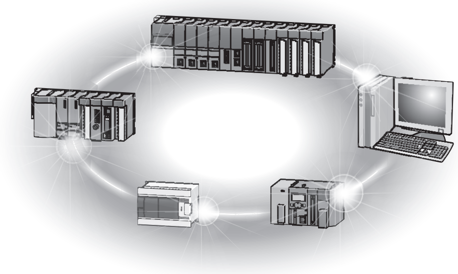
Mitsubishi Programmable Controller

CC-Link IE Field Network Temperature Control Module User's Manual

-NZ2GF2B-60TCTT4
-NZ2GF2B-60TCRT4



●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 for 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

- When a communication failure occurs in the network, data in the master module are held. Check Data link status (each station) (SW00B0 to SW00B7) and configure an interlock circuit in the program to ensure that the entire system will operate safely.
- Do not use any "use prohibited" signals as a remote I/O signal as they are used by the system. Do not write any data to the "use prohibited" areas in the remote register. If these operations are performed, correct operation of the module cannot be guaranteed.

[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.

[Security Precautions]

⚠WARNING

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

[Installation Precautions]

⚠WARNING

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

[Installation Precautions]

⚠CAUTION

- Use the module in an environment that meets the general specifications in this manual. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- Do not directly touch any conductive parts and electronic components of the module. Doing so can cause malfunction or failure of the module.
- Securely connect the cable connectors. Poor contact may cause malfunction.

[Wiring Precautions]

⚠WARNING

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

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG terminal of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Tighten any unused terminal screws within the specified torque range. Undertightening can cause a short circuit due to contact with a solderless terminal.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when a terminal block screw comes loose, resulting in failure.
- Check the rated voltage and terminal 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 a fire or failure.
- Tighten the terminal block screws within the specified torque range. Undertightening can cause short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact.
- 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.
- 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.
- When an overcurrent caused by an error of an external device or a failure of the programmable controller flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Mitsubishi programmable controllers must be installed in control panels. Wiring and replacement of a module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring methods, refer to "INSTALLATION AND WIRING" in this manual.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal block screws or connector screws. Failure to do so may cause the module to fail or malfunction.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not disassemble or modify the module. Doing so may cause failure, malfunction, injury, or a fire.
- Do not drop or apply strong shock to the module. Doing so may damage the module.
- Shut off the external power supply (all phases) used in the system before mounting or removing a module. Failure to do so may cause the module to fail or malfunction.
- After the first use of the product, do not connect/disconnect the terminal block more than 50 times (in accordance with IEC 61131-2).
- Before handling the module or connection cables, 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.
- 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.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

(1) MELSEC 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 ELECTRIC 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 ELECTRIC USER'S, 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 Electric 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 Electric 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 Electric representative in your region.

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

INTRODUCTION

Thank you for purchasing the CC-Link IE Field Network temperature control module (hereafter abbreviated as temperature control module). This manual describes the procedures, system configuration, parameter settings, functions, and troubleshooting of a temperature control module.

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the temperature control module to handle the product correctly. When applying the program examples introduced in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

■Relevant module: NZ2GF2B-60TCTT4, NZ2GF2B-60TCRT4

Remark

Unless otherwise specified, this manual describes the program examples in which the remote I/O signals and remote registers are assigned for a temperature control module as follows.

- Remote input signal: RX0 to RX3F
- Remote output signal: RY0 to RY3F
- Remote register: RWr0 to RWr1F, RWw0 to RWw1F

For the assignment of remote I/O signals and remote registers, refer to the following.

📖 User's manual for the master/local module used

RELEVANT MANUALS

(1) CC-Link IE Field Network (relevant) manuals

When using the CC-Link IE Field Network for the first time, refer to the CC-Link IE Field Network Master/Local Module User's Manual first. The following shows the structure of the CC-Link IE Field Network manuals.

Manual name (manual number, model code)	Description
MELSEC-Q CC-Link IE Field Network Master/Local Module User's Manual (SH-080917ENG, 13JZ47)	Overview of the CC-Link IE Field Network, and specifications, procedures before operation, system configuration, installation, wiring, settings, functions, programming, and troubleshooting of the MELSEC-Q series master/local module
MELSEC-L CC-Link IE Field Network Master/Local Module User's Manual (SH-080972ENG, 13JZ54)	Overview of the CC-Link IE Field Network, and specifications, procedures before operation, system configuration, installation, wiring, settings, functions, programming, and troubleshooting of the MELSEC-L series master/local module
MELSEC iQ-R Ethernet/CC-Link IE User's Manual (Startup) (SH-081256ENG, 13JX09)	Specifications, procedures before operation, system configuration, wiring, and communication examples of Ethernet, CC-Link IE Controller Network, and CC-Link IE Field Network
MELSEC iQ-R CC-Link IE Field Network User's Manual (Application) (SH-081259ENG, 13JX18)	Functions, parameter settings, programming, troubleshooting, I/O signals, and buffer memory of CC-Link IE Field Network
MELSEC-Q QD77GF Simple Motion Module User's Manual (Network) (IB-0300203, 1XB957)	Functions, programming, and troubleshooting for CC-Link IE Field Network of the QD77GF16

(2) Operating manual

Manual name (manual number, model code)	Description
GX Works2 Version 1 Operating Manual (Common) (SH-080779ENG, 13JU63)	System configuration, parameter settings, and online operations of GX Works2, which are common to Simple projects and Structured projects
GX Works3 Operating Manual (SH-081215ENG)	System configuration, parameter settings, and online operations of GX Works3

CONTENTS

MANUAL PAGE ORGANIZATION

In this manual, pages are organized and the symbols are used as shown below.

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.

"" is used for screen names and items.

1. shows operating procedures.

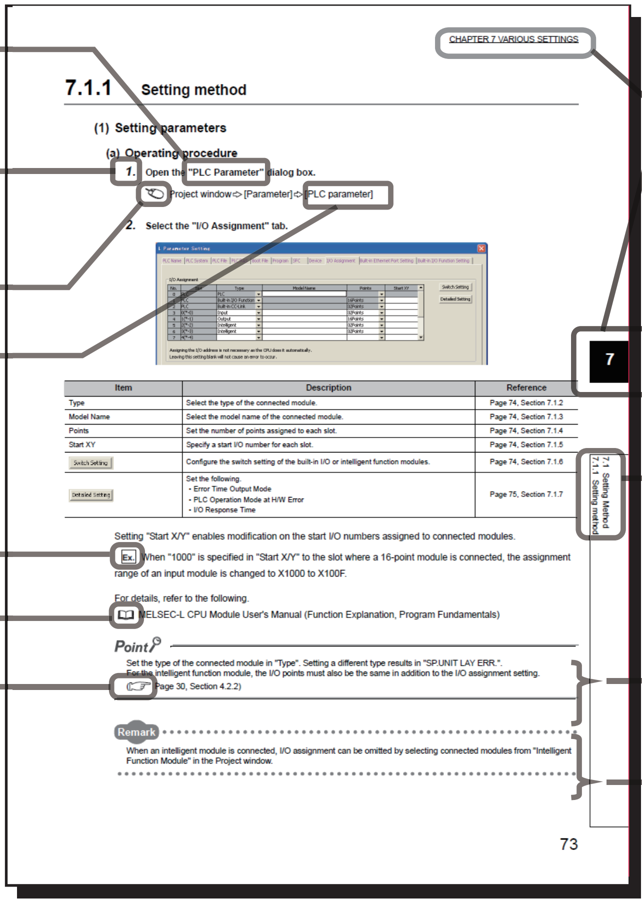
shows mouse operations.*1

[ ] is used for items in the menu bar and the project window.

Ex. shows setting or operating examples.

shows reference manuals.

shows reference pages.



The chapter of the current page is shown.

The section of the current page is shown.

Point shows notes that requires attention.

Remark shows useful information.

*1 The mouse operation example is provided below.

Menu bar

Ex. [Online] ⇨ [Write to PLC...]

Select [Online] on the menu bar, and then select [Write to PLC...].

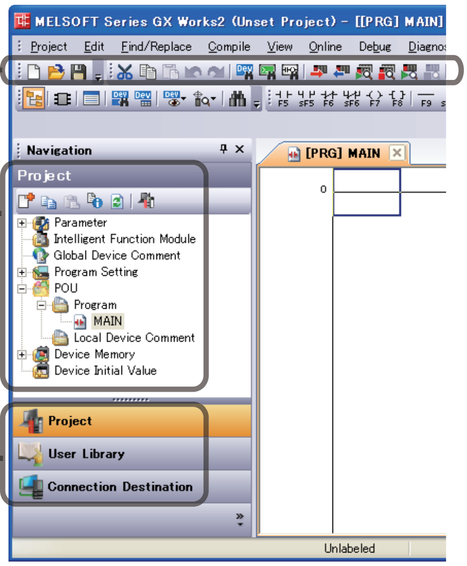
A window selected in the view selection area is displayed.

Ex. Project window ⇨ [Parameter] ⇨ [PLC Parameter]

Select [Project] from the view selection area to open the Project window.

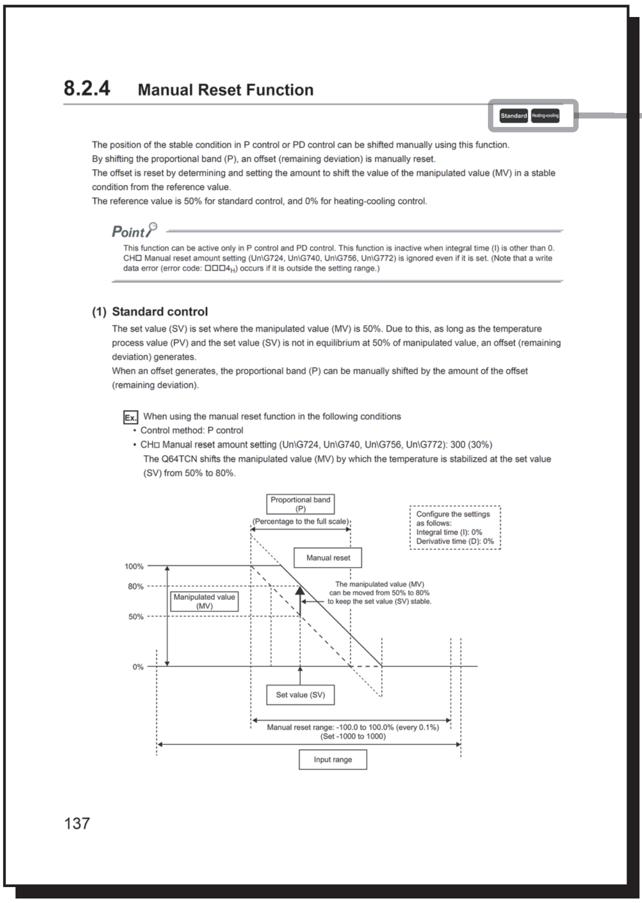
In the Project window, expand [Parameter] and select [PLC Parameter].

View selection area



The meaning of each icon is as follows.

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.



These icons indicate modes that can be used.

Icon		Description
Common to all modes	Common	The corresponding remote I/O signal, remote register, remote buffer memory area, or function is for both temperature control mode and temperature input mode.
Temperature control mode	Standard	The corresponding remote I/O signal, remote register, remote buffer memory area, or function is for standard control in temperature control mode. The available control modes and channels are as follows: • CH1 to CH4 in the standard control • CH3 and CH4 in the mix control (normal mode) • CH3 and CH4 in the mix control (expanded mode)
	Heating-cooling	The corresponding remote I/O signal, remote register, remote buffer memory area, or function is for heating-cooling control in temperature control mode. The available control modes and channels are as follows: • CH1 and CH2 in the heating-cooling control (normal mode) • CH1 to CH4 in the heating-cooling control (expanded mode) • CH1 in the mix control (normal mode) • CH1 and CH2 in the mix control (expanded mode)
Temperature input mode	Temperature Input	The corresponding remote I/O signal, remote register, remote buffer memory area, or function is for temperature input mode.

TERMS

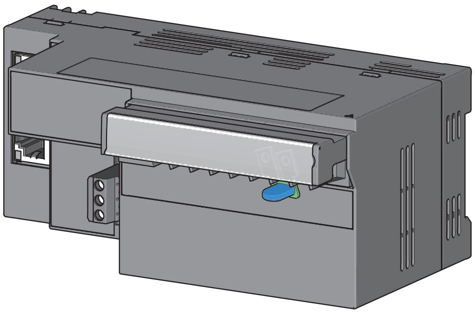
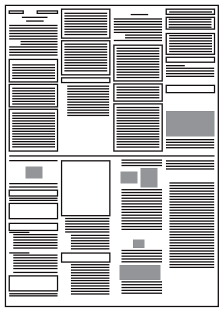
Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) exchanged with a CPU module are stored
CC-Link IE Field Network	A high-speed and large-capacity open field network that is based on Ethernet (1000BASE-T)
Control method	A generic term for two-position control, P control, PI control, PD control, and PID control
Control mode	A generic term for the modes when using the temperature control module in temperature control mode: the standard control, heating-cooling control (normal mode), heating-cooling control (expanded mode), mix control (normal mode), and mix control (expanded mode)
Cyclic transmission	A function by which data are periodically exchanged among stations on the same network using link devices (RX, RY, RWw, and RWr)
Data link	A generic term for cyclic transmission and transient transmission
Dedicated instruction	An instruction that simplifies programming for using functions of intelligent function modules
Disconnection	A process of stopping data link if a data link error occurs
Extension module	A remote module with no CC-Link IE Field Network communication function. This module cannot be used as a single module. However, connecting the module to the main module will increase the number of I/O points per station. The module cannot be connected to the temperature control module.
Fixed value action	A control action when the set value (SV) is maintained at a fixed value
Full scale	The width of an input range. For example, if the selected input range is -200.0℃ to 400.0℃, the full scale is 600.0.
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Works3	
Intelligent device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station responds to a transient transmission request from another station and also issues a transient transmission request to another station.
Link device	A device (RX, RY, RWr, or RWw) in a module on CC-Link IE Field Network
Link special register (SW)	Word data that indicates the operating status and data link status of a module on CC-Link IE Field Network
Link special relay (SB)	Bit data that indicates the operating status and data link status of a module on CC-Link IE Field Network
Local station	A station that performs cyclic transmission and transient transmission with the master station and other local stations. The station is controlled by programs in the CPU module or other equivalent modules on the station.
Main module	A module with the CC-Link IE Field Network communication function, which can be used as a single remote module. The temperature control module belongs to this type.
Master station	A station that controls the entire network. This station can perform cyclic transmission and transient transmission with all stations. Only one master station can be used in a network.
Master/local module	The abbreviation for the CC-Link IE Field Network master/local module
Network module	A generic term for the following modules: • CC-Link IE Field Network module • CC-Link IE Controller Network module • Ethernet interface module • MELSECNET/H module • MELSECNET/10 module
Number of loops	The number of feedback control systems (closed-loop control systems) that can be configured using one temperature control module. In the standard control, one loop consists of one input and one output. In the heating-cooling control, one loop consists of one input and two outputs.
PID constants	A generic term for the proportional band (P), integral time (I), and derivative time (D)
Ramp action	A control action when the set value (SV) is continuously changed
Relay station	A station that includes two or more network modules. Data are passed through this station to stations on other networks.
REMFR	The abbreviation for ZP.REMFR. This dedicated instruction is used in the master/local module. The instruction reads data (in units of words) from the buffer memory of the intelligent device station/remote device station. 📖 User's manual for the master/local module used
Remote buffer memory	Buffer memory in a remote device station
Remote device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station responds to a transient transmission request from another station.
Remote I/O station	A station that exchanges I/O signals (bit data) with the master station by cyclic transmission

Term	Description
Remote input (RX)	Bit data input from a slave station to the master station (For some areas in a local station, data are input in the opposite direction.) 📖 User's manual for the master/local module used
Remote output (RY)	Bit data output from the master station to a slave station (For some areas in a local station, data are output in the opposite direction.) 📖 User's manual for the master/local module used
Remote register (RWr)	Word data input from a slave station to the master station (For some areas in a local station, data are input in the opposite direction.) 📖 User's manual for the master/local module used
Remote register (RWw)	Word data output from the master station to a slave station (For some areas in a local station, data are output in the opposite direction.) 📖 User's manual for the master/local module used
REMTO	The abbreviation for ZP.REMTO. This dedicated instruction is used in the master/local module. The instruction writes data (in units of words) to the buffer memory of the intelligent device station/remote device station. 📖 User's manual for the master/local module used
Reserved station	A station reserved for future use. This station is not actually connected, but counted as a connected station.
Return	A process of restarting data link when a station recovers from an error
Slave station	A generic term for stations other than a master station: local station, remote I/O station, remote device station, and intelligent device station
Temperature control mode	A mode for using the module as a temperature control module
Temperature control module	The abbreviation for the CC-Link IE Field Network temperature control module
Temperature input mode	A mode for using the module as a temperature input module
Temperature sensor	A generic term for thermocouples and platinum resistance thermometers
Transient transmission	A function of communication with another station, which is used when requested by a dedicated instruction or GX Works2

PACKING LIST

The following items are included in the package of this product. Before use, check that all the items are included.

Temperature control module	
	
Temperature control module	Before Using the Product

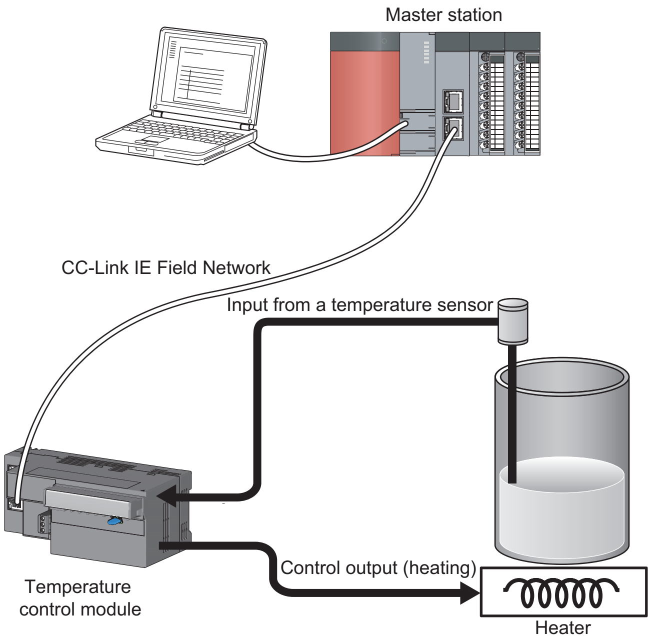
CHAPTER 1 TEMPERATURE CONTROL MODULE

This chapter describes the applications and features of a temperature control module.

1.1 Application

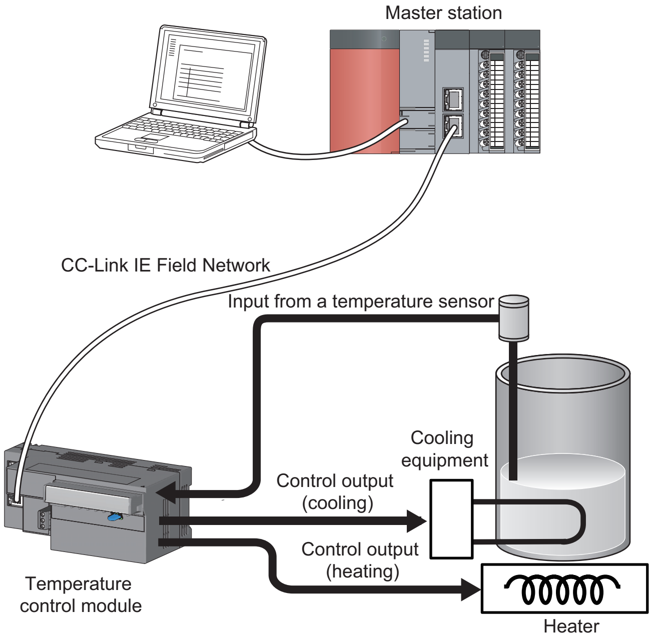
The temperature control module performs PID operation to reach the target temperature based on input from an external temperature sensor. The module controls temperature by outputting the operation result to a heater or others in transistor output.

Ex. Standard control (heating)
PID operation is performed for the input value from a temperature sensor to control the heater temperature.



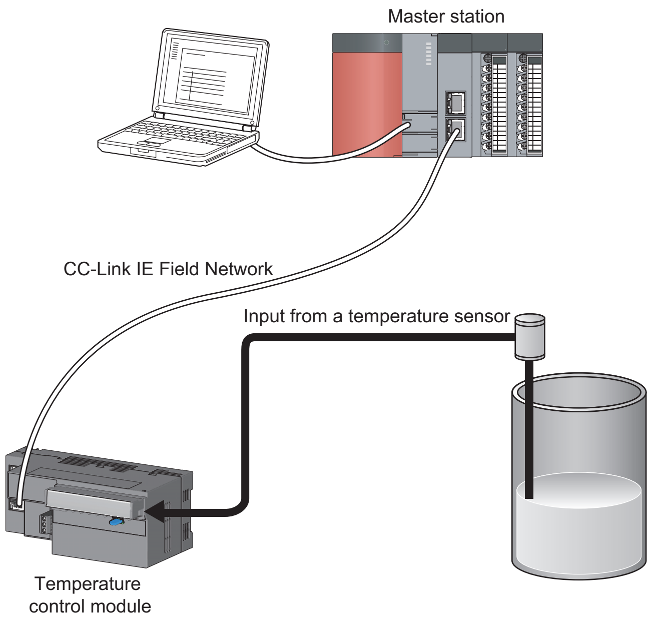
Ex. Heating-cooling control (heating and cooling)

Heating and cooling are performed when the target temperature is lower than the ambient temperature or when the temperature of the controlled object is variable.



Ex. Temperature input (temperature input only)

The temperature control module can also be used as a temperature input module.



1.2 Features

This section describes the features of the temperature control module.

Remark

For functions not described in this section, refer to the following.

☞ Page 38, Section 3.3

(1) Cost reduction (shortening of the sensor cable)

In the standard modules (such as the L series temperature control modules), an extension of the sensor cable is required to control a remote object, which has been costly. Since the temperature control module can be installed near the controlled object, the sensor cable can be shortened, resulting in the cost reduction.

(2) Easy station number setting

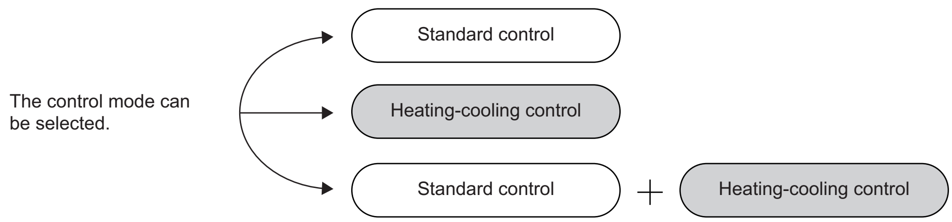
Setting and checking the station number are easy because a rotary switch for the setting is located on the front of the module.

(3) Optimum temperature adjustment control (PID control)

- The temperature control module performs temperature adjustment control automatically by simply setting PID constants necessary for PID operation (proportional band (P), integral time (I), and derivative time (D)), and temperature set value (SV). No special instruction is needed to perform PID control.
- The auto tuning function or self-tuning function enables the temperature control module to set PID constants automatically. No complicated PID operation expression is needed to set PID constants.

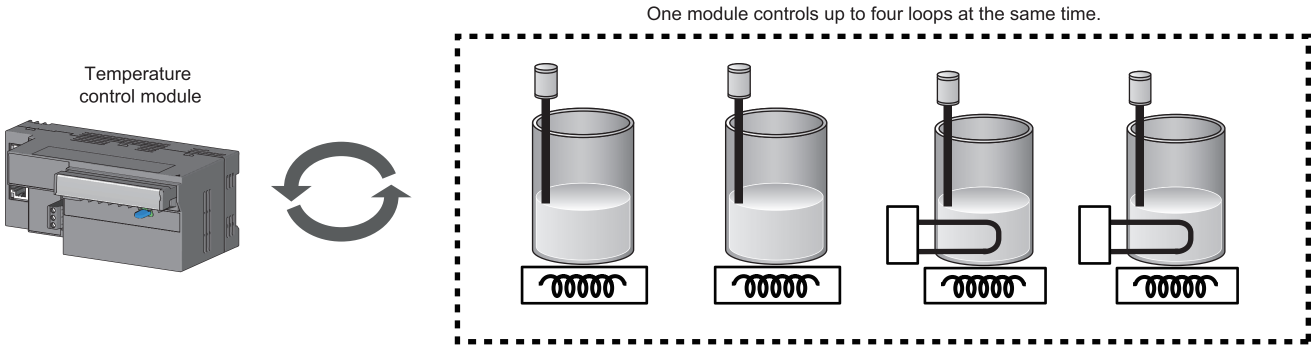
(4) Selectable control mode

Standard control (heating or cooling) or heating-cooling control (heating and cooling) can be selected. Mix control (the combination of standard control and heating-cooling control) also can be selected.



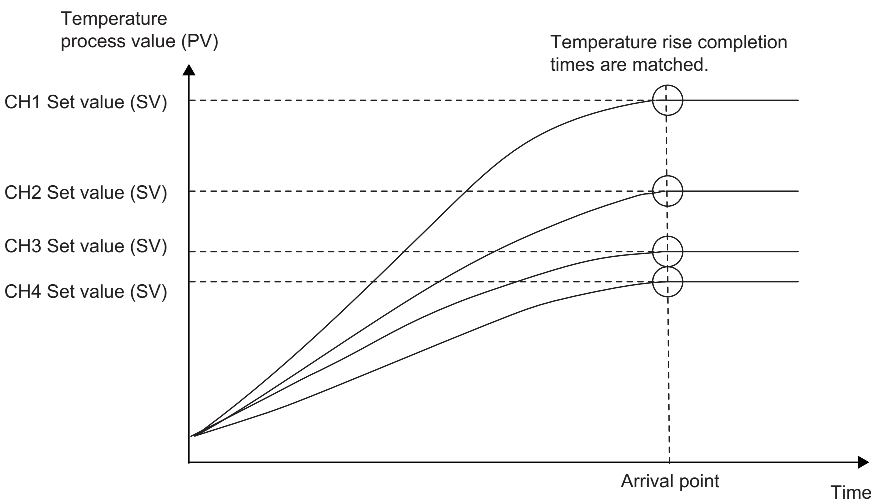
(5) Four loops on one module

Up to four loops of temperature adjustment control can be achieved simultaneously. In addition, input from an A/D converter module or output to a D/A converter module on the network can be used for loop control.



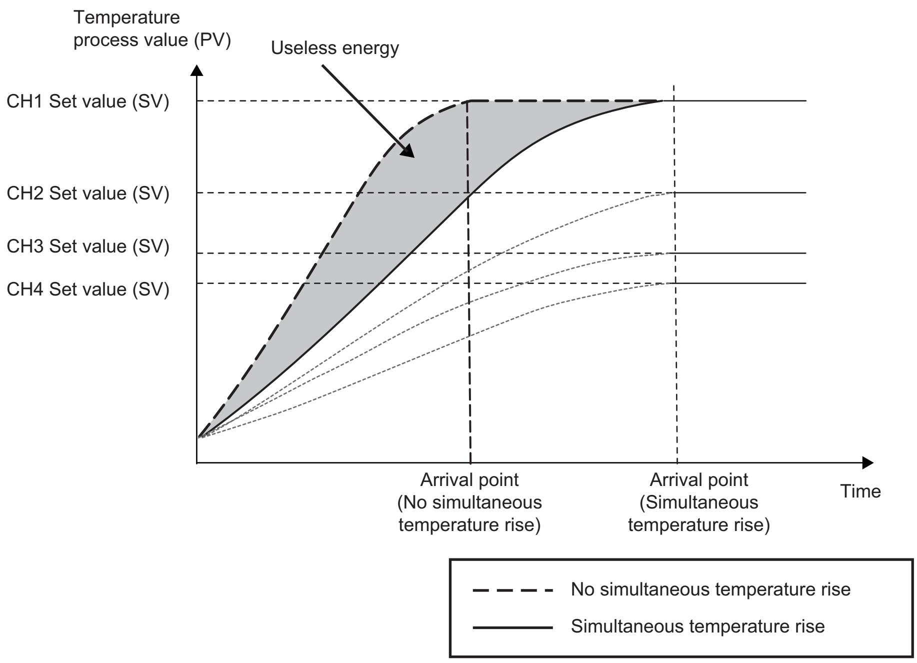
(6) Simultaneous temperature rise of multiple loops

Multiple loops can be set to reach each target temperature simultaneously and thereby an even temperature control can be obtained without any partial burning or partial thermal expansion.



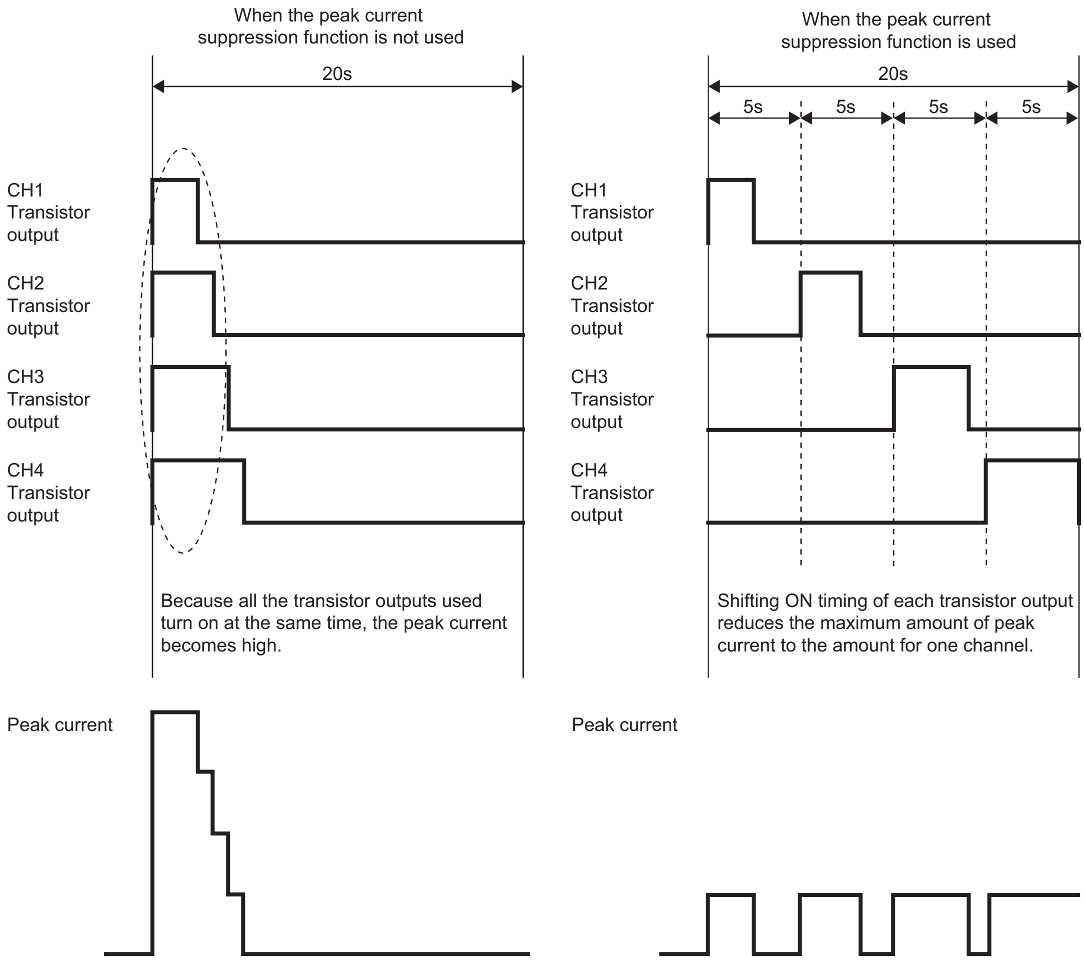
This function also saves energy and cost.

