MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Application)

-R60ADI8-HA
-SW1DNN-HARTCDTM-BD (CommDTM for R60ADI8-HA)

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

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

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the user's manual of the CPU module used.

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

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

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

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

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

[Design Precautions]

⚠ WARNING

● Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.

  (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.

  (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
   • Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
   • Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.

  (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.

  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.

● In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.

● Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.

● For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.

[Design Precautions]

⚠ WARNING

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

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[Design Precautions]

⚠ CAUTION

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

[Installation Precautions]

⚠ WARNING

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

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines included with the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause malfunction.
- When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette or a battery-less option cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, battery-less option cassette, or connector. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

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

[Wiring Precautions]

⚠ CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. Failure to do so may cause a dangling cable to swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction.
  When the module is used in a place that produces a considerable shock or vibration, the weight of the cables may apply a load on the module.
  Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

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

[Startup and Maintenance Precautions]

⚠ **CAUTION**

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.

- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.

- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.

- Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) more than 25cm away in all directions from the programmable controller. Failure to do so may cause malfunction.

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

- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

- After the first use of the product, do not perform each of the following operations more than 50 times (IEC 61131-2/JIS B 3502 compliant):
  Exceeding the limit may cause malfunction.
    - Mounting/removing the module to/from the base unit
    - Inserting/removing the extended SRAM cassette or battery-less option cassette to/from the CPU module
    - Mounting/removing the terminal block to/from the module

- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.

- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure.

- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette or a battery-less option cassette. Doing so may cause malfunction or failure of the module.

- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.

- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.

- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[Operating Precautions]

⚠CAUTION

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

[Disposal Precautions]

⚠CAUTION

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

[Transportation Precautions]

⚠CAUTION

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

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;

i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and

ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;

- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

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

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable controllers.

This manual describes the functions, parameter settings, and troubleshooting of the relevant products listed below.

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.

When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

Please make sure that the end users read this manual.

> **Point**
>
> Unless otherwise specified, this manual provides program examples in which the I/O numbers of X/Y0 to X/YF are assigned to the A/D converter module. Assign I/O numbers when applying the program examples to an actual system. For I/O number assignment, refer to the following.
> 📖 MELSEC iQ-R Module Configuration Manual

Relevant product

R60ADI8-HA

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CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Application) [SH-082048ENG] (this manual)	Functions, parameter settings, I/O signals, buffer memory, and troubleshooting of the HART-enabled analog-digital converter module	Print book
		e-Manual PDF
MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup) [SH-082047ENG]	System configuration, specifications, procedures before operation, wiring, and operation examples of the HART-enabled analog-digital converter module	Print book
		e-Manual PDF
MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks) [SH-081266ENG]	Instructions, standard functions/standard function block for the CPU module	e-Manual PDF

Point

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

e-Manual has the following features:

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

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	A memory in an intelligent function module for storing data such as setting values and monitored values. For the CPU module, this term refers to a memory for storing data such as setting values and monitored values of the Ethernet function and data used for data communication of the multiple CPU system function.
CommDTM(Communication DTM)	Software module to configure settings for communication with field devices from a personal computer via the HART master
Device DTM	A software module to configure parameter settings of and perform monitoring of field devices
DTM(Device Type Manager)	A software module to configure communication settings and parameter settings of field devices and monitor field devices when the FDT frame application is used
Engineering tool	A tool that is used to configure settings of a programmable controller and perform programming, debug, and maintenance of a programmable controller.
FDT frame application	An application for using DTM that complies with the open standards for FDT/DTM
FDT(Field Device Tool)	Software standards for control, maintenance, adjustment, and engineering of field devices
Global label	A label that is valid for all the program data when multiple program data are created in the project. The global label has two types: a module specific label (module label), which is generated automatically by GX Works3, and an optional label, which can be created for any specified device.
MELSOFT FieldDeviceConfigurator	Field device control and setting software manufactured by Mitsubishi Electric that is complaint with the open standards for FDT/DTM. As FDT frame application, this software enables users to configure parameter settings of field devices and perform maintenance and adjustment of field devices.
Module Label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to each module in a given character string. For the module used, GX Works3 automatically generates this label, which can be used as a global label.
Watchdog timer error	Watchdog timer enables the module to monitor whether its own internal processing of the module is normal. A watch dog timer error is an error that occurs if the internal processing of the A/D converter module is abnormal.

GENERIC TERM AND ABBREVIATION

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term and abbreviation	Description
A/D converter module	An abbreviation for MELSEC iQ-R HART-enabled analog-digital converter module

1 FUNCTIONS

This chapter describes the functions of the A/D converter module and the setting procedures for those functions. For details on the I/O signals and the buffer memory, refer to the following.

☞Page 85 I/O Signals

☞Page 95 Buffer Memory Areas

> **Point**
>
> • This chapter describes buffer memory addresses for CH1. For details on the buffer memory addresses for CH2 and later, refer to the following.
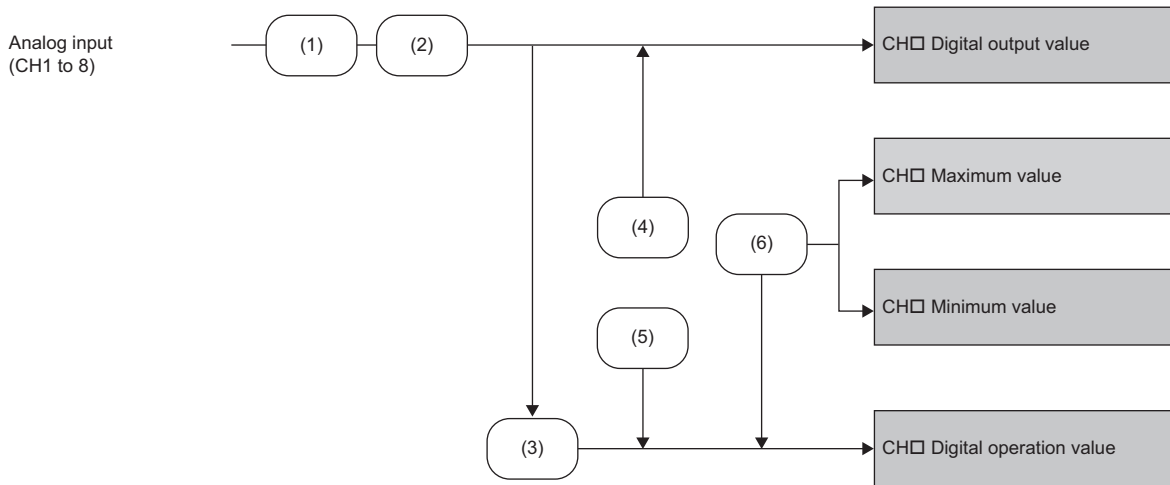> ☞Page 95 List of buffer memory addresses
> • Numerical values come in □ and △ of the error codes and alarm codes described in this chapter. □ indicates the channel where an error has occurred and △ indicates details of the error. For details on the numerical values, refer to the following.
> ☞Page 80 List of Error Codes
> ☞Page 82 List of Alarm Codes

1.1 Processing of Each Function

The functions are processed in the order shown below. If multiple functions are enabled, the output of the first processed function is used as the input of the next function.

No.	Processing details
(1)	Input signal error detection function
(2)	The A/D conversion is executed in one of the following A/D conversion methods. • Sampling processing • Count average • Time average • Moving average • Primary delay filter
(3)	Scaling function
(4)	Warning output function (rate alarm)
(5)	Warning output function (process alarm)
(6)	Maximum value/minimum value hold function

Digital output value

These values are the digital values after the sampling processing, each averaging processing, or primary delay filter has been performed.

Digital operation value

These values are obtained by operating a digital output value using the scaling function. When the scaling function is not used, the same value as the digital output value is stored.

Maximum and minimum values

The maximum and minimum values of the digital operation values are stored.

1.2 Range Switching Function

This function switches the input range of an analog input for each channel.

Switching the range makes it possible to change the I/O conversion characteristics.

Setting method

Set the input range to be used in the "Input range setting".

☞ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Input range switching function]

Input range setting	Digital output value
4 to 20mA	0 to 32000
0 to 20mA	
4 to 20mA (extended mode)	-8000 to 32000

After the data is written, the range is switched when the programmable controller power supply is turned off and on or when the CPU module is reset.

> **Point** 🔎
>
> With the following buffer memory areas, the range switching and range setting can be monitored.
>
> 'CH1 Range setting' (Un\G598)
>
> 'CH1 Range setting monitor' (Un\G430)
>
> For details on the buffer memory, refer to the following.
>
> ☞ Page 122 CH1 Range setting
>
> ☞ Page 112 CH1 Range setting monitor

Precautions

The input range cannot be switched for the channel where A/D conversion disable is set. To switch the input range, set "A/D conversion enable/disable setting" to "A/D conversion enable".

1.3 HART Communication Function

This function enables the A/D converter module to communicate with HART®-enabled external devices as the master module. In addition, using FDT frame application and DTM allows the user to set up the external devices via the A/D converter module. In the HART communication, an analog signal of 4 to 20mADC is superimposed on a digital signal to transmit various information to connected external devices.
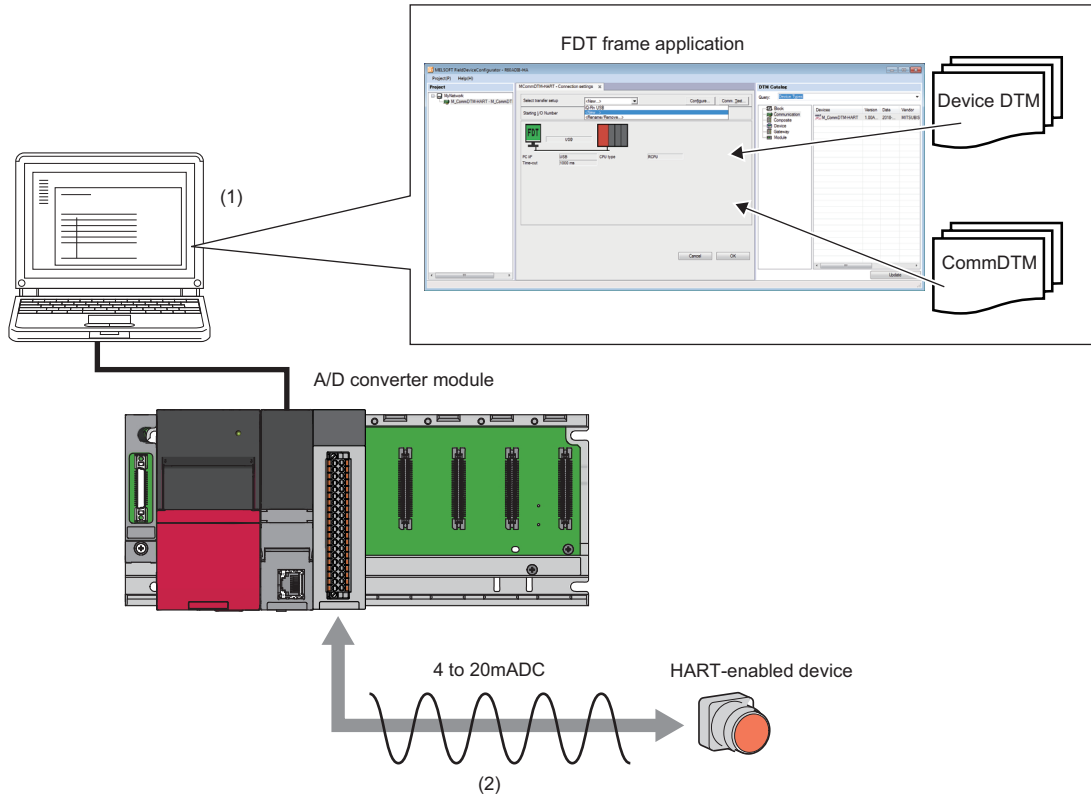
(1) Set parameters of a HART-enabled device or communication path using CommDTM and Device DTM from FDT frame application. The set parameters are written to the HART-enabled device.

(2) Superimpose an analog signal of 4 to 20mADC on HART-enabled device information or HART command between the A/D converter module and the HART-enabled device and send/receive the information.

Constituent device

To use the HART communication function, an external device (HART-enabled device) that supports the HART communication is required. The A/D converter module supports HART revision 7. For how to perform wiring for a HART-enabled device, refer to the following.

📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup)

Procedures of the HART communication function

The following describes the procedures to use the HART communication function.

1. Wiring for the HART-enabled device

Perform wiring for the A/D converter module and the HART-enabled device. (📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup))

2. Settings using CommDTM and Device DTM

Set parameters of the HART-enabled device and communication path from CommDTM and Device DTM. (☞ Page 59 CommDTM)

These settings are not required depending on the used HART-enabled device and control settings.

3. Start of HART communication

Configure the settings of the HART communication function and start the HART communication. (☞ Page 19 Start of HART communication)

4. Monitoring of HART device variables

Monitor HART device variables of the HART-enabled device from the A/D converter module. (☞ Page 21 Monitoring of HART device variables)

5. Diagnostics of the HART-enabled device

Execute the diagnostics of the HART-enabled device. (☞ Page 22 Diagnostics of the HART-enabled device)

6. Execution of HART command

A HART command can be executed from the A/D converter module to the HART-enabled device at an arbitrary timing. (☞ Page 23 Execution of HART command)

Restrictions and precautions

The HART communication function has the following restrictions and precautions.

■Range switching function

When the HART communication function is used, the availability of the input range is not restricted. However, input a current within the range of 4 to 20mA to a channel where the HART communication function is used. When a current outside the range of 4 to 20mA is input, the HART communication may not be properly performed.
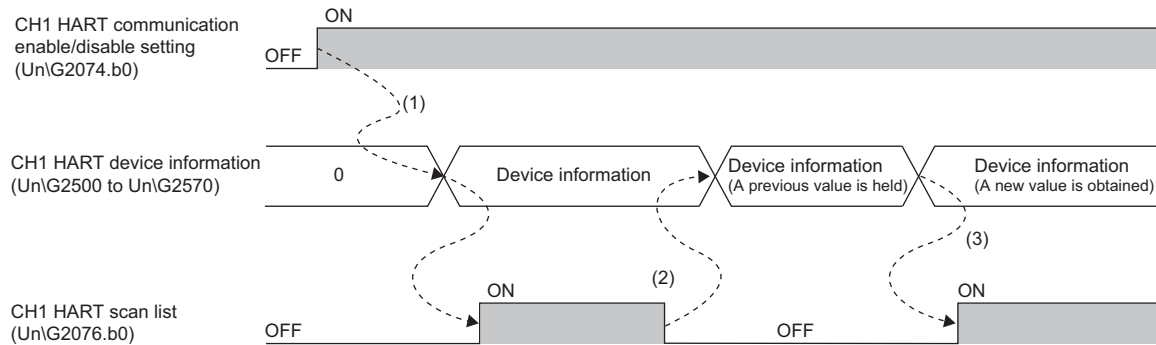
■A/D conversion enable/disable setting function

Unlike other functions, the HART communication function can be used even when the A/D conversion is disabled. However, the digital output value and digital operation value are not updated for the channel on which A/D conversion is disabled. To use the digital output value and digital operation value for the control in a channel where the HART communication function is used, enable the A/D conversion.

Start of HART communication

The HART communication starts when the bit corresponding to 'HART communication enable/disable setting' (Un\G2074) is set to Enable (1).
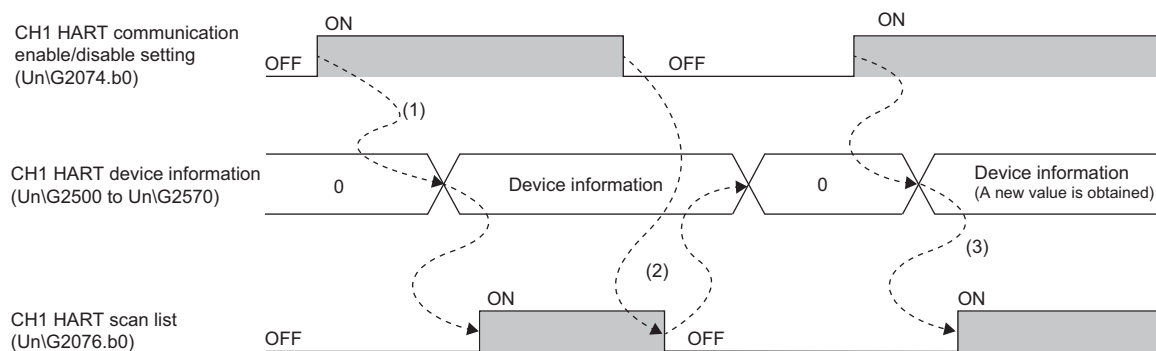
When the HART communication starts, the A/D converter module automatically detects a HART-enabled device of a channel where the HART communication is enabled. When the HART-enabled device is detected, HART-enabled device information is acquired, and Detected (1) is stored in the bit corresponding to 'HART scan list' (Un\G2076).

CH1 HART communication enable/disable setting (Un\G2074.b0): OFF → ON

CH1 HART device information (Un\G2500 to Un\G2570): 0 → (1) → Device information → Device information (A previous value is held) → Device information (A new value is obtained) (3)

CH1 HART scan list (Un\G2076.b0): OFF → ON (2) → OFF → ON

- - - - - - - - ▶ Performed by the A/D converter module

(1) CH1 HART communication enable/disable setting (Un\G2074.b0) is set to Enable, the A/D converter module searches for a HART-enabled device. When the HART-enabled device is detected, HART device information is stored in CH1 HART device information (Un\G2500 to Un\G2570), and Detected (1) is stored in CH1 HART scan list (Un\G2076.b0).

(2) When the HART communication is interrupted due to a disconnection or other factor, Undetected (0) is stored in CH1 HART scan list (Un\G2076.b0). At this time, the last value of CH1 HART device information (Un\G2500 to Un\G2570) is retained.

(3) When the HART-enabled device is detected again and the HART communication is restarted, HART device information is stored again in CH1 HART device information (Un\G2500 to Un\G2570), and Detected (1) is stored again in CH1 HART scan list (Un\G2076.b0).

When the bit corresponding to 'HART communication enable/disable setting' (Un\G2074) is set to Disable (0) during the HART communication, the HART communication stops.

CH1 HART communication enable/disable setting (Un\G2074.b0): OFF → ON → OFF → ON

CH1 HART device information (Un\G2500 to Un\G2570): 0 → (1) → Device information → 0 → Device information (A new value is obtained) (3)

CH1 HART scan list (Un\G2076.b0): OFF → ON (2) → OFF → ON

- - - - - - - - ▶ Performed by the A/D converter module

(1) When CH1 HART communication enable/disable setting (Un\G2074.b0) is set to Enable (1), the A/D converter module searches for a HART-enabled device. When the HART-enabled device is detected, HART device information is stored in CH1 HART device information (Un\G2500 to Un\G2570), and Detected (1) is stored in CH1 HART scan list (Un\G2076.b0).

(2) When CH1 HART communication enable/disable setting (Un\G2074.b0) is set to Disable (0) during the HART communication, the HART communication stops. When the HART communication stops, 0 is stored in CH1 HART device information (Un\G2500 to Un\G2570), and Undetected (0) is stored in CH1 HART scan list (Un\G2076.b0).

(3) To restart the HART communication, set CH1 HART communication enable/disable setting (Un\G2074.b0) to Enable (1) again.

■HART device information

When the HART communication starts, information of a HART-enabled device is acquired and stored in buffer memory areas. The information acquired is as follows.

Acquired information	Details
Tag	☞ Page 136 CH1 HART device information (tag)
Message	☞ Page 137 CH1 HART device information (message)
Descriptor	☞ Page 137 CH1 HART device information (descriptor)
Manufacturer ID/expanded manufacturer ID	☞ Page 138 CH1 HART device information (manufacturer ID/expanded manufacturer ID)
Device type/expanded device type	☞ Page 138 CH1 HART device information (device type/expanded device type)
Device ID	☞ Page 138 CH1 HART device information (device ID)
Revisions	☞ Page 139 CH1 HART device information (revisions)
Device function flags	☞ Page 140 CH1 HART device information (device function flags)
Long tag	☞ Page 141 CH1 HART device information (long tag)
Distributor code	☞ Page 141 CH1 HART device information (private label distributor code)
Device profile	☞ Page 141 CH1 HART device information (device profile)
Final assembly number	☞ Page 142 CH1 HART device information (final assembly number)
Date	☞ Page 142 CH1 HART device information (date)
Write protect	☞ Page 142 CH1 HART device information (write protect)
PV range engineering unit	☞ Page 143 CH1 HART device information (PV range engineering unit)
PV upper range value	☞ Page 143 CH1 HART device information (PV upper range value)
PV lower range value	☞ Page 143 CH1 HART device information (PV lower range value)
PV damping value	☞ Page 143 CH1 HART device information (PV damping value)
PV transfer function	☞ Page 144 CH1 HART device information (PV transfer function)
PV engineering unit	☞ Page 144 CH1 HART device information (PV engineering unit)
SV engineering unit	☞ Page 144 CH1 HART device information (SV engineering unit)
TV engineering unit	☞ Page 144 CH1 HART device information (TV engineering unit)
QV engineering unit	☞ Page 145 CH1 HART device information (QV engineering unit)

To refresh HART device information, set Refresh request made (1) to the bit corresponding to 'HART device information refresh request' (Un\G2031). When refreshing of the HART device information is completed, Refresh completed (1) is stored in the bit corresponding to 'HART device information refresh completed' (Un\G2032).


```
--------▶ Performed by the A/D converter module
————▶ Performed by a program
```
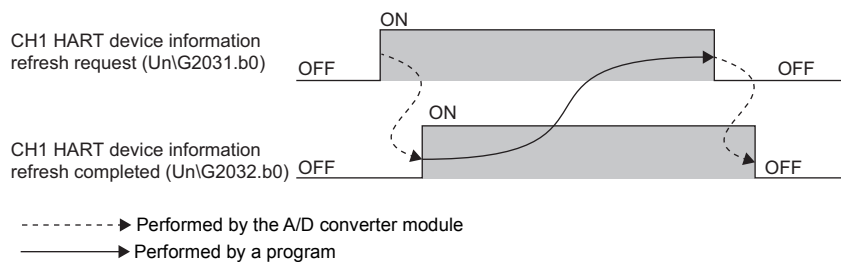
Point

The following device information is refreshed every HART cycle time regardless of the settings of 'HART device information refresh request' (Un\G2031).
- PV engineering unit
- SV engineering unit
- TV engineering unit
- QV engineering unit

Monitoring of HART device variables

When the HART communication starts, HART device variables (PV value, SV value, TV value, and QV value) of the used HART-enabled device are stored in the following buffer memory areas.

- 'CH1 PV value' (Un\G2084, Un\G2085)
- 'CH1 SV value' (Un\G2086, Un\G2087)
- 'CH1 TV value' (Un\G2088, Un\G2089)
- 'CH1 QV value' (Un\G2090, Un\G2091)

Each buffer memory area is refreshed every HART cycle time.

> **Point**
> - A value stored in HART device variables differs depending on the used HART-enabled device. For details on the stored values, refer to the manual of the used HART-enabled device.
> - When there is no HART device variable corresponding to the used HART-enabled device, 7FA00000H is stored.

■Precautions when data is read

The refreshing cycle of HART device variables (HART cycle time) and sequence scan of the CPU module are asynchronous. Because of this, when HART device variables are read to the CPU module while written to the buffer memory areas of the A/D converter module, data inconsistency may occur.

To prevent data inconsistency of HART device variables, read HART device variables according to the following procedures.

1. Turn off and on 'HART device variables access request' (Y3).

2. 'HART device variables access flag' (X3) turns on. After checking this flag is on, read HART device variables.

3. After the reading is completed, turn on and off 'HART device variables access request' (Y3).

4. Check that 'HART device variables access flag' (X3) is off. Values of buffer memory areas of HART device variables are not refreshed while 'HART device variables access flag' (X3) is on.

HART cycle time

HART cycle time is the total time required to access each channel where the HART communication is enabled. Refreshing of each channel is processed in order. Because of this, the HART cycle time differs depending on the number of channels where the HART communication is enabled.

Ex.
When the HART communication is enabled in all channels, the HART cycle time is as follows.

	HART cycle time								
CH1 Refresh processing	CH2 Refresh processing	CH3 Refresh processing	CH4 Refresh processing	CH5 Refresh processing	CH6 Refresh processing	CH7 Refresh processing	CH8 Refresh processing	CH1 Refresh processing	. . .
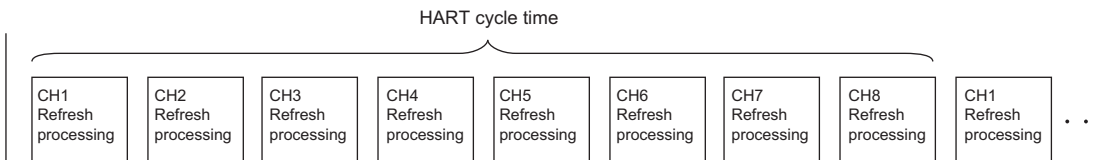
■Checking the HART cycle time

The HART cycle time during the HART communication can be checked in the following buffer memory areas.

Buffer memory area	Description	Refreshing cycle
'HART current cycle time' (Un\G2077)	The current HART cycle time is stored in increments of 10ms.	Updated every time the HART cycle time elapses.
'HART maximum cycle time' (Un\G2078)	The maximum HART cycle time is stored in increments of 10ms.	
'HART minimum cycle time' (Un\G2079)	The minimum HART cycle time is stored in increments of 10ms.	

To reset 'HART maximum cycle time' (Un\G2078) and 'HART minimum cycle time' (Un\G2079), turn off and on 'HART cycle time maximum value/minimum value reset request' (Y2). The values are reset to the value of 'HART current cycle time' (Un\G2077). When the reset is completed, 'HART cycle time maximum value/minimum value reset completed flag' (X2) turns off and on.

Diagnostics of the HART-enabled device

The HART device status information is sent to the A/D converter module every HART cycle time during the HART communication. The status information includes status of HART device variables and that of output current. The status information can be checked and the HART-enabled device can be diagnosed in the following buffer memory areas.

Buffer memory area	Details
'CH1 HART field device status' (Un\G2080)	☞ Page 127 CH1 HART field device status
'CH1 HART extended field device status' (Un\G2081)	☞ Page 128 CH1 HART extended field device status
'CH1 HART device variable status primary value (PV), secondary value (SV)' (Un\G2082)	☞ Page 129 CH1 HART device variable status
'CH1 HART device variable status tertiary value (TV), quaternary value (QV)' (Un\G2083)	

Execution of HART command

A HART command can be executed from the A/D converter module to the HART-enabled device at an arbitrary timing.

Buffer memory area for HART command request — 0 / HART command request (1)

'HART command request flag' (Un\G2200) — OFF / ON / OFF (4)

HART command answer flag (execution accepted flag) (Un\G2344.b8) — OFF / ON / OFF (2)

HART command answer flag (execution completed flag) (Un\G2344.b0) — OFF / ON / OFF

Buffer memory area for HART command answer — 0 / HART command answer / 0 (3)
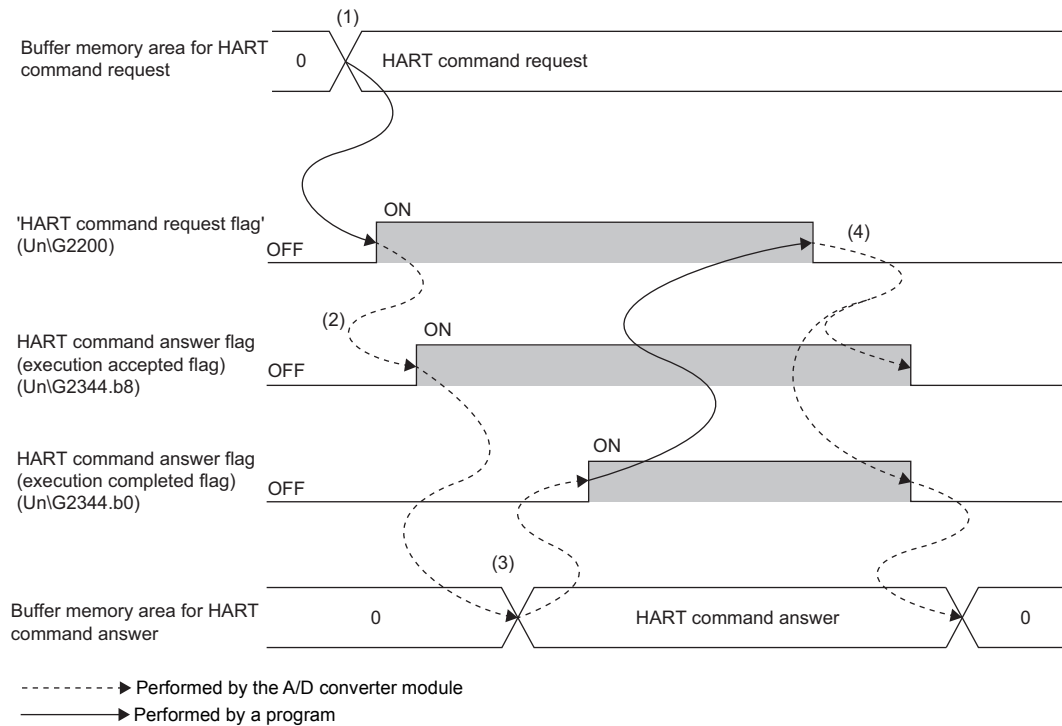
- - - - - - -▶ Performed by the A/D converter module

───────▶ Performed by a program

(1) Set a HART command to be executed and a target channel in the following buffer memory areas for HART command request.
 • 'HART command request channel' (Un\G2201)
 • 'HART command request code' (Un\G2202)
 • 'HART command request data size' (Un\G2203)
 • 'HART command request data' (Un\G2204 to Un\G2331)
(2) When 'HART command request flag' (Un\G2200) is set to Command execution request (1), a HART command is executed. When the execution of the HART command is accepted by the A/D converter module, HART command answer flag (execution acceptance flag) (Un\G2344.b8) is turned on.
(3) When the execution of the HART command is completed, answer details sent from the HART-enabled device are stored in the following buffer memory areas for HART command answer. HART command answer flag (execution completed flag) (Un\G2344.b0) is turned on.
 • 'HART command answer channel' (Un\G2345)
 • 'HART command answer code' (Un\G2346)
 • 'HART command answer data size' (Un\G2347)
 • 'HART command answer data' (Un\G2348 to Un\G2475)
(4) When 'HART command request flag' (Un\G2200) is set to No request (0), the stored values of the following buffer memory areas are refreshed.
 • 'HART command answer flag' (execution completed flag) (Un\G2344.b0)
 • 'HART command answer flag' (execution acceptance flag) (Un\G2344.b8)
 • 'HART command answer channel' (Un\G2345)
 • 'HART command answer code' (Un\G2346)
 • 'HART command answer data size' (Un\G2347)
 • 'HART command answer data' (Un\G2348 to Un\G2475)

1.4 A/D Conversion Enable/Disable Setting Function

This function controls whether to enable or disable the A/D conversion for each channel.

Setting method

Set "A/D conversion enable/disable setting" to "A/D conversion enable" or "A/D conversion disable".

⌐ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

1.5 A/D Conversion Method

An A/D conversion method can be set for each channel. The following shows available conversion methods.

- Sampling processing
- Averaging processing (time average, count average, moving average)
- Primary delay filter

Overview of A/D conversion

The A/D conversion is executed per channel.

■Sampling cycle

Sampling cycle is the internal A/D conversion cycle. The sampling cycle is fixed to 80ms regardless of the settings of the number of conversion enabled channels.

■Conversion cycle

Digital output values are updated on the conversion cycle of sampling processing, averaging processing, or primary delay filter. The following table lists the conversion cycles in each A/D conversion method.

A/D conversion method	Conversion cycle
Sampling processing	Sampling cycle
Time average	((The time set for Time average/Count average/Moving average/Primary delay filter constant setting) ÷ Sampling cycle)[*1] × Sampling cycle
Count average	(The count set for Time average/Count average/Moving average/Primary delay filter constant setting) × Sampling cycle
Moving average	Sampling cycle
Primary delay filter	Sampling cycle

*1 Values after the decimal point are omitted.

Sampling processing

Analog input values are converted at each sampling cycle and stored in the buffer memory as digital output values. The conversion cycle is the sampling cycle.

Setting method

Set "Average processing setting" to "Sampling processing".

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion method]

Averaging processing

The A/D converter module performs the averaging processing on digital output values for each channel. The averaged values are stored in the buffer memory.
The following three types of averaging processing are provided.
• Time average
• Count average
• Moving average

Time average

The A/D conversion is performed for the setting time and the averaging processing is performed on the total value excluding the maximum and the minimum values. The averaged values are stored in the buffer memory.

■Setting time
The setting range of the time (for averaging) is 320 to 5000ms.

■Number of processing times
The processing times within the setting time are as follows.
• Number of processing times (times) = Setting time/Sampling cycle

Ex.
The following shows the number of processing times with the setting below.

Item	Setting
Setting time	500ms

500 (ms)/80 (ms) = 6.25 (times) (Value after the decimal point is omitted.)
Conversion is processed six times and the mean value is output.

Count average

The A/D conversion is performed for the set number of times and the averaging processing is performed on the total value excluding the maximum and the minimum values. The averaged values are stored in the buffer memory.
The time taken to store the average value obtained by the averaging processing in the buffer memory area is as follows.
• Processing time = Set number of times × Sampling cycle

Ex.
The following shows the processing time with the setting below.

Item	Setting
Set number of times	Five times

5 (times) × 80 (ms) = 400 (ms)
A mean value is output every 400ms.

Moving average

The A/D converter module averages digital output values taken at every sampling cycle for a specified number of times, and stores a mean value in the buffer memory. Since the averaging processing is performed on a moving set of sampling, the latest digital output values can be obtained.

The following figure shows the moving average processing of when the set number of times is five.
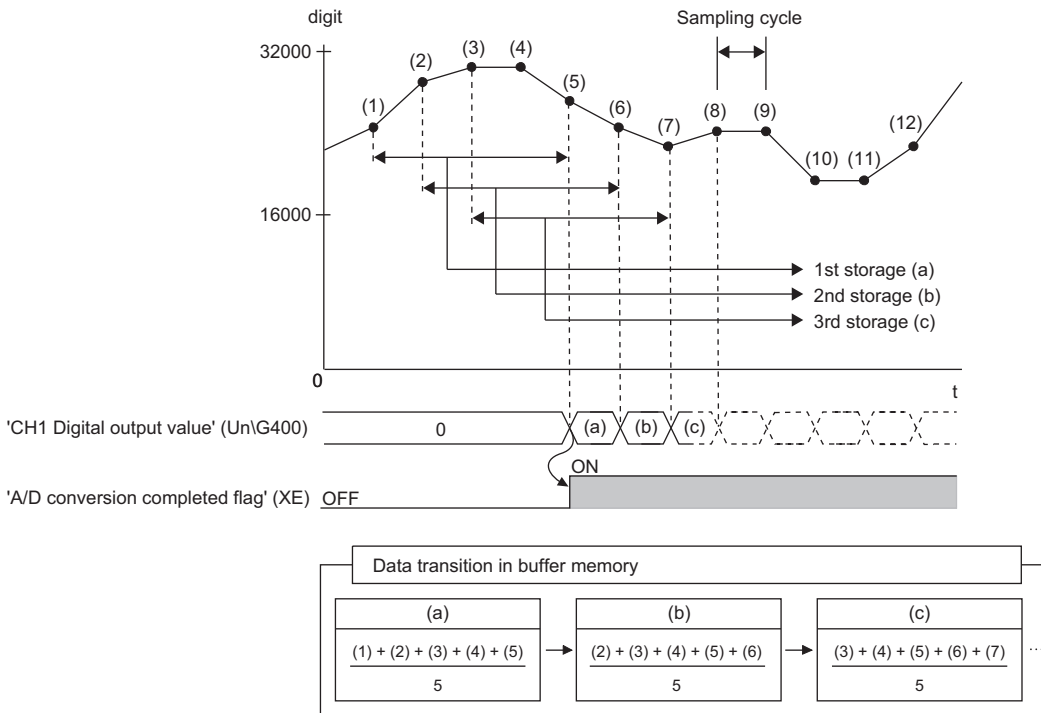
digit: Digital output value
t: Time (ms)

Setting method

1. Set "Average processing setting" to "Time average", "Count average", or "Moving average".

👈 [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion method]

2. Set a value for "Time average/Count average/Moving average/Primary delay filter constant setting".

A/D conversion method	Setting range
Time average	320 to 5000 (ms)
Count average	4 to 500 (times)
Moving average	2 to 1000 (times)

Primary delay filter

The A/D converter module smooths transient noise of an analog input according to the set time constant. The smoothed digital output value is stored in the buffer memory.

Time constant is the time taken for the digital output value to reach 63.2% of the steady-state value. The degree of smoothing changes depending on the setting of a time constant. The following shows the calculation formula of a time constant.

- Time constant = (Conversion cycle) × (Value set in 'CH1 Time average/Count average/Moving average/Primary delay filter constant setting' (Un\G502))

The following table shows the relational expressions of a time constant, digital output values, and current number of sampling (n).

Current number of sampling	Relational expression	Element
n = 1	$Y_n = 0$	Y_n: Current digital output value
n = 2	$Y_n = X_{n-1} + \dfrac{\Delta t}{\Delta t + TA}(X_n - X_{n-1})$	Y_{n-1}: Last digital output value n: Number of sampling X_n: Digital output value before smoothing X_{n-1}: Last digital output value before smoothing
n≥3	$Y_n = Y_{n-1} + \dfrac{\Delta t}{\Delta t + TA}(X_n - Y_{n-1})$	Δt: Sampling cycle TA: Time constant

'A/D conversion completed flag' (XE) turns on when n ≥ 2.

Ex.

The following shows the digital output value of when an analog input value is changed from 0 to 1mA.

Item	Setting
Primary delay filter constant setting	50

After 4s from when the analog input value is changed to 1mA, the digital output value reaches 63.2% of the digital output value of when the sampling processing is selected.
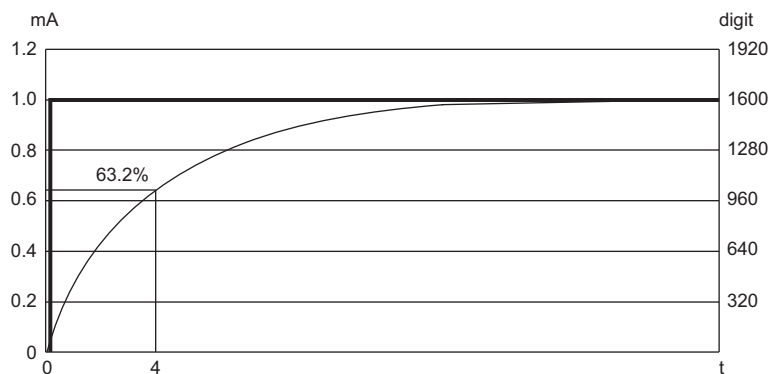
mA: Analog input value (mA)
t: Elapsed time (s)
digit: Digital output value
——— : Change of the analog input value
——— : Change of the digital output value

Setting method

1. Set "Average processing setting" to "Primary delay filter".

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion method]

2. Set a value for "Time average/Count average/Moving average/Primary delay filter constant setting".

A/D conversion method	Setting range
Primary delay filter	1 to 500 (times)

1.6　Scaling Function

This function performs the scale conversion on digital output values. The values are converted within a specified range between a scaling upper limit value and scaling lower limit value. This function reduces the time and effort to create a program of the scale conversion.

The converted values are stored in 'CH1 Digital operation value' (Un\G402).

Concept of scaling setting

Ex.

When the input range is set to 4 to 20mA:

For the scaling lower limit value, set a value corresponding to the lower limit value of the input range (0).

For the scaling upper limit value, set a value corresponding to the upper limit value of the input range (32000).

