbus-RTU communication as master or slave on this unit. For example, you can control a Modbus protocol-compliant equipment, and monitor the operational status of this unit by sending queries from an upper-level communication equipment such as personal computer.

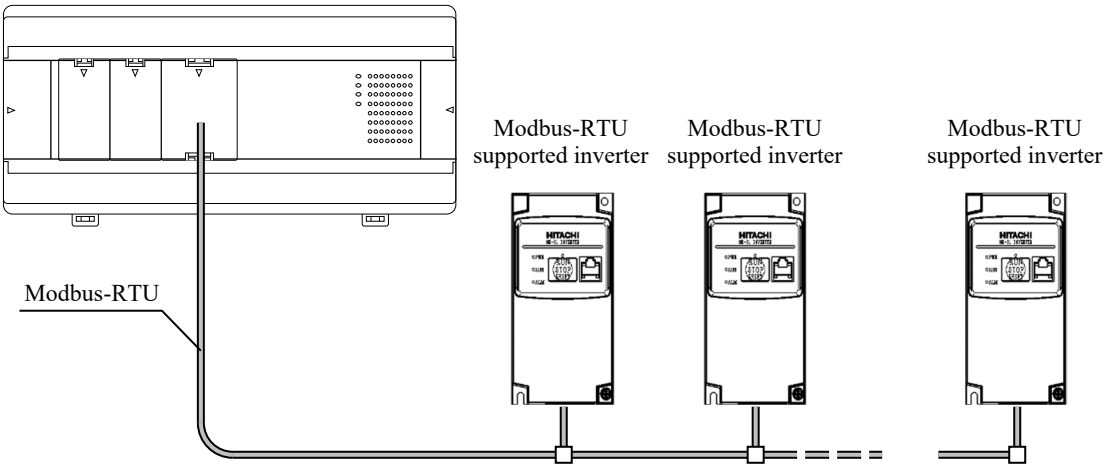

Figure 1.8 System configuration when controlling Modbus-RTU-compliant equipment

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Chapter 2 Using Control Editor

The Control Editor is used to program on this unit and make the communication setting. There are three types of connection modes between this unit and the Control Editor: (1) offline mode, (2) online mode, and (3) on-direct mode. For online or on-direct mode, you need to select a communication channel from the USB port, the serial communication port, and the Ethernet port (MVH only).

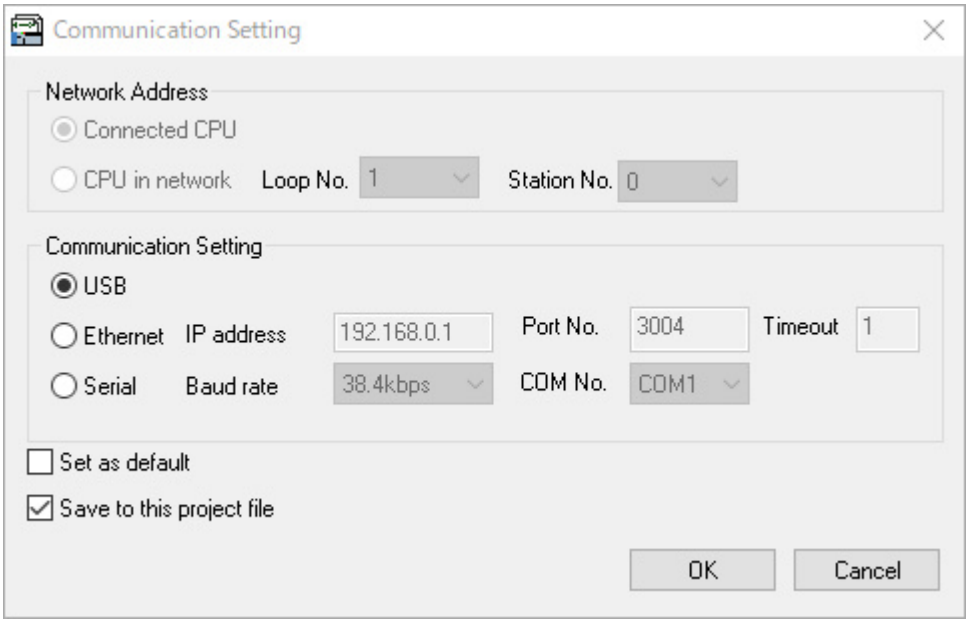


Figure 2.1 Control Editor communication setting window (via USB)

The following sections describe the specific usage for each communication channel.

2.1 Using Control Editor via USB port

There are two USB ports on MVH. One is exclusively used for the Control Editor connection with a connector shape of Type B (USB port for programming), and the other for the USB memory connection with a connector shape of Type A (port for USB memory).

MVL has only the USB port for programming. It does not have the port for USB memory.

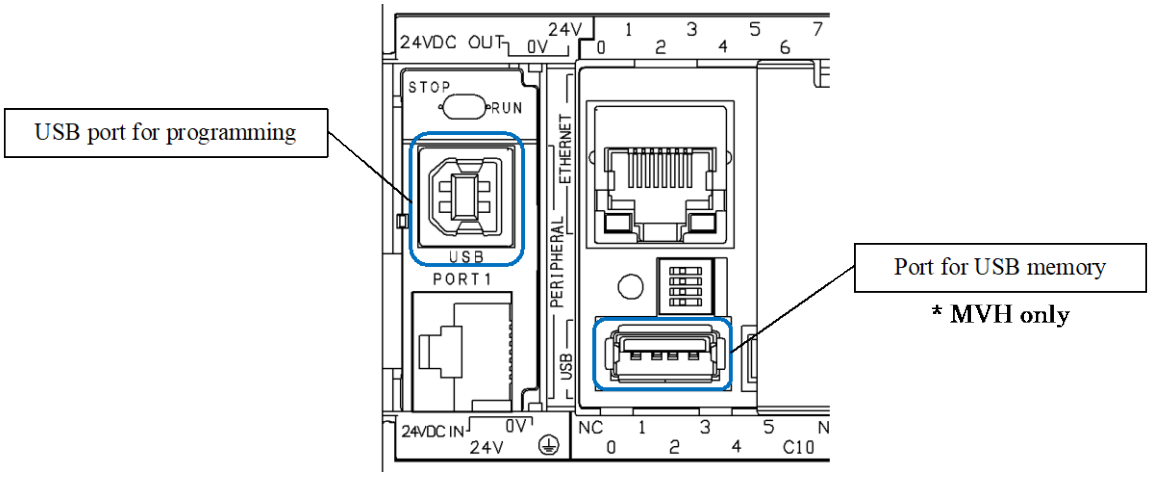


Figure 2.2 USB port

When you want to use the Control Editor via the USB port for programming, you only need to install the USB driver in your personal computer before using it for the first time. You do not need to register the communication rate or other communication parameters on the Control Editor nor this unit. Also, you can use accessible commercial USB cables. So, it is considered to be the most convenient communication channel for many users.

The procedure to have an online/on-direct connection of the Control Editor via the USB port for programming is described below. For the port for USB memory, refer to Chapter 4.

To use the Control Editor via the USB port for programming, prepare a commercial USB cable.

With this unit powered on, connect the USB port on your personal computer and the USB port for programming on this unit with the USB cable. After your personal computer is connected with this unit via the USB cable for the first time, a new hardware is found on your personal computer, and a wizard is shown to install a USB driver. This wizard will guide you through installation process of the USB driver. The installation disk of the Control Editor is needed when installing the USB driver.

Once the USB driver is installed, you can now put the Control Editor in the online connection mode to transmit programs and monitor the ON / OFF status of I/O.

Important

- The installation procedure of the USB driver is described in the Control Editor instruction manual. Refer to it as necessary.
- In general, a personal computer is equipped with multiple USB ports. If you use a USB port on your personal computer that is different from the one used when installing the USB driver for this unit, a wizard may be shown to install a USB driver. For such a scenario, it is recommended that you keep the installation disk of the Control Editor on hand.

2.2 Using Control Editor via Ethernet port (MVH only)

Ethernet communication requires setting communication parameters such as IP address, but using Ethernet communication has a major advantage that you can monitor the programming of MVH grounded in a remote place and the ON / OFF status of I/O.

If both an MVH and a personal computer with the Control Editor exist on an Ethernet network, and you know the communication setting information registered with MVH, you only need to specify the IP address and port number, as well as the timeout period if necessary, from the Control Editor to prepare an online connection.

Menu : [Tool]-[PC Communication Settings]

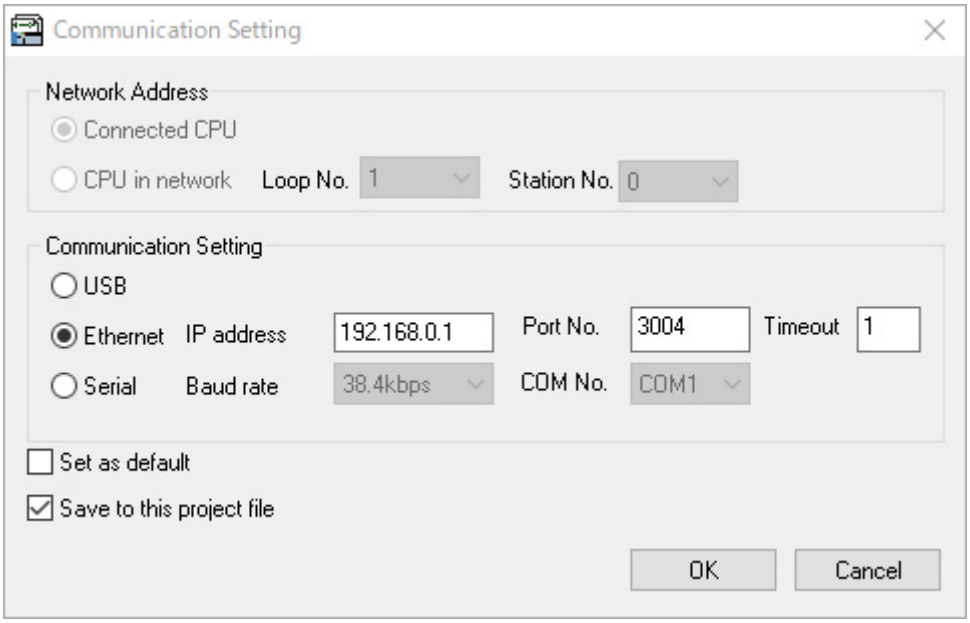


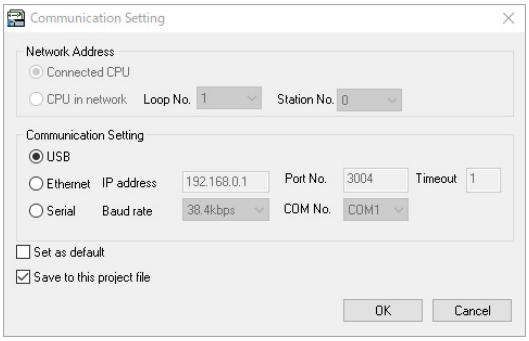
Figure 2.3 Communication setting window

Caution

If the IP address and port number registered with MVH are not known, have an online connection of the Control Editor via the USB or serial communication to check the communication setting information.

Check and change the Ethernet communication setting of MVH as follows:

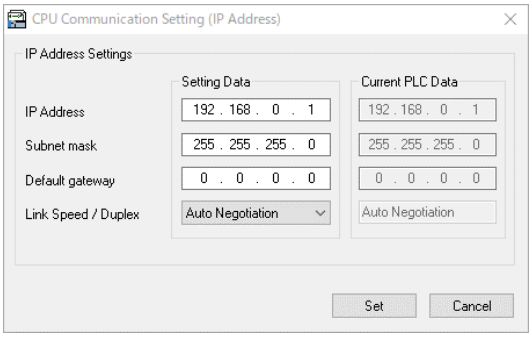
1. Use a commercial USB cable to connect your personal computer and MVH.
2. Turn on MVH.
3. Start the Control Editor,
   select Menu: [Tool] - [PC Communication Settings], and select [USB] on the Communication Setting window.



4. Select Menu: [Online] - [Mode] - [Online].
5. Select Menu: [Tool] - [CPU Settings] - [IP Address].

↓

The information registered with MVH is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window. If you want to change the setting, change setting values, then press the [Set] button.



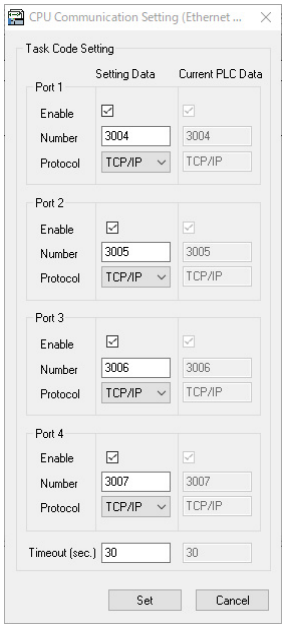
Caution

Match Link Speed / Duplex to the setting of the other device.
Auto Negotiation is a function that automatically switches link speed and Link Speed / Duplex depending on the other device to connect to, but if the other party has a fixed link speed and Link Speed / Duplex, communication may not be possible.

6. Select Menu: [Tool] - [CPU Settings] - [Ethernet (task code)].

↓

The information registered with MVH is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window. If you want to change the setting, change setting values, then press the [Set] button.



Caution

Without information about the IP address and port number registered with MVH, you cannot use the Control Editor via the Ethernet communication. Do not lose the registered communication setting information.

2.2.1 Building network

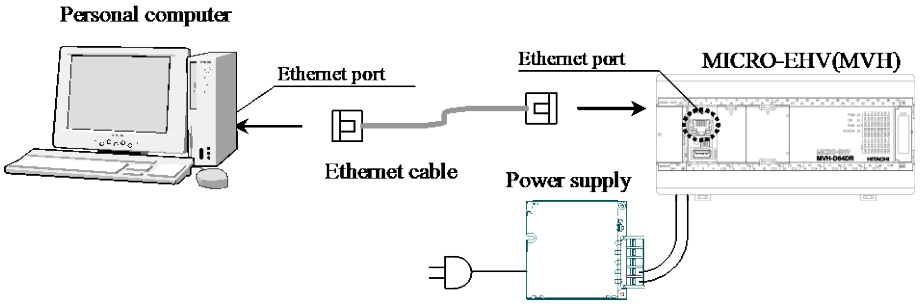
In general, to use the Ethernet communication, you need to register the network information including the IP address with each communication equipment in advance.

This section describes the procedure to build a network using Windows® 10 OS personal computer before having an online connection of the Control Editor with factory default MVH. Table 2.1 shows the necessary equipment, and figure 2.4 shows the network wiring and communication setting items.

Table 2.1 Necessary equipment

Equipment	Specification	Quantity
MICRO-EHV(MVH)	Equipped with the Ethernet port	1
Power supply	Depending on the power feeding type of MICRO-EHV	1
Personal computer with Ethernet port	Windows® 8.1 / 10	1
Programming software	Control Editor (model: EH-CTE-E)	1
Ethernet cable	Category 5-compliant, UTP or STP straight type* 1	2
HUB	General Ethernet hub	1

* 1 If you connect MICRO-EHV with the communication equipment by using one Ethernet cable without HUB, prepare a cross type cable. However, the cable type to be prepared depends on the specification of the HUB.

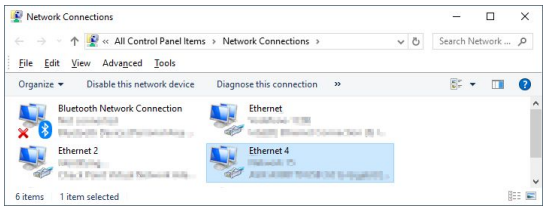


Personal computer	Communication setting item	MICRO-EHV(MVH)
192.168.0.15 (as example)	IP address	192.168.0.1
255.255.255.0	Subnet mask	255.255.255.0
(Blank)	Default gateway	0.0.0.0
(N/A)	Link Speed / Duplex	Auto Negotiation
(N/A)	Logical port	3004

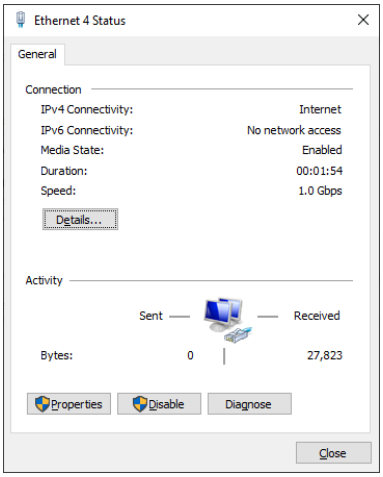
Figure 2.4 The network wiring and communication setting items

Register the network setting on the personal computer for the online connection from the Control Editor as follows:

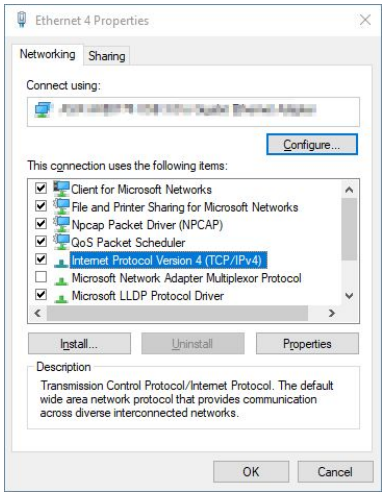
1. Click the [Start] menu, and click [Settings]→[Network & Internet]→[Status]→[Change adapter options] to show the network adapters on your personal computer.
   Click an adapter to use.



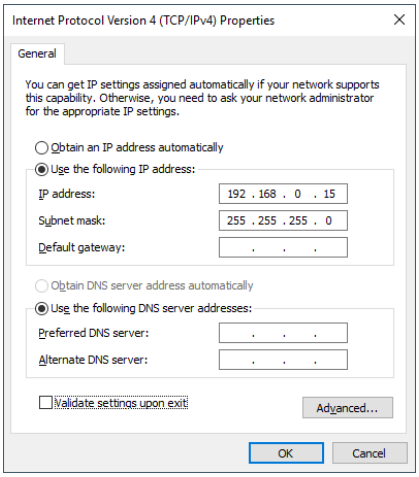
2. Click Properties on selected adapter Status window.



3. Double-click [Internet Protocol Version 4 (TCP/IPv4)].



4. Select [Use the following IP address],
   enter **a number other than 192.168.0.1 and 192.168.0.255** (192.168.0.15 in the right example) in [IP address], and enter **255.255.255.0** in [Subnet mask].



5. Click OK.

When the wiring and the network setting on your personal computer has been finished, turn on MVH. Use the following procedure to check the communication status. In this case, we use the Windows® 10 OS.

Open the command prompt window.	Microsoft Windows [Version 10.0.17134.1304] (c) 2018 Microsoft Corporation. All rights reserved. C:¥>
Enter the ping command. It is not case sensitive. Reply from 192.168.0.1 ... If the above reply is returned four times* 1, the network setting on your personal computer is completed. * 1 Four replies are based on the default setting of the ping command. For details of the ping command, use the following command: ping /help	C:¥>ping 192.168.0.1 Pinging 192.168.0.1 with 32 bytes of data: Reply from 192.168.0.1: bytes=32 time=5ms TTL=32 Reply from 192.168.0.1: bytes=32 time=3ms TTL=32 Reply from 192.168.0.1: bytes=32 time=2ms TTL=32 Reply from 192.168.0.1: bytes=32 time=2ms TTL=32 Ping statistics for 192.168.0.1: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 5ms, Average = 3ms
If the following reply is returned from the ping command, Request timed out. your personal computer cannot currently reach MVH. Check the following points again. [Checkpoint] • Did you change the communication setting on this unit? (not the factory default) • Is the network setting on your personal computer correct? • Does the network equipment operate correctly? • Is the cable type correct?	C:¥>ping 192.168.0.1 Pinging 192.168.0.1 with 32 bytes of data: Request timed out. Request timed out. Request timed out. Request timed out. Ping statistics for 192.168.0.1: Packets: Sent = 4, Received = 0, Lost = 4 (100% loss), C:¥>

2.2.2 Having online connection of Control Editor

Before having an online connection of the Control Editor via the Ethernet port, select [Ethernet] and enter the IP address and the port number on the Communication Setting window. For the factory default MVH, enter 192.168.0.1 in [IP address], 3004 in [Port No.], and 1 in [Timeout], and then press the [OK] button.

Menu : [Tool]-[PC Communication Settings]

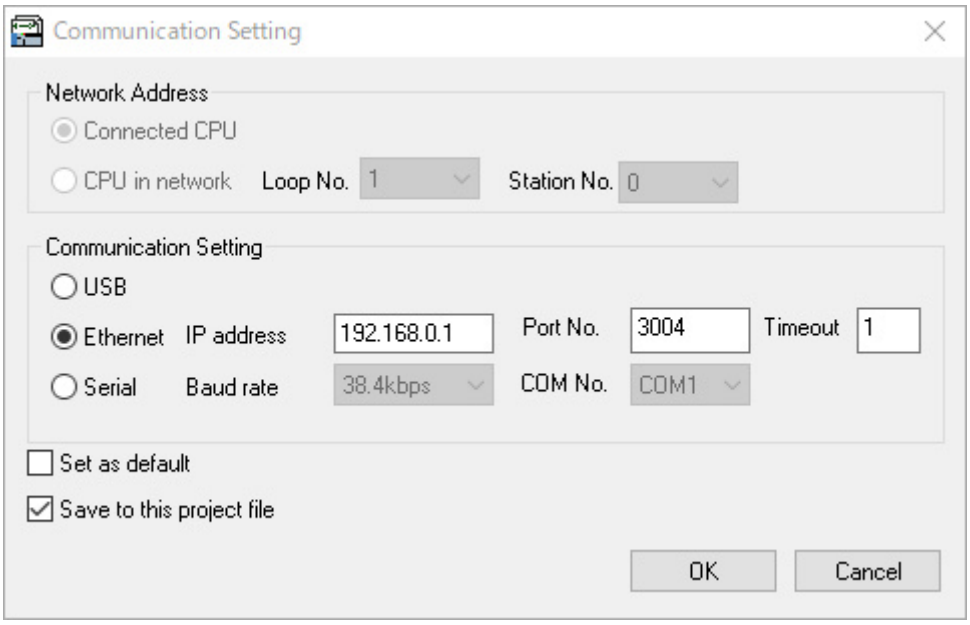


Figure 2.5 Communication setting (via Ethernet port)

Menu : [Online] - [Mode] - [Online]

If the online connection is successful, the status area at the bottom of the screen is displayed as "Online."

2.3 Using Control Editor via serial communication port

If you have the serial communication cable (model: EH-VCB02) which can also be used with a MICRO-EH or H series PLC, you may have an online connection of the Control Editor via the serial communication port.

However, recent personal computers may not have a serial communication port. We recommend that you use the Control Editor via the USB port for programming. If you want to use the serial communication port, prepare a commercial USB serial converter separately.

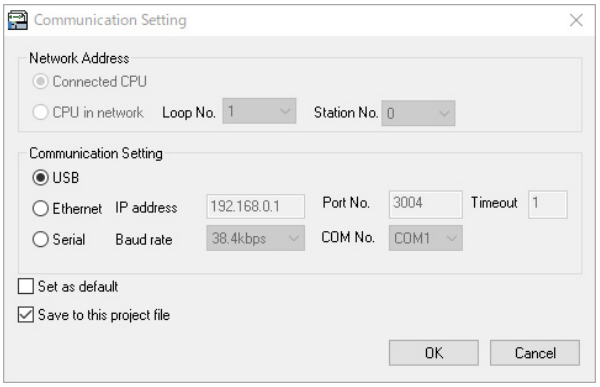
To have an online connection of the Control Editor via the serial communication port, you need to register the serial communication setting of this unit from the Control Editor. Note that, in the factory default communication setting, the Purpose is [Programming], the Baud rate is 38.4kbps, and the Protocol is [Procedure 1[1:1]].

Important

The serial communication setting registered with this unit can be checked only by using an online connection of the Control Editor. Be sure to prepare a commercial USB cable so that you can have an online connection from the Control Editor via the USB port for programming in case you forget the serial communication setting.

Check the serial communication setting for this unit as follows:

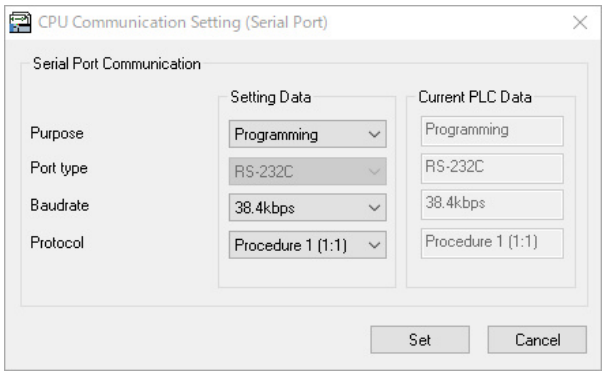
1. Use a commercial USB cable to connect your personal computer and this unit.
2. Turn on this unit.
3. Start the Control Editor,
   select Menu: [Tool] - [PC Communication Settings], and select [USB] on the Communication Setting window.



4. Select Menu: [Online] - [Mode] - [Online].
5. Select Menu: [Tool] - [CPU Settings] - [Serial Communication].

   ↓

   The information registered with this unit is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window. If you want to change the setting, change setting values, then press the [Set] button.



Before having an online connection of the Control Editor via the serial communication port, select [Serial], and then select the Baud rate and the communication port No. on the Communication Setting window. For the factory default unit, select 38.4kbps as the Baud rate. Select a proper communication port No. depending on your personal computer, and then press the [OK] button.

Menu : [Tool]-[PC Communication Settings]

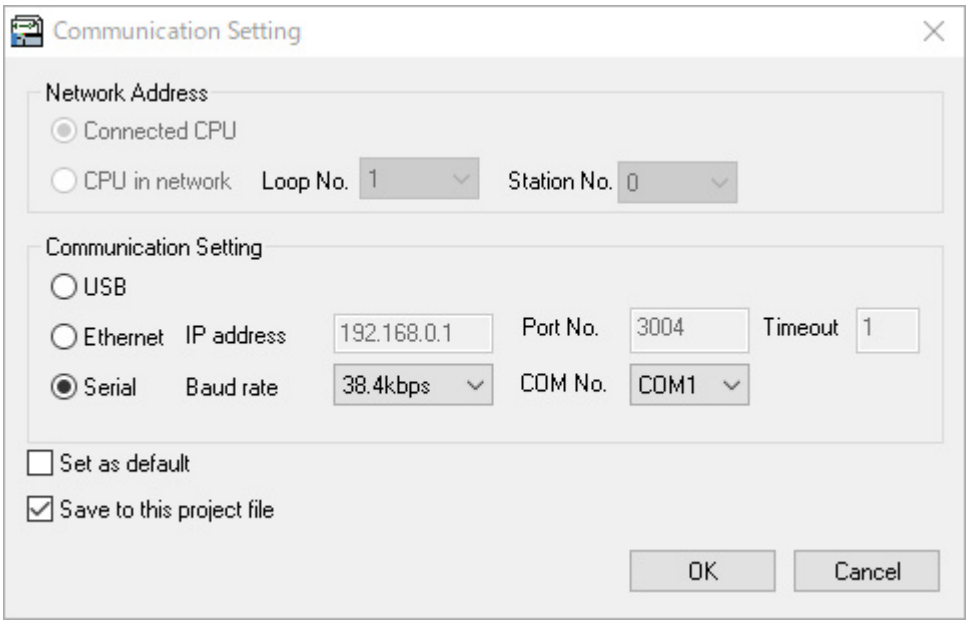
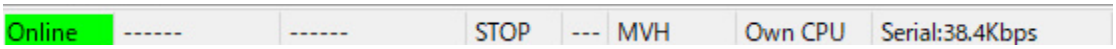


Figure 2.6 Serial communication setting

Menu : [Online] - [Mode] - [Online]

If the online connection is successful, the status area at the bottom of the screen is displayed as "Online."



Chapter 3　Using Communication Function

This unit provides powerful communication functions. This chapter demonstrates how to use these communication functions.

3.1　Modbus communication

MVH provides the Modbus-TCP slave function available on the Ethernet port, the Modbus-RTU master/slave function using the RS-485 serial communication port on the option board, and the Modbus gateway function, as shown in the table below.

Table 3.1 Supported functions

Function	MVH		MVL
	Ethernet port	Option board RS-485 port	Option board RS-485 port
Modbus-RTU master function	No	Yes	Yes
Modbus-RTU slave function	No	Yes	Yes
Modbus-TCP slave function	Yes	No	No
Modbus gateway function	Yes	Yes	No

The Modbus-RTU master is used for this unit to monitor information about the Modbus-RTU slave equipment. This unit sends a function code supported by the Modbus-RTU slave equipment, then receives the reply from the Modbus-RTU slave equipment. For details of a specific Modbus-RTU slave equipment, refer to its instruction manual.

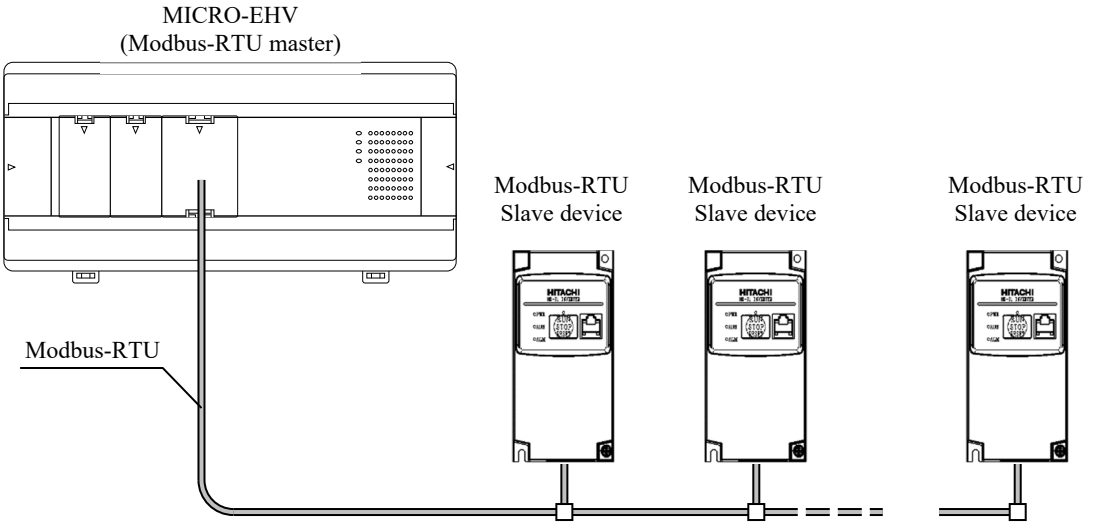


Figure 3.1 Example of Modbus-RTU master equipment configuration

The Modbus-TCP slave function of MVH and Modbus-RTU slave function of MVH/MVL are used for a Modbus master equipment to read/write information in this unit.

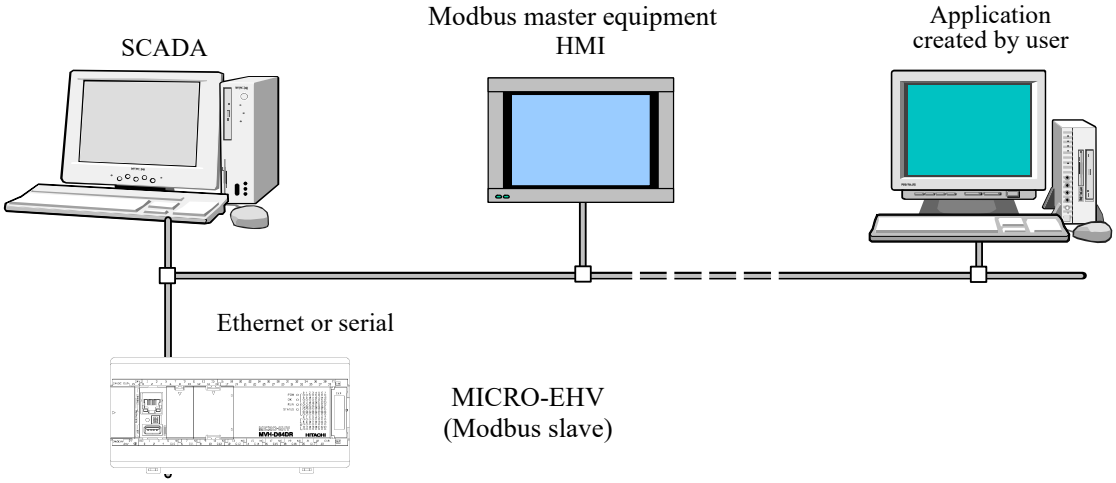


Figure 3.2 Example of Modbus slave equipment configuration

If the Modbus master equipment sends a function code to this unit, this unit sends back data corresponding to the function code. Table 3.2 shows the function codes supported by this unit for the Modbus slave function.

Table 3.2 Supported function codes

hexadecimal	decimal	Function	MICRO-EHV response
0x01	01	Read coil	Read output Y
0x02	02	Read input status	Read input X
0x03	03	Read holding register	Read internal output WR
			Read special internal output
0x04	04	Read input register	Read internal output WM
0x05	05	Write single coil	Write output Y (1 point)
0x06	06	Write single register	Write internal output WM (1 point)
			Write internal output WR (1 point) *
0x0F	15	Write multiple coils	Write output Y (multiple points)
0x10	16	Write multiple registers	Write internal output WR (multiple points)
			Write special internal output (multiple points)

* MICRO-EHV (software version Vx126 or newer) can be changed the type of internal output accessed with function code 06 by setting special internal output (R90F).

Reference

In the Modbus protocol reference guide issued by Modicon Inc., the term "client/server" is used for Modbus-TCP, and "master/slave" for Modbus-RTU. In this manual, "master/slave" is used regardless of Modbus-TCP or Modbus-RTU. The Modbus master means the side which sends queries, and the Modbus slave means the side which sends back responses.

3.1.1 Read / write from Modbus master (slave configuration)

MVL provides the Modbus-RTU slave function, and MVH provides the Modbus-TCP slave function in addition to the Modbus-RTU slave function. In this manual, these are referred to as the Modbus slave configuration.
With the Modbus slave configuration, you can read/write data in this unit from a Modbus master equipment such as SCADA software, HMI, and your own communication application.

How to use Modbus-RTU slave

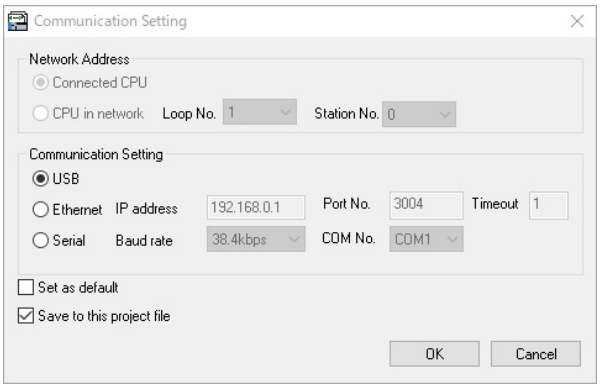
1. Attach a serial communication option board to this unit.
2. Check/change the communication setting.
   Register the communication setting to meet the type of the serial communication option board and the transmission specification of the master equipment.
3. Set the master equipment.
   Refer to the instruction manual of the used master equipment.
4. Send an instruction to this equipment from the master equipment.

How to use Modbus-TCP slave (MVH only)

1. Check/change the communication setting of MVH.
   Register the communication setting such as IP address to meet the environment.
2. Set the master equipment.
   Refer to the instruction manual of the used master equipment.
3. Send an instruction to this equipment from the master equipment.

The procedure to check and change information related to the Modbus-RTU slave function is described below. The following example takes the online connection via USB, but the same procedure is applicable to the serial and Ethernet communications. For the offline setting, refer to the caution described in Chapter 3.1.4.

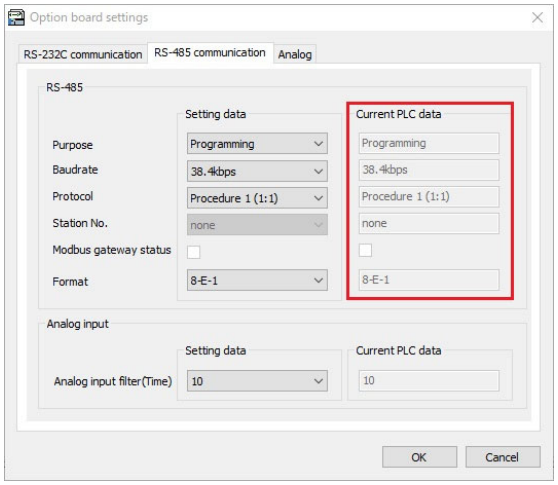
1. Use a commercial USB cable to connect your personal computer and this unit.
2. Turn on this unit.
3. Start the Control Editor,
   select Menu: [Tool] - [PC Communication Settings], and select [USB] on the Communication Setting window.



4. Select Menu: [Online] - [Mode] - [Online].
5. Select Menu: [Tool] - [CPU Settings] - [Option board settings].

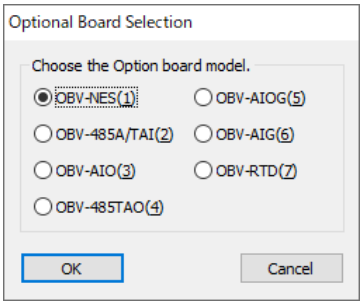
↓

The information registered with this unit is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window.



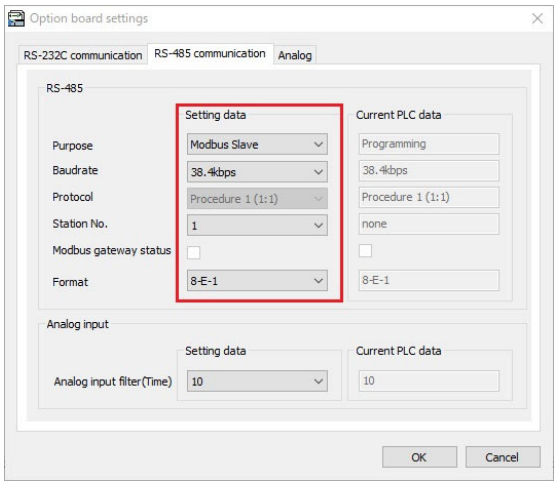
From Control Editor Ver.7.10, When you select “Option board setting” in project tree, right figure will be appeared.

You select the option board which you use, and push OK button, above figure (Option board setting) will be appeared.



If you want to use the Modbus slave function, select [Modbus slave] from the [Purpose] pull-down list, select the [Baudrate] and the [Format], and then press the [OK] button.

Do not change the analog input filter item, which is nothing to do with the Modbus slave function.



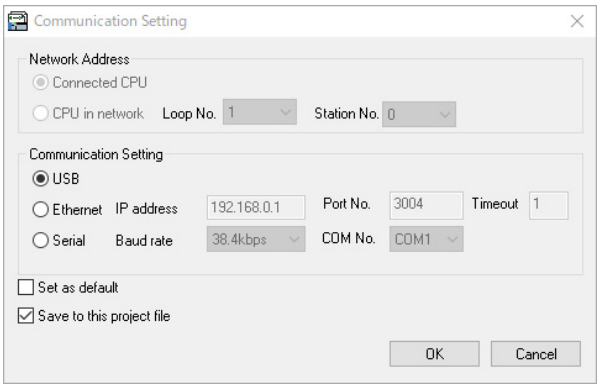
Caution

Without information about the purpose or the Baud rate of the option board setting registered with this unit, you cannot use the Modbus-RTU slave function. Do not lose the registered communication setting information.

The procedure to check and change information related to the Modbus-TCP slave function is described below.

1. Use a commercial USB cable to connect your personal computer and MVH.
2. Turn on MVH.
3. Start the Control Editor,

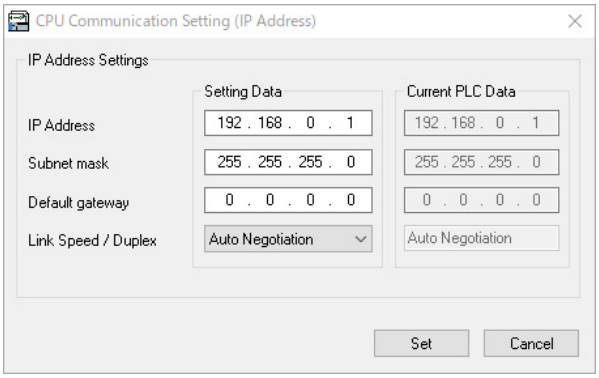
   select Menu: [Tool] - [PC Communication Settings], and select [USB] on the Communication Setting window.



4. Select Menu: [Online] - [Mode] - [Online].
5. Select Menu: [Tool] - [CPU Settings] - [IP address].

   ↓

   The information registered with MVH is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window. If you want to change the setting, change setting values, then press the [Set] button.

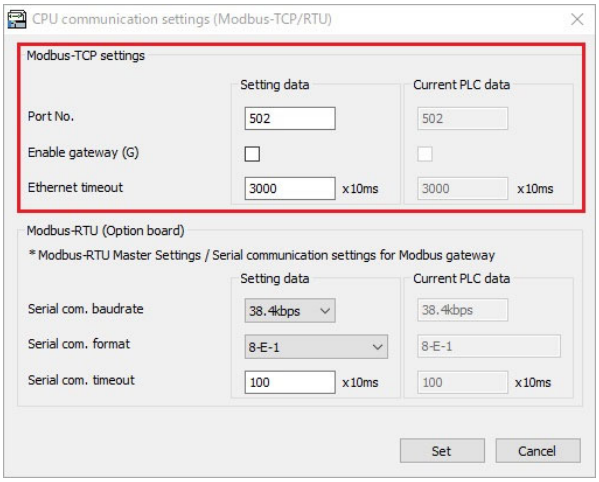


6. Select Menu: [Tool] - [CPU Settings] - [Modbus-TCP/RTU settings].

   ↓

   The information registered with MVH is displayed in the [Current PLC Data] box under the [Modbus-TCP settings] box. If you want to simply check the setting, press the [Cancel] button to close the window.

   If you want to use the Modbus-TCP slave function, enter appropriate values in the [Port No.] and [Ethernet timeout] fields, deselect the [Enable gateway] check box, and then press [Set] button.



Modbus-TCP setting	Description
Port No.	Usually, Modbus-TCP uses port number 502. Unless 502 is used for another purpose, do not change it.
Enable gateway	Select this check box if you want to use the gateway function. For details of the gateway function, refer to Chapter 3.1.3.
Ethernet timeout	This monitors a time after the Ethernet connection is established and before a command is received from master (client), or a time after this unit sends back a response and before the next command is received. If this time is exceeded, a communication error is generated to store the error code 8C-8F (four connections) in WRF000.

Caution

Without information about the IP address registered with MVH and the port No. of the Modbus-TCP setting, you cannot use the Modbus-TCP slave function. Do not lose the registered communication setting information.

To read/write information in this unit from the master equipment, the master equipment sends a function code to this unit as a request (referred to as "query" in this manual). This unit sends back the reply (referred to as "response" in this manual) for the query.

A query to be sent must contain Modbus addresses corresponding to the external I/O number and the internal I/O number of this unit together with a function code. The message data configuration of Modbus is common to the query and the reply, but different between Modbus-RTU and Modbus-TCP. The message data configurations of Modbus-RTU and Modbus-TCP are as follows:

Table 3.3 Modbus-RTU message data configuration

(A)	(B)	(C)	(D)

Code	Name	Number of bytes	Content
(A)	Unit identifier	2	Specify the unit identifier of the Modbus-RTU slave equipment.
(B)	Function code	2	Specify a function code to request.
(C)	Data	N (0 - 252)	The content depends on the function code. For details, refer to the description of each function code.
(D)	CRC	2	For the calculation formula, refer to the Modbus protocol reference guide issued by Modicon Inc.

Table 3.3 Modbus-TCP message data configuration

(1)	(2)	(3)	(4)	(5)	(6)

Code	Name	Number of bytes	Content
(1)	Transaction ID	2	Used for the master and slave equipment to identify communication data. You can specify arbitrary data such as a sequential number.
(2)	Protocol ID	2	Used to indicate the protocol. For Modbus, specify 0x0000.
(3)	Data length	2	(4)Byte length that is the sum of unit ID, (5) function code, and (6) data part. It should be (6) number of data bytes + 2.
(4)	Unit ID	1	For the Modbus-TCP slave, specify 0xFF.
(5)	Function code	1	Specify a function code to request.
(6)	Data	N (0 - 252)	The content depends on the function code. For details, refer to the description of each function code.

Function code	0x01	Purpose	Read information of the external output (I/O type: Y).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x01
Start address	2	0x0000 to 0xFFFF
Number of bits to read	2	0x0001 to 0x07D0 (1 to 2000)

The correspondence of the external output numbers of this unit and Modbus addresses is as follows:

Unit type	External output number	Modbus address
Basic unit	Y100 to Y123	0x0100 to 0x0117
For B1/1 assignment type		
Expansion unit 1	Y1016 to Y1027	0x1010 to 0x101B
Expansion unit 2	Y2016 to Y2027	0x2010 to 0x201B
Expansion unit 3	Y3016 to Y3027	0x3010 to 0x301B
Expansion unit 4	Y4016 to Y4027	0x4010 to 0x401B
For X48/Y32 assignment type		
Expansion unit 1	Y1100 to Y1123	0x1100 to 0x1117
Expansion unit 2	Y2100 to Y2123	0x2100 to 0x2117
Expansion unit 3	Y3100 to Y3123	0x3100 to 0x3117
Expansion unit 4	Y4100 to Y4123	0x4100 to 0x4117

If a Modbus address other than the above ones is specified, this unit returns 0.

Example) Read ON / OFF information for 14 bits from Y1100 in X48/Y32 assignment type expansion unit 1

Output state

Y1115			Y1112	Y1111			Y1108	Y1107			Y1104	Y1103			Y1100
ON	ON	ON	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	ON	ON	OFF
*	*	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

Query		Response	
Field name	Data	Field name	Data
Function code	0x01	Function code	0x01
Start address (upper byte)	0x11	Number of bytes to read	0x02
Start address (lower byte)	0x00	Read data (Y1107 to Y1100)	0x4E
Numbers to read (upper byte)	0x00	Read data (Y1113 to Y1108)*	0x2C
Numbers to read (lower byte)	0x0E		

* 0 should be padded for data not larger than 8 bits.

Reference

In case of general Modbus slave equipment, the start address of coil, input status, input register and holding register is 1. The master unit makes address data by using the offset from 1, and send it to the slave. (For example, if you want to access address 1 of some register, Master unit send “0” (it means 0th register from address 1) as address data.) Regarding to the treatment of address, there are 2 types in the Master. One is “offset” method which is above mentioned. Other one is not used offset, i.e. specified address is used as address data as it is. If the accessed address is differ from the address which you specified, there is possibility that the master unit which you use is adopted offset method. In this case, please try to add 1 to the address which you want to access.

Ex) Access to Y100 ➔ Specify the address to 0x101 (hexadecimal) / 257 (decimal) on the master unit.

The addresses given in this manual are the actual addresses of the MICRO-EHV, not the offsets.

Function code	0x02	Purpose	Read information of the external input (I/O type: X).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x02
Start address	2	0x0000 to 0xFFFF
Number of bits to read	2	0x0001 to 0x07D0 (1 to 2000)

The response data configuration for the function code 0x02 is as follows:

Content	Number of bytes	Data content
Function code	1	0x02
Number of bytes to read	1	0x01 to 0xFA
Read data	N	0x0001 to 0x07D0 (1 to 2000)

The correspondence of the external input numbers of this unit and Modbus addresses is as follows:

Unit type	External input number	Modbus address
Basic unit	X0 to X39	0x0000 to 0x0027
For B1/1 assignment type		
Expansion unit 1	X1000 to X1015	0x1000 to 0x100F
Expansion unit 2	X2000 to X2015	0x2000 to 0x200F
Expansion unit 3	X3000 to X3015	0x3000 to 0x300F
Expansion unit 4	X4000 to X4015	0x4000 to 0x400F
For X48/Y32 assignment type		
Expansion unit 1	X1000 to X1039	0x1000 to 0x1027
Expansion unit 2	X2000 to X2039	0x2000 to 0x2027
Expansion unit 3	X3000 to X3039	0x3000 to 0x3027
Expansion unit 4	X4000 to X4039	0x4000 to 0x4027

If a Modbus address other than the above ones is specified, this unit returns 0.

Example) Read ON / OFF information for 15 bits from X3000 in X48/Y32 assignment type expansion unit 3

Output state

X3015			X3012	X3011			X3008	X3007			X3004	X3003			X3000
OFF	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
※	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

Query		Response	
Field name	Data	Field name	Data
Function code	0x02	Function code	0x02
Start address (upper byte)	0x30	Number of bytes to read	0x02
Start address (lower byte)	0x00	Read data (X3007 to X3000)	0x21
Numbers to read (upper byte)	0x00	Read data (X3014 to X3008)*	0x73
Numbers to read (lower byte)	0x0F		

* 0 should be padded for data not larger than 8 bits.

Function code	0x03	Purpose	Read information of the internal I/O (I/O type: WR).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x03
Start address	2	0x0000 to 0xFFFF
Number of words to read	2	0x0001 to 0x007D (1 to 125)

The correspondence of the internal I/O numbers of this unit and Modbus addresses is as follows:

Internal I/O number	Modbus address
WR0 to WR7FFF	0x0000 to 0x7FFF
WRF000 to WRF1FF	0xF000 to 0xF1FF
Non-supported I/O number	0x8000 to 0xEFFF
	0xF200 to 0xFFFF

If a non-supported Modbus address is specified for the internal I/O number, this unit returns the response code 0x02 indicating a specified address range error.

Example) Read data for 4 words from WR250

WR250	H0011
WR251	H2233
WR252	H4455
WR253	H6677

Query		Response	
Field name	Data	Field name	Data
Function code	0x03	Function code	0x03
Start address (upper byte)	0x02	Number of bytes to read	0x08
Start address (lower byte)	0x50	Read data (upper of WR250)	0x00
Numbers to read (upper byte)	0x00	Read data (lower of WR250)	0x11
Numbers to read (lower byte)	0x04	Read data (upper of WR251)	0x22
		Read data (lower of WR251)	0x33
		Read data (upper of WR252)	0x44
		Read data (lower of WR252)	0x55
		Read data (upper of WR253)	0x66
		Read data (lower of WR253)	0x77

Function code	0x04	Purpose	Read information of the internal I/O (I/O type: WM).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x04
Start address	2	0x0000 to 0x07FF
Number of words to read	2	0x0001 to 0x007D (1 to 125)

The correspondence of the internal I/O numbers of this unit and Modbus addresses is as follows:

Internal I/O number	Modbus address
WM0 to WM07FF	0x0000 to 0x07FF
Non-supported I/O number	0x0800 to 0xFFFF

If a non-supported Modbus address is specified for the internal I/O number, this unit returns the response code 0x02 indicating a specified address range error.

Example) Read data for 4 words from WM250

WM250	H0011
WM251	H2233
WM252	H4455
WM253	H6677

Query		Response	
Field name	Data	Field name	Data
Function code	0x04	Function code	0x04
Start address (upper byte)	0x02	Number of bytes to read	0x08
Start address (lower byte)	0x50	Read data (upper of WM250)	0x00
Numbers to read (upper byte)	0x00	Read data (lower of WM250)	0x11
Numbers to read (lower byte)	0x04	Read data (upper of WM251)	0x22
		Read data (lower of WM251)	0x33
		Read data (upper of WM252)	0x44
		Read data (lower of WM252)	0x55
		Read data (upper of WM253)	0x66
		Read data (lower of WM253)	0x77

Function code	0x05	Purpose	Set ON / OFF to one bit of the external output (I/O type: Y).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x05
Start address	2	0x0000 to 0xFFFF
Data to write	2	0xFF00 to set ON, or 0x0000 to set OFF

The correspondence of the external output numbers of this unit and Modbus addresses is as follows:

Unit type	External output number	Modbus address
Basic unit	Y100 to Y123	0x0100 to 0x0117
For B1/1 assignment type		
Expansion unit 1	Y1016 to Y1027	0x1010 to 0x101B
Expansion unit 2	Y2016 to Y2027	0x2010 to 0x201B
Expansion unit 3	Y3016 to Y3027	0x3010 to 0x301B
Expansion unit 4	Y4016 to Y4027	0x4010 to 0x401B
For X48/Y32 assignment type		
Expansion unit 1	Y1100 to Y1123	0x1100 to 0x1117
Expansion unit 2	Y2100 to Y2123	0x2100 to 0x2117
Expansion unit 3	Y3100 to Y3123	0x3100 to 0x3117
Expansion unit 4	Y4100 to Y4123	0x4100 to 0x4117

If a Modbus address other than the above ones is specified, this unit still returns 0x0000 or 0xFF00 indicating a successful reply.(0xFF for ON request, 0x00 for OFF request)

Example 1) Set ON to the basic unit Y100

Query		Response	
Field name	Data	Field name	Data
Function code	0x05	Function code	0x05
Start address (upper byte)	0x01	Start address (upper byte)	0x01
Start address (lower byte)	0x00	Start address (lower byte)	0x00
Data to write (upper byte)	0xFF	Data to write (upper byte)	0xFF
Data to write (lower byte)	0x00	Data to write (lower byte)	0x00

Example 2) Set ON to Y2118 of X48/Y32 assignment type expansion unit 2

Query		Response	
Field name	Data	Field name	Data
Function code	0x05	Function code	0x05
Start address (upper byte)	0x21	Start address (upper byte)	0x21
Start address (lower byte)	0x12	Start address (lower byte)	0x12
Data to write (upper byte)	0xFF	Data to write (upper byte)	0xFF
Data to write (lower byte)	0x00	Data to write (lower byte)	0x00

Function code	0x06	Purpose	Write data for one word into the internal I/O (I/O type: WM / WR).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x06
Start address	2	0x0000 to 0x07FF (WM) 0x0000 to 0x7FFF / 0xF000 to 0xF1FF (WR)
Data to write	2	0x0000 to 0xFFFF

Reference

MICRO-EHV (software version Vx126 or newer) can be changed the type of internal output accessed with function code 06 by setting special internal output (R90F). (In software version Vx125 or older, function code 06 can access only WM area.)

The correspondence of the internal I/O numbers of this unit and Modbus addresses is as follows:

Internal I/O number	Modbus address
WM0 to WM7FF	0x0000 to 0x07FF
Non-supported I/O number	0x0800 to 0xFFFF

Internal I/O number	Modbus address
WR0 to WR7FFF	0x0000 to 0x7FFF
WRF000 to WRF1FF	0xF000 to 0xF1FF
Non-supported I/O number	0x8000 - 0xEFFF 0xF200 - 0xFFFF

If a non-supported Modbus address is specified for the internal I/O number, this unit returns the response code 0x02 indicating a specified address range error.

Example) Write 0x1234 into WM250

Query		Response	
Field name	Data	Field name	Data
Function code	0x06	Function code	0x06
Start address (upper byte)	0x02	Start address (upper byte)	0x02
Start address (lower byte)	0x50	Start address (lower byte)	0x50
Data to write (upper byte)	0x12	Data to write (upper byte)	0x12
Data to write (lower byte)	0x34	Data to write (lower byte)	0x34

Function code	0x0F	Purpose	Set ON / OFF to multiple bits of the external output (I/O type: Y).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x0F
Start address	2	0x0000 to 0xFFFF
Number of bits to write	2	0x0001 to 0x07B0 (1 to 1968)
Number of bytes to write	1	N = Number of bits to write/8 (rounded up)
Data to write	N	Set 1 to an ON bit, or 0 to an OFF bit

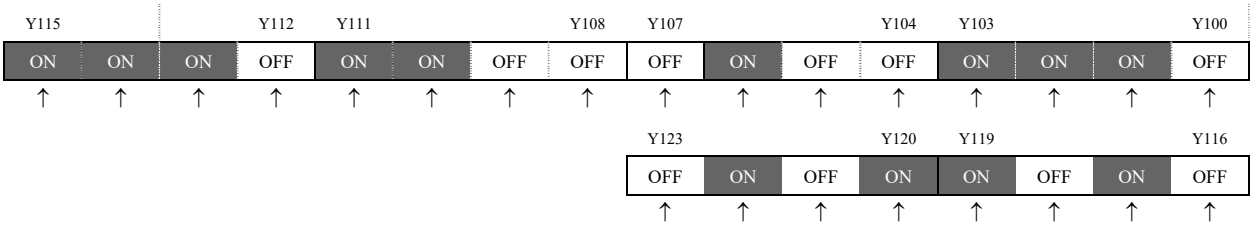
The correspondence of the external output numbers of this unit and Modbus addresses is as follows:

Unit type	External output number	Modbus address
Basic unit	Y100 to Y123	0x0100 to 0x0117
For B1/1 assignment type		
Expansion unit 1	Y1016 to Y1027	0x1010 to 0x101B
Expansion unit 2	Y2016 to Y2027	0x2010 to 0x201B
Expansion unit 3	Y3016 to Y3027	0x3010 to 0x301B
Expansion unit 4	Y4016 to Y4027	0x4010 to 0x401B
For X48/Y32 assignment type		
Expansion unit 1	Y1100 to Y1123	0x1100 to 0x1117
Expansion unit 2	Y2100 to Y2123	0x2100 to 0x2117
Expansion unit 3	Y3100 to Y3123	0x3100 to 0x3117
Expansion unit 4	Y4100 to Y4123	0x4100 to 0x4117

If a Modbus address other than the above ones is specified, this unit returns 0.

Example) Write ON / OFF information for 24 bits from Y100 of the basic unit

Output state



Query		Response	
Field name	Data	Field name	Data
Function code	0x0F	Function code	0x0F
Start address (upper byte)	0x01	Start address (upper byte)	0x01
Start address (lower byte)	0x00	Start address (lower byte)	0x00
Number of bits to write (upper byte)	0x00	Number of bits to write (upper byte)	0x00
Number of bits to write (lower byte)	0x18	Number of bits to write (lower byte)	0x18
Number of bytes to write	0x03		
Data to write (first byte)	0x4E		
Data to write (second byte)	0xEC		
Data to write (third byte)	0x5A		

Function code	0x10	Purpose	Write data for multiple words into the internal I/O (I/O type: WR).

Send data structure from the master is as follows:

Content	Number of bytes	Data content
Function code	1	0x10
Start address	2	0x0000 to 0xFFFF
Number of words to write	2	0x0001 to 0x007D (1 to 125)
Number of bytes to write	1	N = Number of words to write * 2
Data to write	N	

The correspondence of the internal I/O numbers of this unit and Modbus addresses is as follows:

Internal I/O number	Modbus address
WR0 to WR7FFF	0x0000 to 0x7FFF
WRF000 to WRF1FF	0xF000 to 0xF1FF
Non-supported I/O number	0x8000 to 0xEFFF
	0xF200 to 0xFFFF

If a non-supported Modbus address is specified for the internal I/O number, this unit returns the response code 0x02 indicating a specified address range error.

Example) Write data for 4 words from WR250

WR250	H0011
WR251	H2233
WR252	H4455
WR253	H6677

Query		Response	
Field name	Data	Field name	Data
Function code	0x10	Function code	0x10
Start address (upper byte)	0x02	Start address (upper byte)	0x02
Start address (lower byte)	0x50	Start address (lower byte)	0x50
Number of words to write (upper byte)	0x00	Number of words to write (upper byte)	0x00
Number of words to write (lower byte)	0x04	Number of words to write (lower byte)	0x04
Number of data bytes to write	0x08		
Data to write (first byte)	0x00		
Data to write (second byte)	0x11		
Data to write (third byte)	0x22		
Data to write (fourth byte)	0x33		
Data to write (fifth byte)	0x44		
Data to write (sixth byte)	0x55		
Data to write (seventh byte)	0x66		
Data to write (eighth byte)	0x77		

Next, the procedure to communicate this unit with our GP4000 Series HMI is described.

With the GP-Pro EX General MODBUS TCP Master driver, you can set the function code and the maximum data number by (1) using the frame length or (2) individually.

GP-Pro EX General MODBUS TCP Master driver

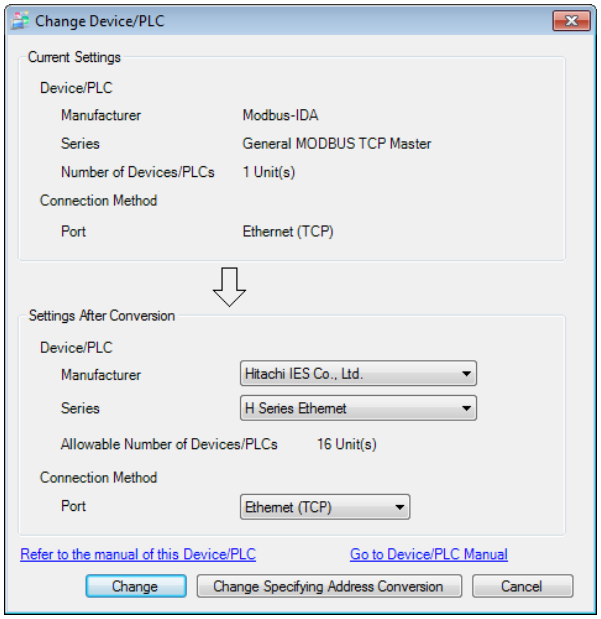
Device	device name	device code (HEX)	Word address
Coil	0	0080	000001 to 065521
Discrete input	1	0081	100001 to 165521
Input register	3	0001	300001 to 365536
Holding register	4	0000	400001 to 465536

The relationship between the monitor word addresses specified with the GP-Pro EX General MODBUS TCP Master driver and the I/O numbers of this unit is as follows:

Monitor word address	I/O number	Description
300001 - 302048	WM1 to WM7FF	It is readable and not writable. Attempting to do so results in the following message: RHAA054: PLC1: There is a dedicated device that touches inside the claim device (Address: 300001)
400001 - 432768	WR0 to WR7FFF	Readable and writable.
432769 - 433280	WRF000 to WRF1FF	
433281 - 465536	Non-supported	The following message will be displayed. RHAA036: PLC1: Error response was received for read request (receive error code: 2 [2H] There is a device out of address range)
302049 - 365536	Non-supported	

Reference

GP4000 HMI can communicate by using Modbus-TCP, however these HMI does not support all the function codes which is supported by MVH.
It is recommended that you use "H Series Ethernet" instead of Modbus-TCP when using these HMI.
For more information on how to connect, refer to GP-Pro EX Device/PLC Connection Manual (Device: Modbus-IDA Driver: General MODBUS TCP Master).



3.1.2 Read / write to Modbus slave (master configuration)

This unit provides the Modbus-RTU master function. In this manual, this is referred to as the Modbus master configuration.

In the Modbus master configuration, you can read and write information to this unit in the Modbus-RTU slave equipment.

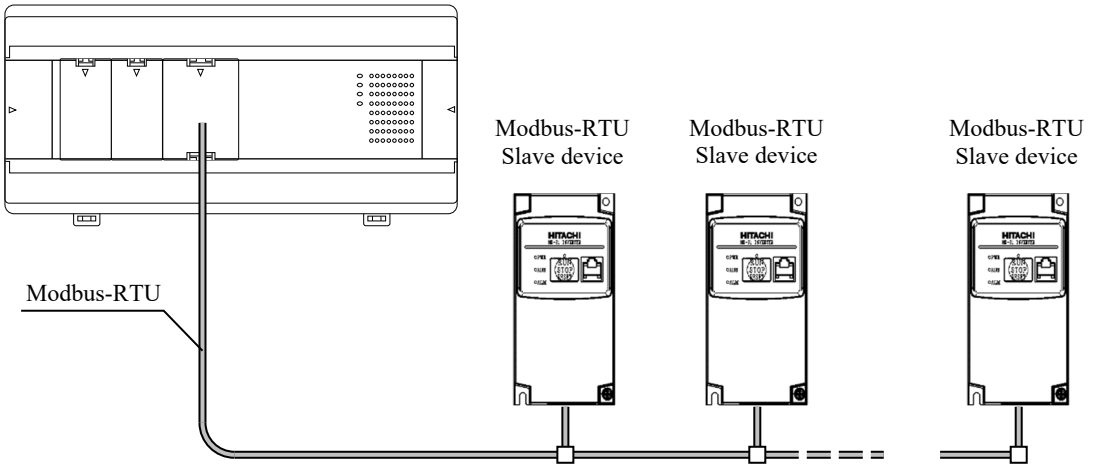


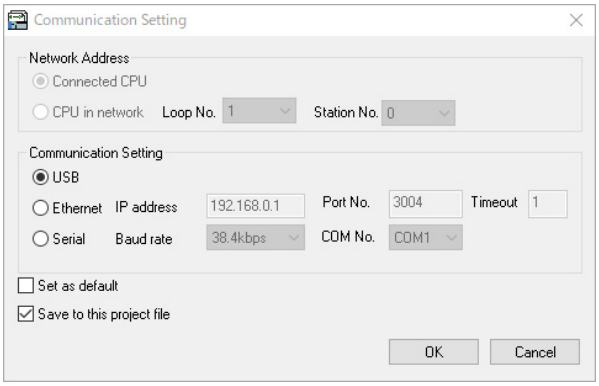
Figure 3.3 Example of Modbus master equipment configuration

How to use Modbus-RTU master

1	Attach a serial communication option board to this unit.
2	Check/change the communication setting. Register the communication setting to meet the type of the serial communication option board and the transmission specification of the slave equipment.
3	Set the slave equipment. Refer to the instruction manual of the used slave equipment.
4	Send an instruction to slave equipment from this unit.

The procedure to check and change information related to the Modbus-RTU master function is described below.

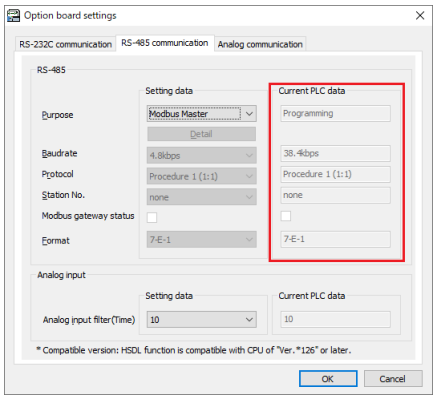
1. Use a commercial USB cable to connect your personal computer and this unit.
2. Turn on this unit.
3. Start the Control Editor,
   select Menu: [Tool] - [PC Communication Settings], and select [USB] on the Communication Setting window.



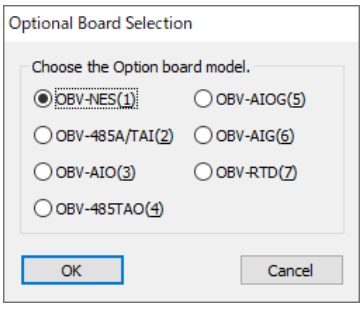
4. Select Menu: [Online] - [Mode] - [Online].
5. Select Menu: [Tool] - [CPU Settings] - [Option board settings].

↓

The information registered with this unit is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window.

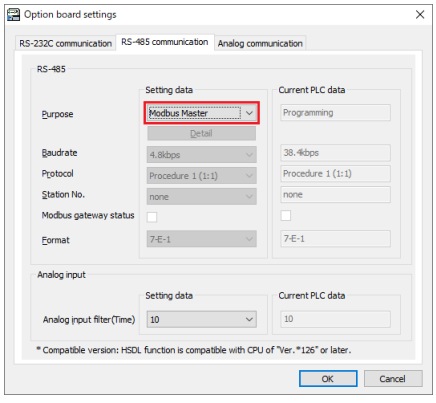


From Control Editor Ver.7.10, when you select “Option board setting” in project tree, right figure will be appeared.
You select the option board which you use, and push OK button, above figure (Option board setting) will be appeared.



If you want to use the Modbus-master function, select the Modbus Master from the [Purpose] pull-down list, and then press the [OK] button.

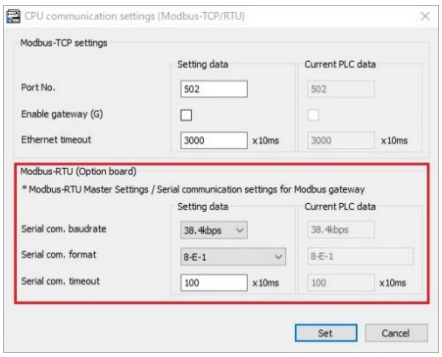
Do not change the analog input filter item, which is nothing to do with the Modbus master function.



6. Select Menu: [Tool] - [CPU Settings] - [Modbus-TCP/RTU settings].

↓

The information registered with this unit is displayed in the [Current PLC Data] box. Specify the baud rate/format/timeout to meet the transmission specification of the slave equipment. If you want to simply check the setting, press the [Cancel] button to close the window.



Caution

Without information about the purpose or the communication rate of the option board setting registered with this unit, you cannot use the Modbus-RTU slave function. Do not lose the registered communication setting information.

To use the Modbus-RTU master function to send queries from this unit, program the MBMST command.

Name	Modbus protocol query send command

Ladder format	Number of steps		Condition code				
	Condition	Steps	R7F4 DER	R7F3 ERR	R7F2 SD	R7F1 V	R7F0 C
MBMST (s, t)	—	6	↕	●	●	●	●

Command processing time (μs)					
Average			Maximum		
Condition	Time		Condition	Time	
	MVH (High Function)	MVL (Standard)		MVH (High Function)	MVL (Standard)
—	51	51	—	—	—

Usable I/O		Bit						Word				Double word			Constant
		X	Y	R,M	TD, SS, MS, CU, CT / TDN, WDT, TMR, RCU,	WR, (.m)	WX	WY	WR, WM	TC	DX	DY	DR,DM	
s	Top I/O of parameter area								✓					
t	Top I/O of communication control bit			✓										

Remarks

- s parameters are occupied up to s + 9.
- t parameters are occupied up to t + 5.

This command perform a serial communication using the Modbus protocol via the serial port on the option board. When you execute this command, a query is sent from the serial port, and then the response is received from the external equipment.

The following table lists the function codes available in this command.

Function code	Function		Broadcast*
0x01	Read Coil Status	Read a coil status	-
0x02	Read Input Status	Read an input status	-
0x03	Read Holding Registers	Read a holding register status	-
0x04	Read Input Registers	Read an input register status	-
0x05	Force Single Coil	Set ON / OFF to a coil status	OK
0x06	Preset Single Register	Change a holding register status	OK
0x08	Diagnostics	Diagnose the slave equipment	-
0x0F	Force Multiple Coils	Set ON / OFF to multiple coil statuses	OK
0x10	Preset Multiple Registers	Set ON / OFF to multiple holding register statuses	OK

* Set the slave address to "0x00" for broadcast communication.

For details of the command, refer to the programming manual (NJI-590*(X)).

3.1.3 Read / write through MICRO-EHV (gateway configuration)

MVH provides the Modbus-TCP gateway function. The gateway function serves as an intermediary between Modbus-TCP in Ethernet and Modbus-RTU in the serial communication (RS-485). A master equipment on Modbus-TCP can access a slave equipment on Modbus-RTU via MVH as a gateway.

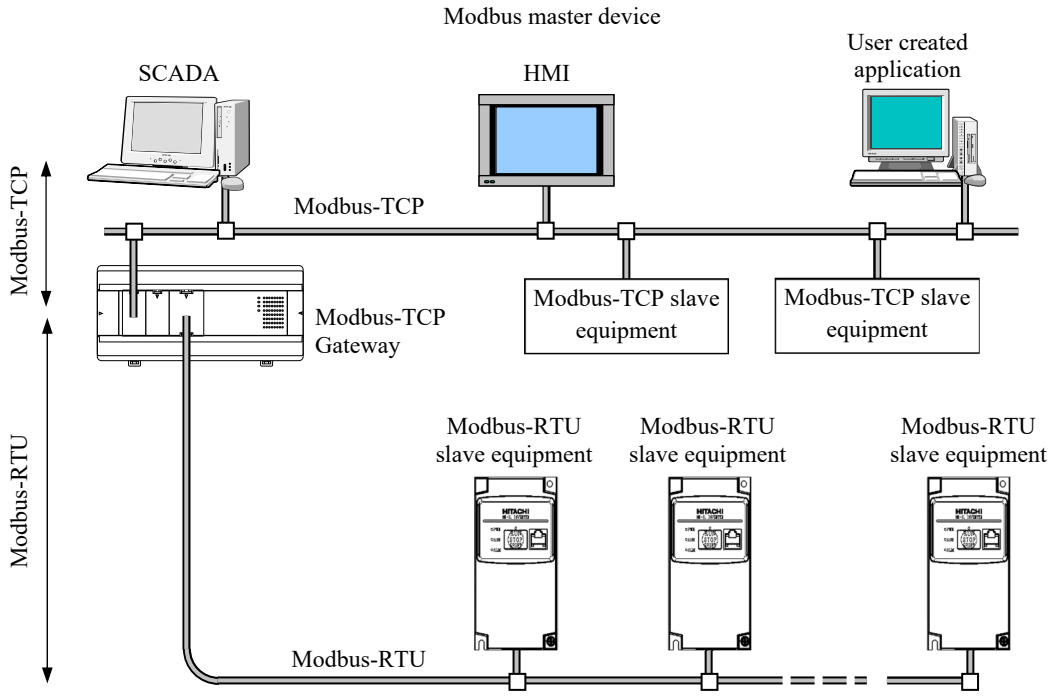


Figure 3.4 Example of Modbus-TCP gateway equipment configuration

Reference

In Modbus protocol reference guide issued by Modicon Inc., it is described as client / server for Modbus-TCP and master / slave for Modbus-RTU. In this document, the term master / slave is used regardless of Modbus-TCP or Modbus-RTU. The Modbus master is the side that sends the query, and the Modbus slave is the side that sends the response.

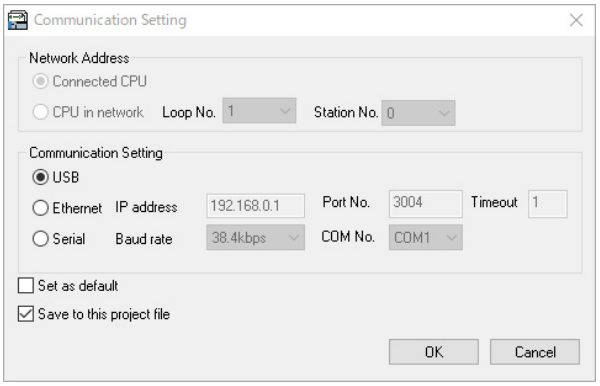
How to use Modbus-TCP gateway (MVH only)

1	Attach a serial communication option board to this unit.
2	Check/change the communication setting of MVH. Register the communication setting such as IP address to meet the environment.
3	Set the master equipment. Use an IP address to specify the address of the gateway from the Modbus-TCP master (client). Use a unit identifier to specify the address of the slave equipment from the Modbus-TCP master (client). Refer to the instruction manual of the used master equipment.
4	This unit relay the query sent from the master device and sends it to the slave device. The response from the slave device is sent to the master device via this unit.

The gateway simply transmits a query from the master equipment to the slave and the response from the slave to the master equipment. Refer to the instruction manual of each equipment or other document for the setting and usage of the master equipment or the setting, usage, and address of the slave equipment.

The procedure to check and change information related to the Modbus-TCP gateway function is described below.

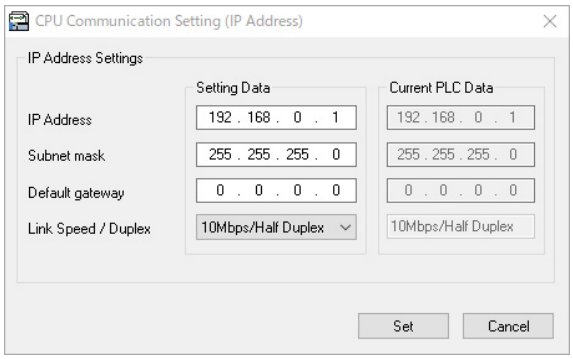
1. Use a commercial USB cable to connect your personal computer and MVH.
2. Turn on MVH.
3. Start the Control Editor,
   select Menu: [Tool] - [PC Communication Setting],
   and select [USB] on the Communication Setting window.



4. Select Menu: [Online] - [Mode] - [Online].
5. Select Menu: [Tool] - [CPU Settings] - [IP address].

   ↓

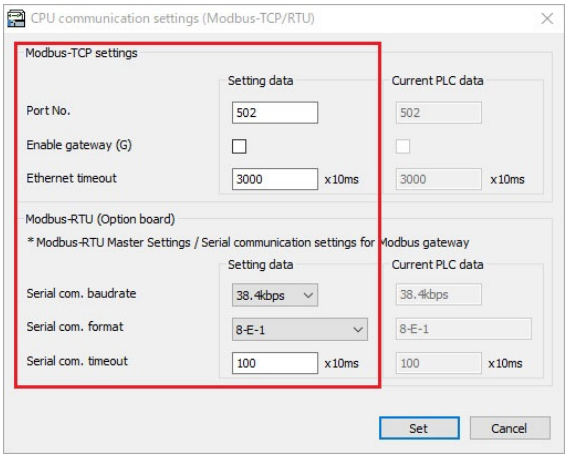
   The information registered with MVH is displayed in the [Current PLC Data] box. If you want to simply check the setting, press the [Cancel] button to close the window. If you want to change the setting, change setting values, then press the [Set] button.



6. Select Menu: [Tool] - [CPU Settings] - [Modbus-TCP/RTU settings].

   ↓

   Select the [Enable gateway] check box and set the parameters in the red frame.
   The information registered with MVH is displayed in the [Current CPU Data] box under the [Modbus-TCP settings] box. If you want to simply check the setting, press the [Cancel] button to close the window. If you want to change the setting, change setting values, then press the [Set] button.