Ex. A comparison of simultaneous temperature rise and no simultaneous temperature rise at CH1



(7) Suppression of peak current

Current flows into a heater can be suppressed by controlling so that each channel's output does not turn on at the same time as other channels. This function also saves energy and cost.



(8) RFB limiter function

The RFB (reset feed back) limiter suppresses an overshoot which is liable to occur at a startup or at an increase of temperature process value (PV).

(9) Correction of temperature process value (PV)

The following functions can easily correct the difference between the temperature process value (PV) and the actual temperature.

- Normal sensor correction (one-point correction) function: Corrects the difference by setting the rate of correction value to the full scale of the input range.
- Sensor two-point correction function: Corrects the difference based on the inclination of the two points set in advance.
- Primary delay digital filter setting: Smoothens transient noise and absorbs its sudden change.

(10)Non-volatile memory for backing up set values

The set values in the remote buffer memory, such as the set values related to PID control, can be backed up to a non-volatile memory. Re-setting these values is thereby not needed when the power supply of the temperature control module is turned off and on or reset.

(11) Detection of disconnection

The loop disconnection detection function can simply detect a heater disconnection.

(12) Selectable sampling cycle

The module can be applied to a wide range of systems because the sampling cycle can be selected from 250ms/4 channels or 500ms/4 channels.

(13) Usable as a temperature input module

The temperature control module can also be used as a temperature input module. The switching to a temperature input module can be easily controlled in the setting.
The primary delay digital filter and the alert output can also be set to temperature input.
☞ Page 138, Section 8.2

(14) Checking the error history

The past history of 15 errors and occurrence time is stored in the temperature control module. The error history facilitates investigation of the causes when a problem occurs.

(15) Easy setting with the CC IE Field configuration of the engineering tool

The CC IE Field configuration of the engineering tool allows the parameters to be set on the window, resulting in reducing the number of programs. The setting status of a module can also be checked easily. The setting status of a module can also be checked easily.

(16) Checking the status of the CC-Link IE Field Network

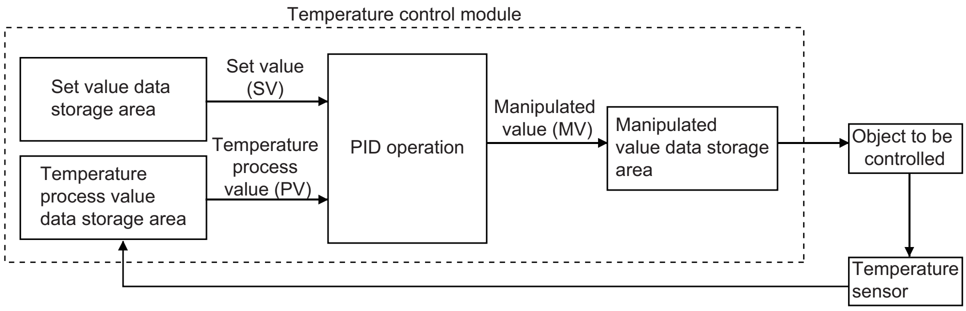
The status of the CC-Link IE Field Network can be checked with the engineering tool. The engineering tool can display the faulty areas, faulty causes, and event history, resulting in shortening the time to recover from an error.

1.3 PID Control System

This section describes the PID control system of the temperature control module.

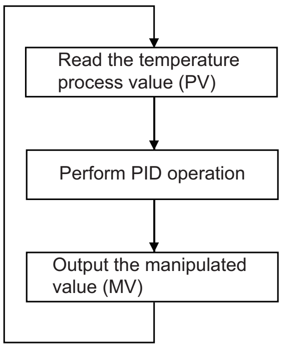
(1) PID Control System

The following figure shows a system for performing the PID control.



(2) PID control procedure

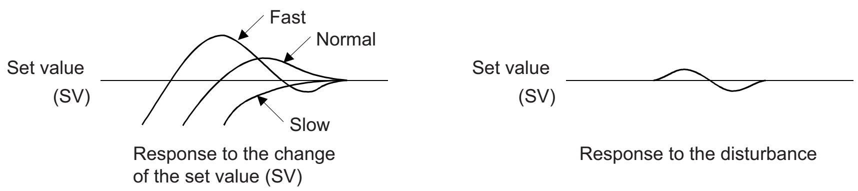
The PID control is performed in the following procedure.



- Import a signal from the temperature sensor and write it to the temperature process value data storage area as a temperature process value (PV).
- Perform PID operation using the set value (SV)/temperature process value (PV) in the set value/temperature process value data storage area.
- Convert the manipulated value (MV) obtained by the PID operation to transistor-output on time and output it.

(3) PID control (simple two-degree-of-freedom)

In the simple two-degree-of-freedom, the module controls the target subject using not only PID constants but also the control response parameter. The parameter can be set to "fast", "normal", or "slow". This setting enables the form of "response to the change of the set value (SV)" to change maintaining "response to the disturbance" in a good condition.



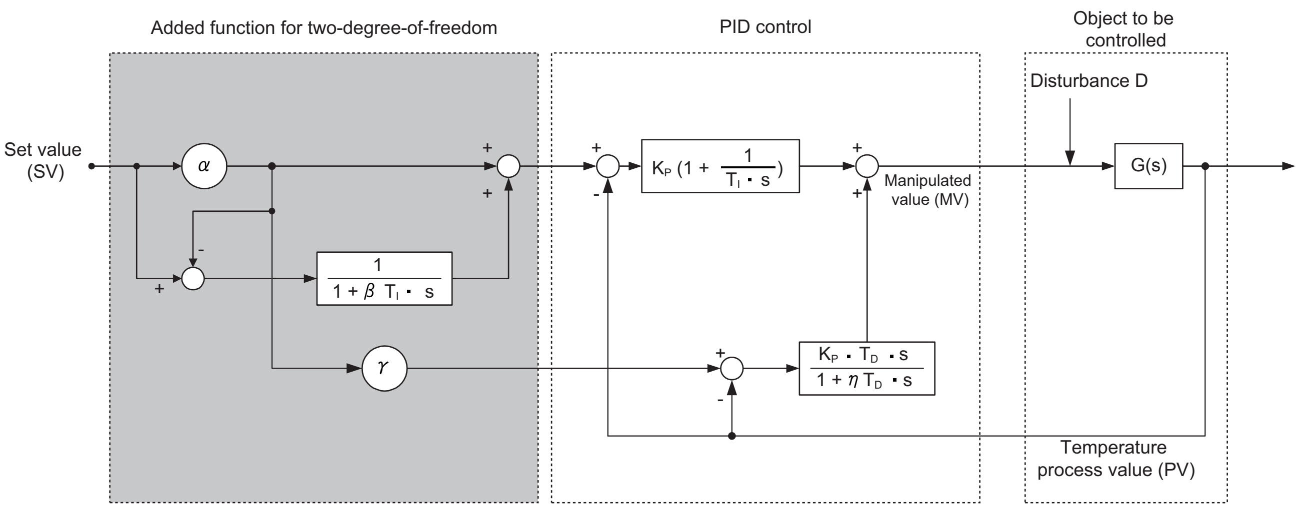
The following describes the difference between the one-degree-of-freedom PID control, two-degree-of-freedom PID control, and simple two-degree-of-freedom PID control.

(a) One-degree-of-freedom PID control and two-degree-of-freedom PID control

- General PID control is called one-degree-of freedom PID control. In the one-degree-of freedom PID control, when PID constants that improve "response to the change of the set value (SV)" are set, "response to the disturbance" worsens. Conversely, when PID constants that improve "response to the disturbance" are set, "response to the change of the set value (SV)" worsens.
- In the two-degree-of-freedom PID control, a manipulated value (MV) is determined considering the set value (SV) and variations. In this form of PID control, "response to the change of the set value (SV)" and "response to the disturbance" can be compatible with each other.

(b) Two-degree-of-freedom PID control and simple two-degree-of-freedom PID control

The following figure is a block diagram of the two-degree-of-freedom PID control.



The appropriate setting of α, β, and γ in the above figure can achieve optimum control. However, a complete and perfect two-degree-of-freedom PID control needs many parameters to be set and the automatic adjustment by auto tuning is also difficult to perform. The temperature control module is therefore equipped with the simple two-degree-of-freedom PID control with simplified parameters.

1.4 PID Operation

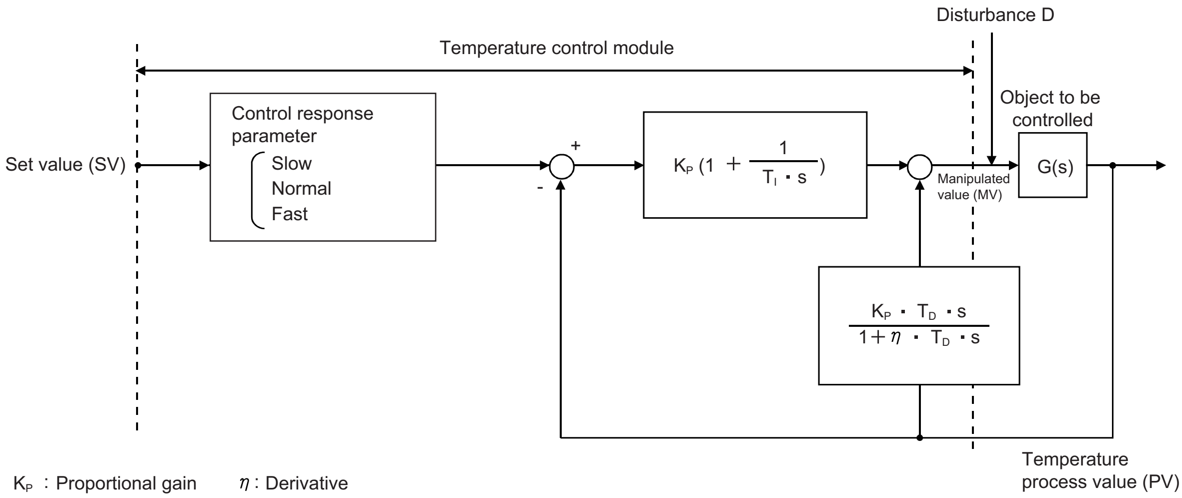
The temperature control module can perform PID control in process-value incomplete derivation.

1.4.1 Operation method and formula

The PID control in process-value incomplete derivation uses primary delay filter for the input of a derivative action. This method performs PID operation to a deviation (E) from which a high frequency noise component is eliminated.

(1) Algorithm of PID control in process-value incomplete derivation

The algorithm of PID control in process-value incomplete derivation is shown below.



K_P : Proportional gain
T_I : Integral time
T_D : Derivative time
η : Derivative
s : Laplace transform

(2) Formula

The formula of the temperature control module is shown below.

$$MV_n = MV_{n-1} + \frac{T_D}{\tau + \eta \cdot T_D} \left\{ (PV_{n-1} - PV_n) - \frac{\tau}{T_D} \cdot MV_{n-1} \right\}$$

τ : Sampling cycle
MV : Incomplete derivative output
PV : Temperature process value
T_D : Derivative time
η : Derivative

Point

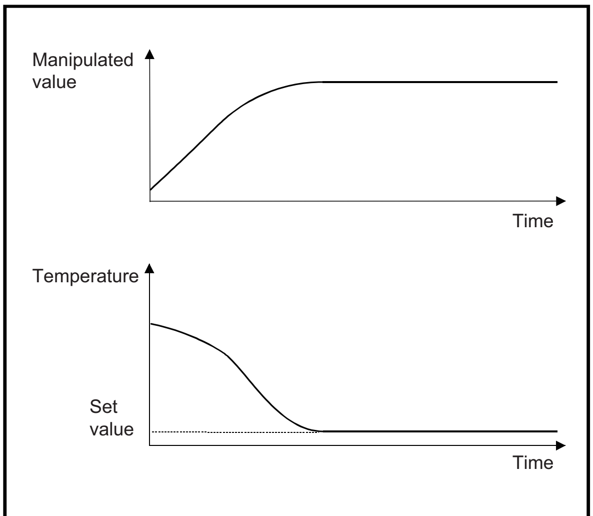
The PID control in process-value derivation is an operation method which uses the temperature process value (PV) as a derivative term in PID operation. Because of no use of the deviation for the derivative term, a sudden change in output by a derivative action is mitigated at the time of the variation of deviation associated with a setting value change.

1.4.2 Actions of a temperature control module

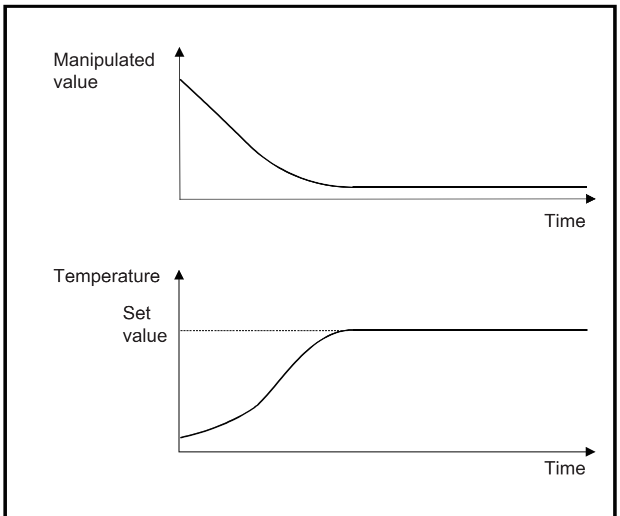
The temperature control module performs PID operation in forward actions and reverse actions.

(1) Forward action

In a forward action, the manipulated value (MV) is increased when the temperature process value (PV) increases from the set value (SV). A forward action is used for cooling control.



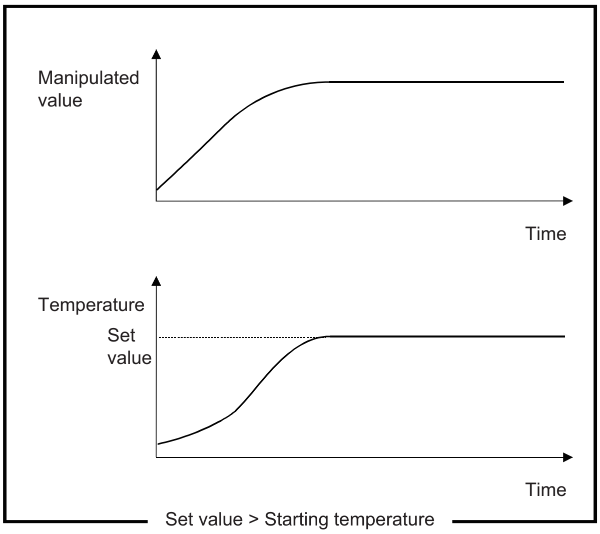
Set value < Starting temperature



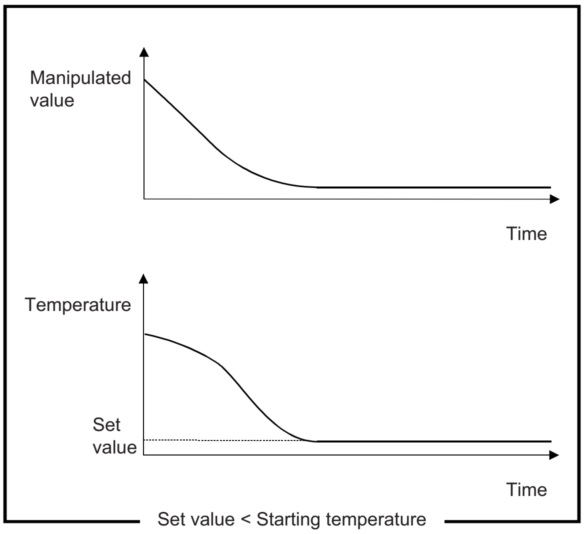
Set value > Starting temperature

(2) Reverse action

In a reverse action, the manipulated value is increased when the temperature process value (PV) decreases from the set value (SV). A reverse action is used for heating control.



Set value > Starting temperature



Set value < Starting temperature

1.4.3 Proportional action (P-action)

A proportional action is an action to obtain the manipulated value (MV) proportional to the deviation (difference between the set value (SV) and the process value (PV)).

(1) Proportional gain

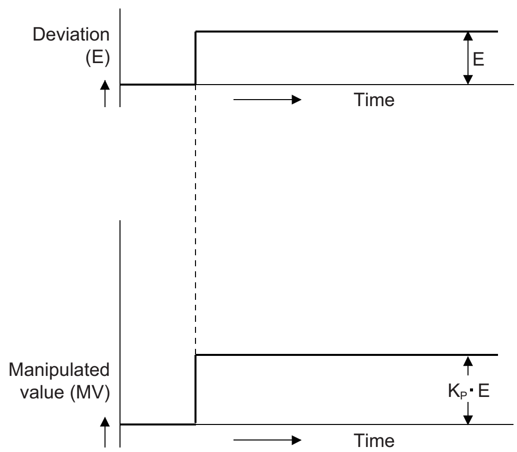
In a proportional action, the relationship between changes in the deviation (E) and the manipulated value (MV) can be expressed in the following formula:

MV = KP·E

where KP is a proportional constant and is called proportional gain. The manipulated value (MV) varies in the range from -5.0% to 105.0%. The following table describes the difference of actions depending on the value of proportional gain, KP.

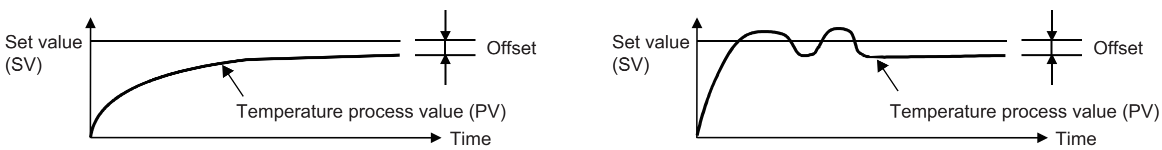
Condition	Proportional action
KP is a small value	The control action slows down.
KP is a large value	The control action speeds up, but hunting is likely to occur.

The following figure shows a proportional action of step responses where the deviation (E) is a fixed value.



(2) Offset

A certain discrepancy between the temperature process value (PV) and the set value (SV) is called an offset (remaining deviation). In an proportional action, an offset (remaining deviation) occurs.

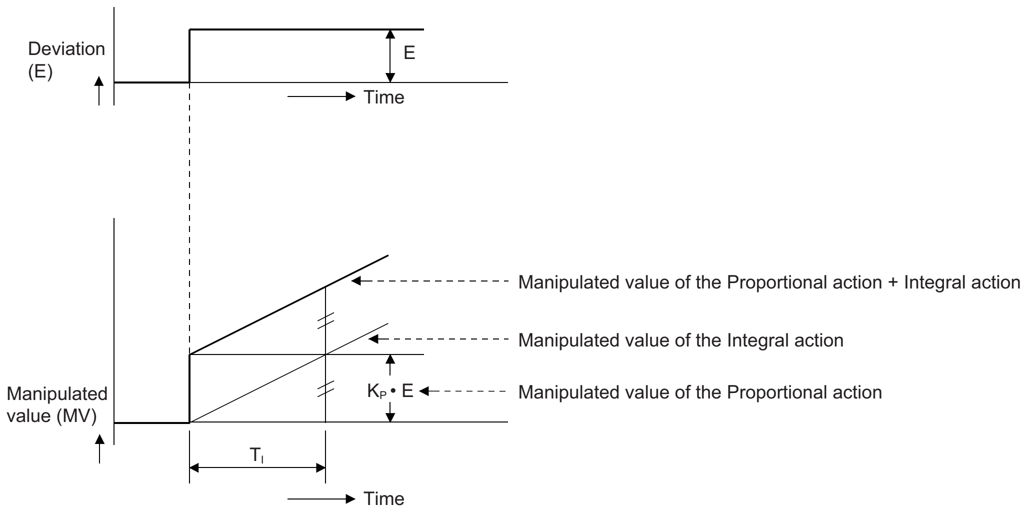


1.4.4 Integral action (I-action)

The integral action changes the manipulated value (MV) continuously to eliminate the deviation (E), if any. The offset caused by a proportional action can be eliminated.
In the integral action, the integral time, TI, represents the time that the manipulated value (MV) of the integral action after the occurrence of deviation (E) becomes equal to that of the proportional action. The following table describes the difference of actions depending on the value of integral time, TI.

Condition	Integral action
TI is a small value	The integral effect becomes larger, and the time to eliminate an offset becomes shorter. However, hunting is likely to occur.
TI is a large value	The integral effect becomes smaller, and the time to eliminate an offset becomes longer.

The following figure shows an integral action under step response where the deviation (E) is a fixed value.



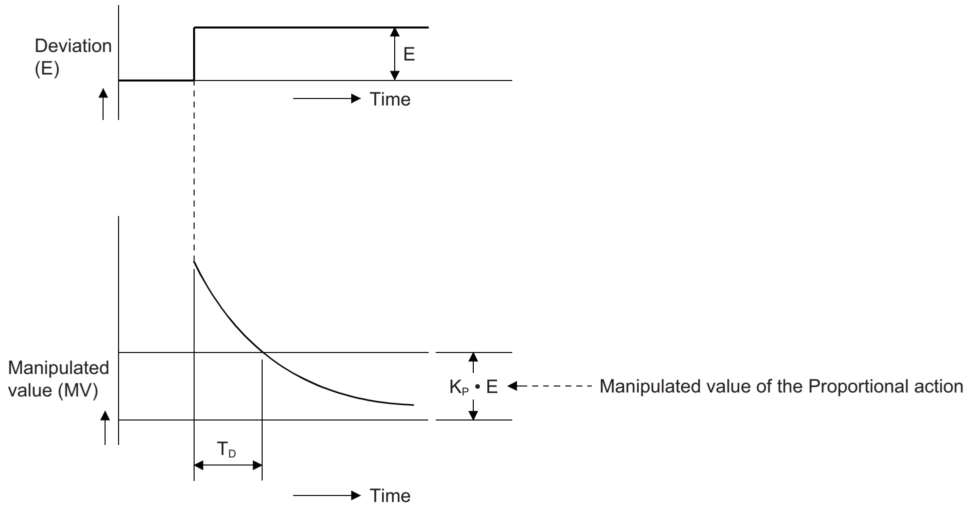
The integral action is used as a PI action in combination with a proportional action, or a PID action in combination with a proportional action and a derivative action. The integral action cannot be used by itself.

1.4.5 Derivative action (D-action)

The derivative action adds the manipulated value (MV) proportional to the change rate to eliminate the deviation (E), if any. The derivative action can prevent the controlled object from changing largely due to disturbance.
In the derivative action, the derivative time, TD, represents the time that the manipulated value (MV) of the derivative action after the occurrence of deviation (E) becomes equal to that of the proportional action. The following table describes the difference of actions depending on the value of derivative time, TD.

Condition	Integral action
TD is a small value	The derivative effect becomes smaller.
TD is a large value	The derivative effect becomes larger. However, a short period hunting is likely to occur.

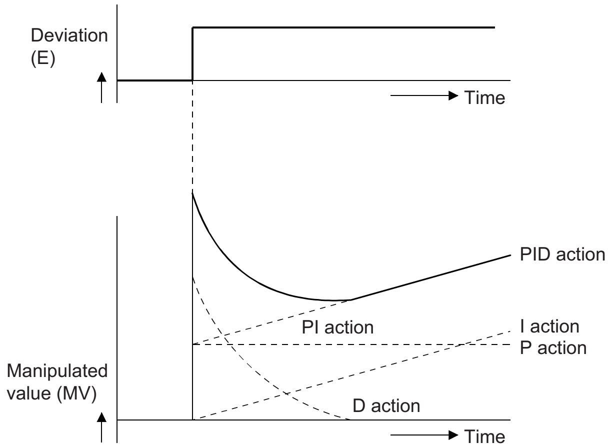
The following figure shows a derivative action under step response where the deviation (E) is a fixed value.



The derivative action is used as a PD action in combination with a proportional action, or a PID action in combination with a proportional action and an integral action. The derivative action cannot be used by itself.

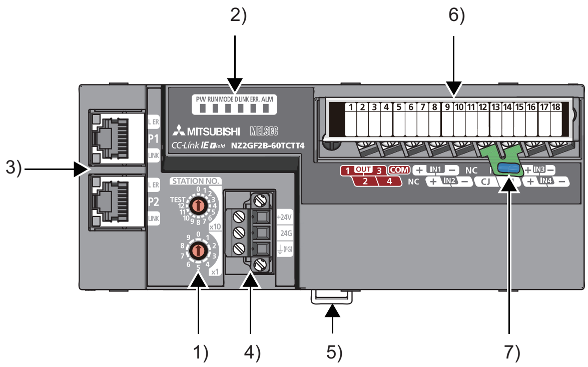
1.4.6 PID action

The PID action performs control using the manipulated value (MV) calculated by the total of the proportional action, integral action, and derivative action. The following figure shows a PID action under step response where the deviation (E) is a fixed value.



CHAPTER 2 PART NAMES

This chapter describes the part names of a temperature control module.



Number	Name	Description
1)	Station number setting switch	A rotary switch for the following setting and test. • Station Number Setting (☞ Page 85, Section 6.1) • Unit Test (☞ Page 282, Section 11.5) When operating the station number setting switch, use a flathead screwdriver with a tip width of 3.5mm or less.
2)	PW LED (green)	Indicates the power supply status of the temperature control module. • On: Power-on • Off: Power-off
	RUN LED (green)	Indicates the operating status of the temperature control module. • On: Operating normally • Off: Major error occurred
	MODE LED (green)	Indicates the mode of the temperature control module. • On: In online mode • Flashing: In unit test mode • Off: At completion of unit test
	D LINK LED (green)	Indicates the data link status of the temperature control module. • On: Data link established (cyclic transmission in progress) • Flashing: Data link established (cyclic transmission stopped) • Off: Data link not established (disconnected)
	ERR. LED (red)	Indicates the error status of the temperature control module. • On: Moderate error or major error occurred • Flashing: Warning issued • Off: Operating normally
	ALM LED (red)	Indicates the alarm status of the temperature control module. • On: Alert 1 to 4 issued, Process alarm upper lower limit alert issued, or Rate alarm upper lower limit alert issued • Flashing: Out of range of PV range measured temperature value upper lower limit or in loop disconnection detection • Off: No alarm of the module

Number	Name	Description
3)	P1	PORT1 connector for CC-Link IE Field Network (RJ45 connector) Connect an Ethernet cable. There are no restrictions on the connection order of the cables for the P1 connector and P2 connector.
	L ER LED (red)	Indicates the line error status. • On: Module received error data or module performing a loopback • Off: Module received normal data or module not performed a loopback
	LINK LED (green)	indicates the link status. • On: Link-up (communicating with other stations normally) • Off: Link-down (not communicating with other stations normally)
	P2	PORT2 connector for CC-Link IE Field Network (RJ45 connector) Connect an Ethernet cable. There are no restrictions on the connection order of the cables for the P1 connector and P2 connector.
	L ER LED (red)	(Same as the P1 connector)
	LINK LED (green)	
4)	Terminal block for module power supply and FG	A terminal block to connect the module power supply (24VDC) and FG
5)	DIN rail hook	A hook to mount a module on a DIN rail
6)	Terminal block cover	Covers for preventing electric shock while the power is on.
	Terminal block for external device connection	Used for temperature sensor input and transistor output ☞ Page 96, Section 6.6
7)	Cold junction temperature compensation resistor (NZ2GF2B-60TCTT4 only)	Used when the NZ2GF2B-60TCTT4 performs cold junction temperature compensation

(1) Module status and LED status

The following table lists the correspondence between the module status and the LED status.

Module status		Data link status	LED status					
			PW LED	RUN LED	MODE LED	D LINK LED	ERR. LED	ALM LED
Normal mode	Disconnected	Disconnection	On	On	On	Off	Off	Off
	Data link established	Data link established	On	On	On	On	Off	Off
	Reserved station specification in progress	Cyclic stopped	On	On	On	Flashing	Off	Off
	Link stopped	Cyclic stopped	On	On	On	Flashing	Off	Off
Unit test	In progress	—	On	On	Flashing	*1	Off	Off
	Normal completion	—	On	On	Off	Off	Off	Off
	Abnormal completion	—	On	On	Off	Off	On	Off
Communication error		Cyclic stopped	On	On	On	Flashing	Off	Off
Error	Major error	—	On	Off	*2	*1	On*4	*1
	Moderate error	—	On	On	*2	*1	On	*1
Warning	Minor error	—	On	On	*2	*1	Flashing	*1
Alarm		—	On	On	On	*1	*1	*3

*1 The status can be either On, Flashing, or Off.
*2 The status can be either On or Off.
*3 The status can be either On or Flashing.
*4 When there is a failure of the module, the LED may not turn on.