Calculating the scaling value

The scale conversion is based on the following formula. (In the scale conversion, values are rounded to the nearest whole number.)

$$D_Y = \frac{D_X \times (S_H - S_L)}{D_{Max}} + S_L$$

D_X: Digital output value[*1]
D_Y: Scaling value (Digital operation value)
D_{Max}: Maximum digital output value of the input range in use
S_H: Scaling upper limit value
S_L: Scaling lower limit value

*1　Although the range of the digital output value in the extended mode is -8000 to 32000, this function performs the scale conversion on digital output values within the range of 0 to 32000.

Setting method

1. Set "Scaling enable/disable setting" to "Enable".

☜ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Scaling setting]

2. Set values for "Scaling upper limit value" and "Scaling lower limit value".

Item	Setting range
Scaling upper limit value	-32000 to 32000
Scaling lower limit value	

Point

- Even when the scaling upper limit value and the scaling lower limit value are set so that the change is greater than the resolution, the resolution will not increase.
- If the relation between the values is scaling lower limit value > scaling upper limit value, the scale conversion can be performed according to a negative slope.
- Set the scaling with the condition "Scaling upper limit value ≠ Scaling lower limit value".

Setting example

Ex.

When 20000 is set for the scaling upper limit value and 4000 is set for the scaling lower limit value for the module with the input range of 0 to 20mA.
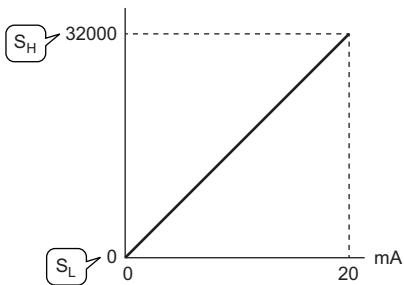
mA: Analog input current (mA)
S_H: Scaling upper limit value: 20000
S_L: Scaling lower limit value: 4000

Current input (mA)	Digital output value	Scaling value (Digital operation value)
0	0	4000
4	6400	7200
8	12800	10400
12	19200	13600
16	25600	16800
20	32000	20000

Ex.

When 20000 is set for the scaling upper limit value and 4000 is set for the scaling lower limit value for the module with the input range of 4 to 20mA (extended mode).
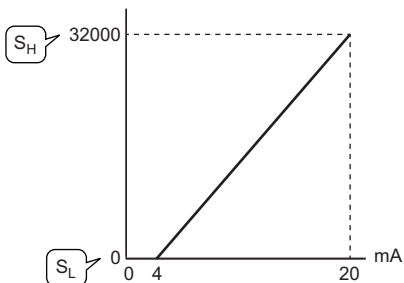
mA: Analog input current (mA)
S_H: Scaling upper limit value: 20000
S_L: Scaling lower limit value: 4000

Current input (mA)	Digital output value	Scaling value (Digital operation value)
0	-8000	0
4	0	4000
8	8000	8000
12	16000	12000
16	24000	16000
20	32000	20000
20.3835	32767	20384

1.7 Maximum Value/Minimum Value Hold Function

This function stores the maximum and minimum values of digital operation values for each channel in the buffer memory.

Resetting the maximum value and the minimum value

Turn on and off 'Maximum value/minimum value reset request' (YD) or 'Operating condition setting request' (Y9) to replace the maximum value and minimum value with the current values.

Turning on 'Maximum value/minimum value reset request' (YD) turns on 'Maximum value/minimum value reset completed flag' (XD).

Values to be the maximum value and the minimum value

The maximum and minimum values of digital operation values are stored in the buffer memory.

When the scaling function is used, the maximum value and minimum value obtained after the operation processing of the scaling function are stored.

1.8 Warning Output Function

This function has process alarms and rate alarms. The following sections describe process alarms and rate alarms.

Process alarm

This function outputs a warning when a digital operation value enters the preset warning output range.
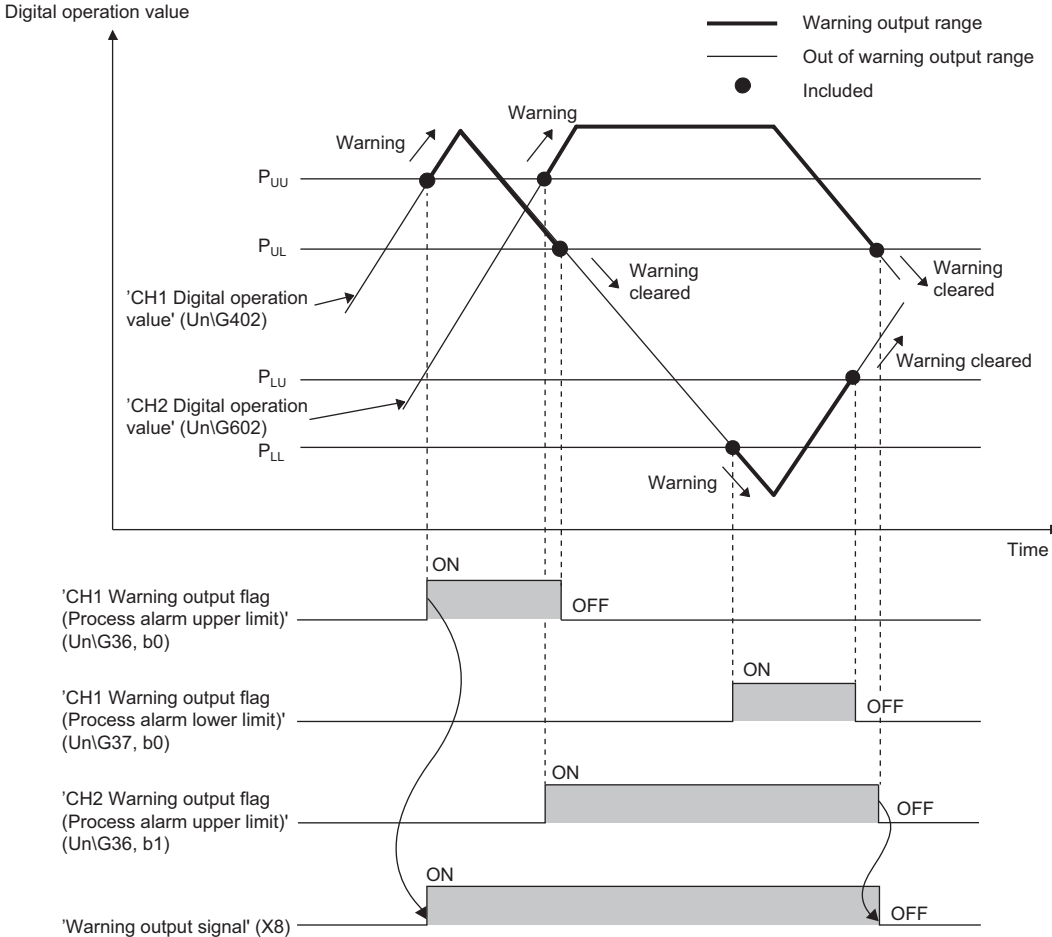
P_{UU}: Process alarm upper upper limit value
P_{UL}: Process alarm upper lower limit value
P_{LU}: Process alarm lower upper limit value
P_{LL}: Process alarm lower lower limit value

Operation

■Operation performed when a warning is output

When a digital operation value is equal to or greater than 'CH1 Process alarm upper upper limit value' (Un\G514), or the value is equal to or smaller than 'CH1 Process alarm lower lower limit value' (Un\G520) and thus the value enters the warning output range, a warning is output as follows.

- Alarm ON (1) is stored in 'Warning output flag (Process alarm upper limit)' (Un\G36) or 'Warning output flag (Process alarm lower limit)' (Un\G37).
- 'Warning output signal' (X8) turns on.
- The ALM LED turns on.

In addition, an alarm code is stored in 'Latest alarm code' (Un\G2).

For details on the alarm codes, refer to the following.

☞ Page 82 List of Alarm Codes

> **Point**
>
> The A/D conversion on a channel where a warning was output continues.

■Operation after a warning was output

After a warning was output, if the digital operation value does not satisfy the warning output condition due to being smaller than 'CH1 Process alarm upper lower limit value' (Un\G516) or being greater than 'CH1 Process alarm lower upper limit value' (Un\G518), Normal (0) is stored in a bit corresponding to the channel number of 'Warning output flag (Process alarm upper limit)' (Un\G36) or 'Warning output flag (Process alarm lower limit)' (Un\G37).

In addition, when all 'Warning output flag (Process alarm upper limit)' (Un\G36) and 'Warning output flag (Process alarm lower limit)' (Un\G37) return to Normal (0), 'Warning output signal' (X8) turns off and the ALM LED turns off. However, the alarm code stored in 'Latest alarm code' (Un\G2) is not cleared. To clear the alarm code, turn on and off 'Error clear request' (YF) after all the bits of 'Warning output flag (Process alarm upper limit)' (Un\G36) and 'Warning output flag (Process alarm lower limit)' (Un\G37) return to Normal (0).

Detection cycle

When time average is specified, the function works at every interval of the time (for averaging). When count average is specified, the function works at every count (for averaging).

When the sampling processing, moving average, or primary delay filter is specified, this function works at every sampling cycle.

Detection target for outputting a warning

When the scaling function is used, the digital operation value obtained after scale conversion is performed is the detection target for outputting a warning. Set values for 'CH1 Process alarm upper upper limit value' (Un\G514), 'CH1 Process alarm upper lower limit value' (Un\G516), 'CH1 Process alarm lower upper limit value' (Un\G518), and 'CH1 Process alarm lower lower limit value' (Un\G520) while considering the scale conversion.

Setting method

1. Set "Warning output setting (Process alarm)" to "Enable".

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Warning output function (Process alarm)]

2. Set values for "Process alarm upper upper limit value", "Process alarm upper lower limit value", "Process alarm lower upper limit value", and "Process alarm lower lower limit value".

Item	Setting range
Process alarm upper upper limit value	-32768 to 32767
Process alarm upper lower limit value	
Process alarm lower upper limit value	
Process alarm lower lower limit value	

Point ℘

Set values within the range satisfying the condition "Process alarm upper upper limit value ≥ Process alarm upper lower limit value ≥ Process alarm lower upper limit value ≥ Process alarm lower lower limit value".

Rate alarm

This function outputs a warning when the change rate of a digital output value is equal to or greater than the rate alarm upper limit value, or the rate is equal to or smaller than the rate alarm lower limit value.
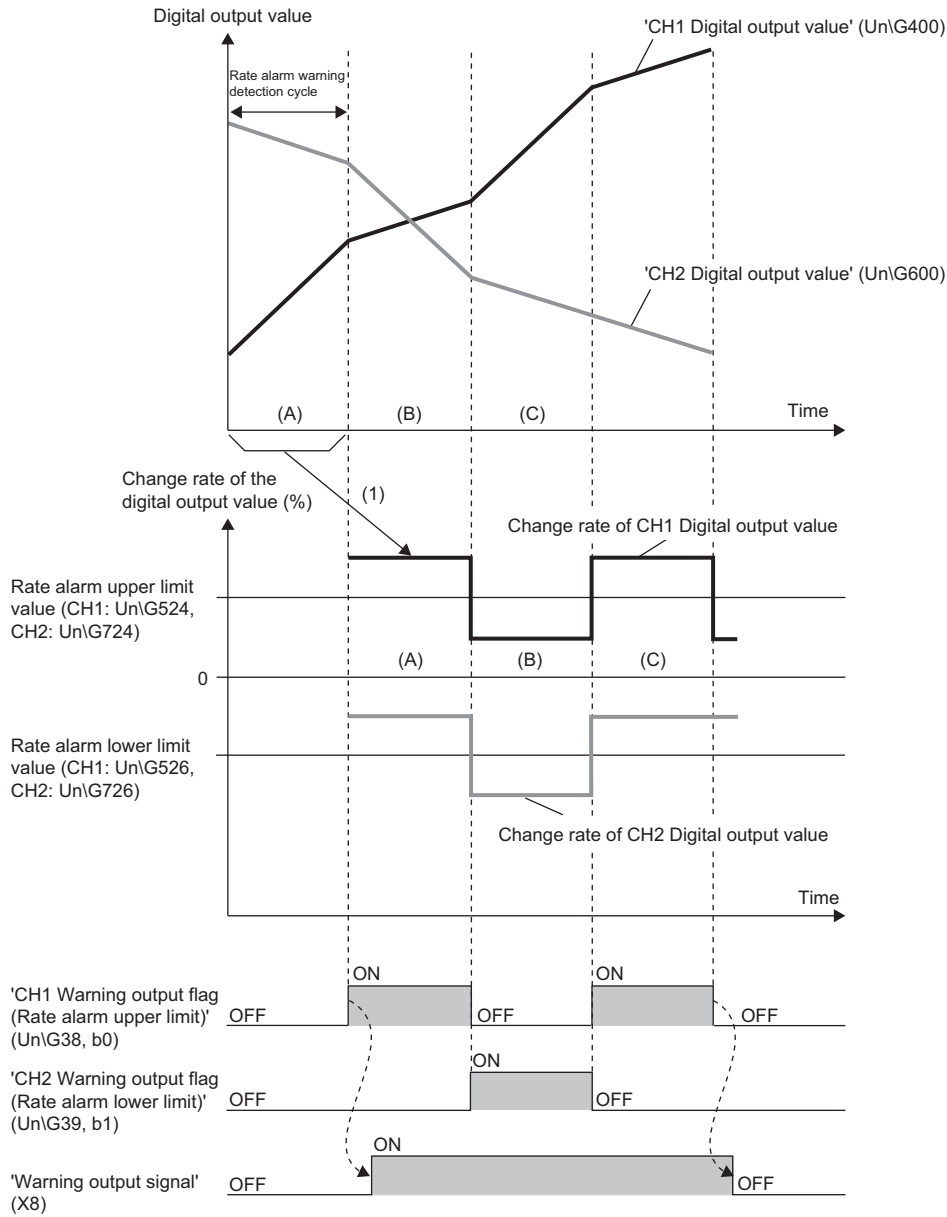
--------▶ Performed by the A/D converter module

(1) The change amount of a digital output value is converted into the change rate at every rate alarm warning detection cycle. When the change amount increases, the change rate is greater than 0. When the change amount decreases, the change rate is smaller than 0.

Operation

■Operation performed when a warning is output

Digital output values are monitored every rate alarm warning detection cycle. When a change rate of a digital output value (from a previous value) is equal to or greater than the rate alarm upper limit value, or the rate is equal to or smaller than the rate alarm lower limit value, a warning is output as follows.

- Alarm ON (1) is stored in 'Warning output flag (Rate alarm upper limit)' (Un\G38) or 'Warning output flag (Rate alarm lower limit)' (Un\G39).
- 'Warning output signal' (X8) turns on.
- The ALM LED turns on.

In addition, an alarm code is stored in 'Latest alarm code' (Un\G2).

For details on the alarm codes, refer to the following.

☞ Page 82 List of Alarm Codes

> **Point**
>
> The A/D conversion on a channel where a warning was output continues.

■Operation after a warning was output

After a warning was output, if the change rate of a digital output value does not satisfy the warning output conditions due to being smaller than the rate alarm upper limit value or being greater than the rate alarm lower limit value, Normal (0) is stored in a bit corresponding to the channel number of 'Warning output flag (Rate alarm upper limit)' (Un\G38) or 'Warning output flag (Rate alarm lower limit)' (Un\G39).

In addition, when all 'Warning output flag (Rate alarm upper limit)' (Un\G38) and 'Warning output flag (Rate alarm lower limit)' (Un\G39) return to Normal (0), 'Warning output signal' (X8) turns off and the ALM LED turns off. However, the alarm code stored in 'Latest alarm code' (Un\G2) is not cleared. To clear the alarm code, turn on and off 'Error clear request' (YF) after all the bits of 'Warning output flag (Rate alarm upper limit)' (Un\G38) and 'Warning output flag (Rate alarm lower limit)' (Un\G39) return to Normal (0).

Detection cycle

Set the rate alarm warning detection cycle in 'CH1 Rate alarm warning detection cycle setting' (Un\G522).
The rate alarm warning detection cycle is the value calculated by multiplying the set value by the conversion cycle.

Ex.
The cycle to detect a rate alarm warning is 800ms (80ms × 10 (times)) when 'CH1 Rate alarm warning detection cycle setting' (Un\G522) is set to 10 (times).
Digital output values are compared in 800ms intervals to check the change rate.

> **Point**
>
> An analog input signal that has reached the A/D converter is smoothed. Thus, if a shorter time than the response time (400ms) is set as a rate alarm warning detection cycle and the set change rate of a detection condition is large, rate alarm may not be detected. When setting a shorter time than the response time (400ms) as the warning detection cycle, set 'CH1 Rate alarm upper limit value' (Un\G524) and 'CH1 Rate alarm lower limit value' (Un\G526) to be low so that rate alarm can be detected for even a smoothed analog input signal.

Judgment of rate alarm

A change rate is judged with digital values per rate alarm warning detection cycle, which are calculated using values in 'CH1 Rate alarm upper limit value' (Un\G524) and 'CH1 Rate alarm lower limit value' (Un\G526).

The following shows the conversion formulas to obtain judgment values (unit: digit) per rate alarm warning detection cycle.

- $D_H = (R_H/1000) \times D_{Max}$
- $D_L = (R_L/1000) \times D_{Max}$

Item	Description
D_H [1]	Upper limit value used for judgment on the rate alarm warning detection cycle (Unit: digit)
D_L [1]	Lower limit value used for judgment on the rate alarm warning detection cycle (Unit: digit)
R_H	Rate alarm upper limit value (Unit: 0.1%)
R_L	Rate alarm lower limit value (Unit: 0.1%)
D_{Max}	Maximum digital output value of the input range (32000)

[1] Values after the decimal point are omitted.

Ex.

The judgment value under the following conditions

- Input range: 4 to 20mA
- 'CH1 Averaging process specification' (Un\G501): Sampling processing (0)
- 'CH1 Rate alarm warning detection cycle setting' (Un\G522): 10 (times)
- 'CH1 Rate alarm upper limit value' (Un\G524): 250 (25.0%)
- 'CH1 Rate alarm lower limit value' (Un\G526): 50 (5.0%)

$$D_H: \frac{250}{1000} \times 32000 = 8000 \text{ (digit)}$$

$$D_L: \frac{50}{1000} \times 32000 = 1600 \text{ (digit)}$$

The current value is compared with the previous value on the rate alarm warning detection cycle of 800ms (Sampling cycle 80ms × 10). A digital value is judged whether it increases 8000 digits (25.0%) or more from the previous value, or whether the increase is 1600 digits (5.0%) or less.

Use the following formula to calculate a change rate to be set based on the change amount of current to detect a warning.

$$RC = \frac{I_X}{I_G - I_O} \times 1000$$

Item	Description
RC [2]	Change rate to be set (Unit: 0.1%)
I_X	Change amount of the current to detect a warning (mA)
I_G	Gain current (mA)
I_O	Offset current (mA)

[2] Values after the decimal point are omitted.

Application examples of rate alarms

A rate alarm serves to monitor that the change rate of a digital output value lies in a limited range as shown below:

Ex.
To monitor that a rising rate of a digital output value is within the specified range
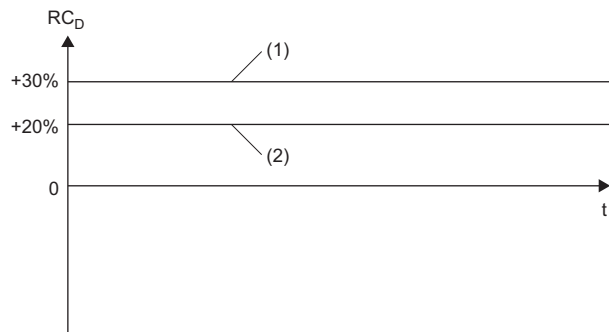
RC_D: Change rate of the digital output value (%)
t: Time
(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

Ex.
To monitor that a drop rate of a digital output value is within the specified range
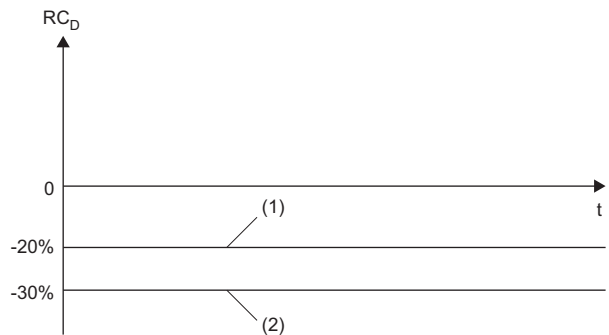
RC_D: Change rate of the digital output value (%)
t: Time
(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

Ex.
To monitor that a change rate of a digital output value is within the specified range
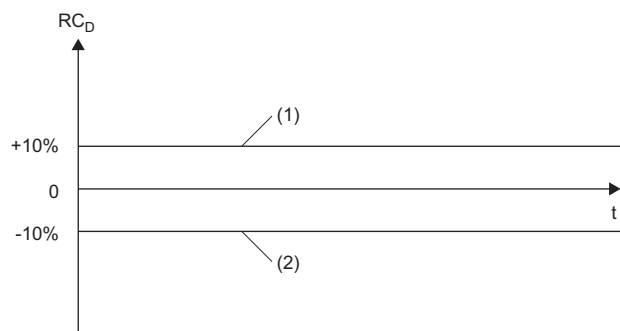
RC_D: Change rate of the digital output value (%)
t: Time
(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

Setting method

1. Set "Warning output function (Rate alarm)" to "Enable".

   [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Warning output function (Rate alarm)]

2. Set a warning detection cycle of rate alarms.

Set the cycle in "Rate alarm detection cycle setting".

Item	Setting range
Rate alarm detection cycle setting	1 to 32000 (times)

3. Set values for "Rate alarm upper limit value" and "Rate alarm lower limit value".

Set a value to the maximum value (32000) of the digital output value in increments of 0.1%.

Item	Setting range
Rate alarm upper limit value	-3276.8 to 3276.7 (%)
Rate alarm lower limit value	

Point

Set values within the range satisfying the condition "Rate alarm upper limit value > Rate alarm lower limit value".

1.9 Input Signal Error Detection Function

This function outputs an alarm when an analog input value exceeds the preset range.

- - - - - - - - ▶ Performed by the A/D converter module
———————▶ Performed by a program

In_H: Input signal error detection upper limit value
In_L: Input signal error detection lower limit value
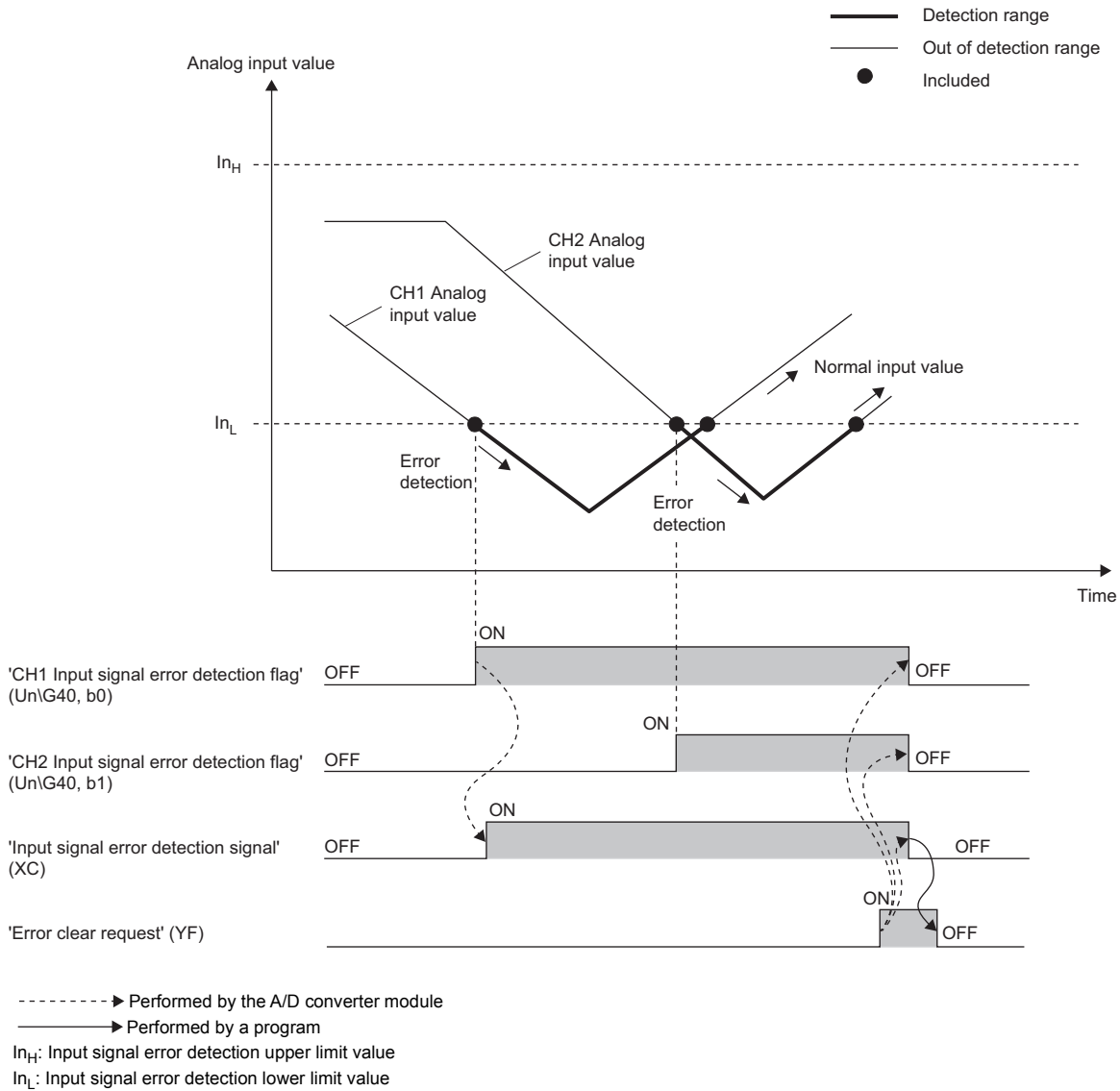
Detection method

Select a detection method from the following table.

Detection method	Detection condition	
0: Disable	Input signal errors are not detected.	—
1: Upper and lower limit detection	An input signal error is detected when the analog input value is equal to or greater than the input signal error detection upper limit value, or when the analog input value is equal to or smaller than the input signal error detection lower limit value.	
2: Lower limit detection	An input signal error is detected when the analog input value is equal to or smaller than the input signal error detection lower limit value.	
3: Upper limit detection	An input signal error is detected when the analog input value is equal to or greater than the input signal error detection upper limit value.	
4: Simple disconnection detection	Simple disconnection detection is performed. For details, refer to the following. ☞ Page 42 Simple disconnection detection	

I: Analog input value

t: Time

In_H: Input signal error detection upper limit value

In_L: Input signal error detection lower limit value

■Simple disconnection detection

An alarm is output when an analog input value is 2mA or lower.

By combining this function with the extended mode in the input range setting, simple disconnection detection is enabled.

When an analog input value satisfies either of the following conditions, it is regarded as a disconnection and 'Input signal error detection flag' (Un\G40) turns on.

Input range	Disconnection detection value
4 to 20mA (extended mode)	Analog input value ≤ 2mA
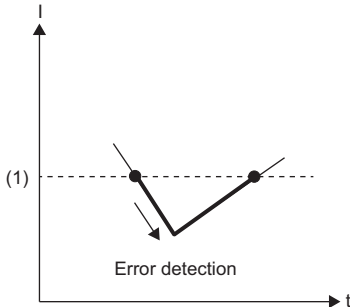
I: Analog input value
t: Time
(1) 2mA

The setting of 'CH1 Input signal error detection setting value' (Un\G529) is ignored.

Notification

When an input signal error is detected, an error is notified as follows.

• Input signal error (1) is stored in the corresponding bit of 'Input signal error detection flag' (Un\G40).
• 'Input signal error detection signal' (XC) turns on.
• The ALM LED flashes.

In addition, an alarm code is stored in 'Latest alarm code' (Un\G2). Alarm codes are stored whenever the analog input satisfies the condition for the input signal error detection.

For details on the alarm codes, refer to the following.

☞ Page 82 List of Alarm Codes

Operation

On the channel where an error is detected, the digital output value and digital operation value just before the detection of the error are stored.

When an analog input value falls within the set range, the A/D conversion is restarted regardless of whether 'Input signal error detection flag' (Un\G40) and 'Input signal error detection signal' (XC) are reset or not. (The ALM LED remains flashing.)

Point

• The values in 'CH1 Digital output value' (Un\G400) and 'CH1 Digital operation value' (Un\G402) are not updated during the occurrence of an input signal error.
• The A/D conversion continues on the channel where no input signal error is detected.
• Whether an input signal error has occurred or not is judged with the value of when the A/D conversion is completed. Thus, the corresponding bit of 'A/D conversion completed flag' (Un\G42) turns on even when an input signal error is detected.

Detection cycle

This function works at every sampling cycle.

Clearing input signal errors

After the analog input value falls within the set range, turn on and off 'Error clear request' (YF).

The A/D converter module arranges the following status when an input signal error is cleared.

- 'Input signal error detection flag' (Un\G40) is cleared.
- 'Input signal error detection signal' (XC) turns off.
- The ALM LED turns off.
- 'Latest alarm code' (Un\G2) is cleared.

Setting of the input signal error detection upper/lower limit value

Set the input signal error detection upper/lower limit values in increments of 1 (0.1%) based on the input signal error detection setting value.

The input signal error detection setting value is reflected into both the input signal error detection upper/lower limit values.

■Input signal error detection upper limit value

This value is calculated by adding "Analog input range width (Gain value - Offset value) × Input signal error detection setting value (%)" to the gain value. Only a value that is equal to or greater than the gain value can be set.

To calculate the input signal error detection setting value based on the input signal error detection upper limit value, use the following formula.

- Input signal error detection setting value = $((In_H - I_G) \div (I_G - I_O)) \times 1000$

Item	Description
In_H	Input signal error detection upper limit value
I_G	Gain value of each range
I_O	Offset value of each range

■Input signal error detection lower limit value

This value is calculated by subtracting "Analog input range width (Gain value - Offset value) × Input signal error detection setting value (%)" from the lower limit value of each range. Only the value that is equal to or smaller than the lower limit value of the range can be set.

To calculate the input signal error detection setting value based on the input signal error detection lower limit value, use the following formula.

- Input signal error detection setting value = $((I_L - In_L) \div (I_G - I_O)) \times 1000$

Item	Description
I_L	Lower limit value of each range
In_L	Input signal error detection lower limit value
I_G	Gain value of each range
I_O	Offset value of each range

The following table lists the lower limit value, offset value, and gain value for each range.

Input range	Lower limit value	Offset value	Gain value
0 to 20mA	0mA		20mA
4 to 20mA	4mA		20mA
4 to 20mA (extended mode)	4mA		20mA

Setting method

1. Select a detection method in "Input signal error detection setting".

✐ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Input signal error detection function]

2. Set a value to "Input signal error detection setting value".

Item	Setting range
Input signal error detection setting value	0.0 to 25.0 (%)

Setting example of the input signal error detection

The following shows a setting example for detecting an input signal error when an analog input value is smaller than 2.4mA in the channel set as shown below.

Item	Setting value
Input range	4 to 20mA
'CH1 Input signal error detection setting' (Un\G528)	Upper and lower limit detection (1)

Assign the following values in the calculation formula using the input signal error detection lower limit value.
- Input signal error detection lower limit value: 2.4mA
- Lower limit value of the range: 4.0mA
- Offset value: 4.0mA
- Gain value: 20.0mA

Input signal error detection setting value = ((4.0 - 2.4) ÷ (20.0 - 4.0)) × 1000 = 100 (10.0%)

Thus, set 'CH1 Input signal error detection setting value' (Un\G529) to 100 (10.0%).

The following graph shows the operation of the input signal error detection setting value. An error is detected not only for the lower limit of 2.4mA, but also for the upper limit of 21.6mA when the setting value is 100 (10.0%).
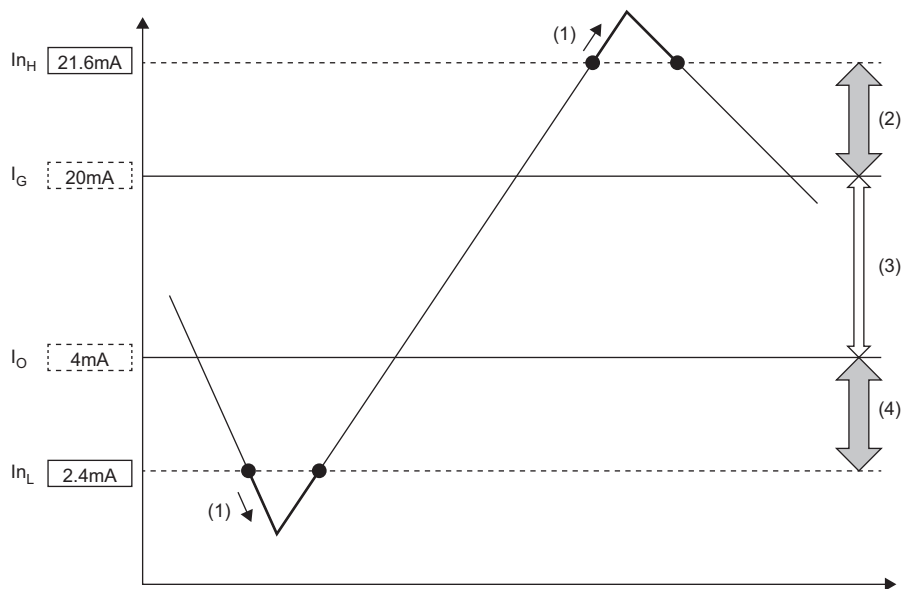
In_H: Input signal error detection upper limit value
I_G: Gain value
I_O: Offset value (Lower limit value of the input range)
In_L: Input signal error detection lower limit value
(1) Error detection
(2) 1.6mA (10.0% of 16mA)
(3) 16mA (Gain value - Offset value)
(4) 1.6mA (10.0% of 16mA)

1.10 Interrupt Function

This function executes interrupt programs of the CPU module when an interrupt factor such as a warning output or an input signal error is detected.

For the A/D converter module, the maximum number of available interrupt pointers is 16 per module.

Operation

■Detecting an interrupt factor
An interrupt factor can be detected by setting "Interrupt setting" of the module parameter and by setting 'Interrupt factor mask [n]' (Un\G124 to Un\G139) to Mask clear (Interrupt used) (1) in advance. When an interrupt factor occurs, an interrupt request is sent to the CPU module at the same time as 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).

■How to reset an interrupt factor
When Reset request (1) is set in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) corresponding to the interrupt factor, the specified interrupt factor is reset and the value of 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) changes to No interrupt factor (0).

Setting method

To use the interrupt function, set "Condition target setting", "Condition target channel setting", "Interrupt factor transaction setting", and "Interrupt pointer" with the engineering tool. After completing the settings, write the project to enable the settings.

🖑 [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Interrupt setting]

Item	Description
Condition target setting	Select a factor of the target for the interrupt detection.
Condition target channel setting	Select a target channel when the condition target setting for the interrupt detection is channel specification.
Interrupt factor transaction setting	Set whether to send an interrupt request when the same interrupt factor occurs during the interrupt factor detection.
Interrupt pointer	Specify the number of an interrupt pointer that is started at the detection of an interrupt factor.

■Condition target setting
Select a factor of the condition target setting for the interrupt detection.

Setting value	Description
Disable	No interrupt is detected.
Error flag	An interrupt is detected at the timing of when 'Error flag' (XF) turns on.
Warning output flag (Process alarm)	An interrupt is detected at the timing of when Warning output flag (Process alarm) turns on (A channel is specified.).
Warning output flag (Rate alarm)	An interrupt is detected at the timing of when Warning output flag (Rate alarm) turns on (A channel is specified.).
Input signal error detection flag	An interrupt is detected at the timing of when Input signal error detection flag turns on (A channel is specified.).
A/D conversion completed	An interrupt is detected every time A/D conversion is completed (A channel is specified.).

■Condition target channel setting
Select a target channel when the condition target setting for the interrupt detection is channel specification.

■Interrupt factor transaction setting
Set whether to send an interrupt request when the same interrupt factor occurs during the interrupt factor detection.
• When "Interrupt reissue requests" has been set and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is sent to the CPU module again.
• When "No interrupt reissue requests" has been set and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is not sent to the CPU module.

■Interrupt pointer
Specify the number of an interrupt pointer that is started when an interrupt factor is detected. For details on the interrupt pointers, refer to the following.
📖 MELSEC iQ-R CPU Module User's Manual (Application)

Precautions

- When 'Condition target setting [n]' (Un\G232 to Un\G247) is Disable (0), an interrupt request is not sent to the CPU module.
- If an interrupt factor occurs when 'Interrupt factor mask [n]' (Un\G124 to Un\G139) is Mask (Interrupt unused) (0), an interrupt request is not sent to the CPU module. 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).
- To reset the interrupt factor, set Reset request (1) until 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) changes to No interrupt factor (0).
- Resetting interrupt factors is executed only when 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) changes from No reset request (0) to Reset request (1).
- Multiple interrupt pointers can share the same setting of 'Condition target setting [n]' (Un\G232 to Un\G247). When multiple interrupt pointers have shared the same setting of 'Condition target setting [n]' (Un\G232 to Un\G247) and interrupts occur, interrupt programs are executed in order of priority of the interrupt pointers. For the priority of the interrupt pointers, refer to the following.

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

- When All channels (0) are set for 'Condition target channel setting [n]' (Un\G264 to Un\G279) and an interrupt detection target is set for 'Condition target setting [n]' (Un\G232 to Un\G247) of each channel, the interrupt requests that have the same interrupt factor are sent to the CPU module if warnings are issued in multiple channels. In this case, a CPU error may occur because the CPU module executes multiple interrupt programs and the scan monitoring function of the CPU module judges that the programs cannot be normally completed. When a CPU error occurs, refer to the following.

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

Setting example

Ex.

To execute the interrupt program (I51) when an error occurs in any channel

• Parameter setting

Set "Interrupt setting" of Module Parameter as follows.