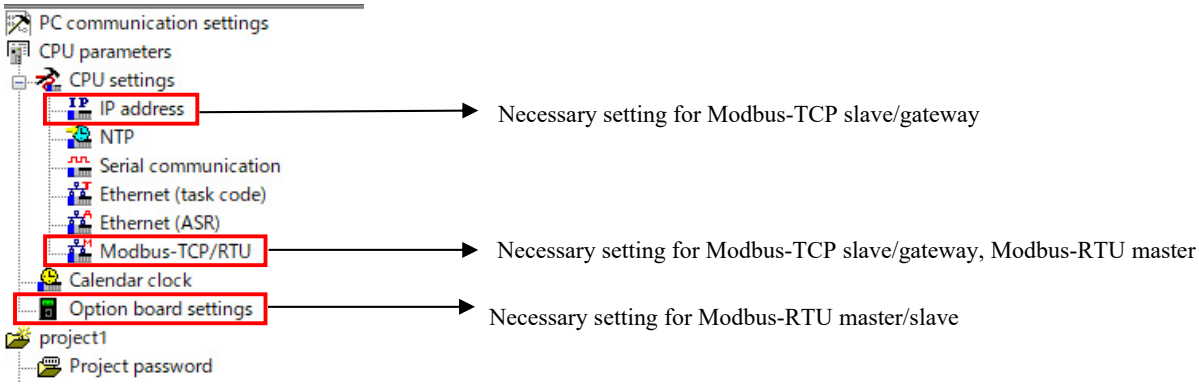


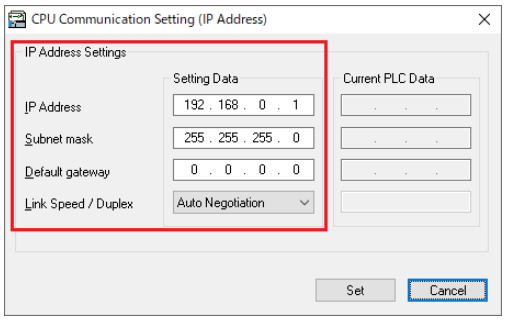
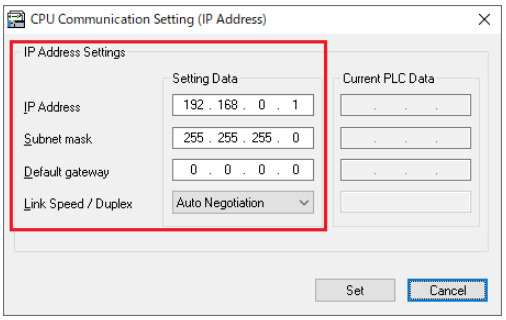
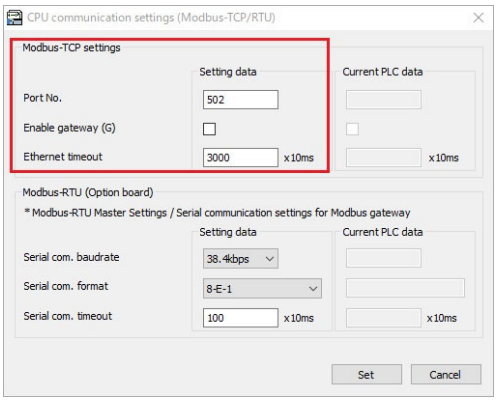
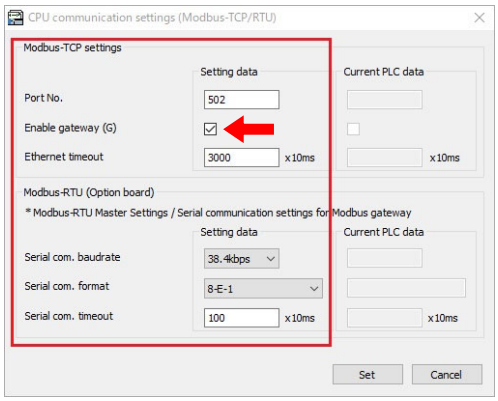
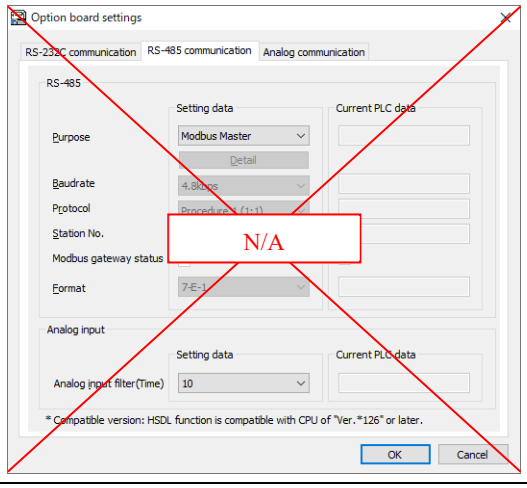
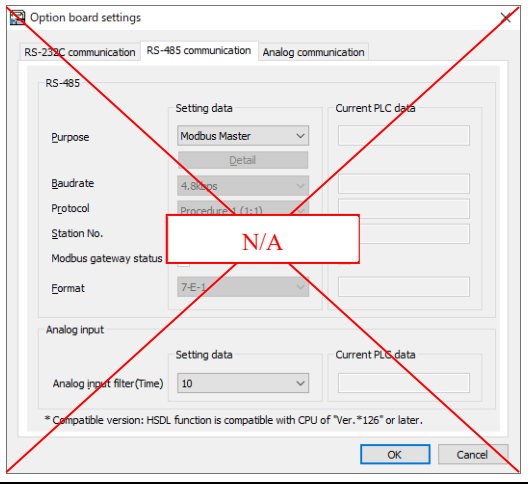
Caution

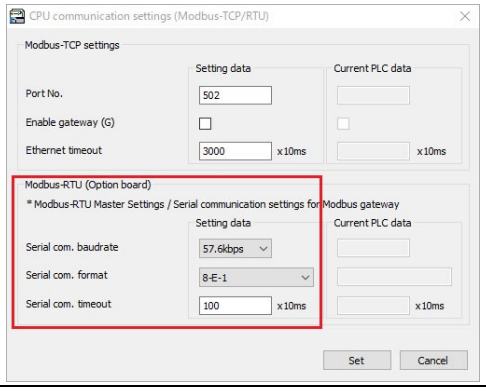
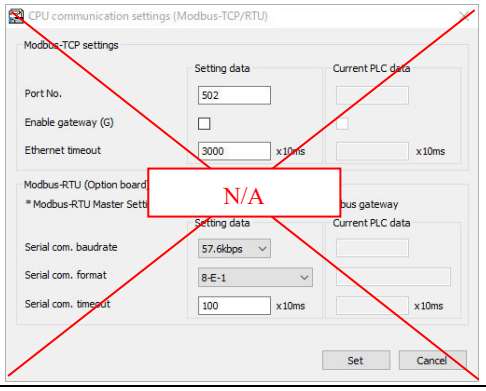
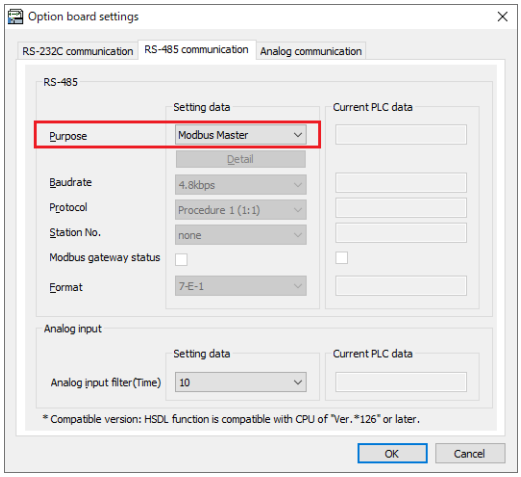
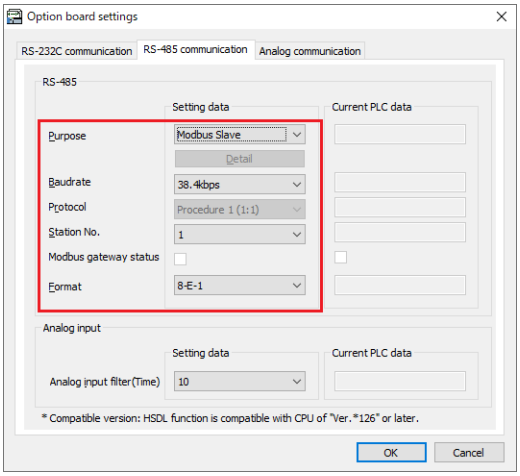
Without information about the IP address registered with MVH and the port No. of the Modbus-TCP setting, you cannot use the Modbus-TCP gateway function. Do not lose the registered communication setting information.

3.1.4 Modbus setting list

This section shows the location where you set each Modbus-TCP/RTU function.



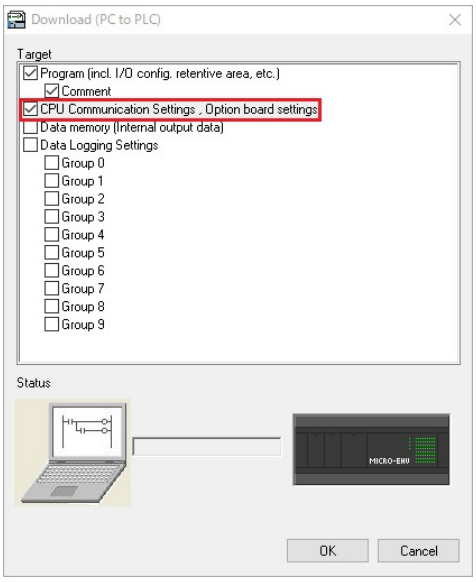
<table>
<tr><th>Modbus-TCP slave</th><th>Modbus-TCP gateway</th></tr>
<tr><td>IP address
 
</td><td>IP address
 
</td></tr>
<tr><td>Modbus-TCP/RTU setting
 
</td><td>Modbus-TCP/RTU setting
 
</td></tr>
<tr><td>Option board setting
 
</td><td>Option board setting
 
</td></tr>
</table>

Modbus-RTU master	Modbus-RTU slave
Modbus-TCP/RTU setting 	Modbus-TCP/RTU setting 
Option board setting (RS-485) 	Option board setting (RS-485) 

Caution

When you click the [Set]/[OK] button on each setting screen during an online connection, the parameters are transmitted to CPU at that point.

If you set them offline, select [CPU communication settings, option board settings] as shown below when transmitting a program to PLC (Download to PLC). The CPU communication setting information is transmitted with the program.



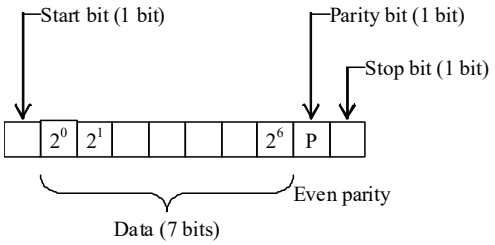
3.2 Task code communication

This unit provides a communication function based on a command/response system which is called "task code" and defined by HI-PROTOCOL, a communication protocol for H series PLC.
The task code communication allows you to connect commercial HMIs to easily build a monitoring system. You can also build a system which supports monitoring or setting data with an application created on your personal computer.

For details of the task code communication, refer to "HITACHI PROGRAMMABLE CONTROLLER H/EH/EHV SERIES PLC-COMPLIANT COMMUNICATION PROTOCOL (HI-PROTOCOL) GUIDE BOOK (NJI-620A) ". NJI-620A is Japanese edition only.

The task code communication can be used on the built-in and option board serial communication port for MVL, and on the Ethernet port in addition to the serial communication por for MVH. The transmission code on the serial communication port is ASCII, The transmission code on the Ethernet port is binary.As the transmission code is different for each communication port, caution should be exercised when creating an application on an upper host. Table 3.5 and table 3.6 show the specification for each communication port.

Table 3.5 Task code communication specification (serial communication port)

Item	Specification	
Baud rate * 1	4,800 bps / 9,600 bps / 19,200 bps / 38,400 bps / 57,600 bps / 115,200 bps	
Interface * 1	Built-in port	Option board
	RS-232C	RS-485
Maximum cable length	15 m	500 m
Connection configuration (maximum number of connections)	1 : 1	1 : 1 / 1 : N (32)
Communication method	Half-duplex	
Synchronization system	Start-stop synchronization	
Start method	One side start by host-side command	
Transmission mode	Serial transmission (bit serial transmission)	
Transmission code	ASCII	
Transmission code configuration		
Transmission code transmission order	Transmit character by character from lower bit	
Error control	Vertical parity checking, sum check, overrun check, and framing check	
Transmission unit	Message (variable-length)	
Maximum message length	1,460 bytes (including control characters)	
Communication procedure* 1	H series dedicated procedure (HI-PROTOCOL), procedure 1, procedure 2	
Connector shape	8-pin modular connector (RJ-45 type)	

* 1 Use the Control Editor to set the communication rate, interface, and communication procedure.
By the factory default, 38,400 bps and [Procedure 1(1:1)] are set.
To enable changed communication settings, the power needs to be cycled.

Thoroughly check creating and setting connected cables to meet your purpose in advance.

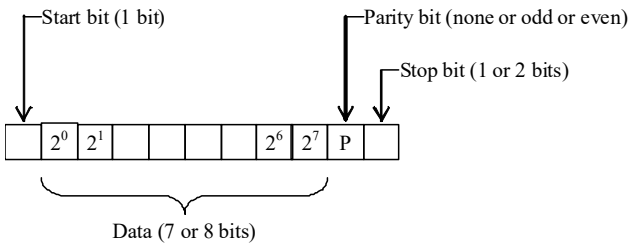
Table 3.6 Task code communication specification (Ethernet port)

Item	Specification
Communication protocol	TCP/IP or UDP/IP
Connection	four (concurrently used)
Connection method	Arbitrary peer station, passive
Timeout monitoring	1 to 65,535 seconds

3.3 General-purpose non-procedural communication

When you specify the general communication for the purpose of the serial communication port, you can program commands to meet a connected equipment for communication control. Use TRNS0 and RECV0 as commands. The following table shows the specification of the general communication.

Table 3.7 General communication specification

Item	Specification	
Baud rate	300 bps, 600 bps, 1,200 bps, 2,400 bps, 4,800 bps, 9,600 bps, 19,200 bps, 38,400 bps, 57,600 bps, 115,200 bps	
Interface	RS-232C	RS-485
Maximum cable length	15 m	500 m
Connection configuration (maximum number of connections)	1 : 1	1 : 1 / 1 : N (32)
Communication method	Half-duplex	
Synchronization system	Start-stop synchronization	
Start method	One side start by host-side command	
Transmission mode	Serial transmission (bit serial transmission)	
Transmission code	User definition	
Transmission code configuration		
Transmission code transmission order	Transmit character by character from lower bit	
Error control	Vertical parity checking, overrun check, and framing check	
Transmission unit	Message (variable-length)	
Maximum message length	1,024 bytes (including control characters)	
Control procedure	Non-procedural	
Control code	User definition	
Used connector	8-pin modular connector (RJ-45 type)	

* To enable changed communication settings, the power needs to be cycled.

Thoroughly check creating and setting connected cables to meet your purpose in advance.

The following example demonstrates a 1:N communication with RS-485.

The 1:N communicationwith RS-485 uses the polling/selecting method for communication, as shown in the sequence of the Figure 3.6. In a sequence of this example, the master sends data to slave stations in the order of the unit identifier 1→2→3, and each slave station receives the data and sends the reply. The convexed parts drawn by solid lines represent reception of data for the own station, and the ones by dotted lines represent reception of data for other stations in the figure 3.6.

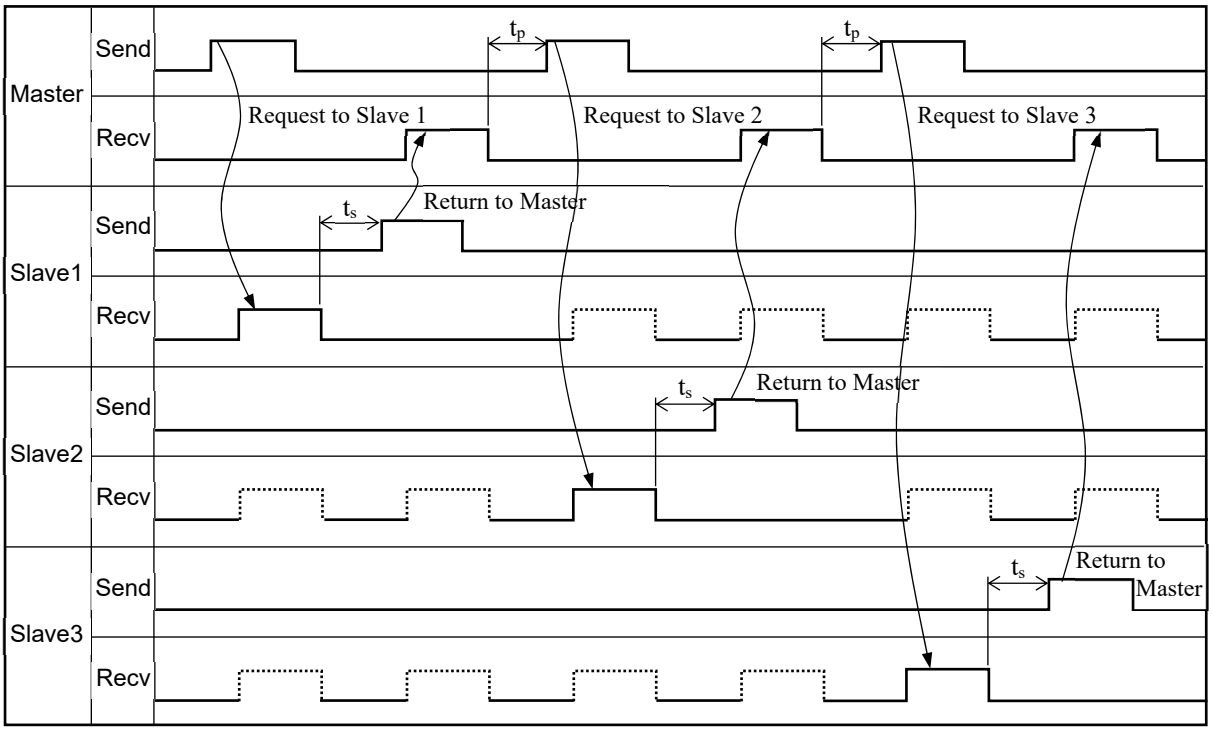


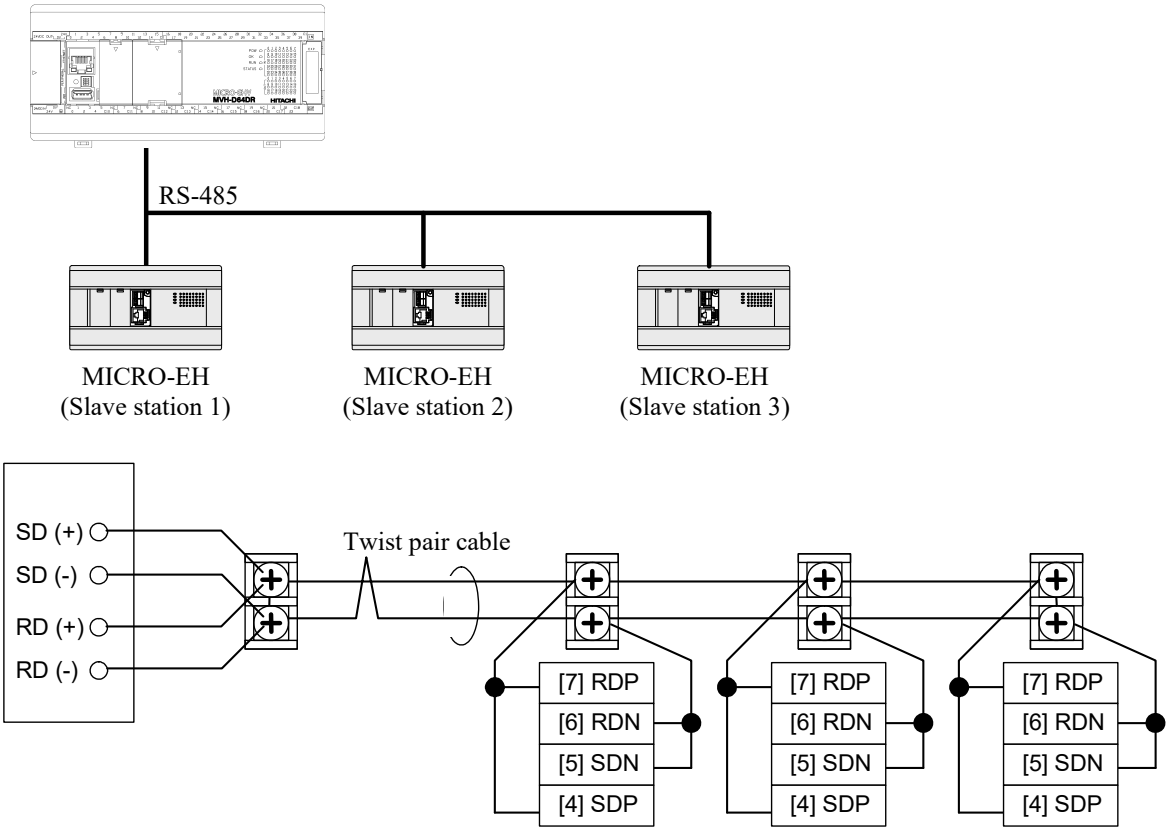
Figure 3.5 1：N sending/receiving sequence

Be careful about the following points when creating a ladder program.

1. The start code should be unified on the master station and the slave stations.
2. The master station should specify the unit identifier of the slave station.
3. The slave station should retrieve the unit identifier from the data sent by the master station, and send back the reply only when the destination is itself. If it receives a request for another station, it should continue to wait for the next data.
4. The master station should wait 20 ms or more (t_p in the figure) after receiving reply data from the slave station before sending the next data.
5. The slave station should wait 20 ms or more (t_s in the figure) after receiving data from the master station before sending the reply data.

The following figure shows an example of equipment configuration.

MICRO-EHV (Master station)



A ladder program can use the following internal outputs.

(a) Internal output on master station

I/O No.	Usage
WR0 to E	TRNS 0 command Parameter area (s to s+14)
R0 to B	TRNS 0 command Communication control bit area (t to t+11)
WR10 to 2F	Sending data area (32 words)
WR30 to 4F	Receiving data area (32 words)
WR50	Unit identifier of the destination slave station
WR51	Number of child stations
WR61 to 63	Storage area of the receiving data
R10	Sending data generation completion flag

(b) Internal output on slave station

I/O No.	Usage
WR100 to 10E	RECV 0 command Parameter area (s to s+14)
R0 to B	RECV 0 command Communication control bit area (t to t+11)
WR110 to 12F	Sending data area (32 words)
WR130 to 14F	Receiving data area (32 words)
WR150 to 15E	TRNS 0 command Parameter area (s to s+14)
R10 to 1B	TRNS 0 command Communication control bit area (t to t+11)
WR160 to 17F	Sending data area (32 words)
WR180 to 19F	Receiving data area (32 words)
WR1A0	Unit identifier of the current slave station
WR1A1	Own unit identifier

If you apply this usage example, change I/O No., etc. to meet your application.

The transmission format is as follows:

(a) Master station ➔ slave station (Total 3 bytes)

Start code	Unit identifier	End code
02H	1 to 3	0DH

(b) Slave station ➔ master station (Total 5 bytes)

Start code	Unit identifier	Data		End code
02H	1 to 3	Arbitrary*	Arbitrary*	0DH

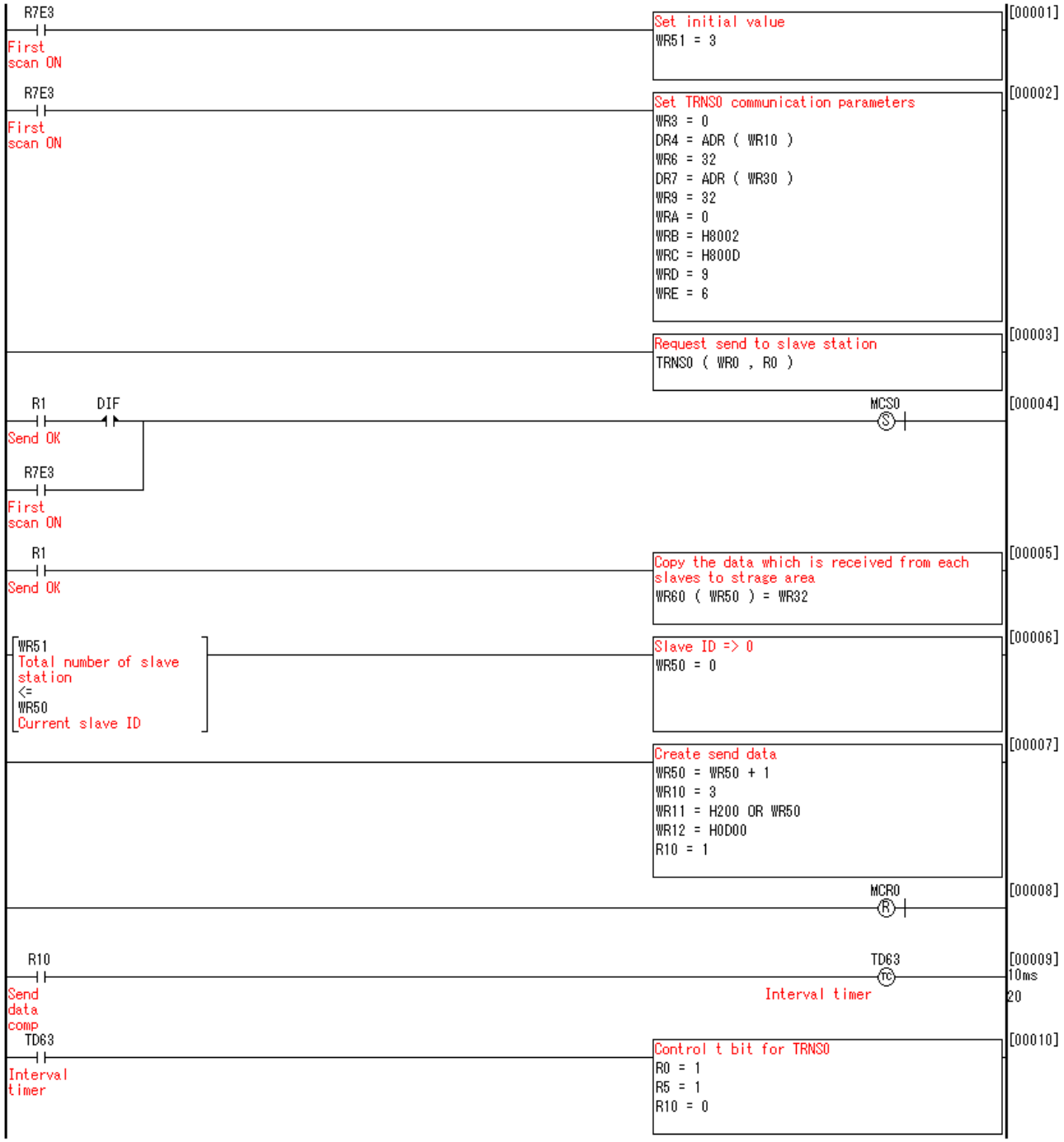
* It can include arbitrary data except the end code (0DH). In this sample program, it includes the year/month/day/time/minute information.

If data is sent to/received from the slave stations 1 - 3 successfully, the data received from each station is stored in the following I/O No. of the master station.

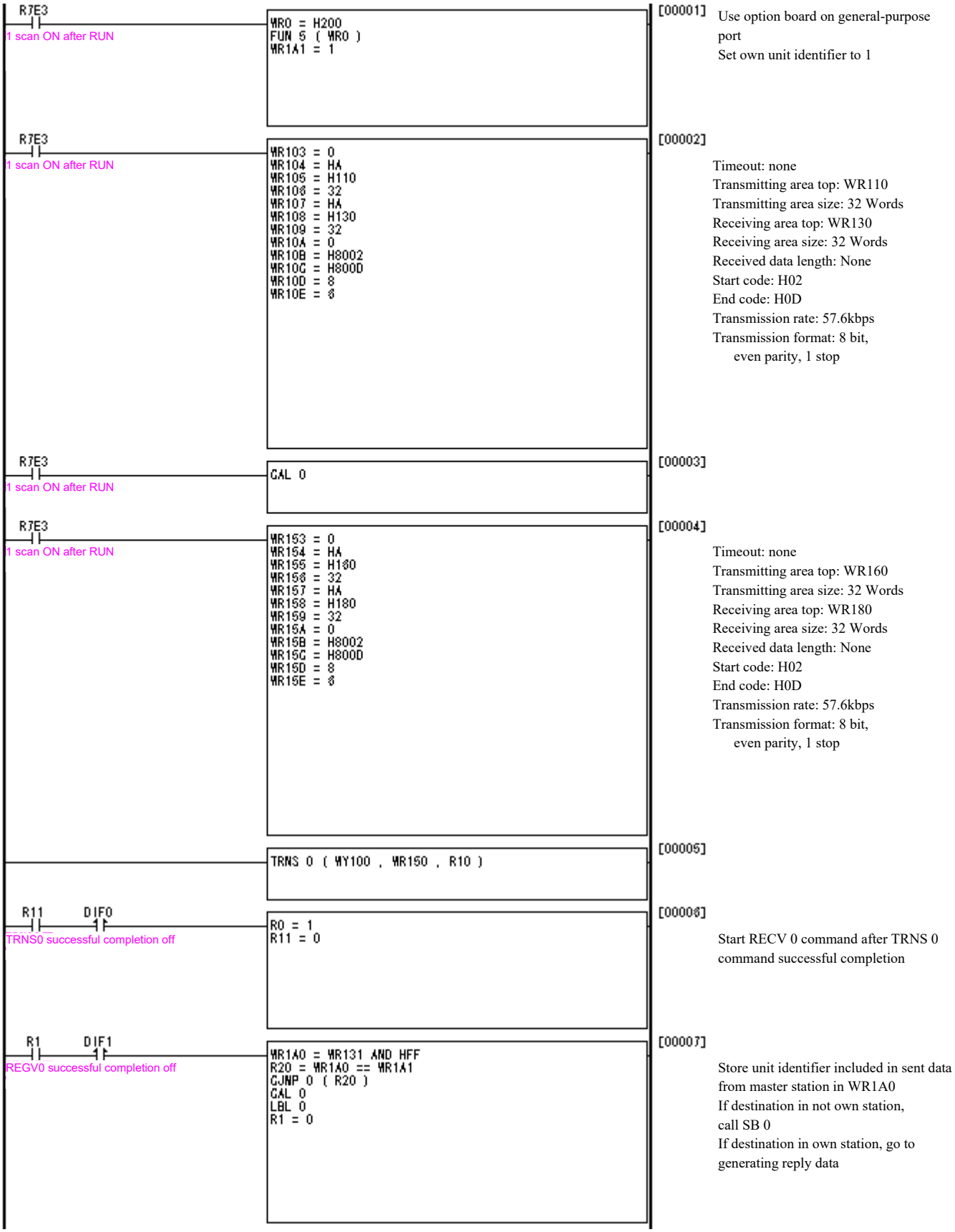
I/O No.	Setting value	Content
WR61	0001H	Data received from the slave station 1
WR62	0002H	Data received from the slave station 2
WR63	0003H	Data received from the slave station 3

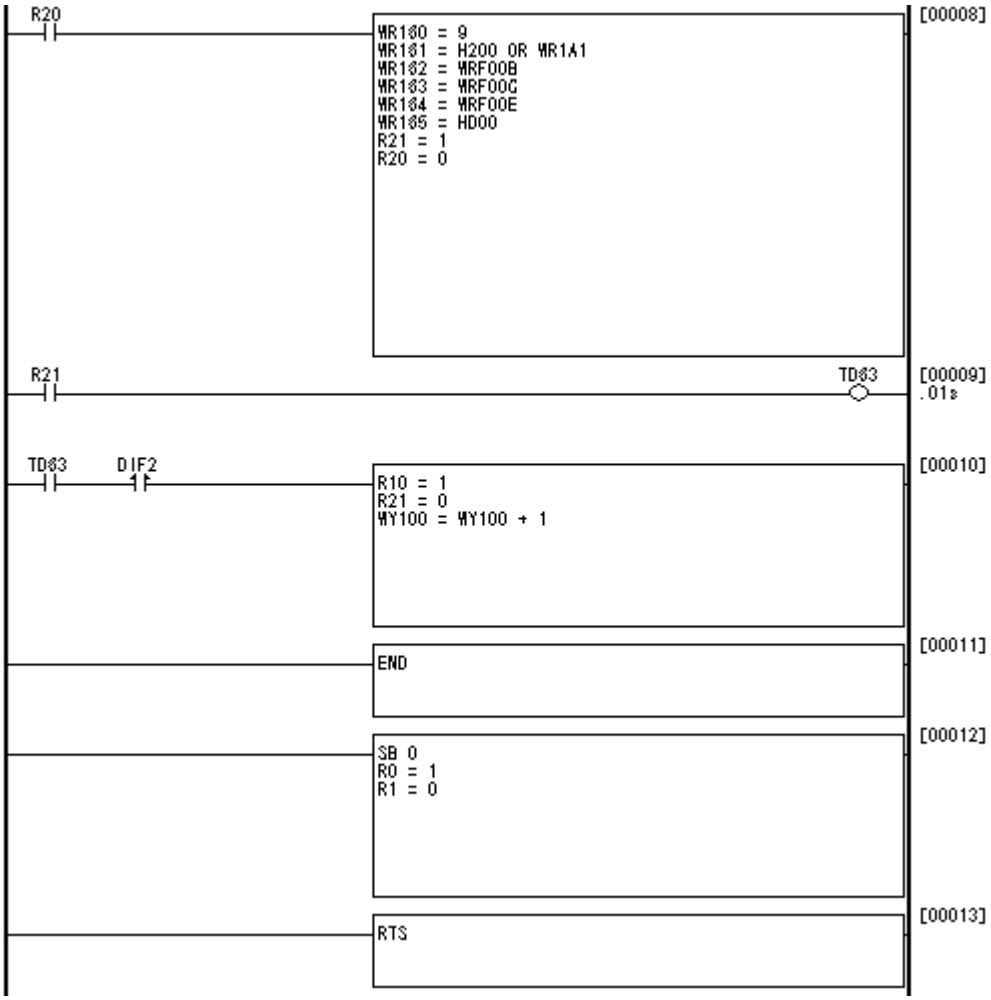
Sample program

(a) Program on the master station (for 3 slave stations)



(b) Program on the slave station No. 1





Generate sent data
Number of bytes to sent: 9 bytes
Set start code and unit identifier
Specify year (WRF00B), month and date (WRF00C), and hour and minute (WRF00E) values for sent data

Data reception→Generate sent data
Wait 20ms after completion to execute TRNS 0 command

3.4 Ethernet ASR communication

ASR communication function can be used when message data is transmitted from this unit to the host actively at the event occurrence, and message data is received from the host at any time. And communication procedures can be established according to the system.

In addition, it is possible to change the transmission data size dynamically during ASR communication by ladder program, and refer to the size of receiving data during ASR communication.

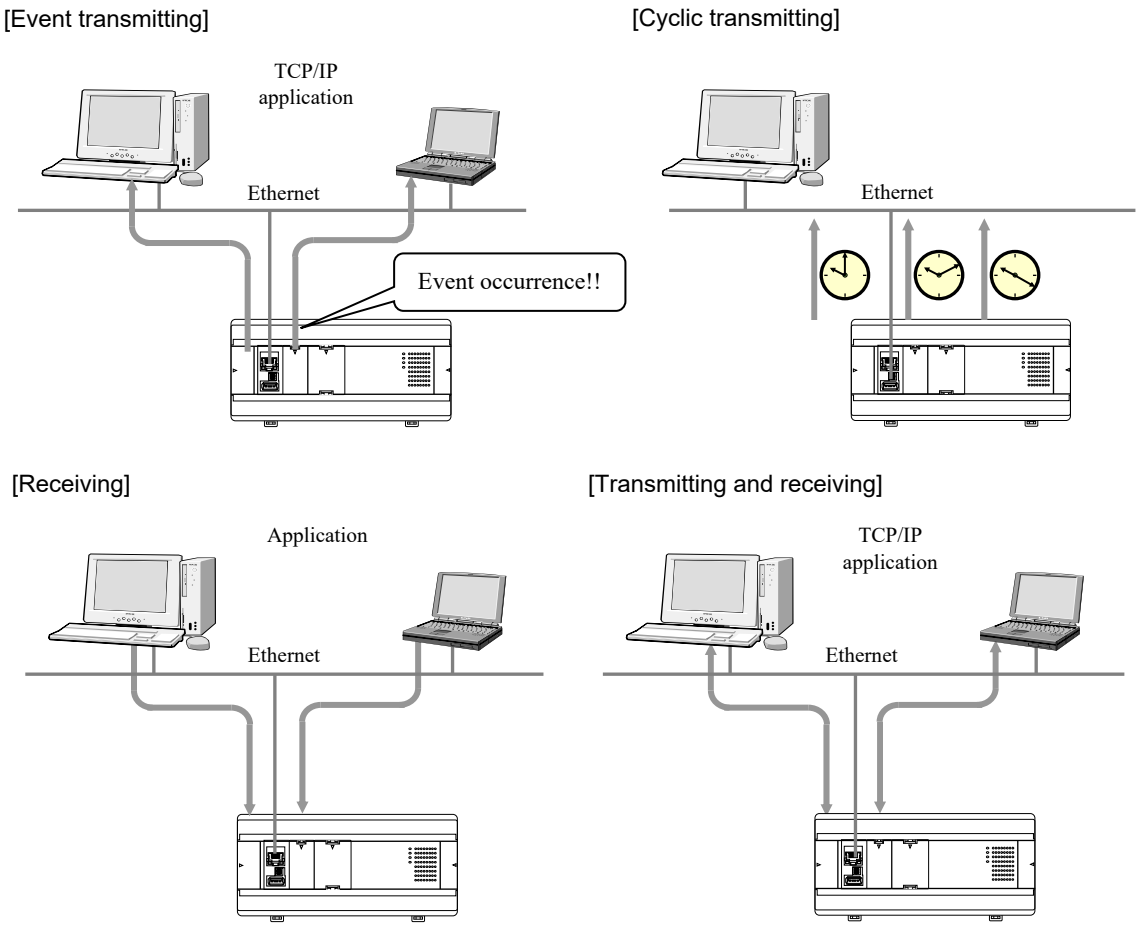


Figure 3.6 ASR communication port

Table 3.8 Communication specifications for ASR communication

No.	Item	Specifications
1	Communication protocol	TCP/IP, UDP/IP
2	Logical port	Up to 6 (A port not to be used can be set up to the Invalid.)
3	Maximum length of message	Up to 730 words
4	Sending area	Specifying from WX,WY and internal output(WR,WM)
5	Receiving area	Specifying from WY and internal output(WR,WM)
6	Transmitting system	Event transmitting, Cyclic transmitting
7	Receiving system	Auto receiving
8	Send mode	Control Editor setting operation mode, Special Internal Output setting operation mode

Communication type

You can specify the following 4 communication types.

Table 3.9 Communication type for ASR communication

No.	Type	Description
1	Not used	Not perform the transmitting and receiving
2	Transmitting and receiving	Performs the transmitting and receiving to the other station.
3	Only transmitting	Performs the transmitting to the other station only.
4	Only receiving	Performs the receiving only.

Connection type

You can specify the following 5 connection types.

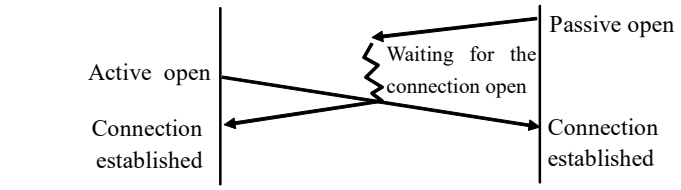
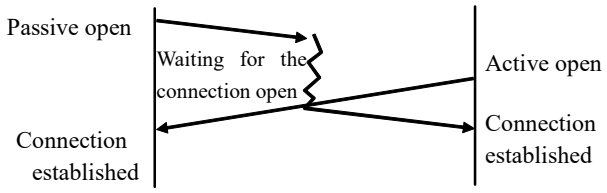
Table 3.10 Connection type for ASR communication

No.	Connection method
1	TCP/IP-Active open
2	TCP/IP-Passive open Designated IP
3	TCP/IP-Passive open Undesignated IP
4	UDP/IP-Designated IP
5	UDP/IP-Undesignated IP

TCP/IP-Active open and TCP/IP-Passive open

When performing the ASR communication using TCP/IP, the logical transmission path for the connection with an open request should be established between MVH and the other station in advance. There are two methods to establish connection, the active open and the passive open.

Table 3.11 Connection method for ASR communication

No	Connection method	Description
1	Active Open	A method to establish connection by transmitting the open request later to the other station waiting for the connection open. 
2	Passive Open	A method to establish connection by receiving the open request from the other station, waiting for the connection open earlier. 

UDP/IP opening and closing

In general, UDP/IP does not require the operation of connection open/close. However, these operations are required in ASR communication. Message data will be able to send/receive after ASR port open. In addition, please close the port at the end of the communication.

"Specified" and "Optional" for the other station

It is able to do ASR communication with any other station without specifying opponent station in the following cases.

-TCP/IP-Passive open

-UDP/IP

Transmitting Broadcast

When "Transmitting and receiving", or "Transmitting only" is specified using UDP/IP, message data can be exchanged between the logical ports which satisfy the following requirements.

(1) Nodes with the same network address (Multiple other stations)

(2) Nodes with the same logical port No., which can perform the UDP/IP communication (Multiple other stations)

(3) Nodes in status which can receive message (Multiple other stations)

This is called "Simultaneous transmission" or "Transmitting Broadcast".

【Transmitting Broadcast】

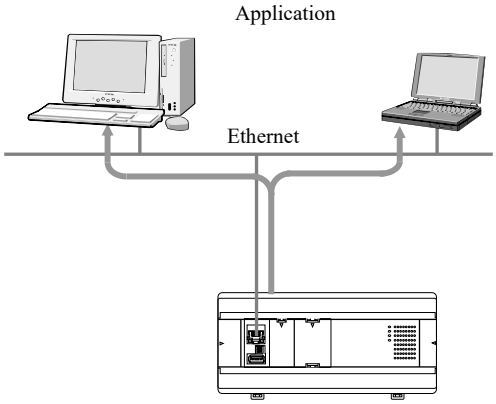
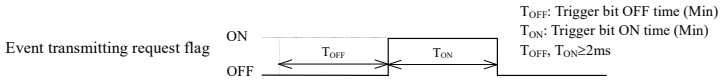


Figure 3.7 Transmitting Broadcast

Transmitting type

There are the following 2 transmitting types.

Table 3.12 Transmitting type for ASR communication

No.	Transmitting type	Description
1	Event transmitting	When the transmitting trigger bit specified is turned from OFF to ON, data in I/O memory specified as the transmitting area is transmitted To transmit data, the event transmission request flag should be ON for 2ms or longer and OFF for 120ms or more. 
2	Cyclic transmitting	Data in I/O memory specified as the transmitting area is transmitted at the interval (1 to 65,535 × 1s, 1 to 65,535 × 40 ms) specified with the cyclic transmitting timer in a constant cycle.

Setup item

First, set the Ethernet IP address, subnet mask, default gateway, and link speed / duplex. Refer to page 2 to 4 for the setting method.

Items need to be set up depending on the combination of the communication type, the connection type, and the transmitting type. Required items are shown below. "✓" is marked to the item which should be set the parameter specifying in the following table for the communication.

* The Control Editor is used in setting up. When the port supply is turned on at next, the set information becomes effective.

Table 3.13 Setup items for ASR communication

No.	Communicatin type	Connection type	Transmitting type	Items which shoeld be setup											
				A	B	C	D	E	F	G	H	I	J	K	L
1	Transmitting and receiving	TCP/IP-Active	Event transmitting	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
			Cyclic transmitting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		TCP/IP-Passive Specified	Event transmitting	✓	✓	✓		✓	✓	✓	✓	✓	✓		
			Cyclic transmitting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
		TCP/IP-Passive Optional	Event transmitting	✓				✓	✓	✓	✓	✓	✓		
			Cyclic transmitting	✓			✓	✓	✓	✓	✓	✓	✓		
		UDP/IP Specified	Event transmitting	✓	✓	✓		✓	✓	✓	✓	✓	✓		
			Cyclic transmitting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
		UDP/IP Optional	Event transmitting	✓		✓		✓	✓	✓	✓	✓	✓		
			Cyclic transmitting	✓		✓	✓	✓	✓	✓	✓	✓	✓		
2	Only transmitting	TCP/IP-Active	Event transmitting	✓	✓	✓		✓	✓	✓				✓	✓
			Cyclic transmitting	✓	✓	✓	✓	✓	✓	✓				✓	✓
		TCP/IP-Passice Specified	Event transmitting	✓	✓	✓		✓	✓	✓					
			Cyclic transmitting	✓	✓	✓	✓	✓	✓	✓					
		TCP/IP-Passice Optional	Event transmitting	✓				✓	✓	✓					
			Cyclic transmitting	✓			✓	✓	✓	✓					
		UDP/IP Specified	Event transmitting	✓	✓	✓		✓	✓	✓					
			Cyclic transmitting	✓	✓	✓	✓	✓	✓	✓					
		UDP/IP Optional	Event transmitting	✓		✓		✓	✓	✓					
			Cyclic transmitting	✓		✓	✓	✓	✓	✓					
3	Only receiving	TCP/IP-Active	—	✓	✓	✓					✓	✓	✓	✓	✓
		TCP/IP-Passice Specified	—	✓	✓	✓					✓	✓	✓		
		TCP/IP-Passice Optional	—	✓							✓	✓	✓		
		UDP/IP Specified	—	✓	✓	✓					✓	✓	✓		
		UDP/IP Optional	—	✓		✓					✓	✓	✓		

[A] Master station port No. [B] Other station IP address [C] Other station port No.

[D] Transmitting cycle timer [E] Transmitting area I/O type [F] Head I/O address in transmitting area

[G] Transmitting area size [H] Receiving area I/O type [I] Head I/O address in receiving area

[J] Receiving area size [K] Number of retry times [L] Retry interval

Transmitting area and receiving are information

In ASR communication, areas for the I/O memory which store message data to transmit and which store message data received need to be specifies.

Both the size which can be transmitted and received are 1 to 730 words.

Table 3.14 Transmitting and receiving are information for ASR communication

No.	Type		I/O memory area which can be specified	Number of areas which can be specified
1	Transmitting area information	WX	*1	10 areas *2
		WY	*1	
		WR	0 to 7FFF	
		WM	0 to 7FF	
2	Receiving area information	WY	*1	1 area
		WR	0 to 7FFF	
		WM	0 to 7FF	

*1 Depends on the I/O assignment.

*2 The size which can be transmitted is up to 730 words totally regardless the number of setting areas

Number of retry times and Retry interval for Connection open

When TCP/IP-active is specified, the number of retry times and the retry interval for the connection open when failing can be specified.

When there is no response to the packet including the SYN flag*1 transmitted from the MVH, the retry is performed three times. And this process is repeated for the number of retry times. The internal between cycles which consist of three retries is specified as the retry interval.

The following is an example in case where the number of retry times is set to 3 and the retry interval is set to 10 seconds.

*1 SYN flag is a connection open request flag.

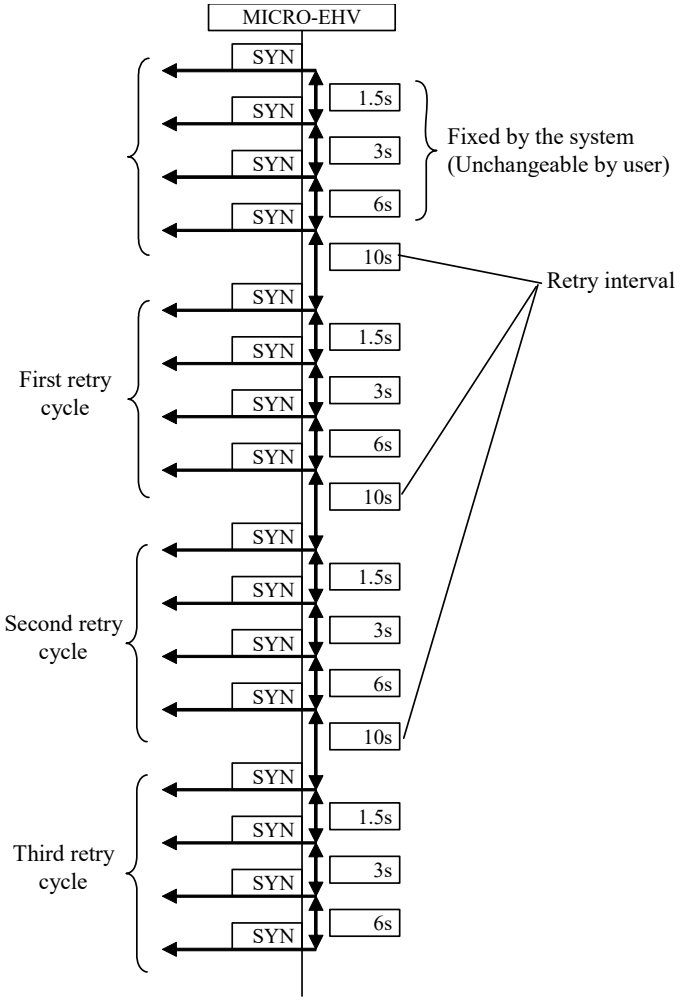


Figure 3.8 Connection open retry sequence

Status register, Control register, Transmitting counter, Receiving counter

The status register, the control register, the transmitting counter, and the receiving counter for ASR communication are assigned to the special internal output WRF060 or later.

Table 3.15 Special internal output for ASR function

No	Name		Set condition	Reset condition
WRF060	ASR port 1	Status register	Set by system	Clear by system or user
WRF061		Control register	Set by user	Clear by user
WRF062		Transmitting counter	Set by system	Clear by user
WRF063		Receiving counter	Set by system	Clear by user
WRF064	ASR port 2	Status register	Set by system	Clear by system or user
WRF065		Control register	Set by user	Clear by user
WRF066		Transmitting counter	Set by system	Clear by user
WRF067		Receiving counter	Set by system	Clear by user
WRF068	ASR port 3	Status register	Set by system	Clear by system or user
WRF069		Control register	Set by user	Clear by user
WRF06A		Transmitting counter	Set by system	Clear by user
WRF06B		Receiving counter	Set by system	Clear by user
WRF06C	ASR port 4	Status register	Set by system	Clear by system or user
WRF06D		Control register	Set by user	Clear by user
WRF06E		Transmitting counter	Set by system	Clear by user
WRF06F		Receiving counter	Set by system	Clear by user
WRF070	ASR port 5	Status register	Set by system	Clear by system or user
WRF071		Control register	Set by user	Clear by user
WRF072		Transmitting counter	Set by system	Clear by user
WRF073		Receiving counter	Set by system	Clear by user
WRF074	ASR port 6	Status register	Set by system	Clear by system or user
WRF075		Control register	Set by user	Clear by user
WRF076		Transmitting counter	Set by system	Clear by user
WRF077		Receiving counter	Set by system	Clear by user

Details of the status register, the control register, the transmitting counter, and the receiving counter are described below.

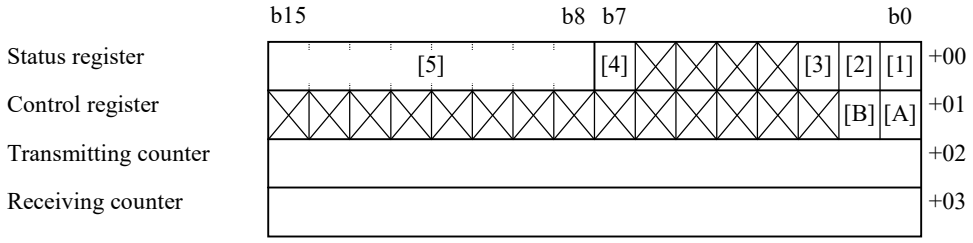


Figure 3.9 Status register, Control register, Transmitting counter, and Receiving counter

[Status register]

[1] ASR port status flag	1: Opened, 0: Closed
[2] Event transmitting completion flag	1: Transmitting completion
[3] Receiving completion flag	1: Receiving completion
[4] Error flag	1: Error occurrence
[5] Error code	0x01: Event transmitting request flag [B] is turned ON while ASR port status flag [A] is closed. 0x02: Event transmitting request flag is turned ON again in status which the transmitting of message is not completed. 0x03: In Special Internal Output setting operation mode, the value that exceeds size of the send area is set. 0x04: In Special Internal Output setting operation mode, the total of send size from the send area 1 to 10 is set to 0.

[Control register]

[A] ASR port open request flag	1: Open request, 0: Close request
[B] Event transmitting request flag	1: Transmitting start

[Transmitting counter]

Stores the number of transmitting of message data.

[Receiving counter]

Stores the number of receiving of message data.

(1) ASR port status flag [1] and ASR port open request flag [A]

[TCP/IP Active]

If user turns on the ASR port open request flag [A], the system will open the connection with the communication other stations. If the other station is waiting for the connection open, the connection will be open normally and the ASR port status flag [1] will turn ON and it will be indicated that the connection is opening. If the other station is not waiting for the connection open and is not found, the connection will not be open normally and the ASR port status flag [1] is still OFF and it will be indicated that the connection is closing. If user turns off the ASR port open request flag [A] while the connection is opened, the connection will be closed and the connection status request flag [A] will turn OFF.

And if the other station closes the connection, user must turn off the ASR port open request flag [A] because it does not turn OFF.

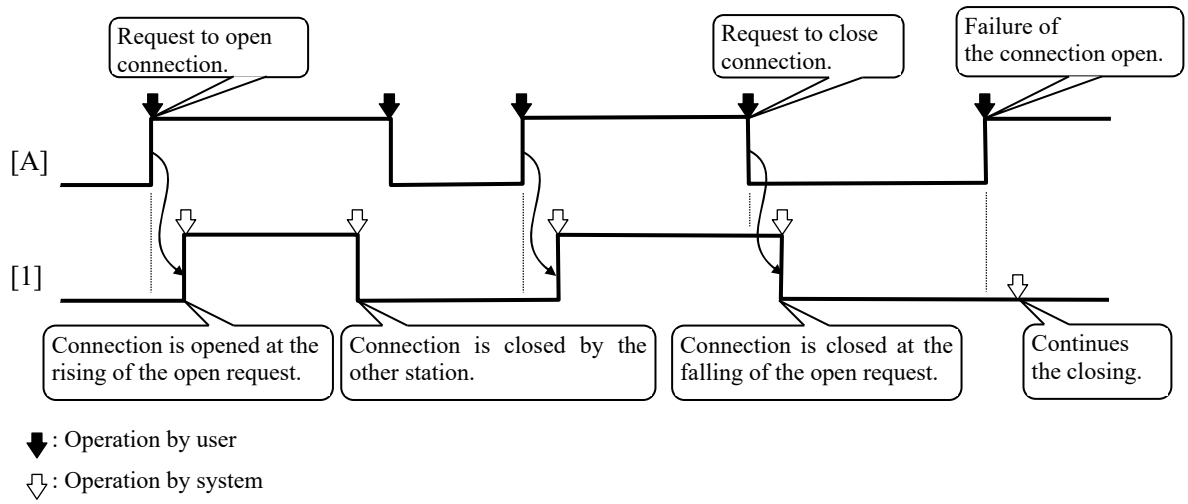


Figure 3.10 ASR port status flag and ASR port open request flag (TCP/IP Active open)

[TCP/IP Passive]

If user turns on the ASR port open request flag [A], the connection open will become the waiting status. In this case, if the other station transmits the connection open request, the connection with the other station will be opened and the ASR port status flag [1] will turn ON and it is indicated that the connection is opening. The connection open does not become the waiting status when the ASR port open request flag [A] is OFF. In this case, if the other station transmits the connection open request, the connection with the other station will not be opened.

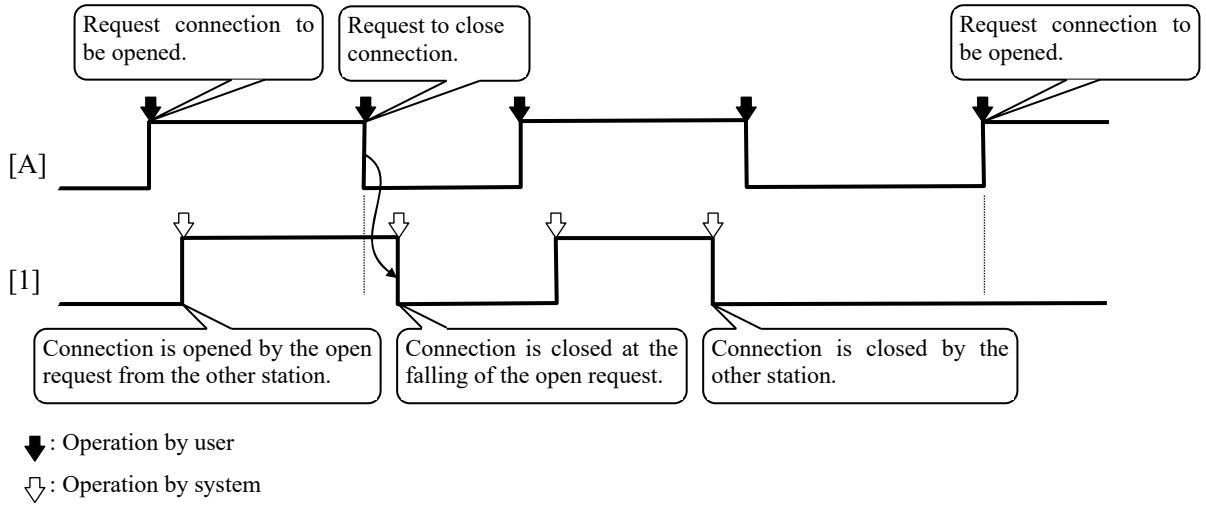


Figure 3.11 ASR port status flag and ASR port open request flag (TCP/IP Passive open)

* In case where the connection is not closed normally.

When the connection is not closed normally for reasons that the cable came off, etc., the process mentioned above is not performed. When the set of the transmitting and receiving is specified to “Transmitting” or “Transmitting and receiving”, it is detected by the transmitting timeout that the connection is not opened normally and the ASR port status flag [1] is turned OFF.

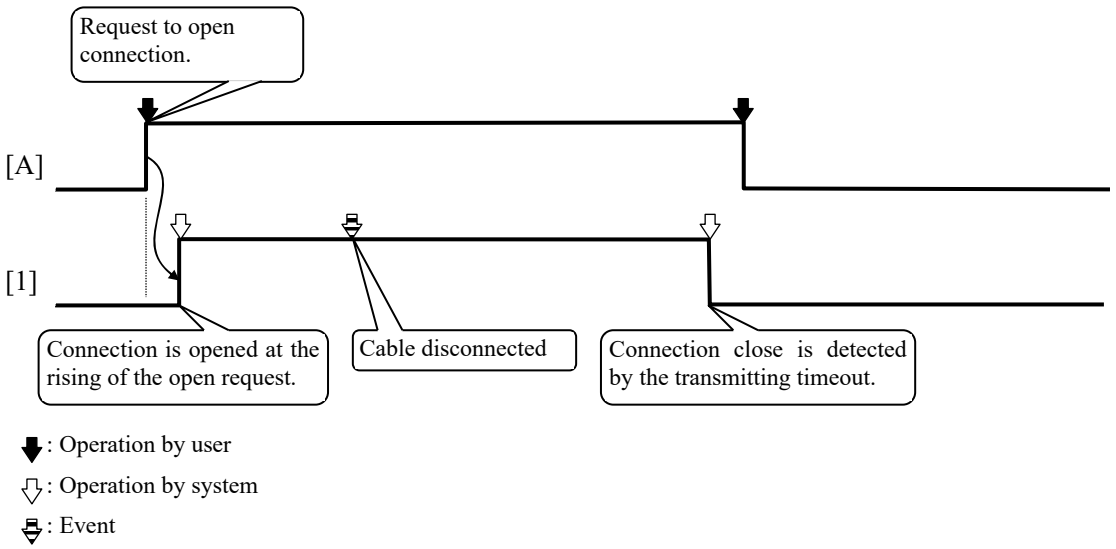


Figure 3.12 ASR port status flag and ASR port open request flag
(TCP/IP Transmitting and Transmitting and receiving side)

When the set of transmitting and receiving is specified to “Receiving”, it is not detected that the connection is closed because of waiting for message data from the other station. When the connection open request is transmitted from the other station again, it is detected that the connection is closed and the ASR port status flag [1] is turned OFF.

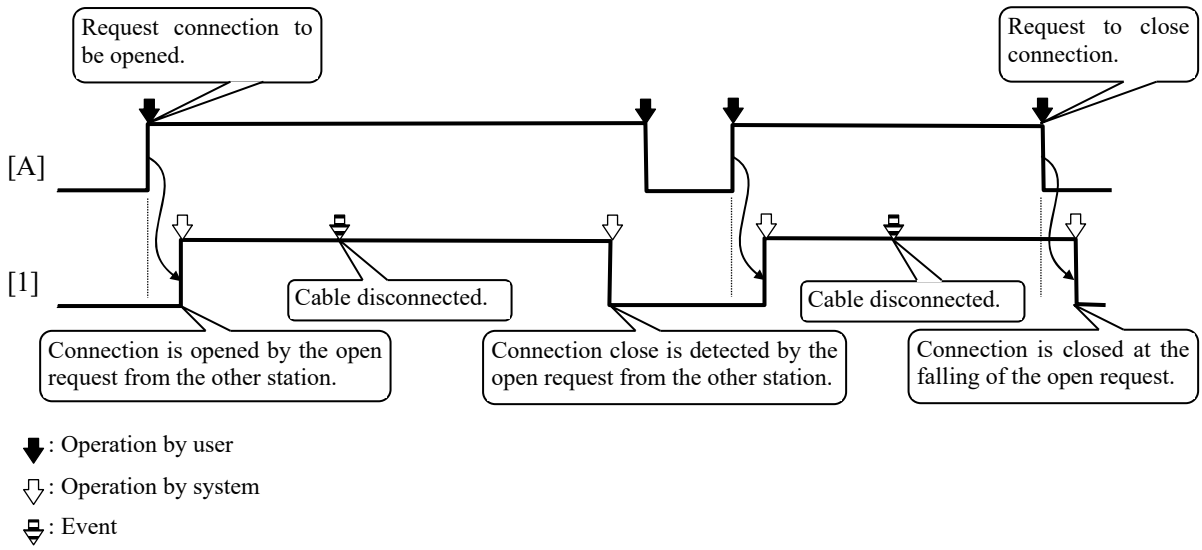


Figure 3.13 ASR port status flag and ASR port open request flag (TCP/IP Receiving side)

[UDP/IP]

If user turns ON the ASR port open request flag [A], the ASR port is opened and it is that the ASR port is opening because the ASR port status flag [1] is turned ON. In this status, message data can be transmitted and received.

When UDP/IP other station is fixed, ARP packet is transmitted to communication destination when message data is transmitted for the first time. If there is no response to this ARP packet, ASR port is closed and the ASR port status flag [1] is turned OFF. In case of only receiving or when message data is transmitted after second time, the system does not close the ASR port because ARP packet is not transmitted to communication destination.

If user turns OFF the ASR port open request flag [A], the ASR port is closed and the ASR port status flag [1] is turned OFF, indicating that it is closed.

In this status, message data cannot be transmitted and received.

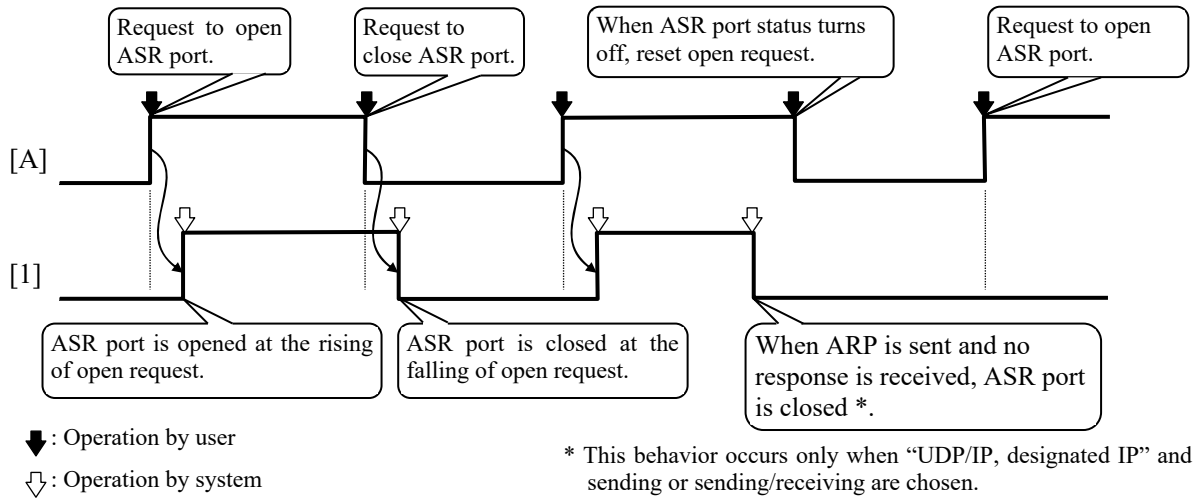


Figure 3.14 ASR port status flag and ASR port open request flag (UDP/IP)

(2) Event transmitting completion flag [2] and Event transmitting request flag [B]

If user turns ON the event transmitting request flag [B] when message data can be transmitted and received (the connection is established in TCP/IP, and ASR port is opened in UDP/IP), the system will transmit message data. If the transmitting of message data is completed, the system will turn ON the event transmitting completion flag [2]. If user performs the event transmitting again, user must turn ON the event transmitting request flag [B] after turning OFF. And when monitoring whether the transmitting to the event transmitting request has been completed or not, user needs t turn OFF the event transmitting completion flag before turning ON the event transmitting request flag.

If the event transmitting request flag [B] is turned ON when message data cannot be transmitted and received (the connection is not established in TCP/IP, and ASR port is not opened in UDP/IP), the error flag and the error code are set because of error.

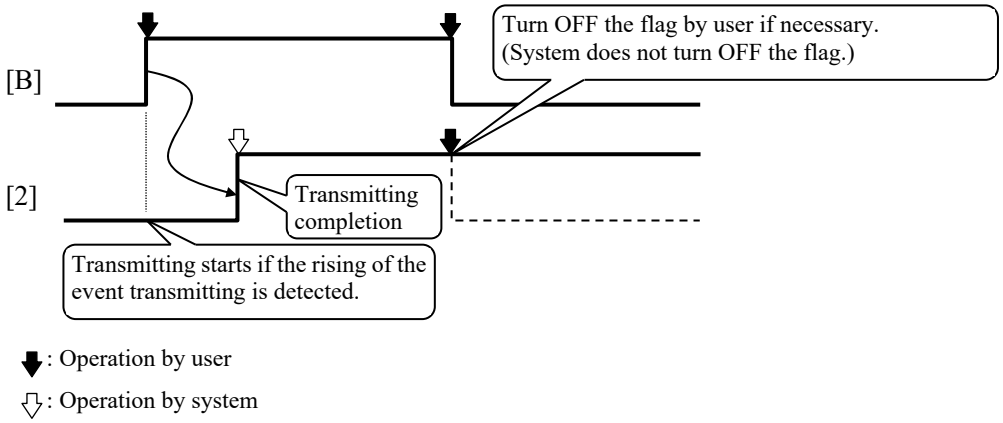


Figure 3.15 Event transmitting completion flag and Event transmitting request flag

(3) Receiving completion flag [3]

If the receiving of message data is completed, the receiving completion flag [3] will turn ON. Since the system turns ON this flag whenever the receiving is completed, user needs to turn OFF this flag when monitoring the receiving using this flag.

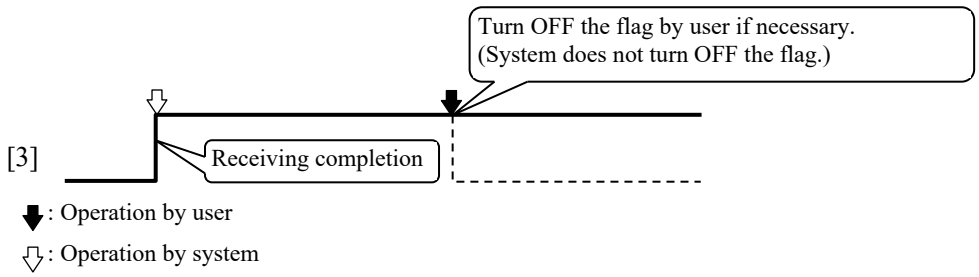


Figure 3.16 Receiving completion flag

(4) Error flag [4] and Error code [5]

The system will turn ON the error flag [4] and store the error code [5] if factors of the error are found in the system. User must clear this flag and area if necessary because the system does not clear them.

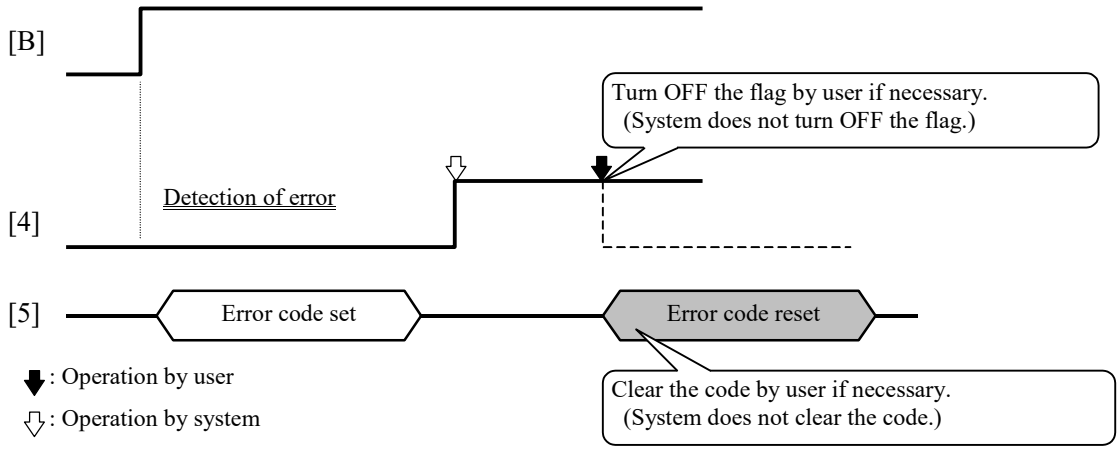


Figure 3.17 Error flag and Error code

(5) Transmitting counter and Receiving counter

The increment of the transmitting counter is performed when message data is transmitted.

The increment of the receiving counter is performed when message data is received.

User must clear the transmitting counter and the receiving counter if necessary because the system does not clear them.

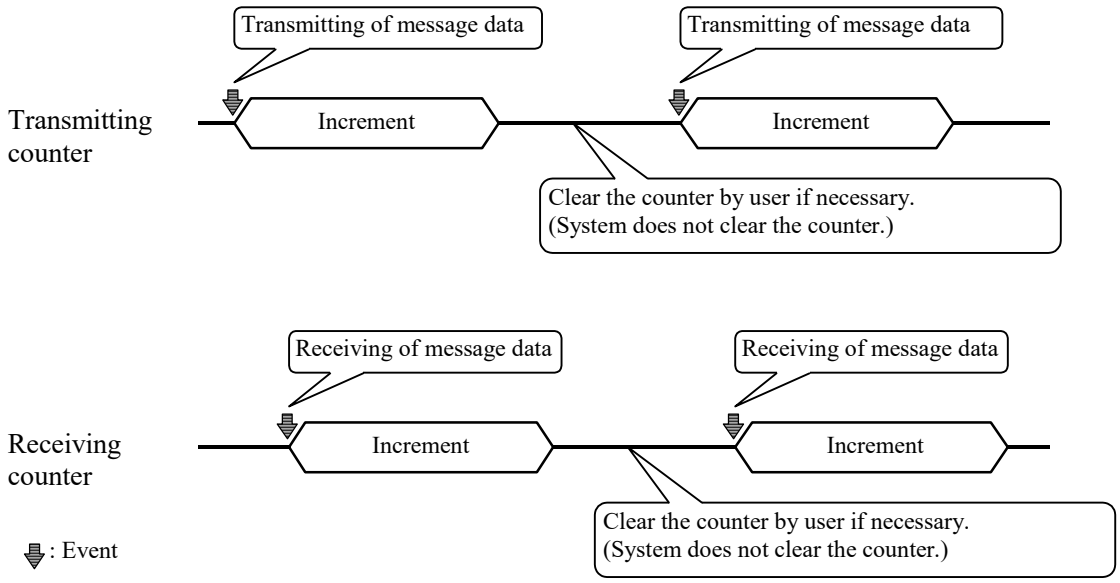


Figure 3.18 Transmitting counter and Receiving counter

TCP/IP protocols

When using TCP/IP to communicate, it is necessary to establish the connection between communication stations. Otherwise, message data cannot be sent and received. In order to establish the connection, set one side to the **TCP/IP connection active open (TCP/IP-Active)**, and set the other side to the **TCP/IP connection passive open (TCP/IP-Passive, Designated IP or TCP/IP-Passive, Undesignated IP)**.

Open a port of the TCP/IP connection passive open side, and then open a port of the TCP/IP connection active open after the connection open stood by to open. After the connection established, data can be sent and received.

And in order to close the connection, close the port you want to close first.

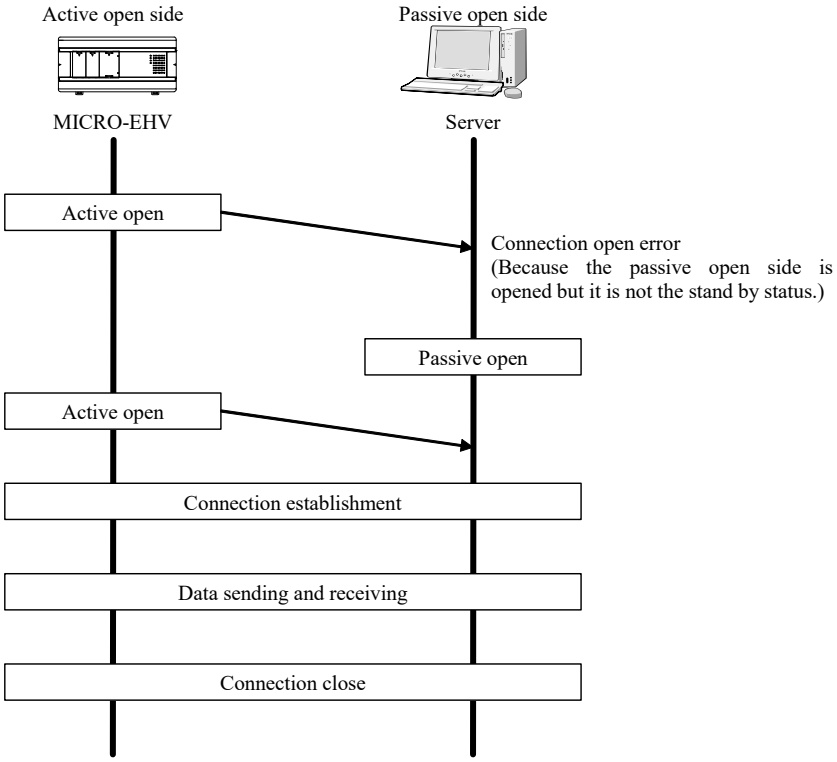


Figure 3.19 Example of TCP/IP protocols

Reference

In order to open the port on the ASR communication port, turn ON the ASR port open request flag of the control register.

Example) In case of ASR communication port 1: WRF061 = H0001

In order to close the port on the ASR communication port, turn OFF the ASR port open request flag of the control register.

Example) In case of ASR communication port 1: WRF061 = H0000

UDP/IP protocols

In the ASR communication port, when using UDP/IP to communication, it is necessary to open the ASR port. Message data can be sent and received after the ASR port is opened. Message data cannot be sent and received if the ASR port is closed. When receiving messages while the ASR port is closed, the receiving data is cancelled.

In the ASR communication port, close the port to terminal the communication.

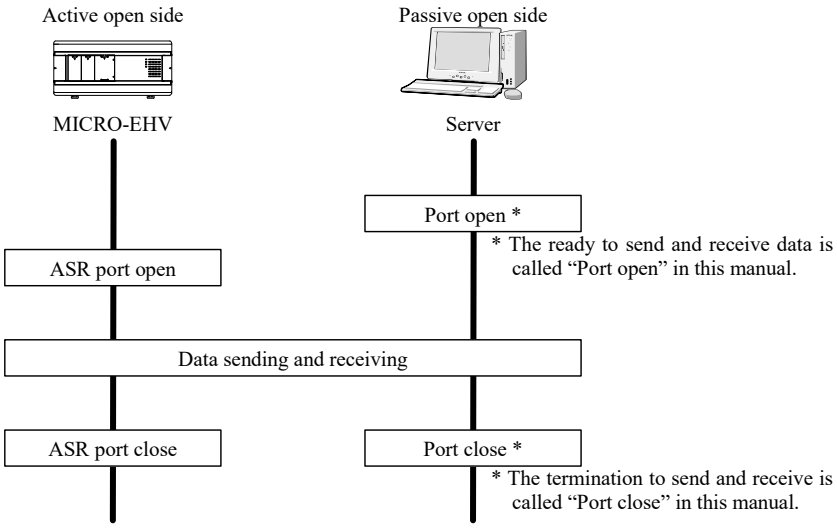


Figure 3.20 Example of UDP/IP protocols

Reference

In order to open the port on the ASR communication port, turn ON the ASR port open request flag of the control register.