CHAPTER 3 SPECIFICATIONS

This chapter describes the specifications of the temperature control module.

3.1 General Specifications

<table>
<tr><th>Item</th><th colspan="6">Specifications</th></tr>
<tr><td>Operating ambient temperature</td><td colspan="6">0 to 55℃</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="6">-25 to 75℃</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="6" rowspan="2">5 to 95%RF, non-condensing</td></tr>
<tr><td>Storage ambient humidity</td></tr>
<tr><td rowspan="5">Vibration resistance</td><td rowspan="5">Compliant with JIS B 3502 and IEC 61131-2</td><td></td><td>Frequency</td><td>Constant acceleration</td><td>Half amplitude</td><td>Number of sweeps</td></tr>
<tr><td rowspan="2">Under intermittent vibration</td><td>5 to 8.4Hz</td><td>—</td><td>3.5mm</td><td rowspan="2">10 times each in X, Y, and Z directions</td></tr>
<tr><td>8.4 to 150Hz</td><td>9.8m/s^2</td><td>—</td></tr>
<tr><td rowspan="2">Under continuous vibration</td><td>5 to 8.4Hz</td><td>—</td><td>1.75mm</td><td rowspan="2">—</td></tr>
<tr><td>8.4 to 150Hz</td><td>4.9m/s^2</td><td>—</td></tr>
<tr><td>Shock resistance</td><td colspan="6">Compliant with JIS B 3502 and IEC 61131-2 (147m/s^2, 3 times each in X, Y, and Z directions)</td></tr>
<tr><td>Operating atmosphere</td><td colspan="6">No corrosive gases</td></tr>
<tr><td>Operating altitude*1</td><td colspan="6">0 to 2000m</td></tr>
<tr><td>Installation location</td><td colspan="6">Inside a control panel*2</td></tr>
<tr><td>Overvoltage category*3</td><td colspan="6">II or less</td></tr>
<tr><td>Pollution degree*4</td><td colspan="6">2 or less</td></tr>
<tr><td>Equipment class</td><td colspan="6">Class I</td></tr>
</table>

*1 Do not use or store the temperature control module under pressure higher than the atmospheric pressure of altitude 0m. Doing so may cause malfunction. When using the temperature control module under pressure, please consult your local Mitsubishi representative.

*2 If the environment satisfies the operating ambient temperature, operating ambient humidity and other conditions, the module can be used even outside the control panel.

*3 This indicates the section of the power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within premises. Category II applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for the equipment with the rated voltage of 300V or less is 2500V.

*4 This index indicates the degree to which conductive material is generated in terms of the environment in which the equipment is used. Pollution degree 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.

Point

To use the temperature control module complying with the EMC Directive, refer to the following.

☞ Page 368, Appendix 4

3.2 Performance Specifications

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="2">Specifications</th></tr>
<tr><th>NZ2GF2B-60TCTT4</th><th>NZ2GF2B-60TCRT4</th></tr>
<tr><td colspan="3">Control output</td><td colspan="2">Transistor output</td></tr>
<tr><td colspan="3">Number of temperature input points</td><td colspan="2">4 channels/module</td></tr>
<tr><td colspan="3">Type of usable temperature sensors, the temperature measurement range, the resolution, and the effect from wiring resistance of 1Ω</td><td colspan="2">☞ Page 36, Section 3.2 (1)</td></tr>
<tr><td rowspan="5">Accuracy[*1]</td><td rowspan="2">Indication accuracy</td><td>Ambient temperature: 25℃±5℃</td><td colspan="2">Full scale × (±0.3%)</td></tr>
<tr><td>Ambient temperature: 0℃ to 5℃</td><td colspan="2">Full scale × (±0.7%)</td></tr>
<tr><td rowspan="3">Cold junction temperature compensation accuracy (ambient temperature: 0℃ to 55℃)</td><td>Temperature process value (PV): -100℃ or more</td><td>Within ±1.0℃</td><td rowspan="3">—</td></tr>
<tr><td>Temperature process value (PV): -150℃ to -100℃</td><td>Within ±2.0℃</td></tr>
<tr><td>Temperature process value (PV): -200℃ to -150℃</td><td>Within±3.0℃</td></tr>
<tr><td colspan="3">Sampling cycle</td><td colspan="2">250ms/4 channels
500ms/4 channels</td></tr>
<tr><td colspan="3">Control output cycle</td><td colspan="2">0.5 to 100.0s</td></tr>
<tr><td colspan="3">Input impedance</td><td colspan="2">1MΩ</td></tr>
<tr><td colspan="3">Input filter</td><td colspan="2">0 to 100s (0: Input filter OFF)</td></tr>
<tr><td colspan="3">Sensor correction value setting</td><td colspan="2">-50.00 to 50.00%</td></tr>
<tr><td colspan="3">Operation at sensor input disconnection</td><td colspan="2">Upscale processing</td></tr>
<tr><td colspan="3">Temperature control method</td><td colspan="2">PID ON/OFF pulse or two-position control</td></tr>
<tr><td colspan="2" rowspan="4">PID constants range</td><td>PID constants setting</td><td colspan="2">Can be set by auto tuning.</td></tr>
<tr><td>Proportional band (P)</td><td colspan="2">0.0 to 1000.0% (0: Two-position control)</td></tr>
<tr><td>Integral time (I)</td><td colspan="2">0 to 3600s (set 0 for P control and PD control.)</td></tr>
<tr><td>Derivative time (D)</td><td colspan="2">0 to 3600s (set 0 for P control and PI control.)</td></tr>
<tr><td colspan="3">Set value (SV) setting range</td><td colspan="2">Within the temperature range set in the thermocouple/platinum resistance thermometer to be used</td></tr>
<tr><td colspan="3">Dead band setting range</td><td colspan="2">0.1 to 10.0%</td></tr>
<tr><td rowspan="7">Transistor output</td><td colspan="2">Output signal</td><td colspan="2">ON/OFF pulse</td></tr>
<tr><td colspan="2">Rated load voltage</td><td colspan="2">10 to 30VDC</td></tr>
<tr><td colspan="2">Max. load current</td><td colspan="2">0.1A/point, 0.4A/common</td></tr>
<tr><td colspan="2">Max. inrush current</td><td colspan="2">0.4A 10ms</td></tr>
<tr><td colspan="2">Leakage current at OFF</td><td colspan="2">0.1mA or less</td></tr>
<tr><td colspan="2">Max. voltage drop at ON</td><td colspan="2">1.0VDC (TYP) at 0.1A 2.5VDC (MAX) at 0.1A</td></tr>
<tr><td colspan="2">Response time</td><td colspan="2">OFF → ON: 2ms or less, ON → OFF: 2ms or less</td></tr>
<tr><td colspan="3">Number of accesses to non-volatile memory</td><td colspan="2">Max. 10^{12} times</td></tr>
<tr><td colspan="3">Isolation method</td><td colspan="2">Between all power supply and communication system input terminals and all input terminals: Transformer isolation and digital isolator isolation
Between input channels: Transformer isolation and digital isolator isolation
Between all power supply and communication system terminals and all output terminals: Photocoupler isolation</td></tr>
<tr><td colspan="3">Withstand voltage</td><td colspan="2">Between all power supply and communication system terminals and all input terminals: 500VAC for 1 minute
Between input channels: 500VAC for 1 minute
Between all power supply and communication system terminals and all output terminals: 500VAC for 1 minute</td></tr>
<tr><td colspan="3">Noise immunity</td><td colspan="2">Noise voltage 500Vp-p, noise width 1μs, noise frequency 25 to 60Hz (noise simulator condition)</td></tr>
</table>

Item		Specifications	
		NZ2GF2B-60TCTT4	NZ2GF2B-60TCRT4
External connection system	Communication part	RJ45 connector	
	Module power supply part	Terminal block for module power supply and FG Tightening torque range for terminal screw (M2.5 screw): 0.5 to 0.6N·m	
	I/O part	18-point terminal block (M3 screw) Tightening torque range for terminal screw (M3 screw): 0.42 to 0.58N·m	
Applicable DIN rail		TH35-7.5Fe, TH35-7.5Al (compliant with IEC 60715)	
Applicable wire size	For power supply	Core: 0.5 to 1.5mm^2 (20 to 16 AWG)	
	For I/O	Core: 0.3 to 0.75mm^2 (22 to 18 AWG)	
Applicable solderless terminal	Terminal block for module power supply and FG*2	TE 0.5-10 (Nichifu Co., Ltd.) [Applicable wire size: 0.5mm^2] TE 0.75-10 (Nichifu Co., Ltd.) [Applicable wire size: 0.75mm^2] TE 1.0-10 (Nichifu Co., Ltd.) [Applicable wire size: 0.9 to 1.0mm^2] TE 1.5-10 (Nichifu Co., Ltd.) [Applicable wire size: 1.25 to 1.5mm^2] AI 0.5-10WH (Phoenix Contact Co., Ltd.) [Applicable wire size: 0.5mm^2] AI 0.75-10GY (Phoenix Contact Co., Ltd.) [Applicable wire size: 0.75mm^2] AI 1-10RD (Phoenix Contact Co., Ltd.) [Applicable wire size: 1.0mm^2] AI 1.5-10BK (Phoenix Contact Co., Ltd.) [Applicable wire size: 1.5mm^2]	
	Terminal block for I/O signals	R1.25-3 (Solderless terminal with sleeve is unavailable.)	
Station type		Remote device station	
Cyclic transmission	RX/RY points	64 points	
	RWr/RWw points	32 points	
Communication cable		An Ethernet cable that meets the 1000BASE-T standard: Category 5e or higher (double shielded, STP), straight cable	
Availability of connecting extension module		Not connectable	
External power supply		24VDC (20.4 to 28.8VDC) Inrush current: 27.9A (for 1.5ms or shorter) Current consumption: 230mA	24VDC (20.4 to 28.8VDC) Inrush current: 28.4A (for 1.5ms or shorter) Current consumption: 230mA
Weight		0.35kg	

*1 Calculate the accuracy in the following method (only when it is not affected by noise).
Accuracy (℃) = full scale × indication accuracy + cold junction temperature compensation accuracy

Ex. Accuracy at the input range of 38 (-200.0℃ to 400.0℃), the operating ambient temperature of 35℃, and Temperature process value (PV) of 300℃
(Full scale) × (indication accuracy) + cold junction temperature compensation accuracy = (400.0℃ - (-200.0℃)) × (±0.007) + (±1.0℃) = ±5.2℃

*2 Do not connect two or more wires to the terminal.

For the noise immunity, withstand voltage, insulation resistance, and others of the programmable controller system which uses the temperature control module, refer to the following.

User's manual for the CPU module to be used

(1) Type of usable temperature sensors, temperature measurement range, resolution, and effect from wiring resistance of 1Ω

This section describes the types of temperature sensors that can be used with the temperature control module, the temperature measurement range, the resolution, and the effect from wiring resistance of 1Ω.

Set the temperature sensor to be used in the following remote buffer memory area.

- CH☐ Input range (address: 100H, 130H, 160H, 190H) (☞ Page 312, Appendix 3 (5))

(a) NZ2GF2B-60TCTT4

The following table lists the types of thermocouples that can be used with the NZ2GF2B-60TCTT4, the temperature measurement range, the resolution, and the effect from wiring resistance of 1Ω.

Thermocouple type	℃			℉		
	Temperature measurement range	Resolution	Effect from wiring resistance of 1Ω (℃/Ω)*1	Temperature measurement range	Resolution	Effect from wiring resistance of 1Ω (℉/Ω)*1
R	0 to 1700	1	0.030	0 to 3000	1	0.054
K	0 to 500 0 to 800 0 to 1300	1	0.005	0 to 1000 0 to 2400	1	0.008
	-200.0 to 1300.0 -200.0 to 400.0 0.0 to 400.0 0.0 to 500.0 0.0 to 800.0	0.1		0.0 to 1000.0	0.1	
J	0 to 500 0 to 800 0 to 1200	1	0.003	0 to 1000 0 to 1600 0 to 2100	1	0.006
	-200.0 to 1000.0 0.0 to 400.0 0.0 to 500.0 0.0 to 800.0	0.1		0.0 to 1000.0	0.1	
T	-200 to 400 -200 to 200 0 to 200 0 to 400	1	0.004	0 to 700 -300 to 400	1	0.008
	-200.0 to 400.0 0.0 to 400.0	0.1		0.0 to 700.0	0.1	
S	0 to 1700	1	0.030	0 to 3000	1	0.054
B	0 to 1800*2	1	0.038	0 to 3000*2	1	0.068
E	0 to 400 0 to 1000	1	0.003	0 to 1800	1	0.005
	-200.0 to 1000.0 0.0 to 700.0	0.1		—	—	—
N	0 to 1300	1	0.006	0 to 2300	1	0.011
	0.0 to 1000.0	0.1		—	—	—
U	0 to 400 -200 to 200	1	0.004	0 to 700 -300 to 400	1	0.009
	0.0 to 600.0	0.1		—	—	—
L	0 to 400 0 to 900	1	0.003	0 to 800 0 to 1600	1	0.006
	0.0 to 400.0 0.0 to 900.0	0.1		—	—	—
PLII	0 to 1200	1	0.005	0 to 2300	1	0.010
W5Re/W26Re	0 to 2300	1	0.017	0 to 3000	1	0.021

*1 Means temperature error per 1Ω of wiring resistance of the thermocouple. The error varies depending on measured temperature or ambient temperature. The temperature error can be corrected by the sensor correction function.
☞ Page 132, Section 8.1.5

*2 While temperature can be measured within less than 400℃/800℉, the accuracy cannot be guaranteed.

(b) NZ2GF2B-60TCRT4

The following table lists the types of platinum resistance thermometer that can be used with the NZ2GF2B-60TCRT4 and temperature measurement range.

Platinum resistance thermometer type	℃		℉	
	Temperature measurement range	Resolution	Temperature measurement range	Resolution
Pt100	-200.0 to 850.0 -200.0 to 600.0 -200.0 to 200.0	0.1	-300 to 1100	1
			-300.0 to 300.0	0.1
JPt100	-200.0 to 640.0 -200.0 to 500.0 -200.0 to 200.0	0.1	-300 to 900	1
			-300.0 to 300.0	0.1

(2) Sampling cycle and control output cycle

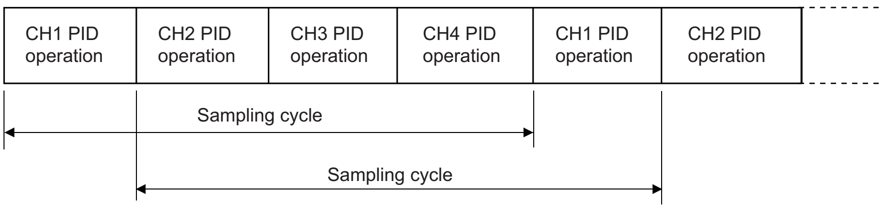
This section describes the sampling cycle and control output cycle of the temperature control module.

(a) Sampling cycle

The temperature control module performs PID operations in the order of CH1, CH2, CH3, CH4, CH1, CH2 .....
The time from when PID operation is started on the current channel (CHn) until PID operation is restarted on the current channel (CHn) is called a sampling cycle. Select 250ms or 500ms as a sampling cycle.

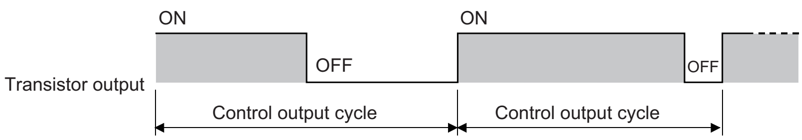
- Sampling cycle selection (address: 1H. b12) (☞ Page 310, Appendix 3 (1) (e))

The number of used channels and the settings of unused channels do not affect the sampling cycle.



(b) Control output cycle

The control output cycle is the ON/OFF cycle of transistor output.



The manipulated value (MV) represents the ON time of the control output cycle in percentage.
Set the control output cycle in the following remote buffer memory area in the range of 1 to 100s (or 0.5 to 100.0s).

- CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) (☞ Page 326, Appendix 3 (15))

In the heating-cooling control, the following remote buffer memory areas are used for the manipulated value (MV) and control output cycle.

Data type	Target	Reference
Manipulated value (MV)	CH☐ Manipulated value for heating (MVh) (RWr10 to RWr13)	Page 305, Appendix 2 (8)
	CH☐ Manipulated value for cooling (MVc) (RWr14 to RWr17)	
Control output cycle	CH☐ Heating control output cycle setting (address: 10CH, 13CH, 16CH, 19CH)	Page 326, Appendix 3 (15)
	CH☐ Cooling control output cycle setting (address: 1C6H, 1CBH, 1D0H, 1D5H)	

3

3.2 Performance Specifications

3.3 Function List

(1) Common Functions

Item	Description	Reference
Operation/stop function	Whether to operate or stop the temperature conversion and the temperature control can be set for each channel.	Page 125, Section 8.1.1
Temperature conversion method	A measured value is stored into CH□ Temperature process value (PV) (RWr8 to RWrB) in every sampling cycle. In addition, the use of the primary delay digital filter smoothens the temperature process value (PV), and its drastic change can be absorbed.	Page 126, Section 8.1.2
Moving averaging process to a temperature process value (PV)	Moving averaging process can be set to a temperature process value (PV). With this function, the fluctuation of temperature process values (PV) can be reduced in electrically noisy environments or in the environments where temperature process values (PV) fluctuate greatly. The moving averaging process can be disabled to hasten the response to the change of temperature process values (PV).	Page 129, Section 8.1.3
Temperature process value (PV) scaling function	The temperature process value (PV) is scaled up or down to the value in a set range, and can be stored into the remote register using this function.	Page 130, Section 8.1.4
Sensor correction function	When a difference occurs between the temperature process value (PV) and the actual temperature due to reasons such as a measuring condition, the difference can be corrected using this function. The following two types are available. • Normal sensor correction (one-point correction) function: The percentage of the full scale of the set input range can be corrected as an error corrected value. • Sensor two-point correction function: With this function, the difference between the temperature process value (PV) and the actual temperature between the two points selected in advance (a corrected offset value and a corrected gain value) is stored. Based on this gradient, the difference between a sensor and the actual temperature is corrected.	Page 132, Section 8.1.5
Auto-setting at input range change	When an input range is changed, using this function automatically changes related parameter data to prevent an error outside the setting range.	Page 135, Section 8.1.6
Set value backup	This function allows remote buffer memory data to be stored in the non-volatile memory and backed up. The backed-up data is transferred from the non-volatile memory to the remote buffer memory when the power is turned off and on. Therefore, temperature can be controlled without newly writing data when the power is turned off and on.	Page 136, Section 8.1.7

(2) When the module is used as a temperature input module

Item	Description	Reference
Alert output function	An alert can be output when the temperature process value (PV) meets the condition set in advance using this function. There are two types of alert: process alarm and rate alarm.	Page 139, Section 8.2.1

(3) When the module is used as a temperature control module

Item	Description	Enable or disable		Reference
		Standard control	Heating-cooling control	
Control mode selection function	A control mode can be selected using this function. • Standard control • Heating-cooling control (normal mode) • Heating-cooling control (expanded mode) • Mix control (normal mode) • Mix control (expanded mode)	○	○	Page 145, Section 8.3.1
HOLD/CLEAR function	Whether to continue or stop the control when a stop error of the CPU module occurs or the communication is disconnected can be selected using this function.	○	○	Page 148, Section 8.3.2
Control method	The following control methods can be used with the settings of proportional band (P), integral time (I), and derivative time (D). • Two-position control • P control • PI control • PD control • PID control	○	○	Page 149, Section 8.3.3

Item	Description	Enable or disable		Reference
		Standard control	Heating-cooling control	
Manual reset function	The position of the stable condition in P control or PD control can be shifted manually using this function.	○	○	Page 155, Section 8.3.4
Manual control	Manual control is a form of control for which the user sets the manipulated value (MV) manually instead of obtaining it automatically by PID control.	○	○	Page 157, Section 8.3.5
Control output cycle unit selection function	The unit of the control output cycle can be selected from 1s or 0.1s using this function. When the control output cycle is set in 0.1s, control can be more attentive.	○	○	Page 158, Section 8.3.6
Auto tuning function	The auto tuning function is designed for the temperature control module to set the optimum PID constants automatically.	○	○	Page 159, Section 8.3.7
Simple two-degree-of-freedom	This is the simplified control form of the two-degree-of-freedom PID control. In this form of PID control, the temperature control module controls the target subject using not only PID constants but also the control response parameter. The response speed toward the change of the set value (SV) can be selected from three levels.	○	○	Page 166, Section 8.3.9
Derivative action selection function	A derivative action appropriate for each of fixed value action and ramp action can be selected and the action characteristic can be improved using this function.	○	○	Page 166, Section 8.3.9
Setting change rate limiter setting function	When the set value (SV) is changed, the change rate in the specified time unit can be set on "Setting Change Rate Limiter Setting". The user can select whether to set this rate for temperature rise and temperature drop individually or at once.	○	○	Page 167, Section 8.3.10
Alert function	When the temperature process value (PV) or deviation (E) reaches the value set in advance, the system is set in an alert status.	○	○	Page 169, Section 8.3.11
RFB limiter function	The RFB (reset feed back) function operates when deviation (E) continues for a long period of time. In such an occasion, this function limits the PID operation result (manipulated value (MV)) from an integral action so that it does not exceed the valid range of the manipulated value (MV).	○	○	Page 180, Section 8.3.12
Input/output (with another analog module) function	Input and output can be processed using other analog modules (such as an A/D converter module or D/A converter module) in the system.	○	○	Page 181, Section 8.3.13
ON delay output function	This function allows the user to set the delay (response/scan time delay/communication delay) of transistor output.	○	○	Page 183, Section 8.3.14
Self-tuning function	The temperature control module constantly monitors the control state. When the control system is oscillatory, this function allows PID constants to be automatically changed under the following situations such as: After the control has been just started, When the set value (SV) is changed, and When the characteristics of a controlled object fluctuates.	○	×	Page 184, Section 8.3.15
Peak current suppression function	The upper limit output limiter value for each channel is changed automatically and the peak current is suppressed by dividing timing for transistor outputs using this function.	○	×	Page 193, Section 8.3.16
Simultaneous temperature rise function	This function allows several loops to reach the set value (SV) at the same time.	○	×	Page 198, Section 8.3.17
Forward/reverse action selection function	Whether PID operation is performed with forward action or reverse action can be selected using this function.	○	×	Page 211, Section 8.3.18
Loop disconnection detection function	Using this function detects an error occurring within a control system (control loop) due to reasons such as a load (heater) disconnection, an externally-operable device (such as a magnetic relay) failure, and input disconnection.	○	×	Page 212, Section 8.3.19
AT loop disconnection detection function	A loop disconnection can be detected during auto tuning (AT) using this function.	○	×	Page 214, Section 8.3.20
Proportional band setting function	Proportional band (P) values can be set for heating and cooling separately using this function.	×	○	Page 216, Section 8.3.21
Cooling method setting function	An auto tuning calculation formula is automatically selected according to the selected cooling method during auto tuning and the operation is started using this function.	×	○	Page 217, Section 8.3.22
Overlap/dead band function	The temperature where the cooling control output starts can be shifted using this function; therefore, whether control stability is prioritized or energy saving is prioritized can be selected.	×	○	Page 219, Section 8.3.23

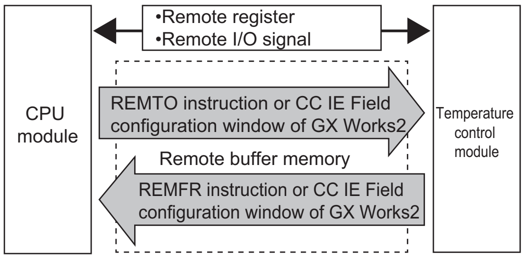
Item	Description	Enable or disable		Reference
		Standard control	Heating-cooling control	
Temperature conversion function (using unused channels)	In heating-cooling control (normal mode) and mix control (normal mode), only temperature measurement can be performed by using unused temperature input terminals.	×	○	Page 222, Section 8.3.24

(4) CC-Link IE Field Network Function

Item	Description	Reference
Cyclic data update watch function	This function is used to watch the time interval between updates on cyclic data. When an update by cyclic transmission remains to be done for a set period of time for watching, the module "continues its operation and produces external outputs (HOLD)" or "stops its operation and external outputs (CLEAR)".	Page 224, Section 8.4.1
Error notification function	When an error, warning, or alarm occurs, the temperature control module notifies the master station of it using remote input signals and remote registers.	Page 225, Section 8.4.2
CC-Link IE Field Network diagnostic function	With this function, whether any network error occurs or not can be checked through GX Works2 connected to the CPU module.	Page 229, Section 8.4.3

3.4 Remote I/O Interface

The temperature control module has remote I/O signals (RX/RY), remote register (RWr/RWw), and remote buffer memory as I/O Interfaces.



(1) Remote I/O signals (RX/RY)

With the cyclic transmission, a signal can be turned on or off without a program. Interlocks for writing parameter for control arranged in remote buffer memory areas and signals that indicate the operating status of the temperature control module are arranged.

(2) Remote register (RWr/RWw)

With the cyclic transmission, data can be read or written without a program.

- Rwr: Monitoring data that indicates the operating status of the temperature control module is arranged.
- RWw: Parameter for control which can be written immediately is arranged.

(3) Remote buffer memory

Module parameter and parameter for control which can be written with both the CPU module and temperature control module are arranged. To receive data, use the REMFR or REMTO instruction.
Programming is reduced since the parameter can be configured on the window with the CC IE Field configuration of GX Works2.

3.5 List of Remote I/O Signals

This section lists I/O signals for a master/local module. In the program example described in this section, the remote I/O signals of the main module are assigned to the I/O numbers of RX0 to RX3F and RY0 to RY3F.
Remote input (RX) indicates the input signal from the temperature control module to the master/local module. Remote output (RY) indicates the output signal from the master/local module to the temperature control module.
For details on the remote I/O signal, refer to the following.
☞ Page 284, Appendix 1

(1) List of Remote input signals

Remote input signal				
Signal direction: Temperature control module → Master/local module				
Device number	**Temperature input**	**Standard control**	**Heating-cooling control**	**Mix control**
RX0 to RX6	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RX7	Warning flag	Warning flag	Warning flag	Warning flag
RX8	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RX9	Initial data setting completed flag	Initial data setting completed flag	Initial data setting completed flag	Initial data setting completed flag
RXA	Error flag	Error flag	Error flag	Error flag
RXB	Remote READY	Remote READY	Remote READY	Remote READY
RXC to RXF	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RX10	During operation setting change completion flag	During operation setting change completion flag	During operation setting change completion flag	During operation setting change completion flag
RX11	CH1 Operation monitor	CH1 Operation monitor	CH1 Operation monitor	CH1 Operation monitor
RX12	CH2 Operation monitor	CH2 Operation monitor	CH2 Operation monitor	CH2 Operation monitor[*2]
RX13	CH3 Operation monitor	CH3 Operation monitor	CH3 Operation monitor[*1]	CH3 Operation monitor
RX14	CH4 Operation monitor	CH4 Operation monitor	CH4 Operation monitor[*1]	CH4 Operation monitor
RX15	Back-up of the set value completion flag	Back-up of the set value completion flag	Back-up of the set value completion flag	Back-up of the set value completion flag
RX16	Default value write completion flag	Default value write completion flag	Default value write completion flag	Default value write completion flag
RX17	Back-up of the set value fail flag	Back-up of the set value fail flag	Back-up of the set value fail flag	Back-up of the set value fail flag
RX18	CH1 Alert occurrence flag	CH1 Alert occurrence flag	CH1 Alert occurrence flag	CH1 Alert occurrence flag
RX19	CH2 Alert occurrence flag	CH2 Alert occurrence flag	CH2 Alert occurrence flag	CH2 Alert occurrence flag[*2]
RX1A	CH3 Alert occurrence flag	CH3 Alert occurrence flag	CH3 Alert occurrence flag[*1]	CH3 Alert occurrence flag
RX1B	CH4 Alert occurrence flag	CH4 Alert occurrence flag	CH4 Alert occurrence flag[*1]	CH4 Alert occurrence flag
RX1C	Use prohibited	CH1 Temperature rise judgment flag	CH1 Temperature rise judgment flag	CH1 Temperature rise judgment flag
RX1D	Use prohibited	CH2 Temperature rise judgment flag	CH2 Temperature rise judgment flag	CH2 Temperature rise judgment flag[*2]
RX1E	Use prohibited	CH3 Temperature rise judgment flag	CH3 Temperature rise judgment flag[*1]	CH3 Temperature rise judgment flag
RX1F	Use prohibited	CH4 Temperature rise judgment flag	CH4 Temperature rise judgment flag[*1]	CH4 Temperature rise judgment flag
RX20	Use prohibited	CH1 Auto tuning status	CH1 Auto tuning status	CH1 Auto tuning status
RX21	Use prohibited	CH2 Auto tuning status	CH2 Auto tuning status	CH2 Auto tuning status[*2]
RX22	Use prohibited	CH3 Auto tuning status	CH3 Auto tuning status[*1]	CH3 Auto tuning status
RX23	Use prohibited	CH4 Auto tuning status	CH4 Auto tuning status[*1]	CH4 Auto tuning status
RX24	Use prohibited	CH1 Simultaneous temperature rise status	Use prohibited	Use prohibited