No.	Condition target setting	Condition target channel setting	Interrupt pointer
2	Error flag	All channels	I51

• Label settings

Classification	Label name	Description	Device
Module label	RCPU.stSM.bAlways_ON	Always ON	SM400
	RCPU.stSM.bAfter_RUN1_Scan_ON	Turning on for one scan after RUN	SM402
	R60ADHART_1.unInterruptFactorMask_D[1].0	Interrupt factor mask	U0\G125.0
	R60ADHART_1.unInterruptFactorResetRequest_D[1].0	Interrupt factor reset request	U0\G157.0
Label to be defined	Define global labels as shown below:		

	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bErrorDetection	Bit	...	VAR_GLOBAL ▼	F0
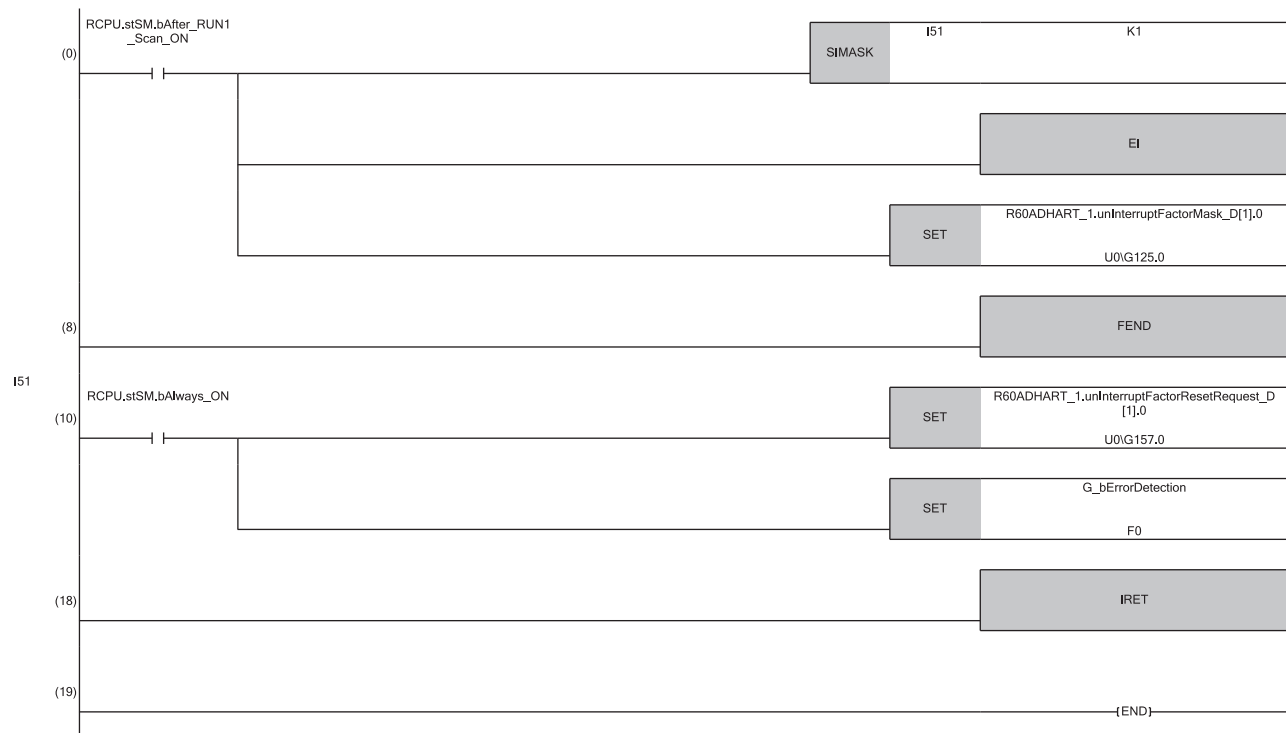
(0) Only the interrupt pointer I51 is enabled.
(10) 'Interrupt factor reset request [2]' (U0\G157) is turned on. The processing of when an error is detected is performed.

1.11 Error History Function

This function stores up to the latest 16 errors and alarms that occurred in the A/D converter module in the buffer memory area.

Operation

When an error occurs, the error code and the error time are stored from Error history 1 (Un\G3600 to Un\G3609) in order.

When an alarm occurs, the alarm code and the alarm time are stored from Alarm history 1 (Un\G3760 to Un\G3769) in order.

Error time and alarm time are stored as follows:

Ex.

The following shows Error history 1 and Alarm history 1.

- Details of the error history

	b15 ... b8	b7 ... b0
Un\G3600	Error code	
Un\G3601	First two digits of the year	Last two digits of the year
Un\G3602	Month	Day
Un\G3603	Hour	Minute
Un\G3604	Second	Day of the week
Un\G3605	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3606 ⋮ Un\G3609	System area	

- Details of the alarm history

	b15 ... b8	b7 ... b0
Un\G3760	Alarm code	
Un\G3761	First two digits of the year	Last two digits of the year
Un\G3762	Month	Day
Un\G3763	Hour	Minute
Un\G3764	Second	Day of the week
Un\G3765	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3766 ⋮ Un\G3769	System area	

Item		Storage contents	Storage example[1]
Error code or alarm code		An error code or alarm code is stored.	1900H
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (higher-order digits)		Stored in BCD code.	7H
Millisecond (lower-order digits)			89H
System area		—	—

[1] Values stored when a CH1 range setting range error (error code: 1900H) occurs at 12:34:56.789 on Thursday, December 24th, 2015.

Checking method

The start address of Error history where the latest error is stored can be checked in 'Latest address of error history' (Un\G1).
The start address of Alarm history where the latest alarm is stored can be checked in 'Latest address of alarm history' (Un\G3).

Ex.

The following shows an example of when the 3rd error occurs. The 3rd error is stored in Error history 3, and the value 3620 (start address of Error history 3) is stored in 'Latest address of error history' (Un\G1).
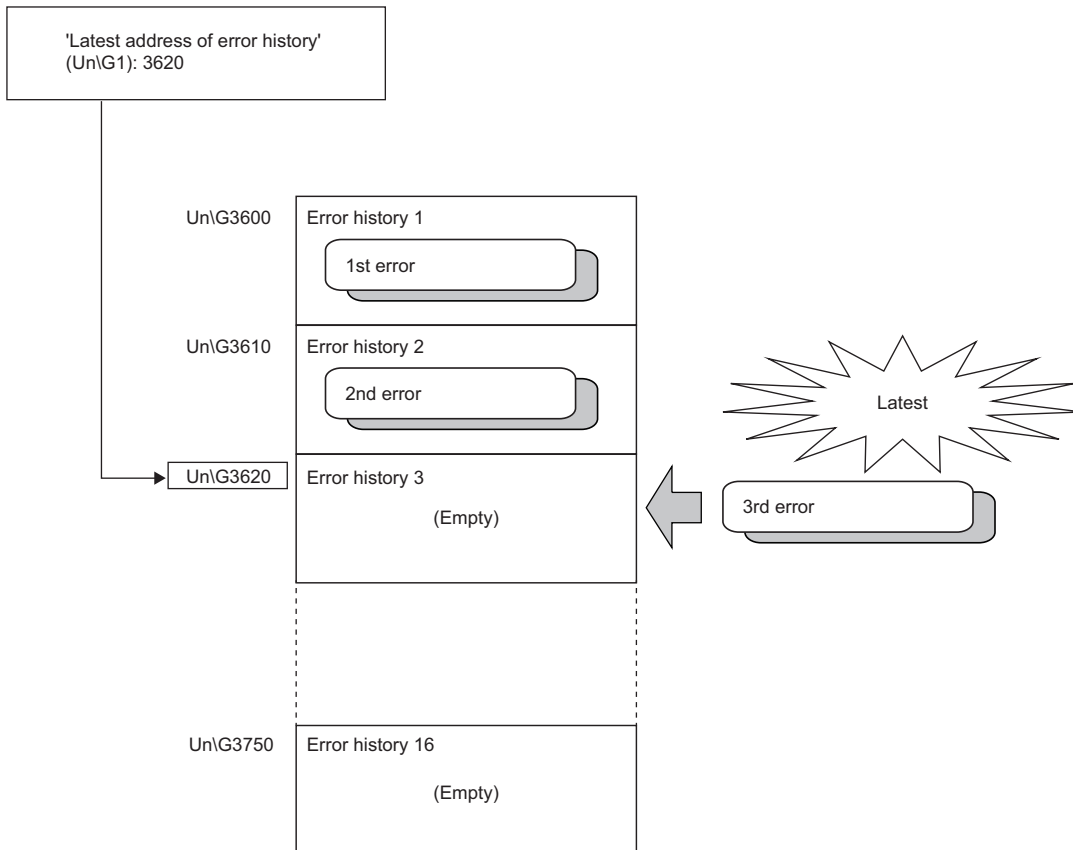
The following shows an example of when the 17th error occurs. The 17th error is stored in Error history 1, and 'Latest address of error history' (Un\G1) is overwritten with the value 3600 (start address of Error history 1).
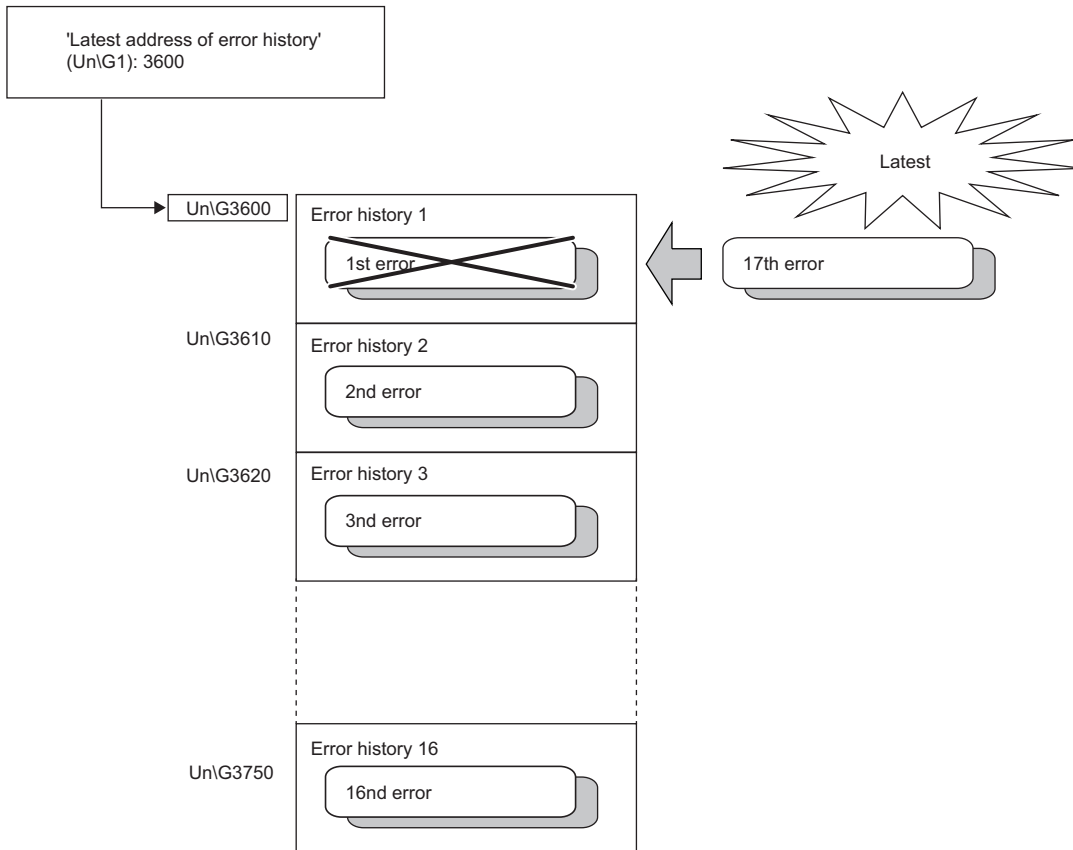
Point

- Once the error history storage area becomes full, subsequent error information will overwrite the existing data, starting from Error history 1 (Un\G3600 to Un\G3609), and the overwriting continues sequentially thereafter. The overwritten history is deleted.
- The same processing is performed for Alarm history when an alarm occurs.
- The stored error history is cleared when the A/D converter module is powered off, or when the CPU module is reset.

1.12 Event History Function

This function collects generated errors, alarms or executed operations in the A/D converter module as event information in the CPU module.

The CPU module collects the event information of the A/D converter module and keeps them in the data memory inside of the CPU module or an SD memory card.

The event information collected by the CPU module can be displayed on an engineering tool to check the occurrence history in a time series.

Event type	Classification	Description
System	Error	An error detected by the self diagnostics in each module.
	Warning	A warning (alarm) detected in each module.
	Information	The operation by the normal detection of the system that is not classified as Error or Warning, or the operation performed automatically by the system.
Security	Warning	Operation that is judged as an unauthorized access to each module.
	Information	Operation that is hard to be judged as the success of unlocking passwords or an unauthorized access.
Operation	Warning	Deleting (data clear) operations that may change the action. (These operations are not judged as errors by the self diagnostics.)
	Information	Operations performed by users to change the system operation or configuration.

Setting method

The event history function can be set from the event history setting window of the engineering tool. For the setting method, refer to the following.

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

Displaying event history

Access the menu window of the engineering tool. For details on the operating procedure and how to view the contents, refer to the following.

📖 GX Works3 Operating Manual

List of event history data

The following table lists the events that would occur in the A/D converter module when the event type is set to "Operation" or "System".

- System

Event code	Event name	Cause	Action	Detailed information
040[*1]	HART field device status information	HART field device status information was received.	Check details on the HART device status information and take appropriate actions.	bit 0 to bit 7 of the HART field device status are turned on, and any of the following statuses occurs. ■Primary variable out of limits The PV value is out of the operation limit range. ■Non-primary variable out of limits The SV, TV, or QV value is out of the operation limit range. ■Loop current saturated Current has reached the upper or lower limit and cannot increase or decrease. ■Loop current fixed The current value is fixed. ■More status available/unavailable The added status information includes diagnostic information. ■Cold start The HART-enabled device has been powered off or reset. ■Configuration changed The settings of the HART-enabled device have been changed. ■Device malfunction Because a serious error or failure has been detected in a HART-enabled device, the HART-enabled device is not properly operated.
041[*1]	HART device communication error detection	The HART-enabled device has detected error information.	• Check whether wiring for the HART-enabled device is performed correctly. • Check whether each wiring is not affected by a noise. • Check whether the supply power to the HART-enabled device meets the specifications.	bit 9 to bit 14 of the HART field device status are turned on, and any of the following statuses occurs. ■Buffer overflow A message to the HART-enabled device is too long for the receive buffer. ■Communication failure The communication has failed. ■Longitudinal parity error The longitudinal parity calculated by the device is not matched with the message check byte. ■Framing error A stop bit of 1 byte or larger is not detected. ■Overrun error The data of 1 byte or larger in the receive buffer is overwritten before read. ■Vertical parity error The parity of one or multiple bytes received is not odd.
042[*1]	HART master communication error detection	The HART master (A/D converter module) has detected error information.	• Check whether wiring for the HART-enabled device is performed correctly. • Check whether each wiring is not affected by a noise. • Check whether the supply power to the HART-enabled device meets the specifications.	bit 9 to bit 14 of the HART field device status are turned on, and any of the following statuses occurs. ■Longitudinal parity error The longitudinal parity calculated by the device is not matched with the message check byte. ■Framing error A stop bit of 1 byte or larger is not detected. ■Overrun error The data of 1 byte or larger in the receive buffer is overwritten before read. ■Vertical parity error The parity of one or multiple bytes received is not odd.
043[*1]	HART command error	The HART-enabled device has returned a warning or error to a received HART command using a HART answer code.	Check the HART answer code by referring to the manual of the used HART-enabled device and take appropriate actions.	• HART command number • HART answer code

*1 □ in an event code: This symbol indicates the number of the channel where an event has occurred. A numerical value of 0 to 7 is used to correspond to CH1 to 8.
(CH1: 0, CH2: 1, CH3: 2, CH4: 3, CH5: 4, CH6: 5, CH7: 6, CH8: 7)

• Operation

Event code	Event name	Event detail	Additional information
20100	Error clear	Error clear request has been issued.	-

2 PARAMETER SETTINGS

Set the parameters of each channel.

Setting parameters here eliminates the need to program them.

2.1 Basic Setting

Setting method

Open "Basic setting" of the engineering tool.

1. Start Module Parameter.

✎ [Navigation window] ➪ [Parameter] ➪ [Module Information] ➪ Module model name ➪ [Basic setting]
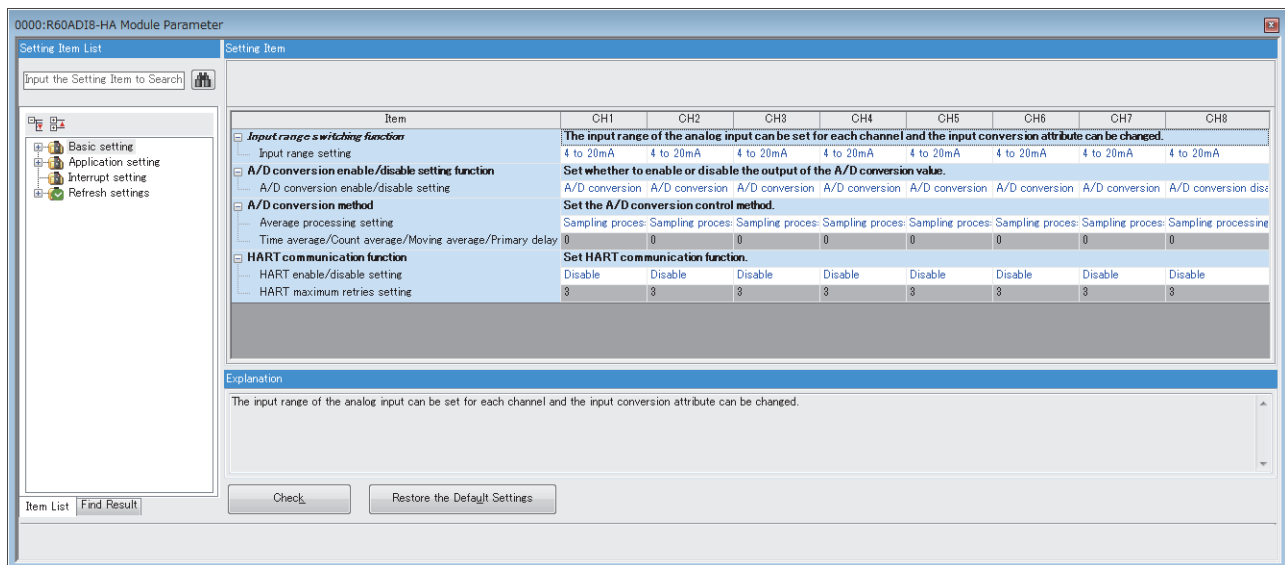
2. Click the item to be changed to enter the setting value.

• Item where a value is selected from the drop-down list

Click the [▼] button of the item to be set, and select the value from the drop-down list that appears.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

2.2 Application Setting

Setting method

Open "Application setting" of the engineering tool.

1. Start Module Parameter.

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting]
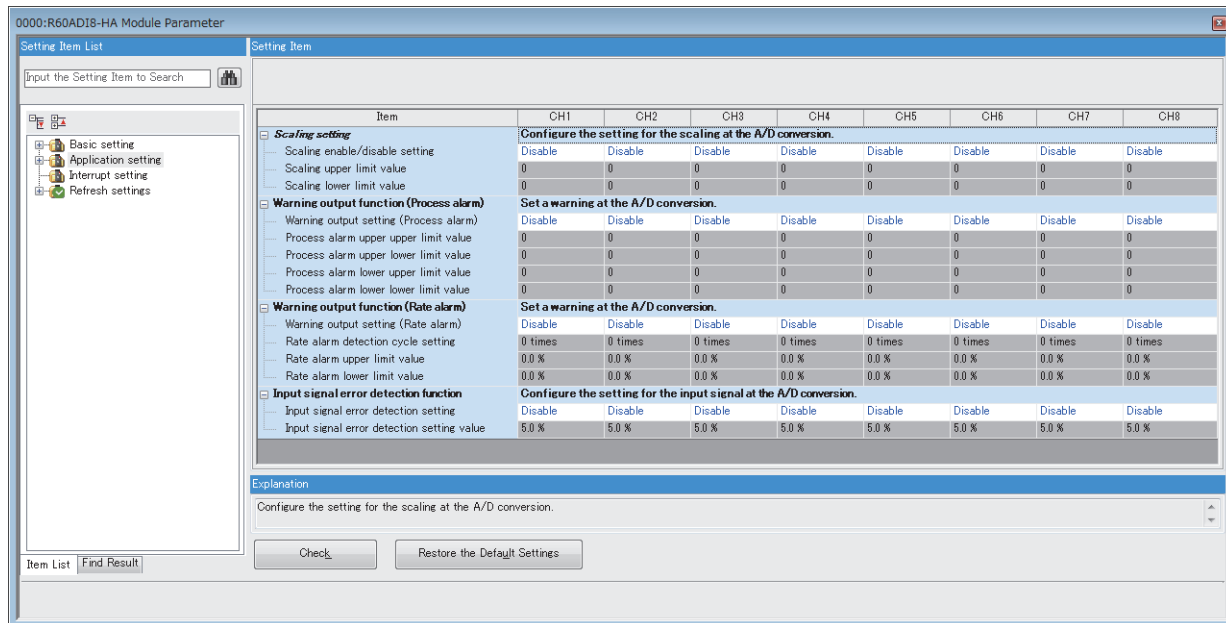
2. Click the item to be changed to enter the setting value.
 • Item where a value is selected from the drop-down list
Click the [▼] button of the item to be set, and select the value from the drop-down list that appears.
 • Item where a value is entered into the text box
Double-click the item to be set to enter the numeric value.

2.3 Interrupt Setting

Setting method

Open "Interrupt setting" of the engineering tool.

1. Start Module Parameter.

🕵 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Interrupt setting]
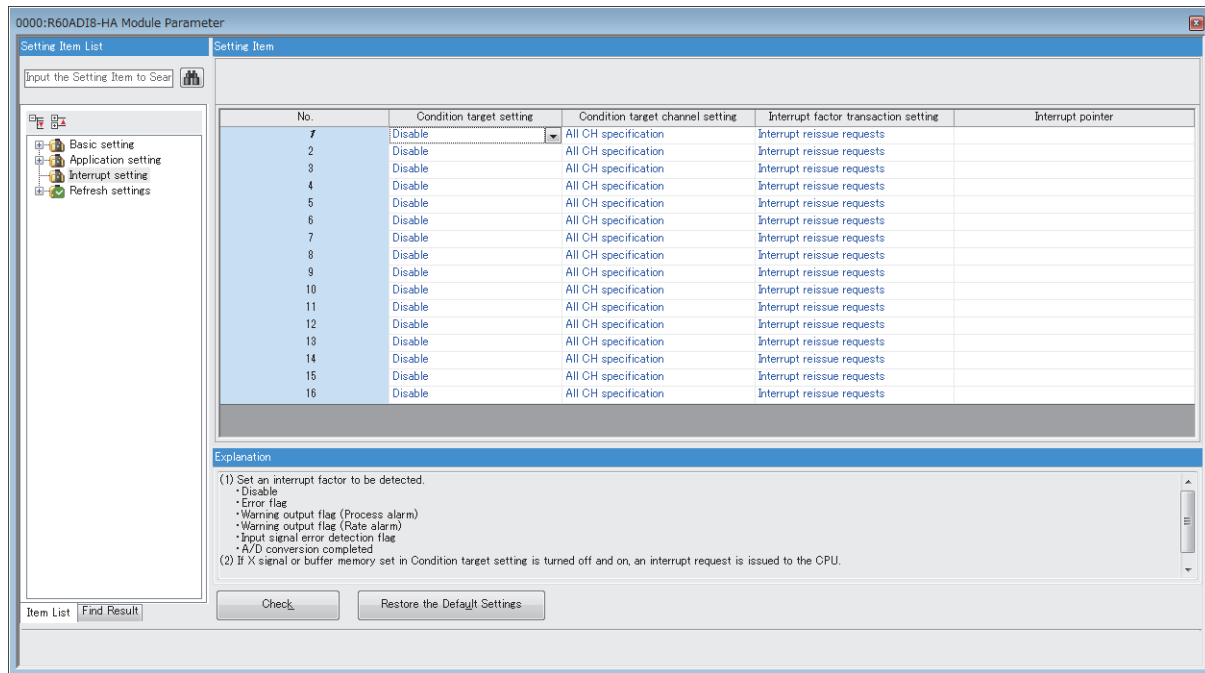
2. Click the item of interrupt setting number (No.1 to 16) to be changed to enter the setting value.

 • Item where a value is selected from the drop-down list

Click the [▼] button of the item to be set, and select the value from the drop-down list that appears.

 • Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

2.4   Refresh Setting

Setting method

Set the buffer memory area of the A/D converter module to be refreshed.

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

1. Start Module Parameter.

> [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Refresh settings]
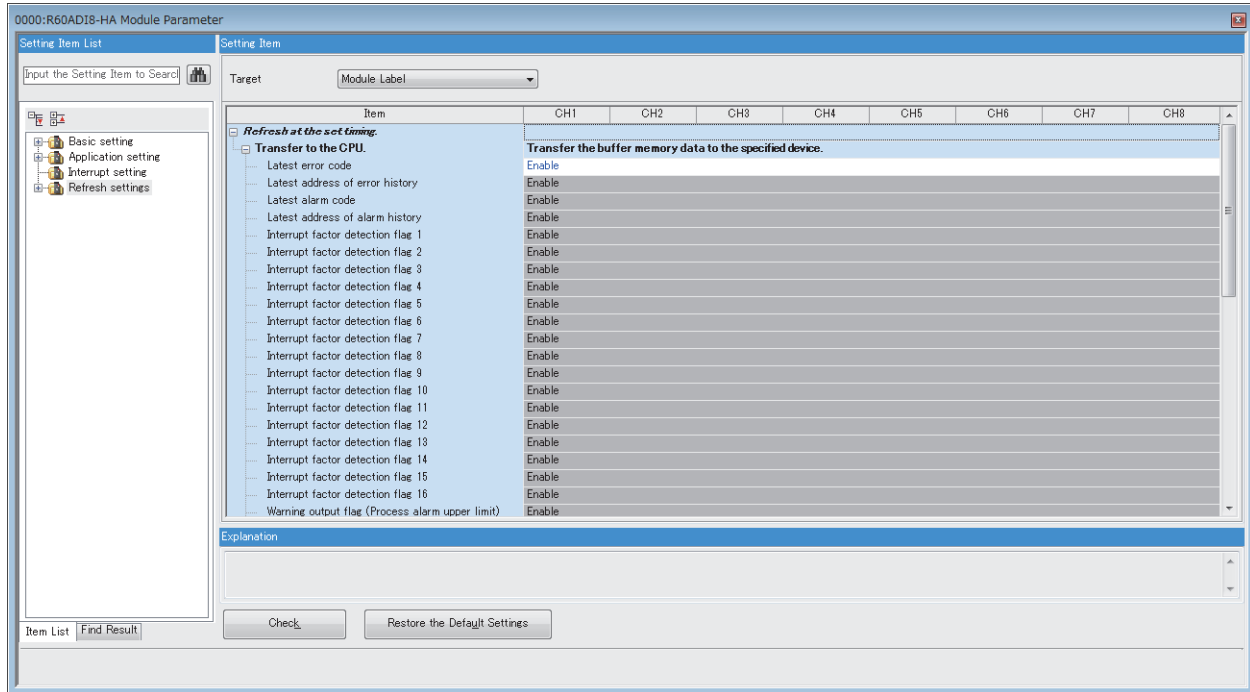
2. Click "Target", and set the auto refresh destination.

• When "Target" is "Module Label"

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

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

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

• When "Target" is "Device"

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

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

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

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

Point

When the refresh is enabled, the values of the refresh target are enabled at the refresh timing set with the engineering tool. At this time, the buffer memory areas are overwritten with the values of the refresh destination. To change the values of the refresh target buffer memory areas, create a program so that the values of module labels or devices of the refresh source are changed.

Refresh processing time

A refresh processing time [μs] is a constituent of the scan time of the CPU module. For details on the scan time, refer to the following.

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

The refresh processing time [μs], which is taken for refresh, is given by:

 • Refresh processing time [μs] = Refresh read time (time for transferring refresh data to the CPU module)

The refresh read time varies depending on the settings of "Target".

When "Target" is "Module Label" or "Refresh Data Register (RD)"

The following table shows the refresh read time with an R□CPU used.

Model	Classification	When using the refresh settings
R60ADI8-HA	Refresh read time	32.29μs

When "Target" is "Device"

Calculate the refresh read time according to the number of items and the number of their transfer data (in units of word) that are set to be refreshed. For the calculation method, refer to the following.

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

3 CommDTM

This chapter describes CommDTM (M_CommDTM-HART) that can be used for A/D converter module.
HART-enabled device parameters can be read and written via an A/D converter module using M_CommDTM-HART in the FDT frame application.

> **Point**
>
> In this manual, MELSOFT FieldDeviceConfigurator (FDC) manufactured by Mitsubishi Electric is used as the FDT frame application. For details on FDC, refer to the following.
> 📖 FieldDeviceConfigurator Operating Manual

3.1 Required Software

To configure the HART-enabled device settings using M_CommDTM-HART, the following software needs to be installed in advance.

FDT frame application

M_CommDTM-HART can be used only in the FDT frame application. Install the FDT frame application in advance that meets the specifications described in the manual below.
CommDTM for R60ADI8-HA Installation Instructions (BCN-P5999-1049)

Device DTM of HART-enabled device to be used

Install in advance Device DTM of a HART-enabled device to be connected to the A/D converter module. For specifications and how to obtain Device DTM, contact the manufacturer of the used HART-enabled device.

3.2 How to Install/Uninstall M_CommDTM-HART

For installation and uninstallation procedures of M_CommDTM-HART, refer to the following.
CommDTM for R60ADI8-HA Installation Instructions (BCN-P5999-1049)

3 CommDTM
3.1 Required Software   **59**

3.3 Creating a Project

Create a project in FDC and add M_CommDTM-HART to the FDC project.

1. Start FDC.

2. Click [Update] in "DTM catalog". Check that M_CommDTM-HART and Device DTM are registered in "DTM catalog".
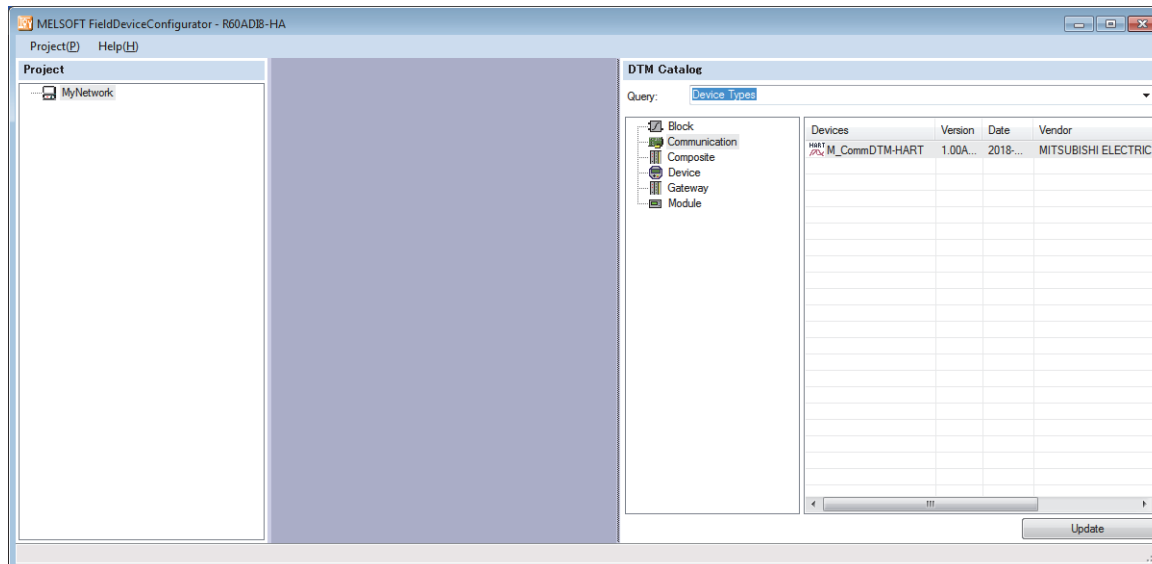
3. Create a new project.

👆 [Project] ⇨ [New]
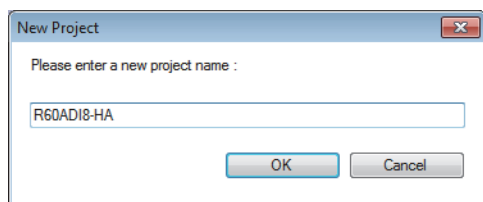
4. Enter a project name in the "New project" window and click [OK].

5. Add M_CommDTM-HART to the project.

👆 [Project view] ⇨ [MyNetwork] ⇨ Right-click ⇨ [Add DTM]

6. Select M_CommDTM-HART from the displayed DTM catalog and click [OK].
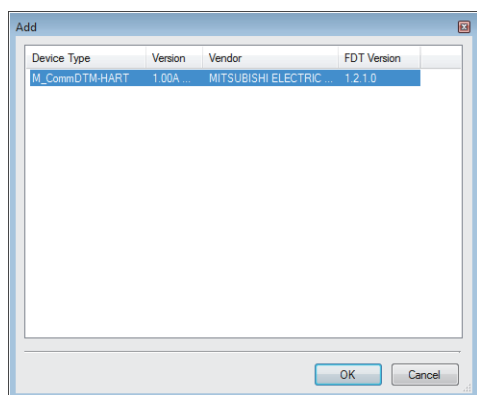
3.4 Connection Settings

Set the method to connect between a personal computer and the A/D converter module. The settings are configured in the M_CommDTM-HART configuration window.

Window structure

The following shows the window structure of M_CommDTM-HART.

| No.	Item name	Description
(1)	Select transfer setup	Selects a connection path to the control CPU of the registered A/D converter module. This item is also used to create a new connection path or delete or change a connection path. ■Setting details • iQ-Rn USB • \<New...> • \<Rename/Remove...>
(2)	Configure	Changes connection path settings.
(3)	Comm. Test	Tests a communication of the connection path selected in "Select transfer setup".
(4)	Starting I/O Number	Sets the start I/O number of the A/D converter module.
(5)	Read from PLC	Reads the start I/O number of the A/D converter module from the connected CPU module.
(6)	Setting details	Displays the details of the set connection path. Displays the window for changing the setting by clicking the displayed window.
(7)	Cancel	Closes the M_CommDTM-HART configuration window without reflecting the configured settings.
(8)	OK	Closes the M_CommDTM-HART configuration window with reflecting the configured settings into the project.

Connection settings of host station A/D converter module

This section describes the connection settings of the host station A/D converter module.

1. Select "New..." in "Select transfer setup".
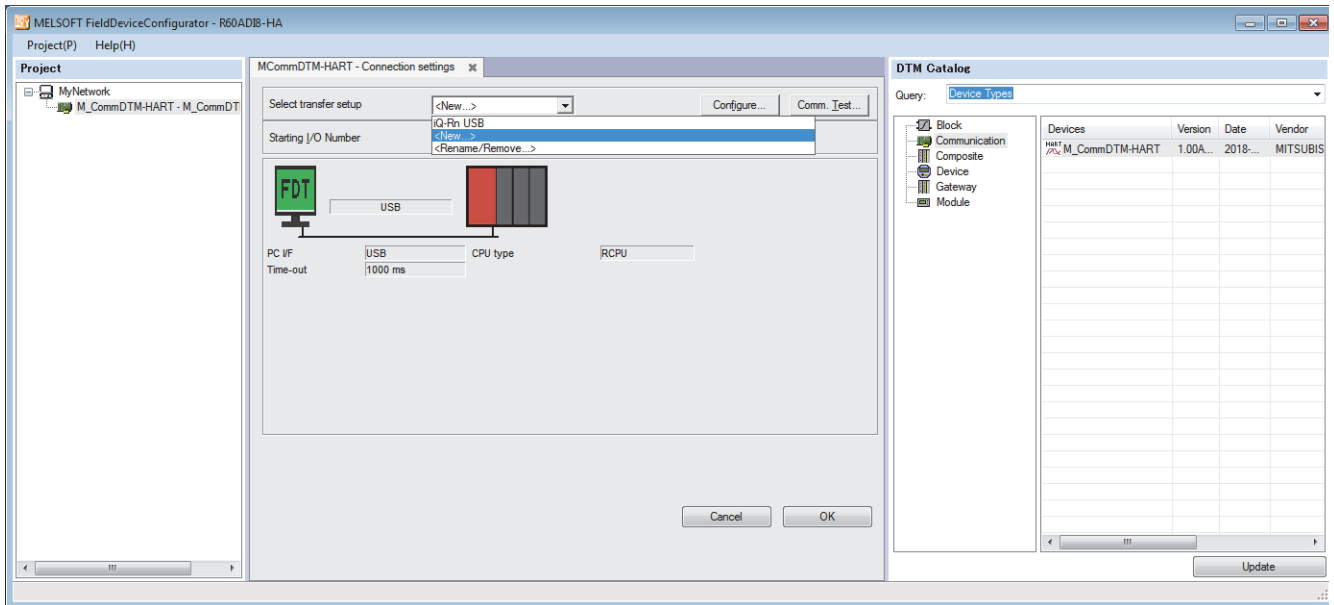
2. Enter a name of the connection destination in "Select transfer setup" and click [OK].
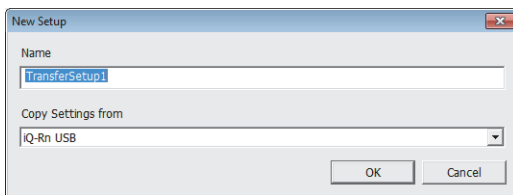
3. Select a connection interface of the personal computer in "PC side I/F" of the "Transfer Setup Wizard - PC side" window.

• USB

• Ethernet board
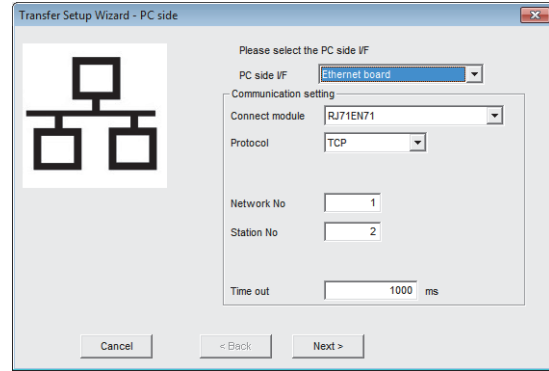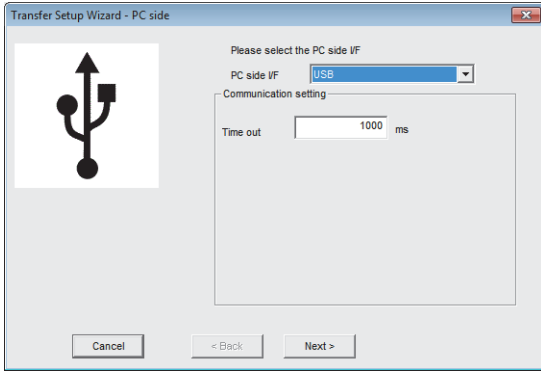
4. Set the details of "Communication setting" corresponding to the selected "PC side I/F".

PC side I/F	Communication setting item	Setting details
USB	Time out	This item is used to set time until connection with the connection destination times out. ■Setting range 1 to 2147483647ms
Ethernet board	Connect module	This item is used to select a type of a module connected from a personal computer. ■Setting range • QJ71E71 • RJ71EN71 • LJ71E71 • CPU module
	Protocol	This item is used to select a predefined protocol. ■Setting range • TCP • UDP
	Network No	This item is used to set a network number. ■Setting range 1 to 239
	Port No	This item is used to set a UDP port number. ■Setting range 0 to 65535 Some port numbers cannot be used depending on the destination module. (🕮 Manual of each module)
	Station No	This item is used to set a station number of the Ethernet board. ■Setting range • QJ71E71 and LJ71E71: 1 to 64 • RJ71EN71: 1 to 120
	Time out	This item is used to set time until connection with the connection destination times out. ■Setting range 1 to 2147483647ms

5. Click the [Next >] button.

6. Set "Communication setting" in the "Transfer Setup Wizard - PLC side" window. The setting details differ depending on the settings made in steps 3 and 4.