Example) In case of ASR communication port 1: WRF061 = H0001

In order to close the port on the ASR communication port, turn OFF the ASR port open request flag of the control register.

Example) In case of ASR communication port 1: WRF061 = H0000

Caution

When an ASR communication port is opened and the other station is not found, the ASR communication port is closed by a system. (The ASR port status flag is OFF. The ASR port open request flag is ON.)

When retrying, reset ASR port open request flag and set again to open ASR port.

Send mode, Transmitting data size and Receiving data size

In ASR communication, the transmitting data size can be changed dynamically in bytes by ladder program, and the receiving data size can be referenced by ladder program. The areas for transmission mode setting, transmiting data size setting, and receiving data size related to this function are allocated to the special internal output WRF080 or later.

Table 3.16 Special internal output for ASR function

Special internal outputs	Meanings
WRF080 to WRF08F	ASR port 1 parameters
WRF090 to WRF09F	ASR port 2 parameters
WRF0A0 to WRF0AF	ASR port 3 parameters
WRF0B0 to WRF0BF	ASR port 4 parameters
WRF0C0 to WRF0CF	ASR port 5 parameters
WRF0D0 to WRF0DF	ASR port 6 parameters

Table 3.17 The details of special internal output for ASR function

No	Name	Meanings
WRF0*0	Transmission mode setting 0: Control Editor setting mode 1: Special Internal Output setting mode	Control Editor setting mode : Data is transmitted depends on the number of I/O points (word units) which is set from Control Editor. Special Internal Output setting mode : Data is transmitted depends on the size (byte units) which is set to the special internal output.
WRF0*1	Setup of transmitting data size for send area 1	Set the transmitting data size in bytes.
WRF0*2	Setup of transmitting data size for send area 2	Set the transmitting data size in bytes.
WRF0*3	Setup of transmitting data size for send area 3	Set the transmitting data size in bytes.
WRF0*4	Setup of transmitting data size for send area 4	Set the transmitting data size in bytes.
WRF0*5	Setup of transmitting data size for send area 5	Set the transmitting data size in bytes.
WRF0*6	Setup of transmitting data size for send area 6	Set the transmitting data size in bytes.
WRF0*7	Setup of transmitting data size for send area 7	Set the transmitting data size in bytes.
WRF0*8	Setup of transmitting data size for send area 8	Set the transmitting data size in bytes.
WRF0*9	Setup of transmitting data size for send area 9	Set the transmitting data size in bytes.
WRF0*A	Setup of transmitting data size for send area 10	Set the transmitting data size in bytes.
WRF0*B	Display of receiving data size	Receive data size is stored in bytes.
WRF0*C to WRF0*F	Reserve	

* "*" of No. means 8 to D.

[Send mode]

Configuration of Send mode on ASR.

0x0000：Control Editor setting operation mode

It is the mode that the operation works according to the value set in Control Editor.

This mode is suitable in the case of the size of sending data is the word unit and unchanged.

0x0001：Special Internal Output setting operation mode

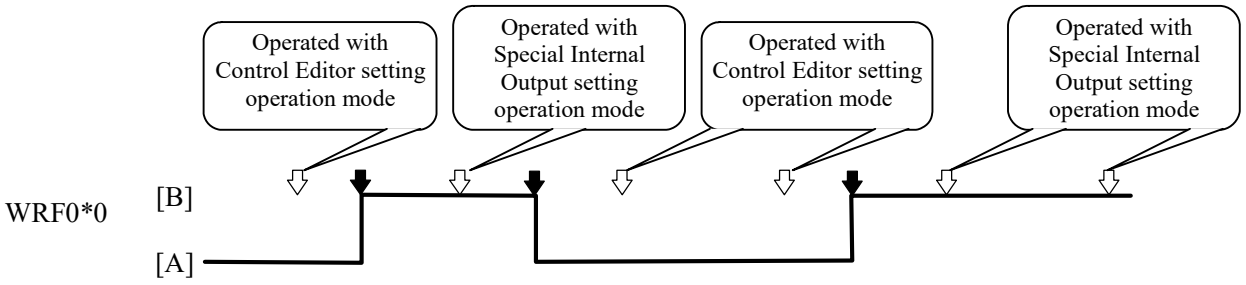
It is the mode that can set the size of sending data to the special internal output with byte unit.

This mode is suitable in the case of the size of sending data is the byte unit or variable.

Except the setup of sending data size, the operation works according to the value set in Control Editor.

* If the value more than 0x0002 were set, the operation works with “Control Editor setting operation mode”.

The change of the setting with Send mode is activated immediately.



[B]: 0x0001 (Special Internal Output setting operation mode) ⬇: Operation by user (Send mode change)
[A] :0x0000 (Control Editor setting operation mode) ⇩: Sending (Cyclic or Event)

Figure 3.21 The operation of Sending (Send mode change)

[Sending data size]

In the case of "Special Internal Output setting operation mode", you can set the sending data size for each send area with byte unit. The upper limit of sending data size to set is twice the size of send area set in Control Editor (the size of send area set in Control Editor is word unit, sending data size is byte unit). The data of the byte length set to sending data size from the top of the send area is transmitted.

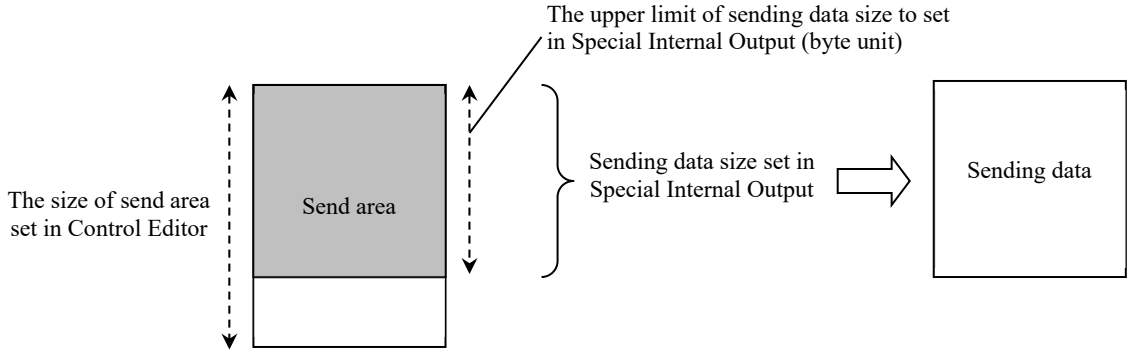


Figure 3.22 The setting of sending data size

The following figure shows data structure in the case of sending data size is odd number and even number (sending data size is n bytes). In the case of odd number, the data of the last byte is stored the higher byte of the word input / output. The data at the lower byte of the word input / output ("xx" of the following figure) is not transmitted.

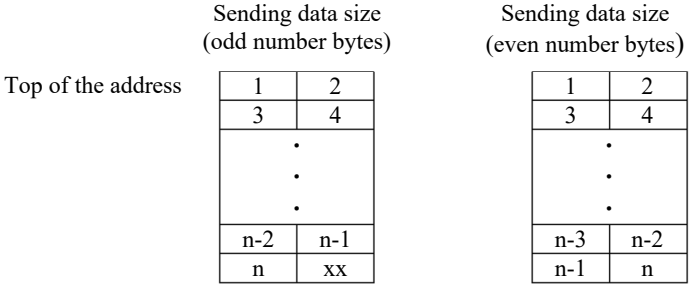


Figure 3.23 The data structure of sending data (n bytes)

In the case of using a number of send areas, the data that consolidated the data of all send areas is transmitted.

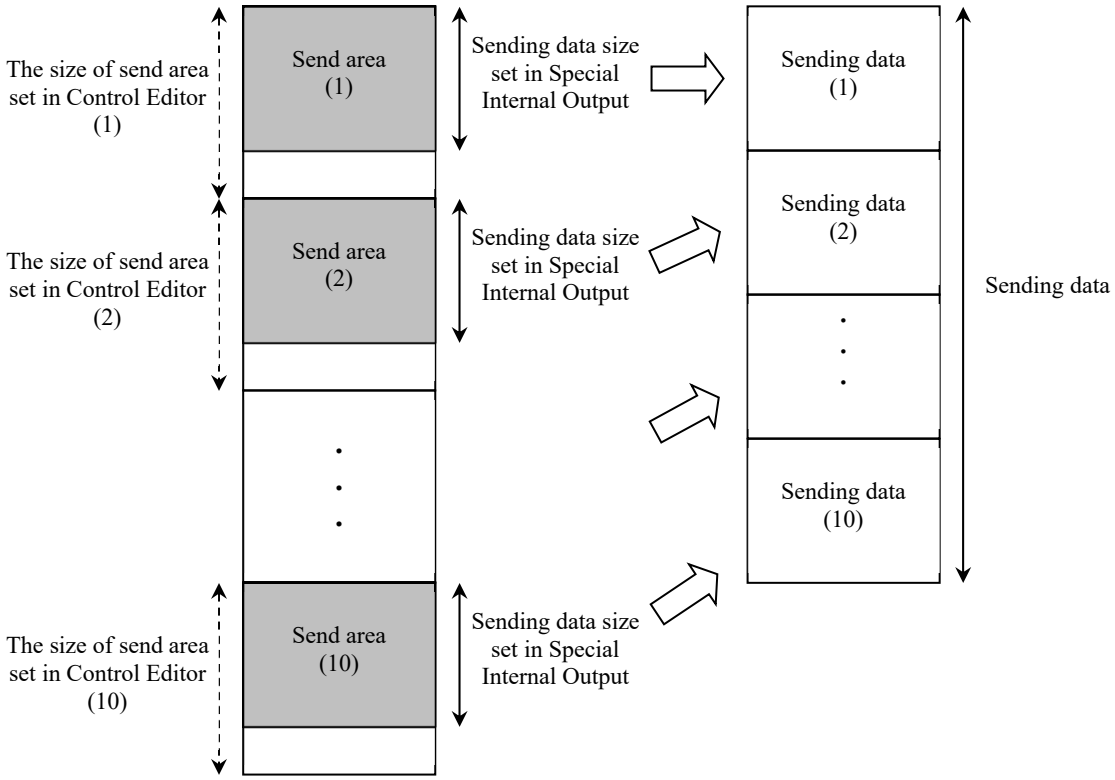


Figure 3.24 Sending data in the case of using a number of send areas

The following figures show the sending operation for Special Internal Output setting operation mode. MVH constructs the sending data according to the setting of Send data size in Special Internal Output, and transmits the data. If the value of Sending data size is invalid, the error code is set in status register and the sending operation does not work.

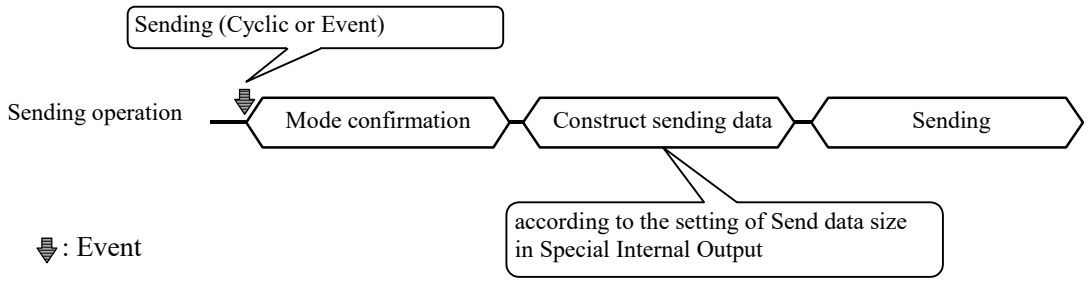


Figure 3.25 Sending operation (Special Internal Output setting operation mode : valid)

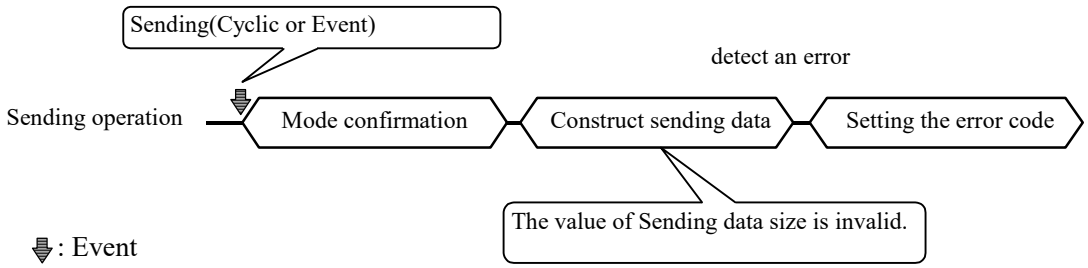


Figure 3.26 Sending operation (Special Internal Output setting operation mode : invalid)

The following figure is a time chart on the transmitting data to peripheral (server of figure) from MVH. An example for the TCP/IP connection, but it is omitted about the procedure of connection open and close.

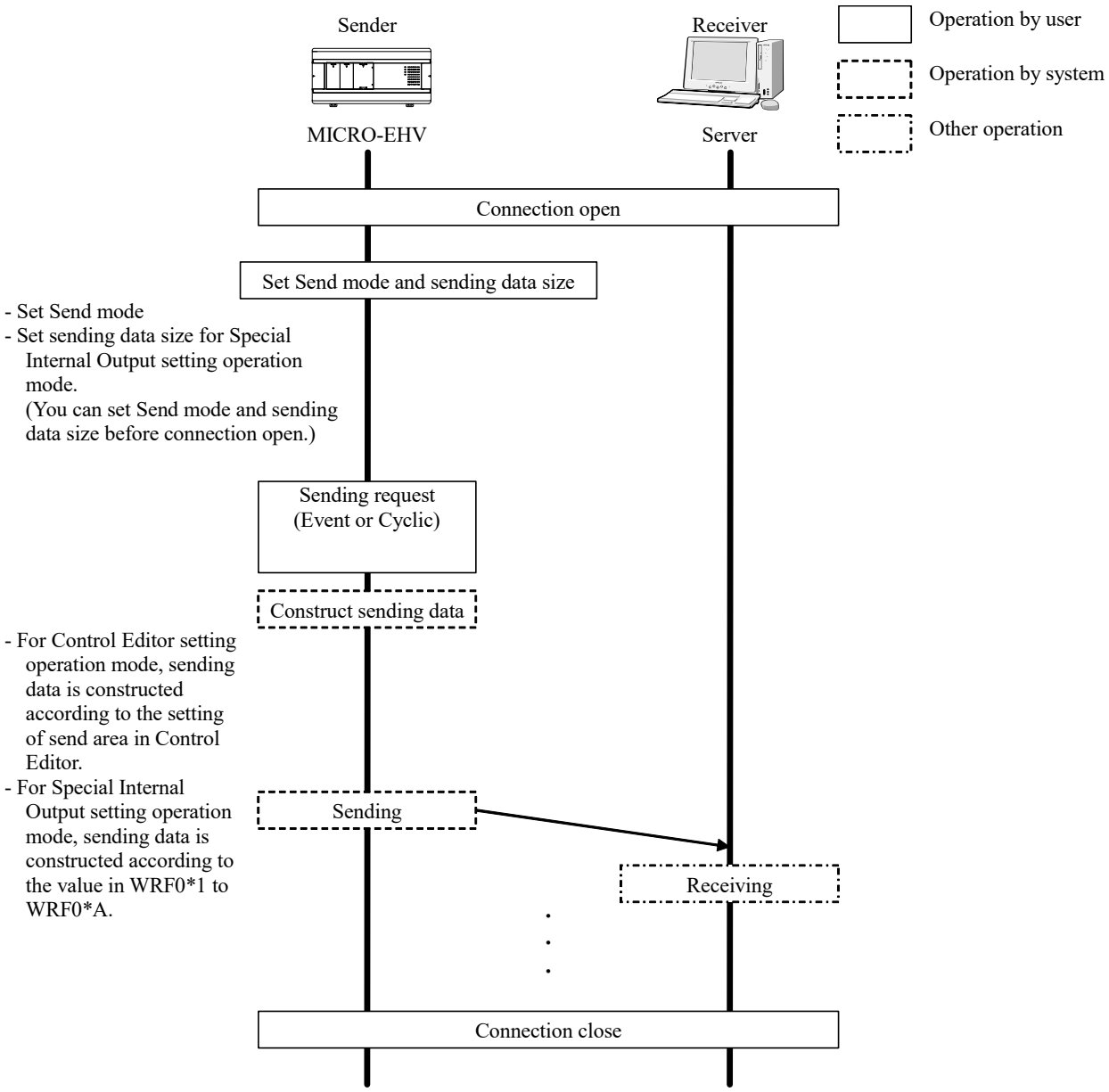


Figure 3.27 Time chart on the sending

[Storage of the size of receiving data]

The size of receiving data is stored with byte unit. This is not affected by mode.

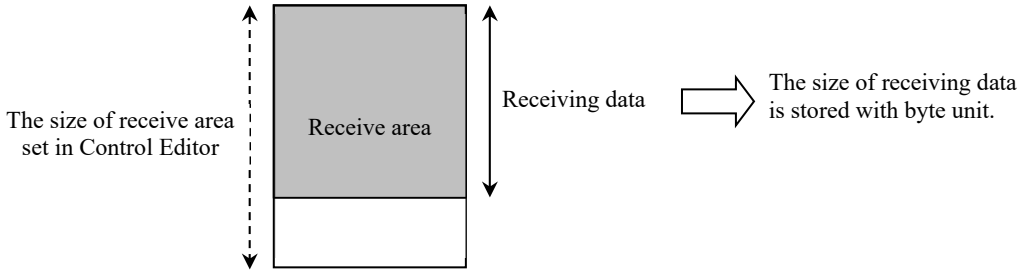


Figure 3.28 Storage of the size of receiving data

If the size of the receiving data is larger than the size of receiving area, the part of overflowing are discarded. The value of the size of receive area set in Control Editor is stored to the area to store the size of receiving data.

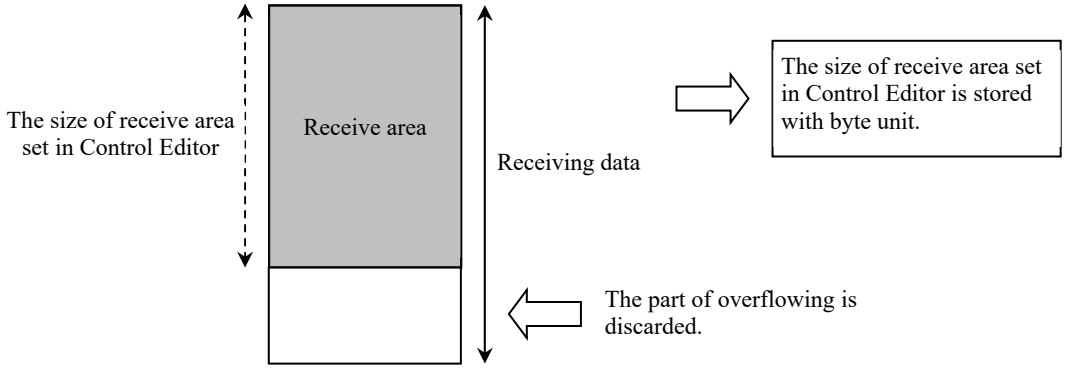


Figure 3.29 In the case of the size of the receiving data is larger than the size of receiving area

The following figure shows data structure in the case of the size of the receiving data is odd number and even number (the size of the receiving data is n byte). In the case of odd number, the data of the last byte is stored the higher byte of the word input / output. The data at the lower byte of the word input / output (“00” of the following figure) is “0x00”.

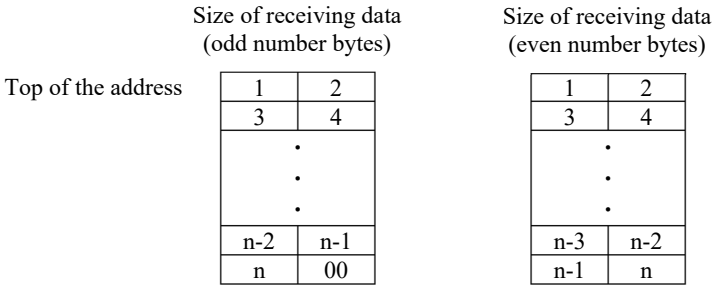


Figure 3.30 The data structure of receiving data (n bytes)

The following figure shows the receiving operation.

1) Store the data to receive area.
2) Store the size of received data.
3) Increment the received counter.
4) Set receive complete flag.

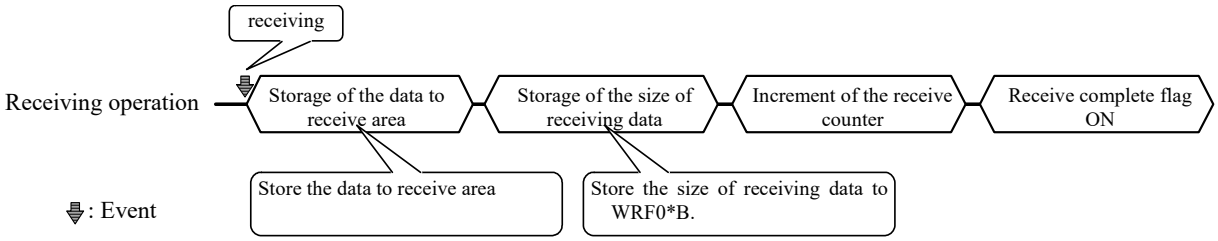


Figure 3.31 Receiving operation

The following figure is a time chart on the receiving data from peripheral (server of figure) to MVH. An example for the TCP/IP connection, but it is omitted about the procedure of connection open and close.

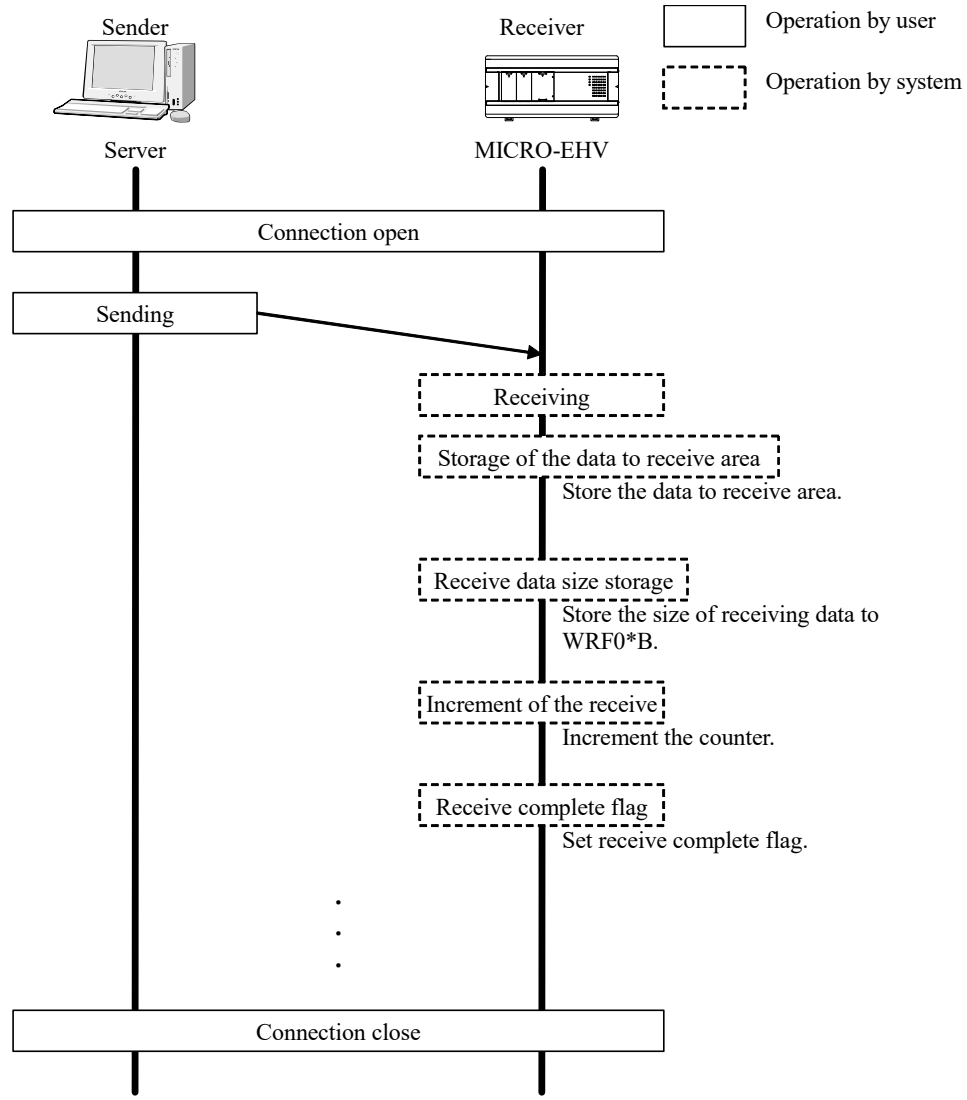


Figure 3.32 Time chart on the receiving

Sample program

[Sample 1]

The network configuration is as following figure, and the ASR communication parameters are set by Control Editor. The setting information for two MVH is as following table.

The 16-word data from WR0 to WRF of MVH1 is transmitted from MVH1 to the other MVH2 every 1 second. MVH2 stores the received data to WM0 to WMF.

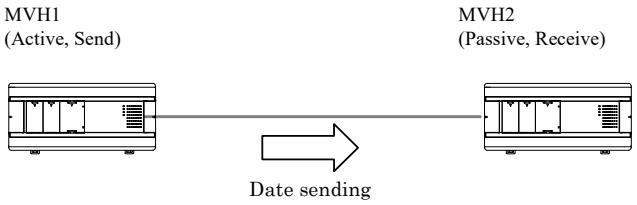


Figure 3.33 Connection diagram of Sample 1

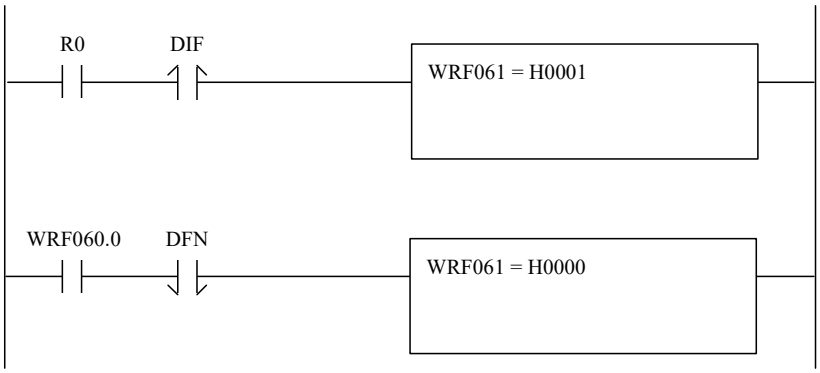
Table 3.18 Setting information of Sample 1

No.	Setting	MVH1	MVH2
1	IP address	192.168.0.1	192.168.0.2
2	Port No.	4000	4000
3	Protocol	TCP/IP-Active, Designated IP	TCP/IP-Passive, Designated IP
4	Send / Receive	Send	Receive
5	Access Point – IP address	192.168.0.2	192.168.0.1
6	Access Point – Port No.	4000	4000
7	Send Timing	Cyclic sending: 1 second	—
8	Send area	WR0 to WRF	—
9	Receiving area	—	WM0 to WMF
10	Send mode	Control Editor setting operation mode	Control Editor setting operation mode

[Description of Sample program]

The connection is opened and the transmitting starts when R0 of MVH1 is turned ON.

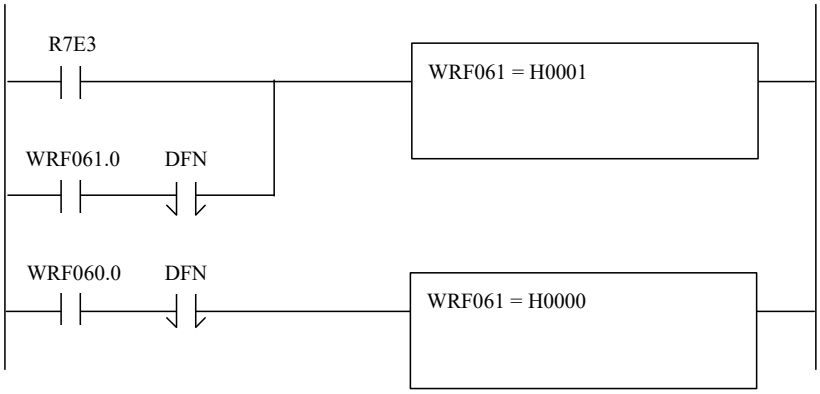
[Sample program of MVH1]



While the connection of ASR port 1 is not established, ASR port 1 is opened at the rising edge of user turns ON R0. After the connection is established,
ASR communication is started according to the setting and data is transmitted at one second interval.

When the connection of ASR port 1 is closed by other station and the cable is cut, the ASR port open request flag falls when the connection is closed.

[Sample program of MVH2]



Opens the connection just after the RUN start, or at the falling of OFF of the ASR open request flag after the connection of ASR port 1 is closed.

When the connection of ASR port 1 is closed by other station and the cable is cut, the ASR port open request flag falls when the connection is closed.

[Sample 2]

Network consists of one MVH and one server as follows, and the Control Editor set the ASR communication of MVH.

The setting information for MVH3 and the server is as follows.

When the even occurs, 5-word data from WRF00B to WRF00F of MVH3 is transmitted from MVH3 to the server.

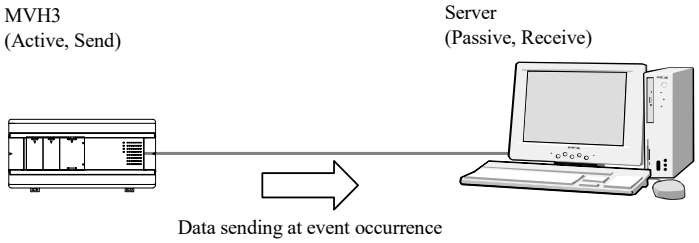


Figure 3.34 Connection diagram of Sample 2

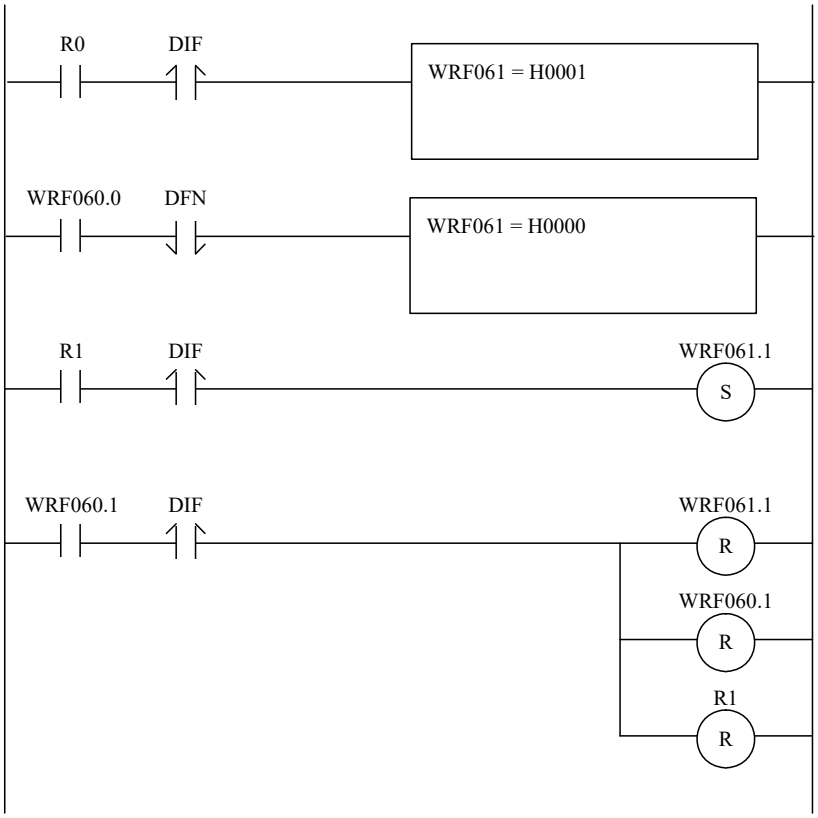
Table 3.19 Setting information of Sample 2

No.	Setting	MVH3	Server
1	IP address	192.168.0.10	192.168.0.11
2	Port No.	4001	4002
3	Protocol	TCP/IP-Active, Designated IP	TCP/IP-Passive, Undesignated IP
4	Send / Receive	Send	Receive
5	Access Point – IP address	192.168.0.11	—
6	Access Point – Port No.	4002	—
7	Send Timing	Event sending	—
8	Send area	WRF00B to WRF00F	—
9	Receiving area	—	—
10	Send mode	Control Editor setting operation mode	—

[Description of sample program]

The connection is opened when R0 of MVH3 is turned ON, and the event transmitting is performed by turning ON R1 at the event occurrence.

[Sample program of MVH3]



[Sample 3]

Network consists of MVH and Web controller as follows, and the Control Editor sets the ASR communication of MVH. ASR communication of Web controller is set using the Web browser. The setting information of MVH4 and Web controller is as follows.

The connection is established between MVH4 and Web controller in two seconds later after RUN of MVH4, 16-word data from WR0 to WRF of MVH4 is transmitted from MVH to Web controller at one second interval. In Web controller, the received data is stored in WR0 to WRF. And 16-word data from WR10 to WR1F of Web controller is transmitted from Web controller to MVH4, and the received data is stored in WR10 to WR1F in MVH4.

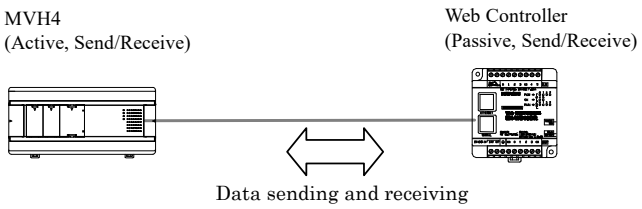


Figure 3.35 Connection diagram of sample 3

Table 3.20 Setting information of Sample 3

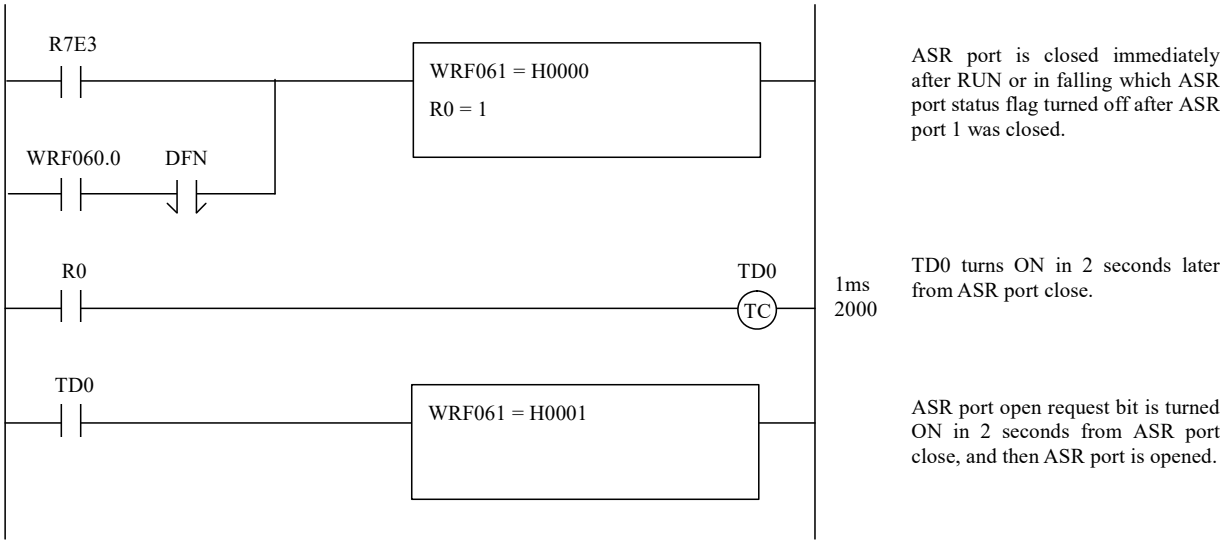
No.	Setting	MVH4	Web controller
1	IP address	192.168.0.1	192.168.0.2
2	Port No.	4000	4000
3	Protocol	TCP/IP-active, Designated IP	TCP/IP-passive, Designated IP
4	Send / Receive	Send / Receive	Send / Receive
5	Access point – IP address	192.168.0.2	192.168.0.1
6	Access point – Port No.	4000	4000
7	Send Timing	Cyclic sending: 1 second	Cyclic sending: 1 second
8	Send area	WR0 to WRF	WR10 to WR1F
9	Receiving area	WR10 to WR1F	WR0 to WRF
10	Send mode	Control Editor setting operation mode	—

[Description of sample program]

The connection is established between MVH4 and Web controller in two seconds after RUN of MVH4, and the sending and receiving are started.

(If the connection is established before RUN of MVH4, the connection is closed immediately after RUN and the connection is established again.)

[Sample program of MVH4]



[Sample program of Web controller]

When Web controller is set to TCP/IP-passive, the connection stands by to open when the power supply is turned ON or immediately after the connection is cut. Therefore a program to control the connection is unnecessary.

[Sample 4]

Network consists of two MVHs as follows, and the Control Editor sets the ASR communication. The setting information of two MVHs is as follows.

16-word data from WR0 to WRF of MVH5 is transmitted from MVH5 to MVH6. In MVH6, the received data is stored in WR0 to WRF.

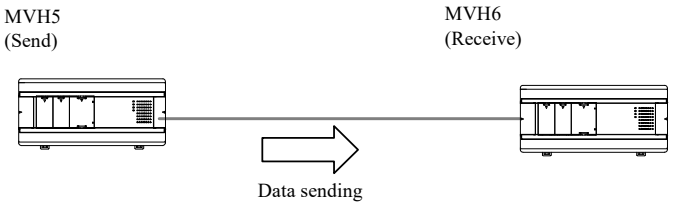


Figure 3.36 Connection diagram of Sample 4

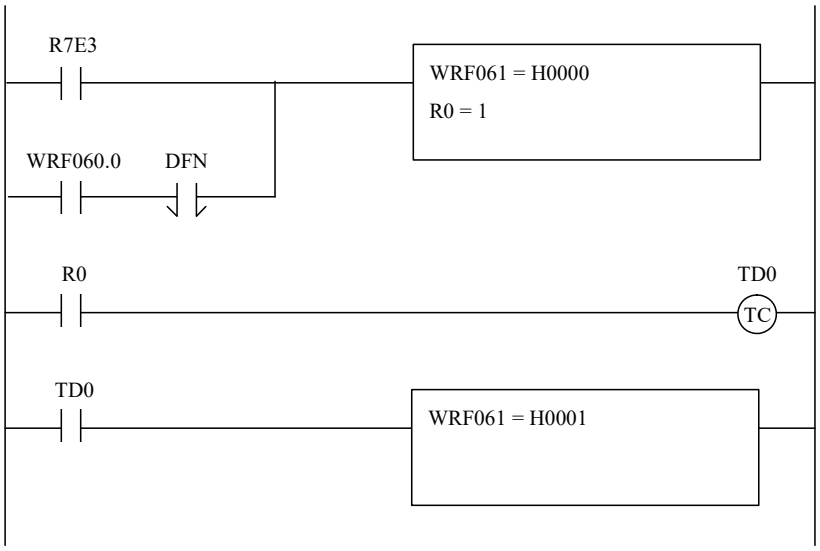
Table 3.21 Setting information of Sample 4

No.	Setting	MVH5	MVH6
1	IP address	192.168.0.101	192.168.0.102
2	Port No.	4000	4000
3	Protocol	UDP/IP, Designated IP	UDP/IP, Designated IP
4	Send / Receive	Send	Receive
5	Access points – IP address	192.168.0.102	192.168.0.101
6	Access points – Port No.	4000	4000
7	Send Timing	Cyclic sending: 1 s	—
8	Send area	WR0 to WRF	—
9	Receiving area	—	WR0 to WRF
10	Send mode	Control Editor setting operation mode	Control Editor setting operation mode

[Description of sample program]

ASR port is opened in two seconds later after RUN of MVH5. If there is a communication target is on the network (there is a response to ARP packet), the transmission is executed automatically. And similarly, MVH6 executes the receiving if the ASR port is opened in MVH6 because the ASR port is opened also in two seconds after RUN of MVH6.

[Sample program of MVH5 and 6]



ASR port is closed immediately after RUN or in falling which ASR port status flag turns off after ASR port 1 is closed.

TD0 turns ON two seconds later after ASR port close.

ASR port open request bit is turned ON two seconds later after ASR port close, and ASR port is opened. In case of UDP/IP, it can be sent and received in this status.

[Sample 5]

Network consists of one MVH and one server as follows, and the Control Editor set the ASR communication of MVH. The setting information for MVH7 and the server is as follows.

When MVH7 receives 3-byte data from the server, MVH7 sends the 5-bytes data of “H1234567890” on Event send.

When MVH7 receives 5-byte data from the server, MVH7 sends the 3-bytes data of “HABCDEF” on Event send.

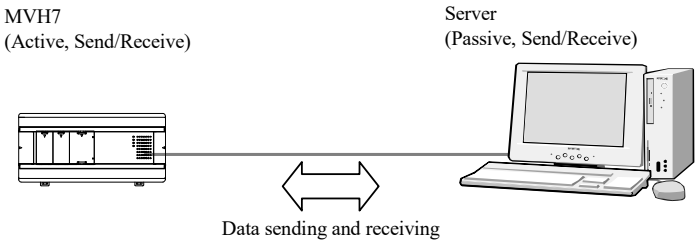


Figure 3.37 Connection diagram of Sample 5

Table 3.22 Setting information of Sample 5

No.	Setting	MVH7	Server
1	IP address	192.168.0.1	192.168.0.2
2	Port No.	4000	4000
3	Protocol	TCP/IP-Active, Designated IP	TCP/IP-Passive, Undesignated IP
4	Send / Receive	Send / Receive	Send / Receive
5	Access Point – IP address	192.168.0.2	—
6	Access Point – Port No.	4000	—
7	Send Timing	Event sending	—
8	Send area	WR0 to WR2	—
9	Receiving area	WR10 to WR1F	—
10	Send mode	Special Internal Output setting operation mode	—

[Description of sample program]

If send mode of ASR communication on MVH7 is “Control Editor setting operation mode” at starting RUN, the program changes send mode to “Special Internal Output setting operation mode”. And the program constructs the following two data to send.

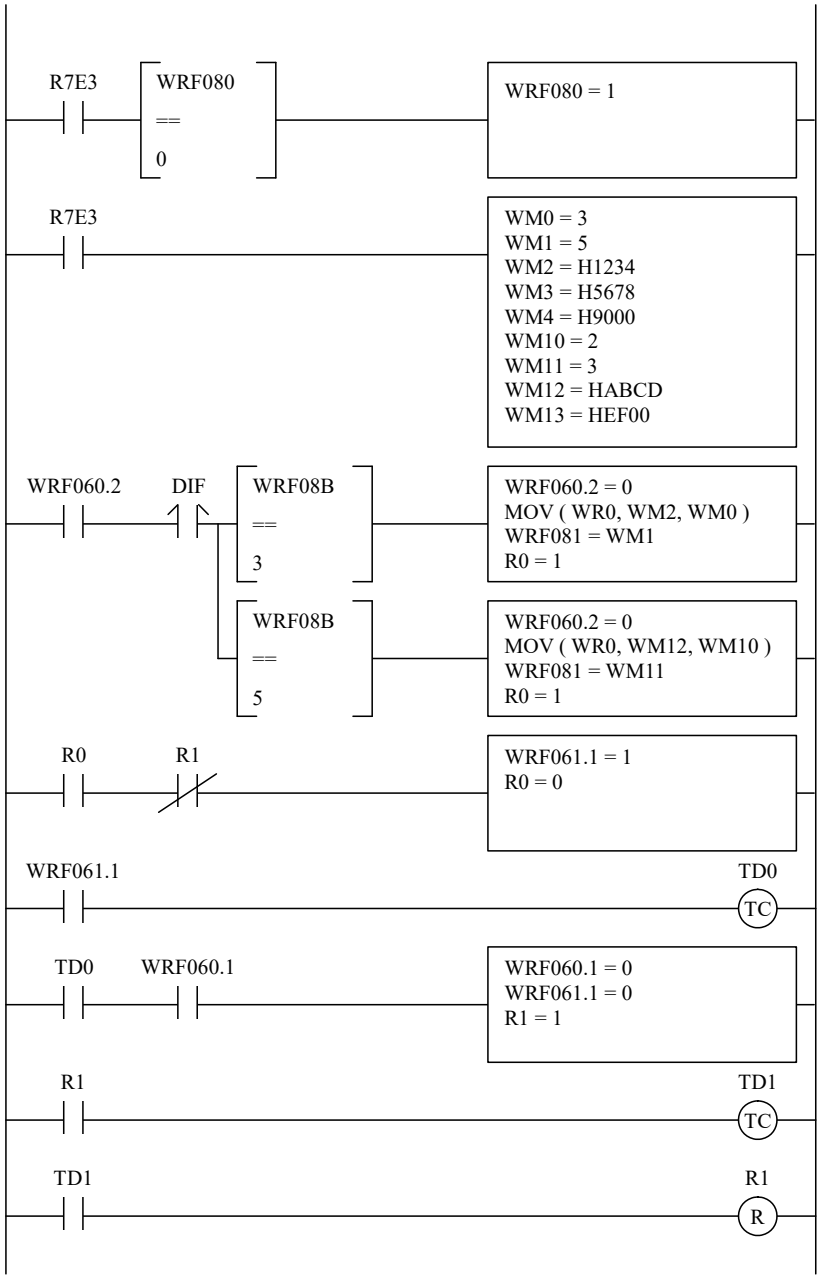
Data 1: H1234567890 (length: 3 words, 5 bytes)

Data 2: HABCDEF (length: 2 words, 3 bytes)

MVH7 sends the data corresponding the size of data received (3 bytes or 5 bytes).

* This sample program does not describe the part of connection. Refer to other sample programs for connection open and close.

[Sample program of MVH7]



If send mode of ASR communication is “Control Editor setting operation mode”, the program changes send mode to “Special Internal Output setting operation mode”.

Constructing the two data to send with setting the data size.

Corresponding the size of data received (3 bytes or 5 bytes), the data to send is copied to send area and the data length is set to Sending data size area.

Set the event transmission request flag.

Set the event transmission request flag 2ms-ON and 2ms-OFF that is required to execute.

[Restrictions on receiving operation in ASR communication]

When using MVH as the receving operation or sending / receving operation, set the data sending cycle from the sending device to the cycle time or more shown in Table 3.23. If it is set less than this cycle time, ASR communication may not be performed normally. Please take care that the communication cycle to be set varies depending on the number of using ports.

Table 3.23 Minimum communication cycle time during receiving operation

Number of ASR communication ports used simultaneously	Communication cycle time [ms]
1	360
2	400
3	440
4	440
5	440
6	440

* The above data is reference data when communicationg between MVH.

Caution

ASR communication may not be able to transfer the data according to the setting cycle time due to the processing performance of the other device and communication load. In this case, please review your system refer to the following method.

・Increase the sending cycle time (sending interval)

・Reduce the amount of data and send it in multi pieces

・Add re-sending processing

3.5 NTP communication

This unit provides an SNTP (Simple Network Time Protocol) client function to get the time information from the NTP (Network Time Protocol) server or SNTP (Simple Network Time Protocol) server. You can set the time acquisition interval in hours and minutes. Also, you can use a user program to control when to acquire the time information.

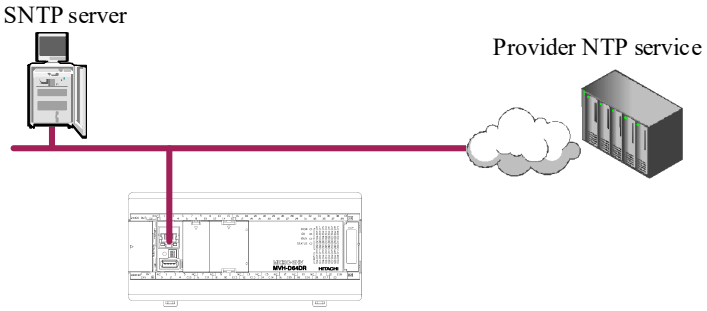


Figure 3.38 SNTP client function

Table 3.24 SNTP client specification

Item	Specification
Communication protocol	SNTP (Simple Network Time Protocol)
Acquisition cycle	User setting (0 hour 1 minute to 99 hours 59 minutes)
Acquired clock data	year / month / day / day of the week / hour / minute / second
Clock data storage location	Special internal output (WRF00B to WRF00F and WRF021 to WRF025)

Clock data acquired by this function is stored in the calendar clock area (WRF00B to WRF00F, WRF021 to WRF025) of the special internal output on this unit. Subsequently, the clock data (WRF00B to WRF00F) is updated by the clock function in this unit. Time acquired from the NTP server is stored in the special internal output (WRF021 to WRF025) on this unit.

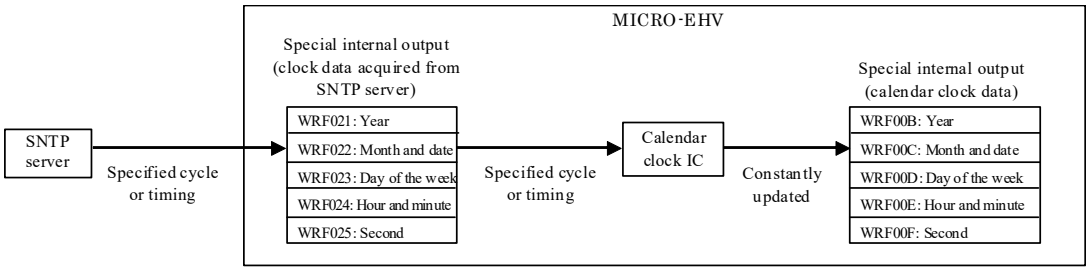


Figure 3.39 NTP function: Word special internal output

(1) How to set

To enable the NTP function, you need an online connection from the Control Editor.

Select [Tool] - [CPU Settings] - [NTP Server…] and set the items in the table 3.25.

Figure 3.40 NTP function: Setting contents

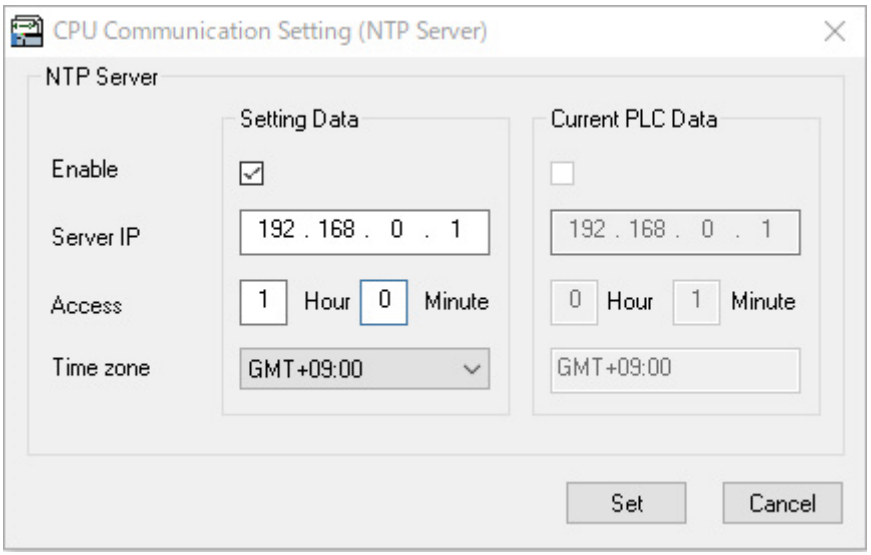


Table 3.25 NTP function: Setting items

Setting item	Setting value
Enabled	Check it to enable the NTP function.
Server IP	Set the IP address of the NTP server.
Access	Set the cycle to acquire the time from the NTP server. Set R900 to 1 if you want to acquire it arbitrarily. In this case, the connection interval information is ignored.
Time zone	Set the time zone. You can also set it with the special internal output WRF020. Specify GMT+9:00 for Japan.

You can use the bit special internal output to control the access timing to the NTP server from a user program. The time zone setting and the time when the time was acquired from the NTP server are stored in the word special internal output.

(2) Bit special internal output

Table 3.26 NTP function: Bit special internal output

No.	Name	Meaning	Content	Set condition	Reset condition
R900	NTP time acquisition user program control enabled/disabled	0: Disabled 1: Enabled	Switches the timing to acquire time data from the NTP server. 0: At a cycle set in the Control Editor 1: By user program (R901)	ON by user	OFF by user
R901	NTP time acquisition request	1: Acquisition request	Acquires time data from the NTP server when ON.	ON by user	OFF by system
R902	NTP time acquisition result	0: Success 1: Failure	Stores the time data result acquired from the NTP server.	ON by system	OFF by system

Caution

If an NTP time acquisition request (R901) conflicts with a read (R7F8) / write (R7F9) of the calendar clock data or a 30s adjust (R7FA), a request which is found earlier is processed first by the system, and until the processing of an earlier request is completed, the other requests are not processed.

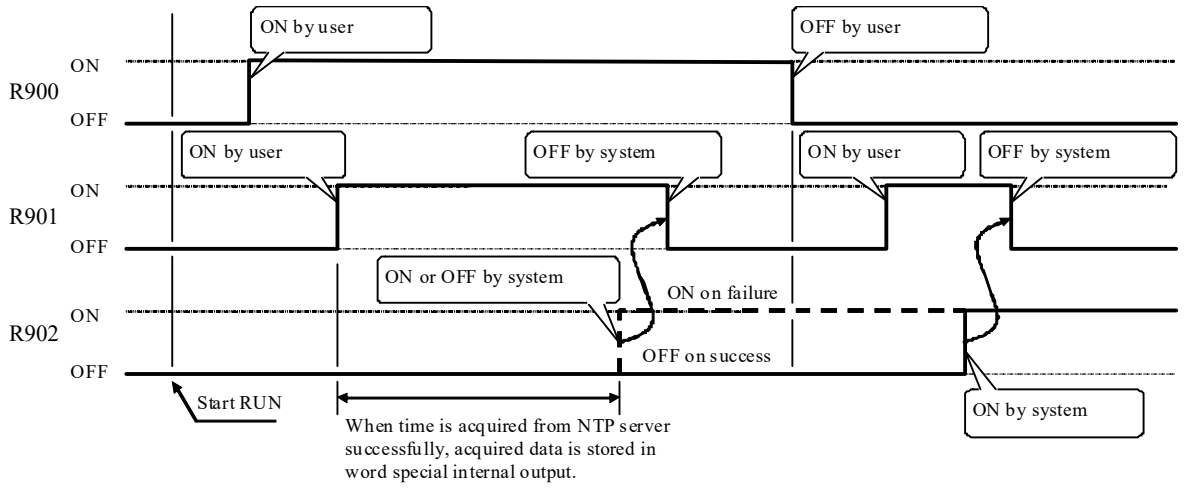


Figure 3.41 NTP function: Bit special internal output (NTP setting enabled)

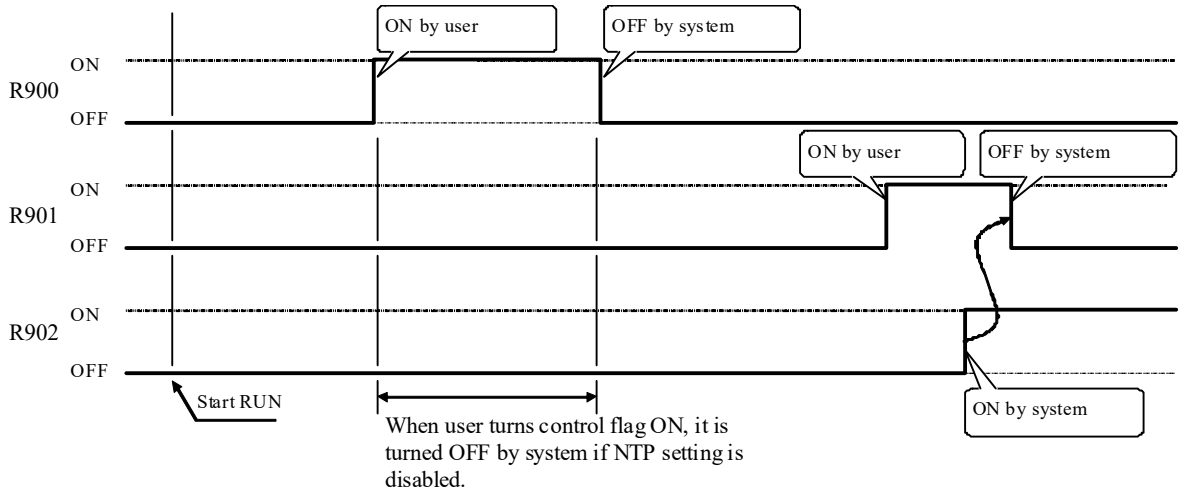


Figure 3.42 NTP function: Bit special internal output (NTP setting disabled)

(3) Word special internal output

Table 3.27 NTP function: Word special internal output

No.	Name	Stored data	Contents	Set condition	Reset condition
WRF020	Time zone setting	Refer to the table below	Stores the time zone information set in the Control Editor, but you can change it. Note that the time zone setting value is stored by the system at power-on.	Set by user (Set by the system only at power-on)	—
WRF021	Calendar clock NTP server acquisition value (BCD 4 digits)	Year	Displays the year (4 digits).	Set by the system (It sets time data without time zone correction at a success of the time data acquisition from the NTP server)	—
WRF022		Month and date	Displays the month and date data.		
WRF023		Day of the week	Displays the day of the week data. (Sunday: 0000 to Saturday: 0006)		
WRF024		Hour and minute	Displays the hour and minute data. (24-hour system)		
WRF025		Second	Displays the second data. (lower 2 digits; upper 2 digits are 00)		

Table 3.28 NTP function: Time zone setting

Setting value	Time zone
H0000	GMT –12:00
H0001	GMT –11:00
H0002	GMT –10:00
H0003	GMT –9:00
H0004	GMT –8:00
H0005	GMT –7:00
H0006	GMT –6:00
H0007	GMT –5:00
H0008	GMT –4:00
H0009	GMT –3:30
H000A	GMT –3:00
H000B	GMT –2:00
H000C	GMT –1:00

Setting value	Time zone
H000D	GMT
H000E	GMT +1:00
H000F	GMT +2:00
H0010	GMT +3:00
H0011	GMT +3:30
H0012	GMT +4:00
H0013	GMT +4:30
H0014	GMT +5:00
H0015	GMT +5:30
H0016	GMT +5:45
H0017	GMT +6:00
H0018	GMT +6:30
H0019	GMT +7:00

Setting value	Time zone
H001A	GMT +8:00
H001B	GMT +9:00
H001C	GMT +9:30
H001D	GMT +10:00
H001E	GMT +11:00
H001F	GMT +12:00
H0020	GMT +13:00
Out of range	GMT

Caution

- If you change the time zone with the special internal output WRF020, the clock data (WRF00B to WRF00F) immediately reflects the changed time zone information.
- The time zone setting value is stored in the back-up memory. Frequent changes of the time zone setting may shorten the back-up memory life.

3.6 Serial communication data link (HSDL)

Serial communication data link (**H**itachi **S**erial **D**ata **L**ink : hereinafter referred to as HSDL) is added from software version x126.

HSDL is the MICRO-EHV-specific communication protocol based on the master-slave method. Communication will start automatically only by setting the station number and send / receive data size and so on. MICRO-EHV can transfer the own data without user program. In HSDL, serial communication port on the option board is used and maximum 31 slave units can be connected to 1 master unit.

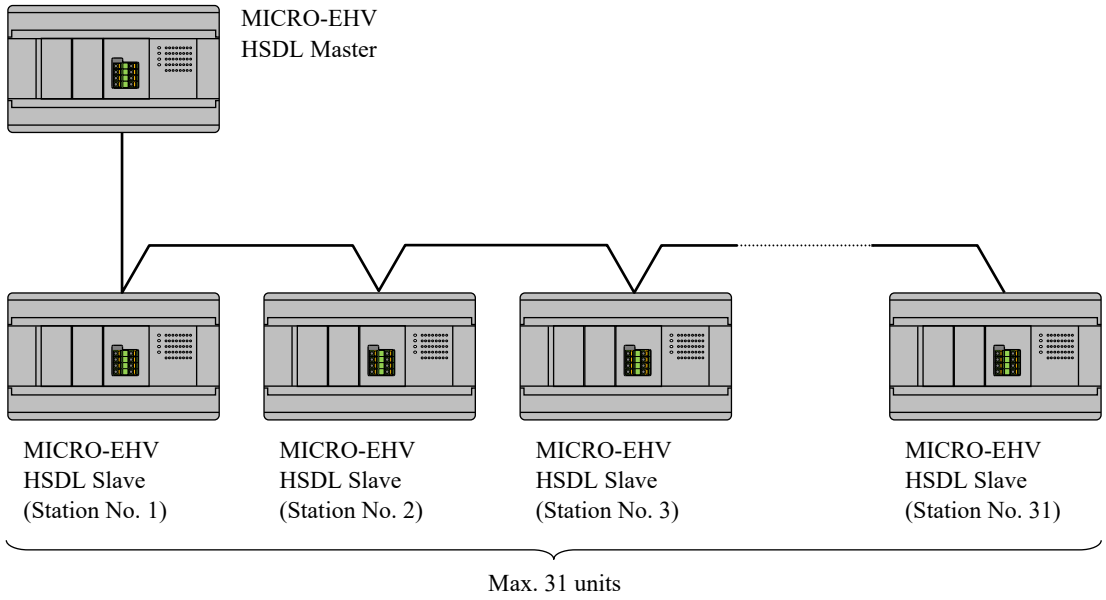


Figure 3.43 HSDL system configuration

MICRO-EHV which supports HSDL can be used as master or slave.

As to the setting of HSDL, please refer to (1) HSDL setting.

Table 3.29 HSDL specification

Item		Specification
Transmission speed		19,200 bps / 38,400 bps / 57,600 bps / 115,200 bps
Interface		Option board communication port (RS-485)
Maximum cable length		200 m
Maximum connected number of slaves		Max. 31 units
Communication protocol		HSDL (Dedicated protocol in MICRO-EHV)
Error control		Vertical parity check, Overrun check, Framing check, time out
Amount of data link	Send	0 to 255 bytes (Unit: byte)
	Receive	0 to 255 bytes (Unit: byte)

Basic action of HSDL

Master unit and slave unit have sending data area and receiving data area.

Master unit send the data on the own sending data area to each slave units. When slave unit receives the data from master units, slave unit will copy it to own receiving area, and send back the data on sending data area as response. When master unit received the response from slave units, Master will copy it to the receiving area.

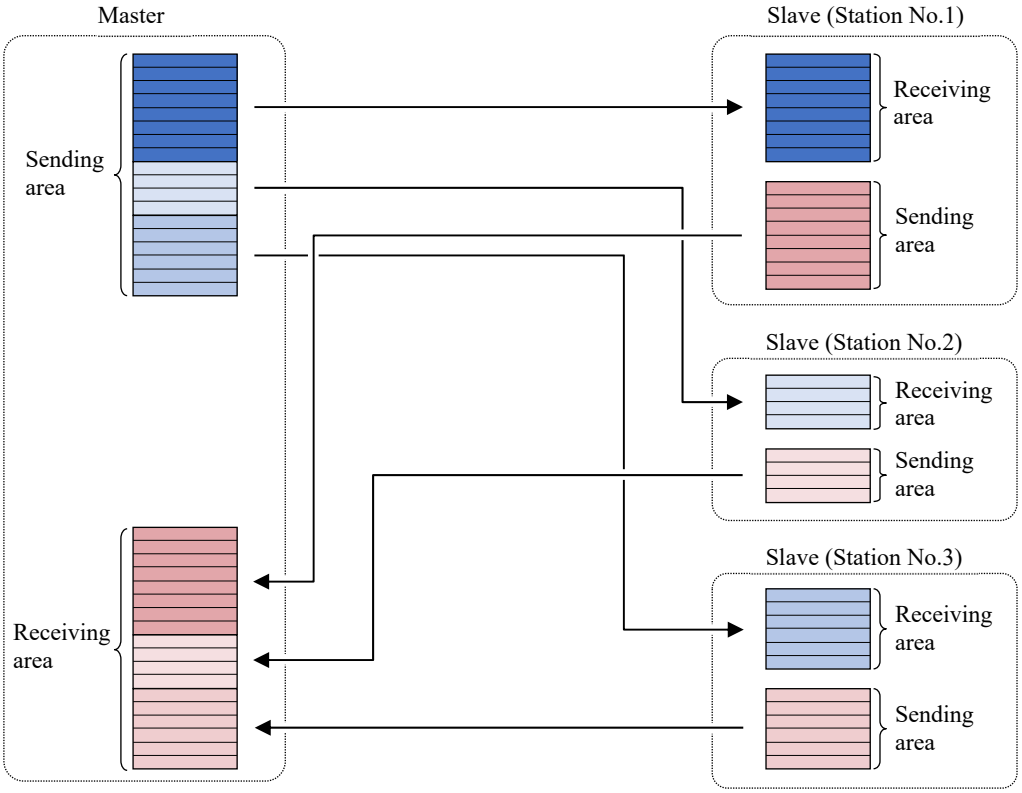


Figure 3.44 HSDL basic operation

Definision of the term for HSDL

- The data transferred by master unit and slave unit is called “Link data”, and the area that stores the link data is called ”Link area” (Figure 3.44). Link areas are divided into “sending area” and “receiving area”.
- The time that master unit exchanges the link data with all slaves is called “update time”. The update time means communication frequency since master unit repeats data exchanging with all slave units.
- Master sending area : Store the data that the master unit sends to each slave units.
- Master receiving area : It is stored the data that the master unit receives from each slave units.
- Slave sending area : Store the data that the slave unit sends to master unit.
- Slave receiving area : It is stored the data that the slave unit receives from master unit.

Update time of HSDL (Estimated time)

The time that the master unit exchanges the link data with 1 slave unit can be calucurated by following formula.
(If amount of sending data size and receiving data size exceed 16 words, the formula changes.)

■Amount of sending / receiving data for slave unit less than 16 words

Update time (ms) = (Amount of sending data[*1] + Amount of receiving data[*1] + 4) × Coefficient C[*2] + 0.4

■Amount of sending / receiving data for slave unit 16 words or more

Update time (ms) = (Amount of sending data[*1] + Amount of receiving data[*1] + 4) × Coefficient C[*2] + 12

*1 Unit of amount of data is byte. (16 words ➔ 32 bytes)

*2 Value of coefficient C : 115.2 kbps … 0.1, 57.6 kbps … 0.2, 38.4 kbps … 0.3, 19.2 kbps … 0.6

The time (update time) for the master unit to make a round of communication with all slave units in HSDL is the total value of the time for communication with each slave.

Example: Transmission speed 115.2kbps, Number of slaves 14 units.

Slave setting : Amount of send data 6 words (12 bytes), Amount of receive data 8 words (16 bytes)

Update time = {(12 + 16 + 4)×0.1 + 0.4}×14 = 50.4 (ms)

Slave setting : Amount of send data 18 words (36 bytes), Amount of receive data 24 words (48 bytes)

Update time = {(36 + 48 + 4)×0.1 + 12}×14 = 291.2 (ms)

Behavior when communication failure

Master unit : Master unit monitors the response from the slave units for a certain period (See Table 3.30), and if there is no response, it determines that the slave unit has left. The master unit confirms the existence at the timing of sending data to the slave unit even after the slave unit leaves. If the slave unit rejoins, the master unit restarts data exchange. If there is no response from the slave unit, the data in the receiving area of the master unit keeps the value of the last data that was normally received.

It should be noted that the master unit waits for the response from the leaved slave unit for a certain period. If even one slave unit is disconnected while multiple slave unitss are connected, the update time will increase by the amount of time it takes to wait for a response.

Slave unit : Slave unit monitors the request from the mastar unit for a certain period (See Table 3.30), and if there is no request, it determines that some error happened in the master unit. However, in the case of the slave unit, the request wait status is kept even if some error happened in the master unit. If master unit recovers, the slave units restart the data exchange automatically. If the data from the master unit does not arrive, the data in the receiving area keeps the last received data.

Existence monitoring for Master / Slave

When slave unit does not return the response for a certain period (Master unit detects receive time-out error), Master unit judges that the slave unit leaves from the HSDL network. When master unit does not send the request for a certain period (Slave unit detects receive time-out error), Slave unit judges that some error happens in the master unit. Receive time-out error time is determined by the transmission speed.

Table 3.30 Receive time-out time for master unit / slave unit

Transmission speed [bps]	Receive time-out time [ms]	
	Master	Slave
19,200	320	15,200
38,400	160	7,720
57,600	110	5,260
115,200	55	2,740

Reference

If you make your program to send incremental data from master unit, and monitor it by slave unit side, CPU unit can be detected the communication error between master unit and slave unit faster than monitorring by HSDL funciton.

Connection of communication cable

Wire the communication cable so that it is a single stroke for each terminal.

Connect the SG signal as needed. If necessary, insert therminating registors at both ends.

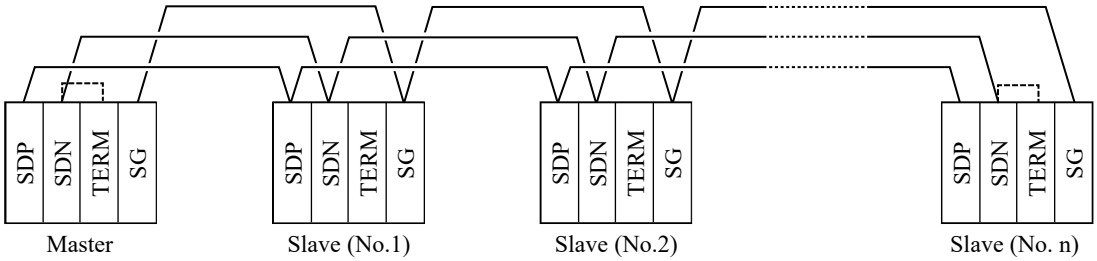


Figure 3.45 Connection of communication cable

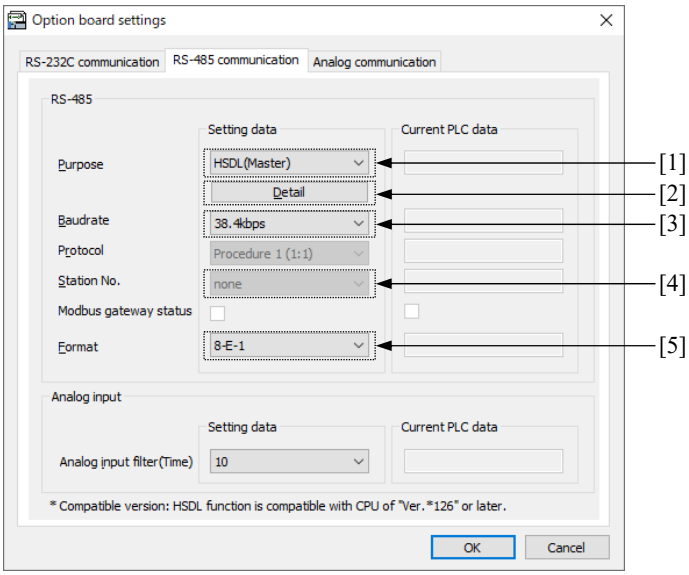
(1) Setting of HSDL

The parameter of HSDL can be set by programming software Control Editor (Ver. 7.10 or newer).

It should be noted that if you use MICRO-EHV as master unit or slave unit, you need to set HSDL parameters.

Port setting for option board

Select [Tool] – [CPU settings] – [Option board settings] from the menu in Control Editor or double-click [Option board settings] icon on the project tree.



No.	Item	Description
[1]	Purpose	If you use MICRO-EHV as HSDL master, chose “HSDL(Master)”. In case of slave, chose “HSDL(Slave)”.
[2]	Detail	If you select to HSDL(Master) or HSDL(Slave) in the purpose item, this button will be activated. When this button is pushed, setting window for HSDL master or HSDL slave will be opened.
[3]	Baudrate	Transmission speed for HSDL can be selected. Select the same speed for both master unit and slave unit.
[4]	Station No.	When "HSDL(Slave)" is selected, set the station number assigned to MICRO-EHV. The valid range is 1 to 31.
[5]	Format	Transmission format for HSDL can be selected. Select the same format for both master unit and slave unit.

Caution

- HSDL setting is in the RS-485 communication sheet on Option board settings window. (HSDL(Master) and HSDL (Slave) are only appeared on pull down menu in RS-485 communication sheet.)
- Even if the option board to be used does not have RS-485 interface, HSDL parameters can be set, but HSDL will not work.

Parameters for HSDL master

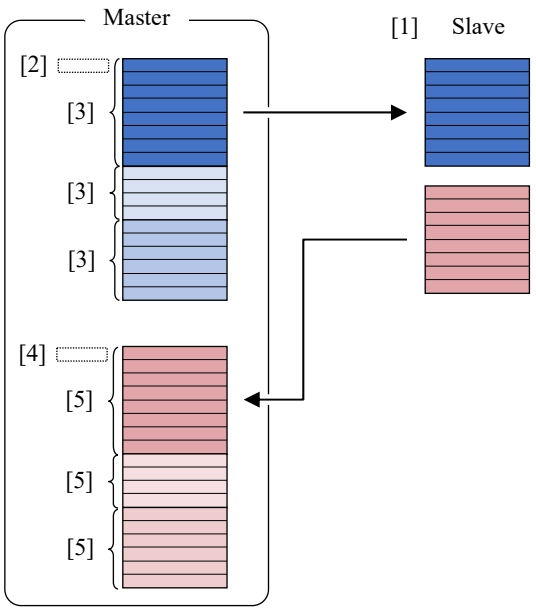


Figure 3.46 Setting parameter of HSDL master unit

As to the master unit, registoring of "Joining slave station number" and "link area" setting are required as parameters.

[1] Joining slave station number

The slave unit that joins in HSDL is registered in the master. Even if the slave unit is physically connected, the master unit does not communicate with the slave unit that has not been registered for joining.

[2] Top address of sending data area (I/O number)

Specifies any address of internal output WR / WM.

[3] Amount of send data to each slave units (number of byte)

Set the amount of data to be sent to the slave unit for each slave unit.

Make sure that the total sending area for each slave does not exceed the maximum address for internal output.

[4] Top address of receiving data area (I/O number)

Specifies any address of internal output WR / WM.

[5] Size of buffer to store the data received from slave units (number of byte)

Set the buffer size for storing the data received from the slave unit for each slave unit.

Make sure that the total receiving area for each slave does not exceed the maximum address for internal output.

Caution

The amount of data specifys by byte unit, however the link area is secured by word unit.

If you specify the amount of send data or the buffer size for receiving data by odd numbered bytes, the high byte of last word in the link area is not used.

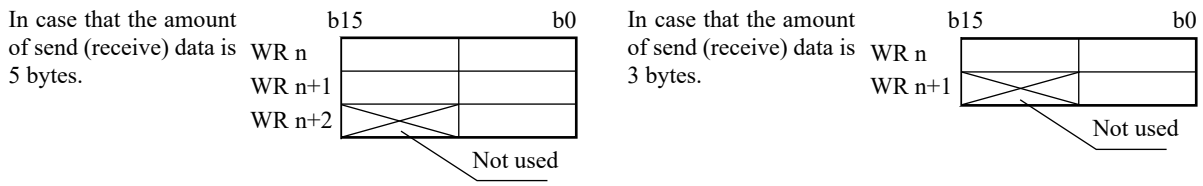
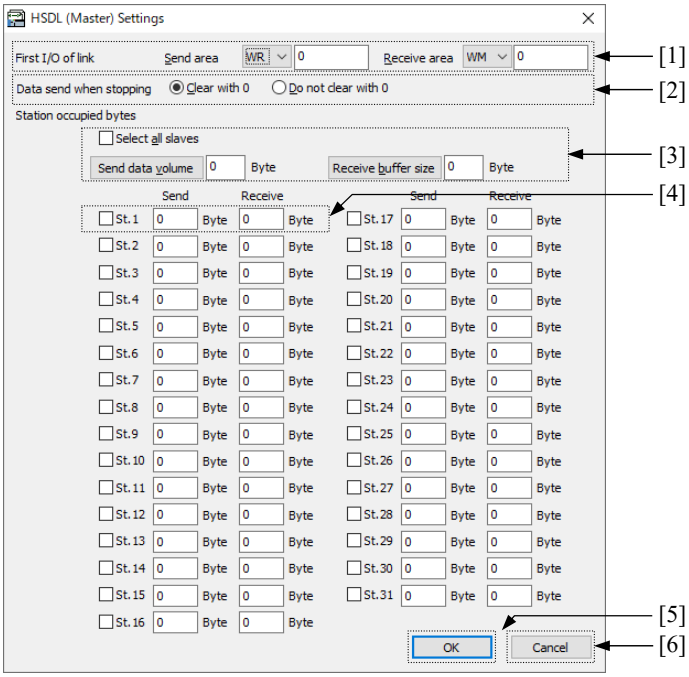


Figure 3.47 Arrangement of data in Link area (Amount of data is odd bytes)

Parameter settings for HSDL master

When you chose “HSDL(Master)” by purpose in Option board settings winidow, and push the detail button, following setting window will be opened.