Remote input signal				
Signal direction: Temperature control module → Master/local module				
Device number	**Temperature input**	**Standard control**	**Heating-cooling control**	**Mix control**
RX25	Use prohibited	CH2 Simultaneous temperature rise status	Use prohibited	Use prohibited
RX26	Use prohibited	CH3 Simultaneous temperature rise status	Use prohibited	CH3 Simultaneous temperature rise status
RX27	Use prohibited	CH4 Simultaneous temperature rise status	Use prohibited	CH4 Simultaneous temperature rise status
RX28	CH1 Sensor two-point correction offset latch completion flag	CH1 Sensor two-point correction offset latch completion flag	CH1 Sensor two-point correction offset latch completion flag	CH1 Sensor two-point correction offset latch completion flag
RX29	CH1 Sensor two-point correction gain latch completion flag	CH1 Sensor two-point correction gain latch completion flag	CH1 Sensor two-point correction gain latch completion flag	CH1 Sensor two-point correction gain latch completion flag
RX2A	CH2 Sensor two-point correction offset latch completion flag	CH2 Sensor two-point correction offset latch completion flag	CH2 Sensor two-point correction offset latch completion flag	CH2 Sensor two-point correction offset latch completion flag
RX2B	CH2 Sensor two-point correction gain latch completion flag	CH2 Sensor two-point correction gain latch completion flag	CH2 Sensor two-point correction gain latch completion flag	CH2 Sensor two-point correction gain latch completion flag
RX2C	CH3 Sensor two-point correction offset latch completion flag	CH3 Sensor two-point correction offset latch completion flag	CH3 Sensor two-point correction offset latch completion flag	CH3 Sensor two-point correction offset latch completion flag
RX2D	CH3 Sensor two-point correction gain latch completion flag	CH3 Sensor two-point correction gain latch completion flag	CH3 Sensor two-point correction gain latch completion flag	CH3 Sensor two-point correction gain latch completion flag
RX2E	CH4 Sensor two-point correction offset latch completion flag	CH4 Sensor two-point correction offset latch completion flag	CH4 Sensor two-point correction offset latch completion flag	CH4 Sensor two-point correction offset latch completion flag
RX2F	CH4 Sensor two-point correction gain latch completion flag	CH4 Sensor two-point correction gain latch completion flag	CH4 Sensor two-point correction gain latch completion flag	CH4 Sensor two-point correction gain latch completion flag
RX30	Use prohibited	CH1 Transistor output flag	CH1 Heating transistor output flag	CH1 Heating transistor output flag
RX31	Use prohibited	CH1 ON delay output flag	CH1 Heating ON delay output flag	CH1 Heating ON delay output flag
RX32	Use prohibited	CH2 Transistor output flag	CH2 Heating transistor output flag	CH2 Heating transistor output flag[*2]
RX33	Use prohibited	CH2 ON delay output flag	CH2 Heating ON delay output flag	CH2 Heating ON delay output flag[*2]
RX34	Use prohibited	CH3 Transistor output flag	CH3 Heating transistor output flag[*1]	CH3 Transistor output flag
RX35	Use prohibited	CH3 ON delay output flag	CH3 Heating ON delay output flag[*1]	CH3 ON delay output flag
RX36	Use prohibited	CH4 Transistor output flag	CH4 Heating transistor output flag[*1]	CH4 Transistor output flag
RX37	Use prohibited	CH4 ON delay output flag	CH4 Heating ON delay output flag[*1]	CH4 ON delay output flag
RX38	Use prohibited	Use prohibited	CH1 Cooling transistor output flag	CH1 Cooling transistor output flag
RX39	Use prohibited	Use prohibited	CH1 Cooling ON delay output flag	CH1 Cooling ON delay output flag
RX3A	Use prohibited	Use prohibited	CH2 Cooling transistor output flag	CH2 Cooling transistor output flag[*2]
RX3B	Use prohibited	Use prohibited	CH2 Cooling ON delay output flag	CH2 Cooling ON delay output flag[*2]
RX3C	Use prohibited	Use prohibited	CH3 Cooling transistor output flag[*1]	Use prohibited

Remote input signal				
Signal direction: Temperature control module → Master/local module				
Device number	Temperature input	Standard control	Heating-cooling control	Mix control
RX3D	Use prohibited	Use prohibited	CH3 Cooling ON delay output flag*1	Use prohibited
RX3E	Use prohibited	Use prohibited	CH4 Cooling transistor output flag*1	Use prohibited
RX3F	Use prohibited	Use prohibited	CH4 Cooling ON delay output flag*1	Use prohibited

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

(2) List of Remote output signals

Remote output				
Signal direction: Master/local module → Temperature control module				
Device number	**Temperature input**	**Standard control**	**Heating-cooling control**	**Mix control**
RY0 to RY8	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RY9	Initial data setting request flag	Initial data setting request flag	Initial data setting request flag	Initial data setting request flag
RYA	Error clear request flag	Error clear request flag	Error clear request flag	Error clear request flag
RYB to RYF	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RY10	During operation setting change instruction	During operation setting change instruction	During operation setting change instruction	During operation setting change instruction
RY11	CH1 Operation request flag	CH1 Operation request flag	CH1 Operation request flag	CH1 Operation request flag
RY12	CH2 Operation request flag	CH2 Operation request flag	CH2 Operation request flag	CH2 Operation request flag*2
RY13	CH3 Operation request flag	CH3 Operation request flag	CH3 Operation request flag*1	CH3 Operation request flag
RY14	CH4 Operation request flag	CH4 Operation request flag	CH4 Operation request flag*1	CH4 Operation request flag
RY15	Set value backup instruction	Set value backup instruction	Set value backup instruction	Set value backup instruction
RY16	Default setting registration instruction	Default setting registration instruction	Default setting registration instruction	Default setting registration instruction
RY17	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RY18	CH1 Stop request flag	CH1 Stop request flag	CH1 Stop request flag	CH1 Stop request flag
RY19	CH2 Stop request flag	CH2 Stop request flag	CH2 Stop request flag	CH2 Stop request flag*2
RY1A	CH3 Stop request flag	CH3 Stop request flag	CH3 Stop request flag*1	CH3 Stop request flag
RY1B	CH4 Stop request flag	CH4 Stop request flag	CH4 Stop request flag*1	CH4 Stop request flag
RY1C to RY1F	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RY20	Use prohibited	CH1 Auto tuning instruction	CH1 Auto tuning instruction	CH1 Auto tuning instruction
RY21	Use prohibited	CH2 Auto tuning instruction	CH2 Auto tuning instruction	CH2 Auto tuning instruction*2
RY22	Use prohibited	CH3 Auto tuning instruction	CH3 Auto tuning instruction*1	CH3 Auto tuning instruction
RY23	Use prohibited	CH4 Auto tuning instruction	CH4 Auto tuning instruction*1	CH4 Auto tuning instruction
RY24 to RY27	Use prohibited	Use prohibited	Use prohibited	Use prohibited
RY28	CH1 Sensor two-point correction offset latch request	CH1 Sensor two-point correction offset latch request	CH1 Sensor two-point correction offset latch request	CH1 Sensor two-point correction offset latch request
RY29	CH1 Sensor two-point correction gain latch request	CH1 Sensor two-point correction gain latch request	CH1 Sensor two-point correction gain latch request	CH1 Sensor two-point correction gain latch request
RY2A	CH2 Sensor two-point correction offset latch request	CH2 Sensor two-point correction offset latch request	CH2 Sensor two-point correction offset latch request	CH2 Sensor two-point correction offset latch request
RY2B	CH2 Sensor two-point correction gain latch request	CH2 Sensor two-point correction gain latch request	CH2 Sensor two-point correction gain latch request	CH2 Sensor two-point correction gain latch request
RY2C	CH3 Sensor two-point correction offset latch request	CH3 Sensor two-point correction offset latch request	CH3 Sensor two-point correction offset latch request	CH3 Sensor two-point correction offset latch request
RY2D	CH3 Sensor two-point correction gain latch request	CH3 Sensor two-point correction gain latch request	CH3 Sensor two-point correction gain latch request	CH3 Sensor two-point correction gain latch request
RY2E	CH4 Sensor two-point correction offset latch request	CH4 Sensor two-point correction offset latch request	CH4 Sensor two-point correction offset latch request	CH4 Sensor two-point correction offset latch request
RY2F	CH4 Sensor two-point correction gain latch request	CH4 Sensor two-point correction gain latch request	CH4 Sensor two-point correction gain latch request	CH4 Sensor two-point correction gain latch request
RY30 to RY3F	Use prohibited	Use prohibited	Use prohibited	Use prohibited

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

Point

Do not use any "Use prohibited" remote I/O signals. If any of the signals are used, correct operation of the module cannot be guaranteed.

3.6 Lists of Remote Register Areas

This section lists remote register areas for a master/local module. In the example of the remote register assignment described in this section, the remote registers of the main module are assigned to the remote registers of RWr0 to RWr1F and RWw0 to RWw1F.
Remote register (RWr) is the information input from the temperature control module to the master/local module.
Remote register (RWw) is the information output from the master/local module to the temperature control module.
For details on the remote register, refer to the following.
☞ Page 301, Appendix 2

(1) List of remote register (RWr) areas

Remote register (RWr)				
Signal direction: Temperature control module → Master/local module				
Device number	**Temperature input**	**Standard control**	**Heating-cooling control**	**Mix control**
RWr0	Latest error code	Latest error code	Latest error code	Latest error code
RWr1	Error occurrence address	Error occurrence address	Error occurrence address	Error occurrence address
RWr2	Latest warning code	Latest warning code	Latest warning code	Latest warning code
RWr3	Use prohibited	CH1 to CH4 AT simultaneous temperature rise parameter calculation flag	Use prohibited	CH1 to CH4 AT simultaneous temperature rise parameter calculation flag
RWr4	CH1 Alert definition	CH1 Alert definition	CH1 Alert definition	CH1 Alert definition
RWr5	CH2 Alert definition	CH2 Alert definition	CH2 Alert definition	CH2 Alert definition*2
RWr6	CH3 Alert definition	CH3 Alert definition	CH3 Alert definition*1	CH3 Alert definition
RWr7	CH4 Alert definition	CH4 Alert definition	CH4 Alert definition*1	CH4 Alert definition
RWr8	CH1 Temperature process value (PV) or CH1 Process value (PV) scaling value	CH1 Temperature process value (PV) or CH1 Process value (PV) scaling value	CH1 Temperature process value (PV) or CH1 Process value (PV) scaling value	CH1 Temperature process value (PV) or CH1 Process value (PV) scaling value
RWr9	CH2 Temperature process value (PV) or CH2 Process value (PV) scaling value	CH2 Temperature process value (PV) or CH2 Process value (PV) scaling value	CH2 Temperature process value (PV) or CH2 Process value (PV) scaling value	CH2 Temperature process value (PV) or CH2 Process value (PV) scaling value*2
RWrA	CH3 Temperature process value (PV) or CH3 Process value (PV) scaling value	CH3 Temperature process value (PV) or CH3 Process value (PV) scaling value	CH3 Temperature process value (PV) or CH3 Process value (PV) scaling value*1	CH3 Temperature process value (PV) or CH3 Process value (PV) scaling value
RWrB	CH4 Temperature process value (PV) or CH4 Process value (PV) scaling value	CH4 Temperature process value (PV) or CH4 Process value (PV) scaling value	CH4 Temperature process value (PV) or CH4 Process value (PV) scaling value*1	CH4 Temperature process value (PV) or CH4 Process value (PV) scaling value
RWrC	Use prohibited	CH1 Set value (SV) monitor	CH1 Set value (SV) monitor	CH1 Set value (SV) monitor
RWrD	Use prohibited	CH2 Set value (SV) monitor	CH2 Set value (SV) monitor	CH2 Set value (SV) monitor*2
RWrE	Use prohibited	CH3 Set value (SV) monitor	CH3 Set value (SV) monitor*1	CH3 Set value (SV) monitor
RWrF	Use prohibited	CH4 Set value (SV) monitor	CH4 Set value (SV) monitor*1	CH4 Set value (SV) monitor
RWr10	Use prohibited	CH1 Manipulated value (MV)	CH1 Manipulated value for heating (MVh)	CH1 Manipulated value for heating (MVh)
RWr11	Use prohibited	CH2 Manipulated value (MV)	CH2 Manipulated value for heating (MVh)	CH2 Manipulated value for heating (MVh)*2
RWr12	Use prohibited	CH3 Manipulated value (MV)	CH3 Manipulated value for heating (MVh)*1	CH3 Manipulated value (MV)

Remote register (RWr)				
Signal direction: Temperature control module → Master/local module				
Device number	Temperature input	Standard control	Heating-cooling control	Mix control
RWr13	Use prohibited	CH4 Manipulated value (MV)	CH4 Manipulated value for heating (MVh)*1	CH4 Manipulated value (MV)
RWr14	Use prohibited	CH1 Self-tuning flag	CH1 Manipulated value for cooling (MVc)	CH1 Manipulated value for cooling (MVc)
RWr15	Use prohibited	CH2 Self-tuning flag	CH2 Manipulated value for cooling (MVc)	CH2 Manipulated value for cooling (MVc)*2
RWr16	Use prohibited	CH3 Self-tuning flag	CH3 Manipulated value for cooling (MVc)*1	CH3 Self-tuning flag
RWr17	Use prohibited	CH4 Self-tuning flag	CH4 Manipulated value for cooling (MVc)*1	CH4 Self-tuning flag
RWr18	Use prohibited	CH1 Manipulated value (MV) for output with another analog module	CH1 Manipulated value of heating (MVh) for output with another analog module	CH1 Manipulated value of heating (MVh) for output with another analog module
RWr19	Use prohibited	CH2 Manipulated value (MV) for output with another analog module	CH2 Manipulated value of heating (MVh) for output with another analog module	CH2 Manipulated value of heating (MVh) for output with another analog module*2
RWr1A	Use prohibited	CH3 Manipulated value (MV) for output with another analog module	CH3 Manipulated value of heating (MVh) for output with another analog module*1	CH3 Manipulated value (MV) for output with another analog module
RWr1B	Use prohibited	CH4 Manipulated value (MV) for output with another analog module	CH4 Manipulated value of heating (MVh) for output with another analog module*1	CH4 Manipulated value (MV) for output with another analog module
RWr1C	Use prohibited	Use prohibited	CH1 Manipulated value of cooling (MVc) for output with another analog module	CH1 Manipulated value of cooling (MVc) for output with another analog module
RWr1D	Use prohibited	Use prohibited	CH2 Manipulated value of cooling (MVc) for output with another analog module	CH2 Manipulated value of cooling (MVc) for output with another analog module*2
RWr1E	Use prohibited	Use prohibited	CH3 Manipulated value of cooling (MVc) for output with another analog module*1	Use prohibited
RWr1F	Use prohibited	Use prohibited	CH4 Manipulated value of cooling (MVc) for output with another analog module*1	Use prohibited

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)
*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

(2) List of remote register (RWw) areas

Remote register (RWw)				
Signal direction: Master/local module → Temperature control module				
Device number	Temperature input	Standard control	Heating-cooling control	Mix control
RWw0	Use prohibited	CH1 Temperature process value for input with another analog module (PV)	CH1 Temperature process value for input with another analog module (PV)	CH1 Temperature process value for input with another analog module (PV)
RWw1	Use prohibited	CH2 Temperature process value for input with another analog module (PV)	CH2 Temperature process value for input with another analog module (PV)	CH2 Temperature process value for input with another analog module (PV)*2
RWw2	Use prohibited	CH3 Temperature process value for input with another analog module (PV)	CH3 Temperature process value for input with another analog module (PV)*1	CH3 Temperature process value for input with another analog module (PV)

Remote register (RWw)				
Signal direction: Master/local module → Temperature control module				
Device number	Temperature input	Standard control	Heating-cooling control	Mix control
RWw3	Use prohibited	CH4 Temperature process value for input with another analog module (PV)	CH4 Temperature process value for input with another analog module (PV)*1	CH4 Temperature process value for input with another analog module (PV)
RWw4 to RWw1F	Use prohibited	Use prohibited	Use prohibited	Use prohibited

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to the following.
☞ Page 147, Section 8.3.1 (3)

3.7 Lists of Remote Buffer Memory Areas

This section lists the remote buffer memory areas of the temperature control module.

Ex. Example of the remote buffer memory in the manual

Control mode shift (address: 80H)

Setting item

Address of a temperature control module

For details on the remote buffer memory, refer to the following.

☞ Page 309, Appendix 3

Buffer memory address		Area	Target		Access method	
Decimal	Hexadecimal				CC IE Field configuration of the engineering tool	REMFR instruction, REMTO instruction*1
0 to 255	0000H to 00FFH	Parameter area	Station-based parameter data		○*2	○
256 to 767	0100H to 02FFH		Module-based parameter data	Main module		
768 to 1279	0300H to 04FFH			System area		
1280 to 1535	0500H to 05FFH	Monitoring area	Station-based monitoring data		×	○
1536 to 2047	0600H to 07FFH		Module-based monitoring data	Main module		
2048 to 2559	0800H to 09FFH			System area		
2560 to 4095	0A00H to 0FFFH	Error history area	Station-based error history data		○*2	○
4096 to 4351	1000H to 10FFH	Module control data area	Station-based control data		×	○
4352 to 4863	1100H to 12FFH		Module-based control data	Main module		
4864 to 5375	1300H to 14FFH			System area		

*1 For the REMFR and REMTO instructions, refer to the following.
User's manual for the master/local module used

*2 For the access method, refer to the following.
☞ Page 108, Section 7.1
☞ Page 267, Section 11.1

Remark

Do not access the system area using the REMFR or REMTO instruction. Doing so may lead the module to malfunction.

(1) In the temperature input mode

(a) Parameter area (address: 0000H to 04FFH)

The settings of the parameter area can be made with either of two methods: the CC IE Field configuration of the engineering tool or the REMTO instruction.

Address (decimal (hexadecimal))	Target channel	Setting contents Temperature input mode	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
0	—	System area	—	—	—	—	—	—	—
1 (1H)	Station	Sampling cycle and function extension setting	4096	R/W	—	○	—	○	Page 309, Appendix 3 (1)
5 (5H)	—	System area	—	—	—	—	—	—	—
6 (6H)	—	System area	—	—	—	—	—	—	—
7 (7H)	Station	Cyclic data update watch time setting	0	R/W	—	○	—	○	Page 311, Appendix 3 (2)
8 to 127(8H to 7FH)	—	System area	—	—	—	—	—	—	—
128 (80H)	Station	Control mode switching	0	R/W	—	○	—	○	Page 311, Appendix 3 (3)
129 (81H)	Station	HOLD/CLEAR setting	0	R/W	—	○	—	○	Page 312, Appendix 3 (4)
130 to 255(82H to FFH)	—	System area	—	—	—	—	—	—	—
256 (100H)	CH1	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
257 to 268(101H to 10CH)	—	System area	—	—	—	—	—	—	—
269(10DH)	CH1	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
270(10EH)	CH1	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
271 to 279(10FH to 117H)	—	System area	—	—	—	—	—	—	—
280 (118H)	CH1	Stop mode setting	0	R/W	—	○	○	○	Page 336, Appendix 3 (27)
281 to 303(119H to 12FH)	—	System area	—	—	—	—	—	—	—
304 (130H)	CH2	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
305 to 316(131H to 13CH)	—	System area	—	—	—	—	—	—	—

Address (decimal (hexadecimal))	Target channel	Setting contents Temperature input mode	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
317(13DH)	CH2	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
318(13EH)	CH2	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
319 to 327(13FH to 147H)	—	System area	—	—	—	—	—	—	—
328 (148H)	CH2	Stop mode setting	0	R/W	—	○	○	○	Page 336, Appendix 3 (27)
329 to 351(149H to 15FH)	—	System area	—	—	—	—	—	—	—
352 (160H)	CH3	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
353 to 364(161H to 16CH)	—	System area	—	—	—	—	—	—	—
365(16DH)	CH3	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
366(16EH)	CH3	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
367 to 375(16FH to 177H)	—	System area	—	—	—	—	—	—	—
376 (178H)	CH3	Stop mode setting	0	R/W	—	○	○	○	Page 336, Appendix 3 (27)
377 to 399(179H to 18FH)	—	System area	—	—	—	—	—	—	—
400 (190H)	CH4	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
401 to 412(191H to 19CH)	—	System area	—	—	—	—	—	—	—
413(19DH)	CH4	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
414(19EH)	CH4	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
415 to 423(19FH to 1A7H)	—	System area	—	—	—	—	—	—	—
424(1A8H)	CH4	Stop mode setting	0	R/W	—	○	○	○	Page 336, Appendix 3 (27)
425 to 483(1A9H to 1E3H)	—	System area	—	—	—	—	—	—	—

Address (decimal (hexadecimal))	Target channel	Setting contents	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
		Temperature input mode							
484(1E4H)	All CHs	Sensor correction function selection	0	R/W	—	○	—	○	Page 341, Appendix 3 (35)
485 to 488(1E5H to 1E8H)	—	System area	—	—	—	—	—	—	—
489(1E9H)	All CHs	Cold junction temperature compensation selection*8	0	R/W	—	○	○	○	Page 344, Appendix 3 (40)
490 to 511(1EAH to 1FFH)	—	System area	—	—	—	—	—	—	—
512 (200H)	CH1	Process value (PV) scaling function enable/disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
513 (201H)	CH1	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 346, Appendix 3 (43)
514 (202H)	CH1	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
515 (203H)	CH2	Process value (PV) scaling function enable/disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
516 (204H)	CH2	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 346, Appendix 3 (43)
517 (205H)	CH2	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
518 (206H)	CH3	Process value (PV) scaling function enable/disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
519 (207H)	CH3	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 346, Appendix 3 (43)
520 (208H)	CH3	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
521 (209H)	CH4	Process value (PV) scaling function enable/disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
522(20AH)	CH4	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 346, Appendix 3 (43)
523(20BH)	CH4	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
524 to 591(20CH to 24FH)	—	System area	—	—	—	—	—	—	—
592 (250H)	CH1	Process alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 349, Appendix 3 (46)
593 (251H)	CH1	Process alarm lower lower limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	Page 350, Appendix 3 (47)
594 (252H)	CH1	Process alarm lower upper limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	
595 (253H)	CH1	Process alarm upper lower limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
596 (254H)	CH1	Process alarm upper upper limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	

Address (decimal (hexadecimal))	Target channel	Setting contents Temperature input mode	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
597 (255H)	CH1	Rate alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 350, Appendix 3 (48)
598 (256H)	CH1	Rate alarm alert detection cycle	1	R/W	—	○	—	○	Page 351, Appendix 3 (49)
599 (257H)	CH1	Rate alarm upper limit value	0	R/W	—	○	—	○	Page 351, Appendix 3 (50)
600 (258H)	CH1	Rate alarm lower limit value	0	R/W	—	○	—	○	
601 (259H)	CH2	Process alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 349, Appendix 3 (46)
602(25AH)	CH2	Process alarm lower lower limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	Page 350, Appendix 3 (47)
603(25BH)	CH2	Process alarm lower upper limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	
604(25CH)	CH2	Process alarm upper lower limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
605(25DH)	CH2	Process alarm upper upper limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
606(25EH)	CH2	Rate alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 350, Appendix 3 (48)
607(25FH)	CH2	Rate alarm alert detection cycle	1	R/W	—	○	—	○	Page 351, Appendix 3 (49)
608 (260H)	CH2	Rate alarm upper limit value	0	R/W	—	○	—	○	Page 351, Appendix 3 (50)
609 (261H)	CH2	Rate alarm lower limit value	0	R/W	—	○	—	○	
610 (262H)	CH3	Process alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 349, Appendix 3 (46)
611 (263H)	CH3	Process alarm lower lower limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	Page 350, Appendix 3 (47)
612 (264H)	CH3	Process alarm lower upper limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	
613 (265H)	CH3	Process alarm upper lower limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
614 (266H)	CH3	Process alarm upper upper limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
615 (267H)	CH3	Rate alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 350, Appendix 3 (48)
616 (268H)	CH3	Rate alarm alert detection cycle	1	R/W	—	○	—	○	Page 351, Appendix 3 (49)
617 (269H)	CH3	Rate alarm upper limit value	0	R/W	—	○	—	○	Page 351, Appendix 3 (50)
618(26AH)	CH3	Rate alarm lower limit value	0	R/W	—	○	—	○	
619(26BH)	CH4	Process alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 349, Appendix 3 (46)

Address (decimal (hexadecimal))	Target channel	Setting contents Temperature input mode	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
620(26CH)	CH4	Process alarm lower lower limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	Page 350, Appendix 3 (47)
621(26DH)	CH4	Process alarm lower upper limit value	0(TT) -2000(RT) *7	R/W	○	○	—	○	
622(26EH)	CH4	Process alarm upper lower limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
623(26FH)	CH4	Process alarm upper upper limit value	1300(TT) 6000(RT)*7	R/W	○	○	—	○	
624 (270H)	CH4	Rate alarm alert output enable/disable setting	1	R/W	—	○	—	○	Page 350, Appendix 3 (48)
625 (271H)	CH4	Rate alarm alert detection cycle	1	R/W	—	○	—	○	Page 351, Appendix 3 (49)
626 (272H)	CH4	Rate alarm upper limit value	0	R/W	—	○	—	○	Page 351, Appendix 3 (50)
627 (273H)	CH4	Rate alarm lower limit value	0	R/W	—	○	—	○	
628 to 639(274H to 27FH)	—	System area	—	—	—	—	—	—	—
640 (280H)	CH1	Sensor correction value setting	0	R/W	—	○	○	○	Page 352, Appendix 3 (51)
641 (281H)	CH2	Sensor correction value setting	0	R/W	—	○	○	○	
642 (282H)	CH3	Sensor correction value setting	0	R/W	—	○	○	○	
643 (283H)	CH4	Sensor correction value setting	0	R/W	—	○	○	○	
644 (284H)	CH1	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
645 (285H)	CH1	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
646 (286H)	CH1	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
647 (287H)	CH1	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)
648 (288H)	CH2	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
649 (289H)	CH2	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
650(28AH)	CH2	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
651(28BH)	CH2	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)

Address (decimal (hexadecimal))	Target channel	Setting contents Temperature input mode	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
652(28CH)	CH3	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
653(28DH)	CH3	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
654(28EH)	CH3	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
655(28FH)	CH3	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)
656 (290H)	CH4	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
657 (291H)	CH4	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
658 (292H)	CH4	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
659 (293H)	CH4	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)
660 to 1279(294H to 4FFH)	—	System area	—	—	—	—	—	—	—

*1 The default value depends on the mode used. For details on the default value, refer to the following.
☞ Page 309, Appendix 3

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

*3 This column indicates whether the setting in the remote buffer memory area is automatically changed when the input range is changed. For details, refer to the following.
☞ Page 135, Section 8.1.6

*4 This column indicates whether data can be written to the non-volatile memory by turning off and on Set value backup instruction (RY15). For details, refer to the following.
☞ Page 136, Section 8.1.7

*5 This column indicates whether or not the setting can be changed by turning off and on During operation setting change instruction (RY10). For details, refer to the following.
☞ Page 295, Appendix 1.2 (3)

*6 This column indicates whether or not the setting can be changed by turning off and on Initial data setting request flag (RY9) when all channels stop. For details, refer to the following.
☞ Page 295, Appendix 1.2 (1)

*7 (TT) represents NZ2GF2B-60TCTT4. (RT) represents NZ2GF2B-60TCRT4.

*8 Available only when the NZ2GF2B-60TCTT4 is used. With other models, this area is handled as a system area.

(b) Monitoring area (address: 0500H to 09FFH)

Address (decimal (hexadecimal))	Target channel	Setting contents	Default value*1	Read/Write*2	Reference
		Temperature input mode			
1280 to 1535(500H to 5FFH)	—	System area	—	—	—
1536 (600H)	All CHs	Cold junction temperature process value*3	0	R	Page 359, Appendix 3 (63)
1537 (601H)	—	System area	—	—	—
1538 (602H)	All CHs	Control switching monitor	0	R	Page 360, Appendix 3 (65)
1539 (603H)	All CHs	Function extension bit monitor	0	R	Page 361, Appendix 3 (66)
1540 (604H)	All CHs	Sampling cycle monitor	1	R	Page 361, Appendix 3 (67)
1541 to 1567(605H to 61FH)	—	System area	—	—	—
1568 (620H)	CH1	Decimal point position	0(TT) 1(RT)*4	R	Page 362, Appendix 3 (68)
1569 (621H)	CH2	Decimal point position	0(TT) 1(RT)*4	R	
1570 (622H)	CH3	Decimal point position	0(TT) 1(RT)*4	R	
1571 (623H)	CH4	Decimal point position	0(TT) 1(RT)*4	R	
1572 to 2559(624H to 9FFH)	—	System area	—	—	—

*1 This is the value for when the module power supply is turned off and on or at the remote reset.

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

*3 Available only when the NZ2GF2B-60TCTT4 is used. With other models, this area is handled as a system area.

*4 (TT) represents NZ2GF2B-60TCTT4. (RT) represents NZ2GF2B-60TCRT4.