• When "PC side I/F" is set to "USB" in step 3
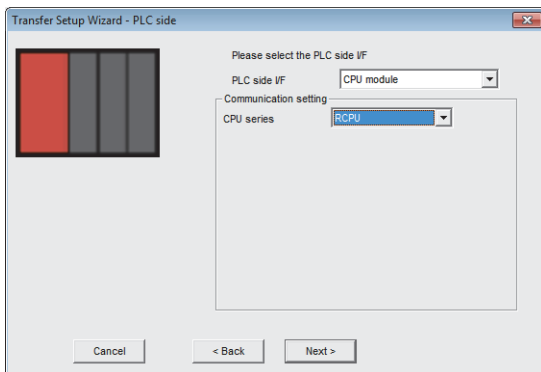
Communication setting item	Description
CPU series	This item is used to select the series of the destination CPU module. ■Setting range • QCPU • RCPU • LCPU

• When "PC side I/F" is set to "Ethernet board" and "Connect module" is set to "CPU module" in step 3

• When "Protocol" is set to "TCP"   • When "Protocol" is set to "UDP"
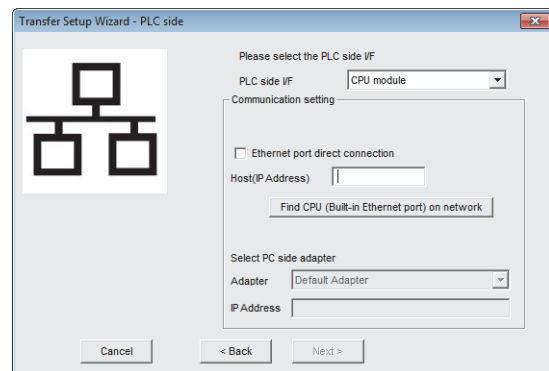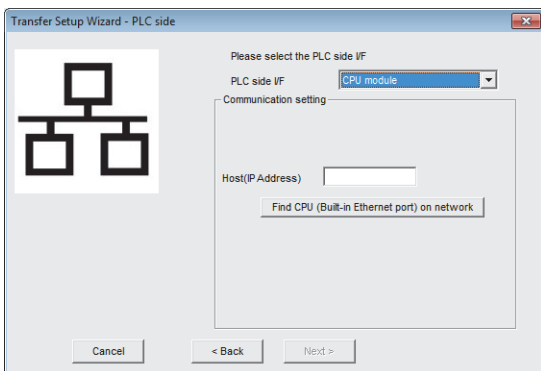
Protocol setting made in step 4	Communication setting item	Description
TCP	Host(IP Address)	Sets a host name (IP address) of the destination CPU module. The set host name can be read from the connected CPU module by clicking the [Find CPU (Built-in Ethernet port) on network] button.
UDP	Ethernet port direct connection	This checkbox is selected when the module is connected to the CPU module directly by the Ethernet port.
	Host(IP Address)	This item is used to set a host name (IP address) of the destination CPU module. The set host name can be read from the connected CPU module by clicking the [Find CPU (Built-in Ethernet port) on network] button.
	Adapter	This item is used to select an adapter of the personal computer when "Ethernet port direct connection" is selected.

- When "PC side I/F" is set to "Ethernet board" and "Connect module" is set to the item other than "CPU module" in step 3

- When "Protocol" is set to "TCP"   • When "Protocol" is set to "UDP"
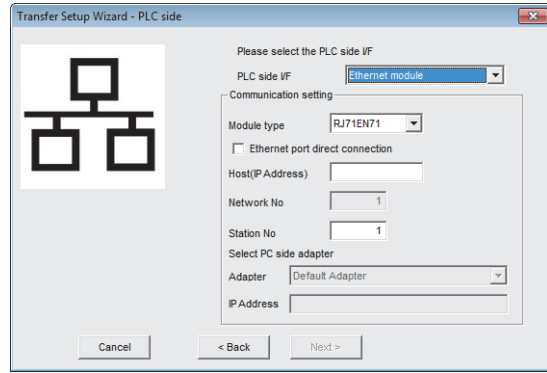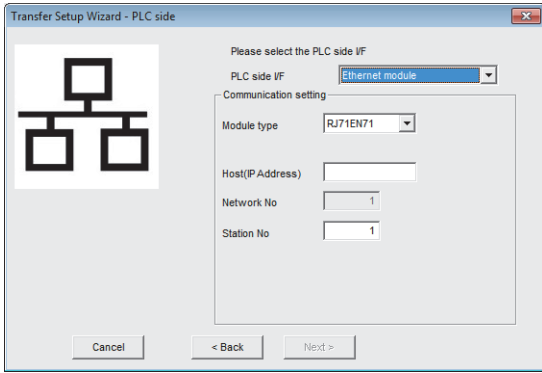
Protocol setting made in step 4	Communication setting item	Description
TCP	Module type	This item automatically sets the setting made in "Connect module" in step 4.
	Host(IP Address)	This item is used to set a host name (IP address) of the destination Ethernet module.
	Network No	Automatically sets the setting made in "Network No." in step 4.
	Station No	Sets a station number of the destination Ethernet module.
UDP	Module type	This item automatically sets the setting made in "Connect module" in step 4.
	Ethernet port direct connection	This checkbox is selected when the module is connected to the Ethernet module directly by the Ethernet port.
	Host(IP Address)	This item is used to set a host name (IP address) of the destination Ethernet module.
	Network No	Automatically sets the setting made in "Network No." in step 4.
	Station No	This item is used to set a station number of the destination Ethernet module.
	Adapter	This item is used to select an adapter of the personal computer when "Ethernet port direct connection" is selected.

7. Click the [Next >] button.

8. Set a network route in the "Transfer Setup Wizard - Network" window.
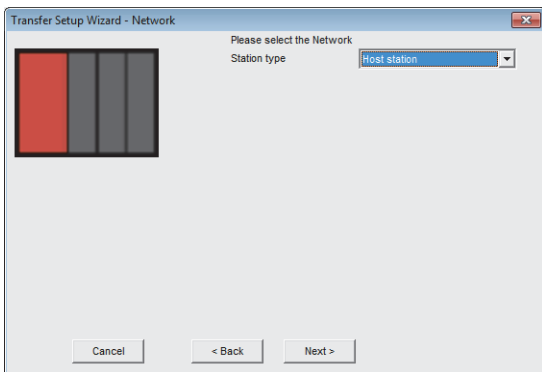
- USB   • Ethernet board
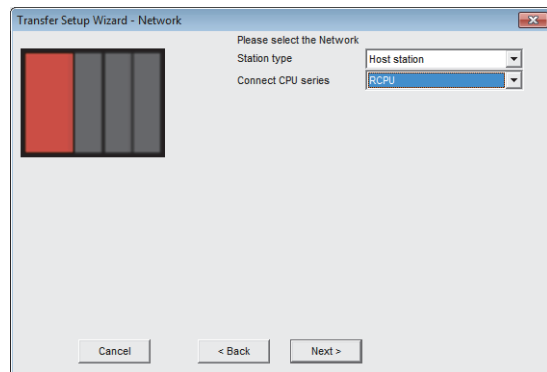
Item	Description
Station type	This item is used to select where to mount the A/D converter module. Select "Host station" in this step. ■Setting range • Host station • Other station
CPU series	This item is used to select the series of the destination CPU module. Select "RCPU" in this step. ■Setting range • QCPU • RCPU • LCPU

9. Click the [Next >] button.

10. Click [Finish] in the "Transfer Setup Wizard - Finished" window.
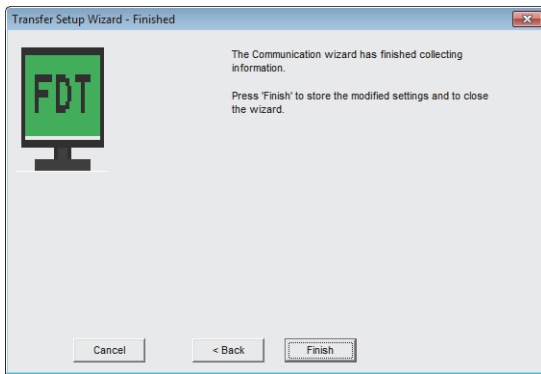
11. Set the start I/O number of the A/D converter module to "Starting I/O Number" in the M_CommDTM-HART configuration window. The start I/O number can be read from the destination programmable controller system by clicking the [Read from PLC] button.
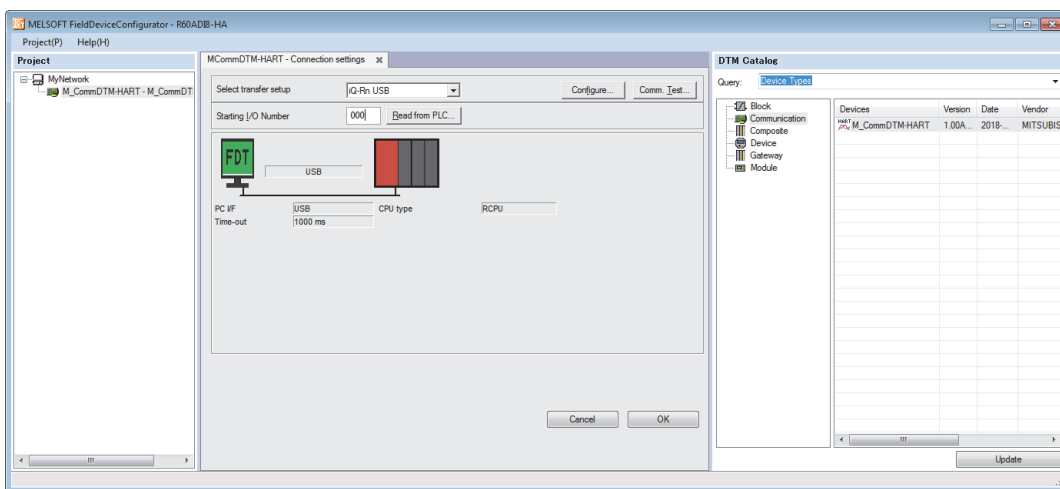
12. Click [OK].

Connection settings of another station A/D converter module

This section describes the connection settings of another station A/D converter module.

1. Configure the settings according to the used programmable controller system by referring to steps 1 to 7 of Page 62 Connection settings of host station A/D converter module.

2. Set a network route in the "Transfer Setup Wizard - Network" window.
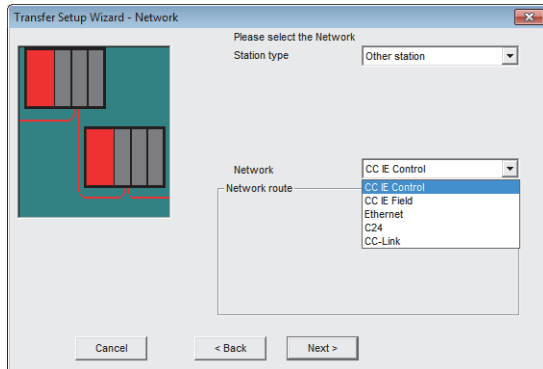
Network item	Description
Station type	This item is used to select where to mount the A/D converter module. Select "Other station" in this step. ■Setting range • Host station • Other station
PLC mode	This item use used to select a CPU module series when the CPU module is set to be connected from the Ethernet board. ■Setting range • QCPU • RCPU • LCPU
Network	This item is used to select a network route to another station. ■Setting range • CC IE Control • CC IE Field • Ethernet • C24 • CC-Link

3. Set "Network route" when "Network" is set to "C24" or "CC-Link".
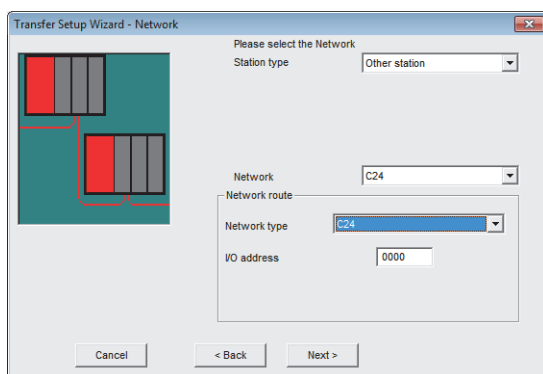
Network item	Description
Network type	Automatically sets the setting made in "Network" in step 2.
I/O address	This item is used to set I/O address of the RJ71C24 or RJ61BT11 of the target station. ■Setting range 0000H to FFF0H

4. Click the [Next >] button.

5. Set "Other station setting" in the "Transfer Setup Wizard - Other station" window.
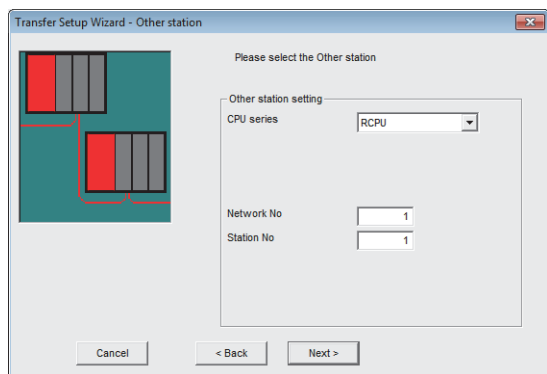
Network item	Description
CPU series	Fixed to RCPU.
Network No	This item is used to set a network number of the target station. ■Setting range 1 to 239 The network number is not required to be set when "Network" is set to "C24" or "CC-Link".
Station No	This item is used to set a station number of the target station. ■Setting range • CC IE Control: 1 to 120 • CC IE Field: 0 to 120 • Ethernet: 1 to 120 • C24: 0 to 31 • CC-Link: 0 to 63

6. Click [Finish] in the "Transfer Setup Wizard - Finished" window.
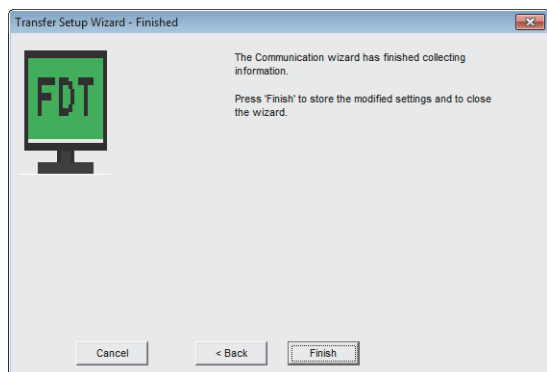
7. Set the start I/O number of the A/D converter module to "Starting I/O Number" in the M_CommDTM-HART configuration window. The start I/O number can be read from the destination programmable controller system by clicking the [Read from PLC] button.
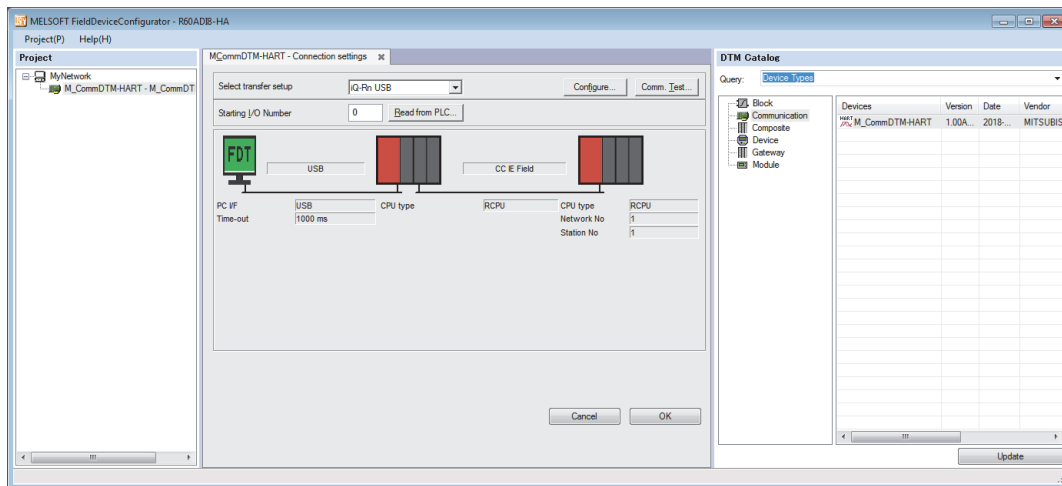
8. Click [OK].

3.5 Device DTM Settings

Set Device DTM of the HART-enabled device. The Device DTM setting details are written to a HART-enabled device via the destination A/D converter module set in M_CommDTM-HART.

> **Point**
>
> The Device DTM setting details and how to write the settings to a HART-enabled device differ depending on the used Device DTM. For details, refer to the manual or help of the used Device DTM.

1. Perform wiring for the A/D converter module and the HART-enabled device.

2. Right-click on "M_CommDTM-HART" of MyNetwork to select "Add DTM/Block".

3. Select the target Device DTM from the displayed DTM catalog and click [OK].

Add			
Device Type	Version	Vendor	FDT Version
ABB TTX300 HART	-	ABB	1.2.1.0

OK   Cancel
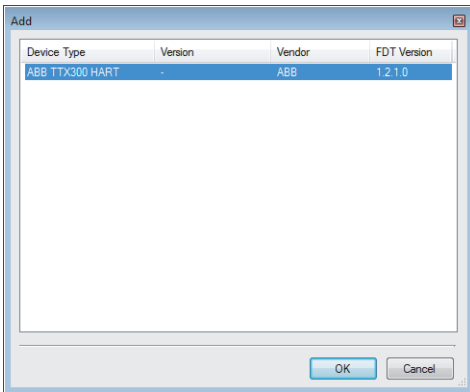
4. Select a channel connected to the HART-enabled device and click [OK].

Select Channel	
Channel	Protocol
Channel1	HART
Channel2	HART
Channel3	HART
Channel4	HART
Channel5	HART
Channel6	HART
Channel7	HART
Channel8	HART

OK   Cancel
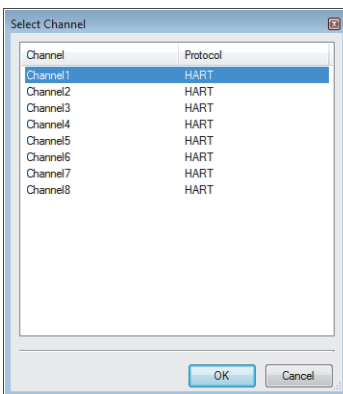
5. Connect a personal computer and the HART-enabled device online.

🖰 [MyNetwork] ⇨ [M_CommDTM-HART] ⇨ Right-click ⇨ [Online]

The following message appears when the HART-enabled device is not properly connected.

MELSOFT FieldDeviceConfigurator

ⓘ This error was notified from DTM.

DTM TAG : M_CommDTM-HART

Message : Failed to connect to the module. Check the network configuration and cables and try to connect again.

OK
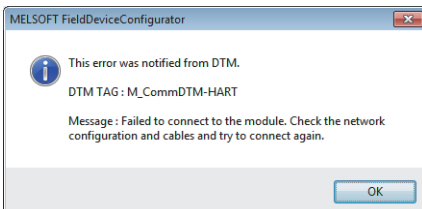
6. Set a parameter of the target HART-enabled device from Device DTM added to the project view.

7. Write a parameter from the Device DTM window to the HART-enabled device.

3.6 Timeout Settings

A timeout may occur when processing various requests from Device DTM to M_CommDTM-HART takes time. The processing time increases especially when the HART communication function is used on multiple channels.
When a timeout occurs, change the time until the timeout occurs according to the following procedures.

1. Right-click on "M_CommDTM-HART" of MyNetwork to select "Timeout settings".

👆 [MyNetwork] ⇨ [M_CommDTM-HART] ⇨ Right-click ⇨ [Configuration] ⇨ [Timeout settings]

2. Set "Request timeout" in the "Timeout settings" window.
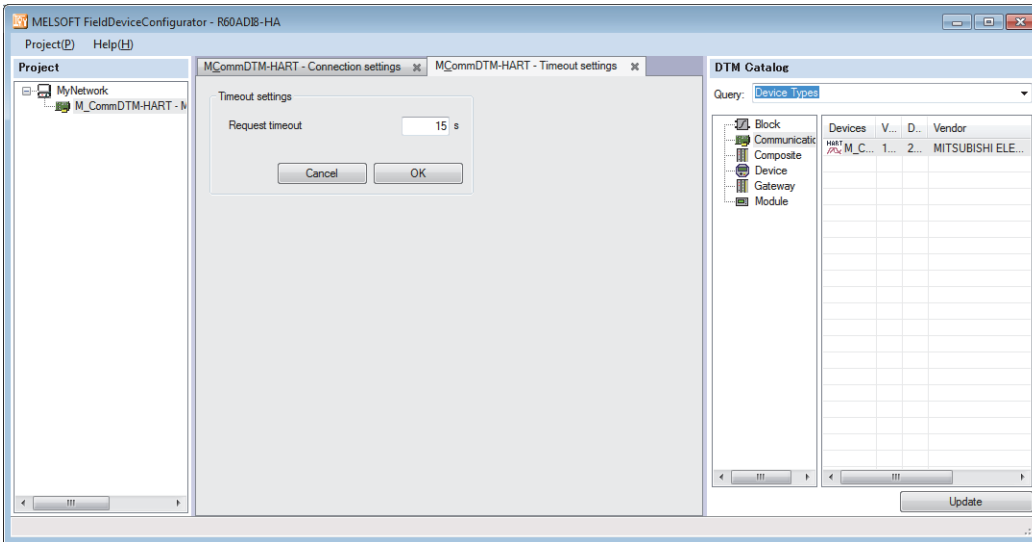
Timeout settings item	Description
Request timeout	This item is used to set the time until the timeout is judged. ■Setting range 5 to 1800 (seconds)

3. Click [OK].

4 TROUBLESHOOTING

This chapter describes errors that may occur in the use of the A/D converter module and those troubleshooting.

4.1 Troubleshooting with the LEDs

Check the state of the LEDs to narrow down the possible causes of the trouble. This step is the first diagnostics before using the engineering tool.

A state of the A/D converter module can be checked with the RUN LED, ERR LED, and ALM LED. The following table shows the correspondence of these LEDs and a state of the A/D converter module.

Name	Description
RUN LED	Indicates the operating status of the module. On: Normal operation Flashing (400ms cycles): Selected as a module for the online module change Off: 5V power supply interrupted, watchdog timer error occurred, or module replacement allowed in the process of the online module change
ERR LED	Indicates the error status of the module.[1] On: Error occurred Off: Normal operation
ALM LED	Indicates the alarm status of the module.[2] On: Warning (process alarm or rate alarm) issued Flashing: Input signal error detected Off: Normal operation

*1 For details, refer to the following.
　　☞ Page 80 List of Error Codes
*2 For details, refer to the following.
　　☞ Page 82 List of Alarm Codes

4.2 Checking the State of the Module

The following functions can be used in the "Module Diagnostics" window of the A/D converter module.

Function	Application
Error Information	Indicates the errors that have occurred. Click the [Event History] button to check not only the errors and alarms that occurred in the A/D converter module, but also the errors detected by each module and the operation history.
Module Information List	Indicates each status information of the A/D converter module.

Error Information

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

👆 [Diagnostics] ⇨ [System Monitor] ⇨ Right-click the module to be checked. ⇨ [Module Diagnostics]
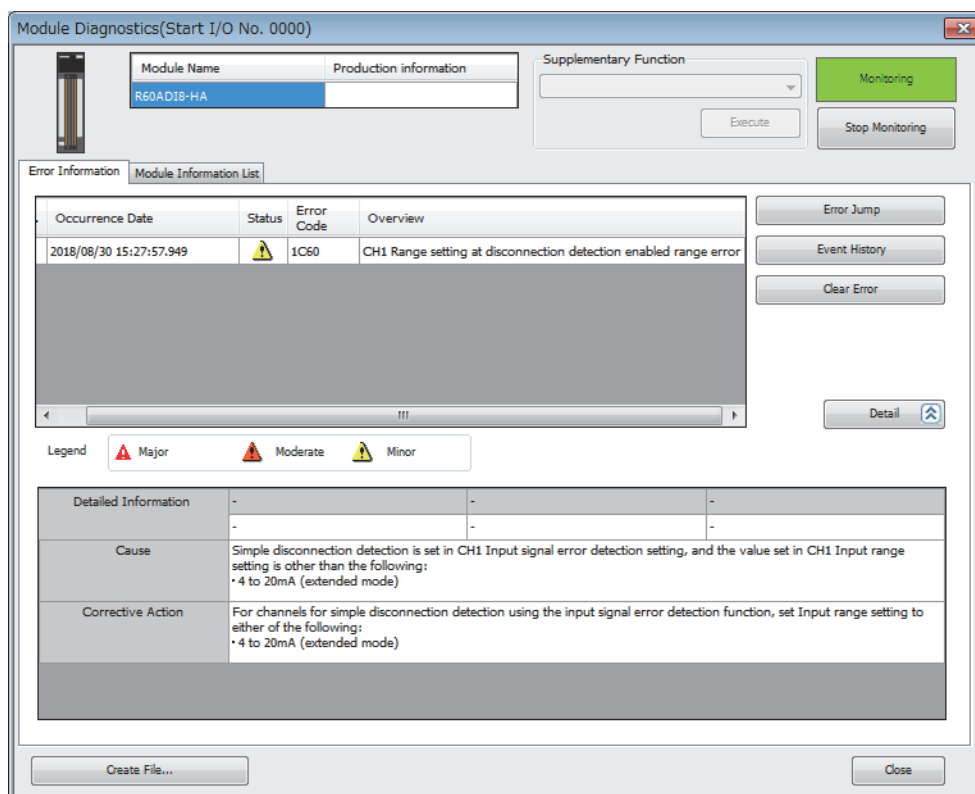
Item	Description
Cause	Indicates detailed causes of the error.
Corrective Action	Indicates the actions for the error.

Check alarm codes, error history, and alarm history on the Event History window of the engineering tool.

☞ [Diagnostics] ⇨ [System Monitor] ⇨ [Event History] button
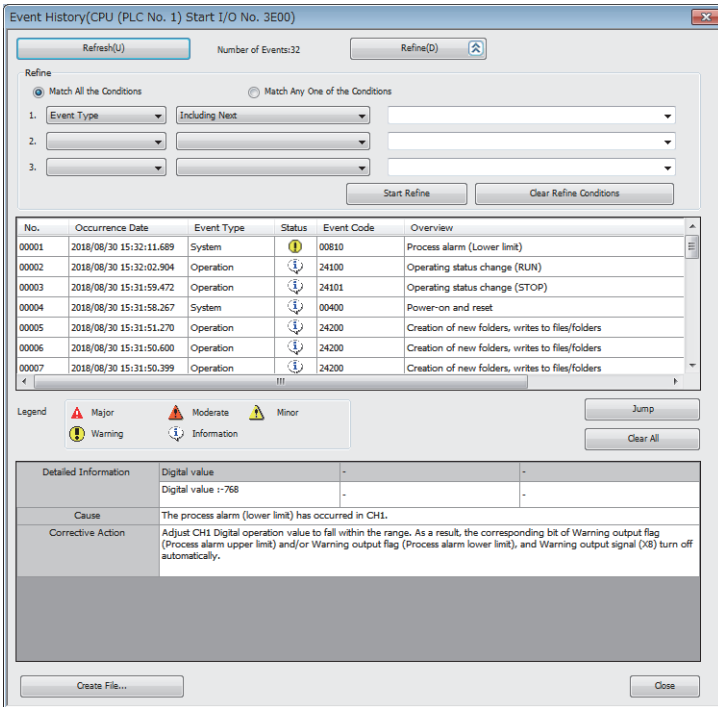
Module Information List

Switch the tab to the "Module Information List" tab and check each status information of the A/D converter module.
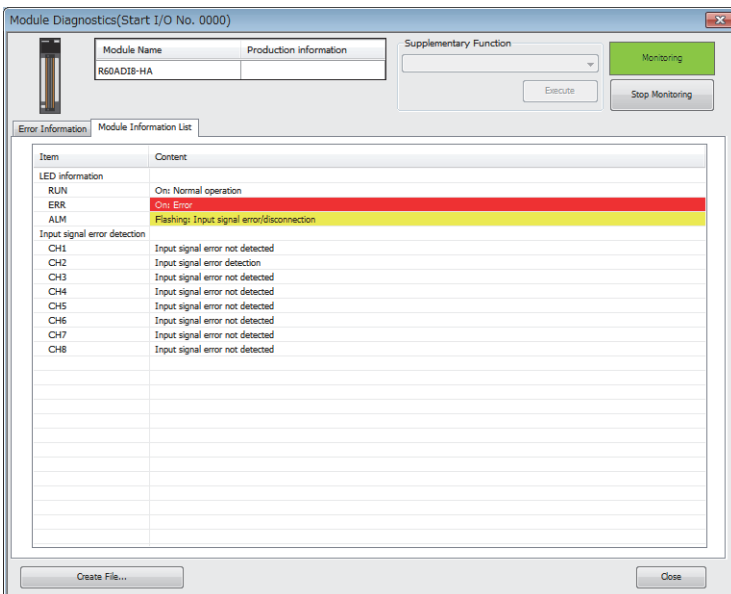
Item	Description
LED information	Indicates the LED status of the A/D converter module.
Input signal error detection	Indicates the input signal error detection status of the A/D converter module for each channel.

4.3 Troubleshooting by Symptom

When the RUN LED flashes or turns off

When flashing

Check item	Cause	Action
Check whether the module is selected as the target module for the online module change.	The base number and slot number of the A/D converter module have been set in Module selection specification (Base No.) (SD1600) and Module selection specification (Slot No.) (SD1601).	Turn on Module selection cancel request flag (SM1615).

When turning off

Check item	Action
Check whether the power is supplied.	Check that the supply voltage of the power supply module is within the rated range.
Check whether the capacity of the power supply module is enough.	Calculate the current consumption of mounted modules, such as the CPU module, I/O modules, and intelligent function modules to check that the power capacity is enough.
Check whether the module is mounted properly.	Check the mounting state of the module.
Check whether the load is applied to the module due to the weight of wires or cables.	Place the wires or cables connected to the module in a duct or clamp them so that the weight of wires or cables does not cause the load applied to the module.
Check whether the module replacement is allowed in the process of the online module change.	Perform the online module change. For details, refer to the following. 📖 MELSEC iQ-R Online Module Change Manual
Cases other than the above	Reset the CPU module, and check if the RUN LED turns on. If the RUN LED still remains off, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.

When the ERR LED turns on

When turning on

Check item	Action
Check whether any error has occurred.	Check 'Latest error code' (Un\G0) and take actions described in the list of error codes. ☞ Page 80 List of Error Codes

When the ALM LED turns on or flashes

When turning on

Check item	Action
Check whether any warning has been issued.	Check 'Warning output flag (Process alarm upper limit)' (Un\G36), 'Warning output flag (Process alarm lower limit)' (Un\G37), 'Warning output flag (Rate alarm upper limit)' (Un\G38), and 'Warning output flag (Rate alarm lower limit)' (Un\G39). Take actions described in the alarm code list. ☞ Page 82 List of Alarm Codes

When flashing

Check item	Action
Check whether any input signal error has occurred.	Check 'Input signal error detection signal' (XC) or 'Input signal error detection flag' (Un\G40). Take actions described in the alarm code list. ☞ Page 82 List of Alarm Codes

When a digital output value cannot be read

Follow the steps in the table below to find the cause of the trouble.

Description	Procedure
■Step 1: Checking the digital output value Check the following. • Check whether digital output values have been stored in the buffer memory. • Check whether the program for reading digital output values has an error.	**When digital output values cannot be read** Check the stored value in 'CH1 Digital output value' (Un\G400). — Monitor the buffer memory area with the monitor function[*1] of the engineering tool. Are the stored digital output values corresponding to the analog input? — **YES** → The read program has an error or the CPU module is in STOP status. ☞ Check item 1 **NO** → ❶
■Step 2: Checking the conversion status Check the execution status of the A/D conversion in the module, such as whether the A/D converter module have executed the A/D conversion.	❶ Check the stored value in 'CH1 A/D conversion enable/disable setting' (Un\G500). — Monitor the buffer memory area with the monitor function[*1] of the engineering tool. Is "A/D conversion disable (1)" stored? — **YES** → A/D conversion is not enabled. ☞ Check item 2 **NO** → Check 'External power supply READY flag' (X7). — Monitor the input signal with the monitor function[*1] of the engineering tool. Is the signal turned off? — **YES** → 24VDC is not supplied to the external power supply. ☞ Check item 3 **NO** → ❷

Description	Procedure
■Step 3: Checking the input range setting Check whether the input range appropriate to the analog input is set.	❷ Check the stored value in 'CH1 Range setting monitor' (Un\G430). --------- Monitor the buffer memory area with the monitor function[1] of the engineering tool. Is the set input range matched with the analog input? — YES → Check and correct the wiring and offset/gain setting. ☞ Check item 4 NO The analog input is not matched with the input range setting. ☞ Check item 5

*1   Monitor the buffer memory areas using "Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor".

Point

If digital output values cannot be read even after the above actions are taken, the possible cause is a failure of the A/D converter module. Please consult your local Mitsubishi representative.

Check item 1

The program for reading digital output values has an error or the CPU module is in the STOP state. Check the following items.

Check item	Action
Check whether the program for reading digital output values has an error.	Check 'CH1 Digital output value' (Un\G400) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). If the digital output value corresponding to the analog input is stored, review and correct the program for reading digital output values.
Check whether the auto refresh setting is correct.	If the value in 'CH1 Digital output value' (Un\G400) is transferred to a device of the CPU module with the auto refresh, review and correct the auto refresh setting.
Check whether the CPU module is in the STOP state.	Change the state of the CPU module to RUN.

Check item 2

The A/D conversion is not executed. Check the following items.

Check item	Action
Check whether A/D conversion disable (1) is set in 'CH1 A/D conversion enable/disable setting' (Un\G500) of the channel where a value is to be input.	Check 'CH1 A/D conversion enable/disable setting' (Un\G500) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). When 'CH1 A/D conversion enable/disable setting' (Un\G500) is set to A/D conversion disable (1), change it to A/D conversion enable (0) with the engineering tool or a program.
Check whether 'Operating condition setting request' (Y9) has been executed after parameter changes.	Turn on and off 'Operating condition setting request' (Y9)[1] with the engineering tool and check that a digital output value is stored in 'CH1 Digital output value' (Un\G400). If the stored value is correct, further check the program to verify the description of 'Operating condition setting request' (Y9).

*1   If 'Operating condition setting request' (Y9) is on, the A/D conversion does not start. Therefore, first turn on 'Operating condition setting request' (Y9), check the off state of 'Operating condition setting completed flag' (X9), and turn off 'Operating condition setting request' (Y9).

4

Check item 3

The external power supply of 24VDC is not supplied to the A/D converter module. Check the following items.

Check item	Action
Check whether the external power supply of 24VDC is supplied to the A/D converter module. (1) Check whether the cables are wired correctly. (2) Check whether the external power supply of 24VDC is supplied within the specified range.	(1) Wire the cables by referring to the external wiring described in the manual. (📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup)) (2) Supply 24VDC within the range of the performance specifications. (📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup))
Cases other than the above	The possible cause is a failure of the A/D converter module. Please consult your local Mitsubishi representative.

Check item 4

The cables are not wired correctly. Check the following items.

Check item	Action
Check whether solderless terminals used meet the specifications.	Use the solderless terminals having specifications described in the manual. (📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup))
Check whether an incorrect terminal is not connected.	Refer to the external wiring example and check and correct the wiring. (📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup))
Check whether there is any problem with the wiring, such as looseness or disconnection of analog signal wires.	Identify the faulty area of signal wires by a visual check and continuity check.
Check whether the voltage required to operate the connected HART-enabled device is supplied to the connected HART-enabled device.	Consider voltage drop across the external power supply and the HART-enabled device when supplying power to the HART-enabled device from the A/D converter module. Check the voltage drop across the A/D converter module and the HART-enabled device to ensure that the sufficient voltage is supplied to the HART-enabled device by referring to the manual below. 📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup)

Check item 5

The analog input and input range setting do not match. Check the following items.

Check item	Action
Check whether "Input range setting" of the module parameter is correct.	Check "Input range setting" of the module parameter and configure the setting again if the setting is incorrect.
When an input range is set in 'CH1 Range setting' (Un\G598) with a program, check whether the program has any error.	Check 'CH1 Range setting' (Un\G598) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). If the set value is incorrect, correct the value with the engineering tool or a program.
Check whether 'Operating condition setting request' (Y9) has been executed after parameter changes.	Turn on and off 'Operating condition setting request' (Y9)[1] with the engineering tool and check that a digital output value is stored in 'CH1 Digital output value' (Un\G400). If the stored value is correct, further check the program to verify the description of 'Operating condition setting request' (Y9).

*1 If 'Operating condition setting request' (Y9) is on, the A/D conversion does not start. Therefore, first turn on 'Operating condition setting request' (Y9), check the off state of 'Operating condition setting completed flag' (X9), and turn off 'Operating condition setting request' (Y9).

When the digital output value does not fall within the range of accuracy

Check item	Action
Check whether any measures have been taken to reduce noise.	To reduce noise, take measures such as the use of shielded cables for connection.

When the bits corresponding to 'HART scan list' (Un\G2076) are not turned on

Check item	Action
Check whether the bit of 'HART communication enable/disable setting' (Un\G2074) of the target channel is set to Enable (1).	Check 'HART communication enable/disable setting' (Un\G2074) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). When the bit of the target channel is set to Disable (0), change it to Enable (1) with the engineering tool or a program.
Check whether the external power supply of 24VDC supplied to the A/D converter module operates properly.	Check 'External power supply READY flag' (X7). If the flag is off, supply the external power supply of 24VDC to the +24V terminal and the 24G terminal.
Check whether wiring for the HART-enabled device is performed correctly.	Check the wiring between the A/D converter module and the HART-enabled device by referring to the manual below. • ☐ MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup) • ☐ Manual of the used HART-enabled device
Check whether wiring for the external power supply of 24VDC is not affected by a noise.	If a noise is included in the output of the external power supply of 24VDC, the noise may be induced to the power supplied to the HART-enabled device. In this case, install a noise filter on the wiring between the external power supply and the A/D converter module.
Check whether the polling address of the HART-enabled device is set to 0.	Set the polling address to 0 using Device DTM of the used HART-enabled device.

When the HART communication error occurs

Check item	Action
Check whether wiring for the HART-enabled device is performed correctly.	Check the wiring between the A/D converter module and the HART-enabled device by referring to the manual below. • ☐ MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup) • ☐ Manual of the used HART-enabled device
Check whether wiring for the external power supply of 24VDC is not affected by a noise.	If a noise is included in the output of the external power supply of 24VDC, the noise may be induced to the power supplied to the HART-enabled device. In this case, install a noise filter on the wiring between the external power supply and the A/D converter module.
Check whether the external power supply of 24VDC is supplied within the specified range.	Check that 24VDC is supplied between the A/D converter module and the HART-enabled device within the specified range by referring to the manual below. • ☐ MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup) • ☐ Manual of the used HART-enabled device

When a timeout error occurs on M_CommDTM-HART

Check item	Action
Check whether "Request timeout" is set appropriately for the system in use.	Set an appropriate value in "Request timeout" according to the specifications of the connected HART-enabled device and the communication path between the HART-enabled device and the personal computer. ☞ Page 71 Timeout Settings

When the status change of Device DTM to offline fails

Check item	Action
Check whether the status change of Device DTM to offline has been performed immediately after the execution of its status change to online using FDT frame application.	After the execution of status change of Device DTM to online, take a few seconds and then perform the status change of Device DTM to offline. If the change to offline fails again, take a longer interval and then perform the processing once again. It may take a minute or longer for a certain HART-enabled device to complete the processing successfully.

4.4 List of Error Codes

If an error occurs during operation, the A/D converter module stores the error code into 'Latest error code' (Un\G0) of the buffer memory. In addition, 'Error flag' (XF) turns on. Turning on 'Error clear request' (YF) allows clearing of the error code of 'Latest error code' (Un\G0) and turning off of 'Error flag' (XF).

Error codes of the A/D converter module are classified in minor errors or moderate errors.

- Minor error: This error is caused by a setting failure of programs and parameters. The A/D conversion continues with the parameter setting before the change. (1000H to 1FFFH)
- Moderate error: Hardware failures are included. The A/D conversion does not continue. (3000H to 3FFFH)

The following table lists the error codes that may be stored.

□ in an error code: This symbol indicates the number of the channel where an error has occurred. A numerical value of 0 to 7 is used to correspond to CH1 to 8.

(CH1: 0, CH2: 1, CH3: 2, CH4: 3, CH5: 4, CH6: 5, CH7: 6, CH8: 7)

△ in an error code: For what this symbol indicates, refer to Description and cause.