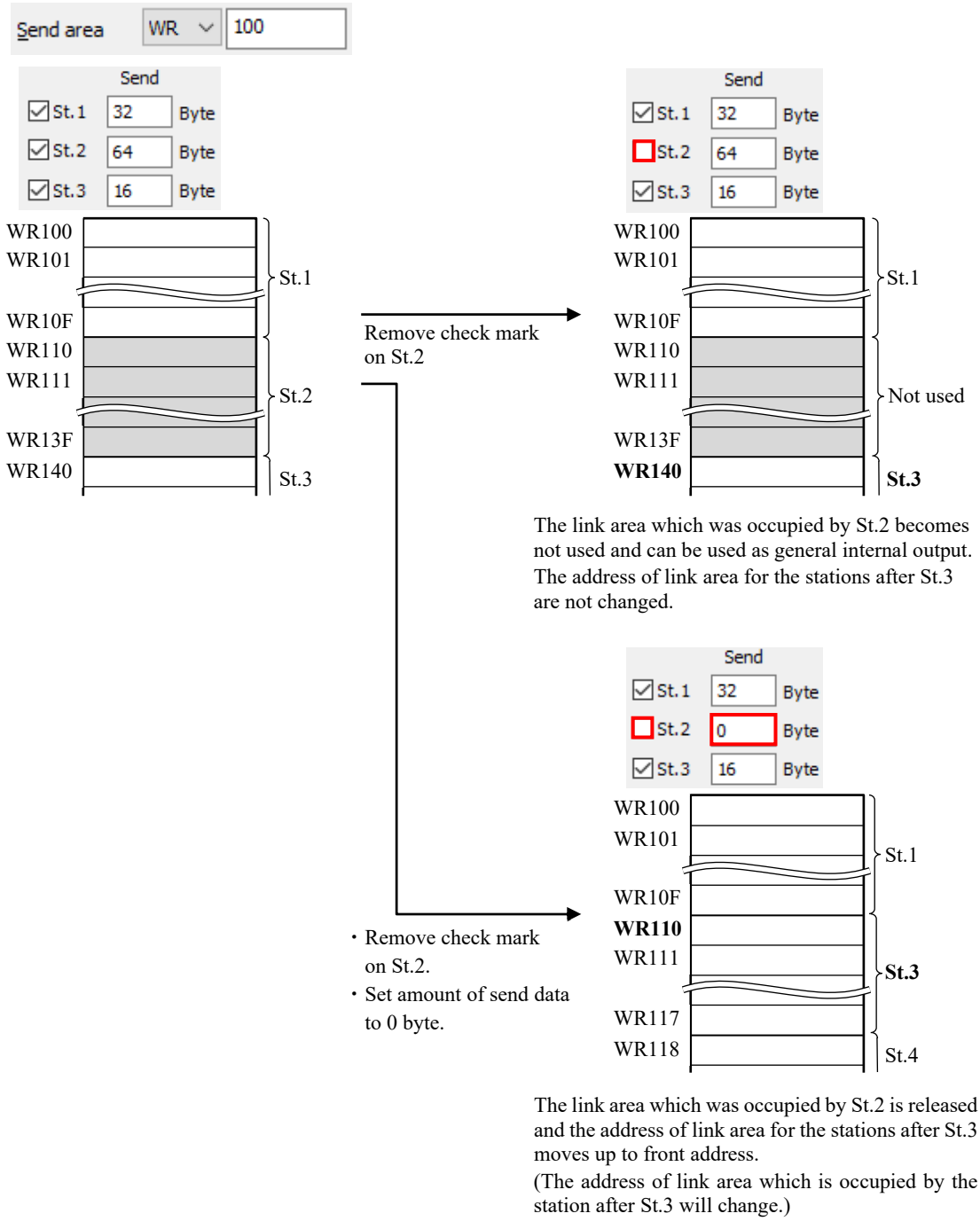
No.	Item	Description
[1]	First I/O of link	Set the top I/O address of link area (for sending and receiving). When abnormal parameter like following set to hear and push OK button, error window will be open and abnormal parameter does not set to MICRO-EHV. - Sending data area and receiving data area are overrupped. - Sending data area / receiving data area are in out of range of internal output.
[2]	Data send when stopping	Chose the value of data which is sent when master unit stops. Clear with 0 … Zero data is sent regardless of the value in sending data area when master unit stops. Do not clear with 0 … Data in sending data area is sent even if master unit stops.
[3]	Input support menu	Select all slaves Check here to select all slave units.
		Send data volume When this button is pushed, the value in the edit box on the right side is set to the amount of send data for selected slave units.
		Receive buffer size When this button is pushed, the value in the edit box on the right side is set to the receive buffer size for selected slave units.
[4]	Link area setting for each slave units	Select the joining station number by checking the left box at the station number. In the “Send” area, set the amount of send data to be sent for that station. Unit of amout of data is byte, and valid range is 0 to 255. In the “Receive” area, set the receive buffer size for that station. Unit of buffer size is byte, and valid range is 0 to 255.
[5]	OK button	When push this button, all parameters will be checked and closed this window.
[6]	Cancel button	When push this button, all parameters you have set will be canceled and closed this window.

Caution

・HSDL setting for master unit takes effect immediately after power on. But control of HSDL like start communication is executed by HSDL control bit (special internal output R820). In other words, if no one controls this bit, HSDL will not start.

・If you change the slave unit registered for participation to non-participation after completing the HSDL setting of the master unit, the send / receive data area secured for that slave unit remains just by unchecking participation. (However this area is not used in HSDL, so it can be used for other purposes.) This is to prevent the address used by other slave units changing by making a slave unit non-participating. If you want to remove the slave unit completely, set the number of bytes for amount of send data and receive buffer size to 0.

Example: Treatment of the amount of send data when removing station number 2



Parameters for HSDL slave

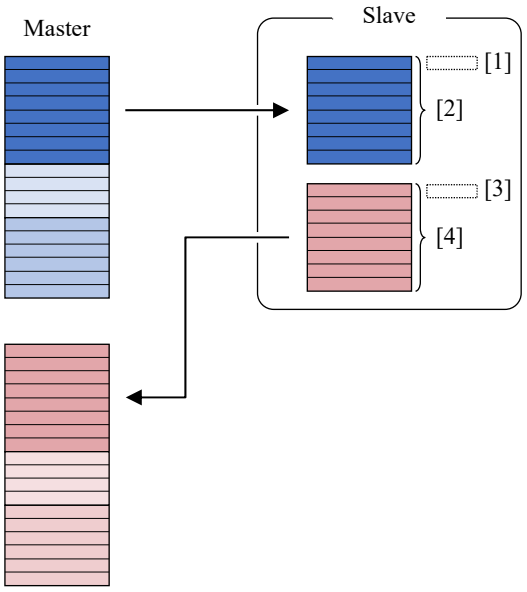


Figure 3.48 Setting parameter of HSDL slave unit

As to the slave unit, “link area” setting is required as parameters.

[1] Top address of receiving data area (I/O number)

Specifies any address of internal output WR / WM.

[2] Size of buffer to store the data received from master unit (number of byte)

Set the buffer size for storing the data received from the master unit.

Make sure that this buffer size and amount of send data size which is set at master unit side are the same value.

This cannot be set if the address obtained by adding the receive buffer size to the top address of the receiving data area exceeds the maximum address of the internal output.

[3] Top address of sendng data area (I/O number)

Specifies any address of internal output WR / WM.

[4] Amount of send data to master unit (number of byte)

Set the amount of data to be sent to the master unit.

Make sure that this amount of send data and receiving buffer size which is set at master unit side are the same value.

This cannot be set if the address obtained by adding the amount of send data to the top address of the sending data area exceeds the maximum address of the internal output.

Caution

・The amount of data specifys by byte unit, however the link area is secured by word unit.
If you specify the amount of send data or the buffer size for receiving data by odd numbered bytes, the high byte of last word in the link area is not used.

・As to the amount of send data and the buffer size for receiving data, use as same value to the value to set to master unit. If the setting values are different for the master unit and slave unit, the operation will be as following.

Master amount of send data > Slave buffer size for receiving data

… Slave unit can be joined to HSDL. In this case, the amount of send data will change to the same value which is set to the buffer size for receiving data area for slave unit.

Master amount of send data < Slave buffer size for receiving data

… Slave unit cannot join to HSDL.

Master buffer size for receiving data < Slave amount of send data

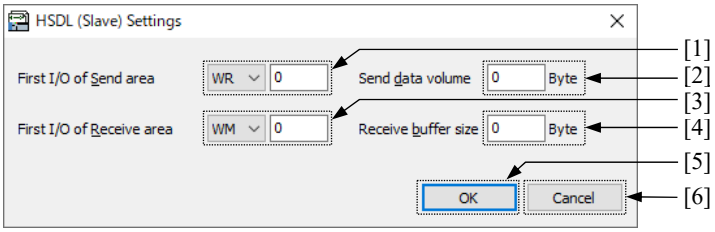
… Slave unit cannot join to HSDL.

Master buffer size for receiving data > Slave amount of send data

… Slave unit can be joined to HSDL. In this case, the receiving buffer which is not filled with the received data from slave unit in master unit is not used.

Parameter settings for HSDL slave

When you chose “HSDL(Slave)” by purpose in Option board settings winidow, and push the detail button, following setting window will be opened.



No.	Item	Description
[1]	First I/O of Send area	Set the top I/O address of link area (sending data area). When abnormal parameter like following set to here and push OK button, error window will be open and abnormal parameter does not set to MICRO-EHV. - Sending data area and receiving data area are overrupped. - Sending data area is in out of range of internal output.
[2]	Send data volume	Set the amount of send data size from slave unit to master unit. Unit of amout of data is byte, and valid range is 0 to 255. Make sure that this parameter and the buffer size for receiving data in master unit are same value. (If this parameter is larger than the buffer size for receiving data in master unit, this slave unit does not join the HSDL network.)
[3]	First I/O of Receive area	Set the top I/O address of link area (receiving data area). When abnormal parameter like following set to here and push OK button, error window will be open and abnormal parameter does not set to MICRO-EHV. - Sending data area and receiving data area are overrupped. - Receiving data area is in out of range of internal output.
[4]	Receive buffer size	Set the buffer size which is stored the receiving data from master unit. Unit of amout of data is byte, and valid range is 0 to 255. Make sure that this parameter and the amout of send data in master unit are same value. (If this parameter is larger than the amout of send data in master unit, this slave unit does not join the HSDL network.)
[5]	OK button	When push this button, all parameters will be checked and closed this window.
[6]	Cancel button	When push this button, all parameters you have set will be canceled and closed this window.

Caution

Setting of HSDL for slave unit is valid from power-on.

In case of slave unit, when you turn on the power, HSDL status will change to “wait message from master unit” automatically. However, the status of MICRO-EHV is STOP, HSDL communication does not start. (For starting HSDL communication, MICRO-EHV should be RUN.)

(2) HSDL communication control

Start / stop of HSDL communication is controlled by master unit.

In the master unit side, you turn on the communication control bit (special internal output R820), HSDL communication starts. And turn off this bit, HSDL communication stops. (As to the slave unit side, if HSDL setting is completed, slave unit becomes “wait the messeage from master unit” status from power on. No need the program for communication in slave unit side.)

Example: HSDL starts immediately after RUN, stops by R0 ON

Figure 3.49 Program example for HSDL control

Caution

- All slave units joining in HSDL must be ready to communicate before the master starts HSDL communication. In the case of the above program example, the slave unit must be ready for HSDL before the master unit runs.
- The master unit continues HSDL communication while the communication control bit (R820) is ON regardless the RUN / STOP status. (The data in send data area is also send to each slave even if the master unit is stopped.) If you want to send zero data when the master is stopped, set the “Data send when stopping” parameter of master unit to “Clear with 0”. In the case of this setting, the data which flows communication line changes to zero, but the value of send data area is retained as it is.
- If the link area is not set as power failure memory regardless the master unit and slave unit, the link area is cleared to zero at the start of RUN.

(3) Special internal output for HSDL

Word special internal output for HSDL

You can check the update time of HSDL and the joining status of master unit and slave unit by monitoring the special internal output shown in the following table.

No	Name [Main uses]	Meanings	Details	Set condition	Reset condition
WRF0ED	Update time for HSDL (Max.) [DISP]	Update time for HSDL (Maximum value)	Maximum update time for HSDL is stored with 1 ms units.	S	U
WRF0EE	Update time for HSDL (Current) [DISP]	Update time for HSDL (Current value)	Current update time for HSDL is stored with 1 ms units.	S	X
WRF0EF	Update time for HSDL (Min.) [DISP]	Update time for HSDL (Minimum value)	Minimum update time for HSDL is stored with 1 ms units.	S	U
WRF150	HSDL status [DISP]	Status of HSDL master and Slaves ➔ Refer to next page for details.	Low byte Status of master unit High byte Status of slave unit (No.1)	S	X
WRF151			Low byte Status of slave unit (No.2) High byte Status of slave unit (No.3)		
WRF152			Low byte Status of slave unit (No.4) High byte Status of slave unit (No.5)		
WRF153			Low byte Status of slave unit (No.6) High byte Status of slave unit (No.7)		
WRF154			Low byte Status of slave unit (No.8) High byte Status of slave unit (No.9)		
WRF155			Low byte Status of slave unit (No.10) High byte Status of slave unit (No.11)		
WRF156			Low byte Status of slave unit (No.12) High byte Status of slave unit (No.13)		
WRF157			Low byte Status of slave unit (No.14) High byte Status of slave unit (No.15)		
WRF158			Low byte Status of slave unit (No.16) High byte Status of slave unit (No.17)		
WRF159			Low byte Status of slave unit (No.18) High byte Status of slave unit (No.19)		
WRF15A			Low byte Status of slave unit (No.20) High byte Status of slave unit (No.21)		
WRF15B			Low byte Status of slave unit (No.22) High byte Status of slave unit (No.23)		
WRF15C			Low byte Status of slave unit (No.24) High byte Status of slave unit (No.25)		
WRF15D			Low byte Status of slave unit (No.26) High byte Status of slave unit (No.27)		
WRF15E			Low byte Status of slave unit (No.28) High byte Status of slave unit (No.29)		
WRF15F			Low byte Status of slave unit (No.30) High byte Status of slave unit (No.31)		

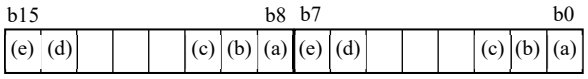
Main uses : [DISP]…Status display
Set / Reset condition column : S…ON/OFF by system, U…ON/OFF by user, X…Always display

Caution

- The HSDL update time is displayed only in the MICRO-EHV operating as the HSDL master.
- If the slave unit leaves from HSDL network and re-joins, the update time is automatically reset when the slave unit re-joins.

HSDL status (Master viewpoint)

The status of master unit and slave units are displayed in 1 byte per 1 station.



(a) Communication status 1 1 : Link area setting correct 0 : Link area setting incorrect

(b) Communication status 2 1 : Under communication 0 : Communication stop

(c) Communication status 3 1 : Slave not exist 0 : Slave exist

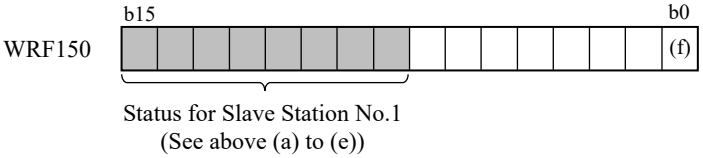
(d) Send / receive data size error 1 : Error 0 : Normal

(e) HSDL error 1 : Error 0 : Normal

When HSDL is started, status bit of each slave units turns ON in the order of (a) and (b), and when HSDL has performed normally, both (a) and (b) keeps turn ON.

When HSDL is not performed due to a communication error or parameter error, (e) will turns ON. If (c) turns ON at the same time as (e) turns ON, it means that the slave unit has left. If (d) turns ON at the same time as (e) turns ON, the amount of send data for slave unit is larger than the receive buffer size of the master unit, or it means that the receive buffer size of the slave unit is smaller than the amount of send data for master unit.

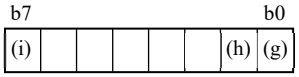
The lower byte of WRF150 is the master status.



(f) Slave not joining 1 : Some slaves has not joined 0 : All registered slaves are joining

HSDL status (Slave viewpoint)

In case of HSDL slave, the status is displayed at the address corresponding to the station number of own station in the special internal output WRF150 to WRF15F.



(g) Communication status 1 1 : Link area setting correct 0 : Link area setting abnormal

(h) Communication status 2 1 : Under communication 0 : Communication stop

(i) HSDL error 1 : Error 0 : Normal

Bit special internal output for HSDL

By using the special internal output shown in the table below, you can control the start and stop of HSDL communication and return the update time displayed in the word special internal output to the initial value.

No	Name [Main uses]	Meanings	Details	Set condition	Reset condition
R820	HSDL start / stop	0 : Stop HSDL 1 : Start HSDL	Control the HSDL start and stop (Only for master unit)	U	U
R821	Initializing update time (Max.) for HSDL	1: Initialize the update time (Max.)	Update time (Max.) for HSDL which is displayed in WRF0ED returns to zero. (Only for master unit)	U	S
R822	Initializing update time (Min.) for HSDL	1: Initialize the update time (Min.)	Update time (Min.) for HSDL which is displayed in WRF0EF returns to HFFFF. (Only for master unit)	U	S

Caution

・Bit special internal outputs are used by only master units.
It should be noted that if the settings are complete, slave unit will start HSDL communication from power-on. Therefore, it is not necessary to start or stop HSDL communiaiton for slaver unit.

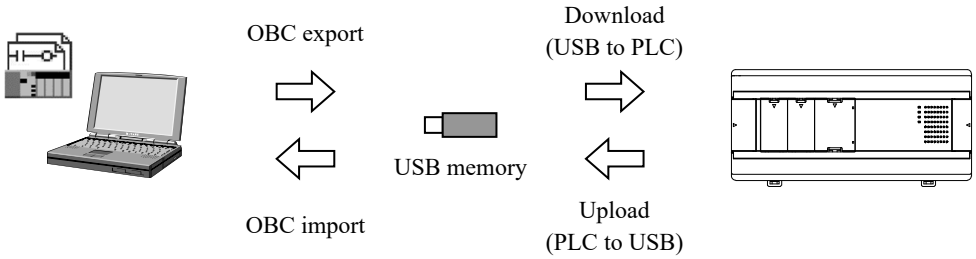
・Update time for HSDL can be initialized under executing HSDL (during R820 turns on). If HSDL stopping, though you turn on the request bit, update time does not initialize.

Chapter 4　Using USB Memory

4.1　Overview

The MVH can use the following functions using a USB memory.

(1)　Download and upload program and settings



The following table shows the data that can be uploaded and downloaded.

Reference

prj, prjh, prjx file column shows the parameters which are stored in the project file by [Save As].

Project tree	Item	Data to be carried by USB memory (obc file)	[Reference] (prj,prjh,prjx file)
PC communication settings	PC communication settings	No	No
CPU parameters	IP address	Yes	Yes
CPU settings	NTP	Yes	Yes
IP address	Serial communication	Yes	Yes
NTP	Ethernet (task code)	Yes	Yes
Serial communication	Ethernet (ASR)	Yes	Yes
Ethernet (task code)	Modbus-TCP/RTU	Yes	Yes
Ethernet (ASR)	Calendar clock	No	No
Modbus-TCP/RTU	Option board settings	Yes	Yes
Calendar clock	Project password	Yes	Yes
Option board settings	Sheet password	Yes	Yes
Project1	I/O Configurations	Yes	Yes
Project password	Retentive area	Yes	Yes
Sheet password	Operation parameters	Yes	Yes
Parameter settings	Data Logging Settings	Yes	Yes (prjh, prjx only)
I/O Configurations	Simplified positioning parameter setting	Yes	Yes (prjx only)
Retentive area	Program	Yes	Yes
Operation parameters	I/O comment	Yes	Yes
Data Logging Settings	Circuit comment	Yes	Yes
Extended parameter setting	Multi-Comment	Yes	Yes
Simplified positioning parameter setting	Random circuit monitor	No	Yes
Program	Time chart monitor	No	Yes (prjh, prjx only)
Program1	Simplified positioning trial operation	No	No
I/O comment	HSDL monitor	No	No
Circuit comment	I/O monitor sheet	No	Yes
Multi-Comment			
Monitor			
Random circuit monitor			
Time chart monitor			
Simplified positioning trial operation			
Ch.1			
Ch.2			
Ch.3			
HSDL monitor			
I/O monitor sheet1			

Caution

・Data on data memory (internal output data) is not included in the download / upload targets.

・The sheet password function is supported from Control Editor Ver.4.10.

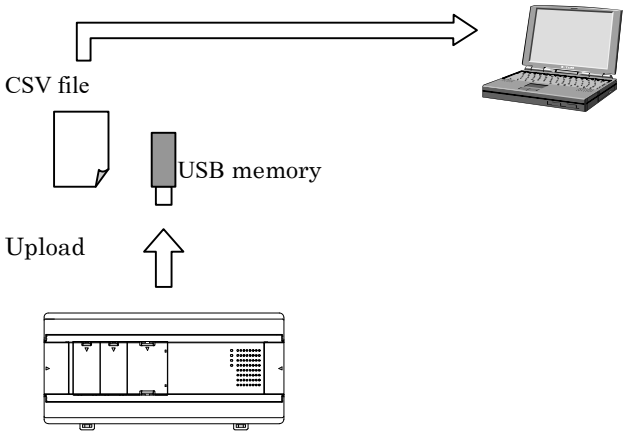
・Data logging and trace functions are supported from Control Editor Ver.4.20.

・Simplified positioning functions are supported from Control Editor Ver.5.01.

・HSDL functions are supported from Control Editor Ver.7.10.

(2) Uploading CPU Log

Upload the operation history and error history stored in the basic unit (CPU) to a USB memory as CSV file.



The CPU Log is saved in the USB memory in CSV file format, the operation history and error history of the basic unit can be confirmed by Control Editor.

Caution

・The CPU Log upload function is supported from MICRO-EHV software Ver.x109.

・The function to refer to the CPU Log file is supported from Control Editor Ver.4.20.

(3) Data logging and trace

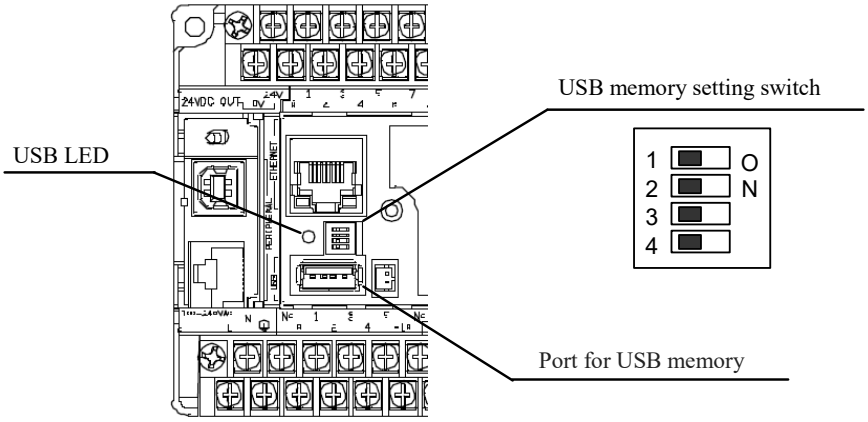
As to the detail of data logging and trace functions, please refer to chapter 7.

Caution

・Data logging and trace functions are supported from MICRO-EHV software Ver.x109.

・Control Editor Ver.4.20 or newer is required for using the data logging and trace functions.

4.2 Setting and viewing



(1) USB memory setting switch details

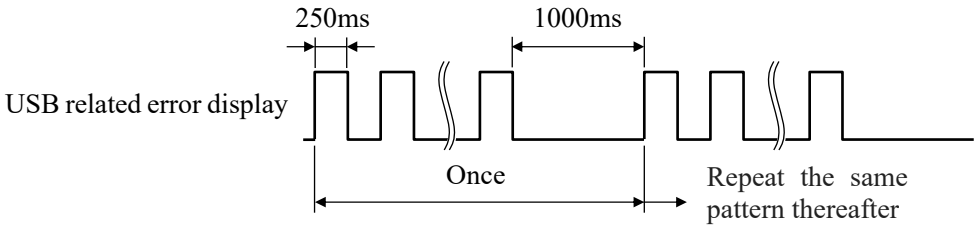
1	2	3	4	Action	Action while running
OFF	OFF	OFF	OFF	Normal operation / Data logging and trace function / CPU Log upload	Yes (possible)
ON	OFF	OFF	OFF	USB memory➔ CPU (download)	No (impossible)
ON	ON	ON	OFF	USB memory← CPU (upload)	Yes (possible)

Do not use other settings.

(2) USB LED lighting pattern

LED display		Action
Turn on	○	USB memory is inserted
Turn off	●	USB memory is not inserted
Blink (1 second interval)	○ / ● 0.5 second / 0.5 second	Uploading / Saving Logging date / Saving CPU Log (turns on after successful completion or abnormal end)
Blink (2 seconds interval)	○ / ● 1 second / 1 second	Downloading (turns on after successful completion or abnormal end)

When error related to the USB memory (Error Code : A1 to A6) occurs, the USB LED blinking in a special pattern as following figure.

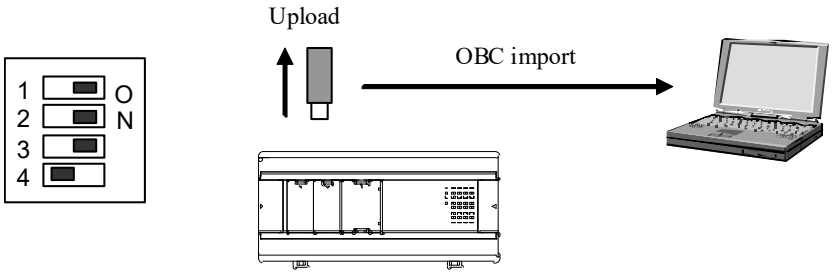


The number of blinks means the least significant digit of the error code. You can recognize the error code by counting the number of blinks.

For example, if LED blinks 5 times, it means A5 error occurs.

4.3 Uploading program

Upload means a transmission of data from MVH to a USB memory.



(1) How to upload

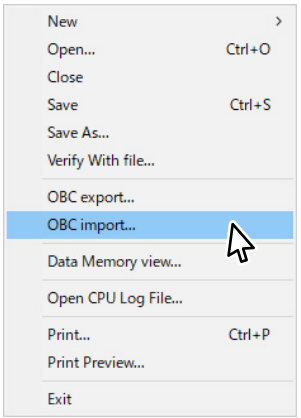
1. Set the USB memory setting switches as shown in the above figure (1 to 3: ON, 4: OFF).
2. Insert a USB memory into the port for USB memory on this unit.
   →The USB LED blinks at 1 second interval.
3. When the USB LED changes from blinking to lighting, the program upload is complete.
   →For software Ver.0107 or older : The file named "upload.obc" is created in the USB memory.
   →For software Ver.0108 or newer : The file named " upload_xxxxxx.obc" is created in the USB memory.
   The above file name ”xxxxxx” is the lower six digits of the MVH MAC address.
   The MAC address is a hardware specific number.
   Therefore, you can upload programs from multiple MVH to the same USB memory continuously.

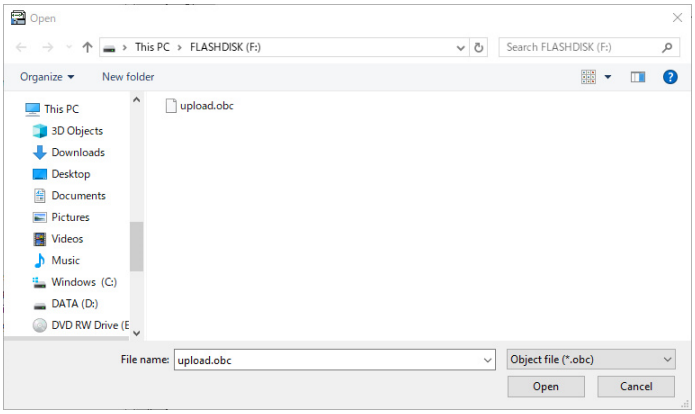
Caution

If software version of MICRO-EHV is Ver.x107 or older, when upload the project from multiple MVH, the file named upload.obc is overwritten in USB memory.

(2) How to open the uploaded program

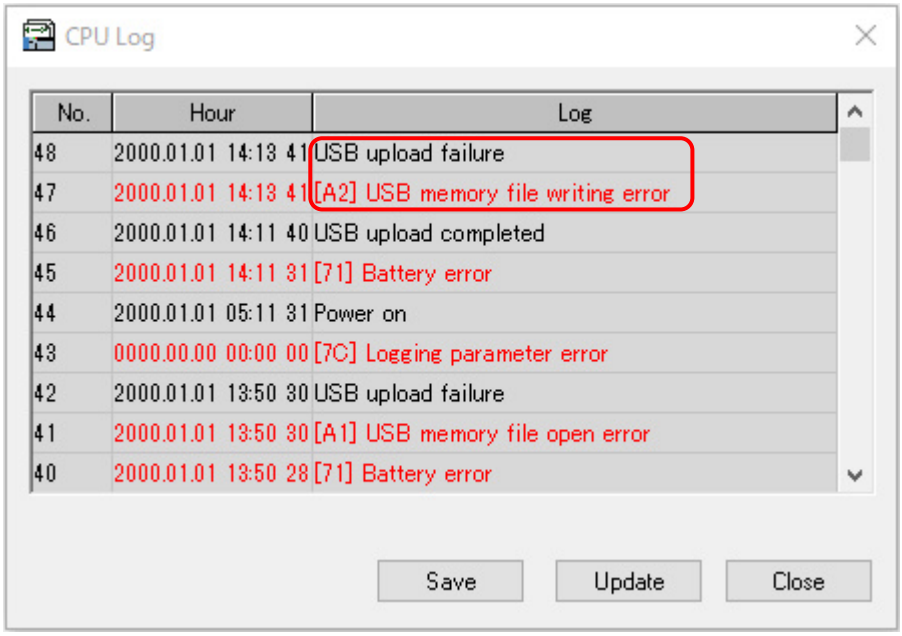
1. Start the Control Editor.
2. Select [OBC import] from the [File] menu.
3. Select "upload.obc" or "upload_xxxxxx.obc" in the USB memory on the displayed [Open] window.





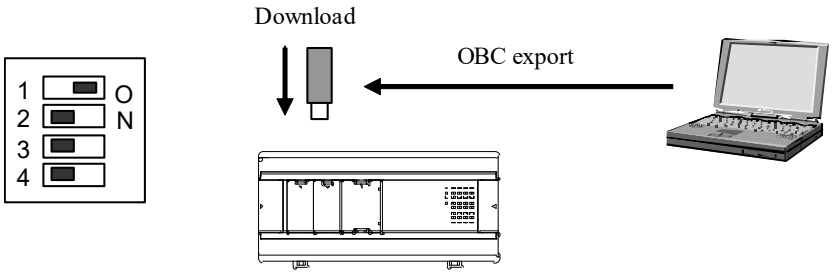
Caution

- The USB memory setting switches can be operated when this unit is turned on. Then, insert a USB memory to start the upload.
- Note that, when you set the USB memory setting switches with this unit turned off, and you turn on this unit with a USBmemory inserted, upload is started.
- You can start upload when the CPU is stopped or operating.
- The USB LED on this unit blinks at 1 second interval during upload. It lights when upload is complete. Do not turn off this unit or take out the USB memory while the USB LED is blinking. This may cause false operations or lose programs.
- If the USB memory is write-protected, or there is not enough free space, the upload.obc file cannot be created in it. You can view such information with the "CPU Log" function.



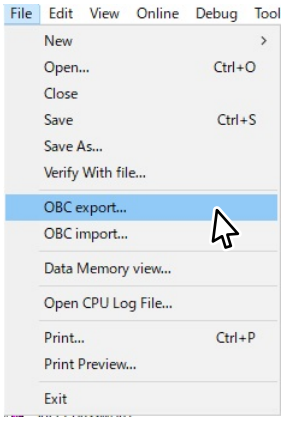
4.4 Downloading program

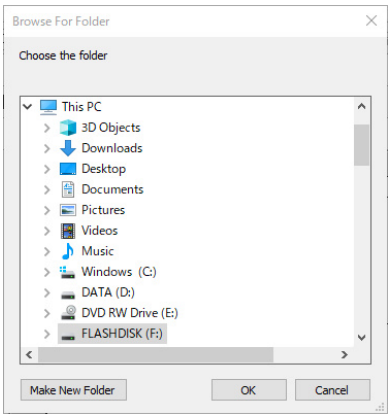
Download means a transmission of data from a USB memory to MVH.



(1) How to create download file

1. Start the Control Editor, and create or open a project to download.
2. Select [OBC export] from the [File] menu.
3. Select the USB memory drive on the displayed [Browse For Folder] window.





4. A file named "download.obc" is created in the USB memory.

(2) How to download

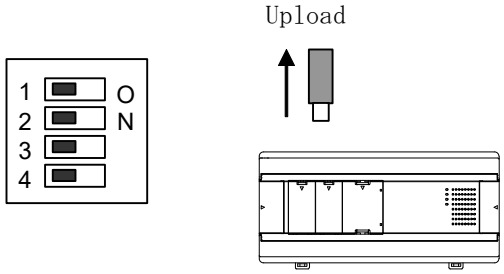
1. Set the USB memory setting switches as shown in the above figure (1: ON, 2 to 4: OFF).
2. Insert the USB memory which contains the download.obc file into the port for USB memory on MVH.
   →The USB LED blinks at 2 seconds interval.
3. When the USB LED changes from blinking to lighting, the program download is complete.

Caution

- The USB memory setting switches can be operated when this unit is turned on. Then, insert a USB memory to start download.
- Note that, when you set the USB memory setting switches with this unit turned off, and you turn on this unit with a USB memory inserted, download is started.
- You can start download only when the CPU is stopped. Download will not be started during operation.
- The USB LED on this unit blinks at 2 seconds interval during download, and it lights when download is complete. Do not turn off this unit or take out the USB memory while the USB LED is blinking. This may cause false operations or lose programs.
- Specify the root (directly under drive) in the USB memory drive for OBC export. If you specify another folder, the OBC file is still created, but download to this unit is not performed.

4.5 Uploading CPU Log

Operation that reading CPU Log from MVH to USB memory is called CPU Log upload.



(1) How to upload

1. Set the USB memory setting switches as shown in the above figure (DIP Switch 1 to 4 : OFF).
2. Insert the USB memory into the port for USB memory on this unit.
   →The USB LED blinks at 1 second interval.
3. When the CPU Log upload is completed, the USB LED changes from blinking to lighting.
   The CPU Log file is saved in the USB memory as follows.

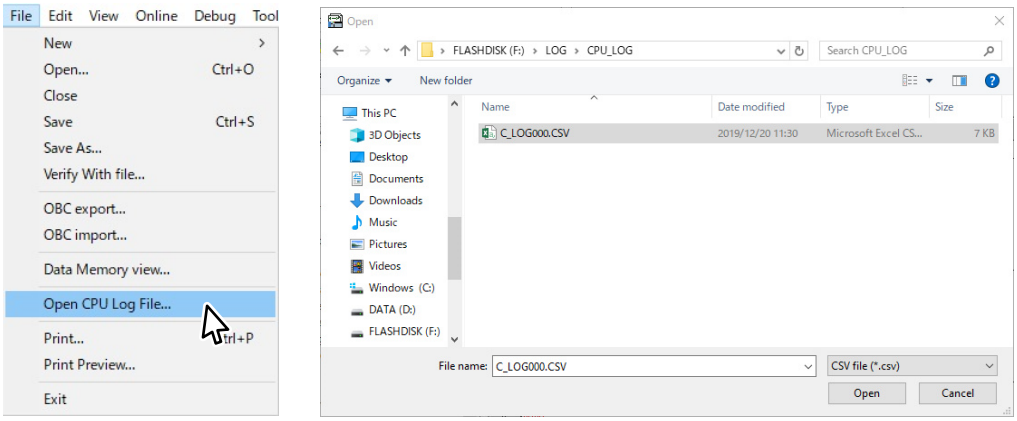
ROOT —— LOG —— CPU_LOG C_LOG000.csv
C_LOG001.csv
C_LOG002.csv
…

Caution

The CPU Log file will be created by doing any operation or detecting any errors. When the CPU Log file is created, the number in name of CPU Log file is updated (+1). If there is no CPU Log file in USB memory, the number in file starts from 000. If the CPU Log file exists in USB memory already, the number in file starts from last number + 1.
The CPU Log file can be created up to 100. When the number of file name reaches to 99, the number of file name restarts from 000. If file with same name exists in USB memory already, this file is overwritten by new the CPU Log file.

(2) How to open the uploaded program

1. Start the Control Editor.
2. Select [Open CPU Log File…] from the [File] menu.
3. Select " C_LOGxxx.CSV " in the USB memory on the displayed [Open] window.



Caution

The CPU Log can be referenced from Control Editor Ver.4.20.

4.6 USB memory specification

The following table shows the USB memory specification supported by MVH.

Item	Specification
Supported standard	USB Ver.2.0 (12M)-compliant
File system	FAT32
Maximum USB memory capacity	32GB
USB connector on the main unit	USB A type female

Caution

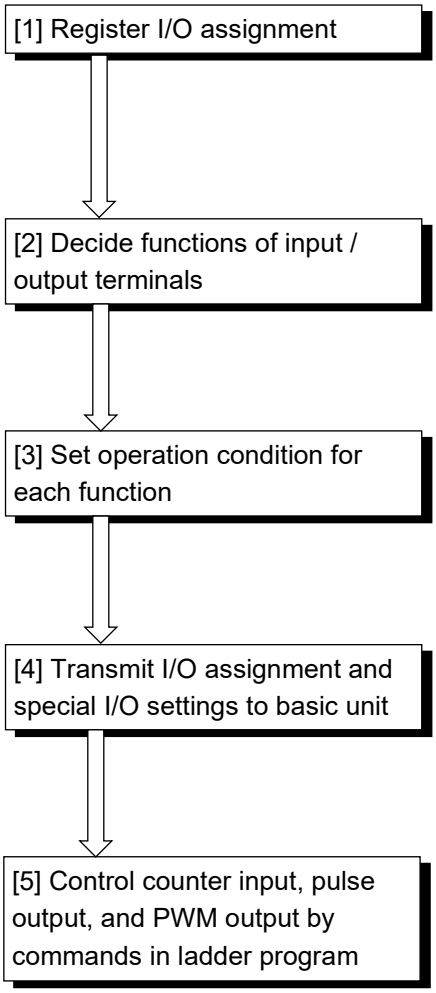
- Do not connect any USB equipment other than a USB memory to the port for USB memory.
- A USB hub cannot be used.

MEMO

Chapter 5 I/O Assignment and Special I/O

5.1 Overview

The basic unit I/O provides the counter input, interrupt input, pulse output, and PWM output functions on behalf of the normal input/output function. When it is used as a normal input terminal, the digital filter function is available. Figure 5.1 shows the flow diagram to switch these input/output functions.



In the Control Editor, register the I/O assignment information according to your equipment configuration.

Determine the input/output terminals to be used as the special I/O, and register the function of each terminal in the I/O Configuration window (special I/O) in the Control Editor.
For terminals used as a normal input/output, any setting does not need to be changed.

Set necessary operation conditions for each function in the I/O Configuration window (special I/O) in the Control Editor. For example, you can select whether the rising edge or falling edge is counted for the 1-phase counter input.

Connect online with the MICRO-EHV, execute "Download", and then transmit the program and the I/O assignment information to the MICRO-EHV.

Set the parameters by the program using the counter input, pulse output, and PWM output dedicated commands, and then start the count input or pulse output.
Parameters can be changed using each dedicated command even when the system is operating.

Figure 5.1 Setting flow of the input/output functions

As to the “simplified positioning function” which is supported from software Ver.x120, please refer to chapter 8 though the usage overlaps with this chapter.

5.1.1 I/O address

This section describes the MICRO-EHV I/O address.

The MICRO-EHV I/O address is fixed but different according to the number of I/O points and the expansion unit type.

Please note that the digital I/O expansion unit has a different output address start number between 64-point units and other units. Table 5.1 shows the I/O addresses by number of points and expansion unit type.

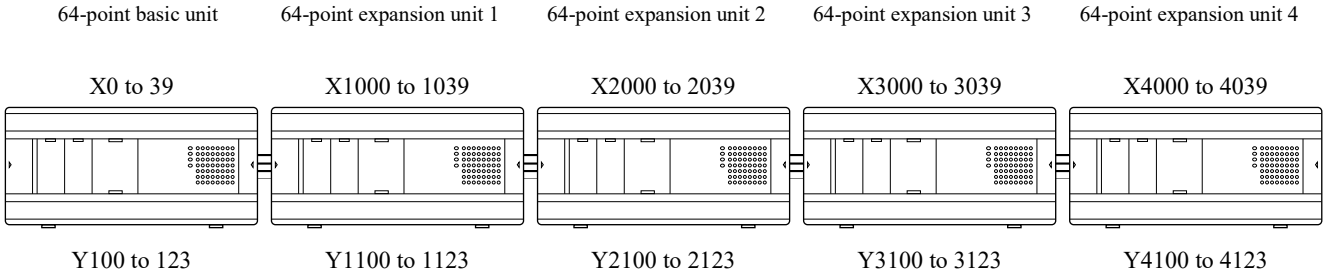


Table 5.1 I/O assignment and I/O address of each unit

Type			I/O assignment	Input/ output	20-point	40-point	64-point
Basic	Digital		(Fixed)	Input	X0 to 11 (WX0)	X0 to 23 (WX0 to 1)	X0 to 39 (WX0 to 2)
				Output	Y100 to 107 (WY10)	Y100 to 115 (WY10)	Y100 to 123 (WY10 to 11)
Expansion 1	Digital	8/14/16/28-point	B1/1	Input	X1000 to 1015 (WX100)		
				Output	Y1016 to 1027 (WY101)		
		64-point expansion	X48/Y32	Input	X1000 to 1039 (WX100 to 102)		
				Output	Y1100 to 1123 (WY110 to 111)		
	Analog		FUN0	Input	WX100 to 104		
				Output	WY105 to 107		
Expansion 2	Digital	8/14/16/28-point	B1/1	Input	X2000 to 2015 (WX200)		
				Output	Y2016 to 2027 (WY201)		
		64-point expansion	X48/Y32	Input	X2000 to 2039 (WX200 to 202)		
				Output	Y2100 to 2123 (WY210 to 211)		
	Analog		FUN0	Input	WX200 to 204		
				Output	WY205 to 207		
Expansion 3	Digital	8/14/16/28-point	B1/1	Input	X3000 to 3015 (WX300)		
				Output	Y3016 to 3027 (WY301)		
		64-point expansion	X48/Y32	Input	X3000 to 3039 (WX300 to 302)		
				Output	Y3100 to 3123 (WY310 to 311)		
	Analog		FUN0	Input	WX300 to 304		
				Output	WY305 to 307		
Expansion 4	Digital	8/14/16/28-point	B1/1	Input	X4000 to 4015 (WX400)		
				Output	Y4016 to 4027 (WY401)		
		64-point expansion	X48/Y32	Input	X4000 to 4039 (WX400 to 402)		
				Output	Y4100 to 4123 (WY410 to 411)		
	Analog		FUN0	Input	WX400 to 404		
				Output	WY405 to 407		

5.1.2 Setting I/O assignment

According to the following operation procedure, select the model name of the basic unit, as well as the model names of any used expansion units, from the Unit list at the right side of the window.

Reference

If you program a contact point or coil containing an external I/O address when I/O information is not assigned on the CPU, an error message "Undefined I/O in I/O configuration exists in program." is displayed when the Build is performed, and the circuit is not determined.

```
Program converting...
[ERROR] Program1, Row No. 1. Undefined I/O in I/O configuration exists in program.
----------Project1 Building complete
```

Figure 5.2 Error message without I/O assignment

When the actual MICRO-EHV unit and the Control Editor are connected online, you can set the I/O assignment following the next procedure.

(1) Online procedure

1. Connect the basic unit and expansion units by expansion cables, and then supply power.
2. Connect online with the Control Editor.
3. Select [Tool] - [Parameter settings] - [I/O Configuration] to open the [I/O Configuration] tab.
4. Press the Read I/O button.
5. Press the OK button to confirm the I/O Configuration.

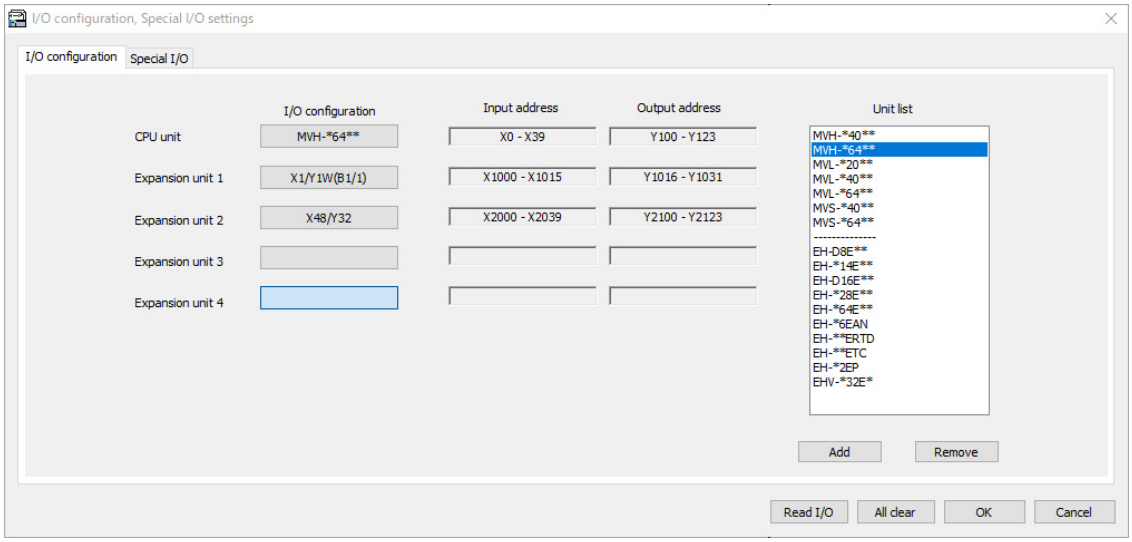


Figure 5.3 I/O Configuration and Special I/O setting window (Online)

If the actual MICRO-EHV unit is not available, you can assigned the I/O information using offline Control Editor with the following procedure.

(2) Offline procedure

1. In the Control Editor, select [Tool] - [Parameter settings] - [I/O Configuration] to open the [I/O Configuration] tab.
2. From the Unit list, select the model of the CPU unit and expansion units to use.
3. Press the Add button or Double-click to assign the selected model..
4. Press the OK button to confirm the I/O assignment.

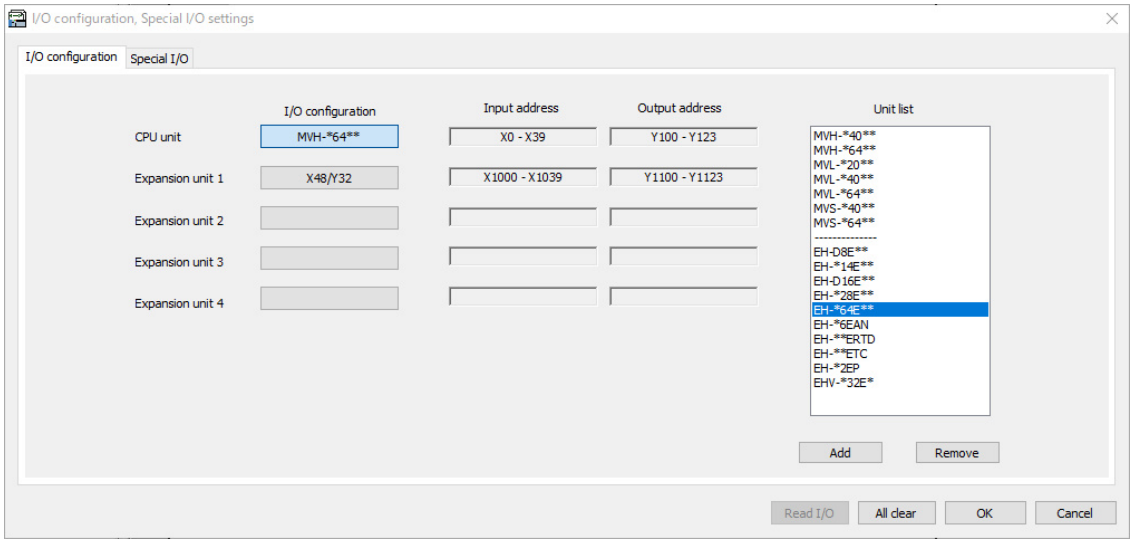


Figure 5.4 I/O Configuration and Special I/O setting window (Offline)

When the I/O assignment information is changed, the Control Editor displays * marks in the project tree. These * marks indicate that the program has been edited, and the Download (PC to PLC) operation is not available when they are displayed. To enable the Download (PC to PLC) operation, execute the Build operation. When the Build operation is completed successfully, * marks disappear from the project tree, and the Download (PC to PLC) operation is enabled.

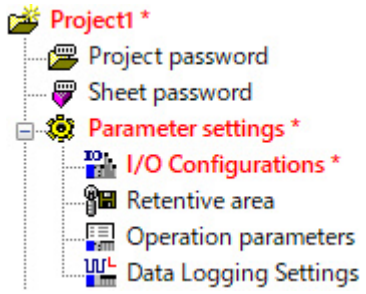
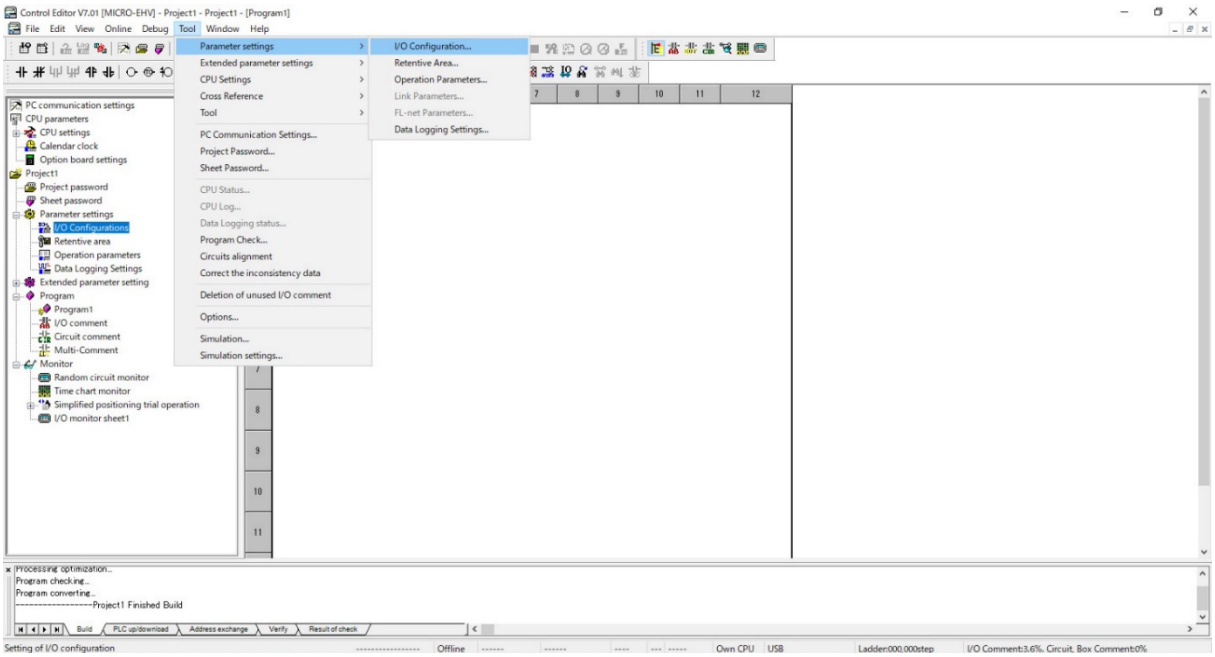


Figure 5.5 Display before Build

5.1.3 Setting special I/O

In the Control Editor, select [Tool] - [Parameter settings] - [I/O Configuration], and then click the [Special I/O] tab. Special I/O setting window is displayed.



Reference

New function which is used by combining input signal and output signal has been added from software Ver.x120. From this reason, the setting window for special I/O has been updated from Control Editor Ver.5.00.

It is possible to upload and edit the special I/O setting in MICRO-EHV software Ver.x110 or older, but the setting of above mentioned new function cannot be set to MICRO-EHV software Ver.x110 or older.

(1) Setting procedure in Control Editor (Ver.4.21 or older)

Select I/O assignment and click the special I/O tab. The following setting window is displayed.

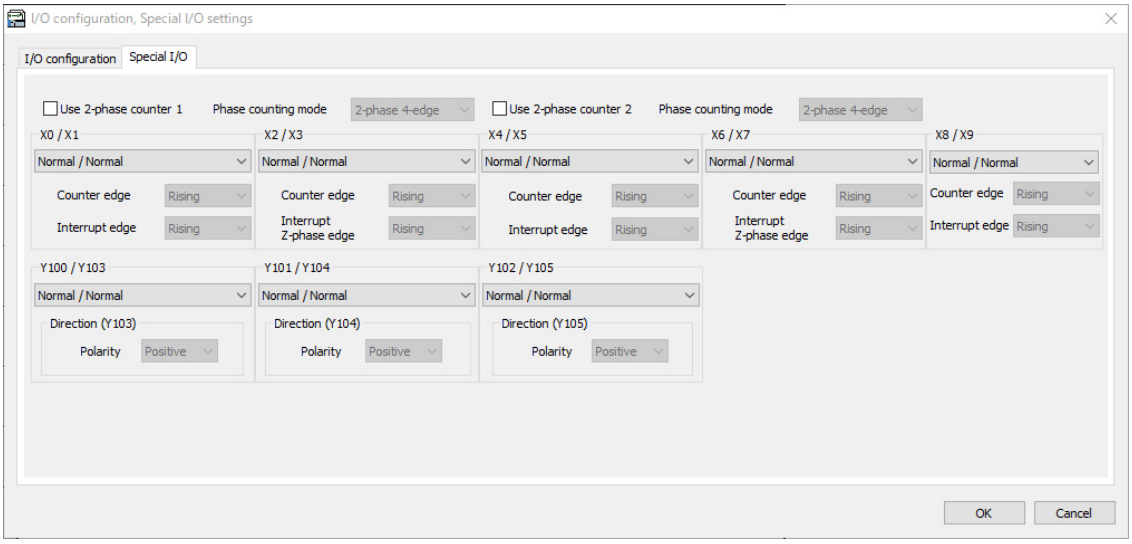
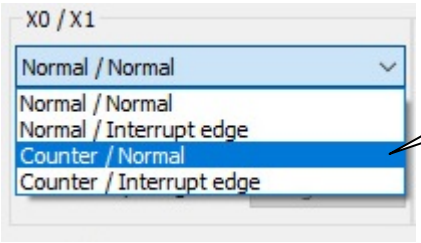


Figure 5.6 Special I/O setting window (Control Editor Ver.4.21 or older)

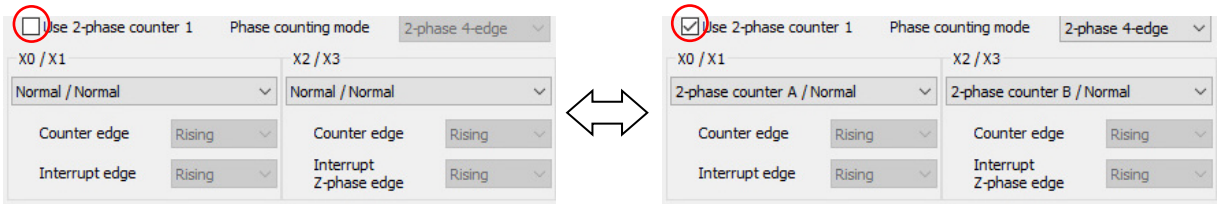
Select the functions to 2 signals from the pull-down menu since 2 signals are combined and displayed. If one or both need individual settings, select a parameter from the pull-down menu below.

Example) Setting X0 and X1



When “Counter/Normal” is selected, the counter is assigned to X0 and the normal input is assigned to X1.

The 2-phase counter uses by combining 4 signals. If you check “Use 2-phase counter”, the pull-down menu changes for 2-phase counter.



(2) Setting procedure in Control Editor (Ver.5.00 or newer)

Select I/O assignment and click the special I/O tab. The following setting window is displayed.

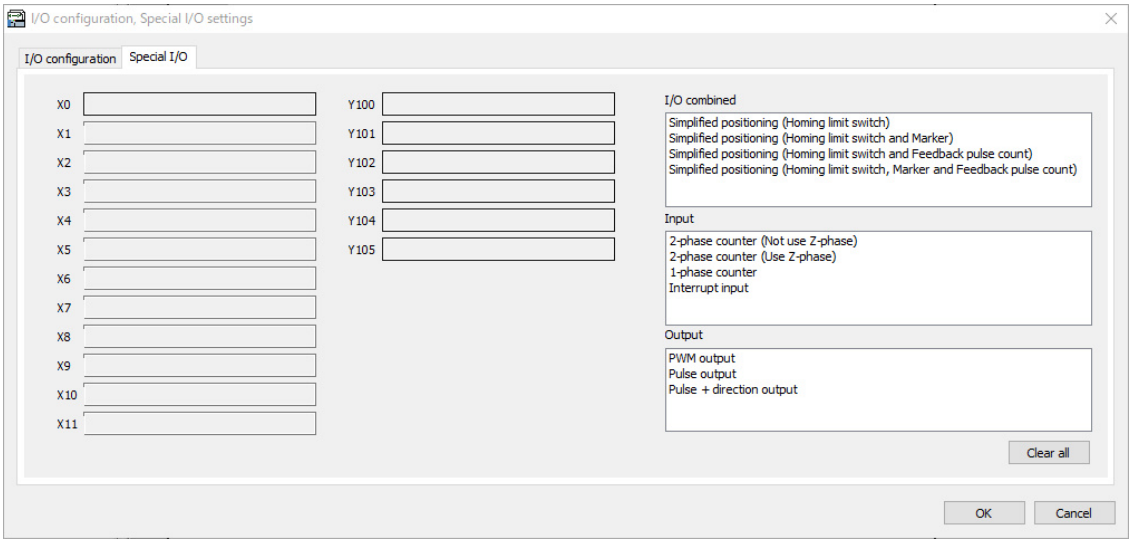
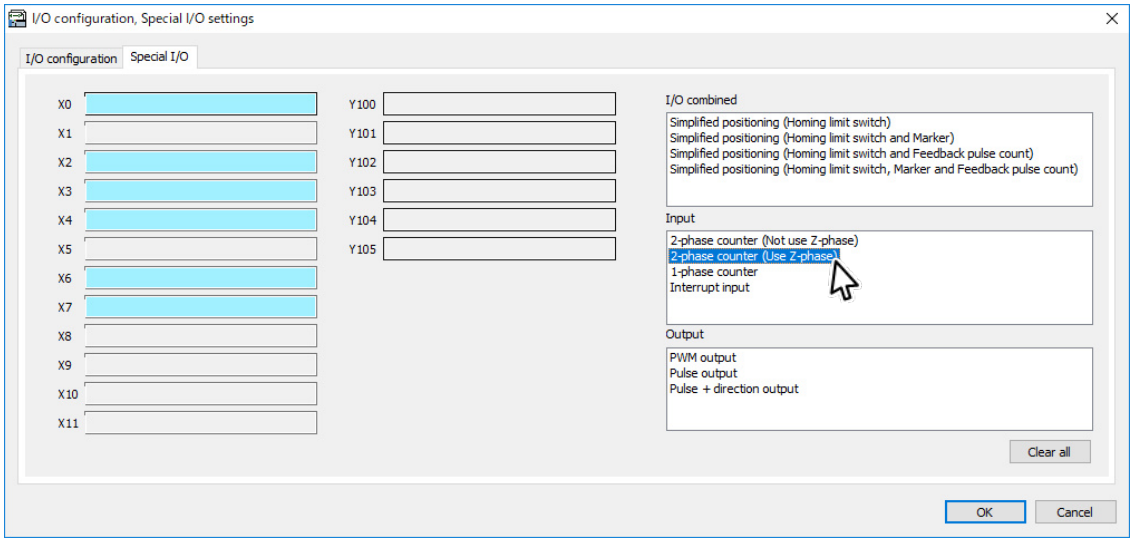
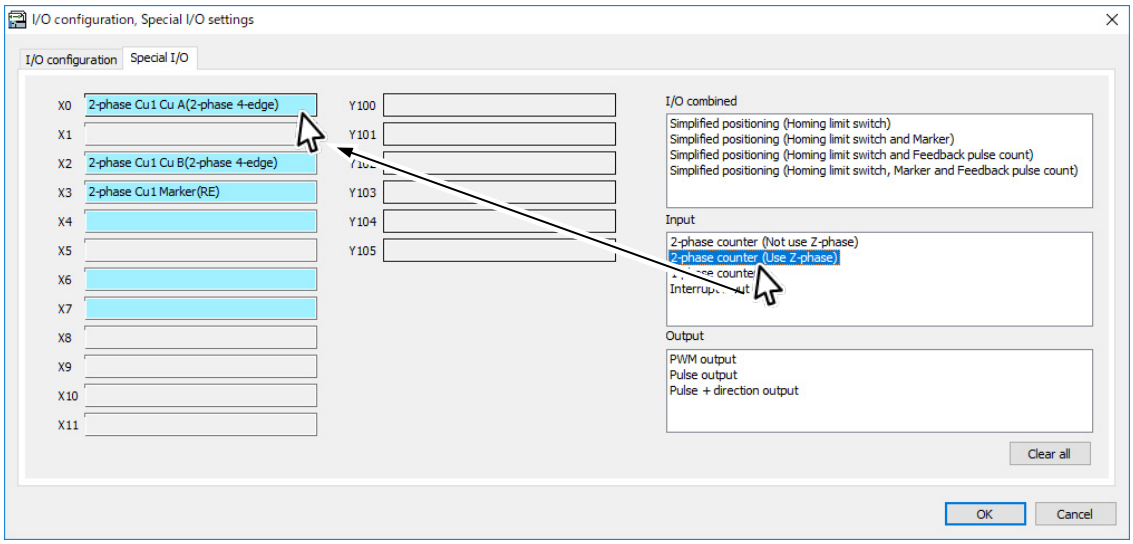


Figure 5.7 Special I/O setting window (Control Editor Ver.5.00 or newer)

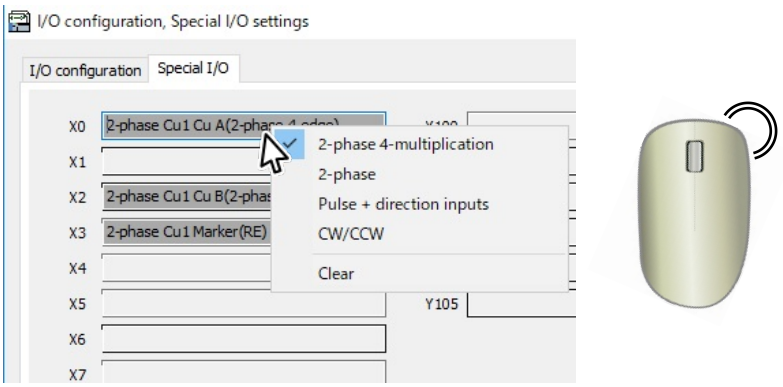
Special I/O functions are displayed on the right side of the setting window. When the special I/O function is selected by the mouse, the color of the I/O frame that can be set changes to blue.



When dragging the special I/O function with the mouse and dropping it into the frame where the color has changed, the dropped function is assigned to the input/output. In addition, when double-clicking the special I/O function, this function is assigned to the empty young number of input/output.



Move the mouse cursor to the frame which is assigned any function and right-click on here, individual setting menu for special I/O will be displayed. You can set or change the setting by this menu, or can cancel the setting of special I/O by this menu. (If you press Clear all button at the lower right of the setting window, all special I/O assignments will be canceled.)



When the I/O mixed function or pulse output + direction signal is assigned, the parameter setting window for simplified positioning is displayed. Set the parameters required for simplified positioning. (This parameter can be set and changed later.)

The simplified positioning parameter setting window will be explained in detail in Chapter 8 Simplified positioning function.

5.2 High-speed counter

You can use five input terminals of MVH (X0, X2, X4, X6, X8) and four input terminals of MVL (X0, X2, X4, X6) as input terminals for 1-phase pulse.

Also, you can use the pair of X0 and X2 and the pair of X4 and X6 as 2-phase pulse input terminals in both of MVH and MVL. Table 5.2 shows the specification of the high-speed counter.

Table 5.2 High-speed counter specification

Item	Content
Number of counters	1-phase pulse input type MVH: 5 points, MVL: 4 points 2-phase pulse input type MVH / MVL: 2 points
Maximum frequency	1-phase pulse input type 100kHz 2-phase pulse input type 60kHz
Count method	32-bit binary ring counter: 0 to HFFFFFFFF During up count, one pulse input changes the maximum current value (HFFFFFFFF) to the minimum value (0). During down count, one pulse input changes the minimum current value (0) to the maximum value (HFFFFFFFF). Up and down can be switched by the CUSTA command.
Counting mode	1-phase pulse input type: 1-phase pulse counting mode 2-phase pulse input type: 2-phase 4-edge evaluation phase counting mode 2-phase phase counting mode Pulse + orientation phase counting mode CW/CCW phase counting mode
Current value storage location (Refer to "Important" in the next page)	1-phase pulse input type: Counter 1: DRF100 Counter 2: DRF102 Counter 3: DRF104 Counter 4: DRF106 Counter 5: DRF108 2-phase pulse input type: Counter 1: DRF100 Counter 3: DRF104
Coincidence interrupt (Common of all counting modes)	Comparison value match detection • Using CUPRE command, set any numbers to the first and second comparison values. • When the current counter value and the first comparison value match, the following interrupt subroutine is called. Counter 1: CINTP(1), Counter 2: CINTP(2) Counter 3: CINTP(3), Counter 4: CINTP(4) Counter 5: CINTP(5) • When the current counter value and the second comparison value match, the following interrupt subroutine is called. Counter 1: CINTN(1), Counter 2: CINTN(2) Counter 3: CINTN(3), Counter 4: CINTN(4) Counter 5: CINTN(5)
Resetting the current value	Set the number 0 using the CUWR command.

If you implement the high-speed counter function, use the commands shown in table 5.3.

Table 5.3 High-speed counter related commands

Command	Content
CUSTA (s)	Specifies counting start/stop and up/down direction of the counter
CUPRE (s)	Sets the counter first and second comparison values
CURD (s)	Reads the current counter value by 32-bit to store it in the internal output
CUWR (s)	Changes the current counter value

For details of the commands, refer to "Application Commands" in Chapter 5 "Command Specifications" in the "PROGRAMMING MANUAL NJI-590*(X)".Section 5.2.9 in this chapter shows sample programs.

Important

The internal counter in this unit is 32-bit long. Although the current counter value is always reflected to the special internal output DRF100 to DRF108, 32-bit synchronism is not guaranteed for this value. Be sure to read the value using CURD command when the ladder program uses the current value. As shown in the diagram below, the current value of the special internal output may not indicate the correct value depending on the carry timing. Use this value as reference information for debugging. If you program an application that performs double-word numerical calculation on values in the special internal output area to control a machinery equipment based on the calculation result, it may cause an unexpected erroneous behavior because of the 32-bit data asynchronism. Figure 5.8 shows this condition.

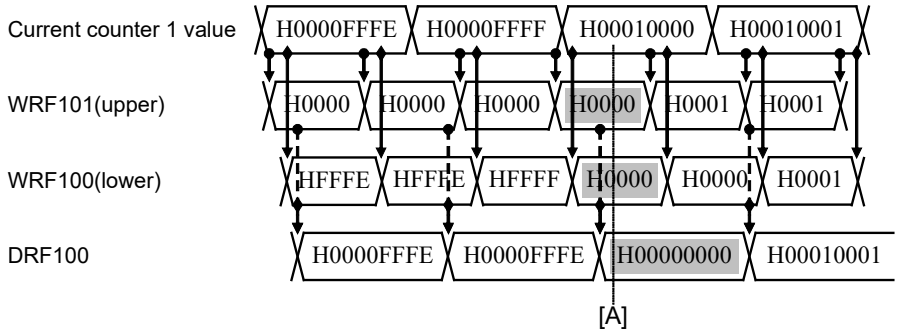


Figure 5.8 Data synchronism problem

The current counter 1 value is updated at the timing when the input pulse is changed, and the numerical value is reflected to WRF101 and WRF100 according to the system internal timing. The update timing of the current counter 1 value and the system internal timing is asynchronous, and generally the timing when the program assigns the WRF101 and WRF100 numerical values to DRF100 is asynchronous and depends on the scan time. So, in the worst case of timing, the counter 1 current value H00010000 may be changed to H00000000 in DRF100 as shown by shaded [A] in the figure.

To avoid such phenomenon, use the CURD command which reads the current counter 1 value by 32-bit and directly stores the result in the double-word internal output.

Please note that the time chart in Figure 5.8 illustrates an extreme change timing under the purpose of clearly describing the data synchronism problem. It may be different from the actual system process timing.

5.2.1 Example of external equipment connection

Figure 5.9 shows an example of external equipment connection (2-phase counter).

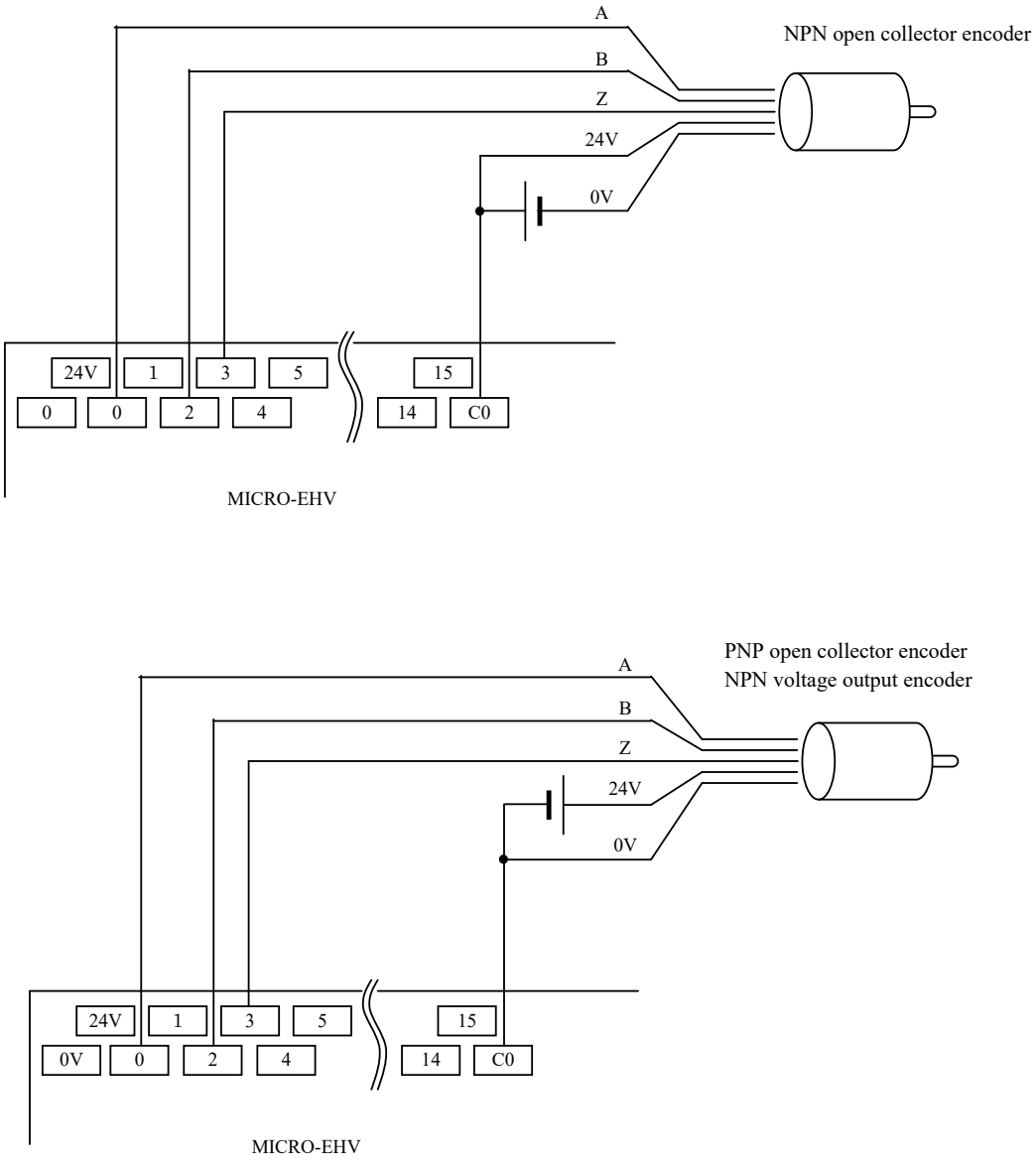


Figure 5.9 Wiring example

5.2.2 Common specification of all counting modes

(1) Counting when the operation is stopped

In case when the system is running (RUN/STOP switch position is RUN), the counting is started by the CUSTA command, and then the operation is stopped (RUN/STOP switch position is STOP), the counting behavior is continued as long as the pulses are input.

To stop the counting when the operation is stopped, use the CUSTA command to stop the counting.

(2) Zero clear of current counter value

To clear the current counter value to zero, write a "0" value using the CUWR command. This realizes an equivalent function as the current value clear command of MICRO-EH.

(3) Behavior of the comparison value coincidence interrupt

The coincidence interrupt subroutine is called when the current counter value and the first/second comparison values are compared and their numerical values match. Thus, if CUWR command overwrites the current counter value with a numerical value over the first/second comparison values, the coincidence interrupt subroutine is not called.

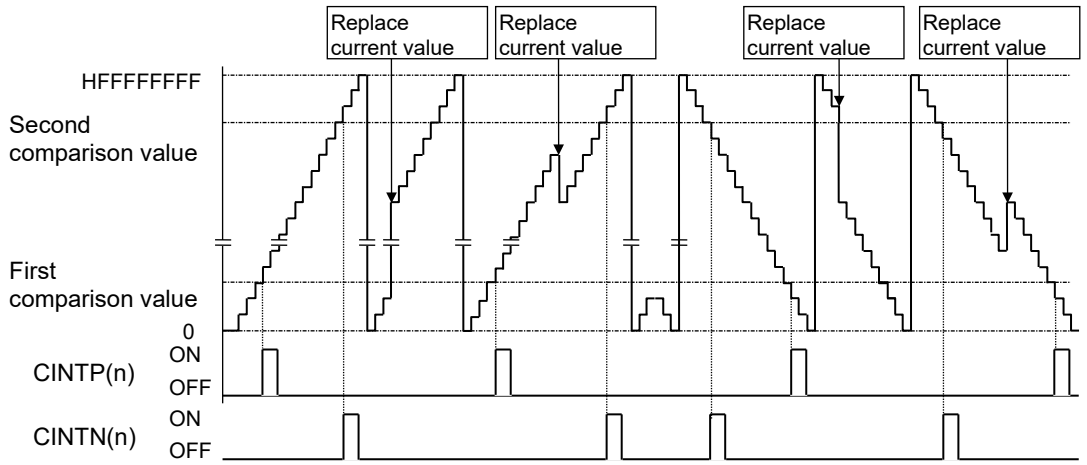


Figure 5.10 Changing the 1-phase current counter value and the interrupt subroutine call

5.2.3 1-phase pulse counting mode

The rising edge or falling edge of the 1-phase pulse input signal is counted.

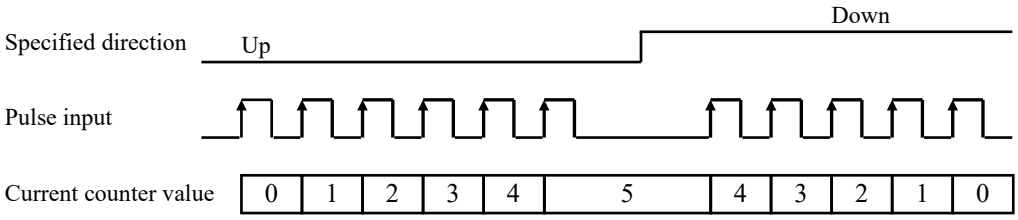
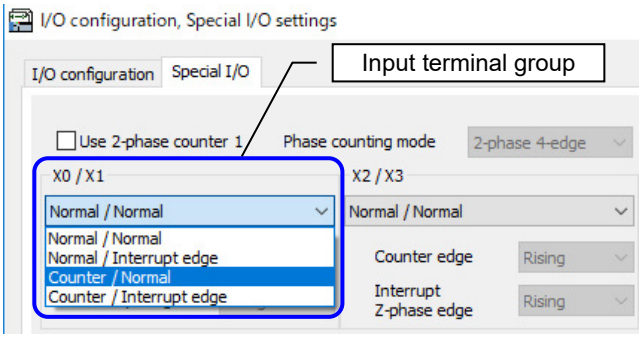


Figure 5.11 Behavior of 1-phase pulse counting mode

The 1-phase pulse input terminal and the counter edge is specified in the Control Editor. The up / down count direction is specified by the CUSTA command.