(c) Error history area (address: 0A00H to 0FFFH)

Address (decimal (hexadecimal))	Description		Default value[*1]	Read/Write[*2]	Reference
2560(A00H)	Error history 1	Error code	0000H	R	Page 363, Appendix 3 (69)
2561(A01H)		Order of generation	0000H	R	
2562(A02H)		[Error time] First two digits of the year/Last two digits of the year	0000H	R	
2563(A03H)		[Error time] Month/Day	0000H	R	
2564(A04H)		[Error time] Hour/Minute	0000H	R	
2565(A05H)		[Error time] Second/00H (Fixed)	0000H	R	
2566(A06H)		Error occurrence address	0000H	R	
2567(A07H)		Process value (PV)	0000H	R	
2568(A08H)		Manipulated value (MV)	0000H	R	
2569(A09H)		Set value (SV)	0000H	R	
2570(A0AH)		System area	—	—	
2571(A0BH)		System area	—	—	
2572(A0CH)		System area	—	—	
2573(A0DH)		System area	—	—	
2574(A0EH)		System area	—	—	
2575(A0FH)		System area	—	—	
2576 to 2591(A10H to A1FH)	Error history 2	Same as Error history 1.			
2592 to 2607(A20H to A2FH)	Error history 3	Same as Error history 1.			
2608 to 2623(A30H to A3FH)	Error history 4	Same as Error history 1.			
2624 to 2639(A40H to A4FH)	Error history 5	Same as Error history 1.			
2640 to 2655(A50H to A5FH)	Error history 6	Same as Error history 1.			
2656 to 2671(A60H to A6FH)	Error history 7	Same as Error history 1.			
2672 to 2687(A70H to A7FH)	Error history 8	Same as Error history 1.			
2688 to 2703(A80H to A8FH)	Error history 9	Same as Error history 1.			
2704 to 2719(A90H to A9FH)	Error history 10	Same as Error history 1.			
2720 to 2735(AA0H to AAFH)	Error history 11	Same as Error history 1.			
2736 to 2751(AB0H to ABFH)	Error history 12	Same as Error history 1.			
2752 to 2767(AC0H to ACFH)	Error history 13	Same as Error history 1.			
2768 to 2783(AD0H to ADFH)	Error history 14	Same as Error history 1.			
2784 to 2799(AE0H to AEFH)	Error history 15	Same as Error history 1.			
2800 to 4095(AF0H to FFFH)	System area			—	—

*1 This is the value at default or initialization by Error history clear command (address: 1000H).
*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

(d) Module control data area (address: 1000H to 14FFH)

Address (decimal (hexadecimal))	Target channel	Setting contents	Default value*1	Read/Write *2	Automatic setting*3	Non-volatile memory write availability*4	Change of setting during operation*5	Change of setting when all channels stop*6	Reference
		Temperature input mode							
4096 (1000H)	Station	Error history clear command	0	R/W	—	—	—	—	Page 364, Appendix 3 (70)
4097 (1001H)	Station	Error history clear completed	0	R	—	—	—	—	Page 364, Appendix 3 (71)
4098 to 5375(1002H to 14FFH)	—	System area	—	—	—	—	—	—	—

*1 The default value depends on the mode used. For details on the default value, refer to the following.
☞ Page 309, Appendix 3

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

*3 This column indicates whether the setting in the remote buffer memory area is automatically changed when the input range is changed. For details, refer to the following.
☞ Page 135, Section 8.1.6

*4 This column indicates whether data can be written to the non-volatile memory by turning off and on Set value backup instruction (RY15). For details, refer to the following.
☞ Page 136, Section 8.1.7

*5 This column indicates whether or not the setting can be changed by turning off and on During operation setting change instruction (RY10). For details, refer to the following.
☞ Page 295, Appendix 1.2 (3)

*6 This column indicates whether or not the setting can be changed by turning off and on Initial data setting request flag (RY9) when all channels stop. For details, refer to the following.
☞ Page 295, Appendix 1.2 (1)

(2) In the temperature control mode

(a) Parameter area (address: 0000H to 04FFH)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
0 (0H)	—	System area	System area	System area	—	—	—	—	—	—	—
1 (1H)	Station	Sampling cycle and function extension setting	Sampling cycle and function extension setting	Sampling cycle and function extension setting	4096	R/W	—	○	—	○	Page 309, Appendix 3 (1)
2 to 6(2H to 6H)	—	System area	System area	System area	—	—	—	—	—	—	—
7 (7H)	Station	Cyclic data update watch time setting	Cyclic data update watch time setting	Cyclic data update watch time setting	0	R/W	—	○	—	○	Page 311, Appendix 3 (2)
8 to 127(8H to 7FH)	—	System area	System area	System area	—	—	—	—	—	—	—
128 (80H)	Station	Control mode switching	Control mode switching	Control mode switching	0	R/W	—	○	—	○	Page 311, Appendix 3 (3)
129 (81H)	Station	HOLD/ CLEAR setting	HOLD/ CLEAR setting	HOLD/ CLEAR setting	0	R/W	—	○	—	○	Page 312, Appendix 3 (4)
130 to 255(82H to FFH)	—	System area	System area	System area	—	—	—	—	—	—	—
256 (100H)	CH1	Input range	Input range	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
257 (101H)	CH1	Set value (SV) setting	Set value (SV) setting	Set value (SV) setting	0	R/W	○	○	○	○	Page 317, Appendix 3 (6)
258 (102H)	CH1	Proportional band (P) setting	Heating proportional band (Ph) setting	Heating proportional band (Ph) setting	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
259 (103H)	CH1	Integral time (I) setting	Integral time (I) setting	Integral time (I) setting	240	R/W	—	○	○	○	Page 320, Appendix 3 (8)
260 (104H)	CH1	Derivative time (D) setting	Derivative time (D) setting	Derivative time (D) setting	60	R/W	—	○	○	○	Page 320, Appendix 3 (9)
261 (105H)	CH1	Upper limit output limiter	Heating upper limit output limiter	Heating upper limit output limiter	1000	R/W	—	○	○	○	Page 321, Appendix 3 (10)
262 (106H)	CH1	Lower limit output limiter	System area	System area	0	R/W	—	○	○	○	Page 321, Appendix 3 (10)
263 (107H)	CH1	Output variation limiter setting	Output variation limiter setting	Output variation limiter setting	0	R/W	—	○	○	○	Page 323, Appendix 3 (11)

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3.7 Lists of Remote Buffer Memory Areas

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
264 (108H)	CH1	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)
265 (109H)	CH1	Setting change rate limiter unit time setting	Setting change rate limiter unit time setting	Setting change rate limiter unit time setting	0	R/W	—	○	○	○	Page 325, Appendix 3 (13)
266(10AH)	CH1	Upper limit setting limiter	Upper limit setting limiter	Upper limit setting limiter	1300(TT) 6000(RT) *7	R/W	○	○	○	○	Page 325, Appendix 3 (14)
267(10BH)	CH1	Lower limit setting limiter	Lower limit setting limiter	Lower limit setting limiter	0(TT) -2000(RT) *7	R/W	○	○	○	○	
268(10CH)	CH1	Control output cycle setting	Heating control output cycle setting	Heating control output cycle setting	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
269(10DH)	CH1	Primary delay digital filter setting	Primary delay digital filter setting	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
270(10EH)	CH1	Number of moving averaging	Number of moving averaging	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
271(10FH)	CH1	Control response parameter	Control response parameter	Control response parameter	0	R/W	—	○	○	○	Page 329, Appendix 3 (18)
272 (110H)	CH1	Derivative action selection	Derivative action selection	Derivative action selection	0	R/W	—	○	—	○	Page 330, Appendix 3 (19)
273 (111H)	CH1	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting	5	R/W	—	○	○	○	Page 331, Appendix 3 (20)
274 (112H)	CH1	Manual reset amount setting	Manual reset amount setting	Manual reset amount setting	0	R/W	—	○	○	○	Page 332, Appendix 3 (21)
275 (113H)	CH1	AUTO/MAN mode shift	AUTO/MAN mode shift	AUTO/MAN mode shift	0	R/W	—	○	○	○	Page 332, Appendix 3 (22)
276 (114H)	CH1	MAN output setting	MAN output setting	MAN output setting	0	R/W	—	○	○	○	Page 333, Appendix 3 (23)
277 (115H)	CH1	Forward/ reverse action setting	System area	System area	1	R/W	—	○	○	○	Page 334, Appendix 3 (24)
278 (116H)	CH1	Loop disconnection detection judgment time	System area	System area	480	R/W	—	○	○	○	Page 334, Appendix 3 (25)
279 (117H)	CH1	Loop disconnection detection dead band	System area	System area	0	R/W	○	○	○	○	Page 335, Appendix 3 (26)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
280 (118H)	CH1	Stop mode setting	Stop mode setting	Stop mode setting	1	R/W	—	○	○	○	Page 336, Appendix 3 (27)
281 (119H)	CH1	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants	0	R/W	—	—	○	○	Page 337, Appendix 3 (28)
282 to 303(11AH to 12FH)	—	System area	System area	System area	—	—	—	—	—	—	—
304 (130H)	CH2	Input range	Input range	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
305 (131H)	CH2	Set value (SV) setting	Set value (SV) setting	Set value (SV) setting*9	0	R/W	○	○	○	○	Page 317, Appendix 3 (6)
306 (132H)	CH2	Proportional band (P) setting	Heating proportional band (Ph) setting	Heating proportional band (Ph) setting*9	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
307 (133H)	CH2	Integral time (I) setting	Integral time (I) setting	Integral time (I) setting*9	240	R/W	—	○	○	○	Page 320, Appendix 3 (8)
308 (134H)	CH2	Derivative time (D) setting	Derivative time (D) setting	Derivative time (D) setting*9	60	R/W	—	○	○	○	Page 320, Appendix 3 (9)
309 (135H)	CH2	Upper limit output limiter	Heating upper limit output limiter	Heating upper limit output limiter*9	1000	R/W	—	○	○	○	Page 321, Appendix 3 (10)
310 (136H)	CH2	Lower limit output limiter	System area	System area	0	R/W	—	○	○	○	Page 321, Appendix 3 (10)
311 (137H)	CH2	Output variation limiter setting	Output variation limiter setting	Output variation limiter setting*9	0	R/W	—	○	○	○	Page 323, Appendix 3 (11)
312 (138H)	CH2	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	Setting change rate limiter/Setting change rate limiter (temperature rise)*8*9	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)
313 (139H)	CH2	Setting change rate limiter unit time setting	Setting change rate limiter unit time setting	Setting change rate limiter unit time setting*9	0	R/W	—	○	○	○	Page 325, Appendix 3 (13)
314(13AH)	CH2	Upper limit setting limiter	Upper limit setting limiter	Upper limit setting limiter*9	1300(TT) 6000(RT) *7	R/W	○	○	○	○	Page 325, Appendix 3 (14)
315(13BH)	CH2	Lower limit setting limiter	Lower limit setting limiter	Lower limit setting limiter*9	0(TT) -2000(RT) *7	R/W	○	○	○	○	

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3.7 Lists of Remote Buffer Memory Areas

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value[*1]	Read/ Write[*2]	Auto-matic setting[*3]	Non-volatile memory write avail-ability[*4]	Change of setting during opera-tion[*5]	Change of setting when all channels stop[*6]	Reference
		Standard control	Heating-cooling control	Mix control							
316(13CH)	CH2	Control output cycle setting	Heating control output cycle setting	Heating control output cycle setting[*9]	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
317(13DH)	CH2	Primary delay digital filter setting	Primary delay digital filter setting	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
318(13EH)	CH2	Number of moving averaging	Number of moving averaging	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
319(13FH)	CH2	Control response parameter	Control response parameter	Control response parameter[*9]	0	R/W	—	○	○	○	Page 329, Appendix 3 (18)
320 (140H)	CH2	Derivative action selection	Derivative action selection	Derivative action selection[*9]	0	R/W	—	○	—	○	Page 330, Appendix 3 (19)
321 (141H)	CH2	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting[*9]	5	R/W	—	○	○	○	Page 331, Appendix 3 (20)
322 (142H)	CH2	Manual reset amount setting	Manual reset amount setting	Manual reset amount setting[*9]	0	R/W	—	○	○	○	Page 332, Appendix 3 (21)
323 (143H)	CH2	AUTO/MAN mode shift	AUTO/MAN mode shift	AUTO/MAN mode shift[*9]	0	R/W	—	○	○	○	Page 332, Appendix 3 (22)
324 (144H)	CH2	MAN output setting	MAN output setting	MAN output setting[*9]	0	R/W	—	○	○	○	Page 333, Appendix 3 (23)
325 (145H)	CH2	Forward/ reverse action setting	System area	System area	1	R/W	—	○	○	○	Page 334, Appendix 3 (24)
326 (146H)	CH2	Loop disconnection detection judgment time	System area	System area	480	R/W	—	○	○	○	Page 334, Appendix 3 (25)
327 (147H)	CH2	Loop disconnection detection dead band	System area	System area	0	R/W	○	○	○	○	Page 335, Appendix 3 (26)
328 (148H)	CH2	Stop mode setting	Stop mode setting	Stop mode setting[*9]	1	R/W	—	○	○	○	Page 336, Appendix 3 (27)
329 (149H)	CH2	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants[*9]	0	R/W	—	—	○	○	Page 337, Appendix 3 (28)
330 to 351(14AH to 15FH)	—	System area	System area	System area	—	—	—	—	—	—	—
352 (160H)	CH3	Input range	Input range	Input range	2(TT) 7(RT)[*7]	R/W	—	○	—	○	Page 312, Appendix 3 (5)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
353 (161H)	CH3	Set value (SV) setting	Set value (SV) setting*10	Set value (SV) setting	0	R/W	○	○	○	○	Page 317, Appendix 3 (6)
354 (162H)	CH3	Proportional band (P) setting	Heating proportional band (Ph) setting*10	Proportional band (P) setting	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
355 (163H)	CH3	Integral time (I) setting	Integral time (I) setting*10	Integral time (I) setting	240	R/W	—	○	○	○	Page 320, Appendix 3 (8)
356 (164H)	CH3	Derivative time (D) setting	Derivative time (D) setting*10	Derivative time (D) setting	60	R/W	—	○	○	○	Page 320, Appendix 3 (9)
357 (165H)	CH3	Upper limit output limiter	Heating upper limit output limiter*10	Upper limit output limiter	1000	R/W	—	○	○	○	Page 321, Appendix 3 (10)
358 (166H)	CH3	Lower limit output limiter	System area	Lower limit output limiter	0	R/W	—	○	○	○	Page 321, Appendix 3 (10)
359 (167H)	CH3	Output variation limiter setting	Output variation limiter setting*10	Output variation limiter setting	0	R/W	—	○	○	○	Page 323, Appendix 3 (11)
360 (168H)	CH3	Setting change rate limiter/Setting change rate limiter (temperature rise)	Setting change rate limiter/Setting change rate limiter (temperature rise)*8*10	Setting change rate limiter/Setting change rate limiter (temperature rise)	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)
361 (169H)	CH3	Setting change rate limiter unit time setting	Setting change rate limiter unit time setting*10	Setting change rate limiter unit time setting	0	R/W	—	○	○	○	Page 325, Appendix 3 (13)
362(16AH)	CH3	Upper limit setting limiter	Upper limit setting limiter*10	Upper limit setting limiter	1300(TT) 6000(RT) *7	R/W	○	○	○	○	Page 325, Appendix 3 (14)
363(16BH)	CH3	Lower limit setting limiter	Lower limit setting limiter*10	Lower limit setting limiter	0(TT) -2000(RT) *7	R/W	○	○	○	○	
364(16CH)	CH3	Control output cycle setting	Heating control output cycle setting*10	Control output cycle setting	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
365(16DH)	CH3	Primary delay digital filter setting	Primary delay digital filter setting	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
366(16EH)	CH3	Number of moving averaging	Number of moving averaging	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
367(16FH)	CH3	Control response parameter	Control response parameter*10	Control response parameter	0	R/W	—	○	○	○	Page 329, Appendix 3 (18)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
368 (170H)	CH3	Derivative action selection	Derivative action selection*10	Derivative action selection	0	R/W	—	○	—	○	Page 330, Appendix 3 (19)
369 (171H)	CH3	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting*10	Adjustment sensitivity (dead band) setting	5	R/W	—	○	○	○	Page 331, Appendix 3 (20)
370 (172H)	CH3	Manual reset amount setting	Manual reset amount setting*10	Manual reset amount setting	0	R/W	—	○	○	○	Page 332, Appendix 3 (21)
371 (173H)	CH3	AUTO/MAN mode shift	AUTO/MAN mode shift*10	AUTO/MAN mode shift	0	R/W	—	○	○	○	Page 332, Appendix 3 (22)
372 (174H)	CH3	MAN output setting	MAN output setting*10	MAN output setting	0	R/W	—	○	○	○	Page 333, Appendix 3 (23)
373 (175H)	CH3	Forward/ reverse action setting	System area	Forward/ reverse action setting	1	R/W	—	○	○	○	Page 334, Appendix 3 (24)
374 (176H)	CH3	Loop disconnection detection judgment time	System area	Loop disconnection detection judgment time	480	R/W	—	○	○	○	Page 334, Appendix 3 (25)
375 (177H)	CH3	Loop disconnection detection dead band	System area	Loop disconnection detection dead band	0	R/W	○	○	○	○	Page 335, Appendix 3 (26)
376 (178H)	CH3	Stop mode setting	Stop mode setting*10	Stop mode setting	1	R/W	—	○	○	○	Page 336, Appendix 3 (27)
377 (179H)	CH3	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants*10	Automatic backup setting after auto tuning of PID constants	0	R/W	—	—	○	○	Page 337, Appendix 3 (28)
378 to 399(17AH to 18FH)	—	System area	System area	System area	—	—	—	—	—	—	—
400 (190H)	CH4	Input range	Input range	Input range	2(TT) 7(RT)*7	R/W	—	○	—	○	Page 312, Appendix 3 (5)
401 (191H)	CH4	Set value (SV) setting	Set value (SV) setting*10	Set value (SV) setting	0	R/W	○	○	○	○	Page 317, Appendix 3 (6)
402 (192H)	CH4	Proportional band (P) setting	Heating proportional band (Ph) setting*10	Proportional band (P) setting	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
403 (193H)	CH4	Integral time (I) setting	Integral time (I) setting*10	Integral time (I) setting	240	R/W	—	○	○	○	Page 320, Appendix 3 (8)
404 (194H)	CH4	Derivative time (D) setting	Derivative time (D) setting*10	Derivative time (D) setting	60	R/W	—	○	○	○	Page 320, Appendix 3 (9)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
405 (195H)	CH4	Upper limit output limiter	Heating upper limit output limiter*10	Upper limit output limiter	1000	R/W	—	○	○	○	Page 321, Appendix 3 (10)
406 (196H)	CH4	Lower limit output limiter	System area	Lower limit output limiter	0	R/W	—	○	○	○	Page 321, Appendix 3 (10)
407 (197H)	CH4	Output variation limiter setting	Output variation limiter setting*10	Output variation limiter setting	0	R/W	—	○	○	○	Page 323, Appendix 3 (11)
408 (198H)	CH4	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	Setting change rate limiter/Setting change rate limiter (temperature rise)*8*10	Setting change rate limiter/Setting change rate limiter (temperature rise)*8	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)
409 (199H)	CH4	Setting change rate limiter unit time setting	Setting change rate limiter unit time setting*10	Setting change rate limiter unit time setting	0	R/W	—	○	○	○	Page 325, Appendix 3 (13)
410(19AH)	CH4	Upper limit setting limiter	Upper limit setting limiter*10	Upper limit setting limiter	1300(TT) 6000(RT) *7	R/W	○	○	○	○	Page 325, Appendix 3 (14)
411(19BH)	CH4	Lower limit setting limiter	Lower limit setting limiter*10	Lower limit setting limiter	0(TT) -2000(RT) *7	R/W	○	○	○	○	
412(19CH)	CH4	Control output cycle setting	Heating control output cycle setting*10	Control output cycle setting	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
413(19DH)	CH4	Primary delay digital filter setting	Primary delay digital filter setting	Primary delay digital filter setting	0	R/W	—	○	○	○	Page 328, Appendix 3 (16)
414(19EH)	CH4	Number of moving averaging	Number of moving averaging	Number of moving averaging	2	R/W	—	○	—	○	Page 329, Appendix 3 (17)
415(19FH)	CH4	Control response parameter	Control response parameter*10	Control response parameter	0	R/W	—	○	○	○	Page 329, Appendix 3 (18)
416(1A0H)	CH4	Derivative action selection	Derivative action selection*10	Derivative action selection	0	R/W	—	○	—	○	Page 330, Appendix 3 (19)
417(1A1H)	CH4	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting*10	Adjustment sensitivity (dead band) setting	5	R/W	—	○	○	○	Page 331, Appendix 3 (20)
418(1A2H)	CH4	Manual reset amount setting	Manual reset amount setting*10	Manual reset amount setting	0	R/W	—	○	○	○	Page 332, Appendix 3 (21)
419(1A3H)	CH4	AUTO/MAN mode shift	AUTO/MAN mode shift*10	AUTO/MAN mode shift	0	R/W	—	○	○	○	Page 332, Appendix 3 (22)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
420(1A4H)	CH4	MAN output setting	MAN output setting*10	MAN output setting	0	R/W	—	○	○	○	Page 333, Appendix 3 (23)
421(1A5H)	CH4	Forward/ reverse action setting	System area	Forward/ reverse action setting	1	R/W	—	○	○	○	Page 334, Appendix 3 (24)
422(1A6H)	CH4	Loop disconnection detection judgment time	System area	Loop disconnection detection judgment time	480	R/W	—	○	○	○	Page 334, Appendix 3 (25)
423(1A7H)	CH4	Loop disconnection detection dead band	System area	Loop disconnection detection dead band	0	R/W	○	○	○	○	Page 335, Appendix 3 (26)
424(1A8H)	CH4	Stop mode setting	Stop mode setting*10	Stop mode setting	1	R/W	—	○	○	○	Page 336, Appendix 3 (27)
425(1A9H)	CH4	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants*10	Automatic backup setting after auto tuning of PID constants	0	R/W	—	—	○	○	Page 337, Appendix 3 (28)
426 to 447(1AAH to 1BFH)	—	System area	System area	System area	—	—	—	—	—	—	—
448(1C0H)	—	System area	System area	System area	—	—	—	—	—	—	—
449(1C1H)	CH2	System area	System area	Temperature conversion setting*11	0	R/W	—	○	○	○	Page 338, Appendix 3 (29)
450(1C2H)	CH3	System area	Temperature conversion setting*12	System area	0	R/W	—	○	○	○	
451(1C3H)	CH4	System area	Temperature conversion setting*12	System area	0	R/W	—	○	○	○	
452(1C4H)	CH1	System area	Cooling proportional band (Pc) setting	Cooling proportional band (Pc) setting	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
453(1C5H)	CH1	System area	Cooling upper limit output limiter	Cooling upper limit output limiter	1000	R/W	—	○	○	○	Page 325, Appendix 3 (14)
454(1C6H)	CH1	System area	Cooling control output cycle setting	Cooling control output cycle setting	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
455(1C7H)	CH1	System area	Overlap/dead band setting	Overlap/dead band setting	0	R/W	—	○	○	○	Page 339, Appendix 3 (30)
456(1C8H)	CH1	Setting change rate limiter (temperature drop)*13	Setting change rate limiter (temperature drop)*13	Setting change rate limiter (temperature drop)*13	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)

Address (decimal (hexa-decimal))	Target channel	Setting contents: Standard control	Heating-cooling control	Mix control	Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
457(1C9H)	CH2	System area	Cooling proportional band (Pc) setting	Cooling proportional band (Pc) setting*9	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
458(1CAH)	CH2	System area	Cooling upper limit output limiter	Cooling upper limit output limiter*9	1000	R/W	—	○	○	○	Page 325, Appendix 3 (14)
459(1CBH)	CH2	System area	Cooling control output cycle setting	Cooling control output cycle setting*9	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
460(1CCH)	CH2	System area	Overlap/dead band setting	Overlap/dead band setting*9	0	R/W	—	○	○	○	Page 339, Appendix 3 (30)
461(1CDH)	CH2	Setting change rate limiter (temperature drop)*13	Setting change rate limiter (temperature drop)*13	Setting change rate limiter (temperature drop)*9*13	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)
462(1CEH)	CH3	System area	Cooling proportional band (Pc) setting*10	System area	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
463(1CFH)	CH3	System area	Cooling upper limit output limiter*10	System area	1000	R/W	—	○	○	○	Page 325, Appendix 3 (14)
464(1D0H)	CH3	System area	Cooling control output cycle setting*10	System area	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
465(1D1H)	CH3	System area	Overlap/dead band setting*10	System area	0	R/W	—	○	○	○	Page 339, Appendix 3 (30)
466(1D2H)	CH3	Setting change rate limiter (temperature drop)*13	Setting change rate limiter (temperature drop)*10*13	Setting change rate limiter (temperature drop)*13	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)
467(1D3H)	CH4	System area	Cooling proportional band (Pc) setting*10	System area	30	R/W	—	○	○	○	Page 318, Appendix 3 (7)
468(1D4H)	CH4	System area	Cooling upper limit output limiter*10	System area	1000	R/W	—	○	○	○	Page 325, Appendix 3 (14)
469(1D5H)	CH4	System area	Cooling control output cycle setting*10	System area	30/300	R/W	—	○	○	○	Page 326, Appendix 3 (15)
470(1D6H)	CH4	System area	Overlap/dead band setting*10	System area	0	R/W	—	○	○	○	Page 339, Appendix 3 (30)
471(1D7H)	CH4	Setting change rate limiter (temperature drop)*13	Setting change rate limiter (temperature drop)*10*13	Setting change rate limiter (temperature drop)*13	0	R/W	—	○	○	○	Page 324, Appendix 3 (12)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
472 to 479(1D8H to 1DFH)	—	System area	System area	System area	—	—	—	—	—	—	—
480(1E0H)	All CHs	Alert dead band setting	Alert dead band setting	Alert dead band setting	5	R/W	—	○	○	○	Page 339, Appendix 3 (31)
481(1E1H)	All CHs	Number of alert delay	Number of alert delay	Number of alert delay	0	R/W	—	○	○	○	Page 340, Appendix 3 (32)
482(1E2H)	All CHs	Temperature rise completion range setting	Temperature rise completion range setting	Temperature rise completion range setting	1	R/W	—	○	○	○	Page 340, Appendix 3 (33)
483(1E3H)	All CHs	Temperature rise completion soak time setting	Temperature rise completion soak time setting	Temperature rise completion soak time setting	0	R/W	—	○	○	○	Page 341, Appendix 3 (34)
484(1E4H)	All CHs	Sensor correction function selection	Sensor correction function selection	Sensor correction function selection	0	R/W	—	○	—	○	Page 341, Appendix 3 (35)
485(1E5H)	All CHs	Peak current suppression control group setting	System area	System area	0	R/W	—	○	—	○	Page 342, Appendix 3 (36)
486(1E6H)	All CHs	System area	Cooling method setting	Cooling method setting	0	R/W	—	○	—	○	Page 343, Appendix 3 (37)
487(1E7H)	All CHs	During AT loop disconnection detection function enable/ disable setting	System area	During AT loop disconnection detection function enable/ disable setting	0	R/W	—	○	○	○	Page 343, Appendix 3 (38)
488(1E8H)	All CHs	Resolution of the manipulated value for output with another analog module	Resolution of the manipulated value for output with another analog module	Resolution of the manipulated value for output with another analog module	0	R/W	—	○	—	○	Page 344, Appendix 3 (39)
489(1E9H)	All CHs	Cold junction temperature compensation selection*14	Cold junction temperature compensation selection*14	Cold junction temperature compensation selection*14	0	R/W	—	○	○	○	Page 344, Appendix 3 (40)
490(1EAH)	All CHs	Transistor output monitor ON delay time setting	Transistor output monitor ON delay time setting	Transistor output monitor ON delay time setting	0	R/W	—	○	○	○	Page 345, Appendix 3 (41)
491 to 511(1EBH to 1FFH)	—	System area	System area	System area	—	—	—	—	—	—	—

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
512 (200H)	CH1	Process value (PV) scaling function enable/ disable setting	Process value (PV) scaling function enable/ disable setting	Process value (PV) scaling function enable/ disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (41)
513 (201H)	CH1	Process value (PV) scaling lower limit value	Process value (PV) scaling lower limit value	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
514 (202H)	CH1	Process value (PV) scaling upper limit value	Process value (PV) scaling upper limit value	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
515 (203H)	CH2	Process value (PV) scaling function enable/ disable setting	Process value (PV) scaling function enable/ disable setting	Process value (PV) scaling function enable/ disable setting*9	0	R/W	—	○	—	○	Page 345, Appendix 3 (41)
516 (204H)	CH2	Process value (PV) scaling lower limit value	Process value (PV) scaling lower limit value	Process value (PV) scaling lower limit value*9	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
517 (205H)	CH2	Process value (PV) scaling upper limit value	Process value (PV) scaling upper limit value	Process value (PV) scaling upper limit value*9	0	R/W	—	○	—	○	
518 (206H)	CH3	Process value (PV) scaling function enable/ disable setting	Process value (PV) scaling function enable/ disable setting*10	Process value (PV) scaling function enable/ disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (41)
519 (207H)	CH3	Process value (PV) scaling lower limit value	Process value (PV) scaling lower limit value*10	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
520 (208H)	CH3	Process value (PV) scaling upper limit value	Process value (PV) scaling upper limit value*10	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
521 (209H)	CH4	Process value (PV) scaling function enable/ disable setting	Process value (PV) scaling function enable/ disable setting*10	Process value (PV) scaling function enable/ disable setting	0	R/W	—	○	—	○	Page 345, Appendix 3 (41)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
522(20AH)	CH4	Process value (PV) scaling lower limit value	Process value (PV) scaling lower limit value*10	Process value (PV) scaling lower limit value	0	R/W	—	○	—	○	Page 345, Appendix 3 (42)
523(20BH)	CH4	Process value (PV) scaling upper limit value	Process value (PV) scaling upper limit value*10	Process value (PV) scaling upper limit value	0	R/W	—	○	—	○	
524 to 543(20CH to 21FH)	—	System area	System area	System area	—	—	—	—	—	—	—
544 (220H)	CH1	Alert 1 mode setting	Alert 1 mode setting	Alert 1 mode setting	0	R/W	—	○	—	○	Page 346, Appendix 3 (44)
545 (221H)	CH1	Alert 2 mode setting	Alert 2 mode setting	Alert 2 mode setting	0	R/W	—	○	—	○	
546 (222H)	CH1	Alert 3 mode setting	Alert 3 mode setting	Alert 3 mode setting	0	R/W	—	○	—	○	
547 (223H)	CH1	Alert 4 mode setting	Alert 4 mode setting	Alert 4 mode setting	0	R/W	—	○	—	○	
548 (224H)	CH1	Alert set value 1	Alert set value 1	Alert set value 1	0	R/W	○	○	○	○	Page 348, Appendix 3 (45)
549 (225H)	CH1	Alert set value 2	Alert set value 2	Alert set value 2	0	R/W	○	○	○	○	
550 (226H)	CH1	Alert set value 3	Alert set value 3	Alert set value 3	0	R/W	○	○	○	○	
551 (227H)	CH1	Alert set value 4	Alert set value 4	Alert set value 4	0	R/W	○	○	○	○	
552 (228H)	CH2	Alert 1 mode setting	Alert 1 mode setting	Alert 1 mode setting*9	0	R/W	—	○	—	○	Page 346, Appendix 3 (44)
553 (229H)	CH2	Alert 2 mode setting	Alert 2 mode setting	Alert 2 mode setting*9	0	R/W	—	○	—	○	
554(22AH)	CH2	Alert 3 mode setting	Alert 3 mode setting	Alert 3 mode setting*9	0	R/W	—	○	—	○	
555(22BH)	CH2	Alert 4 mode setting	Alert 4 mode setting	Alert 4 mode setting*9	0	R/W	—	○	—	○	
556(22CH)	CH2	Alert set value 1	Alert set value 1	Alert set value 1*9	0	R/W	○	○	○	○	Page 348, Appendix 3 (45)
557(22DH)	CH2	Alert set value 2	Alert set value 2	Alert set value 2*9	0	R/W	○	○	○	○	
558(22EH)	CH2	Alert set value 3	Alert set value 3	Alert set value 3*9	0	R/W	○	○	○	○	
559(22FH)	CH2	Alert set value 4	Alert set value 4	Alert set value 4*9	0	R/W	○	○	○	○	
560 (230H)	CH3	Alert 1 mode setting	Alert 1 mode setting*10	Alert 1 mode setting	0	R/W	—	○	—	○	Page 346, Appendix 3 (44)
561 (231H)	CH3	Alert 2 mode setting	Alert 2 mode setting*10	Alert 2 mode setting	0	R/W	—	○	—	○	
562 (232H)	CH3	Alert 3 mode setting	Alert 3 mode setting*10	Alert 3 mode setting	0	R/W	—	○	—	○	
563 (233H)	CH3	Alert 4 mode setting	Alert 4 mode setting*10	Alert 4 mode setting	0	R/W	—	○	—	○	