Error code	Error name	Description and cause	Action
0000H	—	There is no error.	—
180△H	Interrupt factor generation setting range error	A value other than Interrupt resend request (0) and No interrupt resend request (1) is set in Interrupt factor generation setting [n]. △ indicates the interrupt setting related to the error as follows: 0: Setting 1 to F: Setting 16	Set Interrupt factor generation setting [n] to Interrupt resend request (0) or No interrupt resend request (1).
181△H	Condition target setting range error	A value out of the range is set in Condition target setting [n]. △ indicates the interrupt setting related to the error as follows: 0: Setting 1 to F: Setting 16	Set Condition target setting [n] to Disable (0) to A/D conversion completed (5).
182△H	Condition target channel setting range error	A value out of the range is set in Condition target channel setting [n]. △ indicates the interrupt setting related to the error as follows: 0: Setting 1 to F: Setting 16	Set Condition target channel setting [n] to All channels (0) to CH8 (8).
190□H	Range setting range error	A value out of the range is set in CH□ Range setting.	Set CH□ Range setting to the following values: • 4 to 20mA (0H) • 0 to 20mA (1H) • 4 to 20mA (extended mode) (AH)
191□H	Averaging process specification setting range error	A value out of the range is set in CH□ Averaging process specification.	Set CH□ Averaging process specification to Sampling processing (0) to Primary delay filter (4).
192□H	Time average setting range error	When the time average is set in CH□ Averaging process specification, a value other than 320 to 5000 is set in CH□ Time average/Count average/Moving average/Primary delay filter constant setting.	Set CH□ Time average/Count average/Moving average/Primary delay filter constant setting to 320 to 5000.
193□H	Count average setting range error	When the count average is set in CH□ Averaging process specification, a value other than 4 to 500 is set in CH□ Time average/Count average/Moving average/Primary delay filter constant setting.	Set CH□ Time average/Count average/Moving average/Primary delay filter constant setting to 4 to 500.
194□H	Moving average setting range error	When the moving average is set in CH□ Averaging process specification, a value other than 2 to 1000 is set in CH□ Time average/Count average/Moving average/Primary delay filter constant setting.	Set CH□ Time average/Count average/Moving average/Primary delay filter constant setting to 2 to 1000.
195□H	Primary delay filter constant setting range error	When the primary delay filter is set in CH□ Averaging process specification, a value other than 1 to 500 is set in CH□ Time average/Count average/ Moving average/Primary delay filter constant setting.	Set CH□ Time average/Count average/Moving average/Primary delay filter constant setting to 1 to 500.
1A0□H	Scaling enable/disable setting range error	A value other than Enable (0) and Disable (1) is set in CH□ Scaling enable/disable setting.	Set CH□ Scaling enable/disable setting to Enable (0) or Disable (1).
1A1□H	Scaling setting range error	A value other than -32000 to 32000 is set in CH□ Scaling lower limit value and/or CH□ Scaling upper limit value.	Set CH□ Scaling lower limit value and CH□ Scaling upper limit value to -32000 to 32000.

Error code	Error name	Description and cause	Action
1A2□H	Scaling upper/lower limit value setting error	CH□ Scaling upper limit value and CH□ Scaling lower limit value are set as the scaling upper limit value = the scaling lower limit value.	Set CH□ Scaling upper limit value and CH□ Scaling lower limit value as the scaling upper limit value ≠ the scaling lower limit value.
1B0□H	Warning output setting (Process alarm) range error	A value other than Enable (0) and Disable (1) is set in CH□ Warning output setting (Process alarm).	Set CH□ Warning output setting (Process alarm) to Enable (0) or Disable (1).
1B△□H	Process alarm upper lower limit value setting range error	The values set in CH□ Process alarm upper upper limit value to CH□ Process alarm lower lower limit value do not satisfy the following condition: Upper upper limit value ≥ Upper lower limit value ≥ Lower upper limit value ≥ Lower lower limit value △ indicates that the set values are as follows: 1: Process alarm lower lower limit value > Process alarm lower upper limit value 2: Process alarm lower upper limit value > Process alarm upper lower limit value 3: Process alarm upper lower limit value > Process alarm upper upper limit value	Set CH□ Process alarm upper upper limit value to CH□ Process alarm lower lower limit value so that the values satisfy the following condition: Upper upper limit value ≥ Upper lower limit value ≥ Lower upper limit value ≥ Lower lower limit value
1B8□H	Warning output setting (Rate alarm) range error	A value other than Enable (0) and Disable (1) is set in CH□ Warning output setting (Rate alarm).	Set CH□ Warning output setting (Rate alarm) to Enable (0) or Disable (1).
1B9□H	Rate alarm warning detection cycle setting range error	A value other than 1 to 32000 is set in CH□ Rate alarm warning detection cycle setting.	Set CH□ Rate alarm warning detection cycle setting to 1 to 32000.
1BA□H	Rate alarm upper/lower limit setting value inversion error	CH□ Rate alarm upper limit value and CH□ Rate alarm lower limit value are set as Lower limit value ≥ Upper limit value.	Set CH□ Rate alarm upper limit value and CH□ Rate alarm lower limit value as Lower limit value < Upper limit value.
1C0□H	Input signal error detection setting range error	A value out of the range is set in CH□ Input signal error detection setting.	Set CH□ Input signal error detection setting to Disable (0) to Simple disconnection detection (4).
1C1□H	Input signal error detection setting value range error	A value other than 0 to 250 is set in CH□ Input signal error detection setting.	Set CH□ Input signal error detection setting to 0 to 250.
1C6□H	Disconnection detection enabled range setting range error	Simple disconnection detection is set in CH□ Input signal error detection setting, and the value set in CH□ Input range setting is set to anything other than 4 to 20mA (extension) (AH).	For channels where simple disconnection detection is performed using the input signal error detection function, set CH□ Input range setting to 4 to 20mA (extension) (AH).
1F00H	Hardware failure (minor)	A hardware failure (minor) has occurred in the module.	The module may be affected by noise. Check and adjust the cable wiring and the installation environment of the programmable controllers. After the adjustment, turn on and off 'Error clear request' (YF) to clear the error or restart the conversion operation. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
3001H	Hardware failure (moderate)	A hardware failure (moderate) has occurred in the module.	Power off and on the module. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
3030H	Flash memory error	The data in the flash memory is abnormal.	Check the digital output values. If the values are abnormal, please consult your local Mitsubishi representative.

4

4.5 List of Alarm Codes

If an alarm occurs during operation, the A/D converter module stores the alarm code into 'Latest alarm code' (Un\G2) of the buffer memory. Turning on 'Error clear request' (YF) allows clearing of the alarm code of 'Latest alarm code' (Un\G2).

The following table lists the alarm codes that may be stored.

□ in an alarm code: This symbol indicates the number of the channel where an alarm has occurred. A numerical value of 0 to 7 is used to correspond to CH1 to 8.

(CH1: 0, CH2: 1, CH3: 2, CH4: 3, CH5: 4, CH6: 5, CH7: 6, CH8: 7)

Alarm code	Alarm name	Description and cause	Action
080□H	Process alarm (upper limit)	The process alarm (upper limit) has occurred in CH□.	Adjust CH□ Digital operation value to fall within the range. As a result, the corresponding bit of CH□ Warning output flag (Process alarm upper limit) or CH□ Warning output flag (Process alarm lower limit), and 'Warning output signal' (X8) turn off automatically.
081□H	Process alarm (lower limit)	The process alarm (lower limit) has occurred in CH□.	
082□H	Rate alarm (upper limit)	The rate alarm (upper limit) has occurred in CH□.	Adjust the change rate in CH□ Digital output value to fall within the range. As a result, the corresponding bit of CH□ Warning output flag (Rate alarm upper limit) or CH□ Warning output flag (Rate alarm lower limit), and 'Warning output signal' (X8) turn off automatically.
083□H	Rate alarm (lower limit)	The rate alarm (lower limit) has occurred in CH□.	
090□H	Input signal error detection (upper limit)	An input signal error (upper limit) has been detected in CH□.	The following operations are performed by turning on and off 'Error clear request' (YF) after the analog input value returns within the setting range. • All bits of Input signal error detection flag turn to Normal (0). • 'Input signal error detection signal' (XC) turns off. • 'Latest alarm code' (Un\G2) is cleared.
091□H	Input signal error detection (lower limit)	An input signal error (lower limit) has been detected in CH□.	
0A0□H	Input signal error detection (disconnection)	An input signal error (disconnection) has been detected in CH□.	

APPENDICES

Appendix 1 Module Label

The functions of the A/D converter module can be set by using module labels.

Module labels of I/O signals

The module label name of an I/O signal is defined with the following structure:

"Module name"_"Module number".b"Label name" or "Module name"_"Module number".b"Label name"_D

Ex.
R60ADHART_1.bModuleREADY_D

■Module name
The character string of a module model name is given.

■Module number
A number starting from 1 is added to identify modules that have the same module name.

■Label name
The label identifier unique to a module is given.

■_D
This string indicates that the module label is for the direct access input (DX) or direct access output (DY). A module label without the string is for the input (X) or output (Y) of the refresh processing.

Module labels of buffer memory areas

The module label name of a buffer memory area is defined with the following structure:

"Module name"_"Module number"."Data type"_D["(Channel)"]."Data format""Label name"_D

Ex.
R60ADHART_1.stnMonitor_D[0].wDigitalOutputValue_D

■Module name
The character string of a module model name is given.

■Module number
A number starting from 1 is added to identify modules that have the same module name.

■Data type
The data type to sort a buffer memory area is given. Each data type is as follows:

Data type	Description
stnMonitor	Monitor
stnSetting	Setting
stHART	HART communication function

■Channel
The channel number corresponding to a module label is given. A numerical value of 0 to 7 is used to correspond to CH1 to 8.
(CH1: 0, CH2: 1, CH3: 2, CH4: 3, CH5: 4, CH6: 5, CH7: 6, CH8: 7)

A

■Data format

The string that represents the data size of a buffer memory area is given. Each data format is as follows:

Data format	Description
b	Bit
u	Word [Unsigned]/Bit string [16-bit]
w	Word [Signed]
e	Single-precision real number

■Label name

The label identifier unique to a module is given.

■_D

This string indicates that the module label is for the direct access. A module label without the string is for the auto refresh. The following table shows the differences between the auto refresh and direct access.

Type	Description	Access timing	Example
Auto refresh	Values that are read from or written to the module label are reflected in the module collectively at the auto refresh. The run time of the program can be reduced. To use the auto refresh, set "Target" to "Module Label" in "Refresh settings" of "Module Parameter".	At auto refresh	R60ADHART_1.stnMonitor[0].wDigitalOutputValue
Direct access	Values that are read from or written to the module label are reflected in the module instantly. Compared with the auto refresh, the run time of the program becomes longer. However, the responsiveness is high.	At reading/writing from/to the module label	R60ADHART_1.stnMonitor_D[0].wDigitalOutputValue_D

Appendix 2 I/O Signals

List of I/O signals

The following table lists the I/O signals of the A/D converter module.

For details on the I/O signals, refer to the following.

☞ Page 86 Details of input signals

☞ Page 93 Details of output signals

> **Point**
>
> - The I/O number (X/Y) described below shows the case when the start I/O number of the A/D converter module is set to "0".
> - Do not use the "Use prohibited" signals shown below because the system uses them. If users use (turn off and on) the signals, the functions of the A/D converter module cannot be guaranteed.

Input signal

Device number	Signal name
X0	Module READY
X1	Use prohibited
X2	HART cycle time maximum value/minimum value reset completed flag
X3	HART device variables access flag
X4 to X6	Use prohibited
X7	External power supply READY flag
X8	Warning output signal
X9	Operating condition setting completed flag
XA	Use prohibited
XB	Use prohibited
XC	Input signal error detection signal
XD	Maximum value/minimum value reset completed flag
XE	A/D conversion completed flag
XF	Error flag

Output signal

Device number	Signal name
Y0	Use prohibited
Y1	Use prohibited
Y2	HART cycle time maximum value/minimum value reset request
Y3	HART device variables access request
Y4 to Y8	Use prohibited
Y9	Operating condition setting request
YA to YC	Use prohibited
YD	Maximum value/minimum value reset request
YE	Use prohibited
YF	Error clear request

A

Details of input signals

The following describes the details of the input signals for the A/D converter module which are assigned to the CPU module. The I/O numbers (X/Y) described in this section are for the case when the start I/O number of the A/D converter module is set to 0.

> **Point**
>
> This section describes buffer memory addresses for CH1. For details on the buffer memory addresses for CH2 and later, refer to the following.
>
> ☞ Page 95 List of buffer memory addresses

Module READY

Module READY (X0) turns on to indicate that the preparation for the A/D conversion is completed after the power-on or after the reset operation of the CPU module.

When a watchdog timer error occurs in the A/D converter module, 'Module READY' (X0) turns off. (In this case, the A/D conversion processing is not performed.)

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Module READY	X0							

HART cycle time maximum value/minimum value reset completed flag

'HART cycle time maximum value/minimum value reset completed flag' (X2) turns on after the maximum and minimum values stored in 'HART maximum cycle time' (Un\G2078) and 'HART minimum cycle time' (Un\G2079) are reset by turning on and off 'HART cycle time maximum value/minimum value reset request' (Y2). The values stored in 'HART maximum cycle time' (Un\G2078) and 'HART minimum cycle time' (Un\G2079) are reset to the HART current cycle time. Thereafter, the HART maximum/minimum cycle times are monitored and updated.
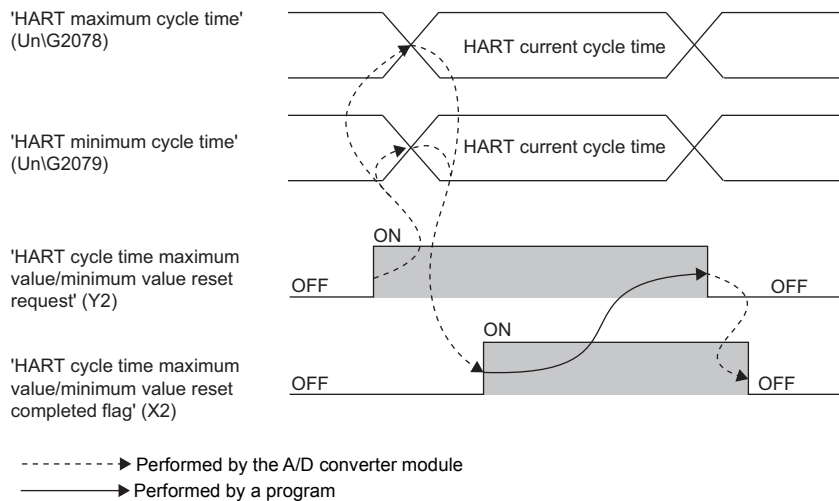
--------▶ Performed by the A/D converter module
————▶ Performed by a program

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART cycle time maximum value/minimum value reset completed flag	X2							

HART device variables access flag

This signal turns on by turning off and on 'HART device variables access request' (Y3). While this signal is on, the following buffer memory areas are not updated. Data inconsistency can be prevented by using this signal that turns on as an interlock when data is read to the CPU module.

- 'CH1 HART field device status' (Un\G2080)
- 'CH1 HART extended field device status' (Un\G2081)
- 'CH1 HART device variable status primary value (PV), secondary value (SV)' (Un\G2082)
- 'CH1 HART device variable status tertiary value (TV), quaternary value (QV)' (Un\G2083)
- 'CH1 PV value' (Un\G2084, Un\G2085)
- 'CH1 SV value' (Un\G2086, Un\G2087)
- 'CH1 TV value' (Un\G2088, Un\G2089)
- 'CH1 QV value' (Un\G2090, Un\G2091)

This signal turns off and the update of the buffer memory restarts when 'HART device variables access request' (Y3) is turned on and off.
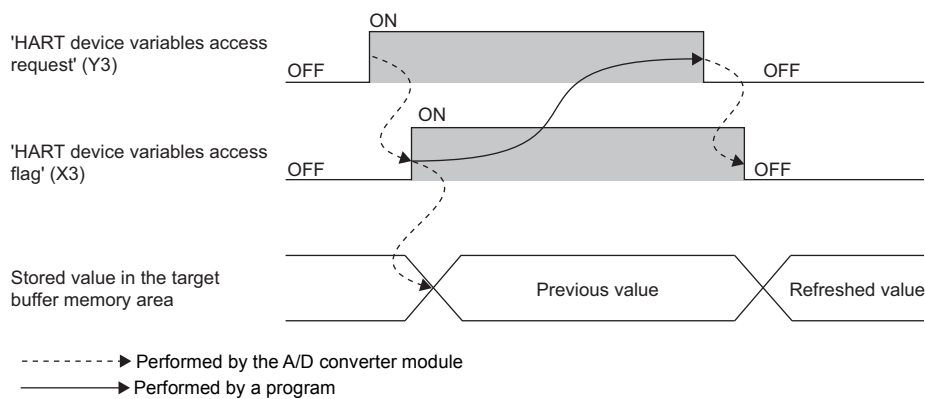
--------▶ Performed by the A/D converter module
————————▶ Performed by a program

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART device variables access flag	X3							

External power supply READY flag

■Device number
The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
External power supply READY flag	X7							

■When the external power supply is off or when the elapsed time after turning off and on the external power supply is less than 200ms
'External power supply READY flag' (X7) remains off, and A/D conversion processing is not performed. At this time, 'A/D conversion completed flag' (XE) turns off.

■When the external power supply is turned off and on
After 200ms, 'External power supply READY flag' (X7) turns on. A/D conversion processing starts on channels where the A/D conversion is enabled.
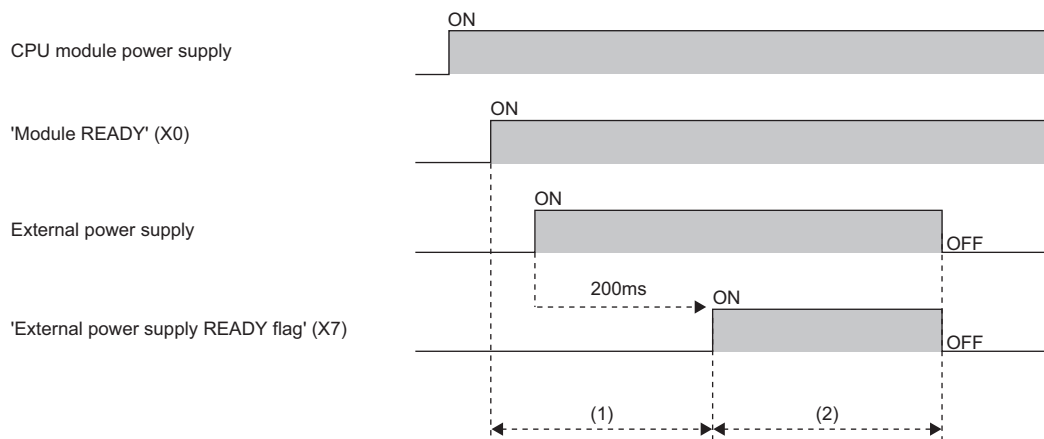
(1) A/D conversion is not performed.
(2) A/D conversion is performed.

■When the external power supply is turned on and off
'External power supply READY flag' (X7) turns off, and A/D conversion processing stops. At this time, 'A/D conversion completed flag' (XE) turns off.

When the external power supply is turned off and on thereafter, 'External power supply READY flag' (X7) turns on and A/D conversion processing starts after 200ms have elapsed, as with when the external power supply is turned off and on.

Restriction

Use an external power supply that meets the specifications described in the performance specifications. When an external power supply does not meet the specifications, 'External power supply READY flag' (X7) does not turn on. For the performance specifications, refer to the following.
📖 MELSEC iQ-R HART-Enabled Analog-Digital Converter Module User's Manual (Startup)

Warning output signal

When the warning output function is disabled for all channels, 'Warning output signal' (X8) is always off.

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Warning output signal	X8							

■Process alarm

- 'Warning output signal' (X8) turns on when digital output values or digital operation values of the A/D conversion enabled channels exceed the ranges of the process alarm lower lower limit value to the process alarm upper upper limit value after 'CH1 Warning output setting (Process alarm)' (Un\G512) is set to Enable (0). The ALM LED also turns on.
- 'Warning output signal' (X8) turns off when the digital output values or digital operation values fall within the setting range in all the A/D conversion enabled channels. The ALM LED also turns off.

■Rate alarm

- 'Warning output signal' (X8) turns on when the change rate of digital output values of the A/D conversion enabled channels exceed the ranges of the rate alarm lower limit value to rate alarm upper limit value after 'CH1 Warning output setting (Rate alarm)' (Un\G513) is set to Enable (0). The ALM LED also turns on.
- 'Warning output signal' (X8) turns off when the change rate of the digital output values fall within the setting range in all the A/D conversion enabled channels. The ALM LED also turns off.

'Warning output flag (Process alarm upper limit)' (Un\G36)
'Warning output flag (Process alarm lower limit)' (Un\G37)
'Warning output flag (Rate alarm upper limit)' (Un\G38)
'Warning output flag (Rate alarm lower limit)' (Un\G39)

0   Alarm ON (1)   0

'Warning output signal' (X8)

ON   OFF

- - - - - - - - ► Performed by the A/D converter module

A
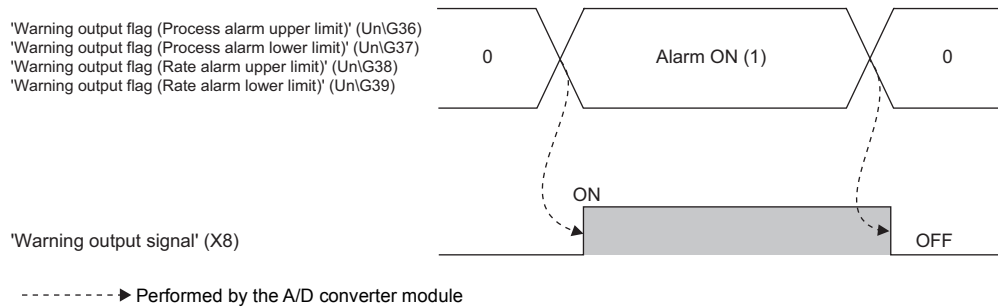
Operating condition setting completed flag

When changing values of the buffer memory, use 'Operating condition setting completed flag' (X9) as an interlock condition to turn on and off 'Operating condition setting request' (Y9). For the buffer memory addresses that require turning on and off of 'Operating condition setting request' (Y9) to enable the new values, refer to the following.

☞ Page 95 List of buffer memory addresses

When 'Operating condition setting completed flag' (X9) is off, the A/D conversion is not performed.

When 'Operating condition setting request' (Y9) is on, 'Operating condition setting completed flag' (X9) turns off.
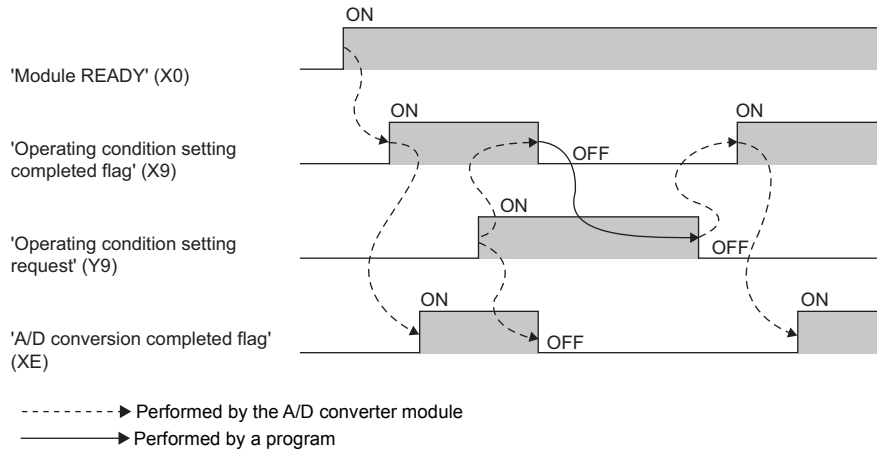
- - - - - - - ▶ Performed by the A/D converter module
——————▶ Performed by a program

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Operating condition setting completed flag	X9							

Input signal error detection signal

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Input signal error detection signal	XC							

■Turning on 'Input signal error detection signal' (XC)

'Input signal error detection signal' (XC) turns on when an analog input value exceeds the range set with 'CH1 Input signal error detection setting value' (Un\G529) in any of A/D conversion enabled channels, after the detection condition is set in 'CH1 Input signal error detection setting' (Un\G528). When the simple disconnection detection is set, the signal ignores the settings of 'CH1 Input signal error detection setting value' (Un\G529) and turns on at the disconnection detection.

When 'Input signal error detection signal' (XC) turns on, the following operations are performed.
- 'CH1 Digital output value' (Un\G400) and 'CH1 Digital operation value' (Un\G402) hold the digital values just before the error was detected.
- The ALM LED flashes.

■Turning off 'Input signal error detection signal' (XC)

'Input signal error detection signal' (XC) turns off by turning on and off 'Error clear request' (YF) after the cause of the input signal error is eliminated and the analog input value falls within the setting range. When 'Input signal error detection signal' (XC) turns off, the following operations are performed.
- The ALM LED turns off.
- 'Input signal error detection flag' (Un\G40) turns off.
- 'Latest alarm code' (Un\G2) is cleared.

--------▶ Performed by the A/D converter module
————▶ Performed by a program
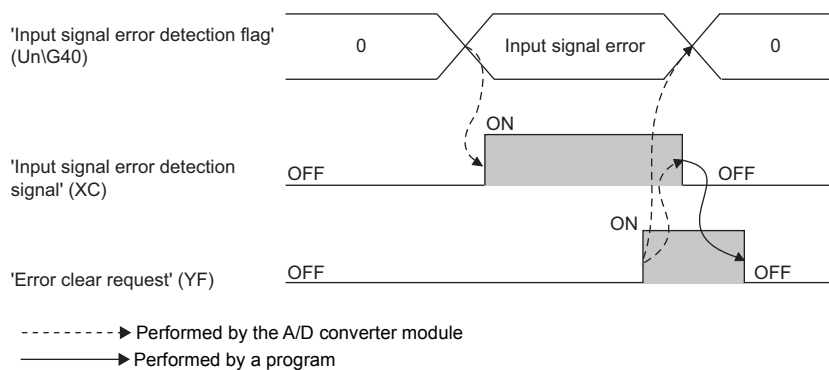
> **Point**
> - When the analog input value falls within the setting range, the A/D conversion is restarted regardless of turning on and off of 'Error clear request' (YF). However, the on state of 'Input signal error detection signal' (XC) and the flashing state of the ALM LED are not cleared.
> - Averaging processing starts from the beginning after the A/D conversion is restarted.
> - 'Input signal error detection signal' (XC) operates only when the input signal error detection function is enabled. When the input signal error detection function is disabled, 'Input signal error detection signal' (XC) is always off.

Maximum value/minimum value reset completed flag

'Maximum value/minimum value reset completed flag' (XD) turns on after the maximum and minimum values stored in 'CH1 Maximum value' (Un\G404) and 'CH1 Minimum value' (Un\G406) are reset by turning on and off 'Maximum value/minimum value reset request' (YD).
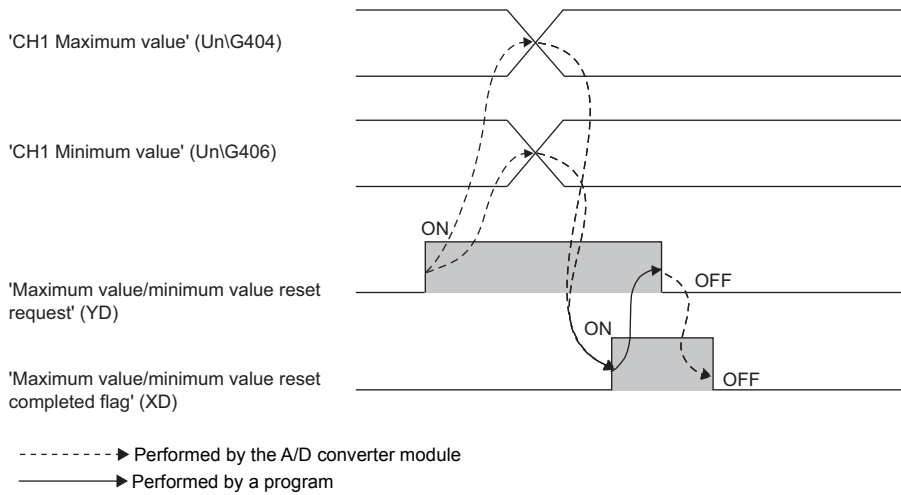
- - - - - - - → Performed by the A/D converter module
──────→ Performed by a program

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Maximum value/minimum value reset completed flag	XD							

A/D conversion completed flag

'A/D conversion completed flag' (XE) turns on when the first A/D conversion of all the channels where the A/D conversion is enabled is completed. To read digital output values, use this signal or 'A/D conversion completed flag' (Un\G42) as an interlock.

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
A/D conversion completed flag	XE							

Error flag

'Error flag' (XF) turns on when an error occurs.

Turn on and off 'Error clear request' (YF) to clear 'Latest error code' (Un\G0) and 'Latest alarm code' (Un\G2).
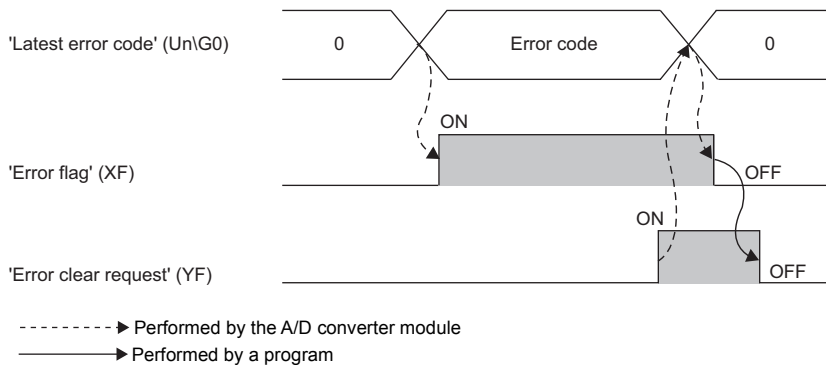
- - - - - - - → Performed by the A/D converter module
──────→ Performed by a program

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Error flag	XF							

Details of output signals

The following describes the details of the output signals for the A/D converter module which are assigned to the CPU module. The I/O numbers (X/Y) described in this section are for the case when the start I/O number of the A/D converter module is set to 0.

> **Point**
>
> This section describes buffer memory addresses for CH1. For details on the buffer memory addresses for CH2 and later, refer to the following.
> ☞ Page 95 List of buffer memory addresses

HART cycle time maximum value/minimum value reset request

'HART maximum cycle time' (Un\G2078) and 'HART minimum cycle time' (Un\G2079) are reset to the HART current cycle time by turning on and off 'HART cycle time maximum value/minimum value reset request' (Y2).

For the timing of turning on and off the signal, refer to the following.

☞ Page 86 HART cycle time maximum value/minimum value reset completed flag

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART cycle time maximum value/minimum value reset request	Y2							

HART device variables access request

Data inconsistency that may occur when data are read from some buffer memory areas can be prevented by turning off and on 'HART device variables access request' (Y3).

For the applicable buffer memory areas and the timing of turning on and off the signal, refer to the following.

☞ Page 87 HART device variables access flag

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART device variables access request	Y3							

A

Operating condition setting request

Turn on and off 'Operating condition setting request' (Y9) to enable the setting of the A/D converter module.

For the timing of turning on and off the signal, refer to the following.

For details on the buffer memory areas to be enabled, refer to the following.

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Operating condition setting request	Y9							

Maximum value/minimum value reset request

Turn on and off 'Maximum value/minimum value reset request' (YD) to clear the maximum and minimum values stored in 'CH1 Maximum value' (Un\G404) and 'CH1 Minimum value' (Un\G406).

For the timing of turning on and off the signal, refer to the following.

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Maximum value/minimum value reset request	YD							

Error clear request

Turn on and off 'Error clear request' (YF) to clear 'Error flag' (XF), 'Input signal error detection signal' (XC), 'Latest error code' (Un\G0), and 'Latest alarm code' (Un\G2). For the timing of turning on and off the signal, refer to the following.

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Error clear request	YF							

Appendix 3 Buffer Memory Areas

List of buffer memory addresses

This section shows the lists of buffer memory addresses of the A/D converter module. For details on the buffer memory, refer to the following.

☞ Page 104 Details of buffer memory addresses

The buffer memory areas of the A/D converter module are classified by the following data types.

Data type	Description	
Setting data	Description	Set this data according to the connected device and the application of the system.
	Write/read attribute	Data can be read and written from/to this area.
	Setting method	Set this data using an engineering tool or a program.
	Setting timing	After changing values, turn on and off 'Operating condition setting request flag' (Y9) to enable the set values.
Control data	Description	Use this data to control the A/D converter module.
	Write/read attribute	Data can be read and written from/to this area.
	Setting method	Set this data using an engineering tool or a program.
	Setting timing	As soon as values are changed, the set values are enabled.
Monitor data	Description	Use this data to monitor the status of the A/D converter module.
	Write/read attribute	Reading data is only allowed. Writing data is not allowed.
	Setting method	—
	Setting timing	—

Point

Do not write data to the system areas and areas whose data types are monitor in the buffer memory. Writing data into these areas can cause the malfunction of the module.

A

Un\G0 to Un\G399

Address (decimal)	Address (hexadecimal)	Name	Default value	Data type	Auto refresh
0	0H	Latest error code	0	Monitor	○
1	1H	Latest address of error history	0	Monitor	○
2	2H	Latest alarm code	0	Monitor	○
3	3H	Latest address of alarm history	0	Monitor	○
4 to 19	4H to 13H	Interrupt factor detection flag [n][*1]	0	Monitor	○
20 to 35	14H to 23H	System area	—	—	—
36	24H	Warning output flag (Process alarm upper limit)	0000H	Monitor	○
37	25H	Warning output flag (Process alarm lower limit)	0000H	Monitor	○
38	26H	Warning output flag (Rate alarm upper limit)	0000H	Monitor	○
39	27H	Warning output flag (Rate alarm lower limit)	0000H	Monitor	○
40	28H	Input signal error detection flag	0000H	Monitor	○
41	29H	System area	—	—	—
42	2AH	A/D conversion completed flag	0000H	Monitor	○
43 to 123	2BH to 7BH	System area	—	—	—
124 to 139	7CH to 8BH	Interrupt factor mask [n][*1]	0	Control	×
140 to 155	8CH to 9BH	System area	—	—	—
156 to 171	9CH to ABH	Interrupt factor reset request [n][*1]	0	Control	×
172 to 199	ACH to C7H	System area	—	—	—
200 to 215	C8H to D7H	Interrupt factor generation setting [n][*1]	0	Setting	×
216 to 231	D8H to E7H	System area	—	—	—
232 to 247	E8H to F7H	Condition target setting [n][*1]	0	Setting	×
248 to 263	F8H to 107H	System area	—	—	—
264 to 279	108H to 117H	Condition target channel setting [n][*1]	0	Setting	×
280 to 399	118H to 18FH	System area	—	—	—

*1 [n] in the table indicates an interrupt setting number. (n = 1 to 16)

Un\G400 to Un\G2015

Address Decimal (hexadecimal)								Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
400 (190H)	600 (258H)	800 (320H)	1000 (3E8H)	1200 (4B0H)	1400 (578H)	1600 (640H)	1800 (708H)	CH□ Digital output value	0	Monitor	○
401 (191H)	601 (259H)	801 (321H)	1001 (3E9H)	1201 (4B1H)	1401 (579H)	1601 (641H)	1801 (709H)	System area	—	—	—
402 (192H)	602 (25AH)	802 (322H)	1002 (3EAH)	1202 (4B2H)	1402 (57AH)	1602 (642H)	1802 (70AH)	CH□ Digital operation value	0	Monitor	○
403 (193H)	603 (25BH)	803 (323H)	1003 (3EBH)	1203 (4B3H)	1403 (57BH)	1603 (643H)	1803 (70BH)	System area	—	—	—
404 (194H)	604 (25CH)	804 (324H)	1004 (3ECH)	1204 (4B4H)	1404 (57CH)	1604 (644H)	1804 (70CH)	CH□ Maximum value	0	Monitor	○
405 (195H)	605 (25DH)	805 (325H)	1005 (3EDH)	1205 (4B5H)	1405 (57DH)	1605 (645H)	1805 (70DH)	System area	—	—	—
406 (196H)	606 (25EH)	806 (326H)	1006 (3EEH)	1206 (4B6H)	1406 (57EH)	1606 (646H)	1806 (70EH)	CH□ Minimum value	0	Monitor	○
407 (197H) to 429 (1ADH)	607 (25FH) to 629 (275H)	807 (327H) to 829 (33DH)	1007 (3EFH) to 1029 (405H)	1207 (4B7H) to 1229 (4CDH)	1407 (57FH) to 1429 (595H)	1607 (647H) to 1629 (65DH)	1807 (70FH) to 1829 (725H)	System area	—	—	—
430 (1AEH)	630 (276H)	830 (33EH)	1030 (406H)	1230 (4CEH)	1430 (596H)	1630 (65EH)	1830 (726H)	CH□ Range setting monitor	0	Monitor	×

Address Decimal (hexadecimal)								Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
431 (1AFH) to 499 (1F3H)	631 (277H) to 699 (2BBH)	831 (33FH) to 899 (383H)	1031 (407H) to 1099 (44BH)	1231 (4CFH) to 1299 (513H)	1431 (597H) to 1499 (5DBH)	1631 (65FH) to 1699 (6A3H)	1831 (727H) to 1899 (76BH)	System area	—	—	—
500 (1F4H)	700 (2BCH)	900 (384H)	1100 (44CH)	1300 (514H)	1500 (5DCH)	1700 (6A4H)	1900 (76CH)	CH☐ A/D conversion enable/disable setting	1	Setting	×
501 (1F5H)	701 (2BDH)	901 (385H)	1101 (44DH)	1301 (515H)	1501 (5DDH)	1701 (6A5H)	1901 (76DH)	CH☐ Averaging process specification	0	Setting	×
502 (1F6H)	702 (2BEH)	902 (386H)	1102 (44EH)	1302 (516H)	1502 (5DEH)	1702 (6A6H)	1902 (76EH)	CH☐ Time average/Count average/Moving average/Primary delay filter constant setting	0	Setting	×
503 (1F7H)	703 (2BFH)	903 (387H)	1103 (44FH)	1303 (517H)	1503 (5DFH)	1703 (6A7H)	1903 (76FH)	System area	—	—	—
504 (1F8H)	704 (2C0H)	904 (388H)	1104 (450H)	1304 (518H)	1504 (5E0H)	1704 (6A8H)	1904 (770H)	CH☐ Scaling enable/disable setting	0	Setting	×
505 (1F9H)	705 (2C1H)	905 (389H)	1105 (451H)	1305 (519H)	1505 (5E1H)	1705 (6A9H)	1905 (771H)	System area	—	—	—
506 (1FAH)	706 (2C2H)	906 (38AH)	1106 (452H)	1306 (51AH)	1506 (5E2H)	1706 (6AAH)	1906 (772H)	CH☐ Scaling upper limit value	0	Setting	×
507 (1FBH)	707 (2C3H)	907 (38BH)	1107 (453H)	1307 (51BH)	1507 (5E3H)	1707 (6ABH)	1907 (773H)	System area	—	—	—
508 (1FCH)	708 (2C4H)	908 (38CH)	1108 (454H)	1308 (51CH)	1508 (5E4H)	1708 (6ACH)	1908 (774H)	CH☐ Scaling lower limit value	0	Setting	×
509 (1FDH) to 511 (1FFH)	709 (2C5H) to 711 (2C7H)	909 (38DH) to 911 (38FH)	1109 (455H) to 1111 (457H)	1309 (51DH) to 1311 (51FH)	1509 (5E5H) to 1511 (5E7H)	1709 (6ADH) to 1711 (6AFH)	1909 (775H) to 1911 (777H)	System area	—	—	—
512 (200H)	712 (2C8H)	912 (390H)	1112 (458H)	1312 (520H)	1512 (5E8H)	1712 (6B0H)	1912 (778H)	CH☐ Warning output setting (Process alarm)	1	Setting	×
513 (201H)	713 (2C9H)	913 (391H)	1113 (459H)	1313 (521H)	1513 (5E9H)	1713 (6B1H)	1913 (779H)	CH☐ Warning output setting (Rate alarm)	1	Setting	×
514 (202H)	714 (2CAH)	914 (392H)	1114 (45AH)	1314 (522H)	1514 (5EAH)	1714 (6B2H)	1914 (77AH)	CH☐ Process alarm upper upper limit value	0	Setting	×
515 (203H)	715 (2CBH)	915 (393H)	1115 (45BH)	1315 (523H)	1515 (5EBH)	1715 (6B3H)	1915 (77BH)	System area	—	—	—
516 (204H)	716 (2CCH)	916 (394H)	1116 (45CH)	1316 (524H)	1516 (5ECH)	1716 (6B4H)	1916 (77CH)	CH☐ Process alarm upper lower limit value	0	Setting	×
517 (205H)	717 (2CDH)	917 (395H)	1117 (45DH)	1317 (525H)	1517 (5EDH)	1717 (6B5H)	1917 (77DH)	System area	—	—	—
518 (206H)	718 (2CEH)	918 (396H)	1118 (45EH)	1318 (526H)	1518 (5EEH)	1718 (6B6H)	1918 (77EH)	CH☐ Process alarm lower upper limit value	0	Setting	×
519 (207H)	719 (2CFH)	919 (397H)	1119 (45FH)	1319 (527H)	1519 (5EFH)	1719 (6B7H)	1919 (77FH)	System area	—	—	—
520 (208H)	720 (2D0H)	920 (398H)	1120 (460H)	1320 (528H)	1520 (5F0H)	1720 (6B8H)	1920 (780H)	CH☐ Process alarm lower lower limit value	0	Setting	×
521 (209H)	721 (2D1H)	920 (399H)	1121 (461H)	1321 (529H)	1521 (5F1H)	1721 (6B9H)	1921 (781H)	System area	—	—	—
522 (20AH)	722 (2D2H)	922 (39AH)	1122 (462H)	1322 (52AH)	1522 (5F2H)	1722 (6BAH)	1922 (782H)	CH☐ Rate alarm warning detection cycle setting	0	Setting	×
523 (20BH)	723 (2D3H)	923 (39BH)	1123 (463H)	1323 (52BH)	1523 (5F3H)	1723 (6BBH)	1923 (783H)	System area	—	—	—
524 (20CH)	724 (2D4H)	924 (39CH)	1124 (464H)	1324 (52CH)	1524 (5F4H)	1724 (6BCH)	1924 (784H)	CH☐ Rate alarm upper limit value	0	Setting	×
525 (20DH)	725 (2D5H)	925 (39DH)	1125 (465H)	1325 (52DH)	1525 (5F5H)	1725 (6BDH)	1925 (785H)	System area	—	—	—
526 (20EH)	726 (2D6H)	926 (39EH)	1126 (466H)	1326 (52EH)	1526 (5F6H)	1726 (6BEH)	1926 (786H)	CH☐ Rate alarm lower limit value	0	Setting	×