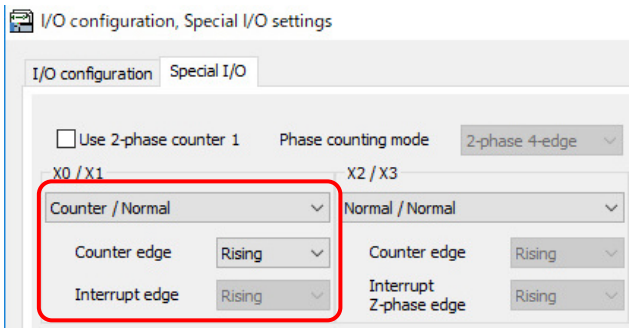
(1) Counting mode setting in Control Editor (Ver.4.21 or older)



According to the special I/O setting rule, neighboring two input terminals are treated as a group in the 1-phase pulse input type (X0/X1, X2/X3, X4/X5, X6/X7, X8/X9). Thus, when specifying a terminal for inputting 1-phase pulses, you should also set the usage of the other input terminal.

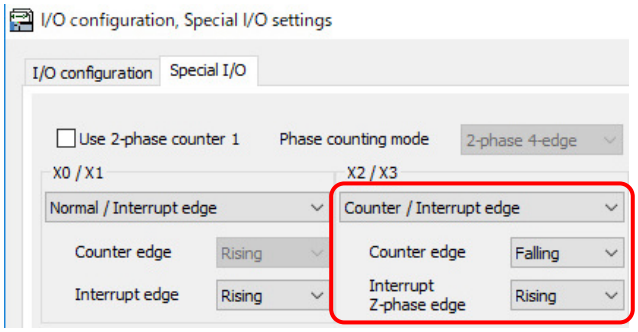
The Control Editor displays the available terminal groups in a pull-down list in the special I/O setting window.

Figure 5.12 Specifying the 1-phase pulse input terminals (Control Editor Ver.4.21 or older)



Input terminal group setting example 1)

Use the X0 terminal for the counter 1 1-phase pulse input, and use the X1 terminal for the normal input. Specify the rising edge for the counter edge.



Input terminal group setting example 2)

Use the X2 terminal for the counter 2 1-phase pulse input, and use the X3 terminal for the interrupt input. Specify the falling edge for the counter edge and the rising edge for the interrupt edge.

Figure 5.13 1-phase pulse input terminal specification setting window (Control Editor Ver.4.21 or older)

(2) Counting mode setting in Control Editor (Ver.5.00 or newer)

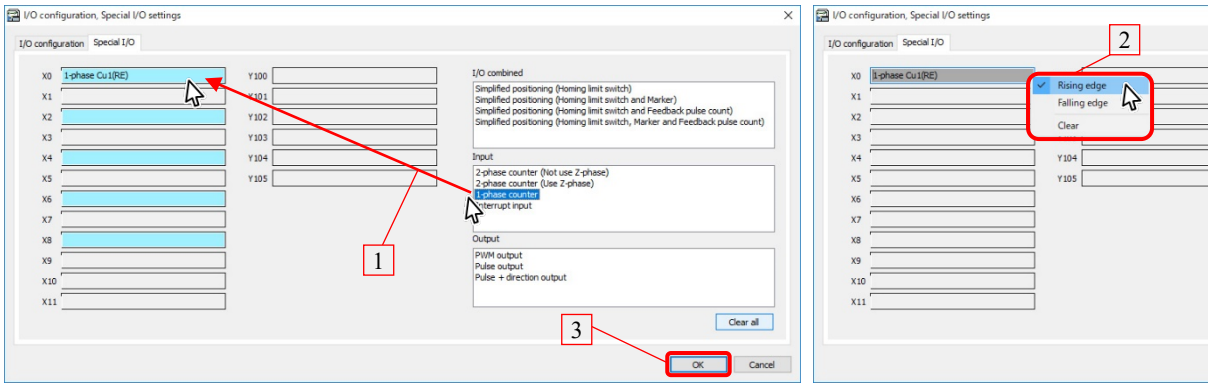


Figure 5.14 Specification and setting of single-phase pulse input terminal (Control Editor Ver.5.00 or newer)

1. Select [1-phase counter] from the list of functions on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which the 1-phase pulse input is assigned, and right-click to select the counter edge type as rising or falling
3. Press the OK button to confirm the settings.

Reference

In the display section of the function currently assigned, “(RE)” is added at the end when the counting mode is rising edge, and “(FE)” is added at the end when falling

5.2.4 Common specification of 2-phase pulse input types

(1) 2-phase pulse input setting in Control Editor (Ver.4.21 or older)

Continuous four input terminals are treated as a group in the 2-phase pulse input type (X0/X1/X2/X3, X4/X5/X6/X7). Thus, when specifying a terminal for inputting 2-phase pulses, you should also set the usage of the other input terminals. The Control Editor displays the available terminal groups in a pull-down list in the special I/O setting window.

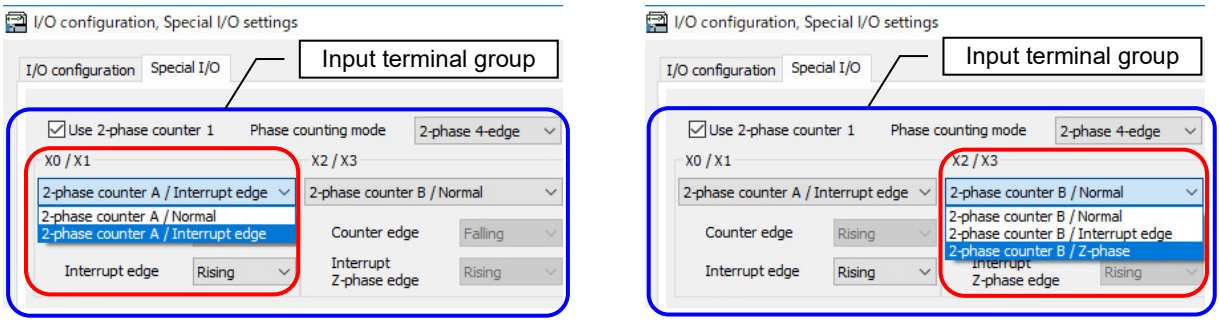


Figure 5.15 Specifying the 2-phase pulse input terminals (Control Editor Ver.4.21 or older)

(2) 2-phase pulse input setting in Control Editor (Ver.5.00 or newer)

When the 2-phase counter is selected from the function list on the right side of the special I/O setting window with the mouse, the color of the I/O frame that can be set changes. If you drag a function and drop it on the frame where the color is changing, a two-phase counter will be assigned.

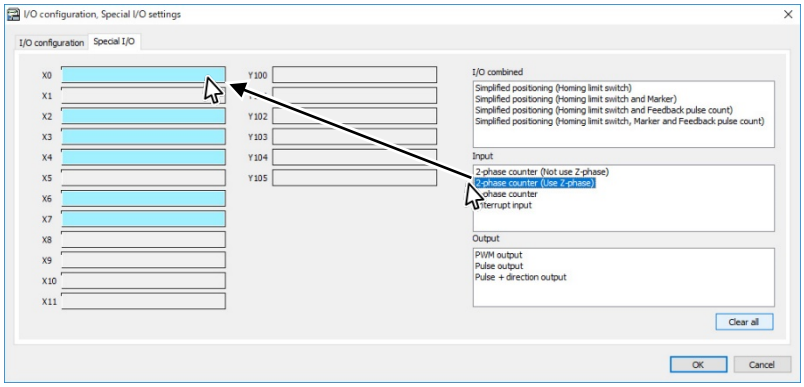
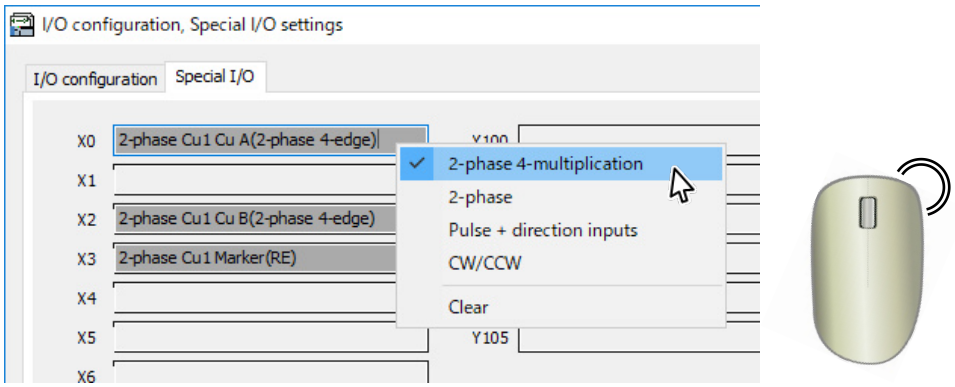


Figure 5.16 Specifying the 2-phase pulse input terminals (Control Editor Ver.5.00 or newer)

Move the mouse cursor over the I/O to which 2-phase pulse input is assigned, and right-click to display the counting mode menu and change the phase counting mode.



5.2.5 2-phase 4-edge evaluation phase counting mode

In the 2-phase 4-edge evaluation phase counting mode, up/down behavior is switched by the phase difference between A-phase input (X0/X4 terminal) and B-phase input (X2/X6 terminal). When the A-phase input pulse leads the B-phase, up count is performed. Conversely, when the A-phase input pulse trails the B-phase, down count is performed.

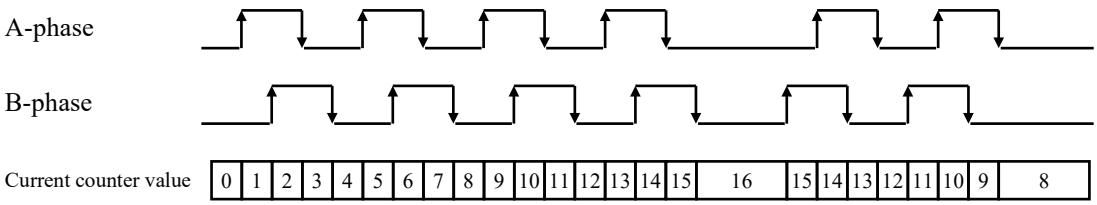


Figure 5.17 Counting of the 2-phase 4-edge evaluation phase counting mode

Table 5.4 Counting condition of the 2-phase 4-edge evaluation phase counting mode

A-phase	B-phase	Behavior
High	↑ (Rising edge)	Up count
Low	↓ (Falling edge)	
↓ (Falling edge)	High	
↑ (Rising edge)	Low	
Low	↑ (Rising edge)	Down count
High	↓ (Falling edge)	
↓ (Falling edge)	Low	
↑ (Rising edge)	High	

To set the 2-phase 4-edge phase counting mode, select [Tool] - [Parameter settings] - [I/O Configurations] in the Control Editor, and then click the [Special I/O] tab to open the setting window. The setting procedure to use 2-phase 4-edge phase counting mode on the 2-phase counter 1 is described below.

(1) 2-phase 4-edge phase counting mode setting in Control Editor (Ver.4.21 or older)

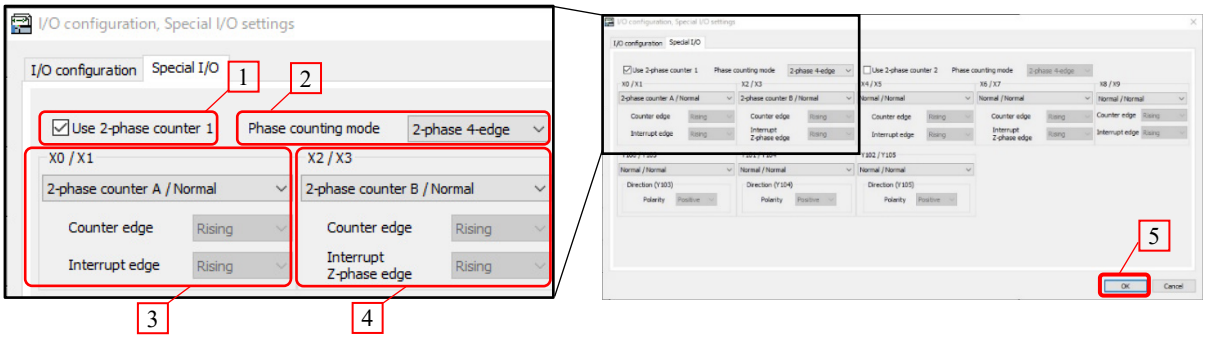


Figure 5.18 Setting 2-phase 4-edge phase counting mode (Control Editor Ver.4.21 or older)

1. Select the [Use 2-phase counter 1] check box.
2. Select [2-phase 4-edge] from the [Phase counting mode]
3. From the pull-down list in [X0 / X1 setting], select [2-phase counter A / Normal].
4. From the pull-down list in [X2 / X3 setting], select [2-phase counter B / Normal].
5. Press OK button to confirm

(2) 2-phase 4-edge phase counting mode setting in Control Editor (Ver.5.00 or newer)

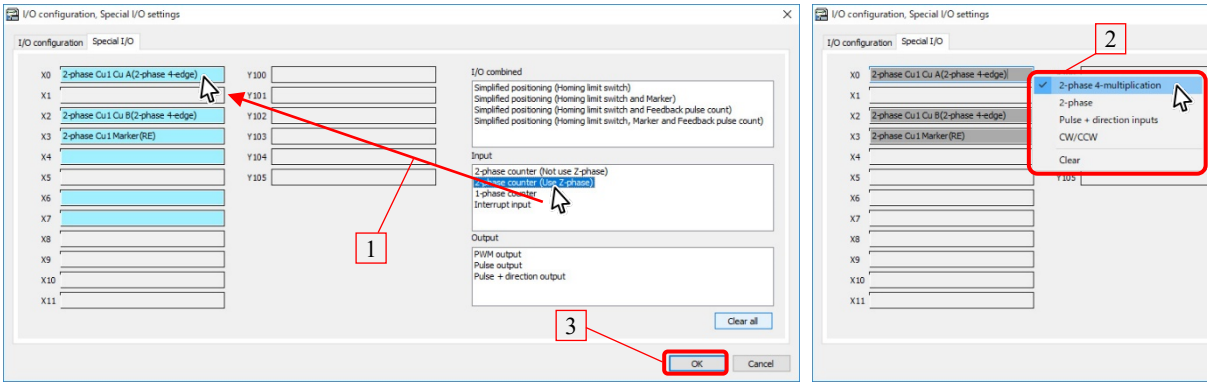


Figure 5.19 Setting 2-phase 4-edge phase counting mode (Control Editor Ver.5.00 or newer)

1. Select [2-phase counter] from the list of functions on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which the 2-phase pulse input is assigned, and right-click to select the [2-phase 4 multiplication].
3. Press the OK button to confirm the settings.

Reference

In the display section of the currently assigned function, if the phase counting mode is 2-phase 4-edge, "(2-phase 4-edge)" is added at the end.

5.2.6 2-phase phase counting mode

In the 2-phase phase counting mode, the rising/falling edges of the B-phase input (X2/X6 terminal) are counted, and when the A-phase input (X0/X4 terminal) leads and trails the B-phase, up and down counts are performed, respectively.

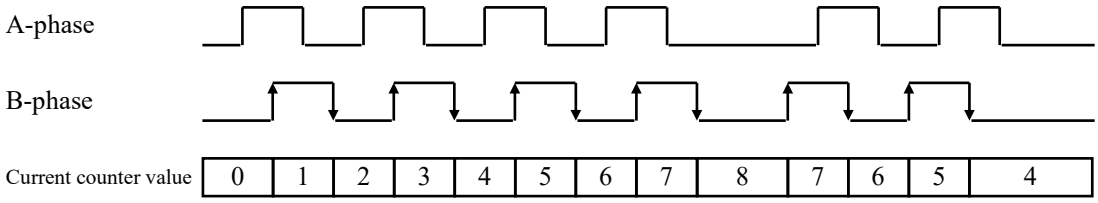


Figure 5.20 Counting of the 2-phase phase counting mode

Table 5.5 Counting condition of the 2-phase phase counting mode

Input A	Input B	Behavior
High	↑ (Rising edge)	Up count
Low	↓ (Falling edge)	
↓ (Falling edge)	High	Not count
↑ (Rising edge)	Low	
Low	↑ (Rising edge)	Down count
High	↓ (Falling edge)	
↓ (Falling edge)	Low	Not count
↑ (Rising edge)	High	

To set the 2-phase phase counting mode, select [Tool] - [Parameter settings] - [I/O Configuration] in the Control Editor, and then click the [Special I/O] tab to open the setting window.

The setting procedure to use the 2-phase phase counting mode on the 2-phase counter 1 is described below.

(1) 2-phase phase counting mode setting in Control Editor (Ver.4.21 or older)

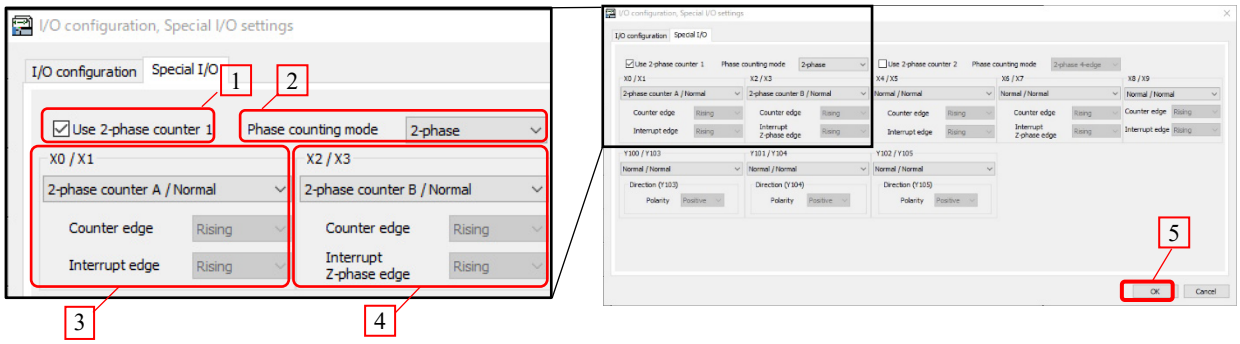


Figure 5.21 2-phase phase counting mode setting (Control Editor Ver.4.21 or older)

1. Select the [Use 2-phase counter 1] check box.
2. Select [2-phase] from the [Phase counting mode] pull-down list.
3. From the pull-down list in [X0 / X1 setting], select [2-phase counter A / Normal].
4. From the pull-down list in [X2 / X3 setting], select [2-phase counter B / Normal].
5. Press the OK button to confirm the settings.

(2) 2-phase phase counting mode setting in Control Editor (Ver.5.00 or newer)

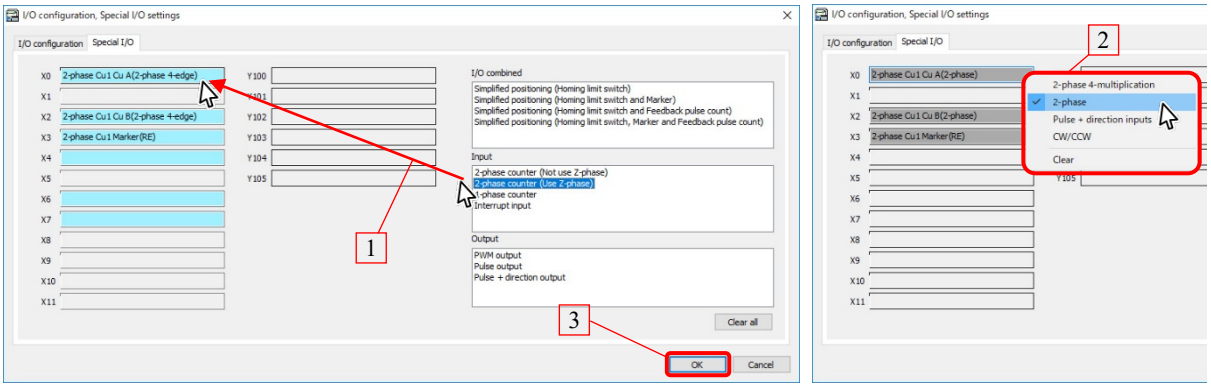


Figure 5.22 2-phase phase counting mode setting (Control Editor Ver.5.00 or newer)

1. Select [2-phase counter] from the list of functions on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which 2-phase pulse input is assigned, right-click and select the [2-phase].
3. Press the OK button to confirm the settings.

Reference

In the display section of the currently assigned function, if the phase counting mode is 2-phase, "(2-phase)" is added at the end.

5.2.7 Pulse + direction phase counting mode

In the pulse + direction phase counting mode, only the rising edge of the A-phase input (X0/X4 terminal) is counted, and when the B-phase input (X2/X6 terminal) is at Low and High levels, up and down counts are performed, respectively.

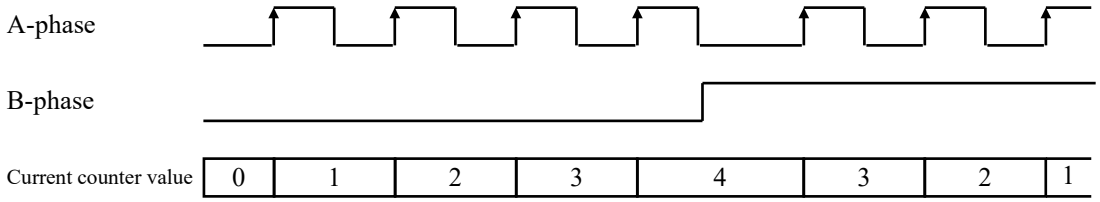


Figure 5.23 Count behavior of pulse + direction phase counting mode

Table 5.6 Count condition of pulse + direction phase counting mode

Input A	Input B	Behavior
High	↑ (Rising edge)	Not count
Low	↓ (Falling edge)	
↓ (Falling edge)	High	
↑ (Rising edge)	Low	Up count
Low	↑ (Rising edge)	Not count
High	↓ (Falling edge)	
↓ (Falling edge)	Low	
↑ (Rising edge)	High	Down count

To set the Pulse + direction phase counting mode, select [Tool] - [Parameter settings] - [I/O Configuration] in the Control Editor, and then click the [Special I/O] tab to open the setting window.

The setting procedure to use the Pulse + direction phase counting mode on the 2-phase counter 1 is described below.

(1) Pulse + direction phase counting mode setting in Control Editor (Ver.4.21 or older)

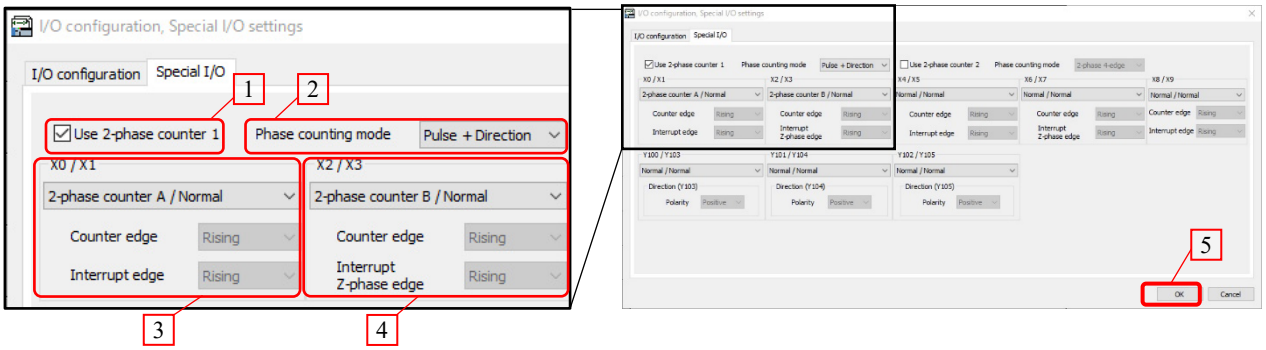


Figure 5.24 Pulse + direction phase counting mode setting (C/E Ver.4.21 or older)

1. Select the [Use 2-phase counter 1] check box.
2. Select [Pulse + Direction] from the [Phase counting mode] pull-down list.
3. From the pull-down list in [X0 / X1 setting], select [2-phase counter A / Normal].
4. From the pull-down list in [X2 / X3 setting], select [2-phase counter B / Normal].
5. Press the OK button to confirm the settings.

(2) Pulse + direction phase counting mode setting in Control Editor (Ver.5.00 or newer)

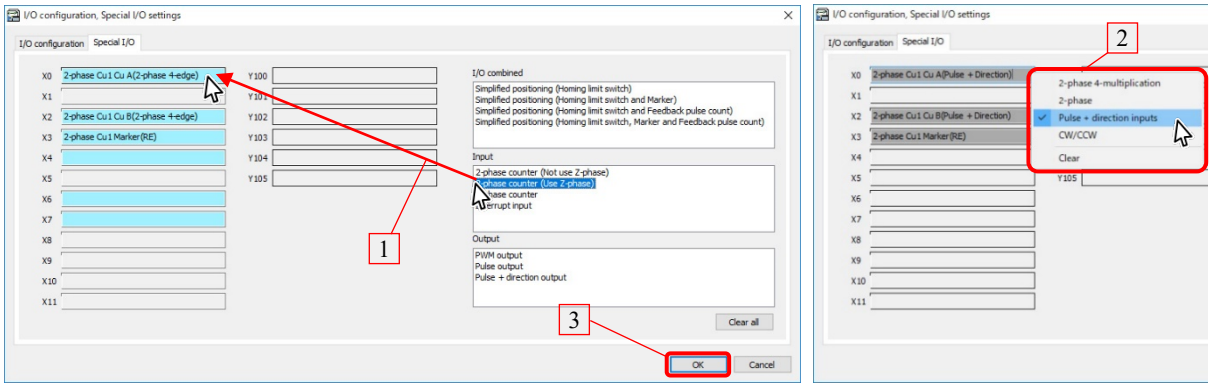


Figure 5.25 Pulse + direction phase counting mode setting (Control Editor Ver.5.00 or newer)

1. Select [2-phase counter] from the list of functions on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which the 2-phase pulse input is assigned, and right-click to select the [Pulse + direction inputs].
3. Press the OK button to confirm the settings.

Reference

In the display section of the currently assigned function, if the phase counting mode is Pulse + direction input, "(Pulse + Direction)" is added at the end.

5.2.8 CW/CCW phase counting mode

In the CW/CCW phase counting mode, up count is performed at rising of the A-phase input (X0/X4 terminal) when the B-phase input (X2/X6 terminal) is at Low level. On the other hand, down count is performed at rising of the B-phase input when the A-phase input is at Low level.

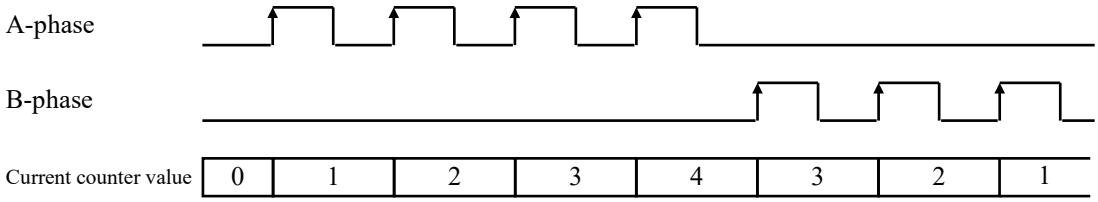


Figure 5.26 counting of the CW/CCW phase counting mode

Table 5.7 Count condition of CW/CCW phase counting mode

Input A	Input B	Behavior
High	↑ (Rising edge)	Not count
Low	↓ (Falling edge)	
↓ (Falling edge)	High	
↑ (Rising edge)	Low	Up count
Low	↑ (Rising edge)	Down count
High	↓ (Falling edge)	Not count
↓ (Falling edge)	Low	
↑ (Rising edge)	High	

* CW: Clock Wise, CCW: Counter Clock Wise

To set the CW/CCW phase counting mode, select [Tool] - [Parameter settings] - [I/O Configuration] in the Control Editor, and then click the [Special I/O] tab to open the setting window.

The setting procedure to use the CW/CCW phase counting mode on the 2-phase counter 1 is described below.

(1) CW/CW phase counting mode setting in Control Editor (Ver.4.21 or older)

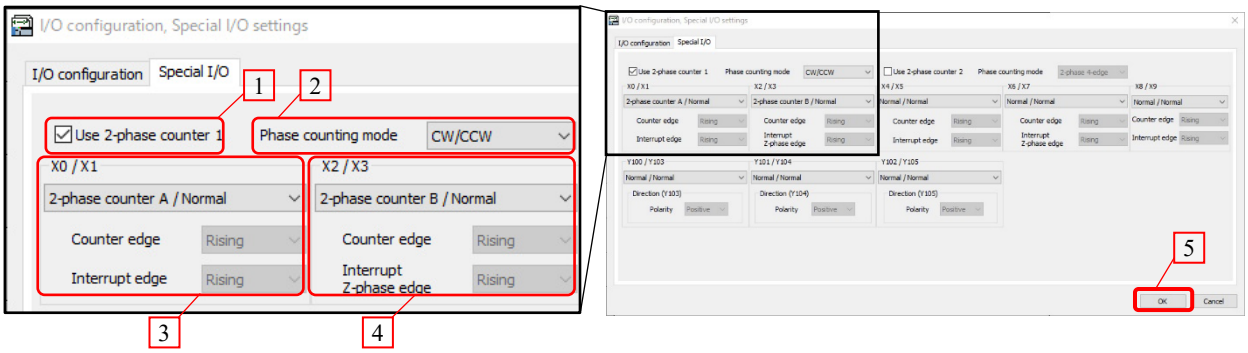


Figure 5.27 CW/CCW phase counting mode setting (Control Editor Ver.4.21 or older)

1. Select the [Use 2-phase counter 1] check box.
2. Select [CW/CCW] from the [Phase counting mode] pull-down list.
3. From the pull-down list in [X0 / X1 setting], select [2-phase counter A / Normal].
4. From the pull-down list in [X2 / X3 setting], select [2-phase counter B / Normal].
5. Press the OK button to confirm the settings.

(2) CW/CCW phase counting mode setting in Control Editor (Ver.5.00 or newer)

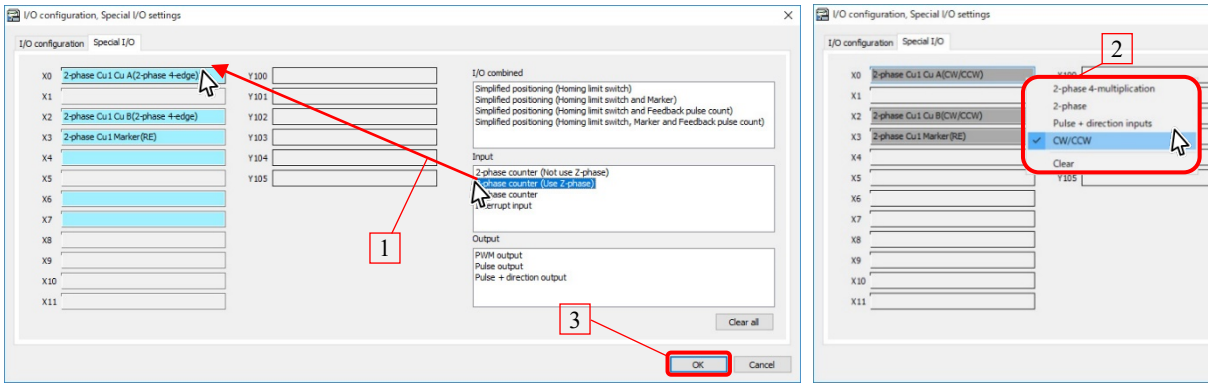


Figure 5.28 CW/CCW phase counting mode setting (Control Editor Ver.5.00 or newer)

1. Select [2-phase counter] from the list of functions on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which the 2-phase pulse input is assigned, and right-click to select the [CW/CCW].
3. Press the OK button to confirm the settings.

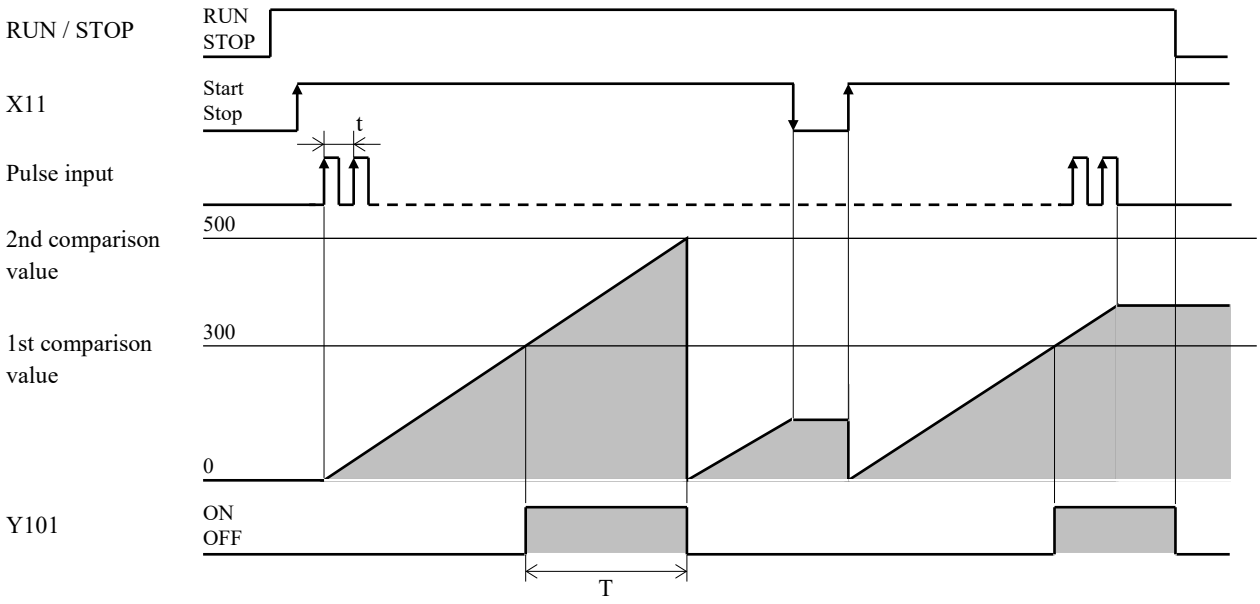
Reference

In the display section of the currently assigned function, if the phase counting mode is CW/CCW, "(CW/CCW)" is added at the end.

5.2.9 High-speed counter sample program

Usage example 1) On-preset / Off-preset behavior

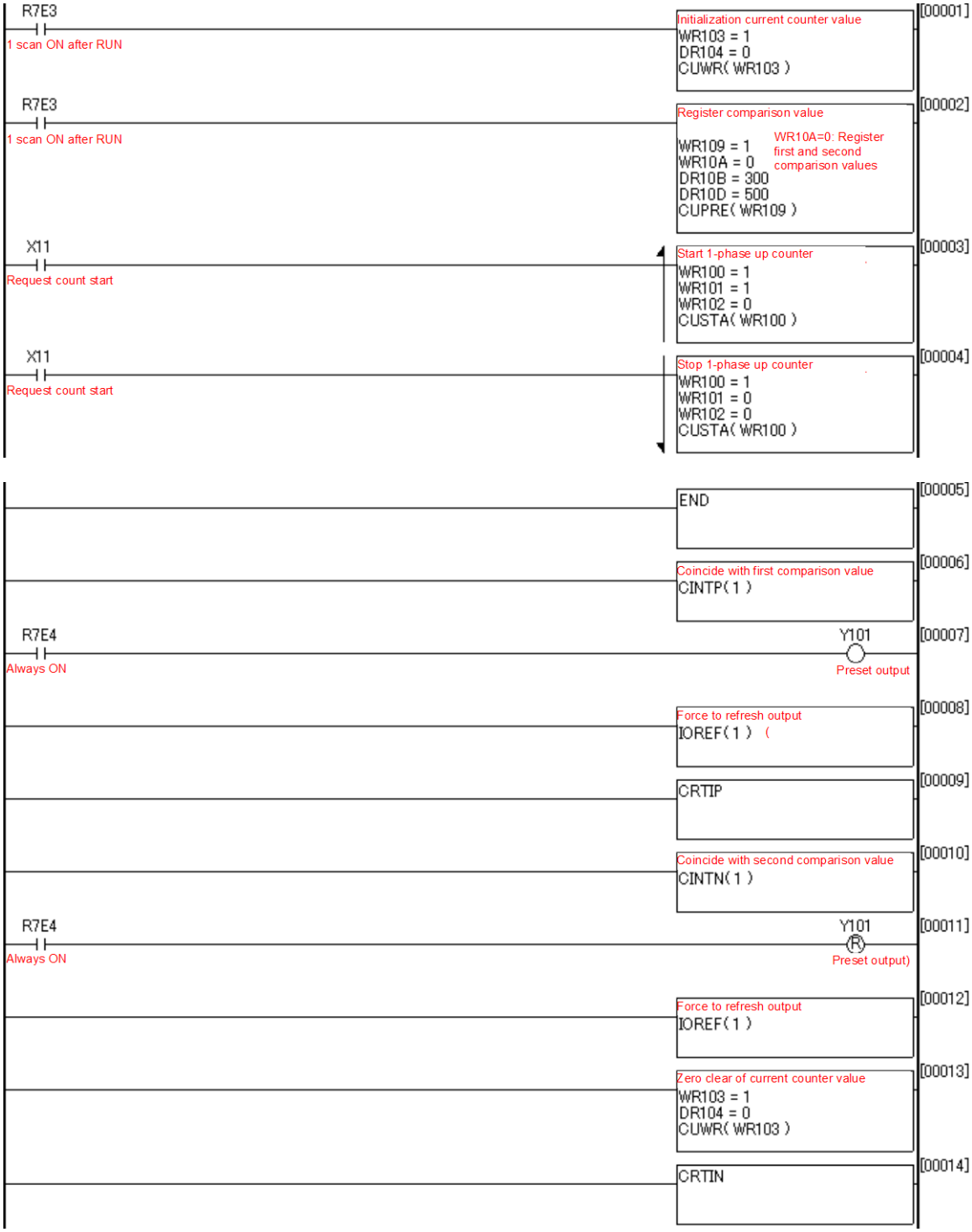
- Start and stop of up count are switched by using the X11 external input signal.
- The CUSTA command clears the current value to 0 when counting starts.
- If the current value matches the first comparison value by up count, the CINTP(1) subroutine is called to output ON to Y101.
- Then, if the current value matches the second comparison value by up count, the CINTN(1) subroutine is called to output OFF to Y101.
- As the current counter value is cleared to 0 in the CINTN(1) subroutine, this operation is repeated.
- ON time T in Y101 preset output is calculated by using T= t * (second comparison value - first comparison value).



Reference

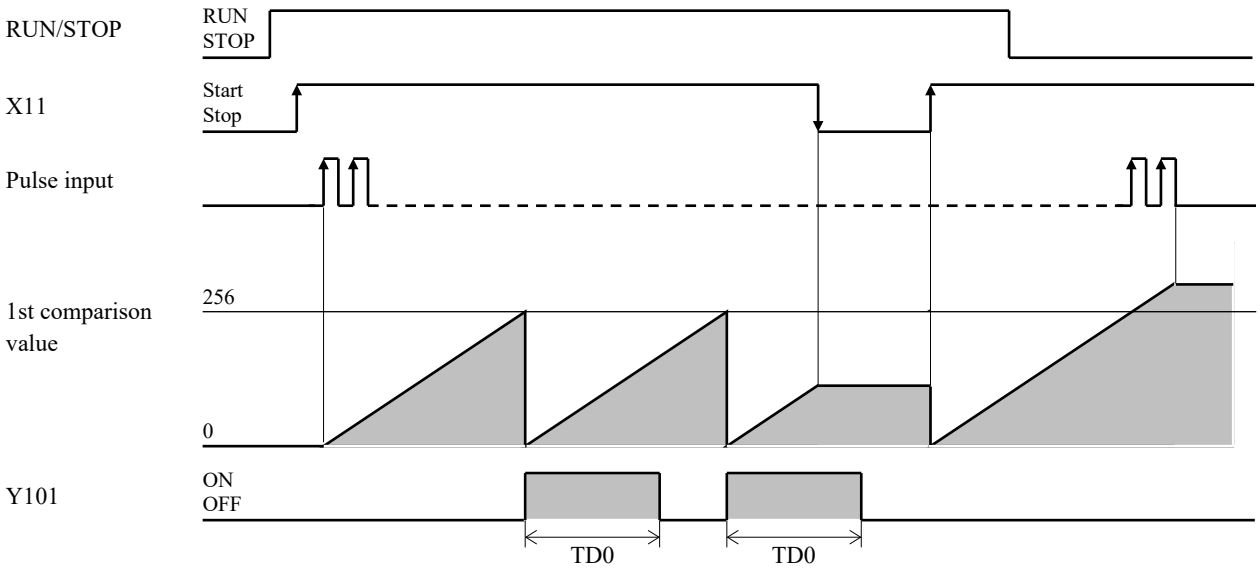
- You can provide an equivalent function of the counter match output of MICRO-EH by describing an arbitrary external output in the interrupt program of each counter number.
- Use the CUWR command to overwrite the current counter value. You can use this command to provide an equivalent function of the preload input behavior of MICRO-EH.

Usage example 1) Sample program

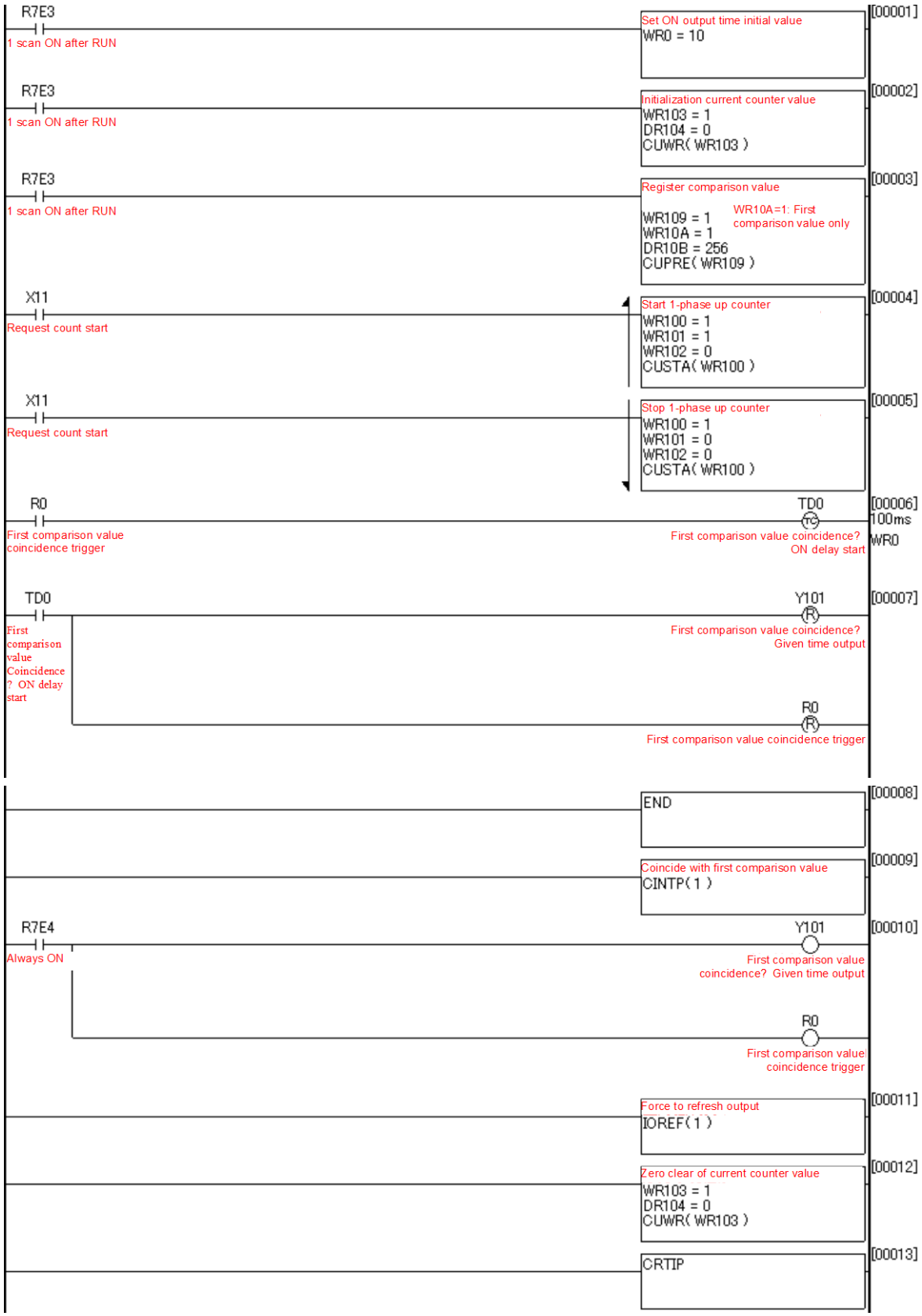


Usage example 2) Given time output behavior

- Start and stop of up count are switched by using the X11 external input signal.
- The CUSTA command clears the current value to 0 when counting starts.
- If the current value matches the first comparison value by up count, the CINTP(1) subroutine is called to output ON to Y101.
- Y101 output ON time can be changed by combining the time base of ON delay timer TD0 in the normal scan program with the first setting value. In the sample program, where the time base is set to 100ms and the first setting value is set to WR0=10, the output ON time of Y101 is 100 ms × 10 = 1 s.
- As the current counter value is cleared to 0 in the CINTP(1) subroutine, this operation is repeated.
- Even if RUN/STOP switch is switched to STOP after up count starts, up count continues when the pulse is input.



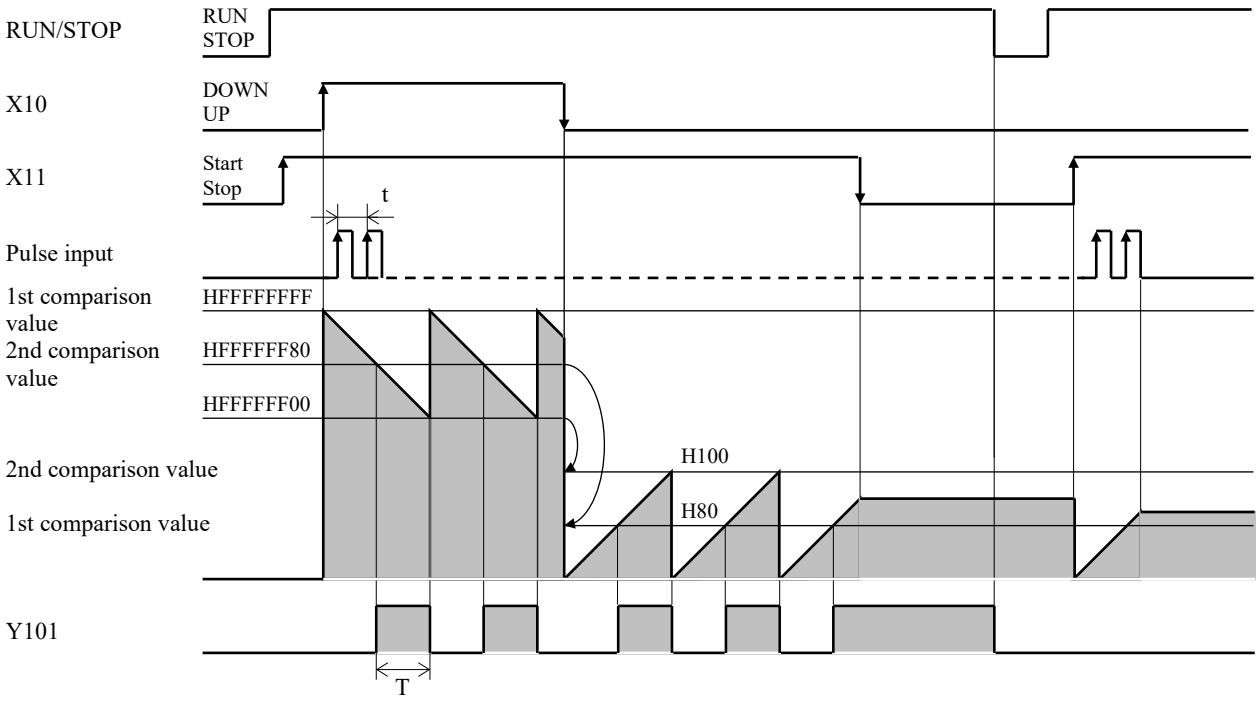
Usage example 2) Sample program



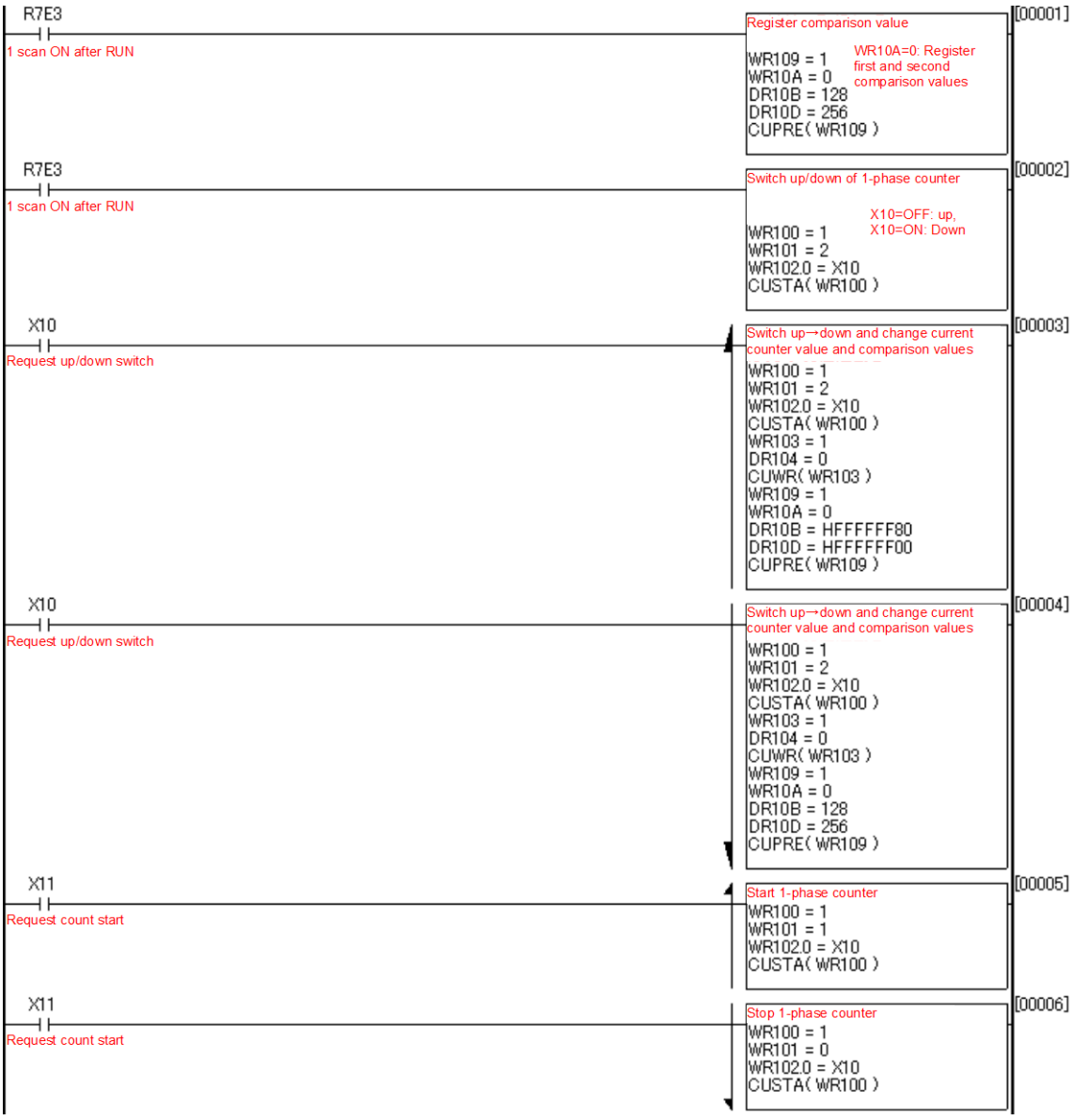
Usage example 3) Down-counting

- Up and down counts are switched by using the X10 external input signal.
- Start and stop of up count are switched by using the X11 external input signal.
- The CUSTA command clears the current value to 0 when counting starts.
- When X10 changes, the CUWR command clears the current value to 0, and the CUPRE command sets the first comparison value and the second comparison value.
- Regardless of up or down count, when the current counter value matches the first comparison value, the CINTP(1) subroutine is called to output ON to Y101.
- Regardless of up or down count, when the current counter value matches the second comparison value, the CINTN(1) subroutine is called to output OFF to Y101.
- As the current counter value is cleared to 0 in the CINTN(1) subroutine, this operation is repeated.
- ON time T of Y101 preset output at down count can be calculated by using T= t * (first comparison value - second comparison value).

  ON time T of Y101 preset output at up count can be calculated by using T= t * (second comparison value - first comparison value).



Usage example 3) Sample program



5.3 Pulse output

Both MVH and MVL can output a pulse from Y100, Y101, and Y102 output terminals. For pulse output, a specified number of pulses (position control) or a specified frequency of pulse (speed control) can be output.

With both position control and speed control, the direction signal can be output, which is allocated to Y103, Y104, and Y105 output terminals.

Table 5.8 Specification of pulse output

Item	Content
Number of output points	Three points (Y100/Y101/Y102)
Output behavior	Position control or speed control
Maximum frequency	for position control: 100 kHz
Direction signal output	Three points (Y103/Y104/Y105), logical polarity can be specified (For "positive" polarity: direction signal ON at normal rotation, and OFF at reverse rotation) (For "negative" polarity: direction signal OFF at normal rotation, and ON at reverse rotation)
Number of output pulses (for position control)	Direction signal not used: 0 to 4,294,967,295 Direction signal used: -2,147,483,648 to 2,147,483,647
Position control command	PLSTA / PLSTAR* / PLSTP / PLSTPR* / PLHM* / PLSRD / PLSWR
Speed control command	PLSPD / PLSPDR* / PLCNG / PLCNGR* / PLSTP / PLSTPR*
Frequency acceleration/decelerating rate	1 to 65,535 Hz/100 ms
Pulse/PWM outputting flag	Show pulse output status in bit special internal output Pulse output 1: R7FC / pulse output 2: R7FD / pulse output 3: R7FE
Pulse position data	Stored in word special internal output Pulse output 1: DRF10A Pulse output 2: DRF10C Pulse output 3: DRF10E

* Supported from software Ver.x120

If you implement the pulse output function, use the commands shown in table 5.9.

Table 5.9 Pulse output related command

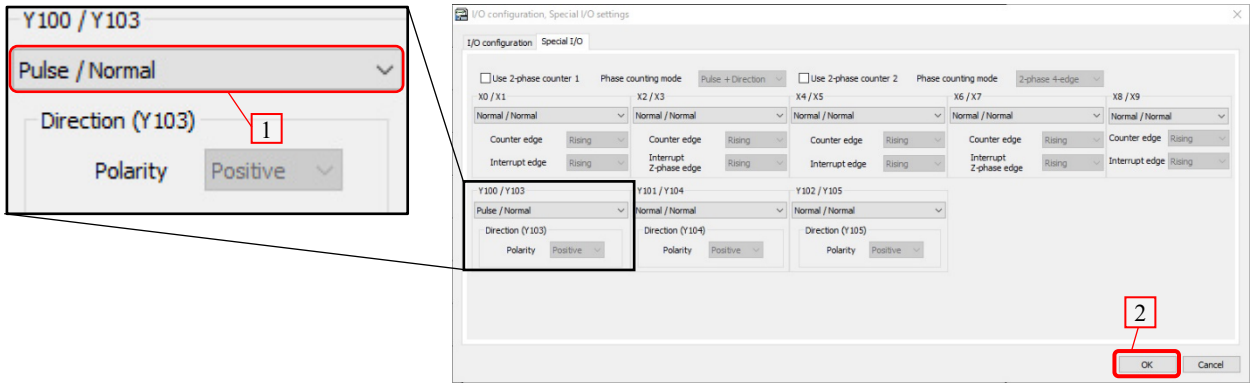
Command	Content
PLSTA (s)	Outputs a pulse train with the specified number of pulses (without/with acceleration and deceleration). Commands with “R” at the end can be set the acceleration rate or deceleration rate to high speed.
PLSTAR (s)	
PLSPD (s)	Continues to output a pulse train with the specified frequency. The command with “R” at the end can be set the acceleration rate to high speed.
PLSPDR (s)	
PLCNG (s)	Changes the output frequency of the pulse train output specified in PLSPD. Commands with “R” at the end can be set the acceleration rate or deceleration rate to high speed.
PLCNGR (s)	
PLSTP (s)	Stops a pulse train output of specified channel. Commands with “R” at the end can set be the deceleration rate to high speed.
PLSTPR (s)	
PLHM (s1, s2)	Returns the position of the specified channel to the home position. As to the homing, please refer to Chapter 8.
PLSRD (s)	Reads the current position of the specified pulse train output to the specified area.
PLSWR (s)	Overwrites the current position of the specified pulse train output by the specified value.

For details of the commands, refer to "Application Commands" in Chapter 5 "Command Specifications" in the "PROGRAMMING MANUAL NJI-590*(X)".

If a serious or medium error occurs, no pulse is output. If a serious or medium error occurs while outputting pulse, pulse output is stopped.

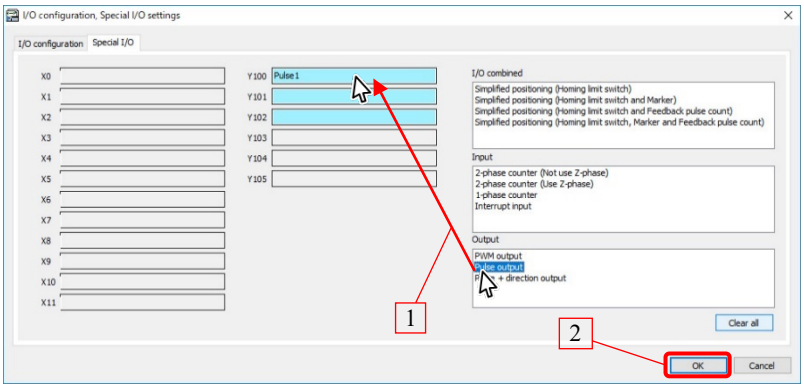
The procedure to set terminals without the direction signal is described below.

(1) Pulse output setting in Control Editor (Ver.4.21 or older)



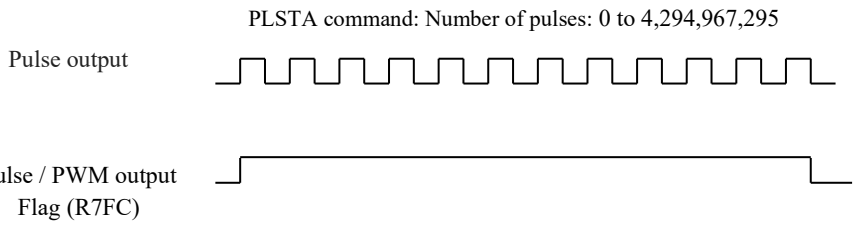
1. Specify the Y100 terminal as the pulse output. Specify Y103 as the normal output since the direction signal is not needed.
2. Press the OK button to confirm the settings.

(2) Pulse output setting in Control Editor (Ver.5.00 or newer)



1. Select the pulse output from the function list on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Press the OK button to confirm the settings.

The above is the procedure for setting the output terminal to “pulse output”, and the parameters (number of output pulses, frequency) of the output pulses are set by the pulse control command.

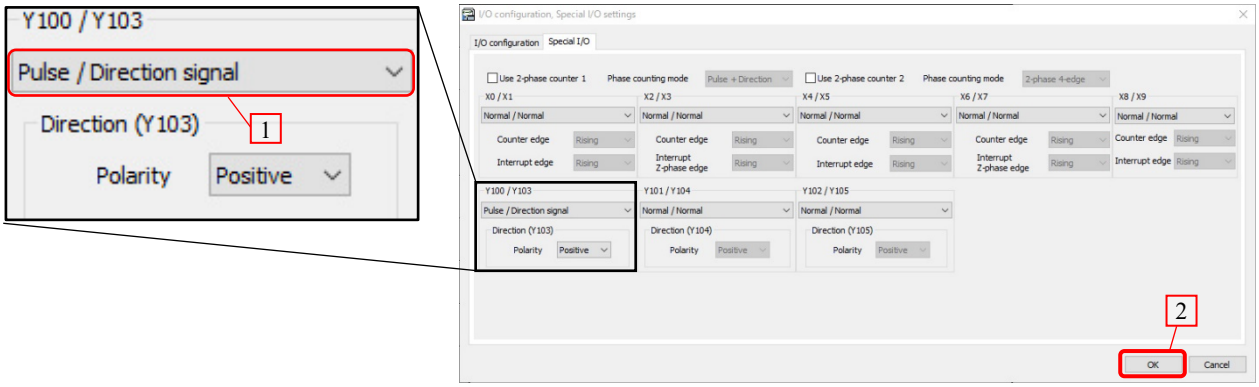


PLSTA command / PLSTAR command (position control) : The number of pulses can be set to 0 to 4,294,967,295.

PLSPD command / PLSPDR command (speed control): A rotation direction is ignored if specified.

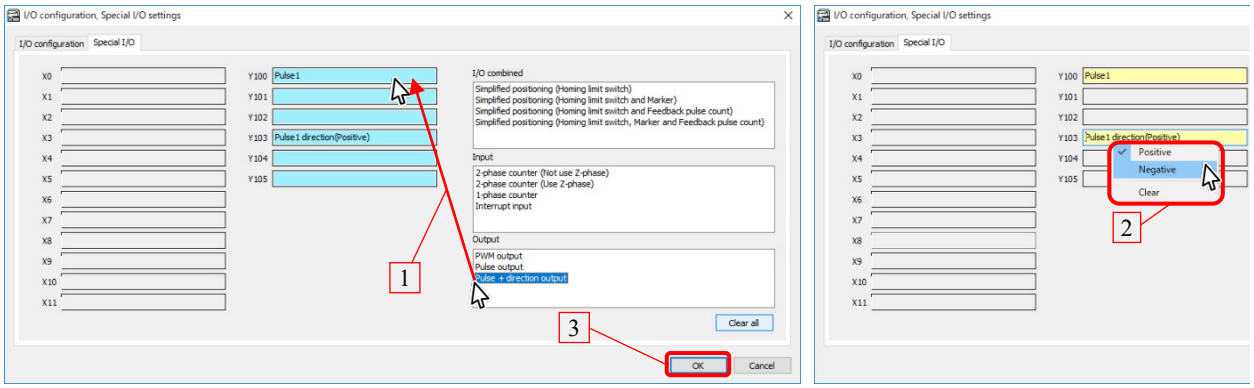
The procedure to set terminals with the direction signal is described below.

(1) “Pulse + direction output” setting in Control Editor (Ver.4.21 or older)



1. Specify the Y100 terminal as the pulse output. Specify Y103 as the direction signal since the direction signal is needed.
2. Press the OK button to confirm the settings.

(2) “Pulse + direction output” setting in Control Editor (Ver.5.00 or newer)



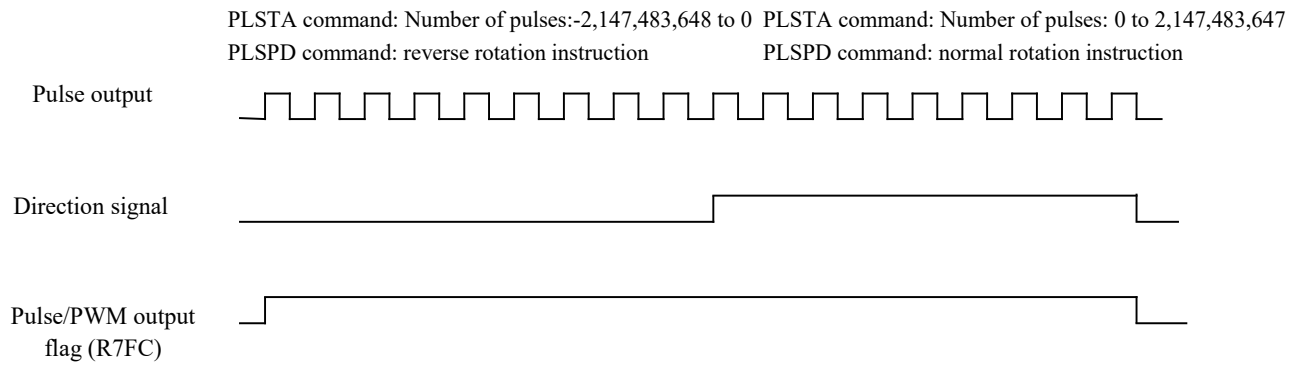
1. Select the pulse output from the function list on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which the direction signal is assigned and right-click to select the direction signal polarity.
3. Press the OK button to confirm the settings.

Reference

As to "pulse + direction signal", if step 1 is executed, the simplified positioning parameter setting window will be displayed. The parameters for checking the operation can be set in this window, but the simplified positioning parameter setting window will be explained in detail in “8.4 Parameter settings”.

If the parameters for checking the operation are not set, when left-click on the I/O portion that the function is assigned, the frame color will be changed to yellow.

The explanation on the previous page is the procedure for setting the output terminal to “pulse output”, and the parameters (number of output pulses, frequency) of the output pulses are set by the pulse control command.



PLSTA / PLSTAR command (position control): The number of pulses can be set to -2,147,483,648 to 2,147,483,647. When the number of pulses is a positive value, the direction signal is turned ON, and when a negative value, turned OFF.

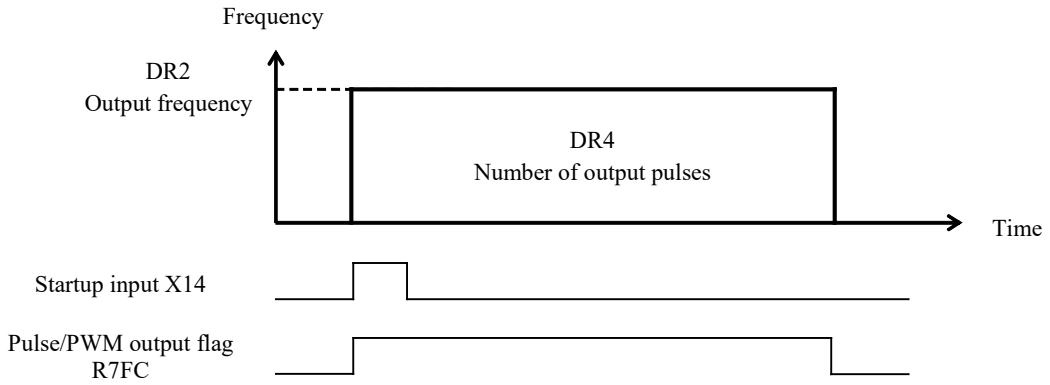
PLSPD / PLSPDR command (speed control): When a normal rotation is specified, the direction signal is turned ON, and when a reverse rotation, turned OFF.

If polarity of the direction signal is negative, the above logic is reversed.

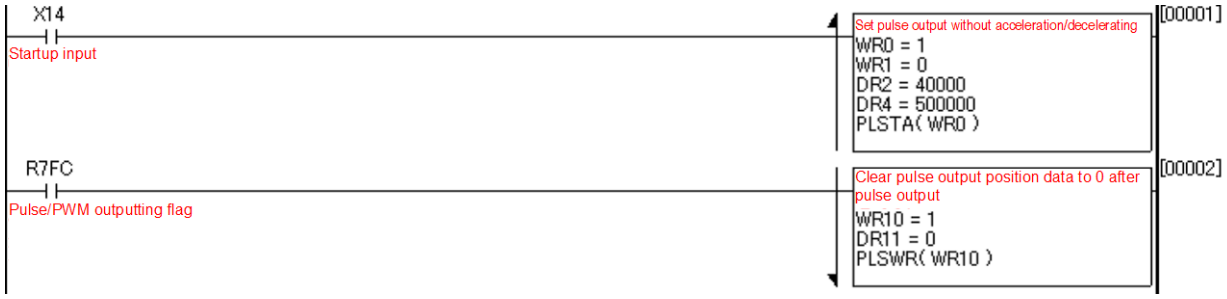
Pulse output example 1) Pulse output without acceleration and deceleration

When startup input X14 is turned ON, 500,000 pulses are output without acceleration and deceleration from the Y100 terminal (pulse output 1), and

the pulse position data is cleared to 0 after the pulse output is completed. The direction signal is not output.



Program example



PLSTA command parameter

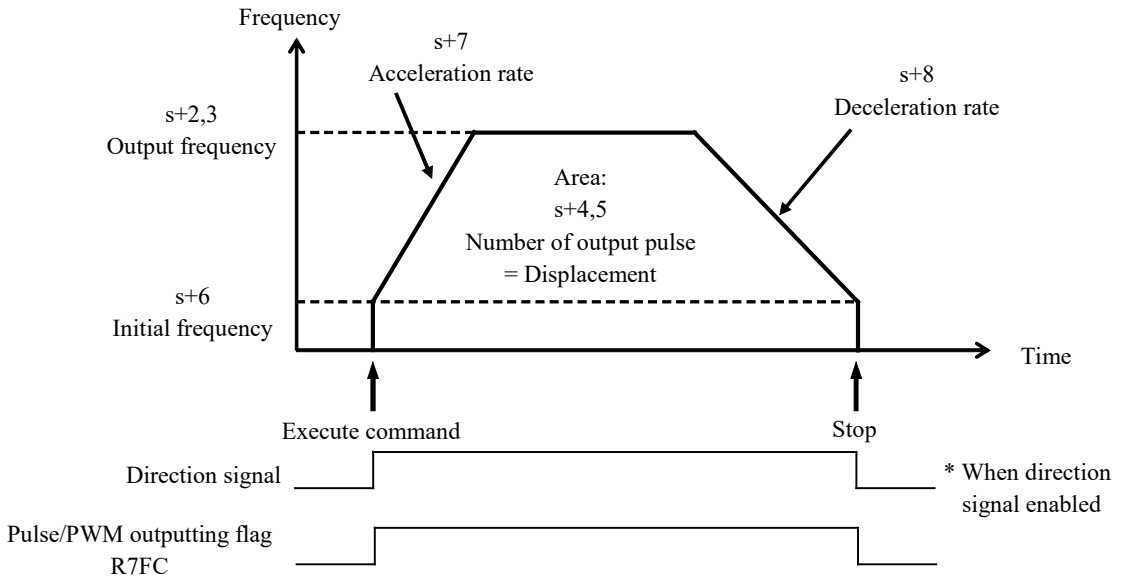
	Content	Setting value
WR0	Output No.	1
WR1	Operation mode	0
WR2	Output frequency (lower)	40,000
WR3	Output frequency (upper)	
WR4	Number of output pulses (lower)	500,000
WR5	Number of output pulses (upper)	
WR6	Initial frequency	(N/A)
WR7	Acceleration rate	(N/A)
WR8	Deceleration rate	(N/A)

PLSWR command parameter

	Content	Setting value
WR10	Output No.	1
WR11	Current position data (lower)	0
WR12	Current position data (upper)	

Pulse output example 2) Trapezoid control

When startup input X14 is turned ON, 500,000 pulses are output with acceleration and deceleration from the Y100 terminal (pulse output 1).



Program example

PLSTA command parameter

	Content	Setting value
WR0	Output No.	1
WR1	Operation mode	0
WR2	Output frequency (lower)	40,000
WR3	Output frequency (upper)	
WR4	Number of output pulses (lower)	500,000
WR5	Number of output pulses (upper)	
WR6	Initial frequency	20
WR7	Acceleration rate	1,200
WR8	Deceleration rate	800

Behavior when changing setting values

You can change the pulse output settings (frequency and number of output pulses) by specifying parameters of the PLSTA and PLCNG commands. When you change the number of output pulses, behavior as follows.

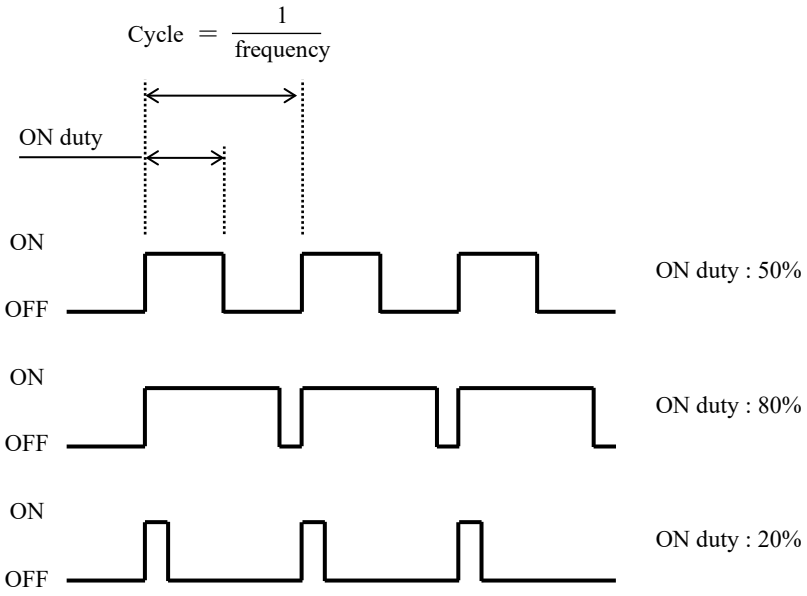
1) if you changed the number of output pulses to larger than the current value, output will be stopped after outputting to the changed value.

2) if you changed the number of output pulses to smaller than the current value, output will be stopped at the current value.

5.4 PWM output

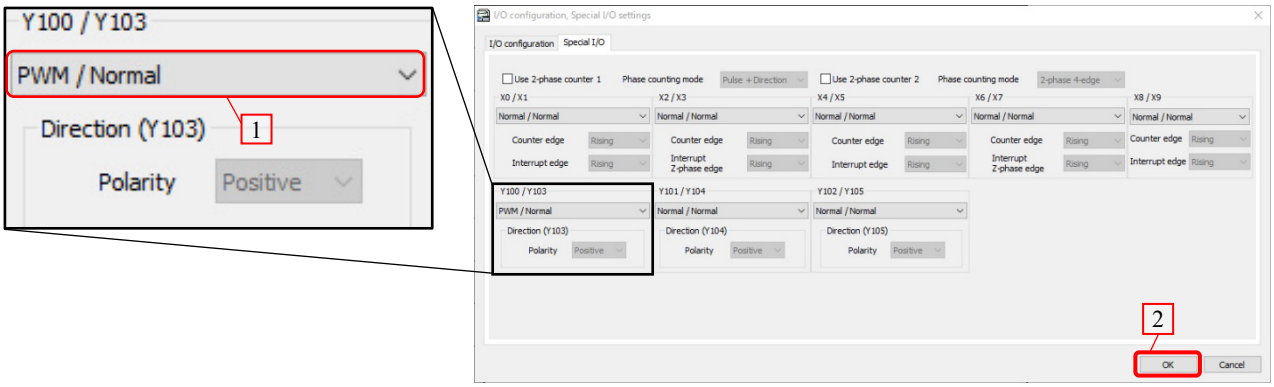
The PWM output means the pulse width modulated output.

It can output pulse with a specified frequency and a specified ON duty.



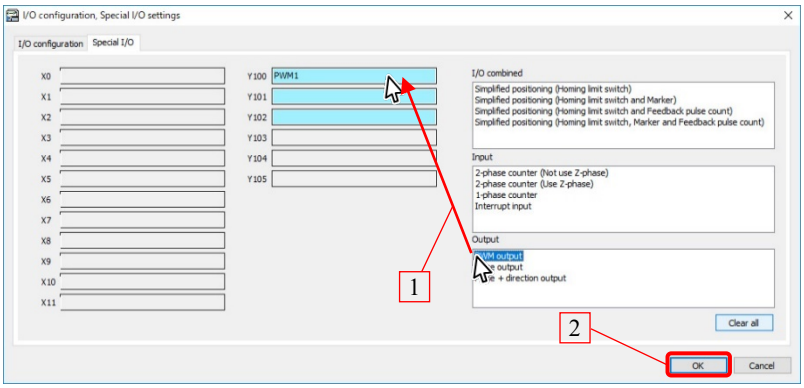
The procedure to set terminals with the PWM output is described below.

(1)PWM output setting in Control Editor (Ver.4.21 or older)



1. Specify the Y100 terminal as the PWM output.
2. Press the OK button to confirm the settings.

(2) PWM output setting in Control Editor (Ver.5.00 or newer)



1. Select the PWM output from the function list on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Press the OK button to confirm the settings.

After setting the special I/O, you can start and stop pulse output and change the setting values using the following commands.

Command	Content
PWMSTA (s)	Changes the start of output, frequency, and ON duty of the specified PWM output.
PWMSTP(s)	Stops outputting the specified PWM output

For details of the commands, refer to "Application Commands" in Chapter 5 "Command Specifications" in the "PROGRAMMING MANUAL NJI-590*(X)".

Basic behavior

After setting the special I/O, use the PWMSTA(s) command to output PWM, using the specified parameters and starting from the specified output. The special internal outputs R7FC to R7FE correspond to pulse outputs 1 to 3 (Y100 to Y102). For example, while PWM is outputting from pulse output 2 (Y101), R7FD is ON.