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
564 (234H)	CH3	Alert set value 1	Alert set value 1*10	Alert set value 1	0	R/W	○	○	○	○	Page 348, Appendix 3 (45)
565 (235H)	CH3	Alert set value 2	Alert set value 2*10	Alert set value 2	0	R/W	○	○	○	○	
566 (236H)	CH3	Alert set value 3	Alert set value 3*10	Alert set value 3	0	R/W	○	○	○	○	
567 (237H)	CH3	Alert set value 4	Alert set value 4*10	Alert set value 4	0	R/W	○	○	○	○	
568 (238H)	CH4	Alert 1 mode setting	Alert 1 mode setting*10	Alert 1 mode setting	0	R/W	—	○	—	○	Page 346, Appendix 3 (44)
569 (239H)	CH4	Alert 2 mode setting	Alert 2 mode setting*10	Alert 2 mode setting	0	R/W	—	○	—	○	
570(23AH)	CH4	Alert 3 mode setting	Alert 3 mode setting*10	Alert 3 mode setting	0	R/W	—	○	—	○	
571(23BH)	CH4	Alert 4 mode setting	Alert 4 mode setting*10	Alert 4 mode setting	0	R/W	—	○	—	○	
572(23CH)	CH4	Alert set value 1	Alert set value 1*10	Alert set value 1	0	R/W	○	○	○	○	Page 348, Appendix 3 (45)
573 (23DH)	CH4	Alert set value 2	Alert set value 2*10	Alert set value 2	0	R/W	○	○	○	○	
574(23EH)	CH4	Alert set value 3	Alert set value 3*10	Alert set value 3	0	R/W	○	○	○	○	
575(23FH)	CH4	Alert set value 4	Alert set value 4*10	Alert set value 4	0	R/W	○	○	○	○	
576 to 639(240H to 27FH)	—	System area	System area	System area	—	—	—	—	—	—	—
640 (280H)	CH1	Sensor correction value setting	Sensor correction value setting	Sensor correction value setting	0	R/W	—	○	○	○	Page 352, Appendix 3 (51)
641 (281H)	CH2	Sensor correction value setting	Sensor correction value setting	Sensor correction value setting	0	R/W	—	○	○	○	
642 (282H)	CH3	Sensor correction value setting	Sensor correction value setting	Sensor correction value setting	0	R/W	—	○	○	○	
643 (283H)	CH4	Sensor correction value setting	Sensor correction value setting	Sensor correction value setting	0	R/W	—	○	○	○	
644 (284H)	CH1	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
645 (285H)	CH1	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
646 (286H)	CH1	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
647 (287H)	CH1	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)
648 (288H)	CH2	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
649 (289H)	CH2	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
650(28AH)	CH2	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
651(28BH)	CH2	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)
652(28CH)	CH3	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
653(28DH)	CH3	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
654(28EH)	CH3	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
655(28FH)	CH3	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
656 (290H)	CH4	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	Sensor two-point correction offset value (measured value)	0	R/W	○	○	—	○	Page 352, Appendix 3 (52)
657 (291H)	CH4	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	Sensor two-point correction offset value (corrected value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (53)
658 (292H)	CH4	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	Sensor two-point correction gain value (measured value)	0	R/W	○	○	—	○	Page 353, Appendix 3 (54)
659 (293H)	CH4	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	Sensor two-point correction gain value (corrected value)	0	R/W	○	○	—	○	Page 354, Appendix 3 (55)
660 to 671(294H to 29FH)	—	System area	System area	System area	—	—	—	—	—	—	—
672(2A0H)	CH1	Auto tuning mode selection	Auto tuning mode selection	Auto tuning mode selection	0	R/W	—	○	○	○	Page 354, Appendix 3 (56)
673(2A1H)	CH1	AT bias setting	AT bias setting	AT bias setting	0	R/W	○	○	○	○	Page 355, Appendix 3 (57)
674 (2A2H)	CH2	Auto tuning mode selection	Auto tuning mode selection	Auto tuning mode selection*9	0	R/W	—	○	○	○	Page 354, Appendix 3 (56)
675 (2A3H)	CH2	AT bias setting	AT bias setting	AT bias setting*9	0	R/W	○	○	○	○	Page 355, Appendix 3 (57)
676 (2A4H)	CH3	Auto tuning mode selection	Auto tuning mode selection*10	Auto tuning mode selection	0	R/W	—	○	○	○	Page 354, Appendix 3 (56)
677 (2A5H)	CH3	AT bias setting	AT bias setting*10	AT bias setting	0	R/W	○	○	○	○	Page 355, Appendix 3 (57)
678 (2A6H)	CH4	Auto tuning mode selection	Auto tuning mode selection*10	Auto tuning mode selection	0	R/W	—	○	○	○	Page 354, Appendix 3 (56)
679 (2A7H)	CH4	AT bias setting	AT bias setting*10	AT bias setting	0	R/W	○	○	○	○	Page 355, Appendix 3 (57)
680 to 703(2A8H to 2BFH)	—	System area	System area	System area	—	—	—	—	—	—	—

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value*1	Read/Write*2	Auto-matic setting*3	Non-volatile memory write avail-ability*4	Change of setting during opera-tion*5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
704(2C0H)	CH1	Self-tuning setting	System area	System area	0	R/W	—	○	○	○	Page 356, Appendix 3 (58)
705 (2C1H)	CH2	Self-tuning setting	System area	System area	0	R/W	—	○	○	○	
706 (2C2H)	CH3	Self-tuning setting	System area	Self-tuning setting	0	R/W	—	○	○	○	
707 (2C3H)	CH4	Self-tuning setting	System area	Self-tuning setting	0	R/W	—	○	○	○	
708 to 719(2C4H to 2CFH)	—	System area	System area	System area	—	—	—	—	—	—	—
720(2D0H)	CH1	Simultaneous temperature rise group setting	System area	System area	0	R/W	—	○	—	○	Page 357, Appendix 3 (59)
721(2D1H)	CH1	Simultaneous temperature rise gradient data	System area	System area	0	R/W	○	○	○	○	Page 357, Appendix 3 (60)
722(2D2H)	CH1	Simultaneous temperature rise dead time	System area	System area	0	R/W	○	○	○	○	Page 358, Appendix 3 (61)
723(2D3H)	CH1	Simultaneous temperature rise AT mode selection	System area	System area	0	R/W	—	○	○	○	Page 359, Appendix 3 (62)
724 (2D4H)	CH2	Simultaneous temperature rise group setting	System area	System area	0	R/W	—	○	—	○	Page 357, Appendix 3 (59)
725 (2D5H)	CH2	Simultaneous temperature rise gradient data	System area	System area	0	R/W	○	○	○	○	Page 357, Appendix 3 (60)
726 (2D6H)	CH2	Simultaneous temperature rise dead time	System area	System area	0	R/W	○	○	○	○	Page 358, Appendix 3 (61)
727 (2D7H)	CH2	Simultaneous temperature rise AT mode selection	System area	System area	0	R/W	—	○	○	○	Page 359, Appendix 3 (62)
728 (2D8H)	CH3	Simultaneous temperature rise group setting	System area	Simultaneous temperature rise group setting	0	R/W	—	○	—	○	Page 357, Appendix 3 (59)
729 (2D9H)	CH3	Simultaneous temperature rise gradient data	System area	Simultaneous temperature rise gradient data	0	R/W	○	○	○	○	Page 357, Appendix 3 (60)
730 (2DAH)	CH3	Simultaneous temperature rise dead time	System area	Simultaneous temperature rise dead time	0	R/W	○	○	○	○	Page 358, Appendix 3 (61)
731 (2DBH)	CH3	Simultaneous temperature rise AT mode selection	System area	Simultaneous temperature rise AT mode selection	0	R/W	—	○	○	○	Page 359, Appendix 3 (62)

Address (decimal (hexa-decimal))	Target channel	Setting contents			Default value[*1]	Read/ Write[*2]	Auto-matic setting[*3]	Non-volatile memory write avail-ability[*4]	Change of setting during opera-tion[*5]	Change of setting when all channels stop[*6]	Reference
		Standard control	Heating-cooling control	Mix control							
732 (2DCH)	CH4	Simultaneous temperature rise group setting	System area	Simultaneous temperature rise group setting	0	R/W	—	○	—	○	Page 357, Appendix 3 (59)
733 (2DDH)	CH4	Simultaneous temperature rise gradient data	System area	Simultaneous temperature rise gradient data	0	R/W	○	○	○	○	Page 357, Appendix 3 (60)
734 (2DEH)	CH4	Simultaneous temperature rise dead time	System area	Simultaneous temperature rise dead time	0	R/W	○	○	○	○	Page 358, Appendix 3 (61)
735 (2DFH)	CH4	Simultaneous temperature rise AT mode selection	System area	Simultaneous temperature rise AT mode selection	0	R/W	—	○	○	○	Page 359, Appendix 3 (62)
736 to 1279(2E0H to 4FFH)	—	System area	System area	System area	—	—	—	—	—	—	—

*1 The default value depends on the mode used. For details on the default value, refer to the following.
☞ Page 309, Appendix 3

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

*3 This column indicates whether the setting in the remote buffer memory area is automatically changed when the input range is changed. For details, refer to the following.
☞ Page 135, Section 8.1.6

*4 This column indicates whether data can be written to the non-volatile memory by turning off and on Set value backup instruction (RY15). For details, refer to the following.
☞ Page 136, Section 8.1.7

*5 This column indicates whether or not the setting can be changed by turning off and on During operation setting change instruction (RY10). For details, refer to the following.
☞ Page 295, Appendix 1.2 (3)

*6 This column indicates whether or not the setting can be changed by turning off and on Initial data setting request flag (RY9) when all channels stop. For details, refer to the following.
☞ Page 295, Appendix 1.2 (1)

*7 (TT) represents NZ2GF2B-60TCTT4. (RT) represents NZ2GF2B-60TCRT4.

*8 By using the setting change rate limiter, whether to set temperature rise/temperature drop in a batch or individually can be selected. In the batch setting, the target of setting change rate limiter is only this area. In the individual setting, this area is the setting target for the temperature rise. For details, refer to the following.
☞ Page 167, Section 8.3.10

*9 Available only under the mix control (expanded mode). With other models, this area is handled as a system area.

*10 Available only under the heating-cooling control (expanded mode). With other models, this area is handled as a system area.

*11 Available only under the mix control (normal mode). With other models, this area is handled as a system area.

*12 Available only under the heating-cooling control (normal mode). With other models, this area is handled as a system area.

*13 By using the setting change rate limiter, whether to set temperature rise/temperature drop in a batch or individually can be selected. In the batch setting, this area is handled as a system area. In the individual setting, this area is the setting target for the temperature drop. For details, refer to the following.
☞ Page 167, Section 8.3.10

*14 Available only when the NZ2GF2B-60TCTT4 is used. With other models, this area is handled as a system area.

(b) Monitoring area (address: 0500H to 09FFH)

Address (decimal (hexadecimal))	Target channel	Setting contents			Default value*1	Read/Write*2	Reference
		Standard control	Heating-cooling control	Mix control			
1208 to 1535(500H to 5FFH)	—	System area	System area	System area	—	—	—
1536 (600H)	All CHs	Cold junction temperature process value*3	Cold junction temperature process value*3	Cold junction temperature process value*3	0	R	Page 359, Appendix 3 (63)
1537 (601H)	All CHs	MAN mode	MAN mode	MAN mode	0	R	Page 360, Appendix 3 (64)
1538 (602H)	All CHs	Control switching monitor	Control switching monitor	Control switching monitor	0	R	Page 360, Appendix 3 (65)
1539 (603H)	All CHs	Function extension bit monitor	Function extension bit monitor	Function extension bit monitor	0	R	Page 361, Appendix 3 (66)
1540 (604H)	All CHs	Sampling cycle monitor	Sampling cycle monitor	Sampling cycle monitor	1	R	Page 361, Appendix 3 (67)
1541 to 1567(605H to 61FH)	—	System area	System area	System area	—	—	—
1568 (620H)	CH1	Decimal point position	Decimal point position	Decimal point position	0(TT) 1(RT)*4	R	Page 362, Appendix 3 (68)
1569 (621H)	CH2	Decimal point position	Decimal point position	Decimal point position	0(TT) 1(RT)*4	R	
1570 (622H)	CH3	Decimal point position	Decimal point position	Decimal point position	0(TT) 1(RT)*4	R	
1571 (623H)	CH4	Decimal point position	Decimal point position	Decimal point position	0(TT) 1(RT)*4	R	
1572 to 2559(624H to 9FFH)	—	System area	System area	System area	—	—	—

*1 This is the value for when the module power supply is turned off and on or at the remote reset.

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

*3 Available only when the NZ2GF2B-60TCTT4 is used. With other models, this area is handled as a system area.

*4 (TT) represents NZ2GF2B-60TCTT4. (RT) represents NZ2GF2B-60TCRT4.

(c) Error history area (address: 0A00H to 0FFFH)

Address (decimal (hexadecimal))	Description		Default value*1	Read/Write*2	Reference
2560(A00H)	Error history 1	Error code	0000H	R	Page 363, Appendix 3 (69)
2561(A01H)		Order of generation	0000H	R	
2562(A02H)		[Error time] First two digits of the year/Last two digits of the year	0000H	R	
2563(A03H)		[Error time] Month/Day	0000H	R	
2564(A04H)		[Error time] Hour/Minute	0000H	R	
2565(A05H)		[Error time] Second/00H (Fixed)	0000H	R	
2566(A06H)		Error occurrence address	0000H	R	
2567(A07H)		Process value (PV)	0000H	R	
2568(A08H)		Manipulated value (MV)	0000H	R	
2569(A09H)		Set value (SV)	0000H	R	
2570(A0AH)		System area	—	—	
2571(A0BH)		System area	—	—	
2572(A0CH)		System area	—	—	
2573(A0DH)		System area	—	—	
2574(A0EH)		System area	—	—	
2575(A0FH)		System area	—	—	
2576 to 2591(A10H to A1FH)	Error history 2	Same as Error history 1.			
2592 to 2607(A20H to A2FH)	Error history 3	Same as Error history 1.			
2608 to 2623(A30H to A3FH)	Error history 4	Same as Error history 1.			
2624 to 2639(A40H to A4FH)	Error history 5	Same as Error history 1.			
2640 to 2655(A50H to A5FH)	Error history 6	Same as Error history 1.			
2656 to 2671(A60H to A6FH)	Error history 7	Same as Error history 1.			
2672 to 2687(A70H to A7FH)	Error history 8	Same as Error history 1.			
2688 to 2703(A80H to A8FH)	Error history 9	Same as Error history 1.			
2704 to 2719(A90H to A9FH)	Error history 10	Same as Error history 1.			
2720 to 2735(AA0H to AAFH)	Error history 11	Same as Error history 1.			
2736 to 2751(AB0H to ABFH)	Error history 12	Same as Error history 1.			
2752 to 2767(AC0H to ACFH)	Error history 13	Same as Error history 1.			
2768 to 2783(AD0H to ADFH)	Error history 14	Same as Error history 1.			
2784 to 2799(AE0H to AEFH)	Error history 15	Same as Error history 1.			
2800 to 4095(AF0H to FFFH)	System area			—	—

*1 This is the value at default or initialization by Error history clear command (address: 1000H).

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

(d) Module control data area (address: 1000H to 14FFH)

Address (decimal (hexadecimal))	Target channel	Setting contents			Default value*1	Read/ Write*2	Automatic setting*3	Non-volatile memory write availability *4	Change of setting during operation *5	Change of setting when all channels stop*6	Reference
		Standard control	Heating-cooling control	Mix control							
4096 (1000H)	Station	Error history clear command	Error history clear command	Error history clear command	0	R/W	—	—	—	—	Page 364, Appendix 3 (70)
4097 (1001H)	Station	Error history clear completed	Error history clear completed	Error history clear completed	0	R	—	—	—	—	Page 364, Appendix 3 (71)
4098 to 4351(1002H to 10FFH)	—	System area	System area	System area	—	—	—	—	—	—	—
4352 (1100H)	CH1	Memory's PID constants read instruction	Memory's PID constants read instruction	Memory's PID constants read instruction	0	R/W	—	—	○	○	Page 365, Appendix 3 (72)
4353 (1101H)	CH2	Memory's PID constants read instruction	Memory's PID constants read instruction	Memory's PID constants read instruction*7	0	R/W	—	—	○	○	
4354 (1102H)	CH3	Memory's PID constants read instruction	Memory's PID constants read instruction*8	Memory's PID constants read instruction	0	R/W	—	—	○	○	
4355 (1103H)	CH4	Memory's PID constants read instruction	Memory's PID constants read instruction*8	Memory's PID constants read instruction	0	R/W	—	—	○	○	
4356 (1104H)	All CHs	Memory's PID constants read/write completion flag	Memory's PID constants read/write completion flag	Memory's PID constants read/write completion flag	0	R	—	—	—	—	Page 366, Appendix 3 (73)
4357 to 5375(1015H to 14FFH)	—	System area	System area	System area	—	—	—	—	—	—	—

*1 The default value depends on the mode used. For details on the default value, refer to the following.
☞ Page 309, Appendix 3

*2 This column indicates whether data can be read from or written to the remote buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled

*3 This column indicates whether the setting in the remote buffer memory area is automatically changed when the input range is changed. For details, refer to the following.
☞ Page 135, Section 8.1.6

*4 This column indicates whether data can be written to the non-volatile memory by turning off and on Set value backup instruction (RY15). For details, refer to the following.
☞ Page 136, Section 8.1.7

*5 This column indicates whether or not the setting can be changed by turning off and on During operation setting change instruction (RY10). For details, refer to the following.
☞ Page 295, Appendix 1.2 (3)

*6 This column indicates whether or not the setting can be changed by turning off and on Initial data setting request flag (RY9) when all channels stop. For details, refer to the following.
☞ Page 295, Appendix 1.2 (1)

*7 Available only under the mix control (expanded mode). With other models, this area is handled as a system area.

*8 Available only under the heating-cooling control (expanded mode). With other models, this area is handled as a system area.

CHAPTER 4 PROCEDURES BEFORE OPERATION

This chapter describes the procedures before operation.

(1) When using the module as a temperature input module

Check box

- [ ] **Station number setting**
  Set a station number for a temperature control module.
- [ ] **Connection**
  Mount the temperature control module to a DIN rail.
- [ ] **Wiring**
  Connect the temperature control module to a power supply, Ethernet cables, and external devices.
- [ ] **Parameter settings and programming**
  Set parameters and create a program.
- [ ] **Warm-up operation (when the NZ2GF2B-60TCTT4 is used)**
  Perform a warm-up operation for about 15 minutes before starting an operation.

For details on the setting of station numbers, refer to the following.

- ☞ Page 85, Section 6.1

For details on the mounting, refer to the following.

- ☞ Page 86, Section 6.2
- ☞ Page 88, Section 6.3

For details on the wiring, refer to the following.

- ☞ Page 91, Section 6.4
- ☞ Page 93, Section 6.5
- ☞ Page 96, Section 6.6

For details on the parameter settings and programming, refer to the following.

- ☞ Page 108, Section 7.1
- ☞ Page 120, Section 7.2
- ☞ Page 232, CHAPTER 9

Point

- A proper performance of temperature compensation is required for the NZ2GF2B-60TCTT4 which uses a thermocouple for the temperature sensors. Perform warm-up operation about 15 minutes before starting operation.
- To replace the module, follow the procedure described below.
  - Turn off the power of the module and remove the temperature control module.
  - Prepare a new temperature control module and follow the above procedure from "Setting a station number" to "Parameter settings and programming". (The network parameter of the master station does not need to be set again.)
  - After checking the operation, restart the control.

(2) When the module is used as a temperature control module

Check box

- ☐ **Station number setting**
  Set a station number for a temperature control module.
- ☐ **Connection**
  Mount the temperature control module to a DIN rail.
- ☐ **Wiring**
  Connect the temperature control module to a power supply, Ethernet cables, and external devices.
- ☐ **Parameter settings and programming**
  Set parameters and create a program.
- ☐ **Auto tuning execution**
  Set PID constants using the auto tuning function.
- ☐ **Warm-up operation (when the NZ2GF2B-60TCTT4 is used)**
  Perform a warm-up operation for about 15 minutes before starting an operation.

For details on the setting of station numbers, refer to the following.
- ☞ Page 85, Section 6.1

For details on the mounting, refer to the following.
- ☞ Page 86, Section 6.2
- ☞ Page 88, Section 6.3

For details on the wiring, refer to the following.
- ☞ Page 91, Section 6.4
- ☞ Page 93, Section 6.5
- ☞ Page 96, Section 6.6

For details on the execution of auto tuning, refer to the following.
- ☞ Page 159, Section 8.3.7

For details on the parameter settings and programming, refer to the following.
- ☞ Page 108, Section 7.1
- ☞ Page 120, Section 7.2
- ☞ Page 232, CHAPTER 9

Point

- A proper performance of temperature compensation is required for the NZ2GF2B-60TCTT4 which uses a thermocouple for the temperature sensors. Perform warm-up operation about 15 minutes before starting operation.
- To replace the module, follow the procedure described below.
  - Turn off the power of the module and remove the temperature control module.
  - Prepare a new temperature control module and follow the above procedure from "Setting a station number" to "Parameter settings and programming". (The network parameter of the master station does not need to be set again.)
  - After checking the operation, restart the control.

CHAPTER 5 SYSTEM CONFIGURATION

This chapter describes the system configuration using a temperature control module.
For CC-Link IE Field Network configuration, refer to the following.
📖 User's manual for the master/local module used

5.1 Applicable Systems

(1) Corresponding master station

When using the temperature control module, use the following products as a master station.

Model	First five digits of serial number
RJ71GF11-T2 RJ71EN71	(no restriction)
QJ71GF11-T2	14102 or later
LJ71GF11-T2	
QD77GF16	14111 or later

(2) Ethernet cable

For the specifications of the Ethernet cable, refer to the following.
📖 User's manual for the master/local module used

(3) Compatible software package

Configuring and diagnosing the temperature control module require GX Works2 or GX Works3. According to the master station used, install the following version of GX Works2 or GX Works3.

Engineering tool	Software version
GX Works2	Version 1.501X or later
GX Works3	Version 1.000A or later

Point

When the latest profile of the temperature control module is necessary, please consult your local Mitsubishi representative. The profile is a setting file that stores information required for the start-up, operation, and maintenance of devices supporting the CC-Link family. A module is added to "Module List" of "CC IE Field Configuration" window by profile registration to GX Works2 or GX Works3. For the profile registration, refer to the following.
📖 GX Works2 Version 1 Operating Manual (Common)
📖 GX Works3 Operating Manual

(4) Temperature sensor

For the available temperature sensors, refer to the following.
☞ Page 36, Section 3.2 (1)

5.2 Precautions for System Configuration

The temperature control module measures temperature based on the temperature of the terminal block. Some operating environments therefore cause an uneven temperature distribution of the terminal block, which results in a larger error in the measured temperature.
In such cases, the temperature error can be corrected by the sensor correction function. For details on the sensor correction function, refer to the following.
☞ Page 132, Section 8.1.5

Memo

CHAPTER 6 INSTALLATION AND WIRING

This chapter describes the installation and wiring of a temperature control module.

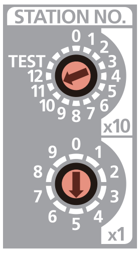
6.1 Station Number Setting

(1) Setting method

Set the station number with the rotary switch on the front of the module. Since the setting value of the station number becomes valid at power-on, set the station number under power-off condition.

- The hundreds and tens place of a station number is set with ×10.
- The ones place of a station number is set with ×1.

Ex. To set the station number to 115, set the switch as shown below.



(2) Setting range

Set the station number from 1 to 120. Setting the value other than 1 to 120 causes a communication error and the D LINK LED flashes.

Remark

- Changing the station number setting switch while the module is powered on causes a minor error and the ERR. LED flashes. Undoing the change allows recovery from the error after five seconds and the ERR. LED turns off.
- Do not set the same station number with the other station numbers. Doing so causes a communication error and the D LINK LED does not turn on.

6.2 Installation Environment and Installation Position

6.2.1 Installation environment

(1) Installation location

Do not install the temperature control module to the place where:

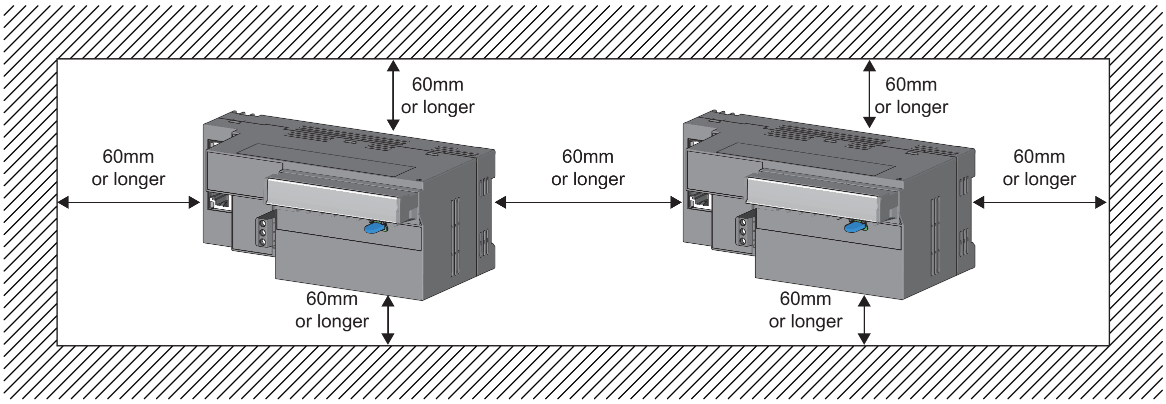
- Ambient temperature is outside the range of 0 to 55℃;
- Ambient humidity is outside the range of 5 to 95%RH;
- Condensation occurs due to rapid temperature change;
- Corrosive gas or combustible gas is present;
- There is a large quantity of conductive powders such as dust and iron powders, oil mist, salts, or organic solvents;
- The module is exposed to direct sunlight;
- A strong electric field or strong magnetic field is generated;
- The module is directly subject to vibration and shock.

(2) Installation surface

Install the temperature control module on a flat surface. If the installation surface is uneven, excessive force is applied to the printed-circuit board, which may cause malfunction.

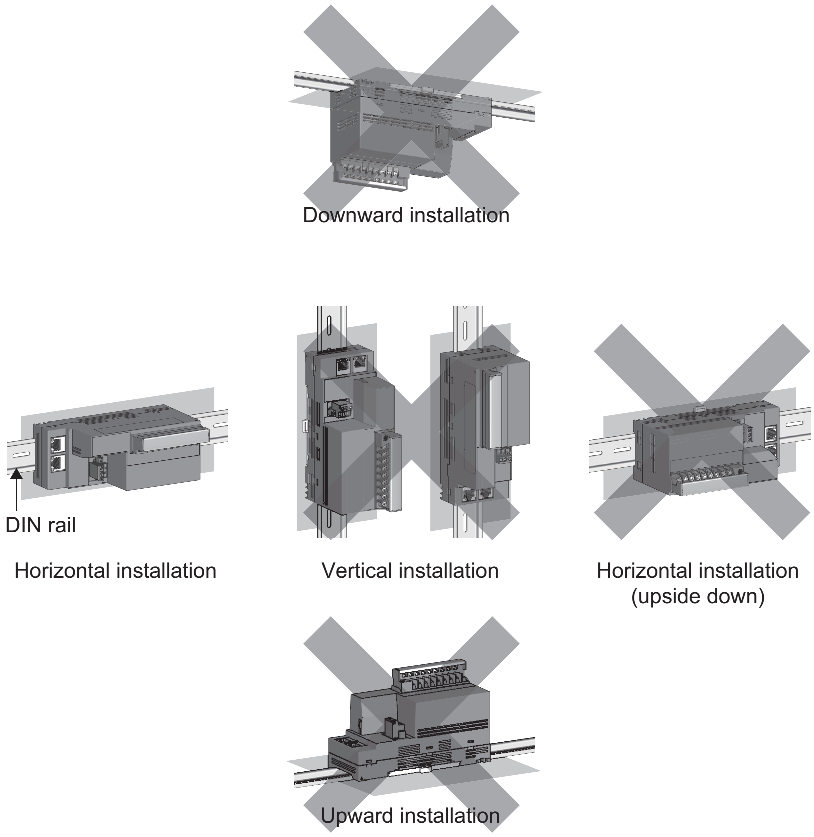
6.2.2 Installation position

When installing the temperature control module in a control panel, provide a distance of 60mm or longer away from the surrounding structures and the adjacent modules to ensure good ventilation. Doing so also allows an easy module replacement.



6.2.3 Installation direction

The temperature control module allows installation in only one direction.
To install the module, use a DIN rail.

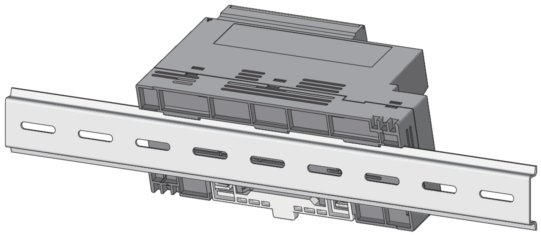


6.3 Installation

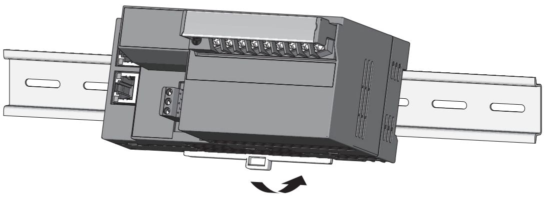
6.3.1 Mounting the module on a DIN rail

Remark

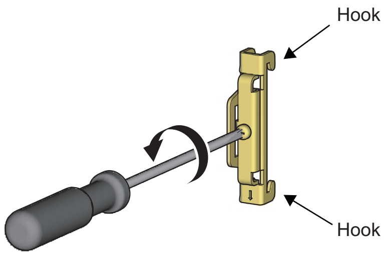
The usage of a DIN rail stopper described below is merely one example. Follow the manual of the DIN rail stopper used to fix the module.