Address Decimal (hexadecimal)								Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
527 (20FH)	727 (2D7H)	927 (39FH)	1127 (467H)	1327 (52FH)	1527 (5F7H)	1727 (6BFH)	1927 (787H)	System area	—	—	—
528 (210H)	728 (2D8H)	928 (3A0H)	1128 (468H)	1328 (530H)	1528 (6C0H)	1728 (6C0H)	1928 (788H)	CH□ Input signal error detection setting	0	Setting	×
529 (211H)	729 (2D9H)	929 (3A1H)	1129 (469H)	1329 (531H)	1529 (5F9H)	1729 (6C1H)	1929 (789H)	CH□ Input signal error detection setting value	50	Setting	×
530 (212H) to 597 (255H)	730 (2DAH) to 797 (31DH)	930 (3A2H) to 997 (3E5H)	1130 (46AH) to 1197 (4ADH)	1330 (532H) to 1397 (575H)	1530 (5FAH) to 1597 (63DH)	1730 (6C2H) to 1797 (705H)	1930 (78AH) to 1997 (7CDH)	System area	—	—	—
598 (256H)	798 (31EH)	998 (3E6H)	1198 (4AEH)	1398 (576H)	1598 (63EH)	1798 (706H)	1998 (7CEH)	CH□ Range setting	0	Setting	×
599 (257H)	799 (31FH)	999 (3E7H)	1199 (4AFH)	1399 (577H)	1599 (63FH)	1799 (707H)	1999 (7CFH)	System area	—	—	—
2000 to 2015 (7D0H to 7DFH)								System area	—	—	—

Un\G2016 to Un\G3599

Address Decimal (hexadecimal)								Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
2016 (7E0H)	2017 (7E1H)	2018 (7E2H)	2019 (7E3H)	2020 (7E4H)	2021 (7E5H)	2022 (7E6H)	2023 (7E7H)	CH□ HART maximum retries setting	3	Setting[*1]	×
2024 to 2030 (7E8H to 7EEH)								System area	—	—	—
2031 (7EFH)								HART device information refresh request	0	Control	×
2032 (7F0H)								HART device information refresh completed	0	Monitor	×
2033 to 2073 (7F1H to 819H)								System area	—	—	—
2074 (81AH)								HART communication enable/disable setting	0	Setting[*1]	×
2075 (81BH)								HART communication enable/disable setting monitor	0	Monitor	○
2076 (81CH)								HART scan list	0	Monitor	○
2077 (81DH)								HART current cycle time	0	Monitor	○
2078 (81EH)								HART maximum cycle time	0	Monitor	○
2079 (81FH)								HART minimum cycle time	0	Monitor	○
2080 (820H)	2092 (82CH)	2104 (838H)	2116 (844H)	2128 (850H)	2140 (85CH)	2152 (868H)	2164 (874H)	CH□ HART field device status	0	Monitor	○
2081 (821H)	2093 (82DH)	2105 (839H)	2117 (845H)	2129 (851H)	2141 (85DH)	2153 (869H)	2165 (875H)	CH□ HART extended field device status	0	Monitor	○
2082 (822H)	2094 (82EH)	2106 (83AH)	2118 (846H)	2130 (852H)	2142 (85EH)	2154 (86AH)	2166 (876H)	CH□ HART device variable status primary value (PV), secondary value (SV)	0	Monitor	○
2083 (823H)	2095 (82FH)	2107 (83BH)	2119 (847H)	2131 (853H)	2143 (85FH)	2155 (86BH)	2167 (877H)	CH□ HART device variable status tertiary value (TV), quaternary value (QV)	0	Monitor	○
2084 (824H)	2096 (830H)	2108 (83CH)	2120 (848H)	2132 (854H)	2144 (860H)	2156 (86CH)	2168 (878H)	CH□ PV value (L)	0000H	Monitor	○
2085 (825H)	2097 (831H)	2109 (83DH)	2121 (849H)	2133 (855H)	2145 (861H)	2157 (86DH)	2169 (879H)	CH□ PV value (H)	7FC0H		
2086 (826H)	2098 (832H)	2110 (83EH)	2122 (84AH)	2134 (856H)	2146 (862H)	2158 (86EH)	2170 (87AH)	CH□ SV value (L)	0000H	Monitor	○
2087 (827H)	2099 (833H)	2111 (83FH)	2123 (84BH)	2135 (857H)	2147 (863H)	2159 (86FH)	2171 (87BH)	CH□ SV value (H)	7FC0H		

Address Decimal (hexadecimal) CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	Name	Default value	Data type	Auto refresh
2088 (828H)	2100 (834H)	2112 (840H)	2124 (84CH)	2136 (858H)	2148 (864H)	2160 (870H)	2172 (87CH)	CH□ TV value (L)	0000H	Monitor	○
2089 (829)	2101 (835H)	2113 (841H)	2125 (84DH)	2137 (859H)	2149 (865H)	2161 (871H)	2173 (87DH)	CH□ TV value (H)	7FC0H		
2090 (82AH)	2102 (836H)	2114 (842H)	2126 (84EH)	2138 (85AH)	2150 (866H)	2162 (872H)	2174 (87EH)	CH□ QV value (L)	0000H	Monitor	○
2091 (82BH)	2103 (837H)	2115 (843H)	2127 (84FH)	2139 (85BH)	2151 (867H)	2162 (873H)	2175 (87FH)	CH□ QV value (H)	7FC0H		
2176 to 2199 (880H to 897H)								System area	—	—	—
2200 (898H)								HART command request flag	0	Control	×
2201 (899H)								HART command request channel	0	Control	×
2202 (89AH)								HART command request code	0	Control	×
2203 (89BH)								HART command request data size	0	Control	×
2204 to 2331 (89CH to 91BH)								HART command request data	0	Control	×
2332 to 2343 (91CH to 927H)								System area	—	—	—
2344 (928H)								HART command answer flag	0	Monitor	×
2345 (929H)								HART command answer channel	0	Monitor	×
2346 (92AH)								HART command answer code	0	Monitor	×
2347 (92BH)								HART command answer data size	0	Monitor	×
2348 to 2475 (92CH to 9ABH)								HART command answer data	0	Monitor	×
2476 to 2499 (9ACH to 9C3H)								System area	—	—	—
2500 (9C4H) to 2503 (9C7H)	2600 (A28H) to 2603 (A2BH)	2700 (A8CH) to 2703 (A8FH)	2800 (AF0H) to 2803 (AF3H)	2900 (B54H) to 2903 (B57H)	3000 (BB8H) to 3003 (BBBH)	3100 (C1CH) to 3103 (C1FH)	3200 (C80H) to 3203 (C83H)	CH□ HART device information (tag)	0	Monitor	×
2504 (9C8H) to 2519 (9D7H)	2604 (A2CH) to 2619 (A3BH)	2704 (A90H) to 2719 (A9FH)	2804 (AF4H) to 2819 (B03H)	2904 (B58H) to 2919 (B67H)	3004 (BBCH) to 3019 (BCBH)	3104 (C20H) to 3119 (C2FH)	3204 (C84H) to 3219 (C93H)	CH□ HART device information (message)	0	Monitor	×
2520 (9D8H) to 2527 (9DFH)	2620 (A3CH) to 2627 (A43H)	2720 (AA0H) to 2727 (AA7H)	2820 (B04H) to 2827 (B0BH)	2920 (B68H) to 2927 (B6FH)	3020 (BCCH) to 3027 (BD3H)	3120 (C30H) to 3127 (C37H)	3220 (C94H) to 3227 (C9BH)	CH□ HART device information (descriptor)	0	Monitor	×
2528 (9E0H)	2628 (A44H)	2728 (AA8H)	2828 (B0CH)	2928 (B70H)	3028 (BD4H)	3128 (C38H)	3228 (C9CH)	CH□ HART device information (manufacturer ID/expanded manufacturer ID)	0	Monitor	×
2529 (9E1H)	2629 (A45H)	2729 (AA9H)	2829 (B0DH)	2929 (B71H)	3029 (BD5H)	3129 (C39H)	3229 (C9DH)	CH□ HART device information (device type/ expanded device type)	0	Monitor	×
2530 (9E2H) to 2531 (9E3H)	2630 (A46H) to 2631 (A47H)	2730 (AAAH) to 2731 (AABH)	2830 (B0EH) to 2831 (B0FH)	2930 (B72H) to 2931 (B73H)	3030 (BD6H) to 3031 (BD7H)	3130 (C3AH) to 3131 (C3BH)	3230 (C9EH) to 3231 (C9FH)	CH□ HART device information (device ID)	0	Monitor	×

A

Address Decimal (hexadecimal)								Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
2532 (9E4H) to 2533 (9E5H)	2632 (A48H) to 2633 (A49H)	2732 (AACH) to 2733 (AADH)	2832 (B10H) to 2833 (B11H)	2932 (B74H) to 2933 (B75H)	3032 (BD8H) to 3033 (BD9H)	3132 (C3CH) to 3133 (C3DH)	3232 (CA0H) to 3233 (CA1H)	CH□ HART device information (revisions)	0	Monitor	×
2534 (9E6H)	2634 (A4AH)	2734 (AAEH)	2834 (B12H)	2934 (B76H)	3034 (BDAH)	3134 (C3EH)	3234 (CA2H)	CH□ HART device information (device function flags)	0	Monitor	×
2535 (9E7H) to 2550 (9F6H)	2635 (A4BH) to 2650 (A5AH)	2735 (AAFH) to 2750 (ABEH)	2835 (B13H) to 2850 (B22H)	2935 (B77H) to 2950 (B86H)	3035 (BDBH) to 3050 (BEAH)	3135 (C3FH) to 3150 (C4EH)	3235 (CA3H) to 3250 (CB2H)	CH□ HART device information (long tag)	0	Monitor	×
2551 (9F7H)	2651 (A5BH)	2751 (ABFH)	2851 (B23H)	2951 (B87H)	3051 (BEBH)	3151 (C4FH)	3251 (CB3H)	CH□ HART device information (private label distributor code)	0	Monitor	×
2552 (9F8H)	2652 (A5CH)	2752 (AC0H)	2852 (B24H)	2952 (B88H)	3052 (BECH)	3152 (C50H)	3252 (CB4H)	CH□ HART device information (device profile)	0	Monitor	×
2553 (9F9H)	2653 (A5DH)	2753 (AC1H)	2853 (B25H)	2953 (B89H)	3053 (BEDH)	3153 (C51H)	3253 (CB5H)	System area	—	—	—
2554 (9FAH) to 2555 (9FBH)	2654 (A5EH) to 2655 (A5FH)	2754 (AC2H) to 2755 (AC3H)	2854 (B26H) to 2855 (B27H)	2954 (B8AH) to 2955 (B8BH)	3054 (BEEH) to 3055 (BEFH)	3154 (C52H) to 3155 (C53H)	3254 (CB6H) to 3255 (CB7H)	CH□ HART device information (final assembly number)	0	Monitor	×
2556 (9FCH) to 2557 (9FDH)	2656 (A60H) to 2657 (A61H)	2756 (AC4H) to 2757 (AC5H)	2856 (B28H) to 2857 (B29H)	2956 (B8CH) to 2957 (B8DH)	3056 (BF0H) to 3057 (BF1H)	3156 (C54H) to 3157 (C55H)	3256 (CB8H) to 3257 (CB9H)	CH□ HART device information (day)	0	Monitor	×
2558 (9FEH)	2658 (A62H)	2758 (AC6H)	2858 (B2AH)	2958 (B8EH)	3058 (BF2H)	3158 (C56H)	3258 (CBAH)	CH□ HART device information (write protect)	0	Monitor	×
2559 (9FFH)	2659 (A63H)	2759 (AC7H)	2859 (B2BH)	2959 (B8FH)	3059 (BF3H)	3159 (C57H)	3259 (CBBH)	CH□ HART device information (PV range engineering unit)	0	Monitor	×
2560 (A00H) to 2561 (A01H)	2660 (A64H) to 2661 (A65H)	2760 (AC8H) to 2761 (AC9H)	2860 (B2CH) to 2861 (B2DH)	2960 (B90H) to 2961 (B91H)	3060 (BF4H) to 3061 (BF5H)	3160 (C58H) to 3161 (C59H)	3260 (CBCH) to 3261 (CBDH)	CH□ HART device information (PV upper range value)	0	Monitor	×
2562 (A02H) to 2563 (A03H)	2662 (A66H) to 2663 (A67H)	2762 (ACAH) to 2763 (ACBH)	2862 (B2EH) to 2863 (B2FH)	2962 (B92H) to 2963 (B93H)	3062 (BF6H) to 3063 (BF7H)	3162 (C5AH) to 3163 (C5BH)	3262 (CBEH) to 3263 (CBFH)	CH□ HART device information (PV lower range value)	0	Monitor	×
2564 (A04H) to 2565 (A05H)	2664 (A68H) to 2665 (A69H)	2764 (ACCH) to 2765 (ACDH)	2864 (B30H) to 2865 (B31H)	2964 (B94H) to 2965 (B95H)	3064 (BF8H) to 3065 (BF9H)	3164 (C5CH) to 3165 (C5DH)	3264 (CC0H) to 3265 (CC1H)	CH□ HART device information (PV damping value)	0	Monitor	×
2566 (A06H)	2666 (A6AH)	2766 (ACEH)	2866 (B32H)	2966 (B96H)	3066 (BFAH)	3166 (C5EH)	3266 (CC2H)	CH□ HART device information (PV transfer function)	0	Monitor	×
2567 (A07H)	2667 (A6BH)	2767 (ACFH)	2867 (B33H)	2967 (B97H)	3067 (BFBH)	3167 (C5FH)	3267 (CC3H)	CH□ HART device information (PV engineering unit)	0	Monitor	×
2568 (A08H)	2668 (A6CH)	2768 (AD0H)	2868 (B34H)	2968 (B98H)	3068 (BFCH)	3168 (C60H)	3268 (CC4H)	CH□ HART device information (SV engineering unit)	0	Monitor	×

Address Decimal (hexadecimal)								Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
2569 (A09H)	2669 (A6DH)	2769 (AD1H)	2869 (B35H)	2969 (B99H)	3069 (BFDH)	3169 (C61H)	3269 (CC5H)	CH□ HART device information (TV engineering unit)	0	Monitor	×
2570 (A0AH)	2670 (A6EH)	2770 (AD2H)	2870 (B36H)	2970 (B9AH)	3070 (BFEH)	3170 (C62H)	3270 (CC6H)	CH□ HART device information (QV engineering unit)	0	Monitor	×
2571 (A0BH) to 2599 (A27H)	2671 (A6FH) to 2699 (A8BH)	2771 (AD3H) to 2799 (AEFH)	2871 (B37H) to 2899 (B53H)	2971 (B9BH) to 2999 (BB7H)	3071 (BFFH) to 3099 (C1BH)	3171 (C63H) to 3199 (C7FH)	3271 (CC7H) to 3299 (CE3H)	System area	—	—	—
3300 to 3599 (CE4H to E0FH)								System area	—	—	—

*1 As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

A

Error history and alarm history (Un\G3600 to Un\G3999)

Address (decimal)	Address (hexadecimal)	Name				Default value	Data type	Auto refresh
3600	E10H	Error history 1	Error code			0	Monitor	×
3601	E11H		Error time	First two digits of the year	Last two digits of the year			
3602	E12H			Month	Day			
3603	E13H			Hour	Minute			
3604	E14H			Second	Day of the week			
3605	E15H			Millisecond				
3606 to 3609	E16H to E19H	System area				—	—	—
3610 to 3615	E1AH to E1FH	Error history 2	Same as error history 1			0	Monitor	×
3616 to 3619	E20H to E23H	System area				—	—	—
3620 to 3625	E24H to E29H	Error history 3	Same as error history 1			0	Monitor	×
3626 to 3629	E2AH to E2DH	System area				—	—	—
3630 to 3635	E2EH to E33H	Error history 4	Same as error history 1			0	Monitor	×
3636 to 3639	E34H to E37H	System area				—	—	—
3640 to 3645	E38H to E3DH	Error history 5	Same as error history 1			0	Monitor	×
3646 to 3649	E3EH to E41H	System area				—	—	—
3650 to 3655	E42H to E47H	Error history 6	Same as error history 1			0	Monitor	×
3656 to 3659	E48H to E4BH	System area				—	—	—
3660 to 3665	E4CH to E51H	Error history 7	Same as error history 1			0	Monitor	×
3666 to 3669	E52H to E55H	System area				—	—	—
3670 to 3675	E56H to E5BH	Error history 8	Same as error history 1			0	Monitor	×
3676 to 3679	E5CH to E5FH	System area				—	—	—
3680 to 3685	E60H to E65H	Error history 9	Same as error history 1			0	Monitor	×
3686 to 3689	E66H to E69H	System area				—	—	—
3690 to 3695	E6AH to E6FH	Error history 10	Same as error history 1			0	Monitor	×
3696 to 3699	E70H to E73H	System area				—	—	—
3700 to 3705	E74H to E79H	Error history 11	Same as error history 1			0	Monitor	×
3706 to 3709	E7AH to E7DH	System area				—	—	—
3710 to 3715	E7EH to E83H	Error history 12	Same as error history 1			0	Monitor	×
3716 to 3719	E84H to E87H	System area				—	—	—
3720 to 3725	E88H to E8DH	Error history 13	Same as error history 1			0	Monitor	×
3726 to 3729	E8EH to E91H	System area				—	—	—
3730 to 3735	E92H to E97H	Error history 14	Same as error history 1			0	Monitor	×
3736 to 3739	E98H to E9BH	System area				—	—	—
3740 to 3745	E9CH to EA1H	Error history 15	Same as error history 1			0	Monitor	×
3746 to 3749	EA2H to EA5H	System area				—	—	—
3750 to 3755	EA6H to EABH	Error history 16	Same as error history 1			0	Monitor	×
3756 to 3759	EACH to EAFH	System area				—	—	—
3760	EB0H	Alarm history 1	Alarm code			0	Monitor	×
3761	EB1H		Alarm time	First two digits of the year	Last two digits of the year			
3762	EB2H			Month	Day			
3763	EB3H			Hour	Minute			
3764	EB4H			Second	Day of the week			
3765	EB5H			Millisecond				
3766 to 3769	EB6H to EB9H	System area				—	—	—
3770 to 3775	EBAH to EBFH	Alarm history 2	Same as alarm history 1			0	Monitor	×

Address (decimal)	Address (hexadecimal)	Name		Default value	Data type	Auto refresh
3776 to 3779	EC0H to EC3H	System area		—	—	—
3780 to 3785	EC4H to EC9H	Alarm history 3	Same as alarm history 1	0	Monitor	×
3786 to 3789	ECAH to ECDH	System area		—	—	—
3790 to 3795	ECEH to ED3H	Alarm history 4	Same as alarm history 1	0	Monitor	×
3796 to 3799	ED4H to ED7H	System area		—	—	—
3800 to 3805	ED8H to EDDH	Alarm history 5	Same as alarm history 1	0	Monitor	×
3806 to 3809	EDEH to EE1H	System area		—	—	—
3810 to 3815	EE2H to EE7H	Alarm history 6	Same as alarm history 1	0	Monitor	×
3816 to 3819	EE8H to EEBH	System area		—	—	—
3820 to 3825	EECH to EF1H	Alarm history 7	Same as alarm history 1	0	Monitor	×
3826 to 3829	EF2H to EF5H	System area		—	—	—
3830 to 3835	EF6H to EFBH	Alarm history 8	Same as alarm history 1	0	Monitor	×
3836 to 3839	EFCH to EFFH	System area		—	—	—
3840 to 3845	F00H to F05H	Alarm history 9	Same as alarm history 1	0	Monitor	×
3846 to 3849	F06H to F09H	System area		—	—	—
3850 to 3855	F0AH to F0FH	Alarm history 10	Same as alarm history 1	0	Monitor	×
3856 to 3859	F10H to F13H	System area		—	—	—
3860 to 3865	F14H to F19H	Alarm history 11	Same as alarm history 1	0	Monitor	×
3866 to 3869	F1AH to F1DH	System area		—	—	—
3870 to 3875	F1EH to F23H	Alarm history 12	Same as alarm history 1	0	Monitor	×
3876 to 3879	F24H to F27H	System area		—	—	—
3880 to 3885	F28H to F2DH	Alarm history 13	Same as alarm history 1	0	Monitor	×
3886 to 3889	F2EH to F31H	System area		—	—	—
3890 to 3895	F32H to F37H	Alarm history 14	Same as alarm history 1	0	Monitor	×
3896 to 3899	F38H to F3BH	System area		—	—	—
3900 to 3905	F3CH to F41H	Alarm history 15	Same as alarm history 1	0	Monitor	×
3906 to 3909	F42H to F45H	System area		—	—	—
3910 to 3915	F46H to F4BH	Alarm history 16	Same as alarm history 1	0	Monitor	×
3916 to 3999	F4CH to F9FH	System area		—	—	—

A

Details of buffer memory addresses

The following describes the details of the buffer memory addresses of the A/D converter module.

> **Point**
>
> This chapter describes buffer memory addresses for CH1.

Latest error code

The latest error code detected in the A/D converter module is stored. For details, refer to the following.

☞ Page 80 List of Error Codes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Latest error code	0							

■Clearing an error

Turn on and off 'Error clear request' (YF) or 'Operating condition setting request' (Y9). However, when 'Operating condition setting request' (Y9) is turned on and off, the A/D conversion is reset and the processing is started from the beginning.

Latest address of error history

Among Error history □ (Un\G3600 to Un\G3759), a buffer memory address which stores the latest error code is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Latest address of error history	1							

Latest alarm code

The latest alarm code detected in the A/D converter module is stored. For details, refer to the following.

☞ Page 82 List of Alarm Codes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Latest alarm code	2							

■Clearing an alarm

Turn on and off 'Error clear request' (YF) or 'Operating condition setting request' (Y9). However, when 'Operating condition setting request' (Y9) is turned on and off, the A/D conversion is reset and the processing is started from the beginning.

Latest address of alarm history

Among Alarm history □ (Un\G3760 to Un\G3919), a buffer memory address which stores the latest alarm code is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Latest address of alarm history	3							

Interrupt factor detection flag [n]

The detection status of the interrupt factor is stored.

Monitored value	Description
0	No interrupt factor
1	Interrupt factor

When an interrupt factor occurs, an interrupt request is sent to the CPU module at the same time as when 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor detection flag [n]	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Warning output flag (Process alarm upper limit)

The upper limit warning of the process alarm can be checked for each channel.

```
b15 b14 b13 b12 b11 b10 b9  b8   b7  b6  b5  b4  b3  b2  b1  b0
 0   0   0   0   0   0   0   0  CH8 CH7 CH6 CH5 CH4 CH3 CH2 CH1
              (2)                            (1)
```
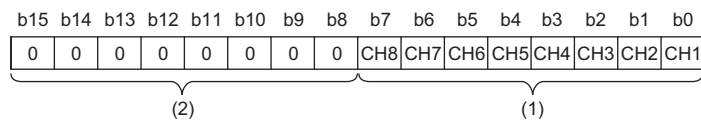
(1) 0: Normal, 1: Alarm ON
(2) b8 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Warning output flag (Process alarm upper limit)	36							

■Warning output flag status
- When a value is out of the range specified in 'CH1 Process alarm upper upper limit value' (Un\G514), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Process alarm upper limit)' (Un\G36).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (process alarm) are enabled, 'Warning output signal' (X8) also turns on.

■Clearing Warning output flag
- When the digital operation value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Warning output flag (Process alarm lower limit)

The lower limit warning of the process alarm can be checked for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2)   (1)

(1) 0: Normal, 1: Alarm ON
(2) b8 to b15 are fixed to 0.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Warning output flag (Process alarm lower limit)	37							

■Warning output flag status
- When a value is out of the range specified in 'CH1 Process alarm lower lower limit value' (Un\G520), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Process alarm lower limit)' (Un\G37).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (process alarm) are enabled, 'Warning output signal' (X8) also turns on.

■Clearing Warning output flag
- When the digital operation value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Warning output flag (Rate alarm upper limit)

The upper limit warning of the rate alarm can be checked for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2)   (1)

(1) 0: Normal, 1: Alarm ON
(2) b8 to b15 are fixed to 0.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Warning output flag (Rate alarm upper limit)	38							

■Warning output flag status
- When a value is out of the range specified in 'CH1 Rate alarm upper limit value' (Un\G524), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Rate alarm upper limit)' (Un\G38).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (rate alarm) are enabled, 'Warning output signal' (X8) also turns on.

■Clearing Warning output flag
- When the change rate of the digital output value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Warning output flag (Rate alarm lower limit)

The lower limit warning of the rate alarm can be checked for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2)   (1)

(1) 0: Normal, 1: Alarm ON
(2) b8 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Warning output flag (Rate alarm lower limit)	39							

■Warning output flag status

- When a value is out of the range specified in 'CH1 Rate alarm lower limit value' (Un\G526), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Rate alarm lower limit)' (Un\G39).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (rate alarm) are enabled, 'Warning output signal' (X8) also turns on.

■Clearing Warning output flag

- When the change rate of the digital output value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Input signal error detection flag

The status of an input signal can be checked for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2)   (1)
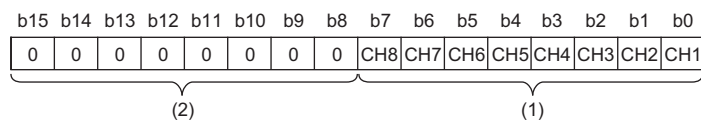
(1) 0: Normal, 1: Input signal error
(2) b8 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Input signal error detection flag	40							

■Input signal error detection flag status

- When an analog input value out of the range set with 'CH1 Input signal error detection setting value' (Un\G529) is detected, Input signal error (1) is stored in the corresponding bit of 'Input signal error detection flag' (Un\G40).
- When an error is detected in any channel where the A/D conversion and the input signal error detection are enabled, 'Input signal error detection signal' (XC) turns on.

■Clearing Input signal error detection flag

When 'Error clear request' (YF) is turned on and off after the cause of the input signal error is eliminated and the analog input value falls within the set range, 'Input signal error detection flag' (Un\G40) turns off. When 'Input signal error detection flag' (Un\G40) turns off, the following operations are performed.

- The ALM LED turns off.
- 'Input signal error detection signal' (XC) turns off.
- 'Latest alarm code' (Un\G2) is cleared.

Turning on and off 'Operating condition setting request '(Y9) also clears 'Input signal error detection flag' (Un\G40). However, the A/D conversion is reset and the processing is started from the beginning.

A/D conversion completed flag

The A/D conversion status can be checked.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2) — (1)
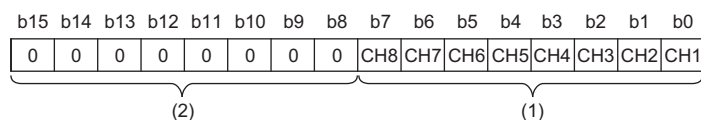
(1) 0: During A/D conversion or unused, 1: A/D conversion completed
(2) b8 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
A/D conversion completed flag	42							

■A/D conversion completed flag status

When the first A/D conversion is completed in the channel where the A/D conversion is enabled, the flag turns to A/D conversion completed (1). 'A/D conversion completed flag' (XE) turns on when the conversion in all the channels where the A/D conversion is enabled is completed.

■Clearing A/D conversion completed flag

Turning on and off 'Operating condition setting request' (Y9) turns the flag back to the default (During A/D conversion or unused (0)), and when the first A/D conversion is completed, the flag turns to A/D conversion completed (1) again.

Interrupt factor mask [n]

Set whether to mask interrupt factors.

Setting value	Setting details
0	Mask (Interrupt unused)
1	Mask clear (Interrupt used)

When 'Interrupt factor mask [n]' (Un\G124 to Un\G139) is changed to Mask clear (Interrupt used) (1) and an interrupt factor occurs, an interrupt request is sent to the CPU module. When the set value is two or larger, the setting is regarded as Mask clear (Interrupt used) (1).
"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor mask [n]	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139

■Default value

The default value is Mask (Interrupt unused) (0) for all areas.

Interrupt factor reset request [n]

Set whether to send the interrupt factor reset request.

Setting value	Setting details
0	No reset request
1	Reset request

When Reset request (1) is set in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) corresponding to the interrupt factor, the interrupt factor of the specified interrupt is reset. After that, 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) turns to No reset request (0). When the set value is two or larger, the setting is regarded as Reset request (1).

Turning on and off 'Operating condition setting request' (Y9) also resets interrupt factors.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor reset request [n]	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171

■Default value
The default value is No reset request (0) for all areas.

Interrupt factor generation setting [n]

Set whether to send an interrupt request when the same interrupt factor occurs during the interrupt factor detection.

Setting value	Setting details
0	Interrupt resend request
1	No interrupt resend request

- If a value other than the above is set, an interrupt factor generation setting range error (error code: 180△H) occurs.
- When 'Interrupt factor generation setting [n]' (Un\G200 to Un\G215) is Interrupt resend request (0) and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is sent to the CPU module again.
- When 'Interrupt factor generation setting [n]' (Un\G200 to Un\G215) is No interrupt resend request (1) and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is not sent to the CPU module. To send an interrupt request to the CPU module, do it after setting Reset request (1) in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) and resetting the interrupt factor.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor generation setting [n]	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is Interrupt resend request (0) for all areas.

Condition target setting [n]

Set an interrupt factor to be detected.

Setting value	Setting details
0	Disable
1	Error flag (XF)
2	Warning output flag (Process alarm)
3	Warning output flag (Rate alarm)
4	Input signal error detection flag
5	A/D conversion completed

- If a value other than the above is set, a condition target setting range error (error code: 181△H) occurs.
- When an input signal (X) or a buffer memory area set in 'Condition target setting [n]' (Un\G232 to Un\G247) turns on, an interrupt request is sent to the CPU module. However, when A/D conversion completed (5) is set, turning on 'A/D conversion completed flag' (Un\G42) sends an interrupt request to the CPU module.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Condition target setting [n]	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (0) for all areas.

Condition target channel setting [n]

Set a channel where an interrupt is detected.

Setting value	Setting details
0	All channels
1	CH1
2	CH2
3	CH3
4	CH4
5	CH5
6	CH6
7	CH7
8	CH8

When an interrupt factor with channel specification is set in 'Condition target setting [n]' (Un\G232 to Un\G247), an interrupt factor is monitored in the channel set by this area. When an interrupt factor of the input signal (X) is set, the setting in this area is ignored.

If a value other than the above is set, a condition target channel setting range error (error code: 182△H) occurs.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Condition target channel setting [n]	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is All channels (0) for all areas.

CH1 Digital output value

The A/D-converted digital output value is stored as a 16-bit signed binary value.
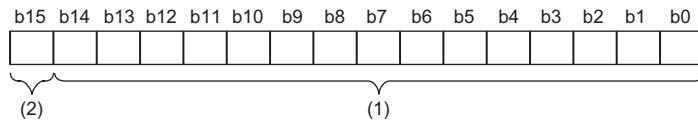
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

(2)   (1)

(1) Data section
(2) Sign bit 0: Positive, 1: Negative

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Digital output value	400	600	800	1000	1200	1400	1600	1800

■Refreshing cycle
When time average or count average is performed, values are updated at every averaging process cycle. When the processing other than them is performed, values are updated at every sampling cycle.

CH1 Digital operation value

A digital operation value obtained by the scaling function is stored as a 16-bit signed binary value.
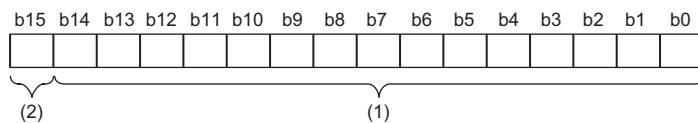
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

(2)   (1)

(1) Data section
(2) Sign bit 0: Positive, 1: Negative

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Digital operation value	402	602	802	1002	1202	1402	1602	1802

■Refreshing cycle
When time average or count average is performed, values are updated at every averaging process cycle. When the processing other than them is performed, values are updated at every sampling cycle.

> **Point**
>
> When the scaling function is not used, the same value as 'CH1 digital output value' (Un\G400) is stored.

CH1 Maximum value, CH1 Minimum value

The maximum value and minimum value of digital operation values or digital output values are stored as 16-bit signed binary values.

In the following cases, 'CH1 Maximum value' (Un\G404) and 'CH1 Minimum value' (Un\G406) are updated with the current values.

• When 'Operating condition setting request' (Y9) is turned on and off and the setting is changed
• When 'Maximum value/minimum value reset request' (YD) is turned on and off

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Maximum value	404	604	804	1004	1204	1404	1604	1804
CH□ Minimum value	406	606	806	1006	1206	1406	1606	1806

Point

- For the channel to which the averaging processing is specified, the maximum and minimum values are stored at every averaging processing time.
- When the scaling function is used, values calculated by the scaling function are stored in Maximum value and Minimum value.

CH1 Range setting monitor

The input range value set in the input range setting or 'CH1 Range setting' (Un\G598) can be checked.

Monitored value	Description
0H	4 to 20mA
1H	0 to 20mA
AH	4 to 20mA (extended mode)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Range setting monitor	430	630	830	1030	1230	1430	1630	1830

Restriction

The stored value in this area is not updated for a channel where A/D conversion disable is set since the input range cannot be switched for that channel. For details, refer to the following.

☞ Page 16 Range Switching Function

CH1 A/D conversion enable/disable setting

Set whether to enable or disable the A/D conversion.

For details on the A/D conversion enable/disable setting function, refer to the following.

☞ Page 24 A/D Conversion Enable/Disable Setting Function

Setting value	Setting details
0	A/D conversion enable
1	A/D conversion disable

When a value other than the above is set, the value is regarded as A/D conversion disable (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ A/D conversion enable/disable setting	500	700	900	1100	1300	1500	1700	1900

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is A/D conversion disable (1) for all channels.

CH1 Averaging process specification

Set the processing to be performed among the sampling processing, averaging processing, and filter processing.

Setting value	Setting details
0	Sampling processing
1	Time average
2	Count average
3	Moving average
4	Primary delay filter

If a value other than the above values is set, an averaging process specification setting range error (error code: 191□H) occurs.

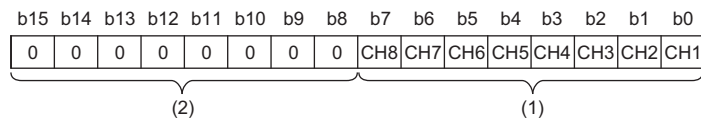### ■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Averaging process specification	501	701	901	1101	1301	1501	1701	1901

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is Sampling processing (0) for all channels.

CH1 Time average/Count average/Moving average/Primary delay filter constant setting

Set the time (for averaging), count (for averaging), moving average count, and primary delay filter constant for when Time average (1), Count average (2), Moving average (3), or Primary delay filter (4) is set in 'CH1 Averaging process specification' (Un\G501).
The following table lists the setting ranges.

Setting value	Setting details
320 to 5000 (ms)	Time average
4 to 500 (times)	Count average
2 to 1000 (times)	Moving average
1 to 500 (times)	Primary delay filter constant

If a value other than the above is set, any of a time average setting range error (error code: 192□H), count average setting range error (error code: 193□H), moving average setting range error (error code: 194□H), or primary delay filter constant setting range error (error code: 195□H) occurs, and the A/D conversion processing is performed with the setting before the occurrence of the error.

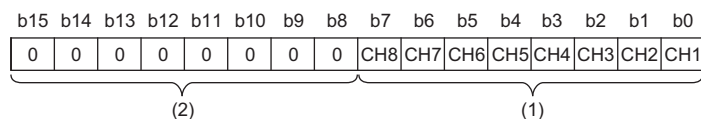### ■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Time average/Count average/Moving average/Primary delay filter constant setting	502	702	902	1102	1302	1502	1702	1902

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is 0 for all channels.

> **Point**
> - Set a primary delay filter constant for the primary delay filter. The value of the time constant (ms) is the product of the primary delay filter constant and the sampling cycle.
> - Since the default value is 0, change the value depending on the processing.
> - When Sampling processing (0) is set in 'CH1 Averaging process specification' (Un\G501), the setting of this area is ignored.

CH1 Scaling enable/disable setting

Set whether to enable or disable the scaling.

For details on the scaling function, refer to the following.

☞ Page 29 Scaling Function

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, a scaling enable/disable setting range error (error code: 1A0□H) occurs.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Scaling enable/disable setting	504	704	904	1104	1304	1504	1704	1904

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is Disable (1) for all channels.

CH1 Scaling upper limit value

Set an upper limit value for the range of the scale conversion.

For details on the scaling function, refer to the following.
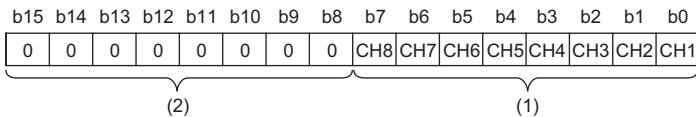
☞ Page 29 Scaling Function

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Scaling upper limit value	506	706	906	1106	1306	1506	1706	1906

■Setting range
- The setting range is from -32000 to 32000.
- In the channel where a set value does not satisfy the condition "the scaling upper limit value ≠ the scaling lower limit value", a scaling upper/lower limit value setting error (error code: 1A2□H) occurs.
- In the channel where a value out of the setting range is set, a scaling setting range error (error code: 1A1□H) occurs.
- When 'CH1 Scaling enable/disable setting' (Un\G504) is set to Disable (1), the setting of 'CH1 Scaling upper limit value' (Un\G506) is ignored.