If a serious or medium malfunction occurs in CPU, nothing is output. If a serious or medium malfunction occurs in CPU during output, output is stopped.

5.5 Interrupt input

You can use X1, X3, X5, X7, and X9 as interrupt input based on the special I/O setting. The interrupt programs as shown in the following table are started at rising or falling edge of the corresponding inputs. In this way, a program can be preferentially executed by an external input.

For details of the commands, refer to "Application Commands" in Chapter 5 "Command Specifications" in the "PROGRAMMING MANUAL NJI-590*(X)".

Table 5.10 Interrupt program

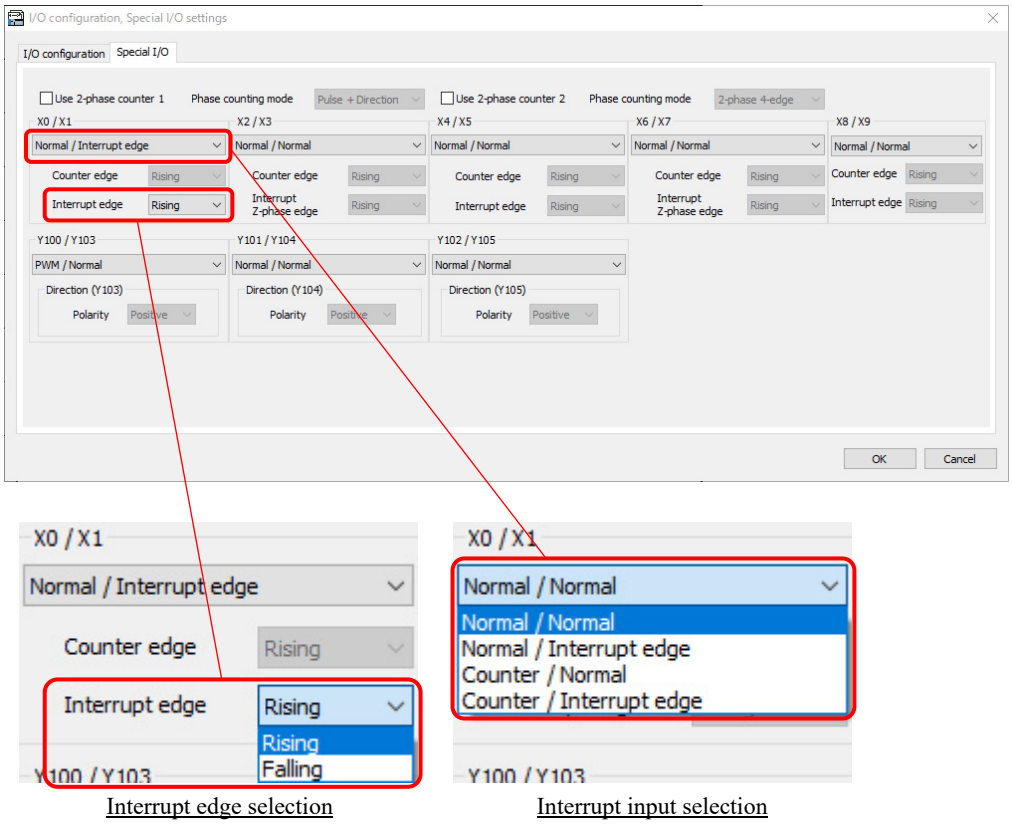
Event	Interrupt program	Return command
X1 interrupt input ON / OFF	XINT1	XRTI
X3 interrupt input ON / OFF	XINT3	XRTI
X5 interrupt input ON / OFF	XINT5	XRTI
X7 interrupt input ON / OFF	XINT7	XRTI
X9 interrupt input ON / OFF	XINT9	XRTI

When using an interrupt input, select [Tool] - [Parameter settings] - [I/O Configuration] in the Control Editor and make the setting on the special I/O tab.

(1) Interrupt input setting in Control Editor (Ver.4.21 or older)

Choose a necessary input from pairs of points X0/X1, X2/X3, X4/X5, X6/X7, and X8/X9 for setting.

Select [Normal / interrupt edge] or [Counter / interrupt edge] from the pull-down menu to set the selected input as an interrupt input. You can also specify the edge of the signal (rising or falling) which causes an interrupt.



Interrupt edge selection　　Interrupt input selection

Figure 5.29 Interrupt input setting (Control Editor Ver.4.21 or older)

(2) Interrupt input setting in Control Editor (Ver.5.00 or newer)

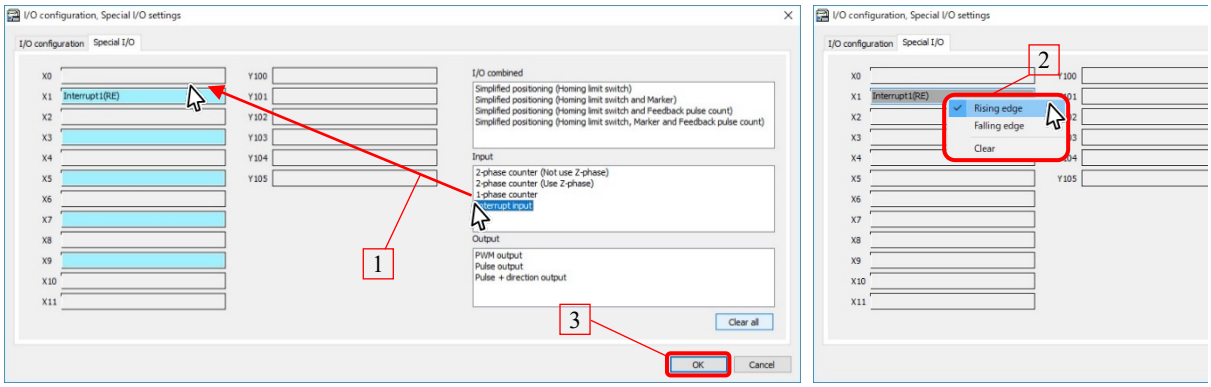


Figure 5.30 Interrupt input setting (Control Editor Ver.5.00 or newer)

1. Select the Interrupt input from the function list on the right side of the special I/O with the mouse and drop it on the frame where the color has changed.
2. Move the mouse cursor over the I/O to which the Interrupt input is assigned, and right-click to select the [Rising edge or Falling edge].
3. Press the OK button to confirm the settings.

The above is the procedure for setting the input terminal to “interrupt input”. To enable the setting, it is necessary to perform [Download] after [Build].

Programs of XINT_n - XRTI should be written after the END command, or in a sheet below the sheet which contains the END command.

When you specify X1, X3, X5, X7, or X9 as interrupt edge-falling, a program of the corresponding XINT_n - XRTI is executed, and the operation returns to the program running before the interrupt.

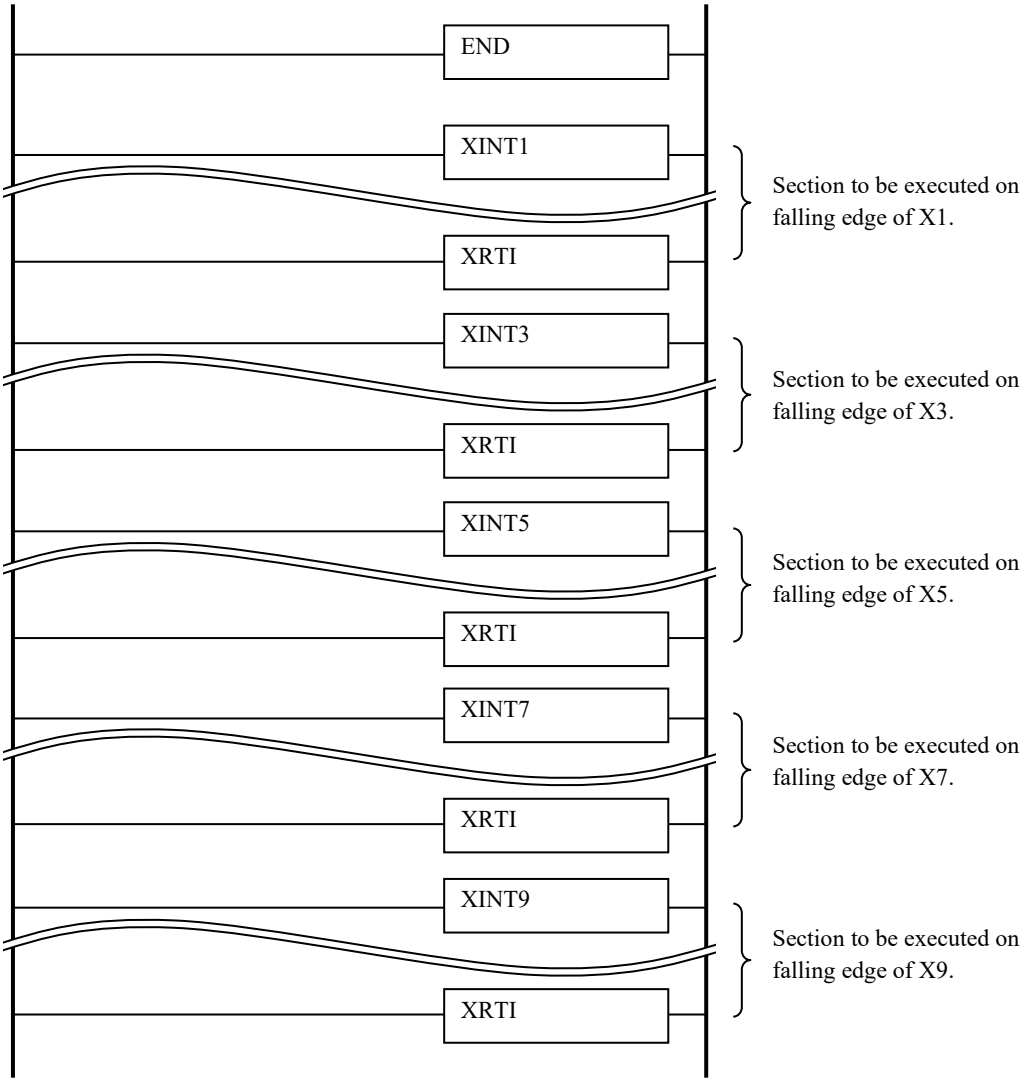


Figure 5.31 Writing example of interrupt program

Note that the priority of user programs is "cycle program>interrupt program>main program," when you use cycle programs with interrupt programs.

Also note that, when connected to equipment which has much chattering, an interrupt program may be started repeatedly.

5.6 Digital filter

With the MICRO-EHV series, you can set the digital filter for DC inputs of the basic unit and expansion units. It is useful to get stable input data in a much disturbance environment.

The filter setting is common to the basic unit and the expansion units.

From [Tool] - [Parameter settings] - [Operation parameters], you can set the digital filter setting value to a value between 1 and 40 on the operation parameter setting window to specify any filter time.

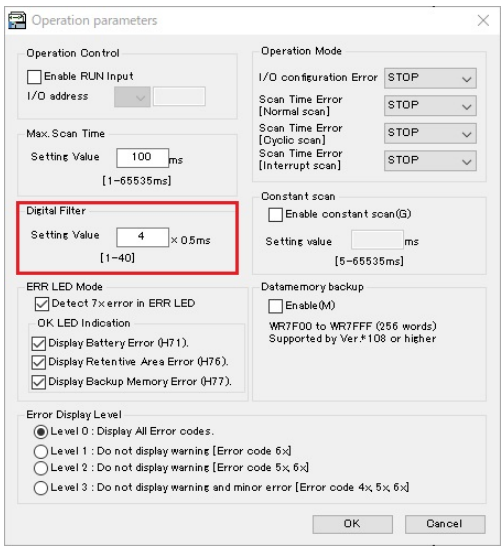


Figure 5.32 Setting for digital filter

The digital filter records input values in the filter memory every 0.5 ms to get input values that exceeds the specified filtering time. It does not get input values that change within the specified filtering time. The initial input value is 4, which means a filtering time of 2 ms.

Example) When you specify 12 for the setting value, the filtering time is 6ms (=12×0.5 ms).

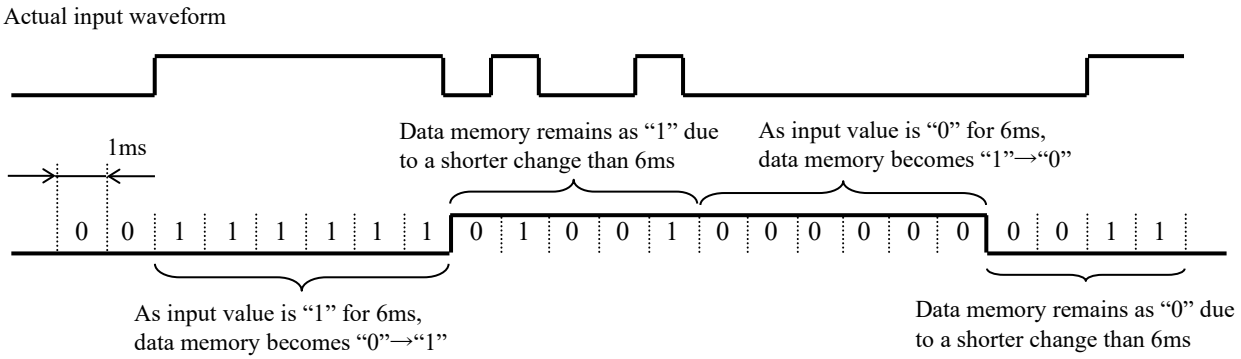


Figure 5.33 Filter behavior

MEMO

Chapter 6　Data Memory Backup Function

6.1　Overview

Data memory backup function is supported from MICRO-EHV software Ver.x108.

MICRO-EHV can backup the data memory to the FLASH memory separately from the retentive area.

The data which is stored to the FLASH memory is kept without battery.

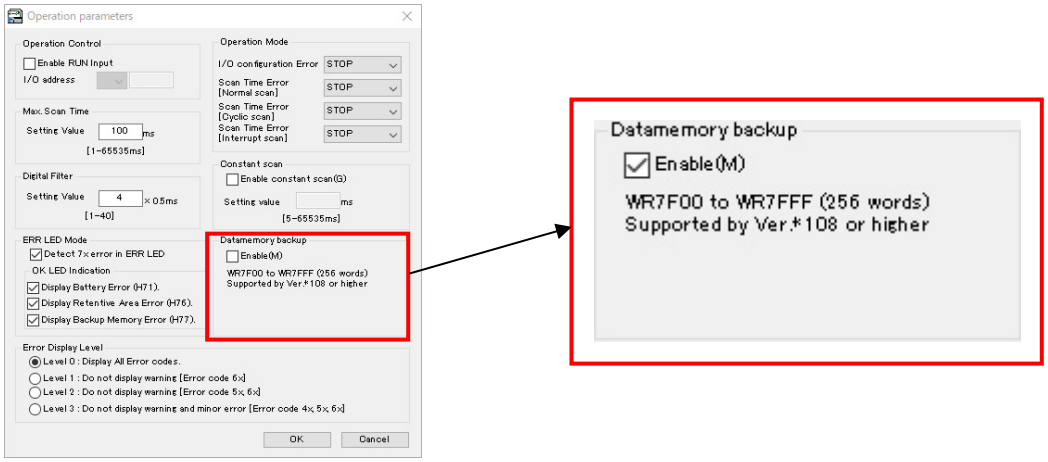
Address and range for this special backup area is fixed, and details are shown in Table 6.1

Table 6.1 Backup data and special internal output for backup function

Item	Contents
Data which is backed up	WR7F00 to 7FFF （256 words）
Backup request bit	R810 (ON by user,　OFF by system)
Backup result bit	R811 (0:Normal　1:Error,　ON / OFF by system)

6.2　Setting for data memory backup

(1) Select “Operation parameters” from Tool – Parameter settings in Control Editor (Ver.4.10 or newer), check the enable box on data memory backup and download this project to MICRO-EHV.



(2) Turn ON the backup request bit (R810) by user program or communication by host device.

(3) Internal output WR7F00 to 7FFF data (256 words) is written to the non-volatile memory (FLASH memory). The STATUS LED blinks during writing. The R810 will automatically turn OFF after writing is complete. The writing time is 300 to 400 ms.

(4) When the power of MICRO-EHV turns ON, the saved data is copied to WR7F00 to 7FFF from the non-volatile memory automatically.

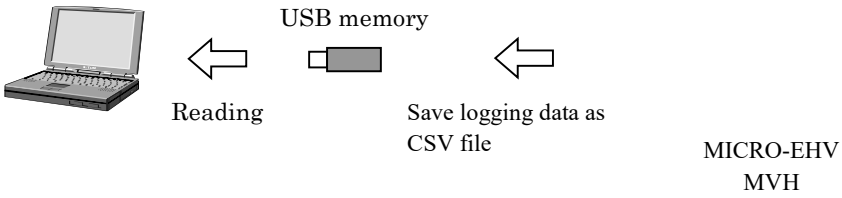
Note

- The data memory area (WR7F00 to WR7FFF) doesn't need to set as retentive area.
- If you turn OFF the power supply immediately after turning ON the backup request bit, backup processing may not worked. To avoid this, turn OFF the power supply after the STATUS LED finishes blinks.
- There is limitation in the number of re-writing data to FLASH memory, about hundred-thousand times. If you back up the data memory at short intervals, MICRO-EHV is less able to back up the data to FLASH memory.
- If you execute CPU initialize, backup data is also initialized. If you turn OFF the power supply immediately after initializing, backup area for data memory may be not initialized correctly.
- This function has been supported from MICRO-EHV software Ver.x108.

Chapter 7　Logging and Trace

7.1　Overview

From MICRO-EHV (MVH) software Ver. x109, USB memory logging and tracing functions are supported.



(1) Logging function

The logging function records the status of external I/O and the value of internal output in chronological order. e recorded time-series data is called log data. The log data is saved in the USB memory in CSV file format, so it is possible to record a large amount of log data and observe the data trends that change over time with a PC.

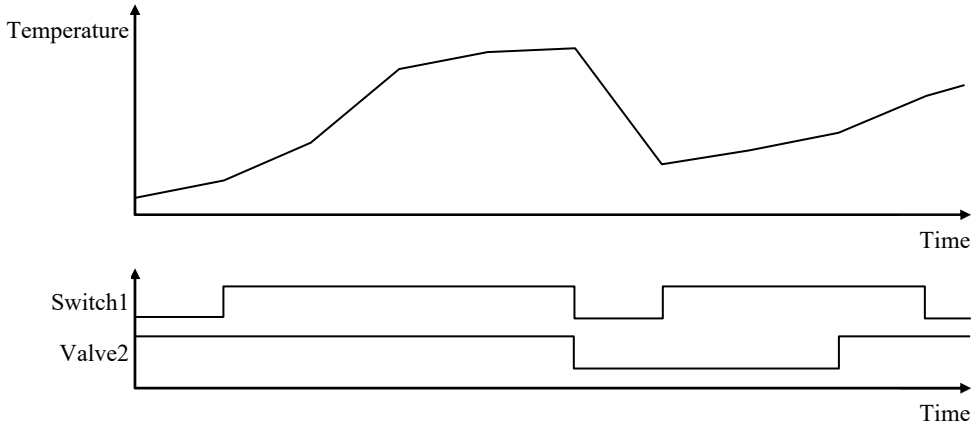


Figure 7.1 Example of using logging data

The MICRO-EHV manages the external I/O and internal output to be recorded in units called "groups", and can specify the timing (trigger condition) for data acquisition for each group. Up to 128 points of external I/O and internal output can be registered in one group, and up to 10 groups can be set.　Set the type of data to be captured and trigger conditions in the Control Editor.

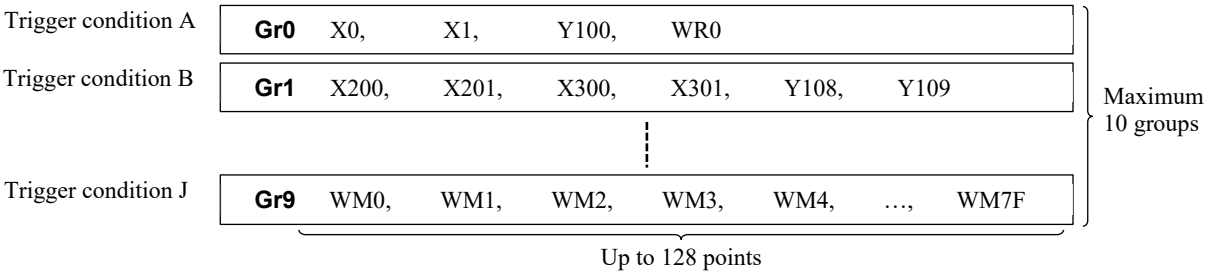


Figure 7.2 Concept of logging group

Caution

Control Editor Ver.4.20 or newer is required to set the logging.

(2) Trace function

The trace function is also a function that records the external I/O status and the value of the internal output to a USB memory, but its purpose is different from the logging function. In the case of the trace function, the external I/O status and internal output value when an event occurs, the external I/O status before and after the event, and the internal output value are recorded. For example, if an error occurrence event of a device is used as a trigger condition, the related I/O and internal output values before and after the error occurrence are automatically saved, which is useful for error analysis.

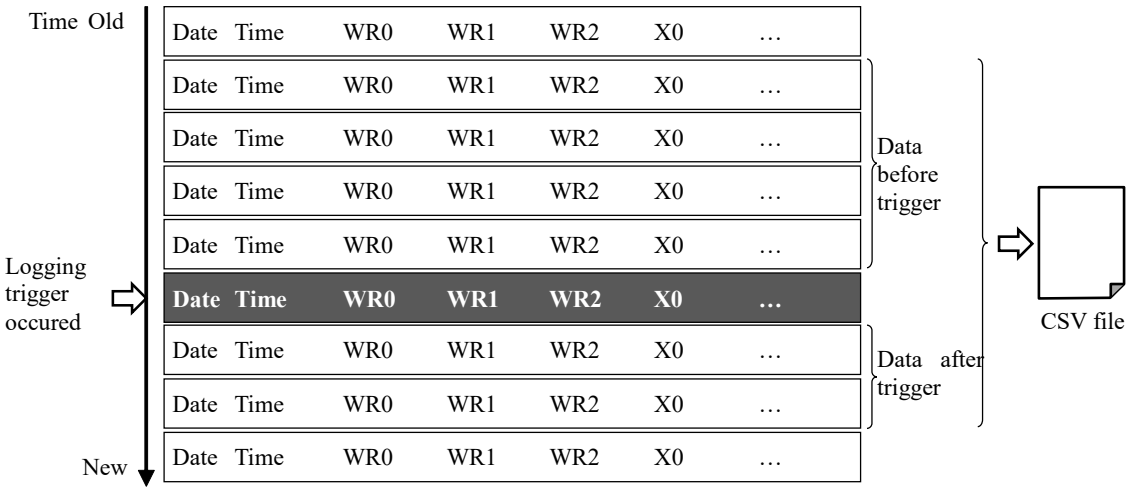


Figure 7.3 Trace data image

Logging is a collection of data when a logging event occurs, and a trace is a collection of time-series data before and after a trace event occurs.

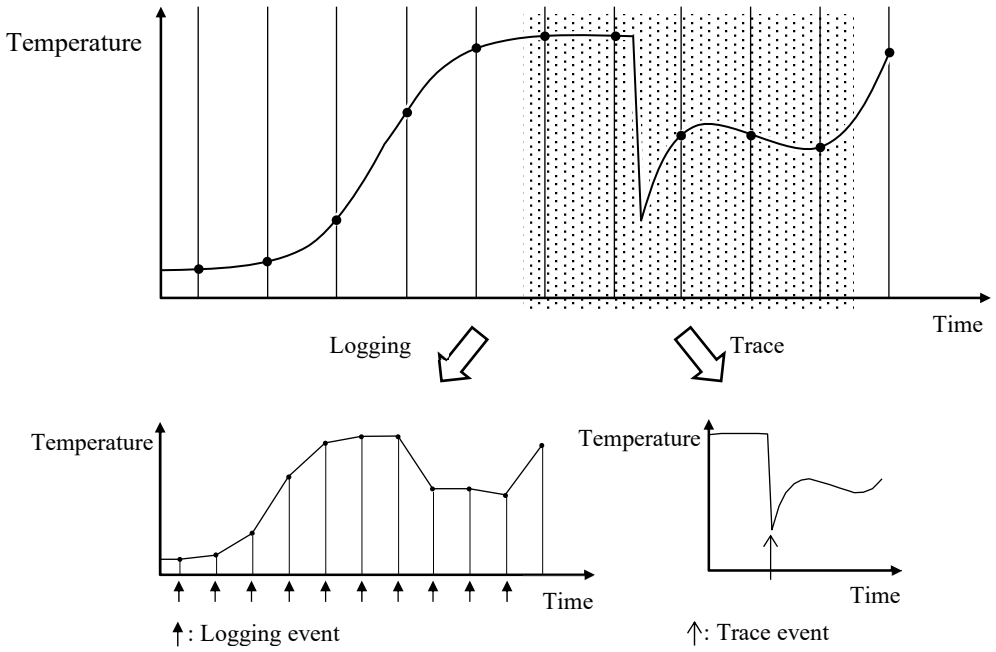
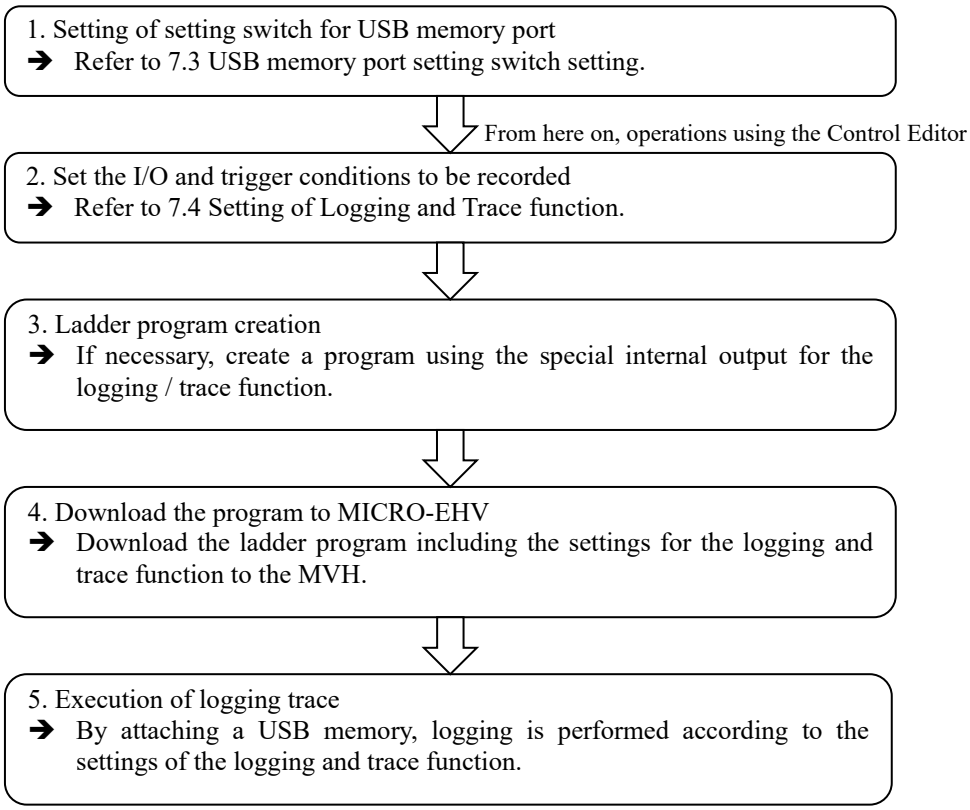


Figure 7.4 Difference between logging function and trace function

7.2 Specification procedure

The following figure shows the procedure for using the logging and trace function.



7.3 Setting the USB memory port setting switch

To use the logging and trace function, set all USB memory port setting switches to OFF.

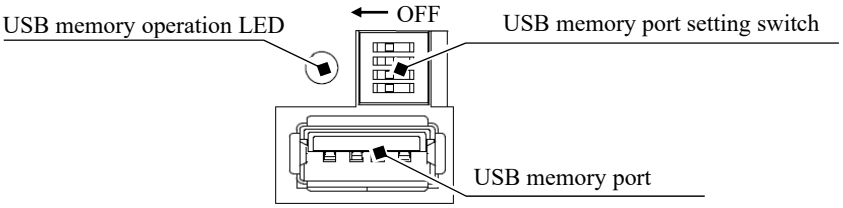


Figure 7.5 USB memory peripheral

1	2	3	4	Operation	Operation during RUN
OFF	OFF	OFF	OFF	Normal operation / Data logging and trace function/ CPU history upload	Yes (possible)
ON	OFF	OFF	OFF	USB memory➔ CPU (download)	No (impossible)
ON	ON	ON	OFF	USB memory← CPU (upload)	Yes (possible)

Caution

- If the USB memory is inserted after the switch is set to upload / download, logging and trace data cannot be saved because the USB memory operates only in that mode.
- Even if the switch is set to OFF (normal operation mode) and the USB memory is inserted and the mode is switched to upload or download, the mode does not change to upload / download mode.

7.4 Logging and Trace function setting

Use Control Editor (Ver.4.20 or newer) to set the logging and trace function.

Make the following settings to use the logging and trace function.

- File name to save to USB memory
- I/O for logging and trace (including internal output)
- Trigger settings

The logging and trace function can be set for up to 10 groups. Also, file name, logging I/O, trigger setting, etc. are required for each group.

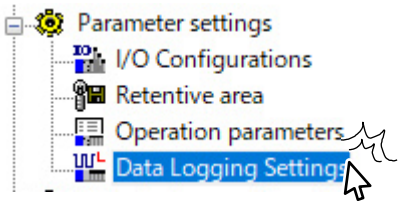
7.4.1 Start data logging configuration

Select [Tool] – [Parameter settings] – [Data Logging Settings] from the Control Editor menu.

The Data Logging Group List dialog is displayed.

Reference

The same operation can be performed by double-clicking [Data Logging Settings] on the project tree.



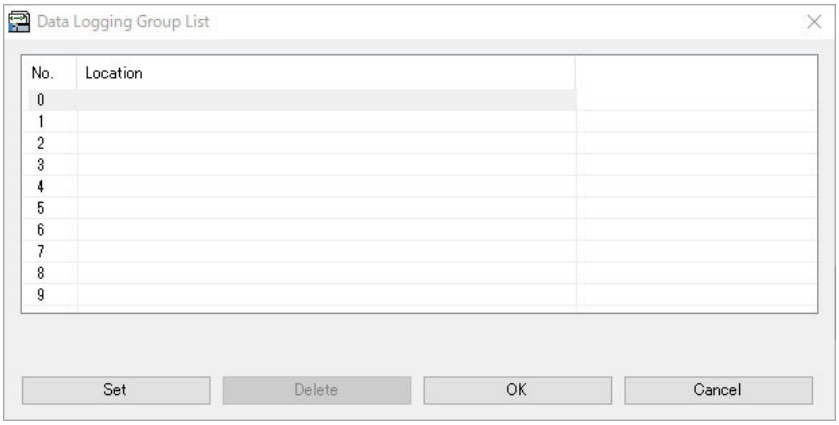


Figure 7.6 Data Logging Group List Dialog Box

Item	Description
Set	The setting dialog box of the selected logging group No. is displayed. The same operation can be performed by double-clicking the number field. A group whose file save location is displayed in the Data Logging Group List dialog box indicates that the parameter has been set.
Delete	The logging setting of the selected logging group No. is deleted.
OK	Confirm the settings and close the dialog box.
Cancel	Cancel the settings and close the dialog box.

7.4.2 Detailed settings for logging group

Figure 7.6 Select a logging group No. to be set on the Logging Group List dialog box and click the "Set" button to display the Logging Group Setting dialog box. (If you select a group where the file save location is displayed, you can edit the settings of that group.)

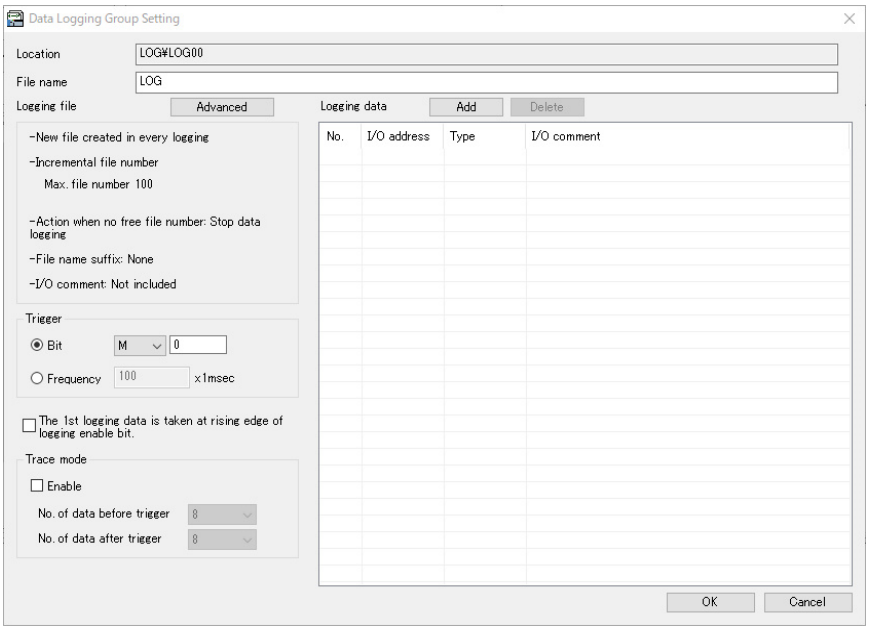


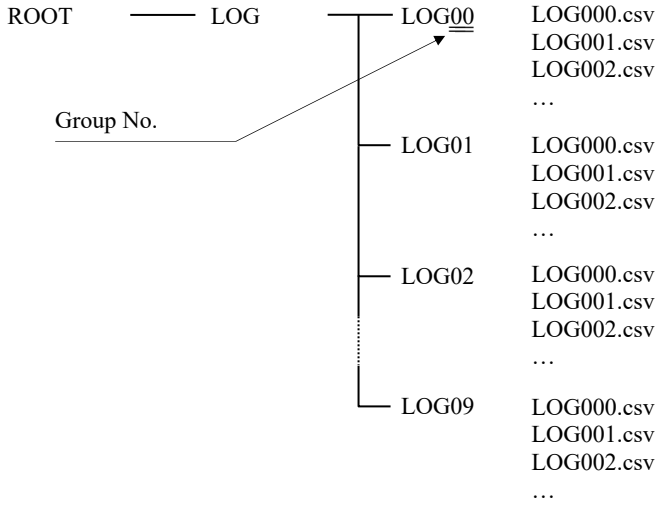
Figure 7.7 Logging Group Setting Dialog Box

(1) File storage location

The location where the file is saved on the USB memory is displayed.

Reference

The logging data file is saved in the USB memory as follows.

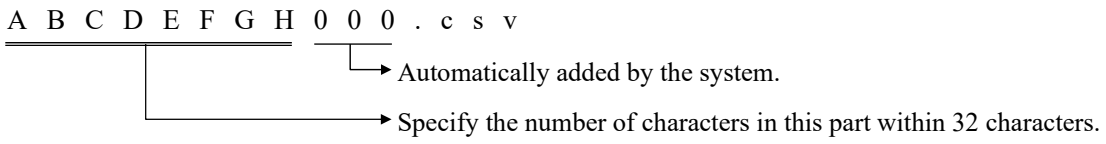


(2) File name

Specifies the file name to be stored in the USB memory.

Caution

・Specify the file name within 32 characters.



・The following characters cannot be used in file names. ¥, /, :, *, ?, ", <, >, |

・If you give a file name with more characters than the 8.3 format *, the access speed to the USB memory will decrease.

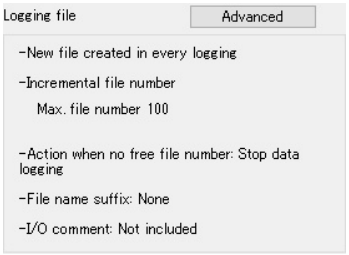
When logging and tracing data every scan or at short intervals, we recommend using the 8.3 format.

* 8.3 format: The number of the letters to extension is the alphanumeric character within 8 characters, extension is the file name of the alphanumeric character within 3 characters.

12345678.123

(3) Saving log files

The currently set save method is displayed.



Pressing the Advanced button allows you to change the log file numbering method and information to be saved.

Save log file advanced settings

(3-1) File numbering method

You can select from the following three types.

- Incremental file number … Generates files with serial numbers and save log data.
- Fixed file number … Save log data in the same file.
- File number set by internal output … Generate a file with the number specified in the internal output and save the log data.

There is a detailed explanation in “7.4.4 Saving Logging and Trace data to USB memory”.

(3-2) Date/Time suffix

You can select whether to add date (year / month / day) and time (hour / minute) to the file name.

(3-3) I/O comment

You can choose to save the I/O comments with the log data.

Reference

If you add an I/O comment, all characters are stored in Unicode.

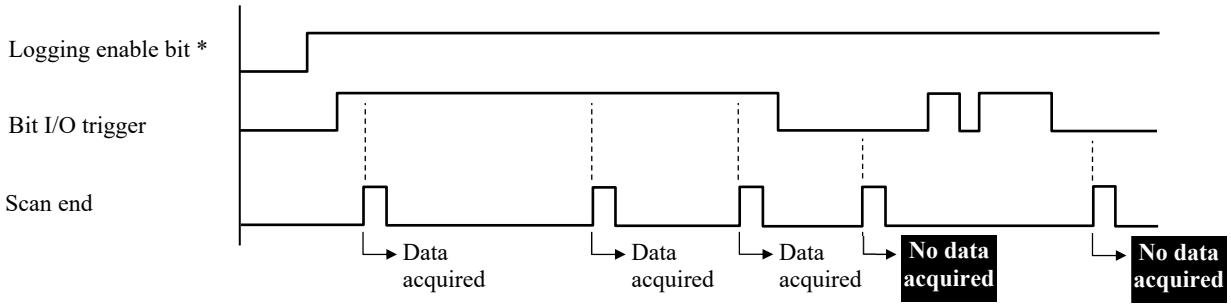
Therefore, the file will be in UTF16LE (little endian) format with tab delimiters.

(4) Trigger

Set the trigger for logging.

You can select either bit I/O (X, Y, M, R) or frequency (1 ms unit, maximum 86,400,000 ms (= 24 hours)).

Example) Bit I/O trigger



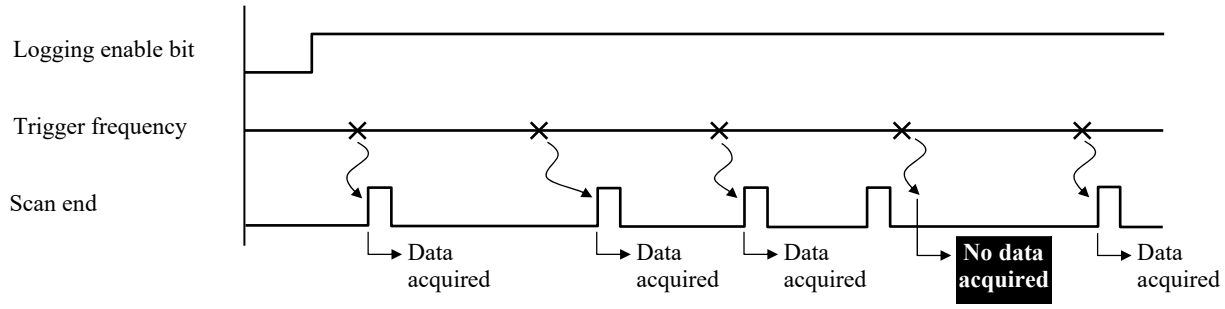
Data acquisition is performed at the scan end. If the bit internal output specified at the scan end execution is OFF, no data is acquired.

* Data logging is performed / not performed by the bit special internal output corresponding to the logging group. For details, refer to “7.7 Special internal output for Logging and Trace function”.

Caution

In the case of a bit I/O trigger, data logging is performed each time the specified trigger bit is ON. If you want to log data only when the bit I/O changes from OFF to ON, you need a program that turns on the specified trigger bit for only one scan.(For details on the program, refer to "7.8 Logging and Trace usage example".)

Example) Frequency trigger

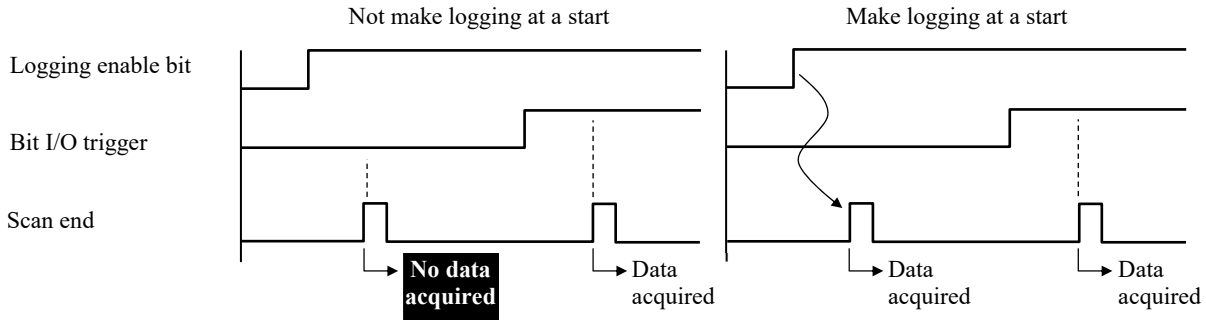


Data acquisition is performed at the scan end. If the scan end is not executed even after the logging acquisition cycle, no data is acquired.

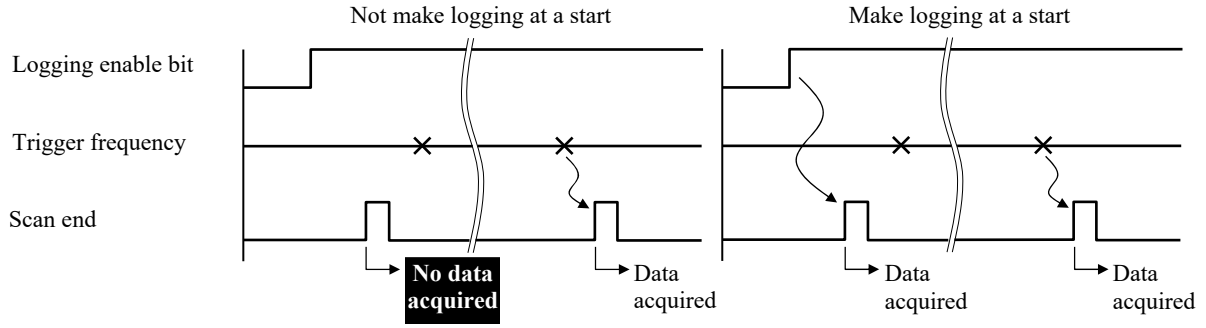
(5) Operation when logging enable bit is ON

Select whether to acquire logging data when the logging enable bit is turned ON.

Example) In case of bit internal output trigger



Example) Frequency trigger



(6) Trace mode

Select whether to use the trace mode.

When using trace mode, specify the number of data before and after data acquisition (trigger event occurrence).

The number of data before and after data acquisition can be selected from 8, 16, 32, and 64.

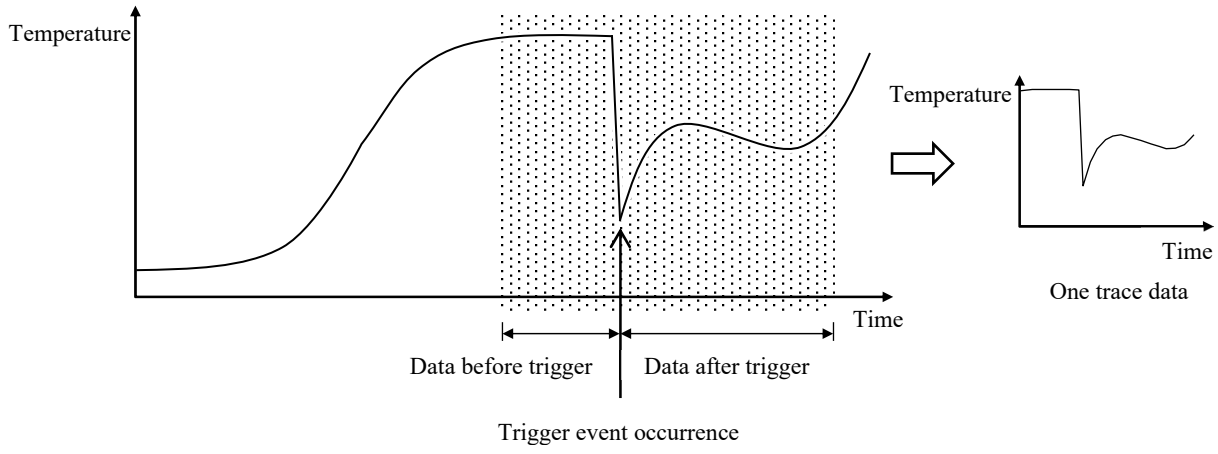


Figure 7.8 One trace data when using trace mode

(7) Logging data setting

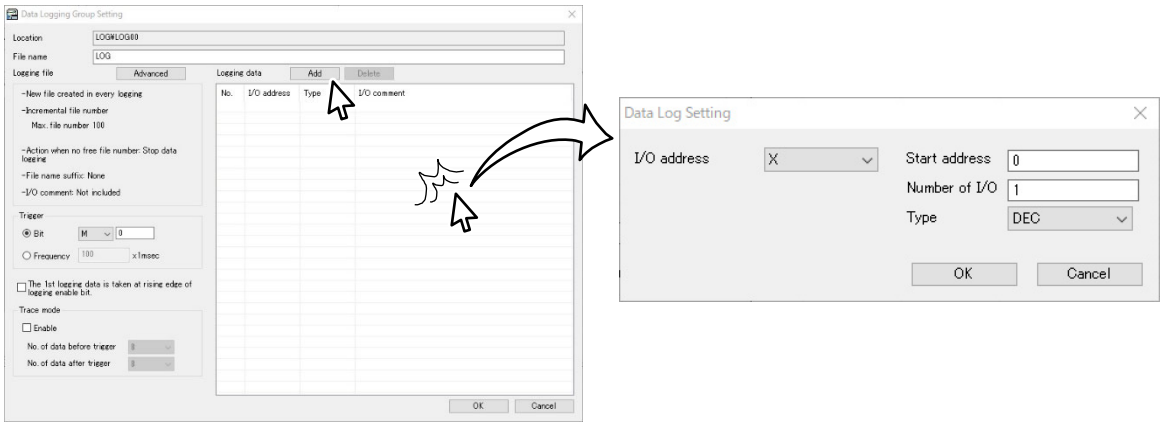
Set the external I/O and internal output to be saved. Bit I/O and word I/O can be set together. Up to 128 points can be set in one group.

Caution

It is possible to select a double word, but in the case of a double word, one data occupies the area for two points. (If all are double word data, the maximum number of points that can be logged is 64 points.)

Logging data setting procedure

Click the Add button at the top of the logging data table, or move the mouse pointer to the logging data area and double-click.



(7-1) Enter the I/O type and number for logging. The following table shows the selectable I/O types.

	Bit	word	double word
Number of occupied points	1 point	1 point	2 points
External input	X	WX	DX
External output	Y	WY	DY
Internal output	M	WM	DM
	R	WR	DR
Timer	TD	TC	

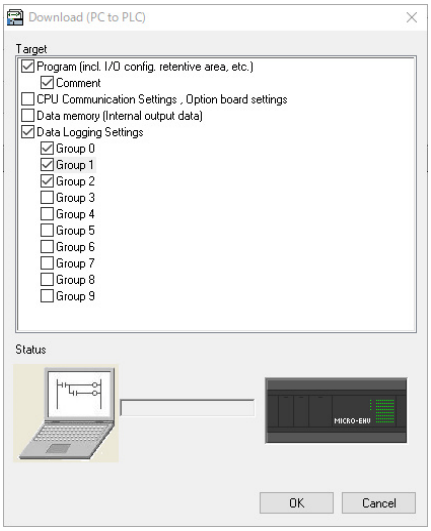
(7-2) When logging continuous I/O, the number of data to be logged starting with the I/O set in (7-1) Enter the.

(7-3) Specify the I/O data format for logging. The data format can be selected from decimal, hexadecimal, ASCII code, and signed (S).

7.4.3 Write data logging setting

Write the data logging setting to MICRO-EHV by Download (PC to PLC).

The following window is displayed when Download (PC to PLC) operation is performed in Control Editor.



Data logging settings can be written independently, or can be written together with programs and CPU communication settings. You can also write in groups.

Select the required items and click the OK button.

Caution

・Data logging settings cannot be written during data logging (While the logging enable bit is ON or the USB memory access bit is ON).

(Data logging settings are not written when data logging is in progress when the data logging settings are written together with programs.)

・Data logging settings can be changed even when MICRO-EHV is running. The operation is similar to the Online change in RUN, and the Build after changing the setting. (Only the data logging group whose setting has been changed is the Online change in RUN.) However, if the group to be changed is executing logging, it cannot be changed without stopping logging once.

・When connecting on-direct, data logging settings are not verified. Even if the data logging setting section is different from the project stored in MICRO-EHV, you can connect on-direct. However, if the PLC verification including the data logging settings is performed online, the data logging settings will not match.

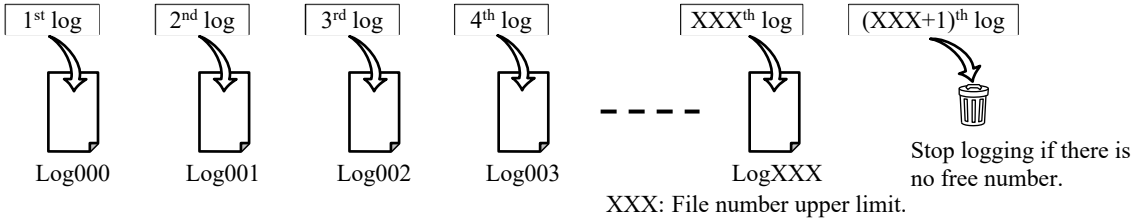
7.4.4 Saving Logging and Trace data to USB memory

Logging and trace data is saved in USB memory in CSV file format. At this time, the file is saved with the file name set in the logging group setting, but a number is added after the specified file name. The numbering method can be selected from three types: "Incremental file number", "Fixed file number", and "File number set by internal output". There are also options that depend on the selected file numbering method. The amount of logging and trace data saved in the file and the operation when data cannot be written differ depending on the option selected.

(1) Incremental file number

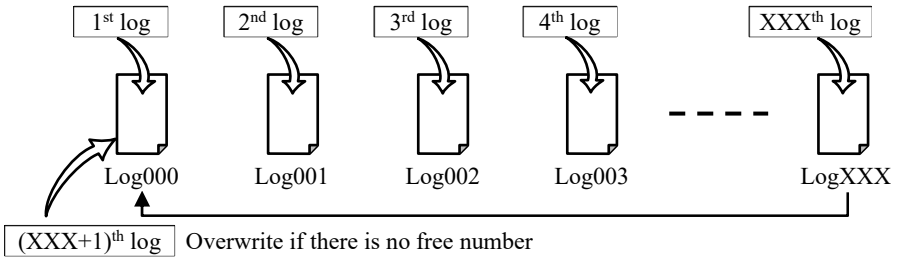
(a) New file created in every logging / Stop data logging when no free file number.

Save one log data to one file. If there is no free file number, no further logging is performed.



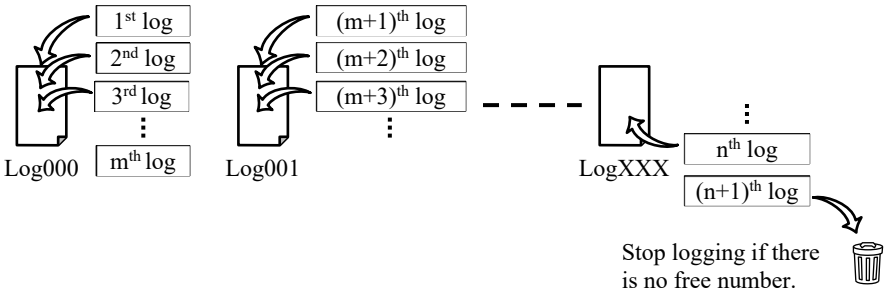
(b) New file created in every logging / Overwriting the same file when no free file number

Save one log data to one file. If there is no free file number, overwrite the log files in ascending order.



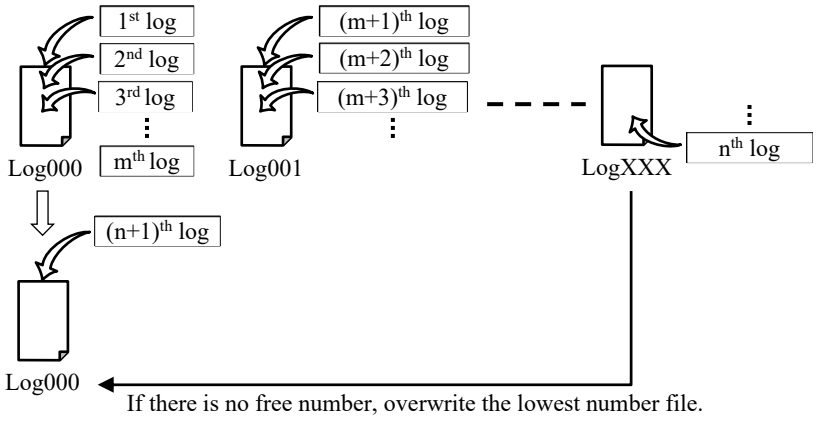
(c) Updating the file / Stop data logging when no free file number

Append the acquired log data to the file. When the file is full, update the file number and create and append a new file. If there are no freer file numbers, no further logging is performed.



(d) Updating the file / Overwriting the same file when no free file number

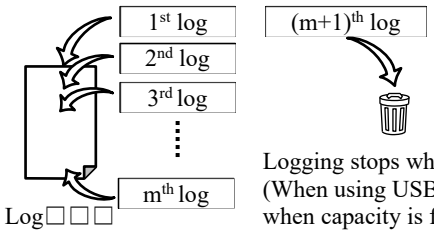
Append the acquired log data to the file. When the file is full, update the file number and create and append a new file. If there are no free file number, overwrite the log files in ascending order.



In this case, the first file is deleted and then generated again.
Log000 has no log data other than (n + 1) th log.
(It is not overwritten by the 1st log.)

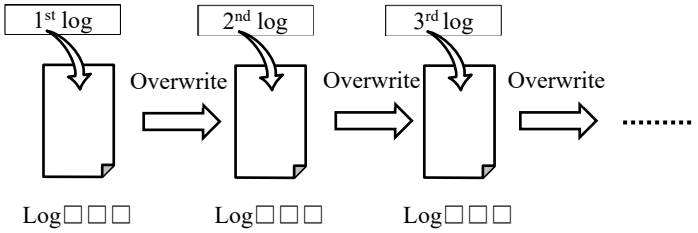
(2) Fixed file number / File number set by internal output

(a) Updating the same file



Logging stops when the file capacity exceeds 2 GB.
(When using USB memory less than 2 GB,stop logging when capacity is full.)

(b) Overwriting the same file



Caution

To change the file number to be saved by internal output, close the file once.

If you change the file number without closing the file, a file open error will occur.

The following shows how to close the file. For the various bits described, refer to "7.7 Special internal output for Logging and Trace function".

・Turn off the logging enable bit.

Turn off the logging enable bit, confirm that the USB memory access bit has been turned off, change the internal output value (file number), and turn the logging enable bit back on.

Note that data logging stops while the logging enable bit is OFF.

・Turn on the Auto file close setting bit.

If the Auto file close setting bit is set to ON, the log data is written to the USB memory and the file is closed automatically after 60 seconds. (The file will be opened automatically the next time you write.) If the logging interval is 60 seconds or more, turning this bit ON allows the file number to be changed without controlling the logging enable bit.

(3) Notes on file generation

・The maximum number of file numbers is 999. (When specifying a file number in internal output, all values with internal output exceeding 999 are treated as 999.)

・If the upper limit number increases, it takes time to search for an empty number when inserting a USB memory. If a logging and trace occurs multiple times while searching for a free number, the logging buffer may overflow. For the time required to search for an empty number, refer to "7.11 Logging and Trace function usage notes ".

・The CPU identifies files by folder name and file number. (Strings, date and time are ignored.)

Do not create multiple files with the same file number and different character strings or date and time in the same folder on the USB memory device with a personal computer.

・The maximum capacity of one file is 2 GB.

・The upper limit of the file number is 999, but if you create more than 126 files in one folder, the access speed to the USB memory will decrease.

・The maximum capacity of the usable USB memory is 32GB. A warning is issued to the special internal output according to the capacity / remaining capacity of the USB memory.

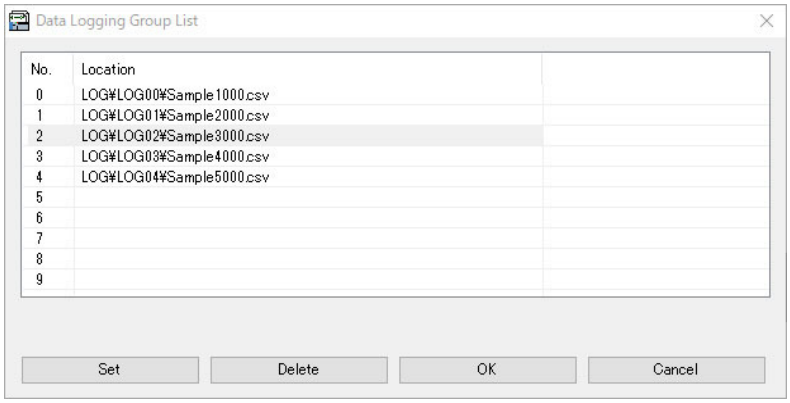
No.	USB memory size (MB)	Warning capacity * (MB)	Remaining capacity / Total capacity (%)
1	Less than 16MB	1.6MB	10%
2	32MB	3.2MB	10%
3	64MB	6.4MB	10%
4	128MB	6.4MB	5%
5	512MB or more	20.48MB	4%

* If free space in USB memory becomes less than this value, MICRO-EHV displays waring to special internal output.

7.4.5 Delete data logging settings

Follow the procedure below to delete the data logging settings in MICRO-EHV.

(1) Select [Tool] – [Parameter setting] – [Data Logging Settings] from the Control Editor menu.
Displays the data logging group list dialog.



(2) Select the group you want to delete and press the delete button.

Caution

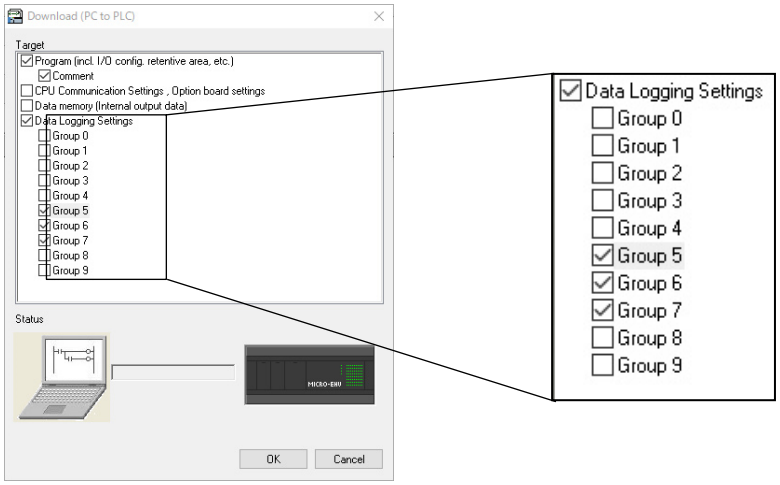
・Multiple groups cannot be deleted at once. Even when deleting multiple groups, delete one group at a time.

(3) Click the OK button to close the logging group list dialog and write the program to MICRO-EHV.

Caution

・Pressing the delete button does not delete the settings recorded in MICRO-EHV. It is necessary to write the information of deletion to MICRO-EHV, so please check the deleted group when writing the program to MICRO-EHV.

Example) When deleting the settings of logging groups 5, 6, and 7



When deleting the data logging setting by Online change in RUN, the logging setting in MICRO-EHV is deleted by the operation of Build. (If the group to be deleted is executing logging, it cannot be deleted.)

Reference

When you initialize the CPU, all the logging settings recorded in MICRO-EHV will be initialized.
Also, log data that has not been written to the USB memory recorded in the logging buffer in MICRO-EHV is discarded.

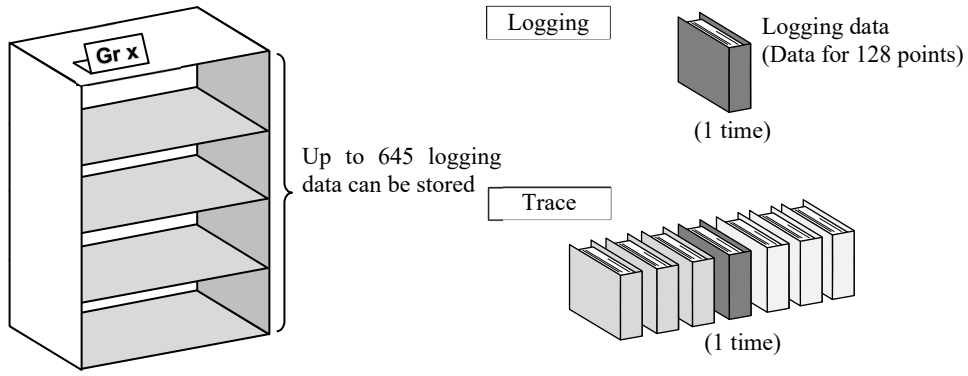
7.5 Logging buffer

MICRO-EHV has a buffer for logging data inside the CPU.

When using the logging and trace function, a USB memory must be mounted, but this buffer can prevent log data from being lost when writing to the USB memory is concentrated. The data in the logging buffer is deleted when the power is turned off.

The concept of the logging buffer is shown below.

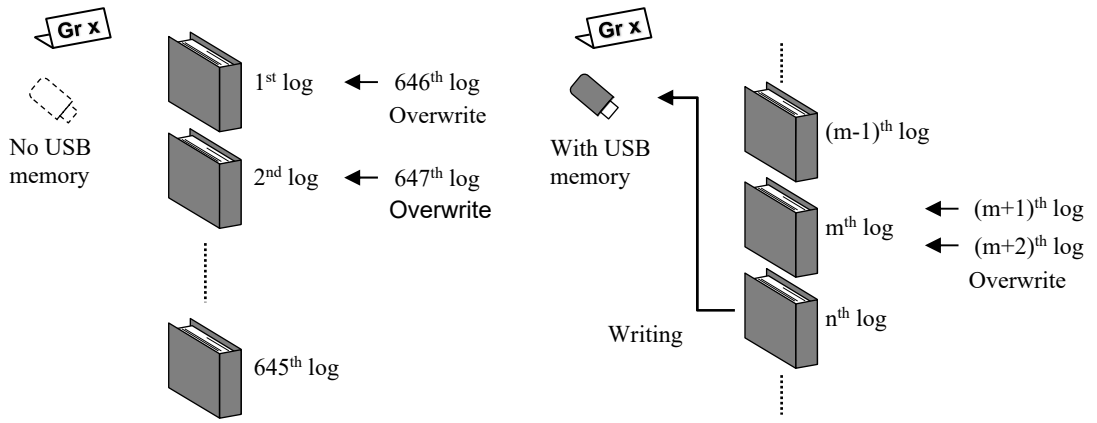
- One log data consists of 128 points of data.
  (Even if the setting of the number of logging data is less than 128 points, the buffer occupies 128 points.)
- The logging buffer is prepared for each group, and each can record 645 logging data.
- In the case of trace, the data before and after the log data also uses the logging data area for that number.
  Example) When the number of data before the trigger is 8 and the number of data after the trigger is 16,
  8 + 1 + 16 = 25 logging data is used.



- The logging buffer is a ring buffer. If a USB memory is mounted, the data is written to the USB memory each time log data is acquired. However, if the logging buffer is full without the USB memory mounted, the oldest logging data will be overwritten in order.

Caution

Even if the USB memory is mounted, if writing to the USB memory cannot keep up with the logging data acquisition, the latest logging data will be overwritten until there is enough space in the logging buffer to record the next logging data.



7.6 CSV file format

The data and I/O are saved in the CSV file automatically generated during logging and tracing.

Items in the file are separated by (comma). The format to be saved changes according to the setting of the file generation option.

Reference

In the following explanation, the figure of the table image is used, but for the sake of expression, the ruled lines are drawn and the width of each item is adjusted. Even if you open the actual CSV file, it will not be displayed as shown in this document.

(1) Log file

c-1 ↓	c-2 ↓	c-3 ↓	c-4				
	ms Counter	I/O address	WR0	WR1	…	WR3FF	← r-1
			DEC	DEC		SIGNED	← r-2
		I/O comment	Room temperature	Flow rate 1	…	Liquid level	← r-3
Date 2014-06-20 18:18:22	127		251	2568	…	2980	r-4
Date 2014-06-20 18:18:22	854		251	2600	…	3120	
Date 2014-06-20 18:18:23	301		255	2594	…	3005	

Figure 7.9 Log file format

c-1 Timestamp

Clock data in the CPU when data was logged.

c-2 ms (millisecond) counter

ms Counter is the counter value in the CPU that counts up in ms units. (0-999)

If you want to know the time between events that occur multiple times within one second, please refer to this counter. Note that the value of this counter is asynchronous with the time stamp "second". (Even if the counter value exceeds 999, the second value does not change.)

Reference

The data length of the ms Counter has been changed to 32 bits since software Ver.x120.

Since the counter value is counted up to 4,294,967,295, you can check the time between events accurately even if the time between events is long.

c-3 Title of the right column (c-4) of the table. Nothing is saved below this (dashed line).

c-4 Logging data

Up to 128 points of logging data.

r-1 Recorded I/O type and address

r-2 Recorded I/O data format

Data format	Decimal number	Hexadecimal number	ASCII code	Signed (S) decimal number
Display in CSV	DEC	HEX	ASCII	SIGNED

r-3 I/O comment of the recorded I/O (only when "Include I/O comment" is selected in the file generation option)

If no comment is added, the format in Figure 7.9 will have no I/O comment lines as shown below.

	ms Counter	I/O address	WR0	WR1	…	WR3FF
			DEC	DEC		SIGNED
Date 2014-06-20 18:18:22	127		251	2568	…	2980

Reference

If you add an I/O comment, all characters are stored in Unicode. Therefore, the file will be in UTF16LE (little endian) format with tab delimiters.

r-4 logging data

One line is one log data.

When "Fixed file number" is selected in the file generation option, multiple logging data are saved in one file. In this case, the new log data will be stored on a new line.

(2) Trace file

c-1	c-2	c-3	c-4	c-5				
		ms Counter	I/O address	WR0	WR1	…	WR3FF	← r-1
				DEC	DEC		SIGNED	← r-2
			I/O comment	Room temperature	Flow rate 1	…	Liquid level	← r-3
-8	Date 2014-06-20 18:18:22	127		251	2568	…	2980	
-7	Date 2014-06-20 18:18:22	854		251	2600	…	3120	
…	…	…		…	…	…	…	
-1	Date 2014-06-20 18:18:27	216		252	2612		3134	
0	Date 2014-06-20 18:18:28	35		252	2611		3134	
1	Date 2014-06-20 18:18:28	762		251	2608		3132	r-4
2	Date 2014-06-20 18:18:29	489		251	2610		3134	
…	…	…		…	…	…	…	
7	Date 2014-06-20 18:18:33	124		254	2602		3124	
8	Date 2014-06-20 18:18:34	32		254	2598		3118	
-8	Date 2014-06-20 18:18:34	704		253	2600		3120	
-7	Date 2014-06-20 18:18:35	450		253	2600		3122	r-5
…	…	…		…	…	…	…	

Figure 7.10 Log file format

c-1 Trace No.

The data acquired when the trigger is turned on is set to 0, and the data before and after the trigger is represented by ± numbers.

The above is an example of saving multiple log data in one file.

c-2 time stamp

See the description of (1) Log file.

c-3 ms Counter

See the description of (1) Log file.

c-4 Title of table right column (c-5)

See the description of (1) Log file.

c-5 Trace data

See the description of (1) Log file.

r-1 Recorded I/O type and address

See the description of (1) Log file.

r-2 Recorded I/O data format

See the description of (1) Log file.

r-3 I/O comment of the recorded I/O (only when "Include I/O comment" is selected in the file generation option)

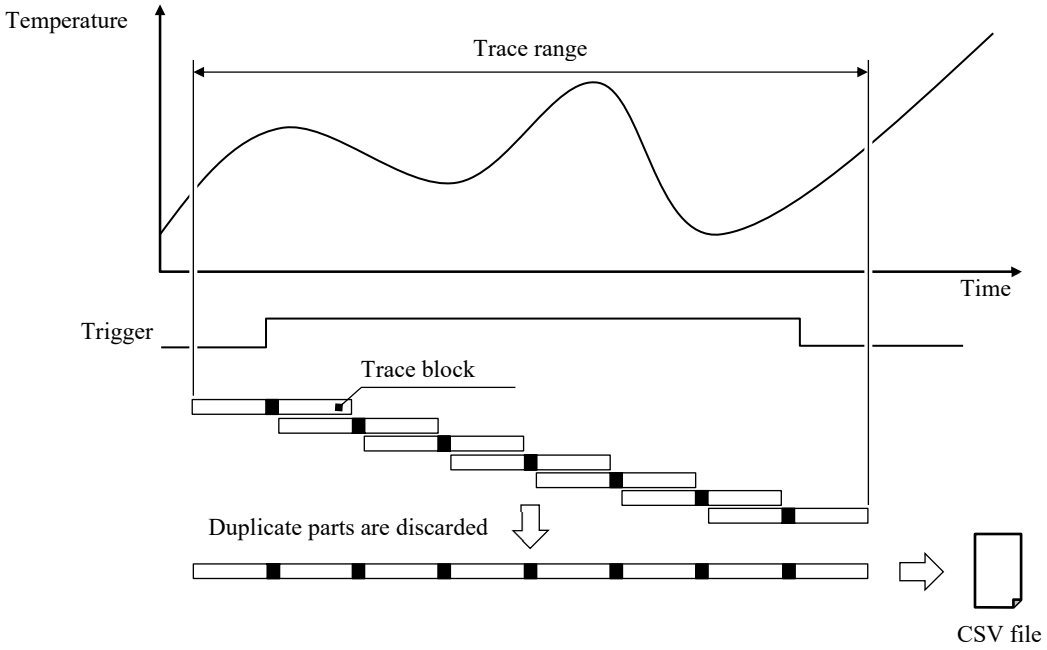
See the description of (1) Log file.

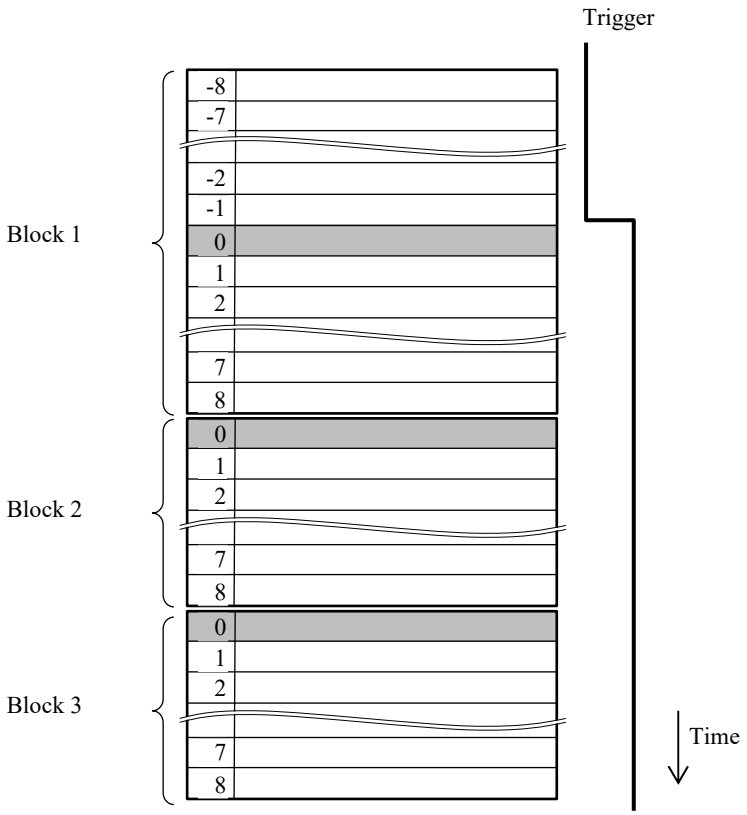
r-4 The trace data is one trace data by adding the data before and after the trigger to the data when the trigger event occurs. The oldest log data of the specified pre-trigger data is placed at the top, and up to the latest log data of the post-trigger data is saved as one log data per line. This is called a trace block. For example, if the number of data before and after the trigger is set to 16, 33 lines become 1 trace block.

When "Fixed file number" is selected in the file generation option, multiple trace blocks are saved in one file. In this case, the new trace block is saved from the next line after the old trace block.

Caution

When a part of the trace block overlap with the next trace block, it is saved so that logging data do not overlap. For example, if the trigger is always ON, the trace data is saved every scan, but if multiple trace blocks are saved in one file, the trace data before the trigger is stored in the second and subsequent trace blocks (r-4). Will not be saved.





7.7 Special internal output for Logging and Trace function

(1) Bit special internal output

A 16-bit special internal output is provided for each group for the special internal output for the logging and trace function. The control bits are used to control logging and trace function. The status bits are used to monitor the status of the logging and trace function.

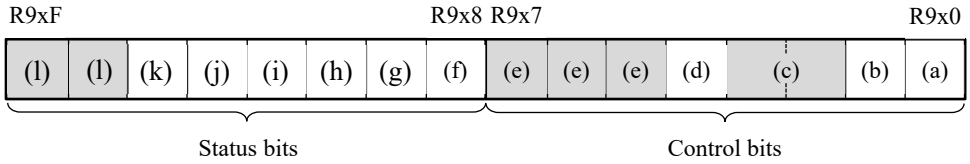
<Bit special internal output address>

The table below shows the address and use of the bit special internal output used by each logging group.

Table 7.1 Bit Special Internal Output for Logging and trace Function

Symbol	detail	Bit for logging and trace function Special internal output address									
		Gr.0	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	Gr.8	Gr.9
(a)	Logging enabled	R930	R940	R950	R960	R970	R980	R990	R9A0	R9B0	R9C0
(b)	Abort logging settings	R931	R941	R951	R961	R971	R981	R991	R9A1	R9B1	R9C1
(c)	Used in system	R932 R933	R942 R943	R952 R953	R962 R963	R972 R973	R982 R983	R992 R993	R9A2 R9A3	R9B2 R9B3	R9C2 R9C3
(d)	File auto close setting	R934	R944	R954	R964	R974	R984	R994	R9A4	R9B4	R9C4
(e)	Reserved (unused)	R935 R936 R937	R945 R946 R947	R955 R956 R957	R965 R966 R967	R975 R976 R977	R985 R986 R987	R995 R996 R997	R9A5 R9A6 R9A7	R9B5 R9B6 R9B7	R9C5 R9C6 R9C7
(f)	Logging execution availability display	R938	R948	R958	R968	R978	R988	R998	R9A8	R9B8	R9C8
(g)	Accessing USB memory	R939	R949	R959	R969	R979	R989	R999	R9A9	R9B9	R9C9
(h)	Logging error	R93A	R94A	R95A	R96A	R97A	R98A	R99A	R9AA	R9BA	R9CA
(i)	Memory error	R93B	R94B	R95B	R96B	R97B	R98B	R99B	R9AB	R9BB	R9CB
(j)	Trigger setting error	R93C	R94C	R95C	R96C	R97C	R98C	R99C	R9AC	R9BC	R9CC
(k)	USB memory free space warning	R93D	R94D	R95D	R96D	R97D	R98D	R99D	R9AD	R9BD	R9CD
(l)	Reserved (unused)	R93E R93F	R94E R94F	R95E R95F	R96E R96F	R97E R97F	R98E R98F	R99E R99F	R9AE R9AF	R9BE R9BF	R9CE R9CF

＜Meaning of each bit＞



Status bits can be read (R) only, and control bits can be read (R) and written (W).

The table below shows the set / reset conditions for each bit.

Symbol	detail	Set condition	Reset condition		
			CPU STOP	CPU initialization	Insert USB memory
(a)	Logging enabled	ON by user	OFF by system	Zero clear (OFF)	Keep previous state
(b)	Abort logging settings	ON by user	Keep previous state	Keep previous state	Keep previous state
(d)	File auto close setting	ON by user	Keep previous state	Keep previous state	Keep previous state
(f)	Logging execution availability display	ON by system	OFF by system	OFF by system	OFF by system
(g)	Accessing USB memory	ON by system	Keep previous state	Keep previous state	OFF by system
(h)	Logging error	ON by system	Keep previous state	Keep previous state	OFF by system
(i)	Memory error	ON by system	Keep previous state	Keep previous state	OFF by system
(j)	Trigger setting error *	ON by system	Keep previous state	Keep previous state	Keep previous state
(k)	USB memory free space warning	ON by system	Keep previous state	Keep previous state	OFF by system

* The trigger setting error bit is cleared to zero when the logging setting is correctly performed.