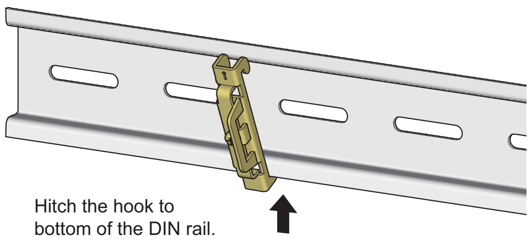
1. **Hitch the upper hook of the module to the top of the DIN rail.**



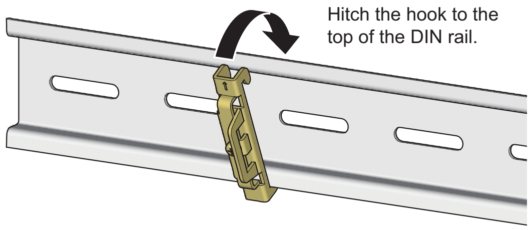
2. **Push the module into the depth until the DIN rail hook clicks.**



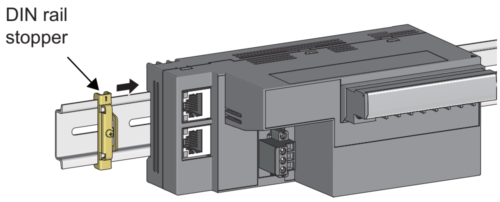
3. **Loosen the screw on the DIN rail stopper.**



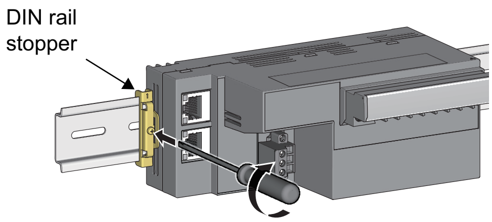
4. **Hitch the lower hook of the DIN rail stopper to the bottom of the DIN rail.**
Check the arrow on the front of the stopper to adjust the upward and downward direction.



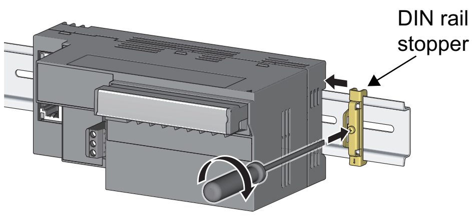
5. **Hitch the upper hook of the DIN rail stopper to the top of the DIN rail.**



6. **Slide the DIN rail stopper up to the left side of the module.**



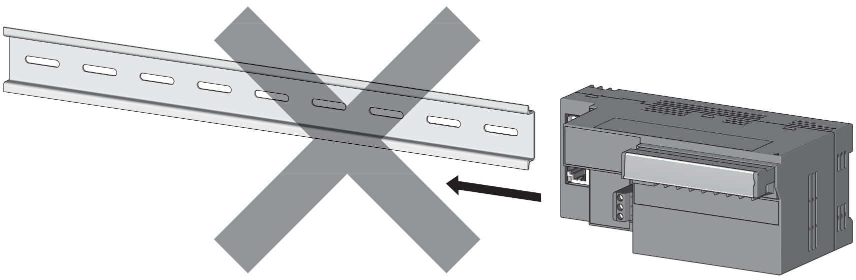
7. **Hold the DIN rail stopper in the direction opposite to the arrow on the stopper and tighten the screw with a screwdriver.**



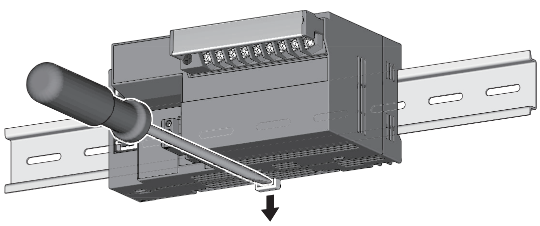
8. **In the same procedure, install the DIN rail stopper on the right side of the module again.**
For the right side installation, note that the direction of the stopper is upside down.

Remark

Do not slide modules from the edge of the DIN rail when mounting them. Doing so may damage the metal part located on the back of the module.



(1) Removal procedure



1. **Remove the DIN rail stoppers.**
Follow the reverse procedure of the installation.

2. **While pushing down on the DIN rail hook with a flathead screwdriver, draw the lower part of the module and remove it from the DIN rail.**

(2) Applicable DIN rail model (compliant with IEC 60715)

- TH35-7.5Fe
- TH35-7.5Al

(3) Interval between DIN rail mounting screws

Tighten the screws at intervals of 200mm or less.

(4) DIN rail stopper

Use a stopper that is attachable to the DIN rail.

6.4 Wiring with a Terminal Block for Module Power Supply and FG

(1) Tightening torque

Tighten the terminal block screws within the following specified torque range. Tightening the screws too much may damage the module case.

Screw type	Tightening torque range
Terminal block mounting screw (M2.5 screw)	0.2 to 0.3N·m
Terminal screw (M2.5 screw)	0.5 to 0.6N·m

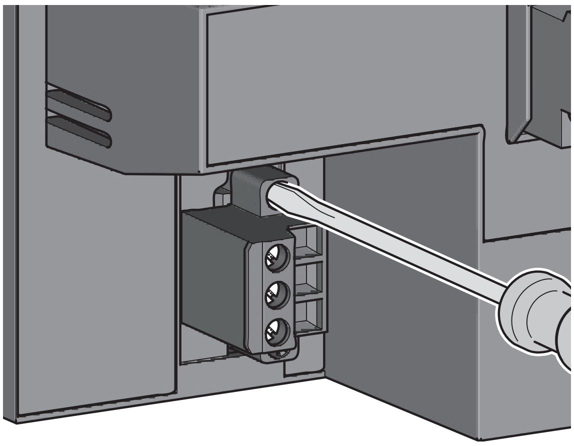
(2) Wire to be used

The following table describes the wire to be connected to the terminal block for module power supply and FG.

Diameter	Type	Material	Temperature rating
20 to 16 AWG	Stranded	Copper	75℃ or more

(3) Installing and removing the terminal block

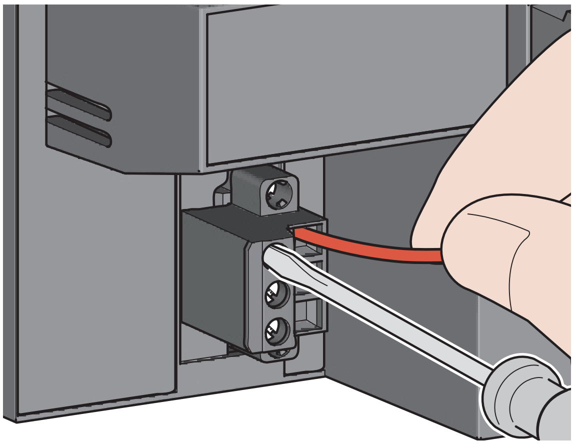
To remove the terminal block, loosen the terminal block fixing screw with a slotted screwdriver.
To install the terminal block, tighten the terminal block fixing screw.
Failure to secure the terminal block may cause drop, short circuit, malfunction.



(4) Connecting and disconnecting the cable

To connect the cable, insert the wire with the cable fixing screw loosened and tighten the screw.

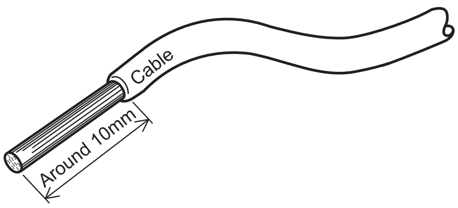
To disconnect the cable, pull out the wire with the cable fixing screw loosened with a flathead screwdriver.



(5) Processing method of the cable terminal

Strip the cable about 10mm from the top.

To use a bar solderless terminal, connect it to the stripped part.



(6) Lists of reference products of the bar solderless terminal

The following table lists the reference products of the bar solderless terminal.

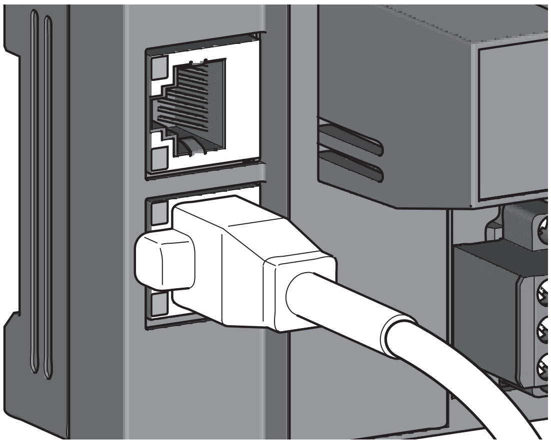
Product	Model	Applicable wire size	Manufacturer
Bar solderless terminal	TE 0.5-10	$0.5mm^2$	NICHIFU Co., ltd.
	TE 0.75-10	$0.75mm^2$	
	TE 1.0-10	0.9 to $1.0mm^2$	
	TE 1.5-10	1.25 to $1.5mm^2$	
Tool dedicated for bar solderless terminal	NH79	—	
Bar solderless terminal	AI 0.5-10WH	$0.5mm^2$	PHOENIX CONTACT GmbH & Co. KG
	AI 0.75-10GY	$0.75mm^2$	
	AI 1-10RD	$1.0mm^2$	
	AI 1.5-10BK	$1.5mm^2$	
Tool dedicated for bar solderless terminal	CRIMPFOX6	—	

6.5 Wiring of an Ethernet Cable

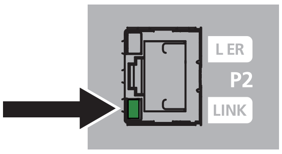
(1) Connecting the Ethernet cable

(a) Connecting

1. Turn off the power supplies of the temperature control module and the external device.
2. Paying attention to the direction of the connector, push the Ethernet cable connector into the temperature control module until it clicks.

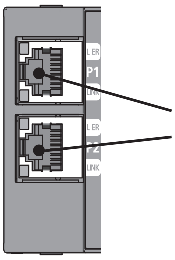


3. Turn on the module power supply.
4. Turn on the power supply of the external device.
5. Check if the LINK LED on the port into which the Ethernet cable is connected is on.

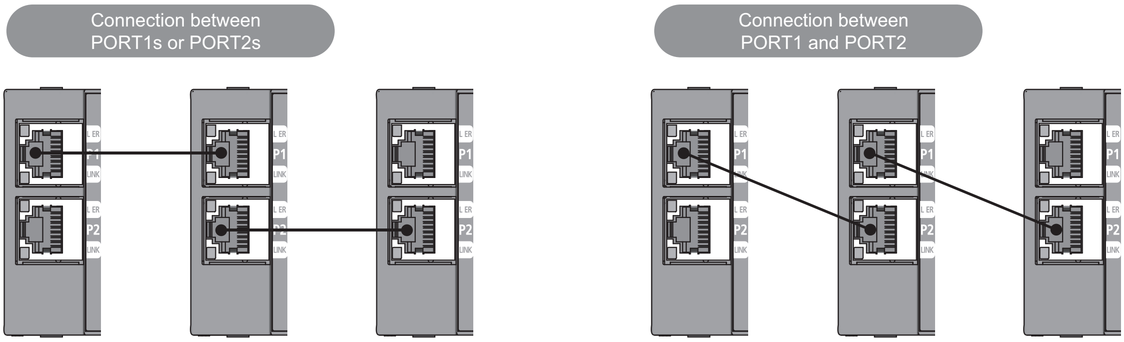


Point

- The time taken for the LINK LED to turn on after connection of the cable may vary. The LINK LED normally turns on in a few second. However, if link-up processing is repeated due to a condition of a device on the line, the longer time may be required. If the LINK LED does not turn on, refer to the following and take a corrective action.
☞ Page 281, Section 11.4 (8)
- PORT1 and PORT2 need not to be distinguished. When only one connector is used in star topology, either PORT1 or PORT2 can be connected.

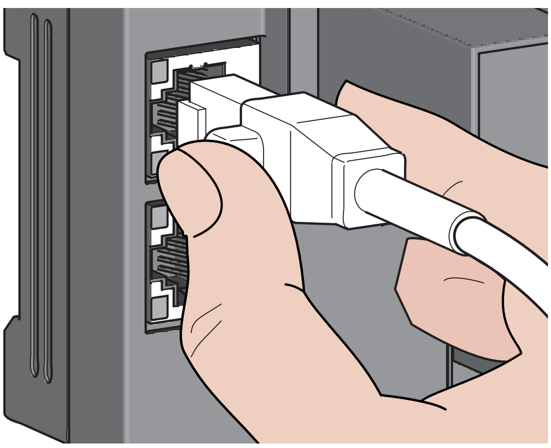


- When two connectors are used in line topology or ring topology, an Ethernet cable can be connected to the connectors in any combination. For example, the cable can be connected between PORT1s and between PORT1 and PORT2.



- For details on the star topology, line topology or ring topology, refer to the following.
📖 User's manual for the master/local module used

(b) Disconnecting



1. **Power off the module.**

2. **Pressing the latch down, unplug the Ethernet cable.**

(2) Precautions

(a) Laying Ethernet cables

- Place the Ethernet cable in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact.
- Do not touch the core of the connector of the cable or the module, and protect it from dirt and dust. If any oil from your hand, or any dirt or dust sticks to the core, it can increase transmission loss, causing data link to fail.
- Check if there is a disconnection of the Ethernet cables used. In addition, check if there is a short or a problem with the connector connection.

(b) Broken cable latch

Do not use Ethernet cables with broken latches. Doing so may cause the cable to unplug or malfunction.

(c) Connecting and disconnecting the Ethernet cable

Hold the connector part when connecting and disconnecting the Ethernet cable. Pulling the cable connected to the module may result in damage to the module or cable or malfunction due to poor contact.

(d) Connectors without Ethernet cable

To prevent dust from entering the module, attach the provided connector cover.

(e) Maximum station-to-station distance (Maximum Ethernet cable length)

The maximum station-to-station distance is 100m. However, the distance may be shorter depending on the operating environment of the cable. For details, contact the manufacturer of the cables used.

(f) Bending radius of the Ethernet cable

There are restrictions on the bending radius of the Ethernet cable. Check the bending radius in the specifications of the Ethernet cables used.

6.6 Wiring of External Devices and Terminal Blocks

(1) Tightening torque

Tighten the terminal block screws within the following specified torque range. Tightening the screws too much may damage the module case.

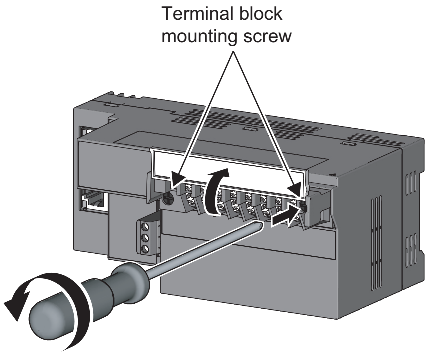
Screw type	Tightening torque range
Terminal screw (M3 screw)	0.42 to 0.58N·m
Terminal block mounting screw (M3.5 screw)	0.68 to 0.92N·m

The following table shows applicable solderless terminals for connecting the terminal block. For wiring, use applicable wires in the following table and fix them with an applicable tightening torque. Use UL-approved solderless terminals. For processing, use a tool recommended by manufacturers of solderless terminals. The solderless terminal with an insulation sleeve cannot be used.

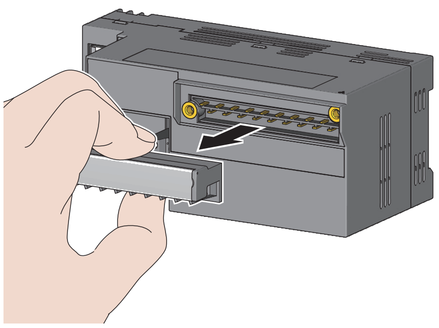
Solderless terminal		Wire			
Model	Applicable tightening torque	Diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N·m	22 to 18 AWG	Stranded	Copper	75℃ or more

(2) Removing and installing the terminal block

(a) Removal procedure

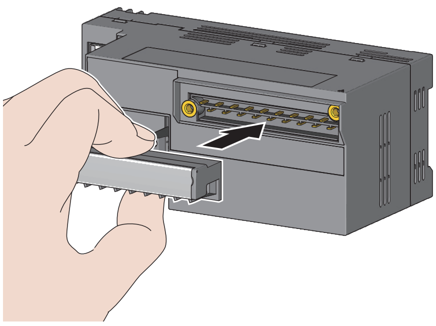


1. **Open the terminal cover and loosen the terminal block mounting screws (two points).**

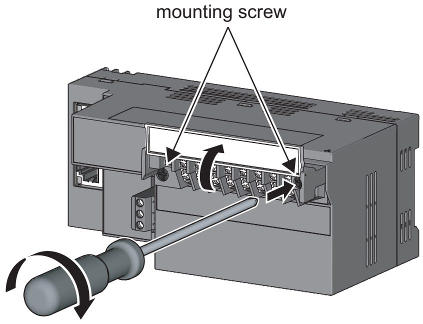


2. **Remove the terminal block.**

(b) Installation procedure



1. **Install the terminal block.**



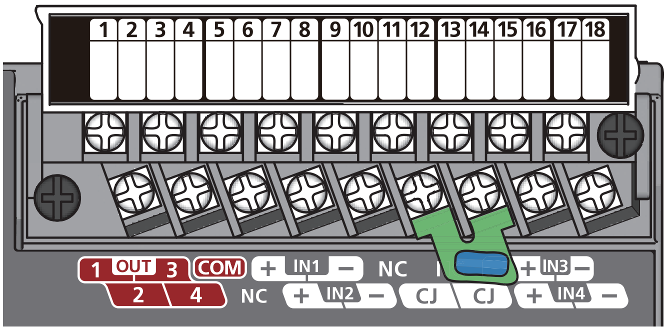
2. **Open the terminal cover and tighten the terminal block mounting screws (two points).**

(3) Wiring of the external device and terminal block

(a) Signal name

The following shows the signal name of the terminal block.

- NZ2GF2B-60TCTT4



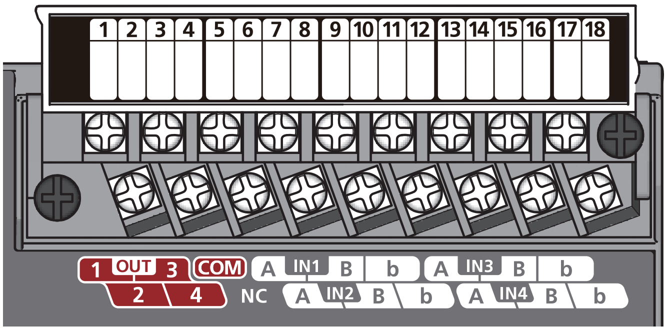
Terminal No.	Indication	Temperature input		Standard control		Heating-cooling control (normal mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	—	Unused	L1	CH1 Output	L1H	CH1 Heating output
2	OUT2	—	Unused	L2	CH2 Output	L1C	CH1 Cooling output
3	OUT3	—	Unused	L3	CH3 Output	L2H	CH2 Heating output
4	OUT4	—	Unused	L4	CH4 Output	L2C	CH2 Cooling output
5	COM	—	Unused	COM -	Output common	COM -	Output common
6	NC	—	Unused	NC	Unused	NC	Unused
7	IN1 +	MT1 +	Monitor 1 thermocouple +	CH1 +	CH1 Thermocouple +	CH1 +	CH1 Thermocouple +
8	IN2 +	MT2 +	Monitor 2 thermocouple +	CH2 +	CH2 Thermocouple +	CH2 +	CH2 Thermocouple +
9	IN1 -	MT1 -	Monitor 1 thermocouple -	CH1 -	CH1 Thermocouple -	CH1 -	CH1 Thermocouple -
10	IN2 -	MT2 -	Monitor 2 thermocouple -	CH2 -	CH2 Thermocouple -	CH2 -	CH2 Thermocouple -
11	NC	—	Unused	NC	Unused	NC	Unused
12	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
13	NC	—	Unused	NC	Unused	NC	Unused
14	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
15	IN3 +	MT3 +	Monitor 3 thermocouple +	CH3 +	CH3 Thermocouple +	MT3 +	Monitor 3 Thermocouple +
16	IN4 +	MT4 +	Monitor 4 thermocouple +	CH4 +	CH4 Thermocouple +	MT4 +	Monitor 4 Thermocouple +
17	IN3 -	MT3 -	Monitor 3 thermocouple -	CH3 -	CH3 Thermocouple -	MT3 -	Monitor 3 thermocouple -
18	IN4 -	MT4 -	Monitor 4 thermocouple -	CH4 -	CH4 Thermocouple -	MT4 -	Monitor 4 thermocouple -

Terminal No.	Indication	Heating-cooling control (expanded mode)		Mix control (normal mode)		Mix control (expanded mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	L1H	CH1 Heating output	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L1C	CH1 Cooling output	L1C	CH1 Cooling output	L1C	CH1 Cooling output
3	OUT3	L2H	CH2 Heating output	L3	CH3 Output	L3	CH3 Output
4	OUT4	L2C	CH2 Cooling output	L4	CH4 Output	L4	CH4 Output
5	COM	COM -	Output common	COM -	Output common	COM -	Output common
6	NC	NC	Unused	NC	Unused	NC	Unused
7	IN1 +	CH1 +	CH1 Thermocouple +	CH1 +	CH1 Thermocouple +	CH1 +	CH1 Thermocouple +
8	IN2 +	CH2 +	CH2 Thermocouple +	MT2 +	Monitor 2 thermocouple +	CH2 +	CH2 Thermocouple +
9	IN1 -	CH1 -	CH1 Thermocouple -	CH1 -	CH1 Thermocouple -	CH1 -	CH1 Thermocouple -
10	IN2 -	CH2 -	CH2 Thermocouple -	MT2 -	Monitor 2 thermocouple -	CH2 -	CH2 Thermocouple -
11	NC	NC	Unused	NC	Unused	NC	Unused
12	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
13	NC	NC	Unused	NC	Unused	NC	Unused
14	CJ	CJ	Cold junction temperature compensation resistor	NC	Cold junction temperature compensation resistor	NC	Cold junction temperature compensation resistor
15	IN3 +	CH3 +	CH3 Thermocouple +	CH3 +	CH3 Thermocouple +	CH3 +	CH3 Thermocouple +
16	IN4 +	CH4 +	CH4 Thermocouple +	CH4 +	CH4 Thermocouple +	CH4 +	CH4 Thermocouple +
17	IN3 -	CH3 -	CH3 Thermocouple -	CH3 -	CH3 Thermocouple -	CH3 -	CH3 Thermocouple -
18	IN4 -	CH4 -	CH4 Thermocouple -	CH4 -	CH4 Thermocouple -	CH4 -	CH4 Thermocouple -

Remark

Do not remove the cold junction temperature compensation resistor from the terminal block.

- NZ2GF2B-60TCRT4



Terminal No.	Indication	Temperature input		Standard control		Heating-cooling control (normal mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	—	Unused	L1	CH1 Output	L1H	CH1 Heating output
2	OUT2	—	Unused	L2	CH2 Output	L1C	CH1 Cooling output
3	OUT3	—	Unused	L3	CH3 Output	L2H	CH2 Heating output
4	OUT4	—	Unused	L4	CH4 Output	L2C	CH2 Cooling output
5	COM	—	Unused	COM -	Output common	COM -	Output common
6	NC	—	Unused	NC	Unused	NC	Unused
7	IN1 A	MT1 A	Monitor 1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A
8	IN2 A	MT2 A	Monitor 2 Resistance thermometer A	CH2 A	CH2 Resistance thermometer A	CH2 A	CH2 Resistance thermometer A
9	IN1 B	MT1 B	Monitor 1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B
10	IN2 B	MT2 B	Monitor 2 Resistance thermometer B	CH2 B	CH2 Resistance thermometer B	CH2 B	CH2 Resistance thermometer B
11	IN1 b	MT1 b	Monitor 1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b
12	IN2 b	MT2 b	Monitor 2 Resistance thermometer b	CH2 b	CH2 Resistance thermometer b	CH2 b	CH2 Resistance thermometer b
13	IN3 A	MT3 A	Monitor 3 Resistance thermometer A	CH3 A	CH3 Resistance thermometer A	MT3 A	Monitor 3 Resistance thermometer A
14	IN4 A	MT4 A	Monitor 4 Resistance thermometer A	CH4 A	CH4 Resistance thermometer A	MT4 A	Monitor 4 Resistance thermometer A
15	IN3 B	MT3 B	Monitor 3 Resistance thermometer B	CH3 B	CH3 Resistance thermometer B	MT3 B	Monitor 3 Resistance thermometer B
16	IN4 B	MT4 B	Monitor 4 Resistance thermometer B	CH4 B	CH4 Resistance thermometer B	MT4 B	Monitor 4 Resistance thermometer B
17	IN3 b	MT3 b	Monitor 3 Resistance thermometer b	CH3 b	CH3 Resistance thermometer b	MT3 b	Monitor 3 Resistance thermometer b
18	IN4 b	MT4 b	Monitor 4 Resistance thermometer b	CH4 b	CH4 Resistance thermometer b	MT4 b	Monitor 4 Resistance thermometer b

Terminal No.	Indication	Heating-cooling control (expanded mode)		Mix control (normal mode)		Mix control (expanded mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	L1H	CH1 Heating output	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L1C	CH1 Cooling output	L1C	CH1 Cooling output	L1C	CH1 Cooling output
3	OUT3	L2H	CH2 Heating output	L3	CH3 Output	L3	CH3 Output
4	OUT4	L2C	CH2 Cooling output	L4	CH4 Output	L4	CH4 Output
5	COM	COM -	Output common	COM -	Output common	COM -	Output common
6	NC	NC	Unused	NC	Unused	NC	Unused
7	IN1 A	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A
8	IN2 A	CH2 A	CH2 Resistance thermometer A	MT2 A	Monitor 2 Resistance thermometer A	CH2 A	CH2 Resistance thermometer A
9	IN1 B	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B
10	IN2 B	CH2 B	CH2 Resistance thermometer B	MT2 B	Monitor 2 Resistance thermometer B	CH2 B	CH2 Resistance thermometer B
11	IN1 b	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b
12	IN2 b	CH2 b	CH2 Resistance thermometer b	MT2 b	Monitor 2 Resistance thermometer b	CH2 b	CH2 Resistance thermometer b
13	IN3 A	CH3 A	CH3 Resistance thermometer A	CH3 A	CH3 Resistance thermometer A	CH3 A	CH3 Resistance thermometer A
14	IN4 A	CH4 A	CH4 Resistance thermometer A	CH4 A	CH4 Resistance thermometer A	CH4 A	CH4 Resistance thermometer A
15	IN3 B	CH3 B	CH3 Resistance thermometer B	CH3 B	CH3 Resistance thermometer B	CH3 B	CH3 Resistance thermometer B
16	IN4 B	CH4 B	CH4 Resistance thermometer B	CH4 B	CH4 Resistance thermometer B	CH4 B	CH4 Resistance thermometer B
17	IN3 b	CH3 b	CH3 Resistance thermometer b	CH3 b	CH3 Resistance thermometer b	CH3 b	CH3 Resistance thermometer b
18	IN4 b	CH4 b	CH4 Resistance thermometer b	CH4 b	CH4 Resistance thermometer b	CH4 b	CH4 Resistance thermometer b

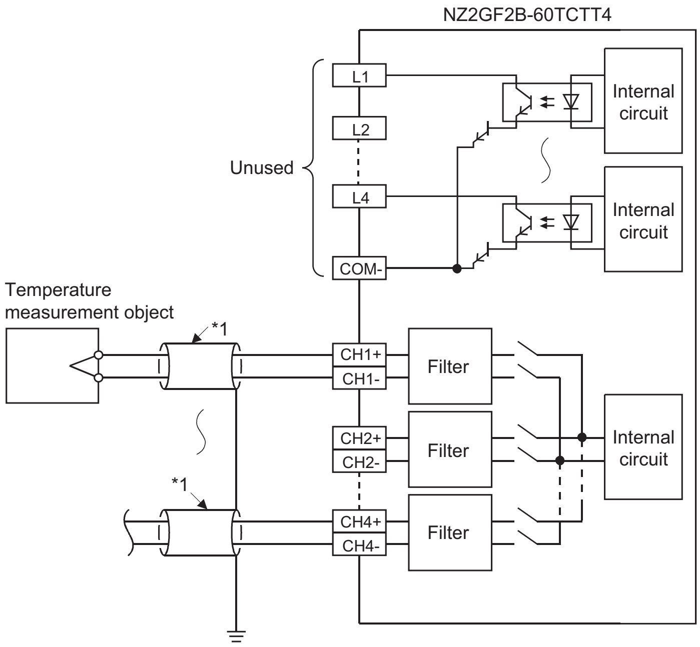
(b) Wiring precautions

To sufficiently exert the function of the temperature control module and improve the system reliability, an external wiring with less noise interference is required. This section describes wiring precautions.

- Use separate cables from the AC control circuit to the external I/O signals of the temperature control module to avoid the influence of the AC side surges or induction.
- Do not tie external wires or lay them together with the main circuit lines, high-voltage cables, and load cables from other than programmable controllers. Provide sufficient distance from a circuit containing high frequencies, such as high-voltage cables and load main circuits of an inverter. Otherwise, the system becomes susceptible to noise, surges, or induction.
- Ground the shield wires or shielded cables at one end on the programmable controller side. However, depending on the external noise condition, it should be grounded on the other side.
- Prevent the adhesion of oil to the terminals and screws. Failure to do so may damage the screw.
- Tighten the terminal screw with an applicable screwdriver. Tightening with an inapplicable screwdriver may damage the screw.