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is 0 for all channels.

CH1 Scaling lower limit value

Set a lower limit value for the range of the scale conversion.

For details on the scaling function, refer to the following.

☞ Page 29 Scaling Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Scaling lower limit value	508	708	908	1108	1308	1508	1708	1908

■Setting range

- The setting range is from -32000 to 32000.
- In the channel where a set value does not satisfy the condition "the scaling upper limit value ≠ the scaling lower limit value", a scaling upper/lower limit value setting error (error code: 1A2□H) occurs.
- In the channel where a value out of the setting range is set, a scaling setting range error (error code: 1A1□H) occurs.
- When 'CH1 Scaling enable/disable setting' (Un\G504) is set to Disable (1), the setting of 'CH1 Scaling lower limit value' (Un\G508) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Warning output setting (Process alarm)

Set whether to enable or disable the warning output of a process alarm.

For details on the warning output function (process alarm), refer to the following.

☞ Page 32 Process alarm

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, a warning output setting (Process alarm) range error (error code: 1B0□H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Warning output setting (Process alarm)	512	712	912	1112	1312	1512	1712	1912

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Warning output setting (Rate alarm)

Set whether to enable or disable the warning output of a rate alarm.

For details on the warning output function (rate alarm), refer to the following.

☞ Page 35 Rate alarm

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, a warning output setting (Rate alarm) range error (error code: 1B8□H) occurs.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Warning output setting (Rate alarm)	513	713	913	1113	1313	1513	1713	1913

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is Disable (1) for all channels.

CH1 Process alarm upper upper limit value

Set an upper upper limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 32 Process alarm

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Process alarm upper upper limit value	514	714	914	1114	1314	1514	1714	1914

■Setting range
The setting range is from -32768 to 32767.

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is 0 for all channels.

CH1 Process alarm upper lower limit value

Set an upper lower limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 32 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Process alarm upper lower limit value	516	716	916	1116	1316	1516	1716	1916

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Process alarm lower upper limit value

Set a lower upper limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 32 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Process alarm lower upper limit value	518	718	918	1118	1318	1518	1718	1918

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

A

CH1 Process alarm lower lower limit value

Set a lower lower limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.
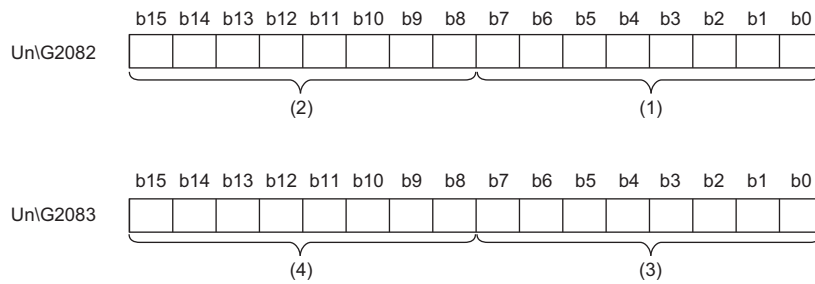
☞ Page 32 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH☐ Process alarm lower lower limit value	520	720	920	1120	1320	1520	1720	1920

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

> **Point**
>
> • When using the process alarm, configure the 4-step settings of the process alarm upper upper limit value, upper lower limit value, lower upper limit value, and lower lower limit value.
> • In the channel where a set value does not satisfy the condition "the upper upper limit value $\geq$ the upper lower limit value $\geq$ the lower upper limit value $\geq$ the lower lower limit value", a process alarm upper lower limit value setting range error (error code: 1B△☐H) occurs.
> • Since the default value is 0, change the value.
> • When the scaling function is used, warning targets are digital operation values to which the operation of the scaling function was reflected. Be sure to consider operation results of the scaling function to set values.

CH1 Rate alarm warning detection cycle setting

Set the cycle to check the change rate of digital output values.

The value of the cycle to detect a rate alarm warning is the product of the value in 'CH1 Rate alarm warning detection cycle setting' (Un\G522) and the conversion cycle.

For details on the warning output function (rate alarm), refer to the following.

☞ Page 35 Rate alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH☐ Rate alarm warning detection cycle setting	522	722	922	1122	1322	1522	1722	1922

■Setting range

The setting range is from 1 to 32000 (times).

In the channel where a value out of the range is set, a rate alarm warning detection cycle setting range error (error code: 1B9☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Rate alarm upper limit value

For rate alarm, the digital output value is checked at every warning detection cycle and the change rate is calculated from the check result. Use this area to set an upper limit value of the change rate of digital output values for each channel.

For details on the warning output function (rate alarm), refer to the following.

☞ Page 35 Rate alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Rate alarm upper limit value	524	724	924	1124	1324	1524	1724	1924

■Setting range

The setting range is from -32768 to 32767 (-3276.8 to 3276.7%). (Set it in increments of 0.1%.)

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Rate alarm lower limit value

For rate alarm, the digital output value is checked at every warning detection cycle and the change rate is calculated from the check result. Use this area to set a lower limit value of the change rate of digital output values for each channel.

For details on the warning output function (rate alarm), refer to the following.

☞ Page 35 Rate alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Rate alarm lower limit value	526	726	926	1126	1326	1526	1726	1926

■Setting range

The setting range is from -32768 to 32767 (-3276.8 to 3276.7%). (Set it in increments of 0.1%.)

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

> **Point**
> - When using rate alarms, configure the 2-step settings of the rate alarm upper limit value and lower limit value.
> - In the channel where a set value satisfies the condition the "rate alarm lower limit value $\geq$ the rate alarm upper limit value", a rate alarm upper/lower limit setting value inversion error (error code: 1BA□H) occurs.
> - Since the default value is 0, change the value.

A

CH1 Input signal error detection setting

Set a condition for detecting an input signal error.

For details on the input signal error detection function, refer to the following.

☞ Page 40 Input Signal Error Detection Function

Setting value	Setting details
0	Disable
1	Upper and lower limit detection
2	Lower limit detection
3	Upper limit detection
4	Simple disconnection detection

If a value other than the above is set, an input signal error detection setting range error (error code: 1C0□H) occurs. If Simple disconnection detection (4) is selected for the channel where the set input range is other than the extended mode, a disconnection detection enabled range setting range error (error code: 1C6□H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Input signal error detection setting	528	728	928	1128	1328	1528	1728	1928

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (0) for all channels.

CH1 Input signal error detection setting value

Set a setting value to detect an error for the input analog value.

For details on the input signal error detection function, refer to the following.

☞Page 40 Input Signal Error Detection Function

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Input signal error detection setting value	529	729	929	1129	1329	1529	1729	1929

■Setting range
The setting range is from 0 to 250 (0 to 25.0%). Set it in increments of 1 (0.1%).

In the channel where a value out of the range is set, an input signal error detection setting value range error (error code: 1C1□H) occurs.

■How to calculate the input signal error detection value
The input signal error detection value is calculated based on the input signal error detection setting value as follows. The input signal error detection value to be calculated varies depending on the input range used.

- Input signal error detection upper limit value = Gain value of each range + (Gain value of each range - Offset value of each range) × (Input signal error detection setting value/1000)
- Input signal error detection lower limit value = Lower limit value of each range - (Gain value of each range - Offset value of each range) × (Input signal error detection setting value/1000)

Ex.

When 'CH1 Input signal error detection setting value' (Un\G529) is set to 100 (10%) with the input range of 4 to 20mA, the input signal error detection upper/lower limit values are calculated as follows:

- Input signal error detection upper limit value = 20 + (20 - 4) × (100/1000) = 21.6mA
- Input signal error detection lower limit value = 4 - (20 - 4) × (100/1000) = 2.4mA

■Detection condition
Detection conditions vary depending on the setting of 'CH1 Input signal error detection setting' (Un\G528) as follows:

- When 'CH1 Input signal error detection setting' (Un\G528) is set to Upper and lower limit detection (1), the detection is performed with both the input signal error detection upper limit value and input signal error detection lower limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Lower limit detection (2), the detection is performed only with the input signal error detection lower limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Upper limit detection (3), the detection is performed only with the input signal error detection upper limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Simple disconnection detection (4), the value set in this area is ignored.

■Enabling the setting
Turn on and off 'Operating condition setting request' (Y9).

■Default value
The default value is 50 for all channels.

CH1 Range setting

This area is for setting an input range.

Setting value	Setting details
0H	4 to 20mA
1H	0 to 20mA
AH	4 to 20mA (extended mode)

- If a value other than the above is set, a range setting range error (error code: 190□H) occurs.
- The input range cannot be switched for the channel where A/D conversion disable is set. To switch the input range, set 'CH1 A/D conversion enable/disable setting' (Un\G500) to A/D conversion enable (0) and turn on and off 'Operating condition setting request' (Y9).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ Range setting	598	798	998	1198	1398	1598	1798	1998

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 4 to 20mA (0H) for all channels.

CH1 HART maximum retries setting

Set the maximum number of retries of a HART communication for each channel.

For details on the HART communication function, refer to the following.

☞ Page 17 HART Communication Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART maximum retries setting	2016	2017	2018	2019	2020	2021	2022	2023

■Setting range

- The setting range is from 0 to 30 (times).
- The maximum number of retries is set to 3 (times) when the value out of the above range is set.

■Enabling the setting

As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value

The default value is 3 for all channels.

HART device information refresh request

Request a refresh of the HART device information. Setting the bit corresponding to a given channel to Refresh request made (1) refreshes the HART device information of the channel. Refreshing of the HART device information of all the channels can be simultaneously requested.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2)   (1)
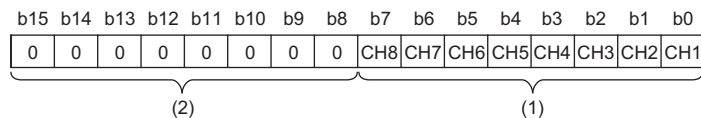
(1) 0: No refresh request, 1: Refresh request made
(2) b8 to b15 are fixed to 0.

When refreshing of the HART device information is completed, Refresh completed (1) is stored in the bit corresponding to 'HART device information refresh completed' (Un\G2032). After Refresh completed (1) is stored, set the bit that was set to Refresh request made (1) to No refresh request (0).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART device information refresh request	2031							

■Default value

The default value is No refresh request (0) for all channels.

HART device information refresh completed

The refresh status of the HART device information can be checked.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2) — under b15 to b8
(1) — under b7 to b0

(1) 0: Refresh uncompleted, 1: Refresh completed
(2) b8 to b15 are fixed to 0.

When the bit corresponding to 'HART device information refresh request' (Un\G2031) is set to Refresh request made (1), and the HART device information of the target channel is refreshed, Refresh completed (1) is stored in the bit corresponding to this area. When the bit corresponding to 'HART device information refresh request' (Un\G2031) is set to No refresh request (0), Refresh uncompleted (0) is stored in the bit corresponding to this area.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART device information refresh completed	2032							

HART communication enable/disable setting

Set whether to enable or disable the HART communication for each channel.

For details on the HART communication function, refer to the following.

☞ Page 17 HART Communication Function

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2) — under b15 to b8
(1) — under b7 to b0

(1) 0: Disable, 1: Enable
(2) b8 to b15 are fixed to 0.

- The HART communication of a target channel is enabled by setting the bit corresponding to the channel to Enable (1). The enable/disable status of the HART communication of each channel can be checked in 'HART communication enable/disable setting monitor' (Un\G2075).
- Setting channels where the HART communication is unused to Disable (0) shortens the HART cycle time.
- When a current outside the range of 4 to 20mA is input to channels where the HART communication is used, the HART communication may not be properly executed.
- The setting of this area is not affected by the setting details of 'CH1 A/D conversion enable/disable setting' (Un\G500). The setting of this area is enabled even when the A/D conversion is disabled. To use 'CH1 Digital output value' (Un\G400) or 'CH1 Digital operation value' (Un\G402) for the control during the HART communication, set 'CH1 A/D conversion enable/disable setting' (Un\G500) to A/D conversion enable (0).

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART communication enable/disable setting	2074							

■Enabling the setting
As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value
The default value is Disable (0) for all channels.

HART communication enable/disable setting monitor

Enable/disable status of the HART communication is stored for each channel.
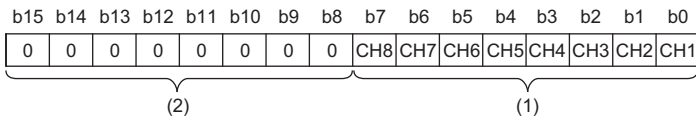
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2) ⟵————————————⟶ (1) ⟵————————————⟶

(1) 0: Disable, 1: Enable
(2) b8 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART communication enable/disable setting monitor	2075							

HART scan list

The detection status of the HART-enabled device is stored for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

(2) ⟵————————————⟶ (1) ⟵————————————⟶

(1) 0: Undetected, 1: Detected
(2) b8 to b15 are fixed to 0.

- When a HART-enabled device is detected in a channel where the HART communication is enabled, Detected (1) is stored in the bit corresponding to the channel.
- When the HART communication is disconnected, Undetected (0) is stored in the bit corresponding to the channel.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART scan list	2076							

HART current cycle time

The current HART cycle time is stored in increments of 10ms. The stored value is updated as the HART cycle time elapses.

Ex.

When the stored value is 100, the current HART cycle time is 1s (100 × 10ms).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART current cycle time	2077							

■Resetting the stored value

The stored value is reset when:

- The power is turned off.
- The CPU module is reset.
- The HART communication functions of all channels are disabled.

HART maximum cycle time

The maximum HART cycle time is stored in increments of 10ms. The stored value is updated as the HART cycle time elapses.

Ex.

When the stored value is 100, the maximum HART cycle time is 1s (100×10ms).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART maximum cycle time	2078							

■Resetting the stored value

The stored value of this area is reset to the value of 'HART current cycle time' (Un\G2077) in any of the following conditions.

• The first HART cycle time has elapsed after the CPU module is reset.

• 'HART cycle time maximum value/minimum value reset request' (Y2) is turned on and off.

HART minimum cycle time

The minimum HART cycle time is stored in increments of 10ms. The stored value is updated as the HART cycle time elapses.

Ex.

When the stored value is 100, the minimum HART cycle time is 1s (100 ×10ms).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART minimum cycle time	2079							

■Resetting the stored value

The stored value of this area is reset to the value of 'HART current cycle time' (Un\G2077) in any of the following conditions.

• The first HART cycle time has elapsed after the CPU module is reset.

• 'HART cycle time maximum value/minimum value reset request' (Y2) is turned on and off.

CH1 HART field device status

The status information sent from the connected HART-enabled device is stored.


```
b15 b14 b13 b12 b11 b10 b9  b8  b7  b6  b5  b4  b3  b2  b1  b0
```

(3)   (2)   (1)
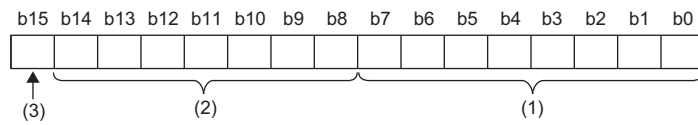
(1) HART field device status
(2) HART field device error information or answer code
(3) Communication error

The value stored in each bit is as follows.

■HART field device status (bit 0 to bit 7)

The status information of the connected HART-enabled device is stored. When each bit is turned on, the status of the HART-enabled device is indicated as follows:

Target bit	Status	Description
bit0	Primary variable out of limits	The PV value is out of the operation limit range.
bit1	Non-primary variable out of limits	The SV, TV, or QV value is out of the operation limit range.
bit2	Loop current saturated	Current has reached the upper or lower limit and cannot increase or decrease.
bit3	Loop current fixed	This bit is turned on when the current value is fixed.
bit4	More status available/unavailable	This bit indicates that the added status includes diagnostic information.
bit5	Cold start	The HART-enabled device has been powered off or reset. This bit is turned on only when the HART-enabled device is powered off or reset for the first time.
bit6	Configuration changed	The settings of the HART-enabled device have been changed. When the HART-enabled device is write-protected, this bit is not reset.
bit7	Device malfunction	Because a serious error or failure has been detected in a HART-enabled device, the HART-enabled device is not properly operated.

■HART field device error code or answer code (bit 8 to bit 14)

The error information or answer code of the connected HART-enabled device is stored. The stored information differs depending on the status of bit 15.

- When bit 15 is turned on, error information is stored. When each bit is turned on, the status of the HART-enabled device is indicated as follows:

Target bit	Error Information	Description
bit8	Not used	—
bit9	Buffer overflow	A message to the HART-enabled device is too long for the receive buffer.
bit10	Communication failure	The communication has failed.
bit11	Longitudinal parity error	The longitudinal parity calculated by the device is not matched with the message check byte.
bit12	Framing error	A stop bit of 1 byte or larger is not detected.
bit13	Overrun error	The data of 1 byte or larger in the receive buffer is overwritten before read.
bit14	Vertical parity error	The parity of one or multiple bytes received is not odd.

- When bit 15 is turned off, the answer code is stored. For details on the stored answer code, refer to the manual of the used HART-enabled device.

■Refreshing cycle

The stored status information is refreshed every HART cycle time.
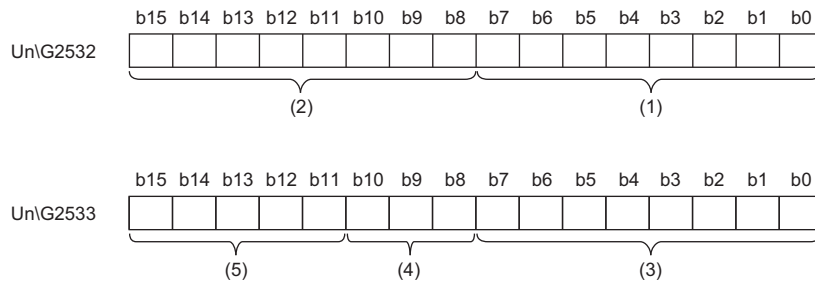
■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART field device status	2080	2092	2104	2116	2128	2140	2152	2164

A

CH1 HART extended field device status

The extended field device status sent from the connected HART-enabled device is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0								

        (2)   (1)

(1) HART extended field device status
(2) b8 to b15 are fixed to 0.

When each bit is turned on, the status of the HART-enabled device is indicated as follows:

Target bit	Extended status	Description
bit0	Maintenance required	Indicates that the maintenance of the HART-enabled device is required.
bit1	Device variable alert	The HART device variables are in a warning state. For details, check the device variable status.
bit2	Critical power failure	This bit is used when a HART-enabled device running on a battery is connected. When the bit is turned on, this indicates electric power is significantly reduced.
bit3	Failure	This bit is turned on when HART device variables (such as process value and control value) become invalid due to a failure of a field device or other peripheral devices.
bit4	Out of specification	This bit is turned on when the environment that does not meet the specifications may adversely affect measurement or accuracy.
bit5	Function check	This bit is turned on when HART device variables become temporarily invalid due to the processing being executed on the HART-enabled device. ■Example When the HART-enabled device is frozen
bit6, bit7	Not used	—

■Refreshing cycle

The stored status information is automatically refreshed every HART cycle time.
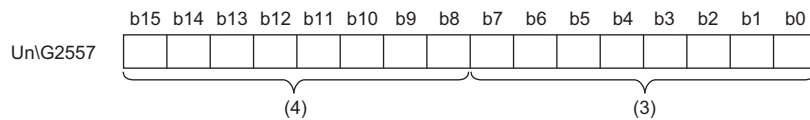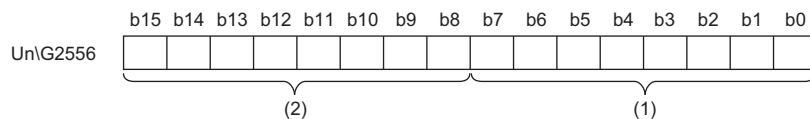
■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART extended field device status	2081	2093	2105	2117	2129	2141	2153	2165

CH1 HART device variable status

Each HART device variable status sent from the connected HART-enabled device is stored. Eight bits are used for one HART device variable, and two words of the buffer memory addresses are stored for each channel.

Un\G2082

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

(2)   (1)

Un\G2083

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

(4)   (3)

(1) PV value status
(2) SV value status
(3) TV value status
(4) QV value status

Each status has the following structure.

b15 b7	b14 b6	b13 b5	b12 b4	b11 b3	b10 b2	b9 b1	b8 b0

(4)   (3)   (2)   (1)
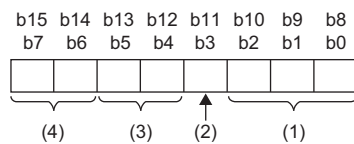
(1) Device family specific status
(2) More device variable status available
(3) Limit status
(4) Process data status

HART device variable status	Description	Supplemental information
Device family specific status	The stored value is dependent on the device family of the HART-enabled device.	For details on the stored value, refer to the manual of the used HART-enabled device or the specifications of the HART.
More device variable status available	Availability of additional device family specific status is stored. This bit indicates whether specific status of the device family is available for a device family command. • 1b: Other HART device variable status is available. • 0b: Other HART device variable status is unavailable.	This bit indicates whether specific status of the device family is available for a device family command.
Limit status	Indicates whether the value of the HART device variables is limited. • 11b: Constant • 01b: Lower limit • 10b: Upper limit • 00b: No limitation	The combination of these four bits in each status indicates the status of the HART device variables. ■Example When process data status is Manual/Fixed (10b) and limit status is No limitation (00b), the HART device variables are manually controlled.
Process data status	The overall status of HART device variables or dynamic variables is saved. • 11b: Good • 01b: Poor accuracy • 10b: Manual/Fixed • 00b: Bad	

■Refreshing cycle

The stored status information is automatically refreshed every HART cycle time.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device variable status primary value (PV), secondary value (SV)	2082	2094	2106	2118	2130	2142	2154	2166
CH□ HART device variable status tertiary value (TV), quaternary value (QV)	2083	2095	2107	2119	2131	2143	2155	2167

A

CH1 PV value

The PV value of the used HART-enabled device is stored in 32-bit floating points.

■Stored value
- The PV value differs depending on the HART-enabled device. For details on the stored values, refer to the manual of the used HART-enabled device.
- The unit of the stored PV value can be checked in 'CH1 HART device information (PV engineering unit)' (Un\G2567).
- When there is no variable corresponding to the PV value in the used HART-enabled device, 7FA00000H is stored in this area.
- When the HART communication function is not used, 7FC00000H (default value) is stored.

■Refreshing cycle
The stored status information is automatically refreshed every HART cycle time.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ PV value	2084 2085	2096 2097	2108 2109	2120 2121	2132 2133	2144 2145	2156 2157	2168 2169

CH1 SV value

The SV value of the used HART-enabled device is stored in 32-bit floating points (single-precision real number).

■Stored value
- The SV value differs depending on the HART-enabled device. For details on the stored values, refer to the manual of the used HART-enabled device.
- The unit of the stored SV value can be checked in 'CH1 HART device information (SV engineering unit)' (Un\G2568).
- When there is no variable corresponding to the SV value in the used HART-enabled device, 7FA00000H is stored in this area.
- When the HART communication function is not used, 7FC00000H (default value) is stored.

■Refreshing cycle
The stored status information is automatically refreshed every HART cycle time.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ SV value	2086 2087	2098 2099	2110 2111	2122 2123	2134 2135	2146 2147	2158 2159	2170 2171

CH1 TV value

The TV value of the used HART-enabled device is stored in 32-bit floating points (single-precision real number).

■Stored value

- The TV value differs depending on the HART-enabled device. For details on the stored values, refer to the manual of the used HART-enabled device.
- The unit of the stored TV value can be checked in 'CH1 HART device information (TV engineering unit)' (Un\G2569).
- When there is no variable corresponding to the TV value in the HART-enabled device, 7FA00000H is stored in this area.
- When the HART communication function is not used, 7FC00000H (default value) is stored.

■Refreshing cycle

The stored status information is automatically refreshed every HART cycle time.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ TV value	2088 2089	2100 2101	2112 2113	2124 2125	2136 2137	2148 2149	2160 2161	2172 2173

CH1 QV value

The QV value of the used HART-enabled device is stored in 32-bit floating points (single-precision real number).

■Stored value

- The QV value differs depending on the HART-enabled device. For details on the stored values, refer to the manual of the used HART-enabled device.
- The unit of the stored QV value can be checked in 'CH1 HART device information (QV engineering unit)' (Un\G2570).
- When there is no variable corresponding to the QV value in the HART-enabled device, 7FC00000H is stored in this area.
- When the HART communication function is not used, 7FC00000H (default value) is stored.

■Refreshing cycle

The stored status information is automatically refreshed every HART cycle time.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ QV value	2090 2091	2102 2103	2114 2115	2126 2127	2138 2139	2150 2151	2162 2163	2174 2175

A

HART command request flag

Set this flag when a HART command is executed.

Setting value	Setting details
0	No request
1	Command execution request

When the value other than the above is set, the setting details are ignored.

A HART command is executed according to the setting details described below when Command execution request (1) is set to this area. Thus, configure the settings for the following buffer memory areas before setting Command execution request (1) to this area.
- 'HART command request channel' (Un\G2201)
- 'HART command request code' (Un\G2202)
- 'HART command request data size' (Un\G2203)
- 'HART command request data' (Un\G2204 to Un\G2331)

Check that the HART command is executed and bit 0 of 'HART command answer flag' (Un\G2344) is turned on. Then, set No request (0) to this area.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command request flag	2200							

■Enabling the setting
As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value
The default value is No request (0).

HART command request channel

Set a channel sending a HART command to a HART-enabled device.

Setting value	Setting details
1	CH1
2	CH2
3	CH3
4	CH4
5	CH5
6	CH6
7	CH7
8	CH8

- When a value other than the above ones is set, bit 15 of 'HART command answer flag' (Un\G2344) is turned on, and an error is notified. Furthermore, the setting details are ignored.
- Set this area before 'HART command request flag' (Un\G2200) is set to Command execution request (1).

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command request channel	2201							

■Enabling the setting

As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value

The default value is 0.

HART command request code

Set a HART command according to the standard specifications of the HART or the manual of the used HART-enabled device. Set this area before 'HART command request flag' (Un\G2200) is set to Command execution request (1).

HART command details that can be set differ depending on the used HART-enabled device. When a HART command that is not supported by the HART-enabled device is set, bit 15 of 'HART command answer flag' (Un\G2344) is turned on, and an error is notified. Furthermore, the setting details are ignored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command request code	2202							

■Enabling the setting

As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value

The default value is 0.

HART command request data size

Set the size of data sent to a HART-enabled device.

■Setting range

- The setting range is from 0 to 255 (byte).
- Set the setting values according to the specifications of a HART command set to 'HART command request code' (Un\G2202) and the specifications of the used HART-enabled device.
- When a value other than the above ones is set, bit 15 of 'HART command answer flag' (Un\G2344) is turned on, and an error is notified. Furthermore, the setting details are ignored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command request data size	2203							

■Enabling the setting

As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value

The default value is 0.

HART command request data

Set data sent to a HART-enabled device. As a setting area, 128 words of the buffer memory areas are assigned. Set the setting details according to the specifications of a HART command set to 'HART command request code' (Un\G2202) and the specifications of the used HART-enabled device.

A

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command request data	2204 to 2331							

■Enabling the setting

As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

■Default value

The default value is 0 for all areas.

HART command answer flag

Status of a HART request command is stored.
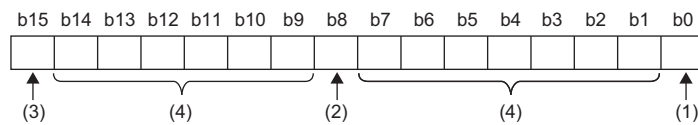
(1) Execution completed flag
 • 0: Command uncompleted
 • 1: Command execution completed
(2) Execution acceptance flag
 • 0: Command execution request unaccepted
 • 1: Command execution request accepted
(3) Execution parameter error flag
 • 0: No error
 • 1: Command execution error
(4) b1 to b7 and b9 to b14 are fixed to 0.

■Execution completed flag

'HART command answer flag' (Un\G2344) is assigned to bit 0. When the processing of a HART command requested to a HART-enabled device is completed, Command execution completed (1) is stored in bit 0. When 'HART command request flag' (Un\G2200) is set to No request (0), Command uncompleted (0) is stored.

■Execution acceptance flag

'HART command answer flag' (Un\G2344) is assigned to bit 8. When 'HART command request flag' (Un\G2200) is set to Command execution request (1), Command execution enabled (1) is stored in bit 8. When 'HART command request flag' (Un\G2200) is set to No request (0), Command execution request unaccepted (0) is stored.

■Execution parameter error flag

'HART command answer flag' (Un\G2344) is assigned to bit 15. When 'HART command request flag' (Un\G2200) is set to Command execution request (1), and a value out of the setting range is set to any of the following buffer memory areas, Command execution error (1) is stored in bit 15.
 • 'HART command request channel' (Un\G2201)
 • 'HART command request code' (Un\G2202)
 • 'HART command request data size' (Un\G2203)
 • 'HART command request data' (Un\G2204 to Un\G2331)
When 'HART command request flag' (Un\G2200) is set to No request (0), No error (0) is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command answer flag	2344							

HART command answer channel

A channel number executing a HART command is stored. The following information is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

(2) — spanning b15 to b8; (1) — spanning b7 to b0
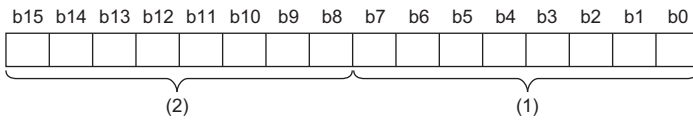
(1) A channel number executing a HART command is stored.
 • 1: CH1
 • 2: CH2
 • 3: CH3
 • 4: CH4
 • 5: CH5
 • 6: CH6
 • 7: CH7
 • 8: CH8
(2) Error information when a communication failure occurs with a HART-enabled device is stored.
 • 0: No error
 • 1: Timeout of a HART device answer
 • 2: The number of retries reaches the maximum number of retries.
 • 3: HART communication of the target channel is disabled.
• When 'HART command request flag' (Un\G2200) is set to No request (0), this area is cleared to 0.
• When Command execution error (1) is stored in bit 15 of 'HART command answer flag' (Un\G2344), 0 remains stored in this area.

■Actions to be taken when error information is acquired

When error information 2 or 3 is stored in bit 8 to bit 15, check that the bit of the target channel is on in 'HART communication enable/disable setting' (Un\G2074) and 'HART scan list' (Un\G2076). When the bit is on normally, check that the HART command settings configured in the following buffer memory areas are correct by referring to the manual of the used HART-enabled device.
 • 'HART command request channel' (Un\G2201)
 • 'HART command request code' (Un\G2202)
 • 'HART command request data size' (Un\G2203)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command answer channel	2345							

HART command answer code

A HART command executed is stored. When 'HART command request flag' (Un\G2200) is set to No request (0), this area is cleared to 0. When Command execution error (1) is stored in bit 15 of 'HART command answer flag' (Un\G2344), 0 remains stored in this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command answer code	2346							

HART command answer data size

Data size of an enabled HART command is stored. The setting values differ depending on the specifications of a HART command set to 'HART command request code' (Un\G2202) and the specifications of the used HART-enabled device. When 'HART command request flag' (Un\G2200) is set to No request (0), this area is cleared to 0. When Command execution error (1) is stored in bit 15 of 'HART command answer flag' (Un\G2344), 0 remains stored in this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command answer data size	2347							

HART command answer data

Answer data sent from a HART-enabled device is stored. As a setting area, 128 words of the buffer memory areas are assigned. The setting values differ depending on the specifications of a HART command set to 'HART command request code' (Un\G2202) and the specifications of the used HART-enabled device. The status information of the HART-enabled device is stored in the first 2 bytes.

When 'HART command request flag' (Un\G2200) is set to No request (0), this area is cleared to 0. When Command execution error (1) is stored in bit 15 of 'HART command answer flag' (Un\G2344), 0 remains stored in this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
HART command answer data	2348 to 2475							

CH1 HART device information (tag)

Tag details set to a HART-enabled device by users are stored. Four words of the buffer memory areas are used per channel.

■Stored value

- The set tag details are converted to 8 characters of ASCII code (hexadecimal) and stored.
- The first character is stored in the lower byte (LSB) of the lowest address.
- A space (code: 20H) is assigned to the last character.

Ex.
When a tag of a CH1 HART device is 1234

0	0	0		4	3	2	1
30H	30H	30H	20H	34H	33H	32H	31H

| Un\G2503 | Un\G2502 | Un\G2501 | Un\G2500 |

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (tag)	2500 to 2503	2600 to 2603	2700 to 2703	2800 to 2803	2900 to 2903	3000 to 3003	3100 to 3103	3200 to 3203

CH1 HART device information (message)

A message set to a HART-enabled device by users is stored. Sixteen words of the buffer memory areas are used per channel.

■Stored value

- The set message is converted to 32 characters of ASCII code (hexadecimal) and stored.
- The first character is stored in the lower byte (LSB) of the lowest address.
- A space (code: 20H) is assigned to the last character.

Ex.

When a message of a CH1 HART device is 1234
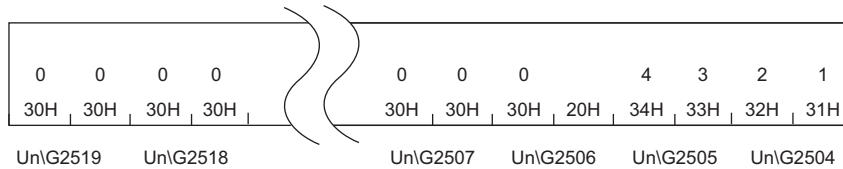
0	0	0	0		0	0	0		4	3	2	1
30H	30H	30H	30H		30H	30H	30H	20H	34H	33H	32H	31H

Un\G2519   Un\G2518   Un\G2507   Un\G2506   Un\G2505   Un\G2504

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (message)	2504 to 2519	2604 to 2619	2700 to 2719	2804 to 2819	2904 to 2919	3004 to 3019	3104 to 3119	3204 to 3219

CH1 HART device information (descriptor)

A description set to a HART-enabled device by users is stored. Eight words of the buffer memory areas are used per channel.

■Stored value

- The set message is converted to 16 characters of ASCII code (hexadecimal) and stored.
- The first character is stored in the lower byte (LSB) of the lowest address.
- A space (code: 20H) is assigned to the last character.

Ex.

When a description of a CH1 HART device is 1234
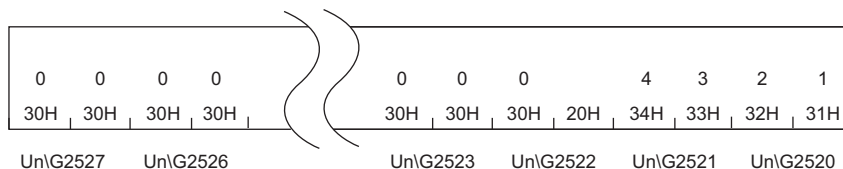
0	0	0	0		0	0	0		4	3	2	1
30H	30H	30H	30H		30H	30H	30H	20H	34H	33H	32H	31H

Un\G2527   Un\G2526   Un\G2523   Un\G2522   Un\G2521   Un\G2520

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (descriptor)	2520 to 2527	2620 to 2627	2720 to 2727	2820 to 2827	2920 to 2927	3020 to 3027	3120 to 3127	3220 to 3227

A

CH1 HART device information (manufacturer ID/expanded manufacturer ID)

The manufacturer ID or extended manufacturer ID of the used HART-enabled device is stored. For details on the stored values, refer to the manual of the used HART-enabled device.

The amount of data used differs depending on the HART pre-defined protocol.

- HART 5/6: 1 byte
- HART 7: 2 bytes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (manufacturer ID/expanded manufacturer ID)	2528	2628	2728	2828	2928	3028	3128	3228

CH1 HART device information (device type/expanded device type)

A device type or expanded device type of the used HART-enabled device is stored. For details on the stored values, refer to the manual of the used HART-enabled device.

The amount of data used differs depending on the HART pre-defined protocol.

- HART 5/6: 1 byte
- HART 7: 2 bytes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (device type/ expanded device type)	2529	2629	2729	2829	2929	3029	3129	3229

CH1 HART device information (device ID)

A device ID of the used HART-enabled device is stored as three-byte data. For details on the stored values, refer to the manual of the used HART-enabled device.

Two words of the buffer memory areas are used per channel.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (device ID)	2530 2531	2630 2631	2730 2731	2830 2831	2930 2931	3030 3031	3130 3131	3230 3231

CH1 HART device information (revisions)

Revision information of the used HART-enabled device is stored. For details on the stored values, refer to the manual of the used HART-enabled device.

Two words of the buffer memory areas are used per channel and stored as follows.

(1) Universal command major revision
(2) Device revision level
(3) Software revision level
(4) Physical signaling code
(5) Hardware revision level

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (revisions)	2532 2533	2632 2633	2732 2733	2832 2833	2932 2933	3032 3033	3132 3133	3232 3233

CH1 HART device information (device function flags)

Availability of the functions of the used HART-enabled device is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0								

(2)   (1)

(1) Device function flag
(2) b8 to b15 are fixed to 0.

When each bit of bit 0 to bit 7 is turned on, a HART-enabled device supports the following functions.

Target bit	Supported functions	Description
bit0	Multi-sensor field device	The used HART-enabled device can execute multiple measurements in one device. (For example, flow rate and concentration can be measured.)
bit1	EEPROM Control	The used HART-enabled device requires EEPROM Control. For details, refer to the manual of the used HART-enabled device.
bit2	Protocol bridge device	The used HART-enabled device can connect one network with another network.
bit3	IEEE 802.15.4 2.4GHz DSSS with O-QPSK modulation	The used HART-enabled device supports a wireless HART communication.
bit4	Not used	—
bit5	Not used	—
bit6	C8psk capable field device	The used HART-enabled device supports coherent 8-way phase-shift keying (C8psk) protocol aside from FSK HART protocol. The A/D converter module does not support C8psk.
bit7	C8psk in Multi-drop only	The used HART-enabled device supports coherent 8-way phase-shift keying (C8psk) protocol in the Multi-drop mode only. The A/D converter module does not support the Multi-drop mode.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (device function flags)	2534	2634	2734	2834	2934	3034	3134	3234

CH1 HART device information (long tag)

Long tag details set to a HART-enabled device by users are stored. This area can be used only when a HART-enabled device that supports HART revision 6 or later is used. Sixteen words of the buffer memory areas are used per channel.

■Stored value
- The set tag details are converted to 32 characters of ASCII code (hexadecimal) and stored.
- The first character is stored in the lower byte (LSB) of the lowest address.
- A space (code: 20H) is assigned to the last character.

Ex.

When a long tag of a CH1 HART device is 1234
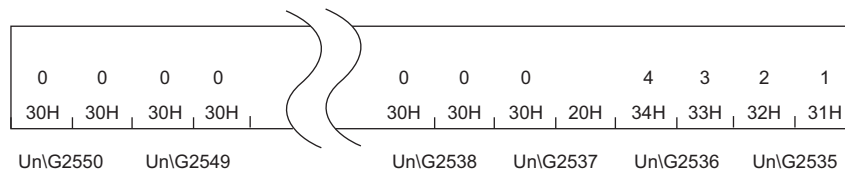
■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (long tag)	2535 to 2550	2635 to 2650	2735 to 2750	2835 to 2850	2935 to 2950	3035 to 3050	3135 to 3150	3235 to 3250

CH1 HART device information (private label distributor code)

A distributor code of the used HART-enabled device is stored. This area can be used when a HART-enabled device that supports HART revision 7 is used. For details on the stored values, refer to the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (private label distributor code)	2551	2651	2751	2851	2951	3051	3151	3251

CH1 HART device information (device profile)

A device profile of the used HART-enabled device is stored. This area can be used when a HART-enabled device that supports HART revision 7 is used. For details on the stored values, refer to the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (device profile)	2552	2652	2752	2852	2952	3052	3152	3252

CH1 HART device information (final assembly number)

The final assembly number of the used HART-enabled device is stored. For details on the stored values, refer to the manual of the used HART-enabled device.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (final assembly number)	2554 2555	2654 2655	2754 2755	2854 2855	2954 2955	3054 3055	3154 3155	3254 3255

CH1 HART device information (date)

The date information set on the used HART-enabled device is stored.