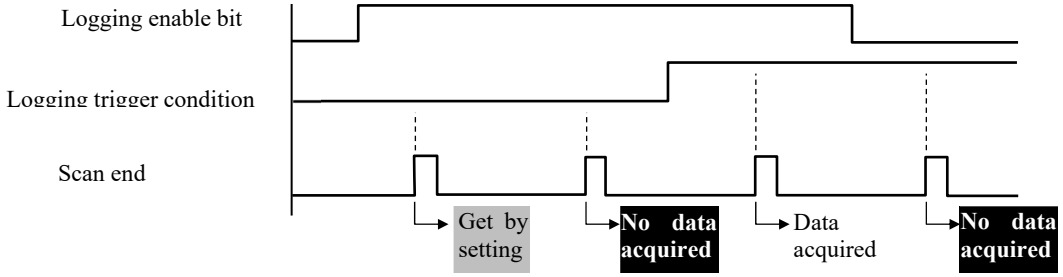
(a) Logging enabled / RW

Turn ON when enabling the logging and trace function, and OFF when disabling.

When the logging trigger condition is satisfied while the logging valid bit is ON, data is logged.

Reference

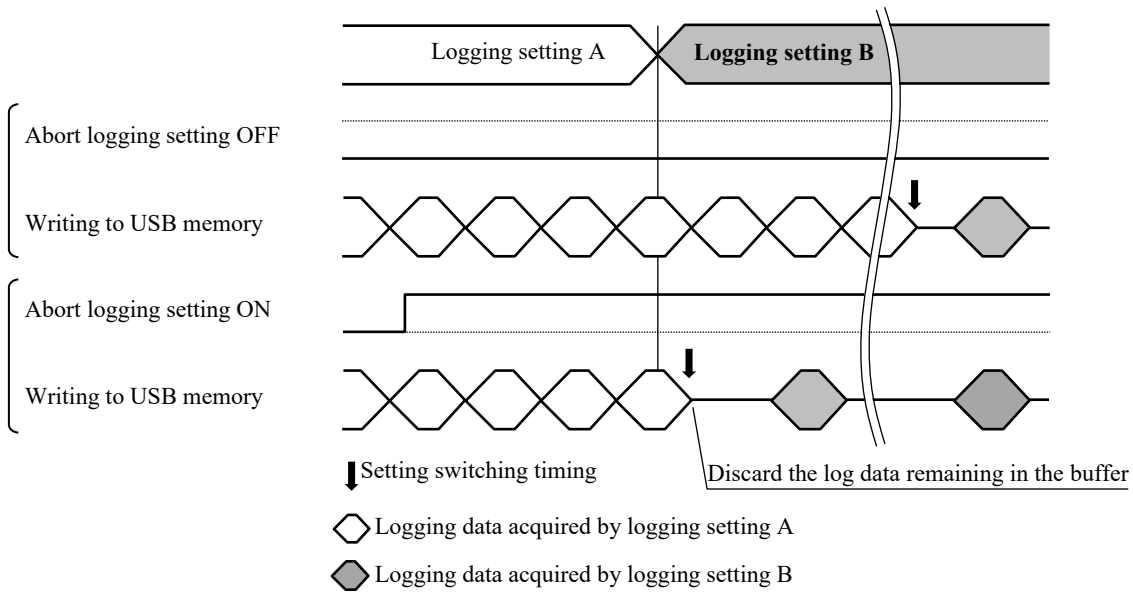
- Data can be logged at the first scan end after turning this bit ON regardless of the logging trigger condition by the setting in the Control Editor.
- If a file on the USB memory is open, turning OFF this bit closes the file. (If there is data to be saved when this bit is OFF, save all to the file and then close the file.)



(b) Abort logging setting / RW

Normally, logging settings are downloaded to MICRO-EHV along with the project, and logging is performed based on these settings. When the logging setting is changed and downloaded, if the log data obtained by the setting before the change remains without being written to the USB memory, it will not be switched to the new logging setting until all the log data is recorded on the USB memory.

By turning ON this bit, the old logging setting can be forcibly terminated and the new logging setting can be used. At this time, the log data that remains in the logging buffer and has not been written to the USB memory is discarded.



(c) Used in system

Do not change the value because it is used by the system.

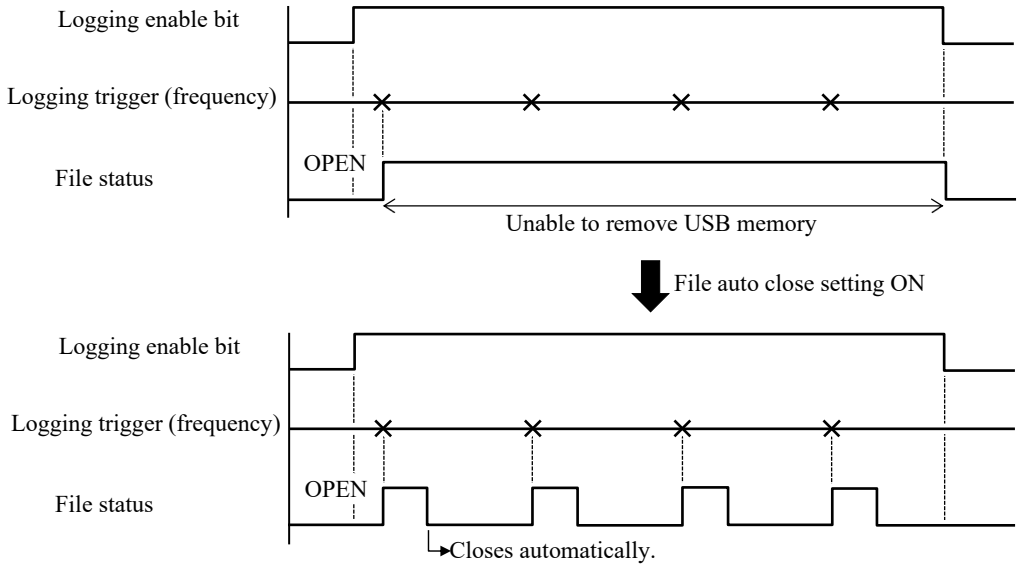
(d) Auto file close setting / RW

When the logging data saving method is appending, the file is closed by the logging enable bit OFF, but by turning ON this bit, the file is closed 60 seconds after opening.

Reference

When appending logging data to a file, the file on the USB memory remains open.

For example, when logging data in a long cycle and appending this log data to a file, the USB memory cannot be removed unless the file is closed (logging enable bit is turned OFF). In this case, it is convenient to turn on this bit and close the file according to time. Even if the file is closed in the system, the system will automatically open the file when the next logging trigger condition is satisfied.



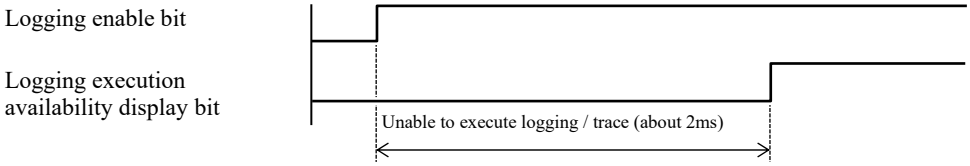
(e) Reserved (unused)

(f) Logging execution availability display / R

This bit turns ON if the MICRO-EHV can execute logging and trace when the Logging enable bit turns ON.

Caution

After the Logging enable bit is turned on, the logging and trace cannot be performed even if an event (cycle, trigger bit ON) for executing the logging and trace occurs until the Logging execution availability display bit turns on.



To ensure that Logging data is recorded using the logging and trace function, use a program that turns on the logging enable bit immediately after the start of RUN and keeps it ON unless the USB memory is removed when the power is turned ON. Recommended.

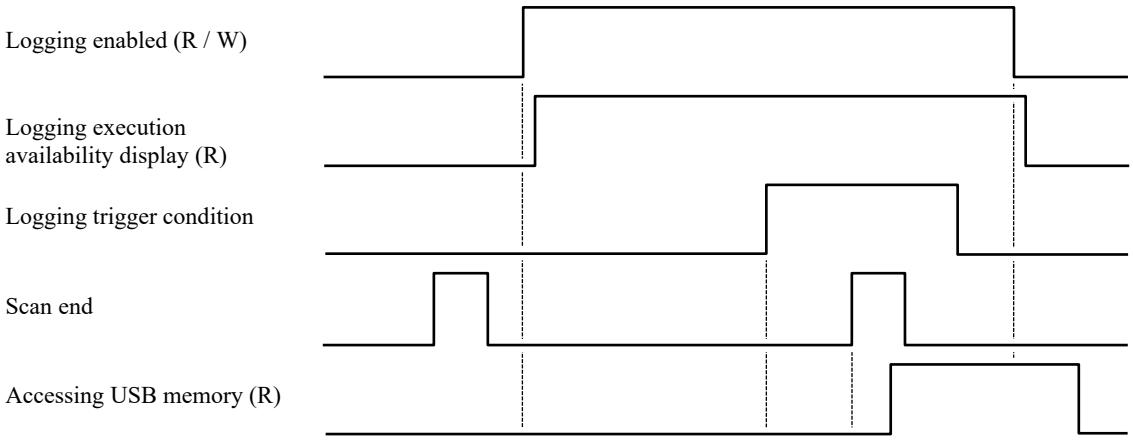
(g) Accessing USB memory / R

This bit turns ON while logging data is being written to the USB memory.

Caution

Logging and trace is performed only during RUN. However, if the CPU is stopped while log data is being written to the USB memory, writing of that log data will continue.

Do not remove the USB memory while this bit is ON even if the CPU is stopped, as this may cause a USB memory failure. (You can also check whether the CPU is accessing the USB memory using the USB memory operation LED.)



(h) Logging error / R

This bit turns ON when the logging buffer of the CPU overflows, and turns OFF when the overflow condition is resolved by saving to the USB memory.

Turns OFF even if the logging buffer is initialized by CPU initialization.

(i) Memory error / R

This bit turns ON if opening / closing of the file or writing to the file fails for some reason, and remains ON until the Usable USB memory is replaced.

(j) Logging and trace setting error / R

This bit turns ON when the information of the logging and trace setting saved in the CPU is corrupted. In this state, logging and trace cannot be executed. Use the Control Editor to reset the settings.

(k) USB memory free space warning / R

This bit turns ON when the free space on the USB memory becomes low. (Refer to page 7-13 for the free space of the USB memory that turns ON this bit.)

We recommend that you replace the USB flash drive as soon as possible.

(l) Reserved (unused)

(2) Word special internal output

You can check the capacity and free space of the USB memory with the word special internal output.

Table 7.2 Word special internal output for logging and trace function

No.	Name	Meaning	hixemp	Set Condition	Reset conditions
WRF0F4	USB memory size (L)	Capacity of USB memory attached to MICRO-EHV	Displays the capacity of the USB memory in kB units.	Set by system	Clear by system
WRF0F5	USB memory size (H)				
WRF0F6	USB memory free space (L)	Free space of USB memory attached to MICRO-EHV	Displays the free space of the USB memory in kB units.	Set by system	Clear by system
WRF0F7	USB memory free space (H)				

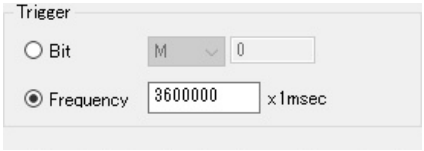
7.8 Logging and Trace usage example

Examples of logging and tracing are shown below.

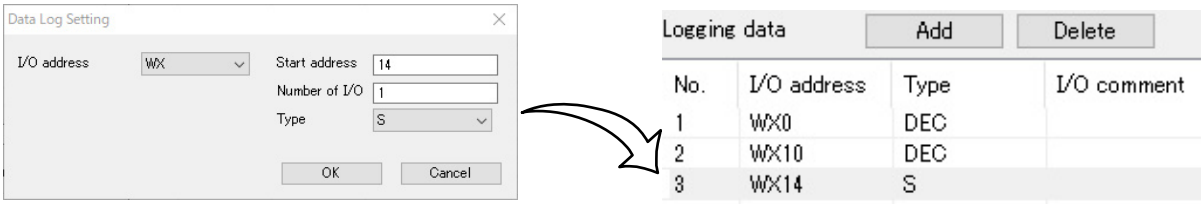
(1) Logging / Record the production amount (counter value) every hour.

Data logging at frequency can be executed only by turning ON the logging enable bit.

(1-1) Set the trigger condition to the Frequency (3,600,000 ms) in the logging group setting.



(1-2) Set the internal output that stores the production amount (counter value) to the logging data.



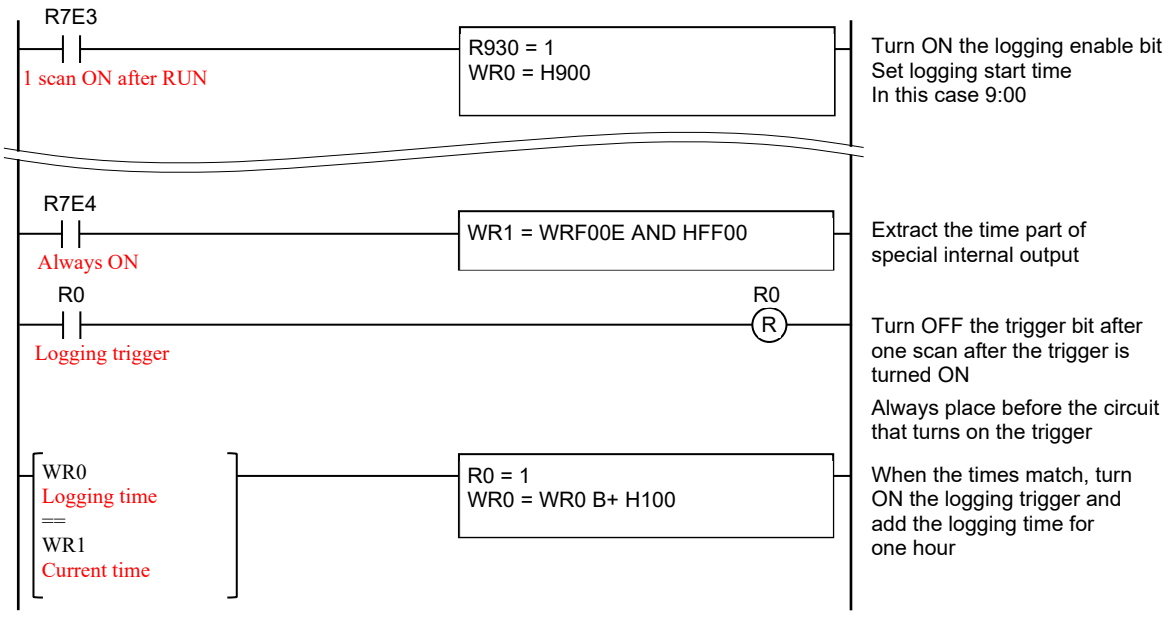
(1-3) Download the project and RUN MICRO-EHV.

Reference

If you want to log every hour at a time (clock data) instead of a frequency, you need a program that turns the trigger bit ON and turns on the trigger bit when the time data changes.

Example, when the logging group is 0, and the trigger is "bit (R0)".

The program to log data at 9 o'clock, 10 o'clock, etc. is shown below. The following program does not assume after 24:00.



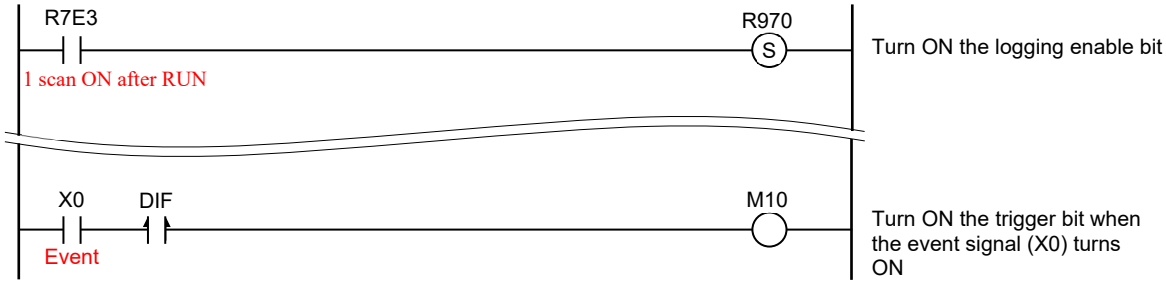
(2) Logging / Record the value of the internal output at the moment when an event occurs (digital input is turned ON).

If the trigger condition is set to bits, a simple program for controlling the trigger bits is required

(2-1) Create a user program.

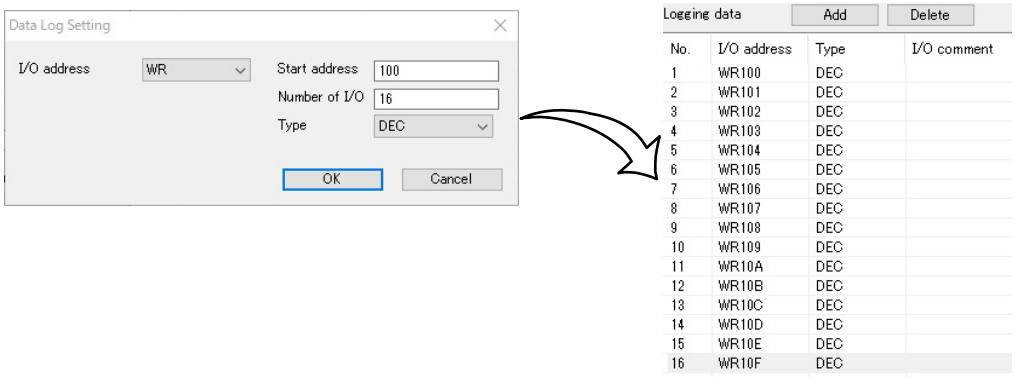
Add a program that turns ON the trigger bit when an event (external input ON) is detected.

(In this example, logging group 4 is used.)



(2-2) Set the trigger condition to bit in the logging group setting. (M10 is used in this example)

(2-3) Set the internal output that records the value at the time of event occurrence to logging data.



(2-4) Download the project and RUN MICRO-EHV.

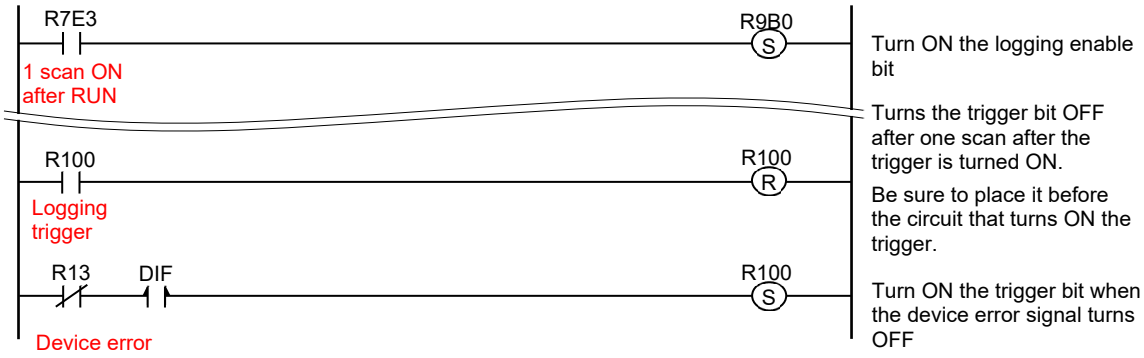
(3) Trace / Record the related signal status before and after the abnormal signal is detected (digital input ON / OFF).

If the trigger condition is set to bits, a simple program for controlling the trigger bits is required.

(3-1) Create a user program.

Added a program that turns ON the trigger bit when an abnormal signal is detected and turns off the trigger bit after one scan

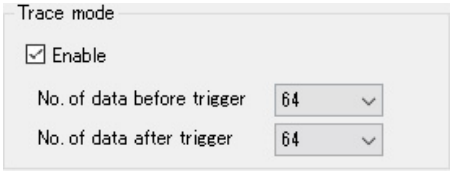
To do. (This example uses logging group 8.)



(3-2) Set the trigger condition to bit in the logging group setting. (R100 is used in this example)

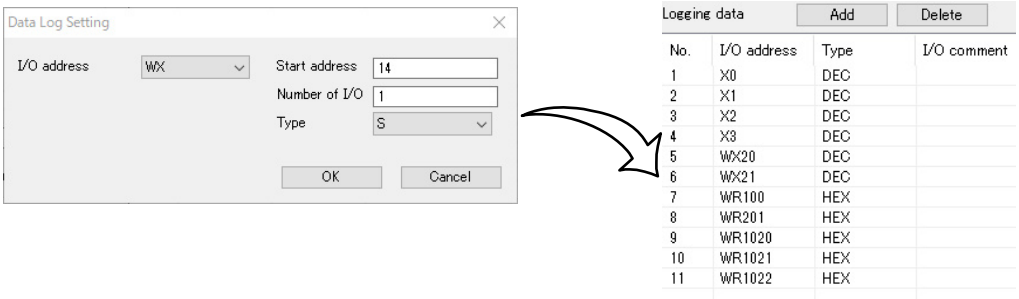
(3-3) Enable trace mode.

If the cause of the error is not exhausted, collect a lot of information by maximizing the number of data before and after the trigger.



(3-4) Set the external I/O and internal output required for error analysis to logging data.

Logging data can be set up to 128 points. Register the data related to the cause of the error without omission.



(3-5) Download the project and RUN MICRO-EHV.

7.9 USB memory attachment or detachment during Logging and Trace

Even if the MICRO-EHV is energized, if the USB memory is not being accessed, the USB memory can be attached and detached regardless of the MICRO-EHV status (RUN/STOP).

(1) Removal

(1-1) Confirm that MICRO-EHV is not accessing the USB memory.

Whether the MICRO-EHV is accessing the USB memory can be checked by the USB memory operation LED on the front of the MICRO-EHV. If the USB memory is removed while the MICRO-EHV is accessing the USB memory, the file in the USB memory may be damaged. Be sure to turn OFF the logging enable bit of the corresponding group and wait until the access to the USB memory is completed.

Reference

When "Updating the file" is selected as the logging data storage method, the file is always open, so the LED display is accessing even if the MICRO-EHV has not written data to the USB memory. In this state, the USB memory cannot be removed.

Logging execution availability display

In such a case, it is convenient to turn ON the "Logging execution availability display" bit in the logging and trace function bit special internal output by a program in advance. (When the Logging execution availability display bit is turned ON, the file is automatically closed 60 seconds after the file is opened. Next, when logging data is acquired, the system automatically opens the file.)

(1-2) Remove the USB memory

(2) Installation

No special precautions should be taken when attaching, but if you turn OFF the logging enable bit when removing it, turn it back ON after attaching the USB memory.

Reference

If the setting is to update and add the log file number, an empty number is searched when a USB memory is attached. If the upper limit number becomes large, it takes time to search for an empty number, so the logging buffer may overflow and data may be missed.

7.10 Abnormal display of Logging and Trace

(1) Self-diagnosis error code

If there is an error in the logging setting information, an error occurs in the special internal output (WRF000) that stores the self-diagnosis error code.

Table 7.3 Error code for logging setting information

Error code	Error name [Detection timing]	Category	Error details	OK LED	Operation	Related special internal output	
						Bit	Word
7C	Logging setting information undefined [At power ON]	Warning	Detected a sum error in the logging setting information stored in MICRO-EHV.	☀	RUN	–	–

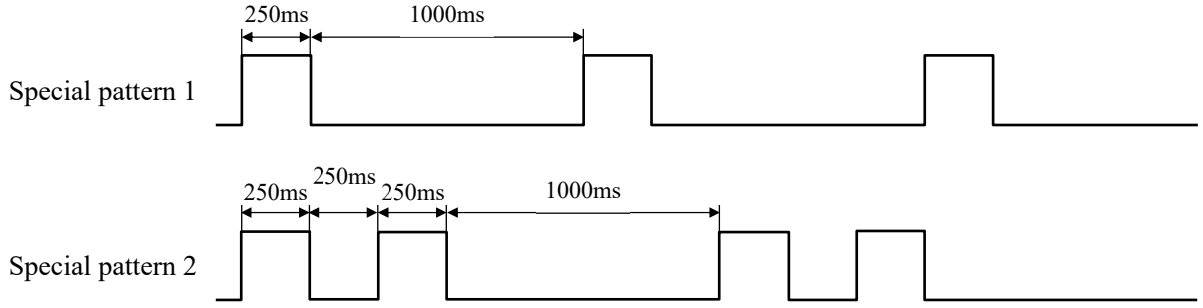
: 2s OFF/2s ON

(2) USB memory operation LED display

If an error occurs while saving the logging and trace data to the USB memory, the error factor is displayed on the USB memory operation LED.

Table 7.4 Logging and Trace Error LED Display

LED display		Meaning of display
Lighting	○	USB memory is inserted.
Turning off	●	USB memory is not inserted.
Blinking (0.5s interval)	○●	Accessing USB memory. Do not remove the USB memory from the main unit while accessing the USB memory. (It may not be possible to read the file from the USB memory on the PC.)
Blinking (Special pattern 1)	○▬ (See the figure below)	File open failure
Blinking (Special pattern 2)	○●○▬ (See the figure below)	File write failure File close failure



Caution

If the logging setting is set to "New file created in every logging", MICRO-EHV will immediately turn on the USB memory operation LED when the file writing process to the USB memory is completed. If the file writing time is short, the display during USB memory access may not have the above blinking pattern.

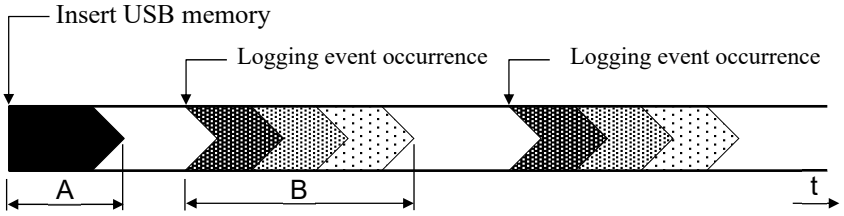
Make sure that the USB memory operation LED is completely lit before removing the USB memory.

7.11 Logging and Trace function usage notes

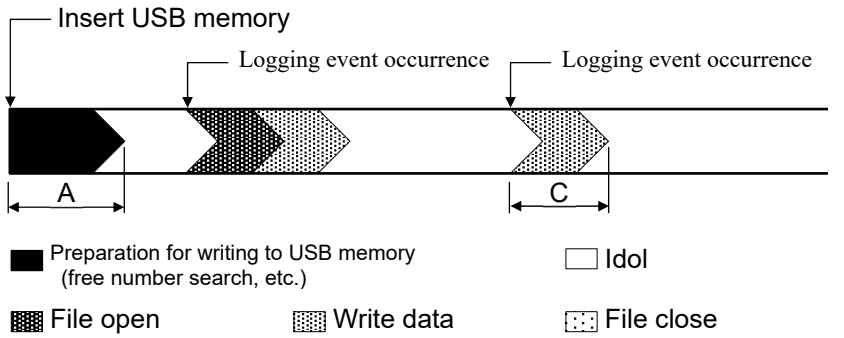
(1) Writing time to USB memory

When writing logging and trace data to USB memory. The time until the USB memory becomes usable or the time to complete the log data changes depending on the number of files already saved, the length of the file name, and the number of logging groups used. The figure below shows the process for USB memory.

When New file created in every logging



When Updating the file



For example, processing B is processing for the USB memory when they performed logging by setting to generate a file at every logging, but the logging data are stored in a buffer in MICRO-EHV when a logging event occurs newly before processing B completes itIf the state where the next logging event occurs continues for a long time before the log data has been written to the USB memory, the buffer overflows and the expected log data cannot be obtained.

The following pages provide guidelines for each of the processes A, B, and C. Take measures such as reducing the frequency of logging execution or replacing the USB memory frequently according to the conditions to be used.

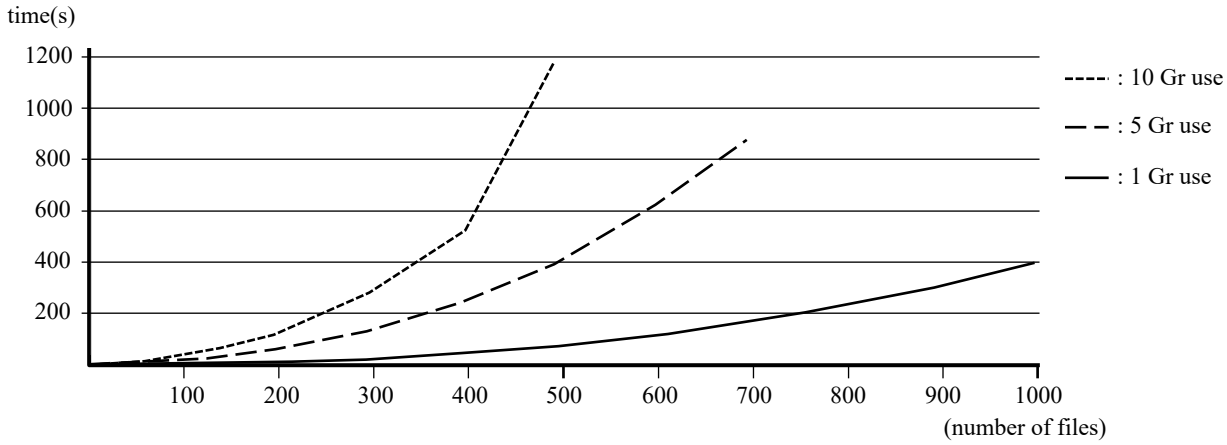
Reference

The time until writing is possible and the writing time vary depending on the manufacturer and capacity of the USB memory.

USB memory with a small capacity will be shorter in the writable time and the writing time.

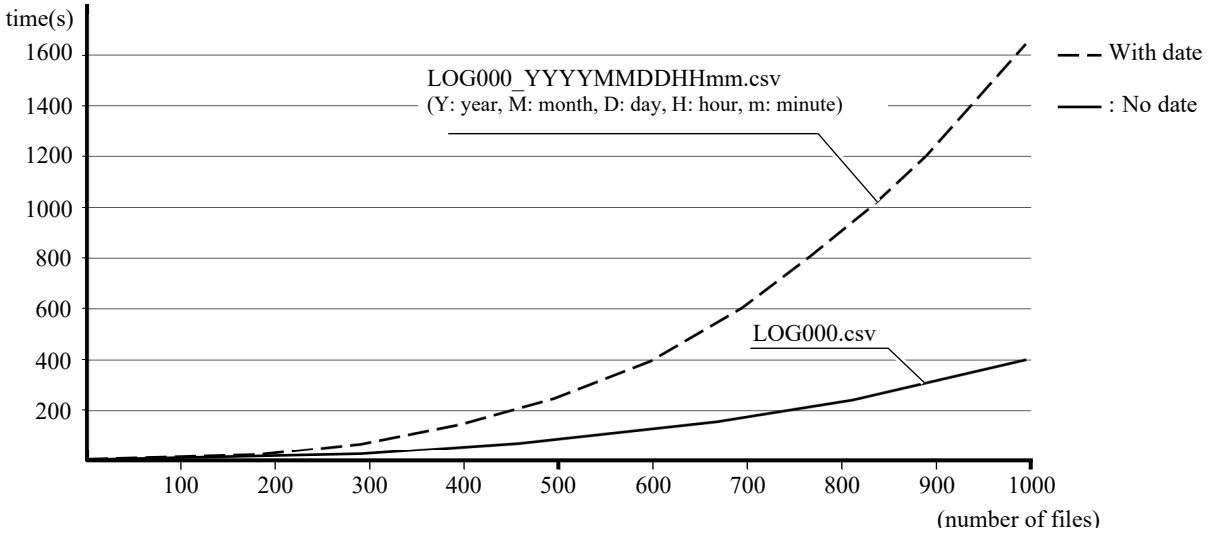
A : Difference in processing time depending on the number of files in USB memory

When the USB memory is attached, MICRO-EHV searches for the free number of the file to write the next log data. Therefore, if there are many past log files in the attached USB memory, it will take some time before the files can be written.



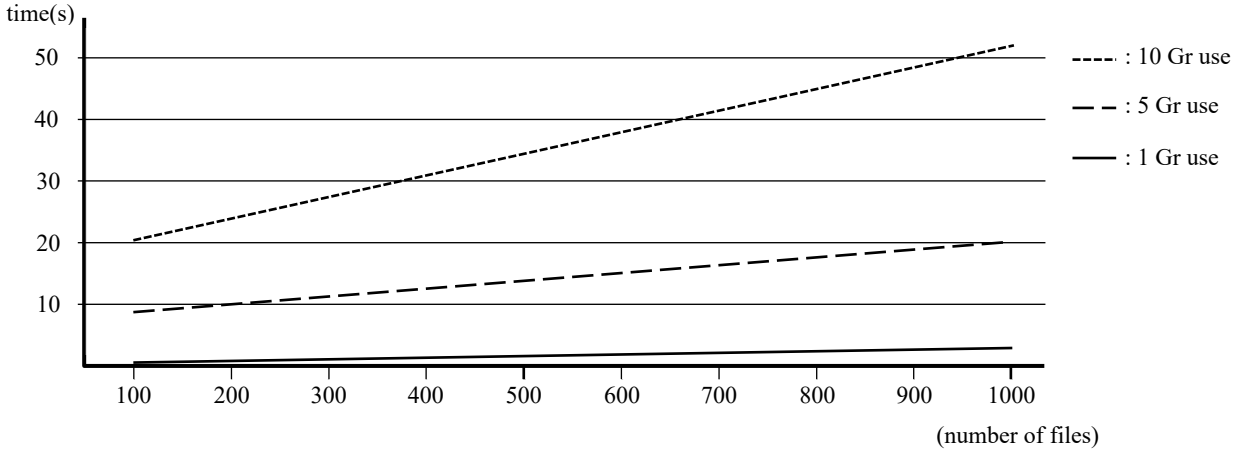
B : Difference in processing time depending on file name length (using one group)

If you register a long file name, it will take some time before the file can be written to the USB memory.



C : Difference in processing time depending on the number of files in USB memory

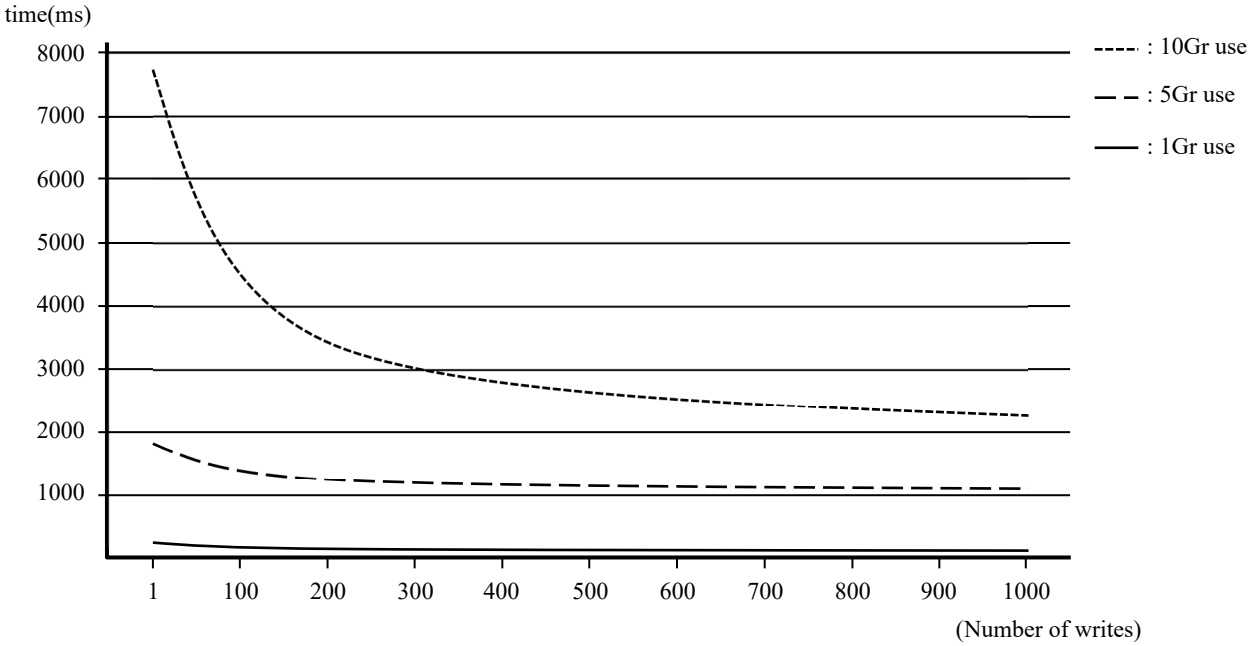
If there are many past log files in the USB memory, it will take some time to complete writing the files.



D : Difference in processing time depending on the number of files in USB memory

When appending log data to a file, the first write takes time, but subsequent write times do not change much.

If multiple groups are registered, interference will occur between the groups and the write time will increase, but if the log data collection timing of each group is completely different (no interference occurs), the write time will be as shown in the graph below Shorter.



(2) Impact of logging and trace function on scan

Recording to the logging buffer is performed at the scan end, and writing to the USB memory is performed by system processing.

- If multiple triggers occur simultaneously, the scan end time will be extended. (The scan time is extended.)
- When writing multiple data to USB memory, it does not affect the scan time, but it takes time to complete writing to USB memory. In system processing, processing other than writing to the USB memory (communication with external devices, self-diagnosis, etc.) is also performed. For example, when the communication load is high, writing to the USB memory takes time.

(3) Online change in RUN

- The setting of the logging and trace function can be Online change in RUN, but cannot be changed if the group to be changed is executing logging. Stop logging once and change it.
- Online change in RUN is performed at the scan end as well as recording to the logging buffer. Executing the change during RUN will slow down the execution of the logging and trace.

(4) Power OFF, USB memory reseat

Make sure that the USB memory LED is on or off before removing the USB memory. If the MICRO-EHV is removed while the USB memory is being accessed (while the USB memory operation LED is blinking), all data in the USB memory will be destroyed, and the USB memory may not be recognized by the PC as well as the MICRO-EHV
Also, do not turn OFF the MICRO-EHV while the CPU is accessing the USB memory.

(Note that logging and trace is executed only during RUN, but access to the USB memory may continue for a while even if the CPU is stopped.)

Reference

A USB memory that has failed to be removed and is no longer recognized can be used again by formatting it on a PC. However, data remaining in the USB memory will be lost due to formatting

(5) Restrictions on available characters

- Character string in CSV file (I/O comment) … "," cannot be used.
- File name string … The following characters cannot be used.

  12 characters * / < > ? ¥ | % , : ; “

  7 double-byte characters ／ ： ？ ￥ ＊ ［ ］

  NEC special characters(H8740 to H879C)①, ㌢, ℡, etc.

  NEC selected IBM extended characters(HED40 to HEEFC)

  IBM selected IBM extended characters(HFA40 to HFC4B)

(6) CSV file

- If "E" or "e" is included in the saved data, the value may be treated as an exponent if edited with PC spreadsheet software.
- If the data format to save is ASCII, add "" (double quotation) before and after the data. However, if control characters are included in the ASCII code, data may be shifted when a CSV file is opened on a PC.

MEMO

Chapter 8　Simplified Positioning Function

This function is supported from software Ver.x120. To use this function, the Control Editor of Ver.5.00 or newer is required.

8.1　Overview

A function has been added to enable simplified positioning control than software Ver.x120. The main improvements are as follows.

(1) Homing return command support

The axis controlled by pulse output can perform homing return simply by executing the homing return command. Since there is no need to monitor the input signal and control the pulse output, the program can be simplified.

(2) "Absolute position" added to pulse output control instruction

The target position of pulse output can be specified by "absolute position". Since it is an absolute position specification, there is no need to calculate in which direction and how much to move from the current position when moving the axis.

(3) Supports jog operation and inching operation

Jog and inching operation are possible from Control Editor. You can actually check the target position by moving the axis. By executing jog and inching operations, external wiring can be checked smoothly.

(4) Interlocking with 2-phase counter

The actual position can be known by connecting the feedback pulse from the encoder to the 2-phase counter. When homing return is performed, the current position of the counter is automatically set to 0 after the homing return is completed.

Caution

There is no function to correct the output pulse according to the feedback pulse.

By using this function, an application as shown below can be constructed

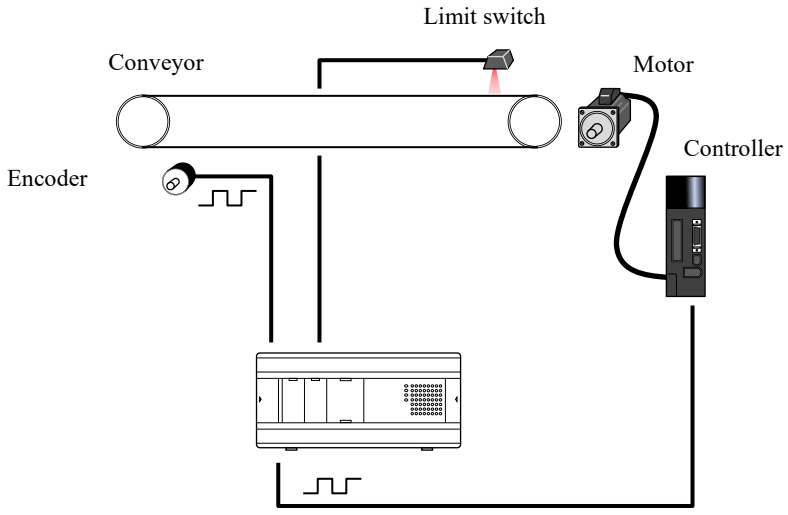
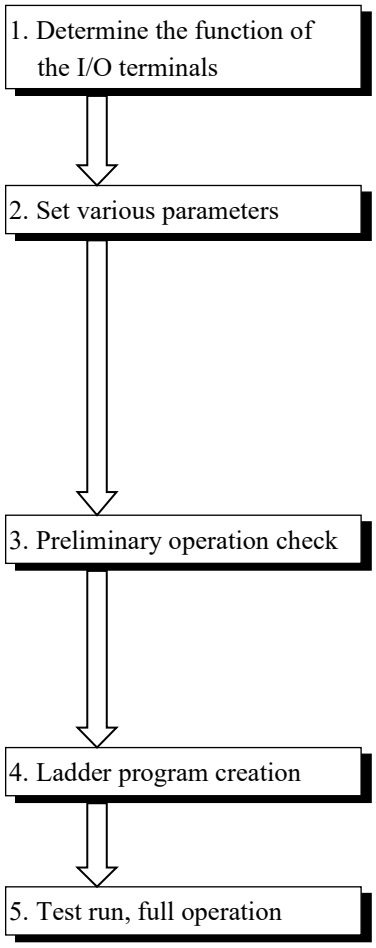


Figure 8.1 Application example using simplified positioning function

8.2 Procedure for simplified positioning control

The following figure shows the flow for performing simplified positioning control.



Determine the input/output terminals used for simplified positioning control, and register the function of each terminal on the I/O configuration window (special I/O) of the Control Editor.

Set the homing return mode, the parameters used for the homing return operation, and the pulse output parameters used for the trial run.

Caution

When controlling with a user program, use the values set here for the parameters related to homing return.
(It cannot be changed in the user program.)

Pulses can be output with the parameters set in 2. in the dedicated window of the Control Editor.

Use it to check the position, check the moving speed, and check the operation homing return.

Create a ladder program for positioning operation using the counter input control command, pulse output command, and r homing return command.

Execute the user program, correct the parameters and user program as necessary, and full operation.

Figure 8.2 Flow for creating a simplified positioning application

8.3 I/O terminal settings

Select [Tool]-[Parameter setting]-[I/O Configurations] of Control Editor, and click the special I/O tab to display the special I/O setting window. .

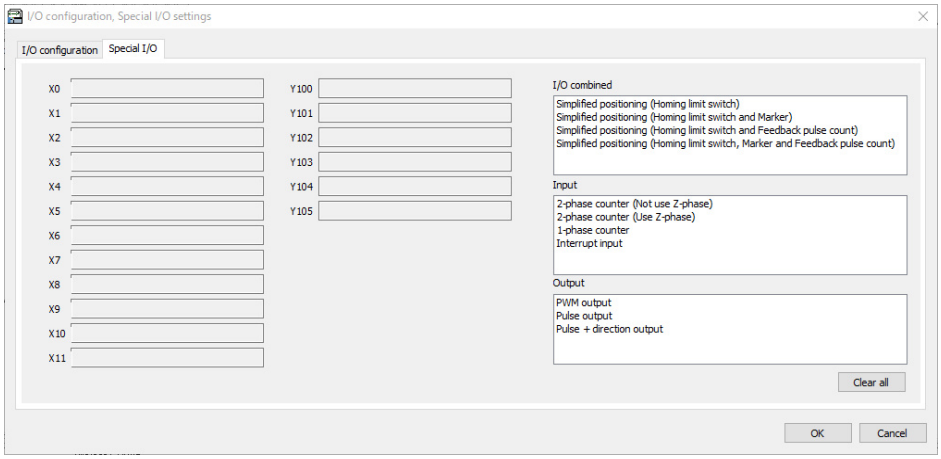
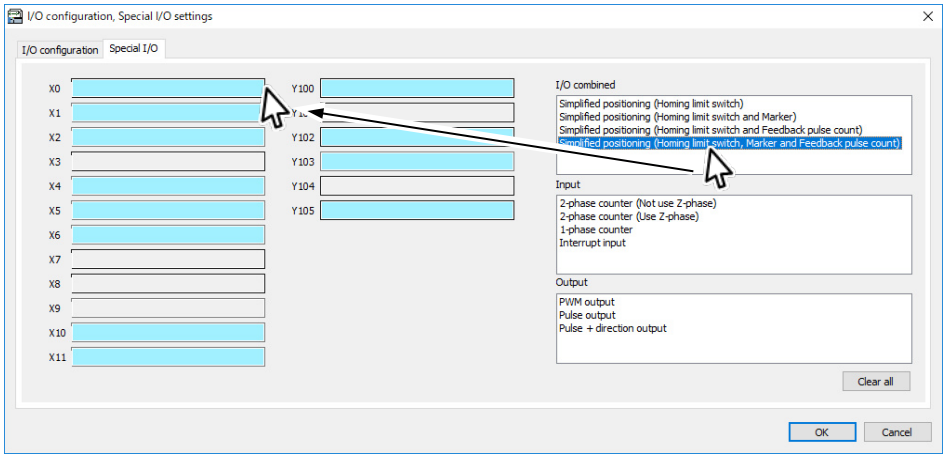


Figure 8.3 Special I/O setting window

When performing simplified positioning control, select the function from the I/O combined on the right side of the window.



Move the mouse cursor to the I/O combined area and select the input/output function to be used. The color of the I/O frame that can be set changes. If you drag the function with the mouse and drop it in the frame where the color has changed, the dropped function is assigned to that I/O.

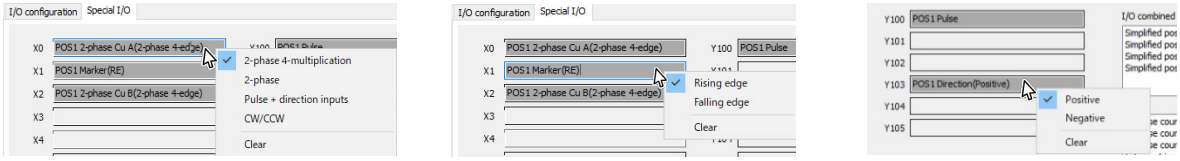
After dropping, a window for confirming whether to assign functions is displayed. If you select "YES", the simplified positioning parameter setting window will be displayed. The simplified positioning parameter setting window will be described in detail in the next chapter, so please refer to that.

Reference

If you double-click on the special I/O, the function will be assigned to the vacant numbers in order from X0.

⚠ Caution

The I/O combined setting can be set only with Control Editor of Ver.5.00 or newer. If you edit a project that contains I/O combined settings with Control Editor Ver.4.21 or older, the special I/O settings may be forcibly changed. When using the I/O combined setting, be sure to use Control Editor Ver.5.00 or newer.

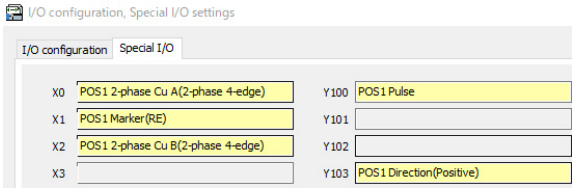


Move the mouse cursor to the frame to which the function is assigned and right-click to display the special I/O individual setting menu, where you can change the parameters.

The assignment can be canceled for each terminal from this menu. (Clicking the Clear All button at the bottom right of the setting window releases all special I/O assignments.)

Reference

If the parameters have not been set in the simplified positioning parameter setting window, move the mouse cursor to the frame to which the function is assigned and right-click to display the inside of the frame in yellow.



The I/O terminal to be assigned to simplified positioning function is determined according to the side of selecting the function. The following table shows the selection items and the I/O terminals used.

Table 8.1 Selection items and application of input/output terminals

Item	Purpose	Ch1	Ch2	Ch3
Simplified positioning (Homing limit switch)	LS	X1	X3	X5
	PLS	Y100	Y101	Y102
	D	Y103	Y104	Y105
Simplified positioning (Homing limit switch, marker)	LS	X8	X9	X10
	MK	X1	X3	X5
	PLS	Y100	Y101	Y102
	D	Y103	Y104	Y105
Simplified positioning (Homing limit switch, feedback pulse count)	LS	X1	—	X5
	CU	X0, X2	—	X4, X6
	PLS	Y100	—	Y102
	D	Y103	—	Y105
Simplified positioning (Homing limit switch, marker, feedback pulse count)	LS	X10	—	X11
	MK	X1	—	X5
	CU	X0, X2	—	X4, X6
	PLS	Y100	—	Y102
	D	Y103	—	Y105

LS: Homing limit switch input, MK: Marker input, CU: Counter input, PLS: Pulse output, D: Direction signal

Reference

If even simplified positioning control does not require homing return, it can be realized by pulse output or pulse output + direction signal. Unless the I/O combined function is selected, the input terminals can be used for other purposes.

8.4 Parameter settings

Parameters for homing return, jog, and inching operation are called simplified positioning parameters.

These parameters must be set in advance (before pulse output).

The simplified positioning parameters can be set and changed from the simplified positioning parameter setting window shown below.

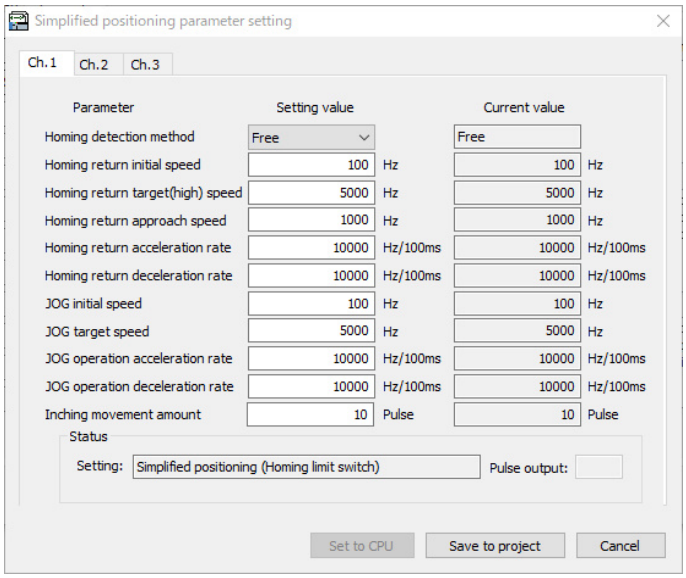


Figure 8.4 Simplified positioning parameter setting window

Starting the simplified positioning parameter setting window

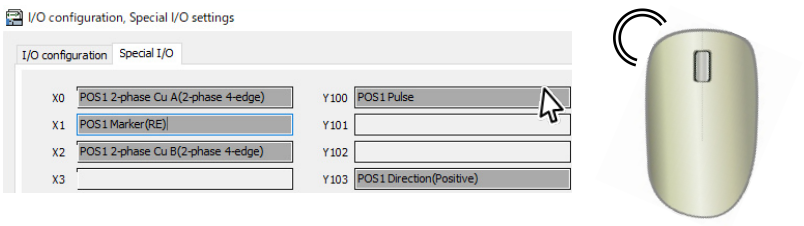
(1) When setting I/O terminals

Starts when a function that requires simplified positioning parameters is assigned to the I/O terminal.

If the parameters have already been determined, set them here.

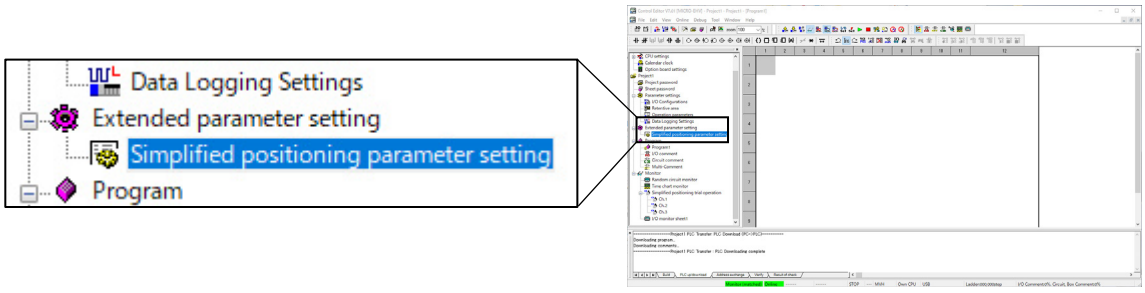
(2) After the input/output terminal function is determined part1

Open the special I/O setting window, move the mouse cursor to the currently assigned function section, and double-click to start.



(3) After the input/output terminal function is determined part2

Select [Tool]-[Extended parameter setting]-[Simplified positioning parameter setting] in the Control Editor, or double-click “Simplified positioning parameter setting " in the project tree.



How to set simplified positioning parameters

Set the parameters shown in the table below. For details of each parameter, see the explanation page in the right column of the table.

Table 8.2 List of simplified positioning parameters

No.	Parameter	Setting value	Explanation page
1	Homing detection method [initial value: Free]	Select the homing mode to use from the following four modes. - Free - High SP1 - High SP2 - Low SP1	P8-7 to 11
2	Homing return initial speed [initial value:20 Hz]	20 to 65,535 (Hz) Adjust so that homing rerun target speed ≥ approach speed ≥ initial speed.	P8-9 to 11
3	Homing return target(high) speed [initial value:20 Hz]	20 to 100,000 (Hz) Adjust so that homing rerun target speed ≥ approach speed ≥ initial speed.	P8-9 to 11
4	Homing return approach speed [initial value:20 Hz]	20 to 65,535 (Hz) Adjust so that homing rerun target speed ≥ approach speed ≥ initial speed.	P8-9 to 11
5	Homing return target(high) speed [initial value:1 Hz/100 ms]	1 to 65,535 (Hz/100 ms)	P8-9 to 11
6	Homing return acceleration rate [initial value:1 Hz/100 ms]	1 to 65,535 (Hz/100 ms)	P8-9 to 11
7	JOG initial speed [initial value:20 Hz]	20 to 65,535 (Hz) Adjust so that JOG target speed ≥ JOG initial speed.	P8-12, 13
8	JOG target speed [initial value:20 Hz]	20 to 100,000 (Hz) Adjust so that JOG target speed ≥ JOG initial speed.	P8-12
9	JOG operation acceleration rate [initial value:1 Hz/100 ms]	1 to 65,535 (Hz/100 ms)	P8-12
10	JOG operation deceleration rate [initial value:1 Hz/100 ms]	1 to 65,535 (Hz/100 ms)	P8-12
11	Inching movement amount [initial value:1 pulse]	1 to 65,535 (pulse)	P8-13

After completing parameter input, press the Set to CPU or Save to project button at the bottom of the simplified parameter setting window.

Set to CPU… Set the input parameters to MICRO-EHV and save them in the project file. It can be used only when the Control Editor is connected online.

Save to project… Saves the set parameters in a project file. The set parameters are set to MICRO-EHV by performing a Download (PC to PLC).

Cancel… Discards the entered parameters and closes the simplified parameter setting window.

8.5 Homing return operation

" Homing Return " means returning the axis position to the origin. If you move the axis while the MICRO-EHV is not controlling or turn OFF the power while the axis is moving, the position information stored by the MICRO-EHV will not match the actual position. In such a case, it is necessary to perform homing return to match the position information in MICRO-EHV with the actual position.

MICRO-EHV has four types of homing return, so select the one that is suitable for your application.

8.5.1 Free homing

Free homing return is homing return that sets the current axis position to 0.

The axis does not move even if the free homing return is executed.

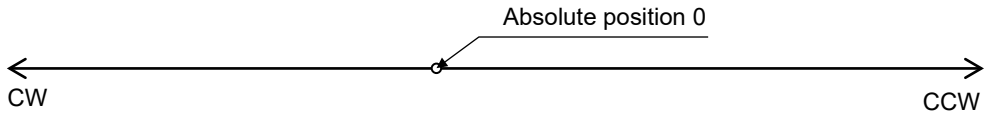


Figure 8.5 Free homing return operation

8.5.2 High-speed homing (Marker stop 1)

High-speed homing return is a homing return method that moves at a high speed in the specified direction, then changes the speed to a low speed and stops.

High precision homing return is possible in a short time because it can move to near the home position at high speed. For “Marker stop 1”, the position where marker input is turned ON immediately after the homing limit switch changes from ON to OFF is defined as the origin (absolute position 0).

Locus of high-speed homing return (marker stop 1)

Figures 8.6 and 8.7 show the locus when high-speed homing return (marker stop 1) is executed in the CCW direction.

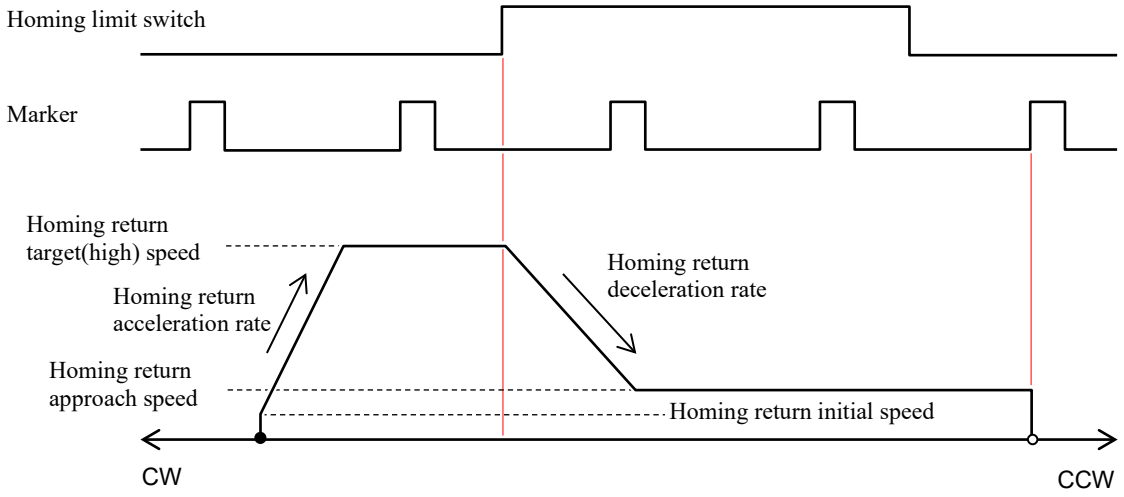


Figure 8.6 High-speed homing return (marker stop 1) Operation 1

As it becomes the stop from the homing return approach speed at the time of the stop, please regulate the homing return approach speed with suddenly stopping it so that there is not it.

When performing homing return, if the axis position is at the homing limit switch ON, the axis will move in the opposite direction to the specified homing return direction.

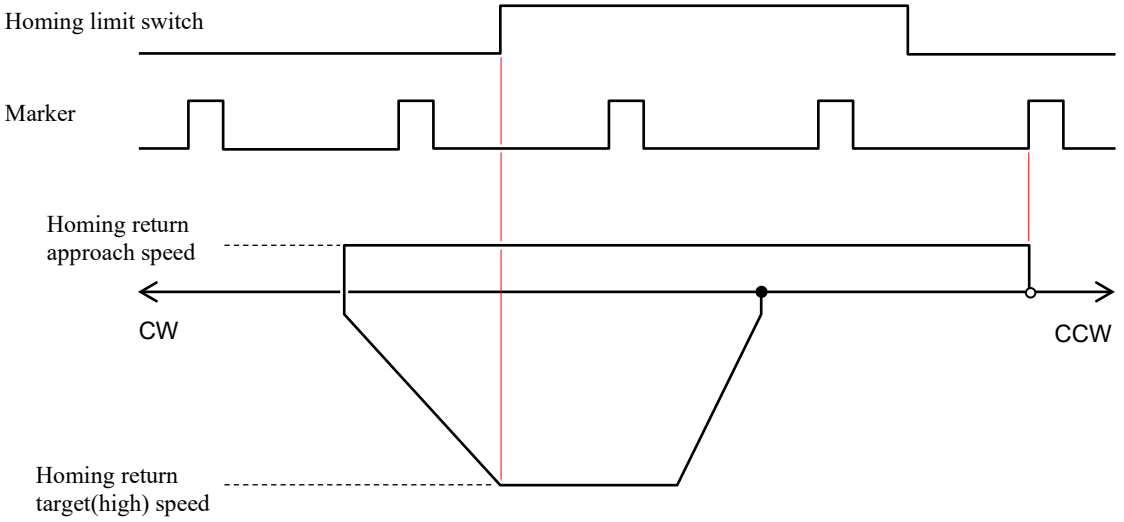


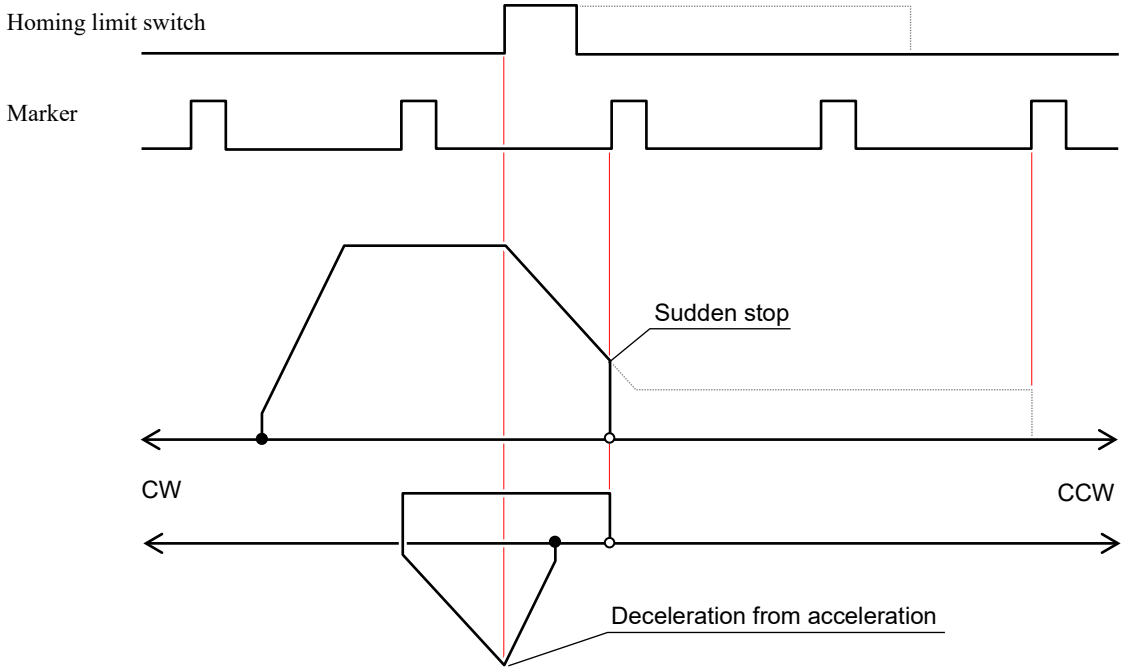
Figure 8.7 High-speed Homing return (Marker Stop 1) Operation 2

When moving in the direction of the home position, the homing return approach speed is used from the start. Set the parameters so that the motor does not step out.

Caution

In high-speed homing return (marker stop 1), marker input ON after the homing limit switch changes to OFF triggers and stops.

If the time for turning on the homing limit switch is extremely short or if the homing return deceleration rate is small, a sudden stop may occur during deceleration.



In such a case, lower the homing return target(high) speed or increase the homing return deceleration rate so that the motor does not step out.

8.5.3 High-speed homing (Marker stop 2)

High-speed homing return is a homing return method that moves at a high speed in the specified direction, then changes the speed to a low speed and stops. High precision homing return is possible in a short time because it can move to near the origin at high speed.

For “Marker stop 2”, the position where marker input is turned ON immediately after the homing return limit switch is turned ON is set as the home position (absolute position 0).

When homing return is started, the axis stops after moving back and forth near the home position, so it appears to be performing useless operation. However, this operation realizes high-speed and accurate homing return.

Locus of high-speed homing return (marker stop 2)

Figures 8.8 and 8.9 show the locus when high-speed homing return(marker stop 2) is performed in the CCW direction.

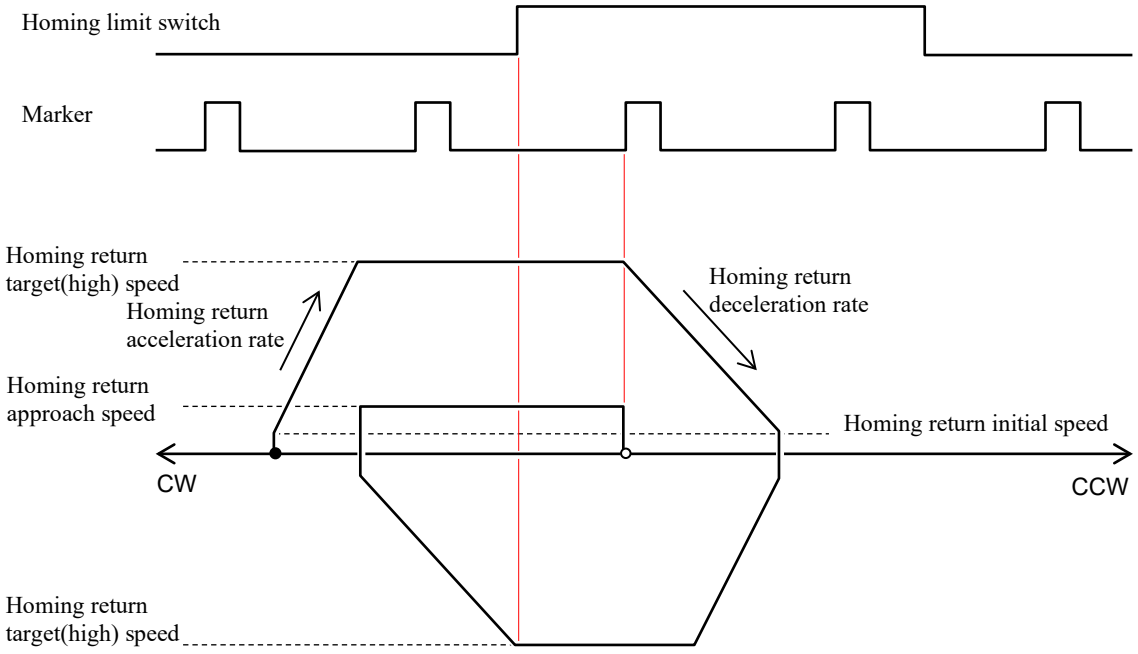


Figure 8.8 High-speed homing return (marker stop 2) Operation 1

When performing homing return, if the axis position is at the homing limit switch ON, the axis will move in the opposite direction to the specified homing return direction.

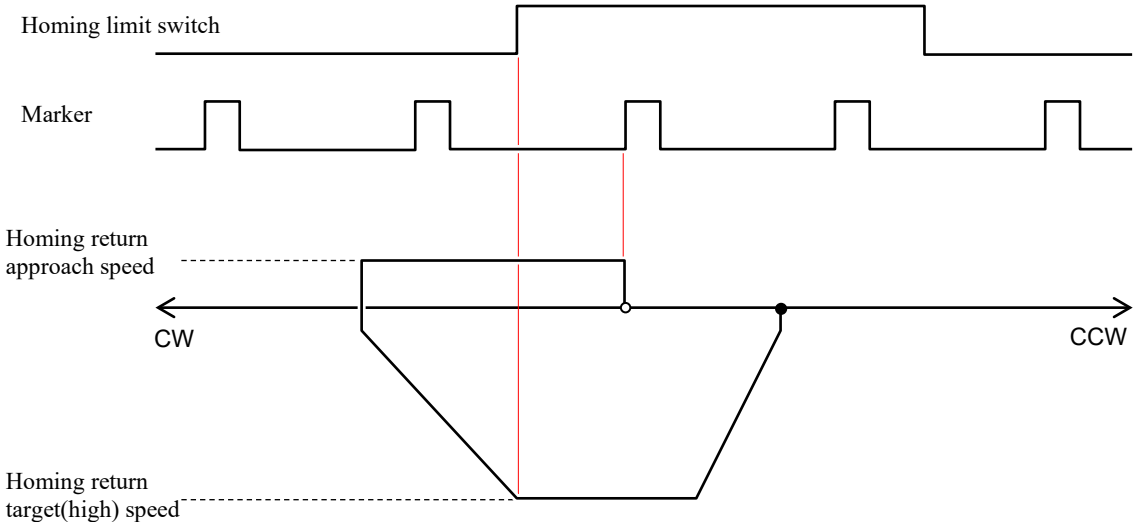


Figure 8.9 High-speed homing return (marker stop 2) Operation 1

8.5.4 Low-speed homing (home limit switch stop)

Low-speed homing return is a homing return method that moves at a low speed in the specified direction and stops. Since the moving speed is constant, it may take some time to complete homing return depending on the axis position and homing return speed setting during homing return, but homing return is possible with only one input of the homing limit switch.

"Homing limit switch stop" sets the position where the homing limit switch is ON to the homing (absolute position 0).

Locus of low-speed homing return (homing limit switch stop)

Figures 8.10 and 8.11 show the trajectories when high-speed homing return (marker stop 2) is executed in the CCW direction.

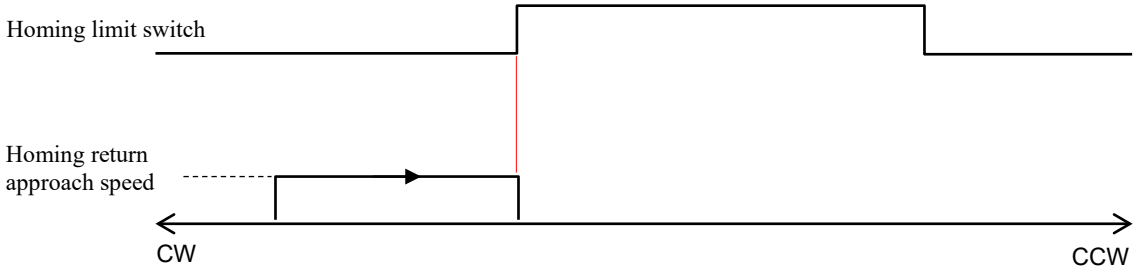


Figure 8.10 Low-speed homing return (homing limit switch stop) Operation 1

When performing homing return, if the axis position is at the homing limit switch ON, the axis will move in the opposite direction to the specified homing return direction.

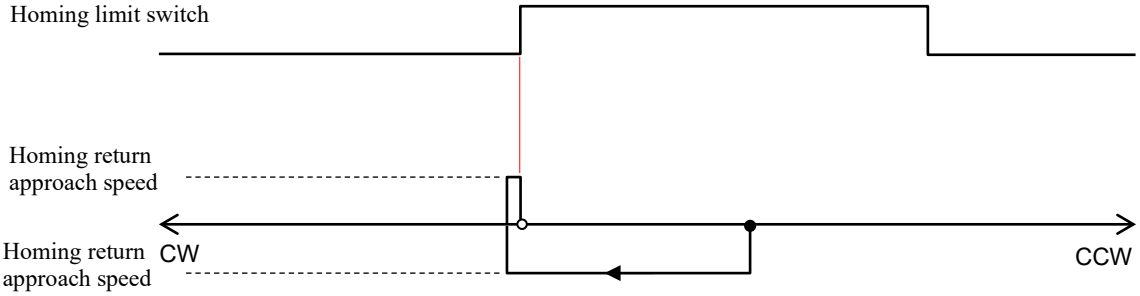


Figure 8.11 Low-speed homing return (homing limit switch stop) Operation 2

Caution

In the case of low-speed homing return, the actuator moves at the homing return approach speed without acceleration / deceleration, and stops where the homing limit switch is turned ON. Increasing the homing return approach speed can shorten the time until completion of homing return, but be aware that the motor may step out or an error may occur in the home position.

8.6 JOG operation

Jog operation is a function that outputs and stops pulses by operating from the Control Editor without determining the target position. JOG operation allows you to check the wiring with external devices and find out the approximate number of pulses corresponding to the target position. JOG operation cannot be started by the user program.
Start from the dedicated window of Control Editor. (Refer to “8.8 Preliminary operation check” for the dedicated window for performing jog operation.)

JOG operation

When jog operation is started in Control Editor, MICRO-EHV outputs a pulse in the specified direction.
The MICRO-EHV continues to output pulses until the Control Editor instructs to stop the jog operation, and when it receives a command to stop the jog operation, it decelerates to a stop. Also, if a forced stop is instructed from the Control Editor, it will stop suddenly.

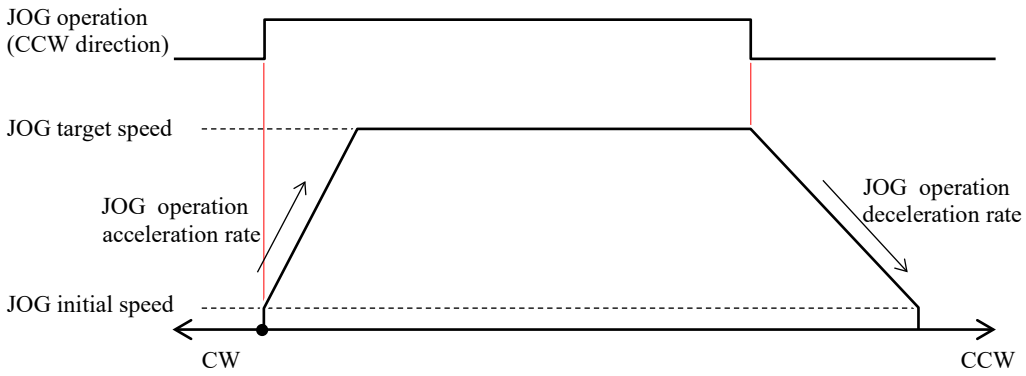


Figure 8.12 Moving by JOG operation

Caution

- JOG operation can be performed while the MICRO-EHV is stopped or running, but cannot be executed when the specified axis is outputting pulses.
- In JOG operation, deceleration stop is possible even if the output pulse is accelerating. However, if the operation that decelerates and stops during acceleration while operating multiple channels at the same time, the number of output pulses may not match the number of pulses actually output. Therefore, operate one channel at a time.

8.7 Inching operation

Inching operation is an operation that outputs a preset number of pulses in one operation. When checking the target position by moving the axis of the actual system, the number of pulses for the target position can be accurately checked by moving to a rough position by jog operation and finely adjusting by inching operation.
Inching operation cannot be started by the user program. Start from the dedicated window of Control Editor. (Refer to "8.8 Preliminary operation check" for the dedicated window for inching operation.)

Inching operation

When inching operation is started with Control Editor, MICRO-EHV outputs the preset number of pulses in the specified direction and stops.
In addition, if the forced stop is instructed from the Control Editor, it will stop suddenly even if the number of output pulses is less than the set number of pulses.

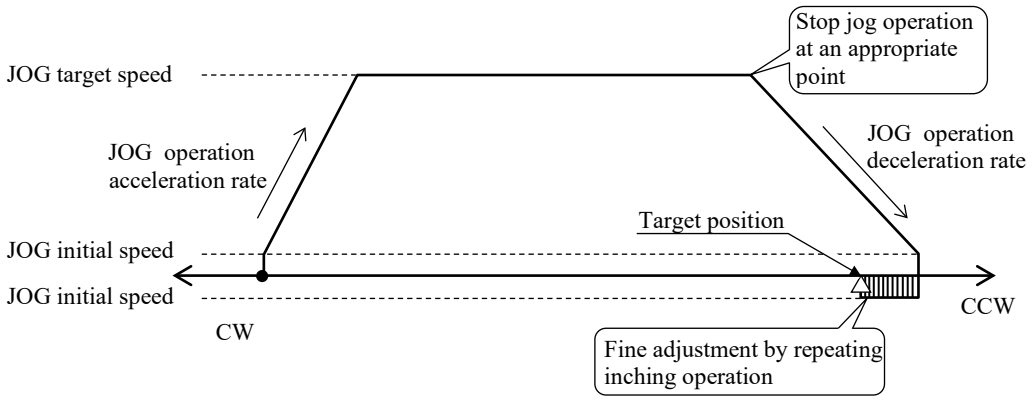


Figure 8.13 Combination of jog operation and inching operation

The speed specified as the initial speed for jog operation is the moving speed for inching operation.

8.8 Preliminary operation check

MICRO-EHV software Ver.x120 or newer allows you to check the pulse output operation without a user program by using it in combination with Control Editor Ver.5.00 or newer.

If steps 1. and 2. described in “Section 8.2 Procedure for simplified positioning control” are completed, you can check the pulse output operation in the simplified positioning trial operation window.