Un\G2556

b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0

(2) (1)

Un\G2557

b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0

(4) (3)

(1) Day
(2) Month
(3) Year - 1900 (For example, 118 (2018-1900) is stored for year 2018.)
(4) Not used (Fixed to 0).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (day)	2556 2557	2656 2657	2756 2757	2856 2857	2956 2957	3056 3057	3156 3157	3256 3257

CH1 HART device information (write protect)

The write protection status of the used HART-enabled device is stored.

Stored value	Description
0	No - Not write protected
1	Yes - Write protected
250	Not used
251	None
252	Unknown
253	Special

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (write protect)	2558	2658	2758	2858	2958	3058	3158	3258

CH1 HART device information (PV range engineering unit)

An engineering unit is stored within the setting range of the PV value of the used HART-enabled device. A value defined by the standard specifications of the HART is stored for each engineering unit. For details on the stored values, refer to the standard specifications of the HART or the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (PV range engineering unit)	2559	2659	2759	2859	2959	3059	3159	3259

CH1 HART device information (PV upper range value)

The PV upper range value of the used HART-enabled device is stored in 32-bit floating points (single-precision real number). A value corresponding to 20mA in the set engineering unit of the PV value is stored.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (PV upper range value)	2560 2561	2660 2661	2760 2761	2860 2861	2960 2961	3060 3061	3160 3161	3260 3261

CH1 HART device information (PV lower range value)

The PV lower range value of the used HART-enabled device is stored in 32-bit floating points (single-precision real number). A value corresponding to 4mA in the set engineering unit of the PV value is stored.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (PV lower range value)	2562 2563	2662 2663	2762 2763	2862 2863	2962 2963	3062 3063	3162 3163	3262 3263

CH1 HART device information (PV damping value)

The damping constant of the PV value of the used HART-enabled device is stored in 32-bit floating points (single-precision real number). The unit of a stored value is second.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (PV damping value)	2564 2565	2664 2665	2764 2765	2864 2865	2964 2965	3064 3065	3164 3165	3264 3265

CH1 HART device information (PV transfer function)

The information on a function used to convert the PV value to the current value by the used HART-enabled device is stored. For details on the stored values, refer to the standard specifications of the HART or the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (PV transfer function)	2566	2666	2766	2866	2966	3066	3166	3266

CH1 HART device information (PV engineering unit)

An engineering unit of the PV value of the used HART-enabled device is stored. A value defined by the standard specifications of the HART is stored for each engineering unit. For details on the stored values, refer to the standard specifications of the HART or the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (PV engineering unit)	2567	2667	2767	2867	2967	3067	3167	3267

CH1 HART device information (SV engineering unit)

An engineering unit of the SV value of the used HART-enabled device is stored. A value defined by the standard specifications of the HART is stored for each engineering unit. For details on the stored values, refer to the standard specifications of the HART or the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (SV engineering unit)	2568	2668	2768	2868	2968	3068	3168	3268

CH1 HART device information (TV engineering unit)

An engineering unit of the TV value of the used HART-enabled device is stored. A value defined by the standard specifications of the HART is stored for each engineering unit. For details on the stored values, refer to the standard specifications of the HART or the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (TV engineering unit)	2569	2669	2769	2869	2969	3069	3169	3269

CH1 HART device information (QV engineering unit)

An engineering unit of the QV value of the used HART-enabled device is stored. A value defined by the standard specifications of the HART is stored for each engineering unit. For details on the stored values, refer to the standard specifications of the HART or the manual of the used HART-enabled device.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
CH□ HART device information (QV engineering unit)	2570	2670	2770	2870	2970	3070	3170	3270

Error history

Up to 16 errors that occurred in the module are recorded.

Ex.
For error history 1

	b15 ... b8	b7 ... b0
Un\G3600	Error code	
Un\G3601	First two digits of the year	Last two digits of the year
Un\G3602	Month	Day
Un\G3603	Hour	Minute
Un\G3604	Second	Day of the week
Un\G3605	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3606 ⋮ Un\G3609	System area	

Item		Storage contents	Storage example[1]
Error code		An error code is stored.	1900H
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (higher-order digits)		Stored in BCD code.	7H
Millisecond (lower-order digits)			89H
System area		—	—

*1 Values stored when a CH1 range setting range error (error code: 1900H) occurs at 12:34:56.789 on Thursday, December 24th, 2015.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	No.1 to No.16
Error history	3600 to 3759

Alarm history

Up to 16 alarms that occurred in the module are recorded.

Ex.
For alarm history 1

	b15 ... b8	b7 ... b0
Un\G3760	Alarm code	
Un\G3761	First two digits of the year	Last two digits of the year
Un\G3762	Month	Day
Un\G3763	Hour	Minute
Un\G3764	Second	Day of the week
Un\G3765	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3766 ⋮ Un\G3769	System area	

Item		Storage contents	Storage example[1]
Alarm code		An alarm code is stored.	0800H
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (higher-order digits)		Stored in BCD code.	7H
Millisecond (lower-order digits)			89H
System area		—	—

*1 Values stored when a CH1 process alarm (upper limit) (alarm code: 0800H) occurs at 12:34:56.789 on Thursday, December 24th, 2015.

■Buffer memory address
The following shows the buffer memory address of this area.

Buffer memory name	No.1 to No.16
Alarm history	3760 to 3919

Appendix 4 Operation Examples of When the Remote Head Module Is Mounted

This section describes operation examples of when the remote head module is mounted

System configuration example

The following system configuration is used to explain an example of operation.
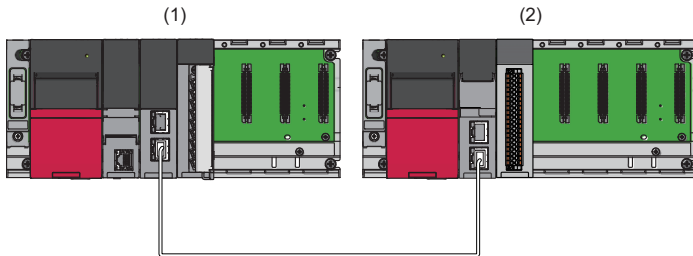
(1) Master station (Network number 1, station number 0)
 • Power supply module: R61P
 • CPU module: R04CPU
 • Master/local module: RJ71GF11-T2 (Start I/O number: 0000H to 001FH)
 • Input module: RX10 (Start I/O number: 0020H to 002FH)
(2) Intelligent device station (Network number 1, station number 1)
 • Power supply module: R61P
 • Remote head module: RJ72GF15-T2
 • A/D converter module: R60ADI8-HA (Start I/O number: 0000H to 000FH)

*1   In the RX/RY setting of the master station, set 1000H to 100FH as the start I/O number of the A/D converter module.

A

Setting in the master station

Connect the engineering tool to the CPU module of the master station and set parameters.

1. Create the project with the following settings.

👆 [Project] ⇨ [New]
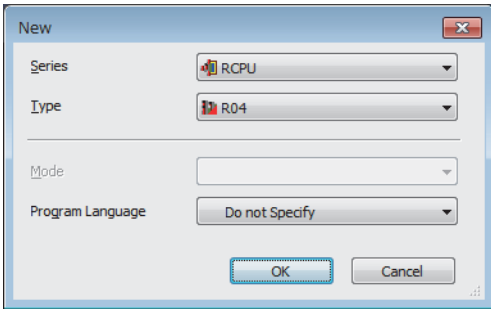
2. Configure the setting to use the module labels and add the module labels of the CPU module.
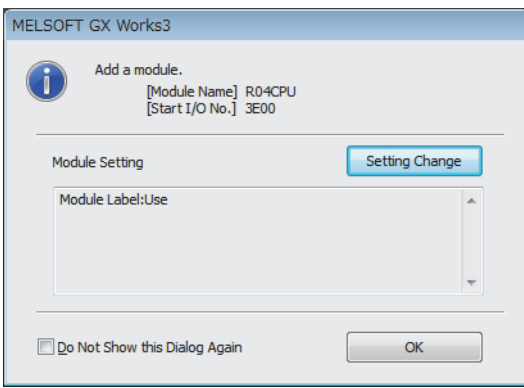
3. Add the master/local module with the following settings.

👆 [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]
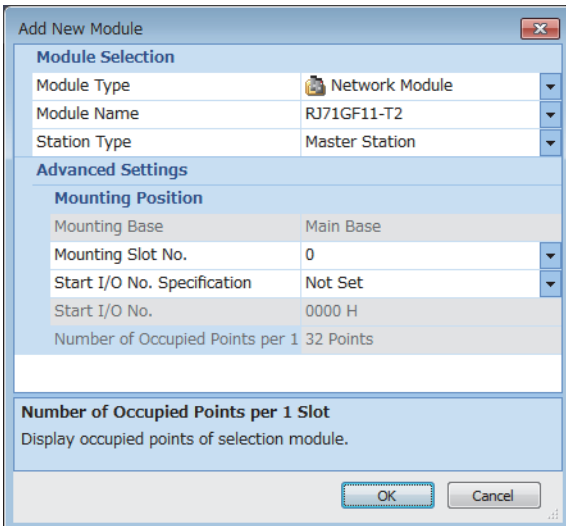
4. Configure the setting to use the module labels and add the module labels of the master/local module.
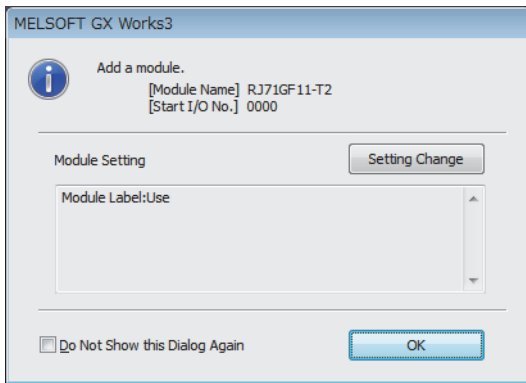
5. Set "Required Settings" of "Module Parameter" of the master/local module as shown below.

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [RJ71GF11-T2] ⇨ [Required Settings]

Item	Setting
Station Type	
Station Type	Master Station
Network Number	
Network Number	1
Station Number	
Setting Method	Parameter Editor
Station No.	0
Parameter Setting Method	
Setting Method of Basic/Application Settings	Parameter Editor

6. Set "Network Configuration Settings" of "Module Parameter" of the master/local module as shown below.

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [RJ71GF11-T2] ⇨ [Basic Settings] ⇨ [Network Configuration Settings]

A

7. Set "Refresh Setting" of "Module Parameter" of the master/local module as shown below.

🖱 [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [RJ71GF11-T2] ⇨ [Basic Settings] ⇨ [Refresh Setting]

No.	Link Side					CPU Side				
	Device Name	Points	Start	End		Target	Device Name	Points	Start	End
–	SB				⬌					
–	SW				⬌					
1	RX	256	00000	000FF	⬌	Specify Device	X	256	01000	010FF
2	RY	256	00000	000FF	⬌	Specify Device	Y	256	01000	010FF
3	RWw	256	00000	000FF	⬌	Specify Device	W	256	00000	000FF
4	RWr	256	00000	000FF	⬌	Specify Device	W	256	01000	010FF
5					⬌					

8. Write the set parameters to the CPU module on the master station. Then reset the CPU module or power off and on the system.

🖱 [Online] ⇨ [Write to PLC]

Point 🔎

For parameters of the master/local module which are not described in this procedure, set default values. For details on parameters of the master/local module, refer to the following.
📖 MELSEC iQ-R CC-Link IE Field Network User's Manual (Application)

Setting in the intelligent device station

Connect the engineering tool to the remote head module of the intelligent device station and set parameters.

1. Create the project with the following settings.

👆 [Project] ⇨ [New]
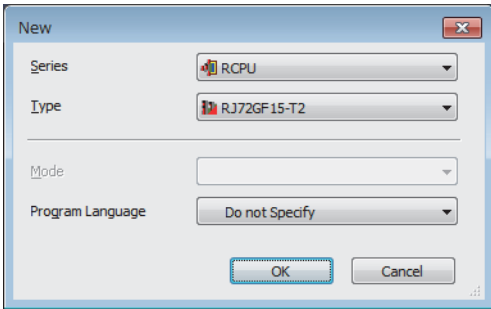
2. Set "Network Required Setting" of "CPU Parameter" of the remote head module as shown below.

👆 [Navigation window] ⇨ [Parameter] ⇨ [RJ72GF15-T2] ⇨ [CPU Parameter] ⇨ [Network Required Setting]

3. Add the A/D converter module with the following settings.

👆 [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]
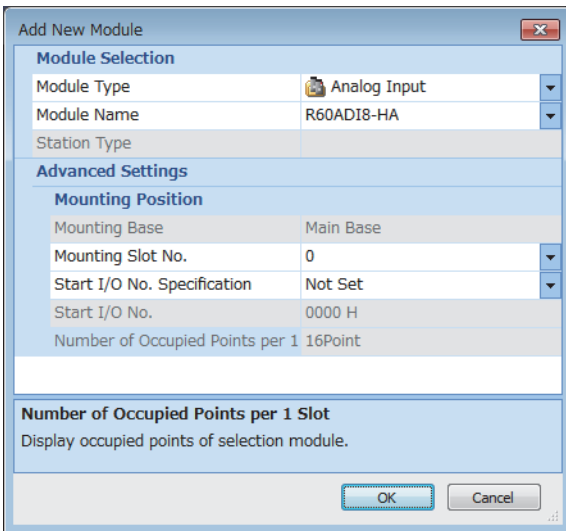
4. Configure the setting not to use the module labels.
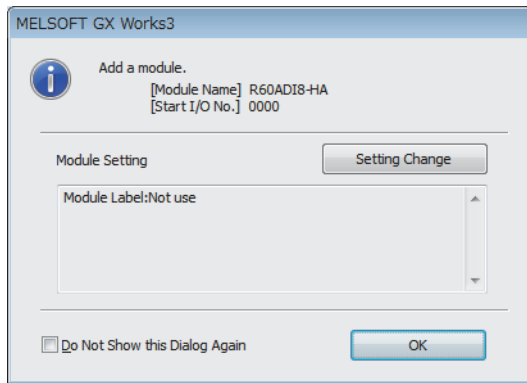
5. Set "Basic setting" of "Module Parameter" of the A/D converter module as shown below.

○ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60ADI8-HA] ⇨ [Basic setting]

Item	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Input range switching function	The input range of the analog input can be set for each channel and the input conversion attribute can be changed.							
Input range setting	0 to 20mA	4 to 20mA	0 to 20mA	4 to 20mA	0 to 20mA	4 to 20mA	0 to 20mA	4 to 20mA
A/D conversion enable/disable setting function	Set whether to enable or disable the output of the A/D conversion value.							
A/D conversion enable/disable setting	A/D conversion enable	A/D conversion enable	A/D conversion enable	A/D conversion enable	A/D conversion d	A/D conversion d	A/D conversion d	A/D conversion disa
A/D conversion method	Set the A/D conversion control method.							
Average processing setting	Sampling processing	Count average	Moving average	Sampling processing	Sampling processi	Sampling process	Sampling processi	Sampling processing
Time average/Count average/Moving average/Prin	0	10 counts	10 counts	0	0	0	0	0
HART communication function	Set HART communication function.							
HART enable/disable setting	Disable	Enable	Disable	Enable	Disable	Disable	Disable	Disable
HART maximum retries setting	3	3	3	3	3	3	3	3

6. Set "Application setting" of "Module Parameter" of the A/D converter module as shown below.

○ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60ADI8-HA] ⇨ [Application setting]

Item	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Scaling setting	Configure the setting for the scaling at the A/D conversion.							
Scaling enable/disable setting	Disable	Disable	Enable	Disable	Disable	Disable	Disable	Disable
Scaling upper limit value	0	0	16000	0	0	0	0	0
Scaling lower limit value	0	0	2000	0	0	0	0	0
Warning output function (Process alarm)	Set a warning at the A/D conversion.							
Warning output setting (Process alarm)	Disable	Enable	Disable	Disable	Disable	Disable	Disable	Disable
Process alarm upper upper limit value	0	32000	0	0	0	0	0	0
Process alarm upper lower limit value	0	28000	0	0	0	0	0	0
Process alarm lower upper limit value	0	4000	0	0	0	0	0	0
Process alarm lower lower limit value	0	0	0	0	0	0	0	0
Warning output function (Rate alarm)	Set a warning at the A/D conversion.							
Warning output setting (Rate alarm)	Enable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
Rate alarm detection cycle setting	5 times	0 times	0 times	0 times	0 times	0 times	0 times	0 times
Rate alarm upper limit value	25.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
Rate alarm lower limit value	−5.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
Input signal error detection function	Configure the setting for the input signal at the A/D conversion.							
Input signal error detection setting	Upper limit detec	Disable	Disable	Disable	Disable	Disable	Disable	Disable
Input signal error detection setting value	10.0 %	5.0 %	5.0 %	5.0 %	5.0 %	5.0 %	5.0 %	5.0 %

7. Set "Refresh Setting" of "Module Parameter" of the A/D converter module as shown below.

✎ [Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60ADI8-HA] ⇨ [Refresh settings]

Item	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	
☐ *Refresh at the set timing.*									
☐ Transfer to the CPU.	Transfer the buffer memory data to the specified device.								
Latest error code	W1020								
Latest address of error history									
Latest alarm code									
Latest address of alarm history									
Interrupt factor detection flag 1									
Interrupt factor detection flag 2									
Interrupt factor detection flag 3									
Interrupt factor detection flag 4									
Interrupt factor detection flag 5									
Interrupt factor detection flag 6									
Interrupt factor detection flag 7									
Interrupt factor detection flag 8									
Interrupt factor detection flag 9									
Interrupt factor detection flag 10									
Interrupt factor detection flag 11									
Interrupt factor detection flag 12									
Interrupt factor detection flag 13									
Interrupt factor detection flag 14									
Interrupt factor detection flag 15									
Interrupt factor detection flag 16									
Warning output flag (Process alarm upper limit)	W1010								
Warning output flag (Process alarm lower limit)	W1011								
Warning output flag (Rate alarm upper limit)	W1012								
Warning output flag (Rate alarm lower limit)	W1013								
Input signal error detection flag	W1014								
A/D conversion completed flag	W1000								
Digital output value	W1001	W1002		W1004					
Digital operation value			W1003						
Maximum value			W1005						
Minimum value			W1006						
HART communication enable/disable setting monitor	W1016								
HART scan list									
HART current cycle time									
HART maximum cycle time									
HART minimum cycle time									
HART field device status									
HART extended field device status									
HART device variable status primary value (PV), secondary value (SV)									
HART device variable status tertiary value (TV), quaternary value (QV)									
Process variable primary value (PV)		W1030		W1038					
Process variable secondary value (SV)		W1032		W1040					
Process variable tertiary value (TV)		W1034							
Process variable quaternary value (QV)		W1036							
☐ Refresh Timing	Set refresh timing.								

8. Write the set parameters to the remote head module on the intelligent device station. Then reset the remote head module or power off and on the system.

✎ [Online] ⇨ [Write to PLC]

> **Point** ✐
>
> For parameters of the remote head module which are not described in this procedure, set default values. For details on parameters of the remote head module, refer to the following.
> 📖 MELSEC iQ-R CC-Link IE Field Network Remote Head Module User's Manual (Application)

A

Checking the network status

After setting parameters to the master station and the intelligent device station, check whether data link is normally performed between the master station and the intelligent device station. Check the network status using the CC-Link IE Field Network diagnostics of the engineering tool.

For how to perform the CC-Link IE Field Network diagnostics from the master station, refer to the following.

📖 MELSEC iQ-R CC-Link IE Field Network User's Manual (Application)

Program examples

For the program examples, the module labels of the master/local module are used.

Write the programs to the CPU module on the master station.

Classification	Label name	Description	Device
Module label	GF11_1.bSts_DataLinkError	Data link error status of own station	SB0049
	GF11_1.bnSts_DataLinkError_Station[1]	Data link status of each station (station number 1)	SW00B0.0
Label to be defined	Define global labels as shown below:		

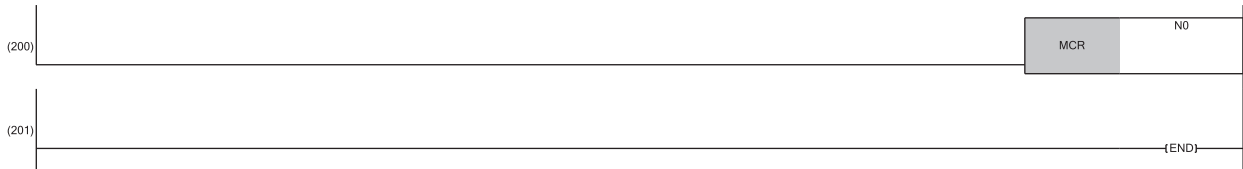|	Label Name	Data Type		Class		Assign (Device/Label)
1	CH1_DigOutValTempArea	Word [Signed]	...	VAR_GLOBAL	▼	D11
2	CH2_DigOutValTempArea	Word [Signed]	...	VAR_GLOBAL	▼	D12
3	CH3_DigCalcValTempArea	Word [Signed]	...	VAR_GLOBAL	▼	D13
4	CH4_DigOutValTempArea	Word [Signed]	...	VAR_GLOBAL	▼	D14
5	CH3_DigMaxValTempArea	Word [Signed]	...	VAR_GLOBAL	▼	D15
6	CH3_DigMinValTempArea	Word [Signed]	...	VAR_GLOBAL	▼	D16
7	CH2_ProcessVariable_PV_TempArea	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	D20
8	CH2_ProcessVariable_SV_TempArea	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	D22
9	CH2_ProcessVariable_TV_TempArea	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	D24
10	CH2_ProcessVariable_FV_TempArea	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	D26
11	CH4_ProcessVariable_PV_TempArea	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	D28
12	CH4_ProcessVariable_SV_TempArea	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	D30
13	CH2_ProcAlmUpLimit	Bit	...	VAR_GLOBAL	▼	F0
14	CH2_ProcAlmLowLimit	Bit	...	VAR_GLOBAL	▼	F1
15	CH1_RateAlmUpLimit	Bit	...	VAR_GLOBAL	▼	F2
16	CH1_RateAlmLowLimit	Bit	...	VAR_GLOBAL	▼	F3
17	CH1_InputSigErr	Bit	...	VAR_GLOBAL	▼	F4
18	Connect_FormationFlg_St1	Bit	...	VAR_GLOBAL	▼	M0
19	CH1_AD_conversionCompletedFlag	Bit	...	VAR_GLOBAL	▼	W1000.0
20	CH2_AD_conversionCompletedFlag	Bit	...	VAR_GLOBAL	▼	W1000.1
21	CH3_AD_conversionCompletedFlag	Bit	...	VAR_GLOBAL	▼	W1000.2
22	CH4_AD_conversionCompletedFlag	Bit	...	VAR_GLOBAL	▼	W1000.3
23	CH1_DigOutVal	Word [Signed]	...	VAR_GLOBAL	▼	W1001
24	CH2_DigOutVal	Word [Signed]	...	VAR_GLOBAL	▼	W1002
25	CH3_DigCalcVal	Word [Signed]	...	VAR_GLOBAL	▼	W1003
26	CH4_DigOutVal	Word [Signed]	...	VAR_GLOBAL	▼	W1004
27	CH3_DigMaxVal	Word [Signed]	...	VAR_GLOBAL	▼	W1005
28	CH3_DigMinVal	Word [Signed]	...	VAR_GLOBAL	▼	W1006
29	CH2_WarningOutputFlagProcessAlarmUpperLimit	Bit	...	VAR_GLOBAL	▼	W1010.1
30	CH2_WarningOutputFlagProcessAlarmLowerLimit	Bit	...	VAR_GLOBAL	▼	W1011.1
31	CH1_WarningOutputFlagRateAlarmUpperLimit	Bit	...	VAR_GLOBAL	▼	W1012.0
32	CH1_WarningOutputFlagRateAlarmLowerLimit	Bit	...	VAR_GLOBAL	▼	W1013.0
33	CH1_InputSignalErrorDetectionFlag	Bit	...	VAR_GLOBAL	▼	W1014.0
34	CH2_HartDeviceFound	Bit	...	VAR_GLOBAL	▼	W1016.1
35	CH4_HartDeviceFound	Bit	...	VAR_GLOBAL	▼	W1016.3
36	CH2_ProcessVariable_PV	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	W1030
37	CH2_ProcessVariable_SV	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	W1032
38	CH2_ProcessVariable_TV	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	W1034
39	CH2_ProcessVariable_QV	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	W1036
40	CH4_ProcessVariable_PV	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	W1038
41	CH4_ProcessVariable_SV	FLOAT [Single Precision]	...	VAR_GLOBAL	▼	W1040
42	DigitOutValSig	Bit	...	VAR_GLOBAL	▼	X20
43	MaxMinReadSig	Bit	...	VAR_GLOBAL	▼	X21
44	MaxMinResetSig	Bit	...	VAR_GLOBAL	▼	X22
45	ErrResetSig	Bit	...	VAR_GLOBAL	▼	X23
46	ModuleREADY	Bit	...	VAR_GLOBAL	▼	X1000
47	ExternalPowerSupplyReadyFlag	Bit	...	VAR_GLOBAL	▼	X1007
48	InputSignalErrorDetectionSignal	Bit	...	VAR_GLOBAL	▼	X100C
49	MaxValueMinValueResetCompletedFlag	Bit	...	VAR_GLOBAL	▼	X100D
50	A_D_conversionCompletedFlag	Bit	...	VAR_GLOBAL	▼	X100E
51	ErrorFlag	Bit	...	VAR_GLOBAL	▼	X100F
52	OperatingConditionSettingRequest	Bit	...	VAR_GLOBAL	▼	Y1009
53	MaxValueMinValueResetRequest	Bit	...	VAR_GLOBAL	▼	Y100D
54	ErrorClearRequest	Bit	...	VAR_GLOBAL	▼	Y100F

Common program

The following figure shows an example of the program to check the data link status of the remote head module (station number 1).

```
(0)   GF11_1.bSts_DataLinkEr   GF11_1.bnSts_DataLink                                              MC    N0    Connect_FormationFl
      ror                      Error_Station[1]                                                                g_St1
      ─┤/├─────────────────────┤/├─                                                                                 M0

      Connect_FormationFlg_S
      t1
  N0──┤ ├─ M0
```
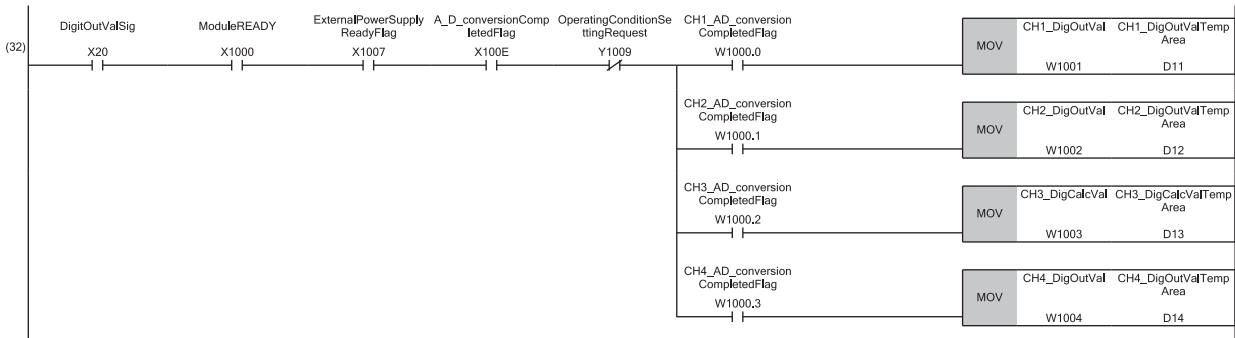
(0)   Checks the data link status of the remote head module (station number 1).

When creating programs shown later, add the MCR instruction to the last of the program as shown below.

```
(200)                                                                                            MCR   N0

(201)                                                                                                  ──[END]
```
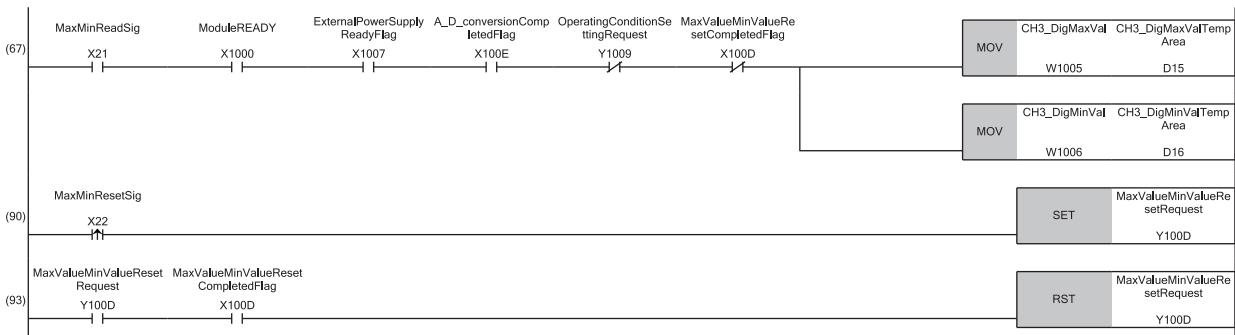
Program example 1

The following figure shows an example of the program to read digital output values of CH1, CH2, and CH4 and digital operation values of CH3 and save them.

```
         DigitOutValSig   ModuleREADY   ExternalPowerSupply  A_D_conversionComp  OperatingConditionSe  CH1_AD_conversion
                                        ReadyFlag            letedFlag           ttingRequest          CompletedFlag
(32)     X20              X1000         X1007                X100E               Y1009                 W1000.0        MOV   CH1_DigOutVal  CH1_DigOutValTemp
         ─┤ ├─────────────┤ ├───────────┤ ├──────────────────┤ ├─────────────────┤/├───────────────────┤ ├──────────────        Area
                                                                                                                           W1001          D11

                                                                                  CH2_AD_conversion
                                                                                  CompletedFlag
                                                                                  W1000.1              MOV   CH2_DigOutVal  CH2_DigOutValTemp
                                                                                  ─┤ ├──────────────────        Area
                                                                                                        W1002          D12

                                                                                  CH3_AD_conversion
                                                                                  CompletedFlag
                                                                                  W1000.2              MOV   CH3_DigCalcVal  CH3_DigCalcValTemp
                                                                                  ─┤ ├──────────────────         Area
                                                                                                        W1003          D13

                                                                                  CH4_AD_conversion
                                                                                  CompletedFlag
                                                                                  W1000.3              MOV   CH4_DigOutVal  CH4_DigOutValTemp
                                                                                  ─┤ ├──────────────────         Area
                                                                                                        W1004          D14
```

(32)   Reads values of CH1 Digital output value, CH2 Digital output value, CH3 Digital operation value, and CH4 Digital output value.

Program example 2

The following figure shows an example of the program to read a maximum value and a minimum value of CH3 and reset them.

```
         MaxMinReadSig   ModuleREADY   ExternalPowerSupply  A_D_conversionComp  OperatingConditionSe  MaxValueMinValueRe
                                       ReadyFlag            letedFlag           ttingRequest          setCompletedFlag
(67)     X21             X1000         X1007                X100E               Y1009                 X100D         MOV   CH3_DigMaxVal  CH3_DigMaxValTemp
         ─┤ ├────────────┤ ├───────────┤ ├──────────────────┤ ├─────────────────┤/├───────────────────┤/├──────────        Area
                                                                                                                    W1005          D15

                                                                                                              MOV   CH3_DigMinVal  CH3_DigMinValTemp
                                                                                                                          Area
                                                                                                                    W1006          D16

         MaxMinResetSig
(90)     X22                                                                                                   SET   MaxValueMinValueRe
         ─┤↑├──────────────────────────────────────────────────────────────────────────────────────────             setRequest
                                                                                                                    Y100D

         MaxValueMinValueReset  MaxValueMinValueReset
         Request                CompletedFlag
(93)     Y100D                  X100D                                                                          RST   MaxValueMinValueRe
         ─┤ ├────────────────────┤ ├──────────────────────────────────────────────────────────────────             setRequest
                                                                                                                    Y100D
```
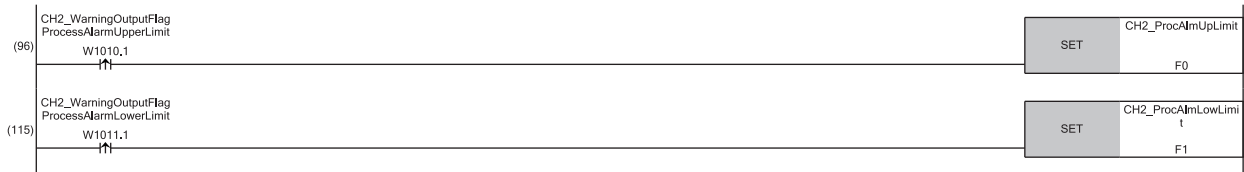
(67)   Reads values of CH3 Maximum value and CH3 Minimum value.
(90)   Turns on 'Maximum value/minimum value reset request' (Y100D).
(93)   Turns off 'Maximum value/minimum value reset request' (Y100D).

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Program example 3

The following figure shows an example of the program to perform operations reacting to a warning if a warning (process alarm upper/lower limit) occurs in CH2.

(96) Performs a processing of when a warning (process alarm upper limit) has occurred in CH2.
(115) Performs a processing of when a warning (process alarm lower limit) has occurred in CH2.

Program example 4

The following figure shows an example of the program to perform operations reacting to a warning if a warning (rate alarm upper/lower limit) occurs in CH1.
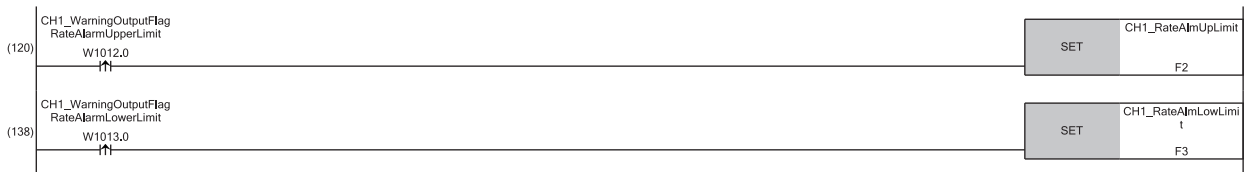
(120) Performs a processing of when a warning (rate alarm upper limit) has occurred in CH1.
(138) Performs a processing of when a warning (rate alarm lower limit) has occurred in CH1.

Program example 5

The following figure shows an example of the program to read and save the PV value, SV value, TV value, and QV value of CH2 and the PV value and SV value of CH4.

```
        CH2_HartDeviceFound
(143)      W1016.1                                                    ┌──────┬ CH2_ProcessVa  CH2_ProcessVariable
    ───────┤ ├───────────────────────────────────────────────────────┤ EMOV │ riable_PV       _PV_TempArea
                                                                      │      │                    
                                                                      └──────┴  W1030           D20

                                                            ┌──────┬ CH2_ProcessVa  CH2_ProcessVariable
    ────────────────────────────────────────────────────────┤ EMOV │ riable_SV       _SV_TempArea
                                                            │      │                    
                                                            └──────┴  W1032           D22

                                                            ┌──────┬ CH2_ProcessVa  CH2_ProcessVariable
    ────────────────────────────────────────────────────────┤ EMOV │ riable_TV       _TV_TempArea
                                                            │      │                    
                                                            └──────┴  W1034           D24

                                                            ┌──────┬ CH2_ProcessVa  CH2_ProcessVariable
    ────────────────────────────────────────────────────────┤ EMOV │ riable_QV       _FV_TempArea
                                                            │      │                    
                                                            └──────┴  W1036           D26

        CH4_HartDeviceFound
(162)      W1016.3                                                    ┌──────┬ CH4_ProcessVa  CH4_ProcessVariable
    ───────┤ ├───────────────────────────────────────────────────────┤ EMOV │ riable_PV       _PV_TempArea
                                                                      │      │                    
                                                                      └──────┴  W1038           D28

                                                            ┌──────┬ CH4_ProcessVa  CH4_ProcessVariable
    ────────────────────────────────────────────────────────┤ EMOV │ riable_SV       _SV_TempArea
                                                            │      │                    
                                                            └──────┴  W1040           D30
```

(143) Reads CH2PV value, CH2SV value, CH2TV value, and CH2QV value.
(162) Reads CH4PV value and CH4SV value.

Program example 6

The following figure shows an example of the program to clear Input signal error detection flag, Error flag, and Latest error code if an input signal error is detected in CH1 or an error occurs in any of the channels.

```
        CH1_InputSignalErrorDet
           ectionFlag                                              ┌──────┬  CH1_InputSigErr
(167)      W1014.0                                                 │ SET  │
    ───────┤ ├──────────────────────────────────────────────────────┤      │  F4
                                                                   └──────┘

        ErrorFlag        ErrResetSig                               ┌──────┬  ErrorClearRequest
(181)   X100F             X23                                      │ SET  │
    ───────┤ ├─────────────┤↑├──────────────────────────────────────┤      │  Y100F
         │                                                         └──────┘
        InputSignalErrorDetectio
           nSignal
        X100C
    ───────┤ ├───┘

        ErrorClearRequest InputSignalErrorDetectio  ErrorFlag      ┌──────┬  ErrorClearRequest
(196)   Y100F                nSignal                                │ RST  │
    ───────┤ ├──────────────┤/├─────────┤/├───────────────────────────┤      │  Y100F
                          X100C         X100F                      └──────┘
```
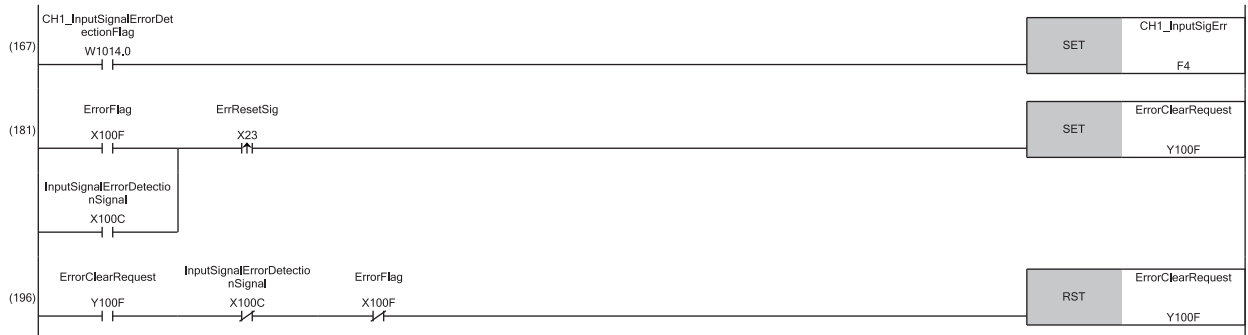
(167) Performs a processing of when an input signal error was detected in CH1.
(181) Turns on 'Error clear request' (Y100F).
(196) Turns off 'Error clear request' (Y100F).

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REVISIONS

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

Revision date	*Manual number	Description
October 2018	SH(NA)-082048ENG-A	First edition

Japanese manual number: SH-082046-A

WARRANTY

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

1. Gratis Warranty Term and Gratis Warranty Range

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

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

[Gratis Warranty Term]

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

[Gratis Warranty Range]

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

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

 1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.

 2. Failure caused by unapproved modifications, etc., to the product by the user.

 3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.

 4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.

 5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.

 6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.

 7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

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

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

3. Overseas service

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

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

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

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

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

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

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

5. Changes in product specifications

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

TRADEMARKS

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MODEL: R60ADI8-HA-U-OU-E
MODEL CODE: 13JX97

MITSUBISHI ELECTRIC CORPORATION

When exported from Japan, this manual does not require application to the
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Specifications subject to change without notice.