Starting the simplified positioning trial operation window

Select [View]-[simplified positioning trial operation] and specify the channel number you want to check, or double-click the icon of the channel number you want to check from "simplified positioning parameter setting" in the project tree.

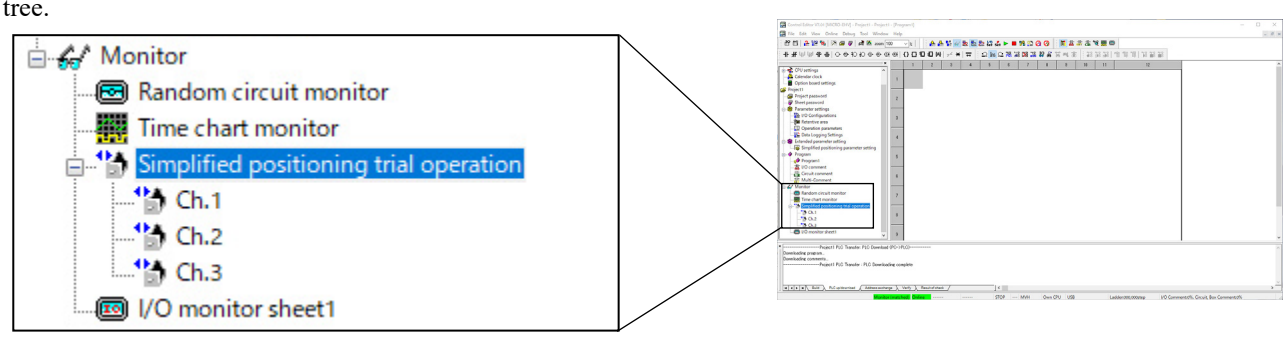


Figure 8.14 Starting the simplified positioning trial operation Window

The simplified positioning trail operation window shown below starts.

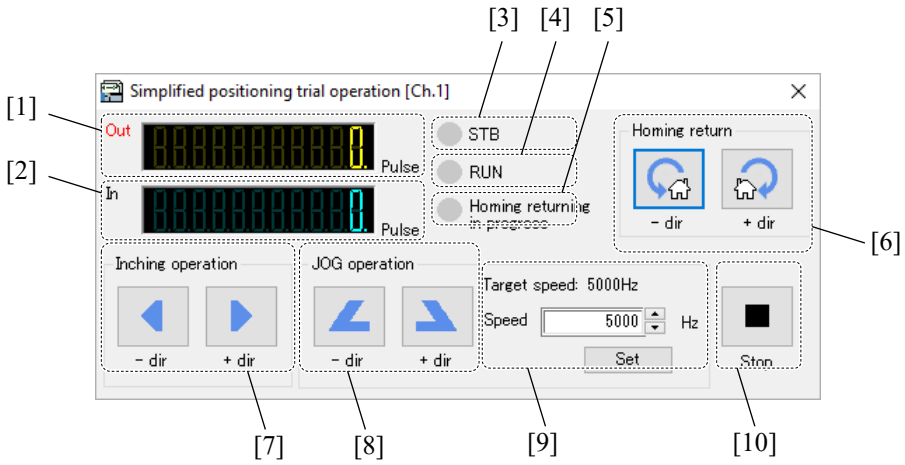


Figure 8.15 Simplified positioning trail operation Window

The buttons and display contents of the simplified positioning trail operation window are shown in the table on the next page.

Table 8.3 Simplified positioning trial operation window [Display contents and operation method]

No.	Name	Display contents / Operation method
1	Output pulse number display	Displays the number of pulses output from the channel corresponding to the window.
2	Input pulse number display	Displays the number of pulses input to the channel corresponding to the window.
3	Axis status (STB)	Indicates whether the channel corresponding to the window is aware of the current location. Lights up green when homing return is completed. Turns OFF when pulse output is stopped by the CPU RUN/STOP or PLSTP / PLSTPR instruction, or when the PLSPD / PLSPDR instruction is executed. Caution If this display is turned off, it means that the MICRO-EHV has not recognized the current position correctly. It is recommended to return to the home position again before starting the positioning operation.
4	Axis status (RUN)	Indicates that the channel corresponding to the window is outputting pulses. Lights up green during pulse output, and goes out during stop.
5	Axis status (homing returning in progress)	Indicates that the channel corresponding to the window is homing returning. Lights up green during homing return, and goes out during stop or operation other than homing return.
6	Start homing return	Press the – dir button to return to the origin in the CW direction. Press the + dir button to return to the origin in the CCW direction. Caution ・If you press the Stop button, it will stop suddenly even during homing return operation. In this case, the standby LED does not light. ・When "free homing return" is selected for the homing return mode, no pulse is output and the homing return is completed regardless of which button is pressed.
7	Inching operation	Pressing the – dir button outputs the pulse specified for the inching movement distance in the CW direction and stops. Pressing the + dir button outputs the pulse specified for the inching movement distance in the CCW direction and stops. Caution If you press the stop button, it will stop suddenly even if the moving distance is less than the specified number of pulses.
8	Jog operation	Press the – dir button to move in the CW direction according to the set parameters. Press the – dir button again to decelerate and stop. Press the + dir button to move in the CCW direction according to the set parameters. Press the + dir button again to decelerate and stop Caution Press the Stop button to stop immediately.
9	Jog operation speed change	Enter the changed speed in the speed column and press the Set button to change the jog operation speed. The speed can be changed even during pulse output, but it cannot be changed to a speed lower than the speed set as the initial speed.
10	Emergency stop	Pressing the Stop button forcibly stops homing return, inching operation, and jog operation.

8.9 Special internal output for simplified positioning control

The bit special internal output has been added for simplified positioning control.

Table 8.4 Simplified positioning control bit special internal output

No.	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
RA0B	Ch1 Under Homing	0: Stop / Running except homing operation 1: Under homing	Indicates the status for Ch1.	S	S
RA0D	Ch1 Stand-by operation	0: Homing not complete. 1: Homing complete.	It shows whether the homing is finished or not for Ch1.	S	S
RA1B	Ch2 Under Homing	0: Stop / Running except homing operation 1: Under homing	Indicates the status for Ch2.	S	S
RA1D	Ch2 Stand-by operation	0: Homing not complete. 1: Homing complete.	It shows whether the homing is finished or not for Ch2.	S	S
RA2B	Ch3 Under Homing	0: Stop / Running except homing operation 1: Under homing	Indicates the status for Ch3.	S	S
RA2D	Ch3 Stand-by operation	0: Homing not complete. 1: Homing complete.	It shows whether the homing is finished or not for Ch3.	S	S

Set / Reset Condition :

S … ON / OFF by system

Appendix1　List of Special Internal Output

The special internal output is an internal output of bit or word that special functions are assigned.

The special internal output area is retentive area, the value is retained even if the power supply is OFF if the battery is installed.

A1.1 Bit special internal output

The bit special internal output area is from R7C0 to RFFF. The functions of each bit are shown in the following table.

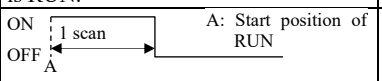
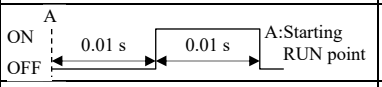
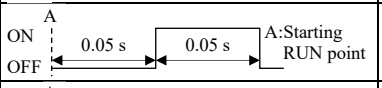
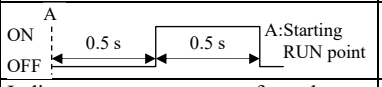
No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
R7C0 to R7C7	Undefined	—	—	—	—
R7C8	Serious failure flag	0: No serious failure 1: Serious failure	Indicates whether there is an abnormal in system.	S	U, R7EB, R7EC
R7C9	Microcomputer error	0: Normal 1: Error	Indicates whether there is an abnormal in the microcomputer.	S	U, R7EB, R7EC
R7CA	User memory error	0: Normal 1: Error	Indicates whether there is an abnormal in the user memory.	S	U, R7EB, R7EC
R7CB	Undefined	—	—	—	—
R7CC	Undefined	—	—	—	—
R7CD	I/O verify mismatch	0: Normal 1: Unmatched	Indicates whether I/O assignment and loading are matched. (Mismatched information output to WRF002)	S	U, R7EB, R7EC
R7CE	Undefined	—	—	—	—
R7CF	Undefined	—	—	—	—
R7D0	Undefined	—	—	—	—
R7D1	Overload error (normal scan)	0: Normal 1: Scan time over	Indicates whether the normal scan execution time has exceeded the designated time.	S	U, R7EB, R7EC
R7D2	Overload error (cyclic scan)	0: Normal 1: Scan time over	Indicates whether the cyclic scan was completed within cycle time.	S	U, R7EB, R7EC
R7D3	Overload error (interrupt scan)	0: Normal 1: Scan time over	Indicates whether an interrupt of the same factor occurred during interrupt scan execution.	S	U, R7EB, R7EC
R7D4	Undefined	—	—	—	—
R7D5	Undefined	—	—	—	—
R7D6	IO assignment points over	0: Normal 1: I/O assignment points over	Indicates whether the number of I/O assigned points has exceeded the maximum points.	S	U, R7EB, R7EC
R7D7	Undefined	—	—	—	—
R7D8	Clock error	0: Normal 1: Error	When clock IC is in error, this bit is activated.	S	U, R7EC
R7D9	Battery error	0: Normal 1: Error	Indicates the battery voltage drop or the backup memory abnormal.	S	U *1 R7EB, R7EC
R7DA	Undefined	—	—	—	—
R7DB	Self-diagnostic error	0: Normal 1: Error	Indicates whether there is a self-diagnostic error. (Detailed information output to WRF000)	S *2	U, R7EB, R7EC
R7DC to R7DF	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

*1 Battery error (R7D9) will be turned off if the cause of the error is removed by replacing the battery.

*2 Self-diagnostic error (R7DB) turns on only when there is the serious, medium, or minor failure. Unlike EH-CPU, it does not turn on with the warning level error.

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
R7E0	RUN switch position (STOP)	0: RUN/STOP Sw; RUN 1: RUN/STOP Sw; STOP	Turn on when RUN/STOP Sw position is STOP.	S	S
R7E1	Undefined	—	—	—	—
R7E2	RUN switch position (RUN)	0: RUN/STOP Sw; STOP 1: RUN/STOP Sw; RUN	Turn on when RUN/STOP Sw position is RUN.	S	S
R7E3	The first scan is ON after RUN	0: The 2nd scan or later after RUN 1: The 1st scan after RUN		S	S
R7E4	Always ON	0: Non-status of 0 1: Always	Always outputs 1 regardless of CPU status.	S	Cannot be turned OFF.
R7E5	0.02 second clock	0: 0.01 seconds 1: 0.01 seconds		S	S
R7E6	0.1 second clock	0: 0.05 seconds 1: 0.05 seconds		S	S
R7E7	1.0 second clock	0: 0.5 seconds 1: 0.5 seconds		S	S
R7E8	Occupied flag	0: Unoccupied 1: Occupied	Indicates occupancy status from the peripheral unit.	S	S
R7E9	RUN prohibited	0: Operation allowed 1: Operation prohibited	Indicates whether it is operation prohibited status.	S	S
R7EA	Executing a 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.	S	S
R7EB	Clear the retentive area	0: - 1: Clear the retentive area and error	Clear the retentive area and error special internal output. (WRF000, WRF002, R7C8 to R7CA, R7CD, R7D1 to R7D3, R7D6, R7D9, R7DB, R800 to R804, R806, R807, R9DC to R9DF)	U	S
R7EC	Clear error special internal output	0: - 1: Clear error information	Clear error special internal output (WRF000, WRF002, R7C8 to R7CA, R7CD, R7D1 to R7D3, R7D6, R7D8, R7D9, R7DB, R800 to R804, R806, R807, R9DC to R9DF), ERR Display, CPU status	U	S
R7ED	Undefined	—	—	—	—
R7EE	Undefined	—	—	—	—
R7EF	Backup memory writing execution flag	0: Write complete 1: Write in progress	Indicates whether or not data is being written to the backup memory.	S	S
R7F0	Carry flag (CY)	0: No carry 1: Carry	Indicates whether there is a carryover from the operation result.	S	S
R7F1	Overflow flag (V)	0: No overflow 1: Overflow	Indicates whether there is overflow in the operation result.	S	S
R7F2	Shift data (SD)	0: Shift data “0” 1: Shift data “1”	Designates the shift data used in shift instructions, etc.	U	U
R7F3	Operation error (ERR)	0: Normal 1: Error	Indicates whether there is an operation error when operation is executed.	S	S
R7F4	Data error (DER)	0: Normal 1: Error	Indicates whether there is a data error when operation is being executed.	S	S
R7F5 to R7F7	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
R7F8	Calendar, clock read request	1: Read	Read the present values of calendar, clock and set in WRF01B to WRF01F	U	S
R7F9	Calendar, clock setting request	1: Set	Set the data set in WRF01B to WRF01F in the calendar and clock.	U	S
R7FA	Clock ±30 second adjustment request	1: Request adjustment	When second data (WRF00F) is 0 to 29, it becomes 0 seconds and when it is 30 to 59, +1 minute is added and second data becomes 0.	U	S
R7FB	Calendar and clock set data error	0: Normal 1: Error	Indicates whether there is an error in calendar and clock set data.	S	S
R7FC	Pulse/PWM running flag 1 (Y100)	0: Pulse/PWM output stopped 1: Pulse/PWM output	ON during pulse / PWM output at Y100.	S	S
R7FD	Pulse/PWM running flag 2 (Y101)	0: Pulse/PWM output stopped 1: Pulse/PWM output	ON during pulse / PWM output at Y101.	S	S
R7FE	Pulse/PWM running flag 3 (Y102)	0: Pulse/PWM output stopped 1: Pulse/PWM output	ON during pulse / PWM output at Y102.	S	S
R7FF	Undefined	—	—	—	—
R800 *3	IP address undefined	0: Normal 1: Error	IP address of Ethernet port is unfixed.	S	U, R7EB, R7EC
R801 *3	Serial communication setting data undefined	0: Normal 1: Error	Setup about serial communication port is unfixed.	S	U, R7EB, R7EC
R802 *3	Ethernet task code communication setting data undefined	0: Normal 1: Error	Parameter about task code function of Ethernet port is not fixed.	S	U, R7EB, R7EC
R803 *3	ASR function setting data undefined	0: Normal 1: Error	Parameter about ASR function of Ethernet port is not fixed.	S	U, R7EB, R7EC
R804 *3	NTP setting data undefined	0: Normal 1: Error	Parameter about NTP function of Ethernet port is not fixed.	S	U, R7EB, R7EC
R805	Undefined	—	—	—	—
R806 *3	ASR mode setting data undefined	0: Normal 1: Error	Parameter about ASR mode of Ethernet port is not fixed.	S	U, R7EB, R7EC
R807 *3	Modbus-TCP parameter undefined	0: Normal 1: Error	The parameter about a Modbus-TCP function is undefined.	S	U, R7EB, R7EC
R808 to R80F	Undefined	—	—	—	—
R810	Backup request bit	1: Backup request	When data memory backup function enables and this bit is turned on, data from WR7F00 to WR7FFF is written to FLASH memory.	U	S
R811	Backup result bit	0: Normal 1: Error	The result of data memory backup is shown.	S	S
R812 to R81F	Undefined	—	—	—	—
R820	HSDL Run / Stop	0: HSDL Stop 1: HSDL Run	Serial data link (HSDL) can be controlled by this bit (Only for master).	U	U
R821	HSDL link data update time (Max.) initialization	1: Initialization	HSDL link data update time (Max.) in WRF0ED will be update to zero (Only for master).	U	S
R822	HSDL link data update time (Min.) initialization	1: Initialization	HSDL link data update time (Min.) in WRF0EF will be update to 65,535 (Only for master).	U	S
R823 to R8FF	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

*3 Even if there were multiple error factors, only one bit is turned on.

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
R900	NTP time retrieval user program control valid/invalid	0: Program setting cycle 1: Control by R901 ➔For details, refer to User's Manual chapter 3, 3.5 setting a clock with NTP Communication.	Specifies whether to perform the time data retrieval from NTP server with the cycle set in programmer, or to control it by R901.	U	U
R901	NTP time retrieval request	1: Retrieval start ➔For details, refer to User's Manual chapter 3, 3.5 setting a clock with NTP Communication.	Retrieves the time data from NTP server.	U	S
R902	NTP time retrieval result	0: Retrieval success 1: Retrieval failure ➔For details, refer to User's Manual chapter 3, 3.5 setting a clock with NTP Communication.	Indicates failure of the time data retrieval from NTP server.	S	U
R903 to R90E	Undefined	—	—	—	—
R90F	Modbus-TCP server access target switching	0: Write to WM 1: Write to WR	Type of internal output which is wrote by Modbus protocol function code 06 can be changed.	U	U
R910	Ethernet port (Task code port 1) Reset request	1: Reset request	Reset task code port 1. Clear the task code send / receive counter (WRF1F0 to WRF1F3) to 0. (Setting data by Control Editor remains.)	U	S
R911	Ethernet port (Task code port 2) Reset request	1: Reset request	Reset task code port 2. Clear the task code send / receive counter (WRF1F4 to WRF1F7) to 0. (Setting data by Control Editor remains.)	U	S
R912	Ethernet port (Task code port 3) Reset request	1: Reset request	Reset task code port 3. Clear the task code send / receive counter (WRF1F8 to WRF1FB) to 0. (Setting data by Control Editor remains.)	U	S
R913	Ethernet port (Task code port 4) Reset request	1: Reset request	Reset task code port 4. Clear the task code send / receive counter (WRF1FC to WRF1FF) to 0. (Setting data by Control Editor remains.)	U	S
R914	Ethernet port (ASR port 1) Reset request	1: Reset request	Reset ASR port 1. (Setting data by Control Editor remains.)	U	S
R915	Ethernet port (ASR port 2) Reset request	1: Reset request	Reset ASR port 2. (Setting data by Control Editor remains.)	U	S
R916	Ethernet port (ASR port 3) Reset request	1: Reset request	Reset ASR port 3. (Setting data by Control Editor remains.)	U	S
R917	Ethernet port (ASR port 4) Reset request	1: Reset request	Reset ASR port 4. (Setting data by Control Editor remains.)	U	S
R918	Ethernet port (ASR port 5) Reset request	1: Reset request	Reset ASR port 5. (Setting data by Control Editor remains.)	U	S
R919	Ethernet port (ASR port 6) Reset request	1: Reset request	Reset ASR port 6. (Setting data by Control Editor remains.)	U	S
R91A	Ethernet port (Modbus-TCP) Reset request	1: Reset request	Reset Modbus-TCP port. (Setting data by Control Editor remains.)	U	S
R91B to R91F	Undefined	—	—	—	—
R920	Ethernet communication initialization completed	0: Initializing 1: Initialization complete	This bit turns ON when the power is turned on and initialization of the Ethernet port is completed.	S	S
R921	Task code send / receive counter clear	1: Counter clear request	Clear the task code send / receive counter (WRF1F0 to WRF1FF) to 0.	U	S

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
R922 to R92F	Undefined	—	—	—	—
R930 to R9CF	Data logging status / control bit	For details, refer to User's Manual Chapter 7, 7.7 Special internal output for Logging and Trace function.		U, S	U, S
R9D0	Ethernet port (Task code port 1) Reset complete	1: Reset complete	Turns ON when reset of task code port 1 is completed.	S	U
R9D1	Ethernet port (Task code port 2) Reset complete	1: Reset complete	Turns ON when reset of task code port 2 is completed.	S	U
R9D2	Ethernet port (Task code port 3) Reset complete	1: Reset complete	Turns ON when reset of task code port 3 is completed.	S	U
R9D3	Ethernet port (Task code port 4) Reset complete	1: Reset complete	Turns ON when reset of task code port 4 is completed.	S	U
R9D4	Ethernet port (ASR port 1) Reset complete	1: Reset complete	Turns ON when ASR port 1 reset is complete.	S	U
R9D5	Ethernet port (ASR port 2) Reset complete	1: Reset complete	Turns ON when ASR port 2 reset is complete.	S	U
R9D6	Ethernet port (ASR port 3) Reset complete	1: Reset complete	Turns ON when ASR port 3 reset is complete.	S	U
R9D7	Ethernet port (ASR port 4) Reset complete	1: Reset complete	Turns ON when ASR port 4 reset is complete.	S	U
R9D8	Ethernet port (ASR port 5) Reset complete	1: Reset complete	Turns ON when ASR port 5 reset is complete.	S	U
R9D9	Ethernet port (ASR port 6) Reset complete	1: Reset complete	Turns ON when ASR port 6 reset is complete.	S	U
R9DA	Ethernet port (Modbus-TCP) Reset complete	1: Reset complete	Turns ON when reset of Modbus-TCP port is completed.	S	U
R9DB	Undefined	—	—	—	—
R9DC	Ethernet port (Task code port 1) Error occurred	0: Normal 1: Error	Turns ON when a communication error occurs on the Ethernet port (task code port 1).	S	U, R7EB, R7EC
R9DD	Ethernet port (Task code port 2) Error occurred	0: Normal 1: Error	Turns ON when a communication error occurs on the Ethernet port (task code port 2).	S	U, R7EB, R7EC
R9DE	Ethernet port (Task code port 3) Error occurred	0: Normal 1: Error	Turns ON when a communication error occurs on the Ethernet port (task code port 3).	S	U, R7EB, R7EC
R9DF	Ethernet port (Task code port 4) Error occurred	0: Normal 1: Error	Turns ON when a communication error occurs on the Ethernet port (task code port 4).	S	U, R7EB, R7EC
R9E0 to R9FF	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
RA00 to RA0A	System use area	—	(Area which is used by system.)	—	—
RA0B	Ch1 Homing in progress	0: Before homing or executing other operation. 1: Under Homing.	Indicates that ch1 is performing the homing operation.	S	S
RA0C	System use area	—	(Area which is used by system.)	—	—
RA0D	Ch1 Homing complete	0: Before homing or executing other operation. 1: Under Homing.	If homing operation for Ch1 completed it will be turned on, and after this, when pulse outputs this bit will be turned off.	S	S
RA0E to RA1A	System use area	—	(Area which is used by system.)	—	—
RA1B	Ch2 Homing in progress	0: Before homing or executing other operation. 1: Under Homing.	Indicates that ch2 is performing the homing operation.	S	S
RA1C	System use area	—	(Area which is used by system.)	—	—
RA1D	Ch2 Homing complete	0: Before homing or during pulse output. 1: Homing complete.	If homing operation for Ch2 completed it will be turned on, and after this, when pulse outputs this bit will be turned off.	S	S
RA1E to RA2A	System use area	—	(Area which is used by system.)	—	—
RA2B	Ch3 Homing in progress	0: Before homing or executing other operation. 1: Under Homing.	Indicates that ch3 is performing the homing operation.	S	S
RA2C	System use area	—	(Area which is used by system.)	—	—
RA2D	Ch3 Homing complete	0: Before homing or during pulse output. 1: Homing complete.	If homing operation for Ch3 completed it will be turned on, and after this, when pulse outputs this bit will be turned off.	S	S
RA2E to RA3F	System use area	—	(Area which is used by system.)	—	—
RA40 to RFFF	Undefined	—	—	—	—

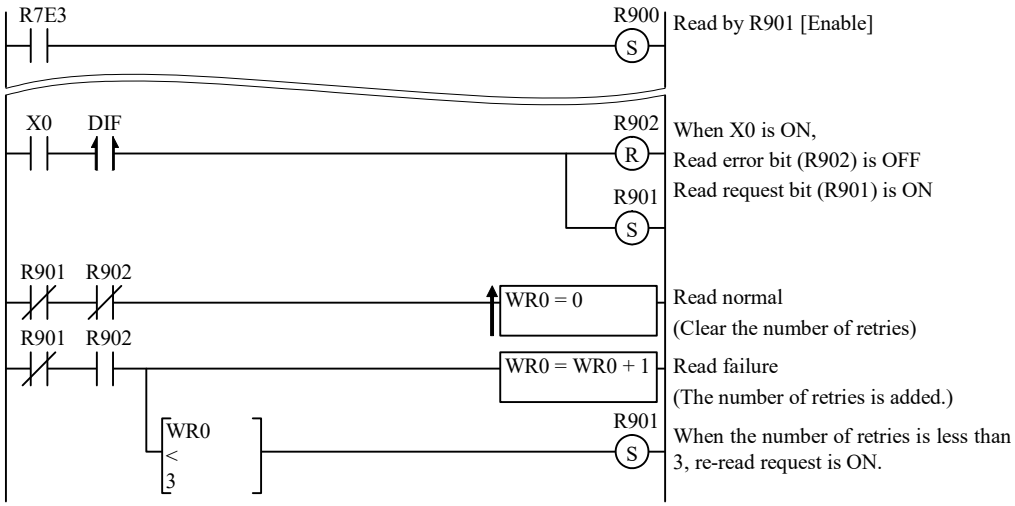
Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

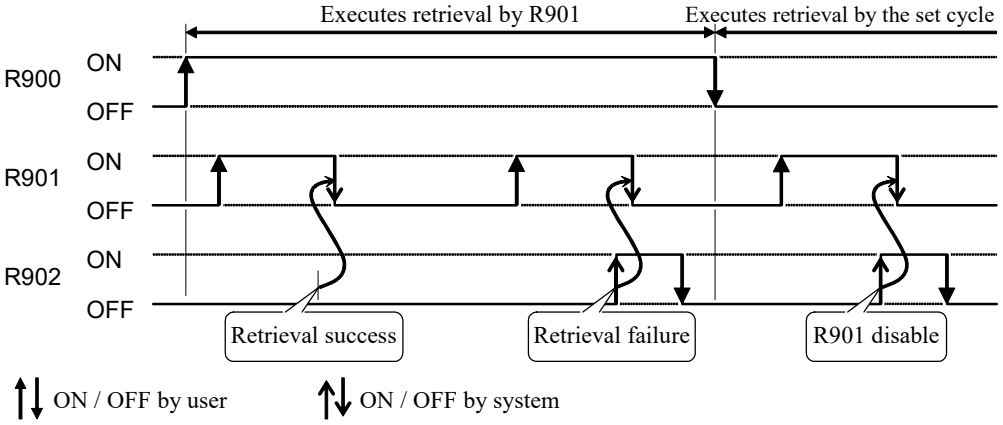
(1) Special internal output for NTP client function

The clock data can be acquired from NTP server automatically by setting NTP client function using Control Editor. There are two methods to acquisition the clock data, one is a method by a constant cycle and the other is a method by the user program. In the case of the former, the cycle is specified using Control Editor. In the case of the latter, the bit special internal output is used. (In both cases, it needs to validate the NTP client function beforehand using Control Editor.)

■ Clock data read using NTP client function Sample program



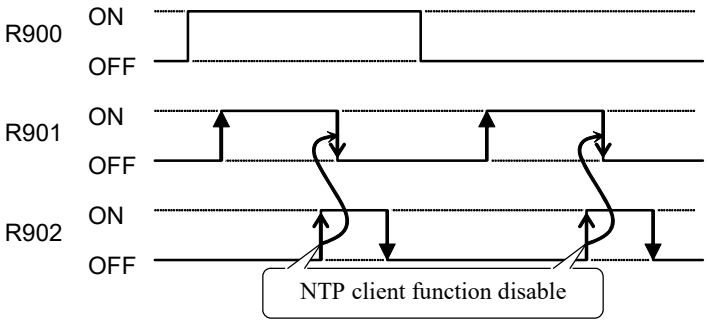
■ Control of special internal output



Note

In order to enable NTP client function, the power supply needs to be turned ON again after setting the parameter using Control Editor.

When NTP client function is disable, the clock data cannot be read from NTP server using the special internal output.

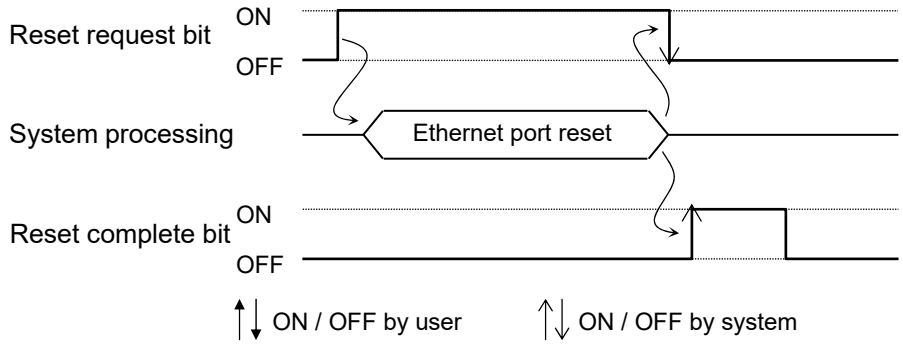


(2) Reset function for Ethernet port

If the Ethernet port (task code port, ASR port, Modbus-TCP port) becomes unable to communicate for some reason, the Ethernet port can be returned to the initial state using a programming tool. (In the case of TCP/IP, it returns to the state before connection establishment.)

The Ethernet port is reset by bit special internal output.

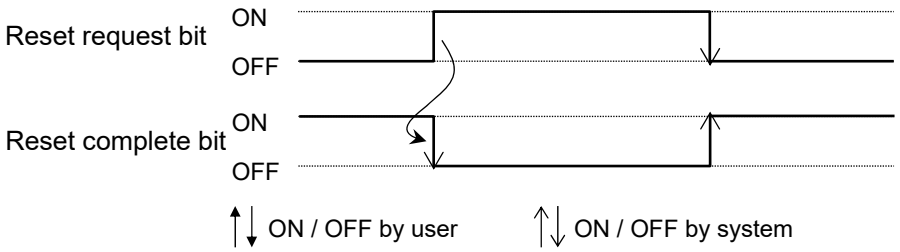
Ethernet port reset request bits (R910 to R91A) and reset completion bits (R9D0 to R9DA) are provided for bit special internal output. When the reset request bit of the corresponding Ethernet port is turned ON, the Ethernet port reset starts. When the reset of the Ethernet port is completed, the reset request bit is automatically turned OFF and the reset completion bit is turned ON.



Reference

The reset completion bit indicates the result, so even if the reset completion bit is ON, the Ethernet port can be reset by turning ON the reset request bit.

(When the reset request flag is turned ON, the reset completion flag is automatically turned OFF.)



A1.2 Word special internal output

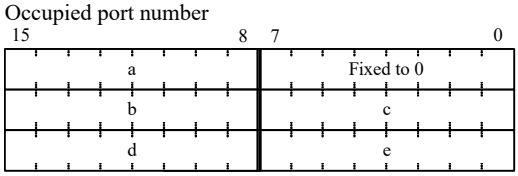
The word special internal output area is WRF000 to WRFFFF. Functions of each word are shown below.

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF000	Self-diagnosis error code	Error code (2 digit hexadecimal, upper 2 digits are 00)	Stores the error No. in CPU as a binary code.	S	U, R7EB, R7EC
WRF001	Undefined	—	—	—	—
WRF002 (R7CD)	I/O verify mismatch details	Mismatched slot number *	15 12 11 8 7 4 3 0 0 | a | b | 0 a: Unit number (0 to 5) b: Slot number (0 to F)	S	U, R7EB, R7EC
WRF003 to WRF00A	Undefined	—	—	—	—
WRF00B	Calendar and clock current value (4 digit BCD)	Year	Always displays the 4 digit year.	S	X
WRF00C		Month/day	Always displays month/day data.	S	X
WRF00D		Day of the week	Always displays day of the week data.	S	X
WRF00E		Hour/minute	(Sunday: 0000 to Saturday: 0006)	S	X
WRF00F		Seconds	Always displays hour/minute data.	S	X
WRF010	Scan time (maximum value)	Maximum execution time for a normal scan	Maximum execution time for a normal scan is stored in 1 ms units.	S	S
WRF011	Scan time (current value)	Present value of execution time for a normal scan	Present value of execution time for a normal scan is stored in 1 ms units.	S	S
WRF012	Scan time (minimum value)	Minimum execution time for a normal scan	Minimum execution time for a normal scan is stored in 1 ms units. (the first scan after RUN is HFFFF)	S	S
WRF013	CPU status	15 14 13 8 7 6 5 4 3 2 1 0 a | b | c | d | e b15,14 : Unused, b13 to b8 : (a)CPU type MVH-*64* : 100101 MVH-*40* : 100100 MVL-*64* : 100010 MVL-*40* : 100001 MVL-*20* : 100000 b7 : (b) Battery error 0 : No Error, 1 : Error b6 to b4 : Unused b3 : (c) Error 0 : No Error, 1 : Error b2 : Unused b1 : (d) HALT 0 : No Executing, 1 : Executing b0 : (e)CPU operation 0 : STOP, 1 : RUN		S	S
WRF014	Word internal output capacity	Number of words for word internal output (WR)	MICRO-EHV: H8000	S	X
WRF015	Operation error code	Operation error code	Operation error code is stored. (4 digit hexadecimal)	S	U
WRF016	Division remainder register (lower)	Remainder data when division instruction executed	For a word operation: WRF016 only	S	S
WRF017	Division remainder register (upper)		For a double word operation: WRF017 (upper), WRF016 (lower)	S	S
WRF018 to WRF01A	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

* You must turn the applicable bit special internal output (inside ( ) of No) OFF once if you want to check which slot the error is occurring currently. And you must check it after turning R7EC ON once.

No.	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF01B	Reading (latch) or writing data area for the calendar clock (BCD 4 digits)	Year	Stores the 4-digit year read or sets the set value.	S, U	U
WRF01C		Month/day	Stores month/day data read or sets the set value.	S, U	U
WRF01D		Day of the week data (Sunday: 0000 to Saturday: 0006)	Stores day data of the week read or sets the set value.	S, U	U
WRF01E		Hour/minute (24-hour system)	Stores hour/minute data read or sets the set value.	S, U	U
WRF01F		Seconds	Stores second data read or sets the set value.	S, U	U
WRF020	NTP client time zone	Time zone setup	Time zone of NTP client function is specified. ➔ refer to appendix A1-16 * Current time zone setting value is set on the system only when the power supply is ON.	U	S
WRF021	Reading (latch) or writing data area for the calendar clock (BCD 4 digits)	Year	4 digits for year [yyyy]	S	S
WRF022		Month/day	Month and day [mmdd]	S	S
WRF023		Day of the week data (Sunday : 0000 to Saturday : 0006)	Sunday : 0000 to Saturday : 0006	S	S
WRF024		Hour/minute(24-hour system)	Hour and minute [hhmm] (24-hour)	S	S
WRF025		Seconds	Second [00ss] (Upper 2 digits are 00.)	S	S
WRF026 to WRF03B	Undefined	—	—	—	—
WRF03C	Option board analog output 1	Output value of analog channel 1 on option board	Stores the analog value output from option board analog channel 1.	U	S, U
WRF03D	Option board analog output 2	Output value of analog channel 2 on option board	Stores the analog value output from option board analog channel 2.	U	S, U
WRF03E	Option board analog input 1	Input value of analog channel 1 on option board	Analog input value of option board analog channel 1 is stored.	S	S
WRF03F	Option board analog input 2	Input value of analog channel 2 on option board	Analog input value of option board analog channel 2 is stored.	S	S
WRF040 to WRF042	Occupied member registration area 1	Occupied port number  a: 0=Not occupied, 1=Read-occupied, 2=Write-occupied b: Loop number c: Unit number d: Module number e: Port number (serial :H01 , Ethernet :H03 to H06, USB :H07)		S	S
WRF043 to WRF045	Occupied member registration area 2			S	S
WRF046 to WRF048	Occupied member registration area 3			S	S
WRF049 to WRF04B	Occupied member registration area 4			S	S
WRF04C to WRF04D	Undefined	—	—	—	—
WRF04E	Option board analog input 3	Input value of analog channel 3 on option board	Analog input value of option board analog channel 3 is stored.	S	S
WRF04F	Option board analog input 4	Input value of analog channel 4 on option board	Analog input value of option board analog channel 4 is stored.	S	S
WRF050	System software version [DISP]	System software version	The most significant digit in the hexadecimal display indicates the model. 0 ***: High function model (MVH) 1 ***: Standard model (MVL)	S	S
WRF051 to WRF053	System use area	—	(Area which is used by system.)	X	X
WRF054 WRF055	Total power-on time	Displays cumulative energization time in seconds	Accumulated energization time is stored in double word.(DRF054)	S	X

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF056 to WRF05F	System use area	—	(Area which is used by system.)	X	X
WRF060 to WRF077	Ethernet port ASR communication control	ASR communication control and status display ➔ Refer to Appendix 1-16	WRF060 to WRF063 ASR port 1 WRF064 to WRF067 ASR port 2 WRF068 to WRF06B ASR port 3 WRF06C to WRF06F ASR port 4 WRF070 to WRF073 ASR port 5 WRF074 to WRF077 ASR port 6	Refer to Appendix 1-16	Refer to Appendix 1-16
WRF078 to WRF07F	System use area	—	(Area which is used by system.)	X	X
WRF080 to WRF0DF	Ethernet port ASR communication control	ASR communication mode, transmission size setting, reception size display ➔ Refer to Appendix 1-17	WRF080 to WRF08F ASR port 1 WRF090 to WRF09F ASR port 2 WRF0A0 to WRF0AF ASR port 3 WRF0B0 to WRF0BF ASR port 4 WRF0C0 to WRF0CF ASR port 5 WRF0D0 to WRF0DF ASR port 6	Refer to Appendix 1-17	Refer to Appendix 1-17
WRF0E0	Modbus-RTU waiting time (master)	Modbus-RTU waiting time (master)	Wait time can be set before query transmission in MBMST command, INV command, OMST command, OCTP command, Modbus-TCP gateway. Unit of time : ms	U	U
WRF0E1	Modbus-RTU waiting time (slave)	Modbus-RTU waiting time (slave)	The time from query reception to response transmission can be set in the Modbus slave function. Unit of time : ms	U	U
WRF0E2 to WRF0EC	Undefined	—	—	—	—
WRF0ED	HSDL link data update time (max)	Maximum update time for HSDL	Maximum update time for HSDL is stored in 1 ms units.	S	U
WRF0EE	HSDL link data update time (current)	Current update time for HSDL	Current update time for HSDL is stored in 1 ms units.	S	X
WRF0EF	HSDL link data update time (min)	Minimum update time for HSDL	Minimum update time for HSDL is stored in 1 ms units.	S	U
WRF0F0 to WRF0F2	MAC address	Displays Ethernet peculiar address of MICRO-EHV (MAC address)	□□:□□:□□:□□:□□:□□ WRF0F0 WRF0F1 WRF0F2 Upper digits | Middle digits | Lower digits Example) Case of A4:97:BB:05:12:00 WRF0F0 … HA497 WRF0F1 … HBB05 WRF0F2 … H1200	S	X
WRF0F3	Ethernet port communication speed [DISP]	Displays communication speed of Ethernet port which is set to MICRO-EHV	0: Auto-negotiation 1: 100 Mbps / Full duplex 2: 100 Mbps / Half duplex 3: 10 Mbps / Full duplex 4: 10 Mbps / Half duplex	S	X
WRF0F4	USB memory size (L)	The capacity of USB memory attached on MICRO-EHV	Displays the capacity of the USB memory in kilobytes.	S	X
WRF0F5	USB memory size (H)				
WRF0F6	USB free space (L)	Free space of USB memory attached on MICRO-EHV	Displays the free space of the USB memory in kilobytes.	S	X
WRF0F7	USB free space (H)				
WRF0F8 to WRF0FF	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF100 WRF101	Counter 1 Current value	Current value of counter 1	The current value of counter 1 is stored as a double word. (DRF100)	S	U
WRF102 WRF103	Counter 2 Current value	Current value of counter 2	The current value of counter 2 is stored as a double word. (DRF102)	S	U
WRF104 WRF105	Counter 3 Current value	Current value of counter 3	The current value of counter 3 is stored as a double word. (DRF104)	S	U
WRF106 WRF107	Counter 4 Current value	Current value of counter 4	The current value of counter 4 is stored as a double word. (DRF106)	S	U
WRF108 WRF109	Counter 5 Current value	Current value of counter 5	The current value of counter 5 is stored as a double word. (DRF108)	S	U
WRF10A WRF10B	Pulse 1 Position data	Pulse output 1 position data	The position data of pulse output 1 is stored as a double word. (DRF10A)	S	U
WRF10C WRF10D	Pulse 2 Position data	Pulse output 2 position data	The position data of pulse output 2 is stored as a double word.（DRF10C）	S	U
WRF10E WRF10F	Pulse 3 Position data	Pulse output 3 position data	The position data of pulse output 3 is stored as a double word.（DRF10E）	S	U
WRF110	Counter 1 system use area	—	(Area which is used by system.)	X	X
WRF111	Undefined	—	—	—	—
WRF112 WRF113	Counter 1 ON-preset	Counter 1 ON-preset	Counter 1 ON-preset value is stored in double word. (DRF112)	S	S
WRF114 WRF115	Counter 1 OFF-preset	Counter 1 OFF-preset	Counter 1-OFF preset value is stored in double word. (DRF114)	S	S
WRF116 to WRF119	System use area	—	(Area which is used by system.)	X	X
WRF11A WRF11B	Counter 2 ON-preset	Counter 2 ON-preset	Counter 2 ON-preset value is stored in double word. (DRF11A)	S	S
WRF11C WRF11D	Counter 2 OFF-preset	Counter 2 OFF-preset	Counter 2 OFF-preset value is stored in double word. (DRF11C)	S	S
WRF11E to WRF121	System use area	—	(Area which is used by system.)	X	X
WRF122 WRF123	Counter 3 ON-preset	Counter 3 ON-preset	Counter 3 ON-preset value is stored in double word. (DRF122)	S	S
WRF124 WRF125	Counter 3 OFF-preset	Counter 3 OFF-preset	Counter 3 OFF-preset value is stored in double word. (DRF124)	S	S
WRF126 to WRF129	System use area	—	(Area which is used by system.)	X	X
WRF12A WRF12B	Counter 4 ON-preset	Counter 4 ON-preset	Counter 4 ON-preset value is stored in double word. (DRF12A)	S	S
WRF12C WRF12D	Counter 4 OFF-preset	Counter 4 OFF-preset	Counter 4 OFF-preset value is stored in double word. (DRF12C)	S	S
WRF12E WRF131	System use area	—	(Area which is used by system.)	X	X
WRF132 WRF133	Counter 5 ON-preset	Counter 5 ON-preset	Counter 5 ON-preset value is stored in double word. (DRF132)	S	S
WRF134 WRF135	Counter 5 OFF-preset	Counter 5 OFF-preset	Counter 5 OFF-preset value is stored in double word. (DRF134)	S	S
WRF136 to WRF137	System use area	—	(Area which is used by system.)	X	X

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF138 WRF139	Pulse/PWM 1 Output frequency	Pulse/PWM 1 Output frequency	Pulse / PWM 1 output frequency is stored in double word. (DRF138)	S	U
WRF13A WRF13B	Pulse 1 Number of pulses	Pulse 1 Number of pulses	The number of output pulses of pulse 1 is stored as a double word. (DRF13A)	S	U
	PWM 1 ON-Duty	PWM 1 ON-Duty	PWM 1 ON-Duty is stored in double word. (DRF13A)		
WRF13C to WRF13F	System use area	—	(Area which is used by system.)	X	X
WRF140 WRF141	Pulse/PWM 2 Output frequency	Pulse/PWM 1 Output frequency	Pulse / PWM 2 output frequency is stored in double word. (DRF140)	S	U
WRF142 WRF143	Pulse 2 Number of pulses	Pulse 2 Number of pulses	The number of output pulses of pulse 2 is stored as a double word. (DRF142)	S	U
	PWM 2 ON-Duty	PWM 2 ON-Duty	PWM 2 ON-Duty is stored in double word. (DRF142)		
WRF144 to WRF147	System use area	—	(Area which is used by system.)	X	X
WRF148 WRF149	Pulse/PWM 3 Output frequency	Pulse/PWM 3 Output frequency	Pulse / PWM 3 output frequency is stored in double word. (DRF148)	S	U
WRF14A WRF14B	Pulse 3 Number of pulses	Pulse 3 Number of pulses	The number of output pulses of pulse 3 is stored as a double word. (DRF14A)	S	U
	PWM 3 ON-Duty	PWM 3 ON-Duty	PWM 3 ON-Duty is stored in double word. (DRF14A)		
WRF14C to WRF14F	System use area	—	(Area which is used by system.)	X	X
WRF150 to WRF15F	HSDL status area	Status display for HSDL master and slave	As to the details, refer to “3.6 Serial data link communication”. WRF150 … St. No.1, Master WRF151 … St. No.3, St. No.2 WRF152 … St. No.5, St. No.4 WRF153 … St. No.7, St. No.6 WRF154 … St. No.9, St. No.8 WRF155 … St. No.11, St. No.10 WRF156 … St. No.13, St. No.12 WRF157 … St. No.15, St. No.14 WRF158 … St. No.17, St. No.16 WRF159 … St. No.19, St. No.18 WRF15A … St. No.21, St. No.20 WRF15B … St. No.23, St. No.22 WRF15C … St. No.25, St. No.24 WRF15D … St. No.27, St. No.26 WRF15E … St. No.29, St. No.28 WRF15F … St. No.31, St. No.30	S	X
WRF160 to WRF1DF	System use area	—	(Area which is used by system.)	X	X
WRF1E0 WRF1EF	Undefined	—	—	—	—

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF1F0	Ethernet port (task code port 1) sending counter	Task code port 1 response sending counter	In Hitachi protocol communication, the number of times is added each time a response is sent to a request from a host.	S	U
WRF1F1	Ethernet port (task code port 1) receiving counter 1	Task code port 1 request Receiving counter	In Hitachi protocol communication, the number of times is added when a packet that exceeds 7 bytes and the start code is the specified value is received.	S	U
WRF1F2	Ethernet port (task code port 1) receiving counter 2	Task code port 1 error request (error command) reception count	In Hitachi protocol communication, if a packet of less than 7 bytes is received or a packet of 7 bytes or more whose leading code is not the specified value is received, the number of times is added.	S	U
WRF1F3	Ethernet port (task code port 1) receiving counter 3	Task code port 1 error request (error format) reception count	In Hitachi protocol communication, when a request task code that returns an abnormal response is received or a request that returns a non-executable response is received, the number is added.	S	U
WRF1F4	Ethernet port (task code port 2) sending counter	Task code port 2 response transmission count	In Hitachi protocol communication, the number of times is added each time a response is sent to a request from a host.	S	U
WRF1F5	Ethernet port (task code port 2) receiving counter 1	Task code port 2 request reception count	In Hitachi protocol communication, the number of times is added when a packet that exceeds 7 bytes and the start code is the specified value is received.	S	U
WRF1F6	Ethernet port (task code port 2) receiving counter 2	Task code port 2 error request (error command) reception count	In Hitachi protocol communication, if a packet of less than 7 bytes is received or a packet of 7 bytes or more whose leading code is not the specified value is received, the number of times is added.	S	U
WRF1F7	Ethernet port (task code port 2) receiving counter 3	Task code port 2 error request (error format) reception count	In Hitachi protocol communication, when a request task code that returns an abnormal response is received or a request that returns a non-executable response is received, the number is added.	S	U
WRF1F8	Ethernet port (task code port 3) sending counter	Task code port 3 response transmission count	In Hitachi protocol communication, the number of times is added each time a response is sent to a request from a host.	S	U
WRF1F9	Ethernet port (task code port 3) receiving counter 1	Task code port 3 request reception count	In Hitachi protocol communication, the number of times is added when a packet that exceeds 7 bytes and the start code is the specified value is received.	S	U
WRF1FA	Ethernet port (task code port 3) receiving counter 2	Task code port 3 error request (error command) reception count	In Hitachi protocol communication, if a packet of less than 7 bytes is received or a packet of 7 bytes or more whose leading code is not the specified value is received, the number of times is added.	S	U
WRF1FB	Ethernet port (task code port 3) receiving counter 3	Task code port 3 error request (error format) reception count	In Hitachi protocol communication, when a request task code that returns an abnormal response is received or a request that returns a non-executable response is received, the number is added.	S	U

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

No	Name [Main use]	Meaning	Description	Setting condition	Resetting condition
WRF1FC	Ethernet port (task code port 4) transmission counter	Task code port 4 response transmission count.	In Hitachi protocol communication, the number of times is added each time a response is sent to a request from a host.	S	U
WRF1FD	Ethernet port (task code port 4) reception counter 1	Task code port 4 request reception count.	In Hitachi protocol communication, the number of times is added when a packet that exceeds 7 bytes and the start code is the specified value is received.	S	U
WRF1FE	Ethernet port (task code port 4) reception counter 2	Task code port 4 error request (error command) reception count.	In Hitachi protocol communication, if a packet of less than 7 bytes is received or a packet of 7 bytes or more whose leading code is not the specified value is received, the number of times is added.	S	U
WRF1FF	Ethernet port (task code port 4) reception counter 3	Task code port 4 error request (error format) reception count.	In Hitachi protocol communication, when a request task code that returns an abnormal response is received or a request that returns a non-executable response is received, the number is added.	S	U

Set / Reset Condition :

S…ON / OFF by system, U…ON / OFF by user, R7EB…Set 1 to R7EB, R7EC…Set 1 to R7EC,
X…Always display

(1) NTP client function time zone

The relation between the value set to WRF020 and time zone is shown below.

Set value	Time zone
H0000	GMT – 12:00
H0001	GMT – 11:00
H0002	GMT – 10:00
H0003	GMT – 9:00
H0004	GMT – 8:00
H0005	GMT – 7:00
H0006	GMT – 6:00
H0007	GMT – 5:00
H0008	GMT – 4:00
H0009	GMT – 3:30
H000A	GMT – 3:00
H000B	GMT – 2:00
H000C	GMT – 1:00

Set value	Time zone
H000D	GMT
H000E	GMT + 1:00
H000F	GMT + 2:00
H0010	GMT + 3:00
H0011	GMT + 3:30
H0012	GMT + 4:00
H0013	GMT + 4:30
H0014	GMT + 5:00
H0015	GMT + 5:30
H0016	GMT + 5:45
H0017	GMT + 6:00
H0018	GMT + 6:30
H0019	GMT + 7:00

Set value	Time zone
H001A	GMT + 8:00
H001B	GMT + 9:00
H001C	GMT + 9:30
H001D	GMT + 10:00
H001E	GMT + 11:00
H001F	GMT + 12:00
H0020	GMT + 13:00
Out of range	GMT

Note

Setting the parameter to WRF020. Makes the time zone valid. However, even if a time zone is changed while time data is read from the NTP server, the time zone is not reflected.

(2) Ethernet communication port ASR function

■Status register, Control register and Sending/Receiving counter

ASR communication registers are assigned to the special internal outputs WRF060 to WRF077 (24 words). As shown in Figure A1.1, it consists of 4 words per port and 24 words for 6 ports. Refer to the status register information and control the ASR function with the control register.

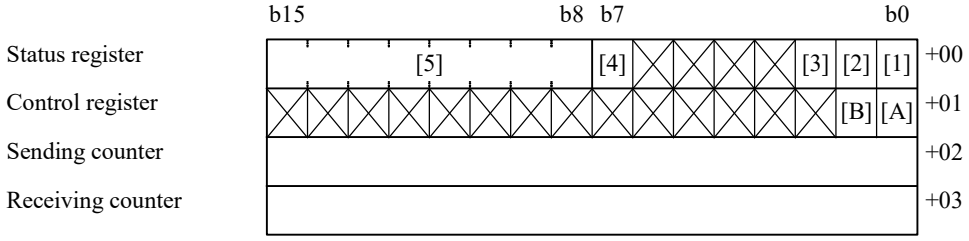


Figure A1.1 Status register and Control register

[Status register]

[1] Port status flag 1: Open

[2] Even transmitted completed flag 1: Transmitting completed

[3] Receiving completed flag 1: Receiving completed

[4] Error flag 1: Error occurred

[5] Error code 0x01: Despite not opening the port, the event transmitted request flag was turned ON.

0x02: The event transmitted request flag was re-turned ON while the transmitting has not completed.

[Control register]

[A] Port opened request flag 1: Open request 0: Close request

[B] Event transmitted request flag 1: Start transmitting

■ Sending mode, Sending data size and Receiving data size

-The sending data size is dynamically changed of bytes in the ladder program.

-The receiving data size is referred to in the ladder program.

-Special internal outputs about this function are assigned after WRF080.

Special internal outputs	Meanings
WRF080 to WRF08F	Mode, Sending data size and Receiving data size about ASR port 1.
WRF090 to WRF09F	Mode, Sending data size and Receiving data size about ASR port 2.
WRF0A0 to WRF0AF	Mode, Sending data size and Receiving data size about ASR port 3.
WRF0B0 to WRF0BF	Mode, Sending data size and Receiving data size about ASR port 4.
WRF0C0 to WRF0CF	Mode, Sending data size and Receiving data size about ASR port 5.
WRF0D0 to WRF0DF	Mode, Sending data size and Receiving data size about ASR port 6.

No.	Name	Meanings
WRF0x0	Setup of mode 0: Control Editor setting operation mode 1: Special Internal Output setting operation mode	Control Editor setting operation mode transmits data (word unit) for the number of I/O points set from Control Editor. Special Internal Output setting operation mode transmits data (byte unit) of the size set for special internal output.
WRF0*1	Setup of sending data size for send area 1	Set the send data size in bytes.
WRF0*2	Setup of sending data size for send area 2	Set the send data size in bytes.
WRF0*3	Setup of sending data size for send area 3	Set the send data size in bytes.
WRF0*4	Setup of sending data size for send area 4	Set the send data size in bytes.
WRF0*5	Setup of sending data size for send area 5	Set the send data size in bytes.
WRF0*6	Setup of sending data size for send area 6	Set the send data size in bytes.
WRF0*7	Setup of sending data size for send area 7	Set the send data size in bytes.
WRF0*8	Setup of sending data size for send area 8	Set the send data size in bytes.
WRF0*9	Setup of sending data size for send area 9	Set the send data size in bytes.
WRF0*A	Setup of sending data size for send area 10	Set the send data size in bytes.
WRF0*B	Display of receiving data size	Receive data size is stored in bytes.
WRF0*C to WRF0*F	Reserve	

* It means 8 to D corresponding to ASR ports 1 to 6.

MEMO

Appendix 2 I/O Address

A2.1 External I/O

The external input is represented by X and the external output is represented by Y.

List of external I/O classification and data type

I/O symbols	Input or output	Data types	Remarks
X	External input	Bit (Bool) (1 bit)	Decimal number (X0, 1, 2, .., 9, 10, .., 15, 16, 17, .., 39)
WX		Word (16 bits)	Data in 0 to 15 are batch-processed. 16-point synchronicity is guaranteed.
DX		Double word (32 bits)	Address is hexadecimal number. Simultaneity of 32 bits data is not ensured.
Y	External output	Bit (Bool) (1 bit)	Decimal number (Y100, 101, 102, .., 109, 110, .., 115, 116, 117, .., 123)
WY		Word (16 bits)	Data in 0 to 15 are batch-processed. 16-point synchronicity is guaranteed.
DY		Double word (32 bits)	Two word data are batch-expressed. 32-point synchronicity is not guaranteed

The I/O configuration and I/O address of each unit are shown below.

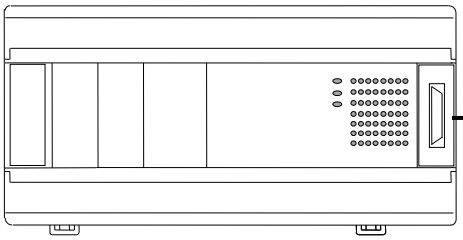
I/O configuration and I/O address of each unit

Type			I/O configuration	Input/ output	20-point	40-point	64-point
Basic	Digital		(Fixed)	Input	X0 to 11 (WX0)	X0 to 23 (WX0 to 1)	X0 to 39 (WX0 to 2)
				Output	Y100 to 107 (WY10)	Y100 to 115 (WY10)	Y100 to 123 (WY10 to 11)
Expansion 1	Digital	8/14/16/28-point	B1/1	Input	X1000 to 1015 (WX100)		
				Output	Y1016 to 1027 (WY101)		
		64-point expansion	X48/Y32	Input	X1000 to 1039 (WX100 to 102)		
				Output	Y1100 to 1123 (WY110 to 111)		
	Analog		FUN0	Input	WX100 to 104		
				Output	WY105 to 107		
Expansion 2	Digital	8/14/16/28-point	B1/1	Input	X2000 to 2015 (WX200)		
				Output	Y2016 to 2027 (WY201)		
		64-point expansion	X48/Y32	Input	X2000 to 2039 (WX200 to 202)		
				Output	Y2100 to 2123 (WY210 to 211)		
	Analog		FUN0	Input	WX200 to 204		
				Output	WY205 to 207		
Expansion 3	Digital	8/14/16/28-point	B1/1	Input	X3000 to 3015 (WX300)		
				Output	Y3016 to 3027 (WY301)		
		64-point expansion	X48/Y32	Input	X3000 to 3039 (WX300 to 302)		
				Output	Y3100 to 3123 (WY310 to 311)		
	Analog		FUN0	Input	WX300 to 304		
				Output	WY305 to 307		
Expansion 4	Digital	8/14/16/28-point	B1/1	Input	X4000 to 4015 (WX400)		
				Output	Y4016 to 4027 (WY401)		
		64-point expansion	X48/Y32	Input	X4000 to 4039 (WX400 to 402)		
				Output	Y4100 to 4123 (WY410 to 411)		
	Analog		FUN0	Input	WX400 to 404		
				Output	WY405 to 407		

I/O number example

MV*-*64**

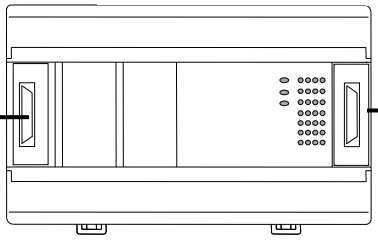
X0 to X39 (WX0 to WX2)



Y100 to Y123 （WY10, WY11）

EH-A28EDR

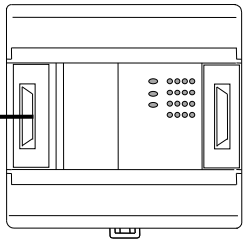
X1000 to X1015 (WX100)



Y1016 to Y1027 (WY101)

EH-A6EAN (Analog expansion)

WX201 to WX204



WY206, WY207

A2.2 Internal output

The internal output is a register that the user program can use.

The EHV series internal output has a bit dedicated area (R), a word dedicated area (WR, WN) and a bit / word shared area (M / WM) in the internal output. And there is a link area (L / WL) for exchanging data with other CPU using the link module. However, the MICRO-EHV series does not have a dedicated word area (WN) or link area (L / WL).

The internal output includes an area that can be freely accessed by the user and an area that is used for a specific purpose. The area that is used for a specific purpose is called "special internal output". The special internal output is used for setting the system and indicating the status. Refer to “Appendix 1 List of Special Internal Output” for the details.

List of internal outputs

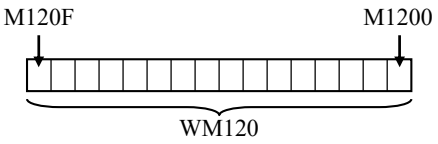
I/O type \ CPU model		Number of points	
		MVL-*20/40/64** (Standard model)	MVH-*40/64** (High Function model)
Bit		1,984 bits (R0 to R7BF)	
Word (WR)		32,768 words (WR0 to WR7FFF)	
Word (WN)		-	
Bit/word shared (WM)		32,768 bits, 2,048 words (M0 to M7FFF, WM0 to WM7FF)	
Special internal output	Bit	2,112 bits (R7C0 to RFFF)	
	Word	4,096 words (WRF000 to WRF1FF)	
CPU link		-	

Internal output I/O numbers are represented based on the following rules.

List of internal output I/O numbering rules (1/2)

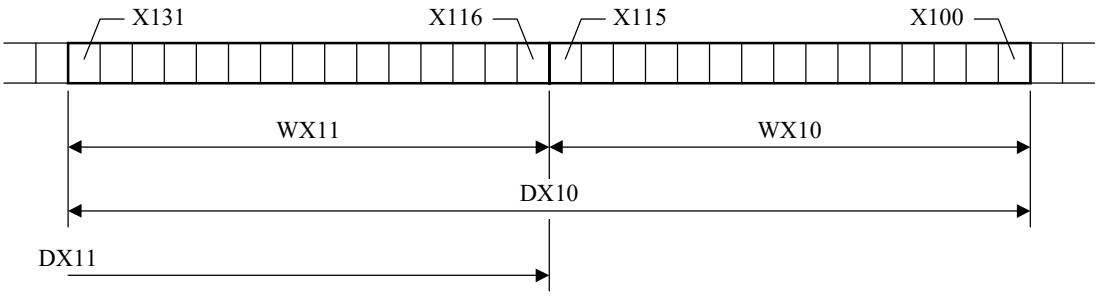
Data type	Numbering rule	
Bit-dedicated type	R □□□	Normal area H000 to H7BF Special area H7C0 to H7FF Both hexadecimal
Word-dedicated type	<For word>	W R □□□□ Normal area H0000 or above Special area HF000 or above Both hexadecimal
	[Bit specification]	W R □□□□.□ Specify ".n". (n: Bit No., 0 to F)
	[Signed integer]	W R □□□□.S Specify ".S".
	[String specification]	W R □□□□.ASC.n Specify ".n". (n: Number of bytes, 1 to 32 [decimal]) Specify ".ASC".
	<For double word>	D R □□□□ Normal area H0000 or above Special area HF000 or above Sequential 2-word WR representation Both hexadecimal
	[Signed integer]	D R □□□□.S Specify ".S".
	[Real number (floating point)]	D R □□□□.FL Specify ".FL".

List of internal output I/O numbering rules (2/2)

Data type	Numbering rule
Bit/word shared type	<For bit> M □□□□□ H00000 or above / H0000 or above Hexadecimal
	<For word> W M □□□□ H0000 or above Hexadecimal  * No bit specification is available for the bit/word shared type.
	[Signed integer] W M □□□□.S Specify ".S".
	[String specification] W M □□□□.A S C.n Specify ".n". (n: Number of bytes, 1 to 32 [decimal]) Specify ".ASC".
	<For double word> D M □□□□ H0000～ Both hexadecimal Sequential 2-word WR representation
	[Signed integer] D M □□□□.S Specify ".S".
	[Real number (floating point)] D M □□□□.FL Specify ".FL".

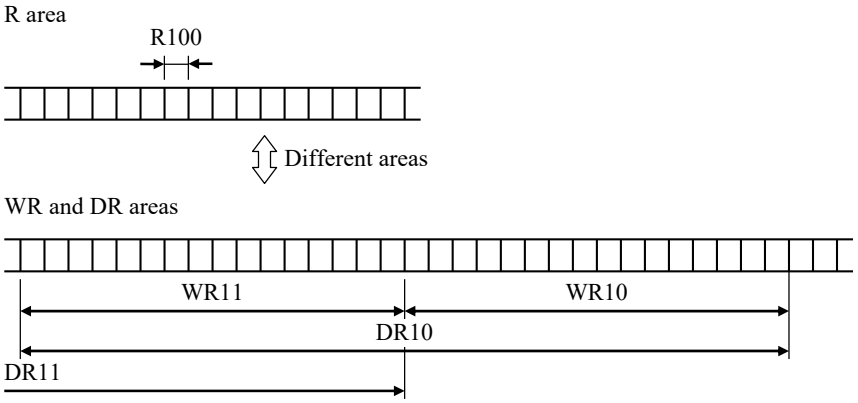
The word type data for external input / output is data that puts together 16 points bit data, and the double word type data is data that puts together 32 points.

Example: Relationship between DX10, WX10 and X100-X115



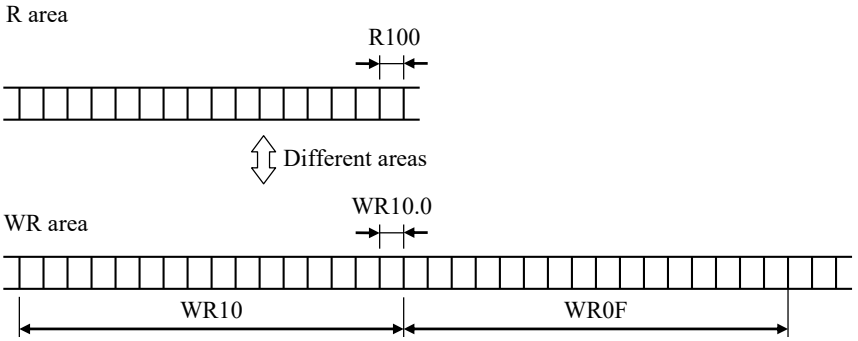
The internal output R area is different from the WR and DR areas.

Example: Correspondence between R100 and WR10/DR10



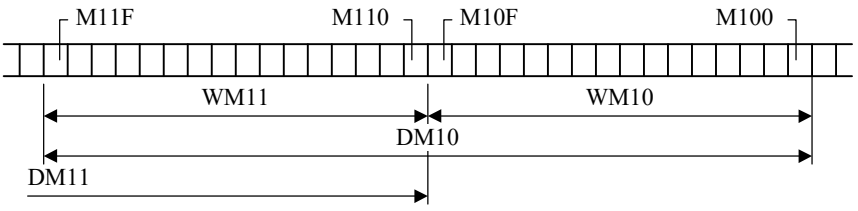
Caution

MICRO-EHV can select a specific bit from word data to access.



The internal outputs M, WM, and DM use the same area. (Each bit can be manipulated via word I/O.)

Example: Correspondence between M100 and WM10/DM10



Appendix 3 List of Supported Functions

MICRO-EHV has different functions depending on the software version. The software version can be monitored with the special internal output WRF050 (hexadecimal display).

Function				Software version		
			High Function (MVH)	0102 or older	0104	0105
			Standard (MVL)	1102 or older	1104	1105
Command	Basic command			✔	✔	✔
	Arithmetic command (all except the following)			✔	✔	✔
	Arithmetic command (SGET, EXT, SQR, BSQR, POW, EXP, FLOG, FLOG10 Radian trigonometric function)			-	✔	✔
	Application command (all except the following)			✔	✔	✔
	Application command (PID)			-	✔	✔
	Application command (High speed counter)			✔	✔	✔
	Application command (Pulse・PWM output) *1			-	✔	✔
	Application command (BMOV / BCOPY)			-	-	-
	Control command			✔	✔	✔
	Transfer command (TRNS0 / RECV 0)			✔	✔	✔
	Transfer command (MBMST / INV1)			-	✔	✔
	Transfer command (OMST1 / OCTP1)			-	-	-
I/O	Expansion	Expansion unit (Digital)		✔	✔	✔
		Expansion unit (Analog)		-	✔	✔
		Expansion unit (RTD, Thermocouple)		-	✔	✔
		Expansion unit (Positioning)		-	-	-
	Special internal output	NTP client function *2		-	✔	✔
		Task code port reset *2		-	-	✔
		Option board analog		-	-	✔
		communication speed setting *2		-	-	✔
	Special IO	High-speed counter input		✔	✔	✔
		Interrupt input		✔	✔	✔
		Pulse / PWM output *1		-	✔	✔
Communication function	Serial communication port (RS-232C)	Programming / Display		✔	✔	✔
		General-purpose communication (TRNS0 / RECEIVE 0)		✔	✔	✔
	Ethernet port *2	Programming / Display (TCP / IP)		✔	✔	✔
		Display etc. (UDP / IP)		-	-	-
		Modbus-TCP server		✔	✔	✔
		ASR communication function (TCP / IP)		-	-	✔
		ASR communication function (UDP / IP)		-	-	-
		Variable communication speed		-	-	✔
	USB port	Programming		✔	✔	✔
USB memory (host) *2	Uploading program (USB memory ← PLC)			✔	✔	✔
	Downloading program(USB memory → PLC)			✔	✔	✔
	Data logging			-	-	-
	Multiple programs of USB upload (in the file name MAC added)			-	-	-
Other	Data memory backup function			-	-	-
Option board	Communication	Programming / display (serial)		-	✔	✔
		Modbus-RTU master		-	✔	✔
		Modbus-RTU slave		-	✔	✔
		General-purpose communication (TRNS0 / RECEIVE 0)		-	✔	✔
		Modbus gateway *2		-	✔	✔
	Analog input			-	-	✔

✔ : Supported - : Not supported

* 1 This function is supported only for the transistor output type.

* 2 This function is supported only by the high function version (MVH).

Function			Software version			
		High Function (MVH)	0106	0107	0108	0109
		Standard (MVL)	1106	1107	1108	1109
Command	Basic command		✔	✔	✔	✔
	Arithmetic command (all except the following)		✔	✔	✔	✔
	Arithmetic command (SGET, EXT, SQR, BSQR, POW, EXP, FLOG, FLOG10 Radian trigonometric function)		✔	✔	✔	✔
	Application command (all except the following)		✔	✔	✔	✔
	Application command (PID)		✔	✔	✔	✔
	Application command (High speed counter)		✔	✔	✔	✔
	Application command (Pulse・PWM output) *1		✔	✔	✔	✔
	Application command (BMOV / BCOPY)		✔	✔	✔	✔
	Control command		✔	✔	✔	✔
	Transfer command (TRNS0 / RECV 0)		✔	✔	✔	✔
	Transfer command (MBMST / INV1)		✔	✔	✔	✔
	Transfer command (OMST1 / OCTP1)		✔	✔	✔	✔
I/O	Expansion	Expansion unit (Digital)	✔	✔	✔	✔
		Expansion unit (Analog)	✔	✔	✔	✔
		Expansion unit (RTD, Thermocouple)	✔	✔	✔	✔
		Expansion unit (Positioning)	-	-	-	-
	Special internal output	NTP client function *2	✔	✔	✔	✔
		Task code port reset *2	✔	✔	✔	✔
		Option board analog	✔	✔	✔	✔
		communication speed setting *2	✔	✔	✔	✔
	Special IO	High-speed counter input	✔	✔	✔	✔
		Interrupt input	✔	✔	✔	✔
		Pulse / PWM output *1	✔	✔	✔	✔
		Programming / Display	-	-	-	✔
Communication function	Serial communication port （RS-232C）	General-purpose communication (TRNS0 / RECV 0)	✔	✔	✔	✔
		Programming / Display (TCP / IP)	✔	✔	✔	✔
	Ethernet port *2	Display etc. (UDP / IP)	✔	✔	✔	✔
		Modbus-TCP server	-	-	✔	✔
		ASR communication function (TCP / IP)	✔	✔	✔	✔
		ASR communication function (UDP / IP)	✔	✔	✔	✔
		Variable communication speed	-	✔	✔	✔
		Programming	✔	✔	✔	✔
	USB port	Expansion unit (Digital)	✔	✔	✔	✔
USB memory (host) *2	Uploading program (USB memory ← PLC)		✔	✔	✔	✔
	Downloading program (USB memory → PLC)		✔	✔	✔	✔
	Data logging		-	-	✔	✔
	Multiple programs of USB upload (in the file name MAC added)		-	-	-	✔
	Data memory backup function		-	-	-	✔
Other	Uploading program (USB memory ← PLC)		-	-	✔	✔
Option board	Communication	Programming / display (serial)	✔	✔	✔	✔
		Modbus-RTU master	✔	✔	✔	✔
		Modbus-RTU slave	✔	✔	✔	✔
		General-purpose communication (TRNS0 / RECV 0)	✔	✔	✔	✔
		Modbus gateway *2	✔	✔	✔	✔
	Analog input		✔	✔	✔	✔
	Analog output		-	-	-	✔

✔ : Supported - : Not supported

*1 This function is supported only for the transistor output type.

*2 This function is supported only by the high function version (MVH).

*3 The counter ON / OFF preset value, pulse / PWM output frequency, pulse output pulse count, and PWM ON duty are displayed on the special internal output.

Function			Software version	
		High Function (MVH)	0109 or older	0110
		Standard (MVL)	1109 or older	1110
Special internal Output (Bit)	Reset Ethernet Modbus-TCP	[R91A]	-	✔
	Clear Task code transmit counter	[R921]	-	✔
	Task code P1 resetting completed	[R9D0]	-	✔
	Task code P2 resetting completed	[R9D1]	-	✔
	Task code P3 resetting completed	[R9D2]	-	✔
	Task code P4 resetting completed	[R9D3]	-	✔
	ASR port1 resetting completed	[R9D4]	-	✔
	ASR port2 resetting completed	[R9D5]	-	✔
	ASR port3 resetting completed	[R9D6]	-	✔
	ASR port4 resetting completed	[R9D7]	-	✔
	ASR port5 resetting completed	[R9D8]	-	✔
	ASR port6 resetting completed	[R9D9]	-	✔
	Ethernet port (Modbus-TCP port) Reset completed	[R9DA]	-	✔
	Task code port1 error	[R9DC]	-	✔
	Task code port2 error	[R9DD]	-	✔
	Task code port3 error	[R9DE]	-	✔
	Task code port4 error	[R9DF]	-	✔
Special internal Output(Word)	Task code P1 send count	[WRF1F0]	-	✔
	Task code P1 correctly receive count	[WRF1F1]	-	✔
	Task code P1 receive error (command)	[WRF1F2]	-	✔
	Task code P1 receive error (format)	[WRF1F3]	-	✔
	Task code P2 send count	[WRF1F4]	-	✔
	Task code P2 correctly receive count	[WRF1F5]	-	✔
	Task code P2 receive error (command)	[WRF1F6]	-	✔
	Task code P2 receive error (format)	[WRF1F7]	-	✔
	Task code P3 send count	[WRF1F8]	-	✔
	Task code P3 correctly receive count	[WRF1F9]	-	✔
	Task code P3 receive error (command)	[WRF1FA]	-	✔
	Task code P3 receive error (format)	[WRF1FB]	-	✔
	Task code P4 send count	[WRF1FC]	-	✔
	Task code P4 correctly receive count	[WRF1FD]	-	✔
	Task code P4 receive error (command)	[WRF1FE]	-	✔
	Task code P4 receive error (format)	[WRF1FF]	-	✔

✔ : Supported - : Not supported

Function				Software version	
			High Function (MVH)	0110 or older	0120
			Standard (MVL)	1110 or older	1120
I/O	Special I/O	I/O mixed setting		-	✔
		Operation from Control Editor (Jog operation)		-	✔
		Operation from Control Editor (Inching operation)		-	✔
		Operation from Control Editor (Return to origin)		-	✔
Command	Application command (PLSTA) Absolute position coordinate specification			-	✔
	Application command (PLSTAR)			-	✔
	Application command (PLSPDR)			-	✔
	Application command (PLSCNGR)			-	✔
	Application command (PLSTPR)			-	✔
Special internal Output (Bit)	Ch1 Homing returning in progress		[RA0B]	-	✔
	Ch1 Homing returned		[RA0D]	-	✔
	Ch2 Homing returning in progress		[RA1B]	-	✔
	Ch2 Homing returned		[RA1D]	-	✔
	Ch3 Homing returning in progress		[RA2B]	-	✔
	Ch3 Homing returned		[RA2D]	-	✔

✔ : Supported - : Not supported

Function				Software version	
			High Function (MVH)	0125 or older	0126
			Standard (MVL)	1125 or older	1126
Communication	Option board port	Hitachi Serial Data Link (HSDL) protocol		-	✔
Option board	Analog input (OBV-AIG)			-	✔
	Analog input / output (OBV-AIOG)			-	✔
	RTD input (OBV-RTD)			-	✔
Special internal Output (Bit)	R7C8 (Serious failure), R7DB (Self-diagnostic error) turns on in WDT error.			-	✔
	HSDL Run / Stop		[R820]	-	✔
	HSDL Link data update time (max) initialization		[R821]	-	✔
	HSDL Link data update time (min) initialization		[R822]	-	✔
	Modbus F.C.		[R90F]	-	✔
Special internal Output (Word)	Option board analog input 3		[WRF04E]	-	✔
	Option board analog input 4		[WRF04F]	-	✔
	HSDL Link data update time (max)		[WRF0ED]	-	✔
	HSDL Link data update time (current)		[WRF0EE]	-	✔
	HSDL Link data update time (min)		[WRF0EF]	-	✔
	HSDL Status (Station 1, Master)		[WRF150]	-	✔
	HSDL Status (Station 3, Station 2)		[WRF151]	-	✔
	HSDL Status (Station 5, Station 4)		[WRF152]	-	✔
	HSDL Status (Station 7, Station 6)		[WRF153]	-	✔
	HSDL Status (Station 9, Station 8)		[WRF154]	-	✔
	HSDL Status (Station 11, Station 10)		[WRF155]	-	✔
	HSDL Status (Station 13, Station 12)		[WRF156]	-	✔
	HSDL Status (Station 15, Station 14)		[WRF157]	-	✔
	HSDL Status (Station 17, Station 16)		[WRF158]	-	✔
	HSDL Status (Station 19, Station 18)		[WRF159]	-	✔
	HSDL Status (Station 21, Station 20)		[WRF15A]	-	✔
	HSDL Status (Station 23, Station 22)		[WRF15B]	-	✔
	HSDL Status (Station 25, Station 24)		[WRF15C]	-	✔
	HSDL Status (Station 27, Station 26)		[WRF15D]	-	✔
	HSDL Status (Station 29, Station 28)		[WRF15E]	-	✔
	HSDL Status (Station 31, Station 30)		[WRF15F]	-	✔
Error code	H42 Option board verification error			-	✔
	H7D Analog option board *4 conversion processing delay			-	✔
	HA7 Too many files opened in USB memory			-	✔
	HA8 USB download program not supported			-	✔
	HA9 Insufficient USB download program information			-	✔

✔ : Supported - : Not supported

*4 This error will be detected only in OBV-AIG, OBV-AIOG, OBV-RTD.

MEMO