6.6.1 External wiring of the NZ2GF2B-60TCTT4

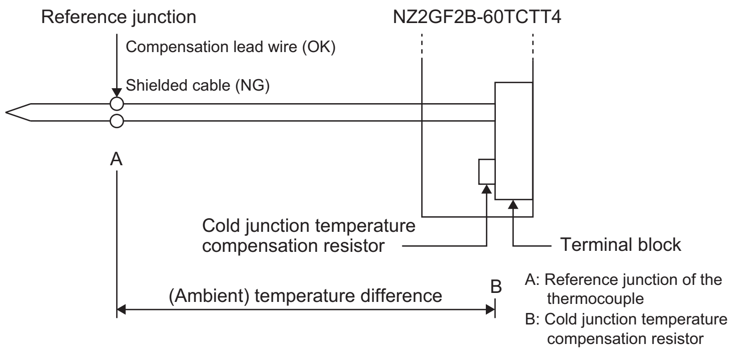
(1) In the temperature input mode



*1 Be sure to use the shielded compensation lead wire.

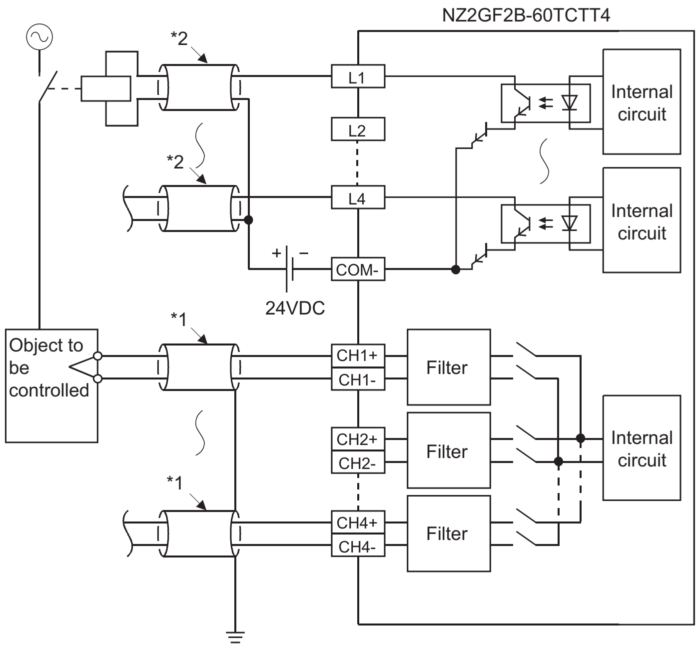
Point

Use the compensation lead wire for the cable of the thermocouple. If the compensation lead wire is not used, and when the cold junction temperature compensation resistor is away from the end tip of thermocouple, the (ambient) temperature difference may lead to a faulty temperature process value (PV).



(2) In the temperature control mode

(a) In the standard control

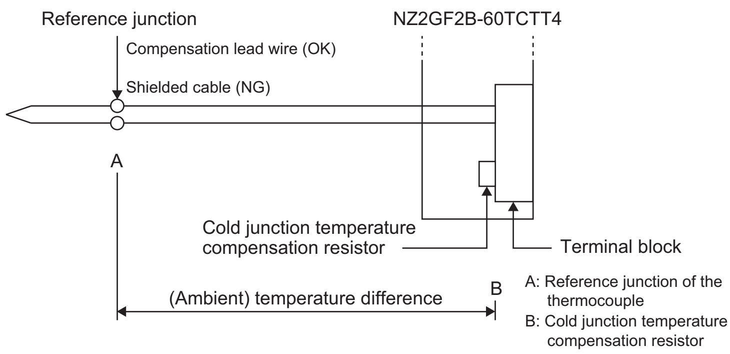


*1 Be sure to use the shielded compensation lead wire.

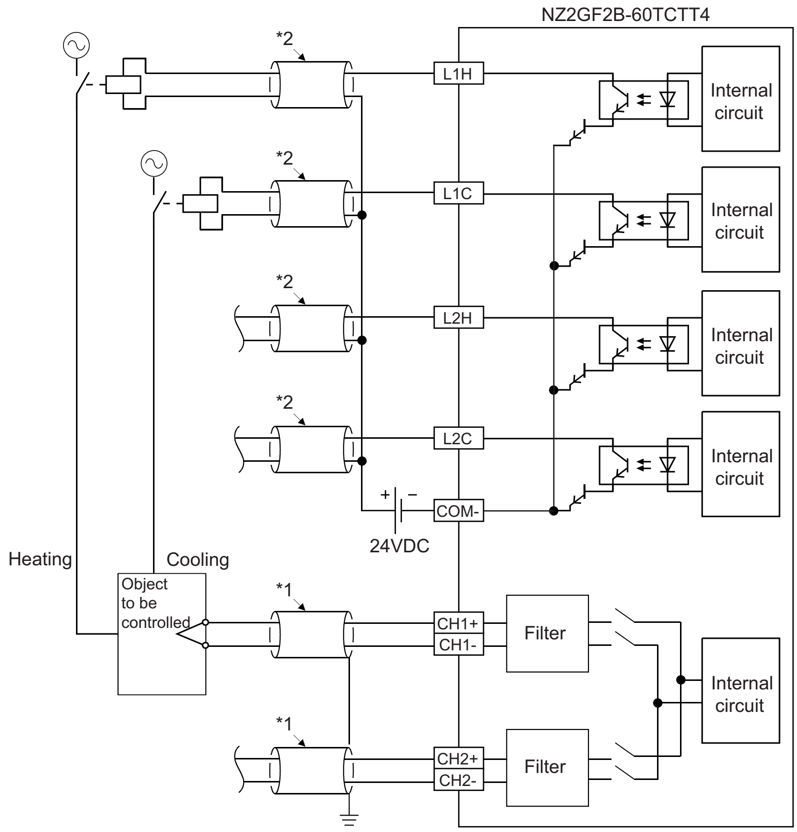
*2 Be sure to use the shielded cable.

Point

Use the compensation lead wire for the cable of the thermocouple. If the compensation lead wire is not used, and when the cold junction temperature compensation resistor is away from the end tip of thermocouple, the (ambient) temperature difference may lead to a faulty temperature process value (PV).



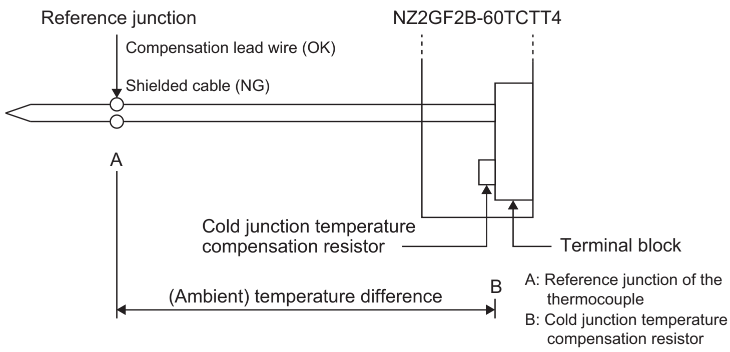
(b) In the heating-cooling control



*1 Be sure to use the shielded compensation lead wire.
*2 Be sure to use the shielded cable.

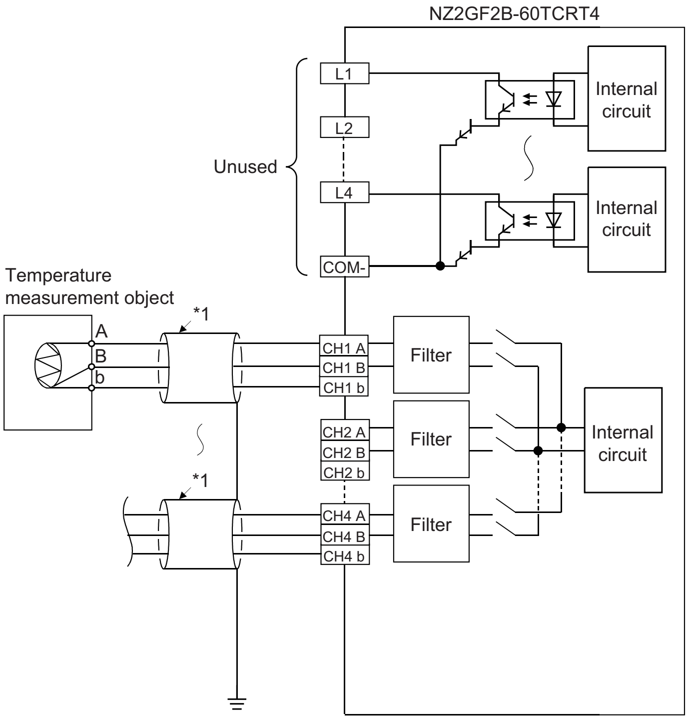
Point

Use the compensation lead wire for the cable of the thermocouple. If the compensation lead wire is not used, and when the cold junction temperature compensation resistor is away from the end tip of thermocouple, the (ambient) temperature difference may lead to a faulty temperature process value (PV).



6.6.2 External wiring of the NZ2GF2B-60TCRT4

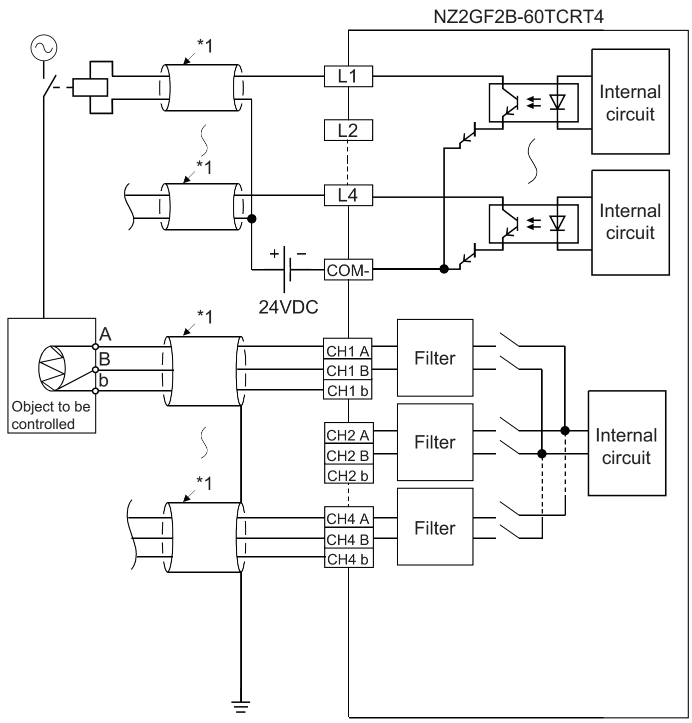
(1) In the temperature input mode



*1 Be sure to use the shielded cable.

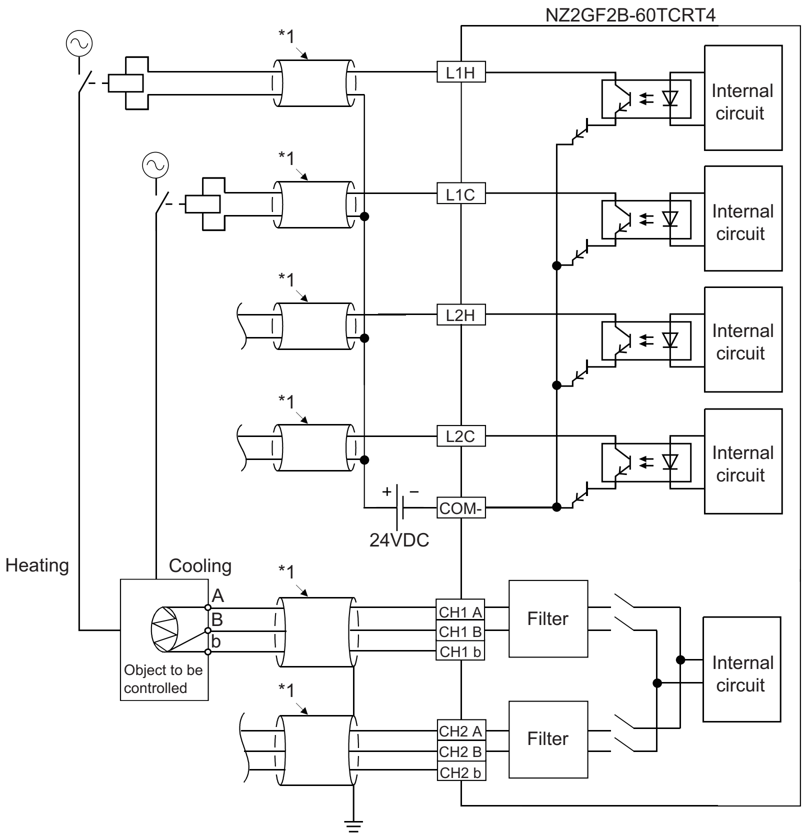
(2) In the temperature control mode

(a) In the standard control



*1 Be sure to use the shielded cable.

(b) In the heating-cooling control



*1 Be sure to use the shielded cable.

CHAPTER 7 VARIOUS SETTINGS

This chapter describes the setting procedures of a temperature control module.

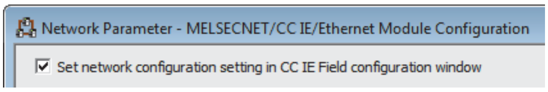
7.1 Parameter Settings

Set the parameter of this module with the network parameter written to the CPU module of the master station. For the setting procedure of the master station, refer to the following.

📖 User's manual for the master/local module used

Remark

- Check in advance the box next to "Set network configuration setting in CC IE Field configuration window" in MELSECNET/CC IE/Ethernet Module Configuration window.



- Set the same number of points of the temperature control module to remote I/O signals and remote register. If the set points are less than the ones of the temperature control module, the cyclic transmission is performed only for the set points of data from the start, the temperature control module may not operate normally. In that case, an error does not occur.

(1) Precautions

(a) Before parameter settings

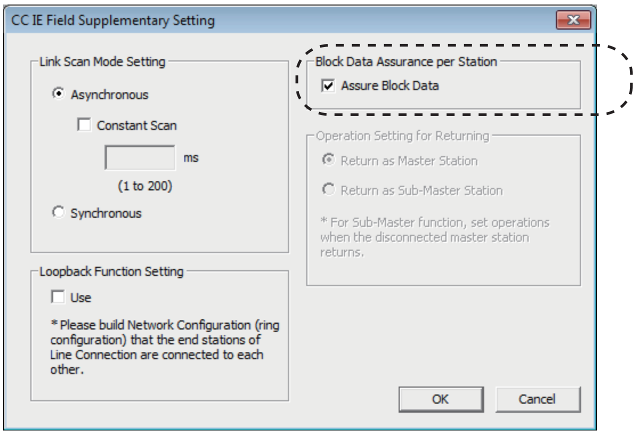
For the precautions before parameter settings, refer to the following.

GX Works3 Operating Manual

GX Works2 Version 1 Operating Manual (Common)

(b) Parameter settings

- When using the temperature control module, enable the block data assurance per station. If it is disabled, correct operation of the temperature control module cannot be guaranteed. For the block data assurance per station, refer to the following. User's manual for the master/local module used



- Do not set the parameter using the CCPASET instruction in the master station. If the CCPASET instruction is executed, correct operation of the temperature control module cannot be guaranteed because the module operates with the block data assurance per station disabled. (The CCPASET instruction is used to set parameter to a master/local module. For details on the CCPASET instruction, refer to the following. User's manual for the master/local module used)

7

7.1 Parameter Settings

(2) Procedures

(a) Parameter settings

1. Display the CC IE Field Configuration window.

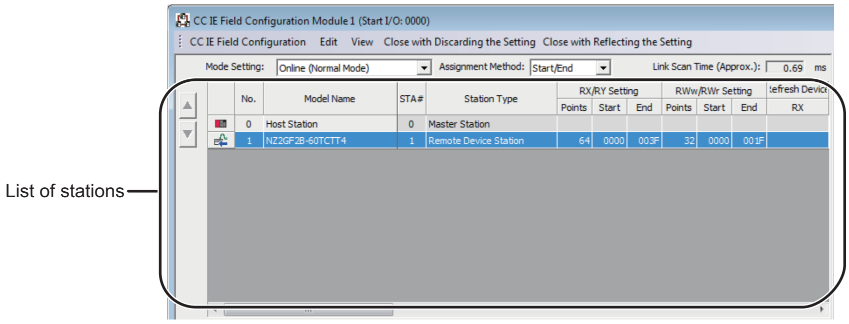
- When the master/local module is the QJ71GF11-T2

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET] ⇨ [CC IE Field Configuration Setting] button

- When the master/local module is the LJ71GF11-T2

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE Field] ⇨ [CC IE Field Configuration Setting] button

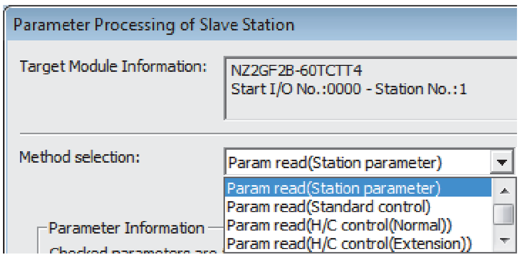
2. Select the temperature control module in "List of stations" on the CC IE Field Configuration window.



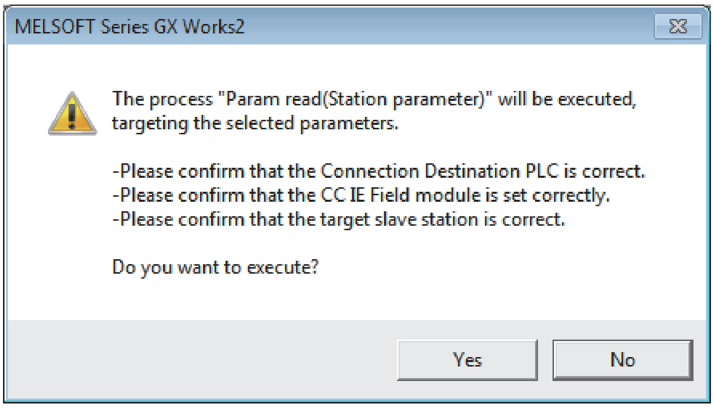
3. Open the "Parameter Processing of Slave Station" window.

[CC IE Field Configuration] ⇨ [Online] ⇨ [Parameter Processing of Slave Station]

4. Set "Method selection" to "Param read (Station parameter)".

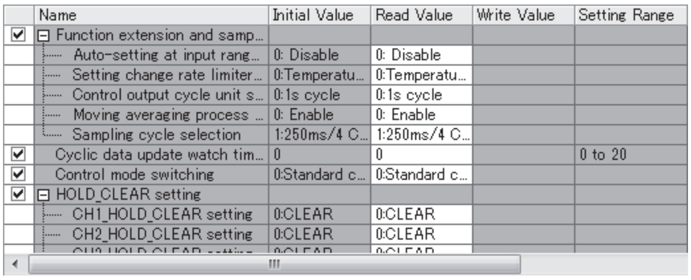


5. **Click the [Execute] button and the following window is displayed.**



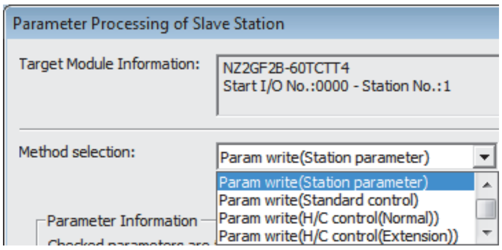
6. **Click the [Yes] button.**

7. **The parameter is read from the temperature control module.**



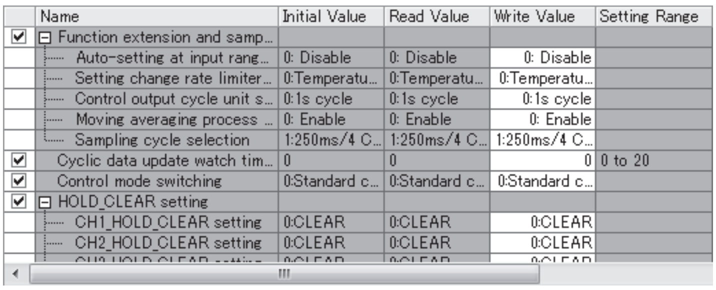
Name	Initial Value	Read Value	Write Value	Setting Range
Function extension and samp...				
Auto-setting at input rang...	0: Disable	0: Disable		
Setting change rate limiter...	0:Temperatu...	0:Temperatu...		
Control output cycle unit s...	0:1s cycle	0:1s cycle		
Moving averaging process ...	0: Enable	0: Enable		
Sampling cycle selection	1:250ms/4 C...	1:250ms/4 C...		
Cyclic data update watch tim...	0	0		0 to 20
Control mode switching	0:Standard c...	0:Standard c...		
HOLD_CLEAR setting				
CH1_HOLD_CLEAR setting	0:CLEAR	0:CLEAR		
CH2_HOLD_CLEAR setting	0:CLEAR	0:CLEAR		

8. **Set "Method selection" to "Param write (Station parameter)".**



9. **Set "Write Value". The following are the procedure.**

- Click the title cell of "Initial Value" or "Read Value" to select all the items.
- Right-click on the items to copy them.
- Click the title cell of "Write Value" to select all the items.
- Right-click on the items to paste the copy.



Name	Initial Value	Read Value	Write Value	Setting Range
Function extension and samp...				
Auto-setting at input rang...	0: Disable	0: Disable	0: Disable	
Setting change rate limiter...	0:Temperatu...	0:Temperatu...	0:Temperatu...	
Control output cycle unit s...	0:1s cycle	0:1s cycle	0:1s cycle	
Moving averaging process ...	0: Enable	0: Enable	0: Enable	
Sampling cycle selection	1:250ms/4 C...	1:250ms/4 C...	1:250ms/4 C...	
Cyclic data update watch tim...	0	0	0	0 to 20
Control mode switching	0:Standard c...	0:Standard c...	0:Standard c...	
HOLD_CLEAR setting				
CH1_HOLD_CLEAR setting	0:CLEAR	0:CLEAR	0:CLEAR	
CH2_HOLD_CLEAR setting	0:CLEAR	0:CLEAR	0:CLEAR	

Point

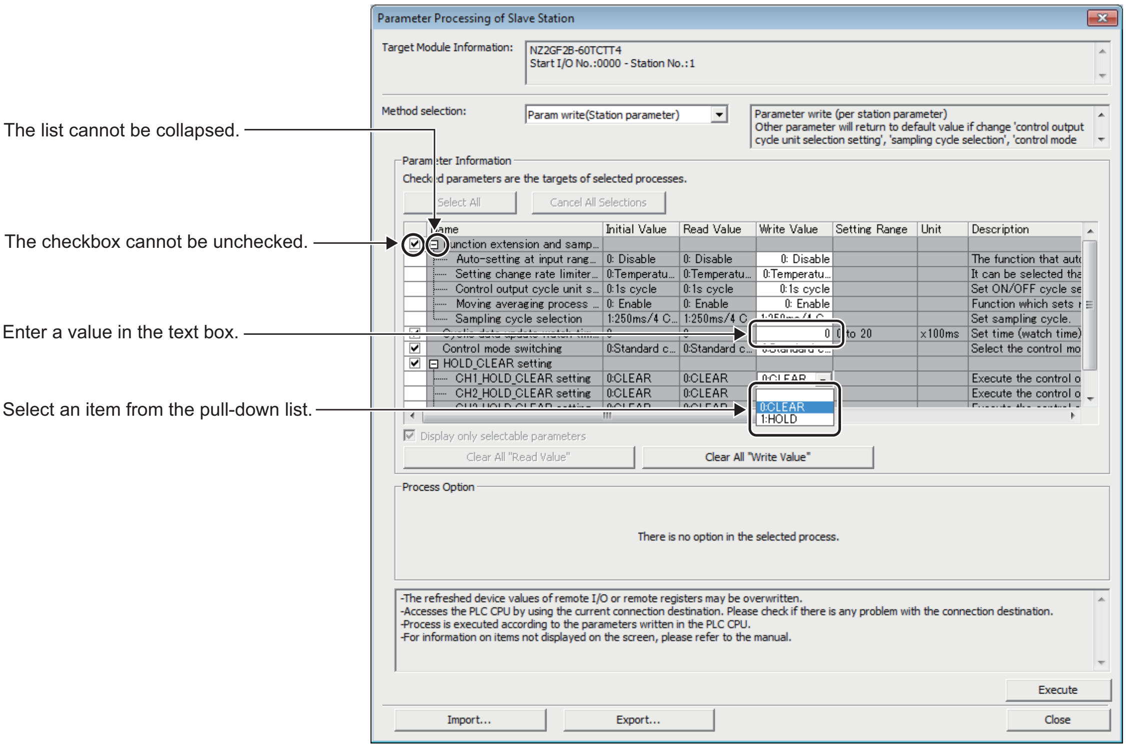
Set all the items for the parameter. If any blank exists, the parameter cannot be written to the temperature control module.

10. **Double-click the item to change, and set a new value.**

- Items to be set from the pull-down list

  Double-click the item to display the pull-down list, and select the value from the list.
- Items to be entered in the text box

  Double-click the item and enter a value.

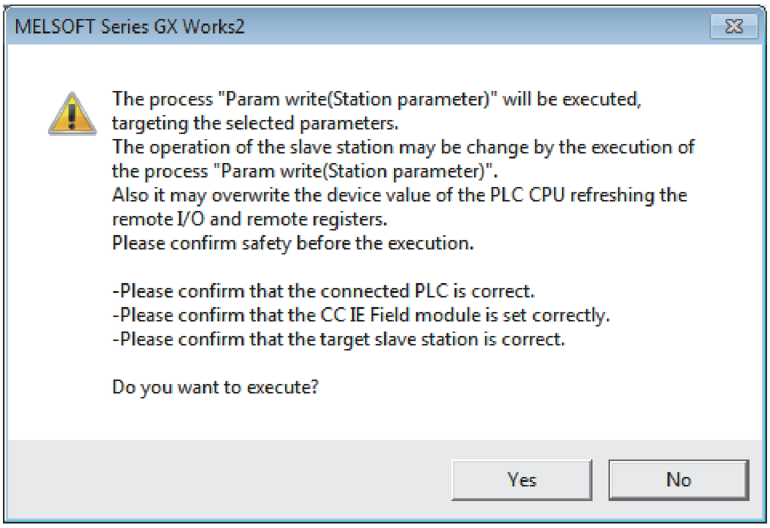


Setting item		Reference
Function extension and sampling cycle selection	Auto-setting at input range change	Page 309, Appendix 3 (1) (a)
	Setting change rate limiter setting	Page 310, Appendix 3 (1) (b)
	Control output cycle unit switching setting	Page 310, Appendix 3 (1) (c)
	Moving averaging process setting	Page 310, Appendix 3 (1) (d)
	Sampling cycle selection	Page 310, Appendix 3 (1) (e)
Cyclic data update watch time setting		Page 311, Appendix 3 (2)
Control mode switching		Page 311, Appendix 3 (3)
HOLD_CLEAR setting	CH□_HOLD_CLEAR setting	Page 312, Appendix 3 (4)

Point

- When "Control mode switching" is changed and the parameter write is performed, remote buffer memory areas (address of 100H or later) are overwritten with default values.
- When "Control output cycle unit switching setting" is changed and the parameter write is performed, the following parameters are overwritten with default values.
  - "Control output cycle setting"
  - "Heating control output cycle setting"
  - "Cooling control output cycle setting"
- When "Sampling cycle selection" is changed and the parameter write is performed, remote buffer memory areas (address of 100H or later) are overwritten with default values.

11. **Click the [Execute] button and the following window is displayed.**



12. **Click the [Yes] button.**

13. **The station-based parameter is written to the temperature control module.**

14. **To set the parameters of different control modes, select the mode when setting "Method selection", repeat operations of 4 to 9 to reflect "Read Value" to "Write Value". After that, correct the parameter items if necessary, and write the parameter to the temperature control module.**

(b) Setting items of when "Param write (Standard control)" is set

Setting item		Reference
CH□ Basic setting	CH□ Input range	Page 312, Appendix 3 (5)
	CH□ Target value_SV_setting[*1]	Page 317, Appendix 3 (6)
CH□ PID Constant setting	CH□ Proportion belt_P_setting_CH□ Heating proportion belt	Page 318, Appendix 3 (7)
	CH□ Integration time_I_setting	Page 320, Appendix 3 (8)
	CH□ Differentiation time_D_setting	Page 320, Appendix 3 (9)
CH□ Limiter setting	CH□ Upper limit output limiter	Page 321, Appendix 3 (10)
	CH□ Lower limit output limiter	
	CH□ Output change amount limiter	Page 323, Appendix 3 (11)
	CH□ Setting change rate limiter or CH□ Setting change rate limiter_temperature rise	Page 324, Appendix 3 (12)
	CH□ Setting change rate limiter unit time setting	Page 325, Appendix 3 (13)
	CH□ Upper limit setting limiter[*1]	Page 325, Appendix 3 (14)
	CH□ Lower limit setting limiter[*1]	
CH□ Control output cycle setting_CH□ Heating control output cycle setting		Page 326, Appendix 3 (15)
CH□ Primary delay digital filter setting		Page 328, Appendix 3 (16)
CH□ Moving averaging count setting		Page 329, Appendix 3 (17)
CH□ Control response parameter		Page 329, Appendix 3 (18)
CH□ Differentiation operation selection		Page 330, Appendix 3 (19)
CH□ Adjustment sensitivity_non-inductive belt_setting		Page 331, Appendix 3 (20)
CH□ Forward action_Reverse action setting		Page 334, Appendix 3 (24)
CH□ Loop disconnection detection	CH□ Loop disconnection detection judgment time	Page 334, Appendix 3 (25)
	CH□ Loop disconnection detection dead band	Page 335, Appendix 3 (26)
CH□ Stop mode setting		Page 336, Appendix 3 (27)
CH□ Automatic backup setting after auto tuning of PID constants		Page 337, Appendix 3 (28)
CH□ Setting change rate limiter_temperature drop		Page 324, Appendix 3 (12)

Setting item		Reference
Warning error control	Warning non-inductive belt setting	Page 339, Appendix 3 (31)
	Warning delay count	Page 340, Appendix 3 (32)
Temperature rise completion setting	Temperature rise completion range setting	Page 340, Appendix 3 (33)
	Temperature rise completion soak time setting	Page 341, Appendix 3 (34)
Sensor correction function selection	CH☐ Sensor correction function selection	Page 341, Appendix 3 (35)
Peak current control function	CH☐ Peak current restrain control_divide group setting	Page 342, Appendix 3 (36)
AT loop disconnection detection function	CH☐ AT loop disconnection detection function enable_disable setting	Page 343, Appendix 3 (38)
Manipulated value resolution switching for output with another analog module		Page 344, Appendix 3 (39)
Cold junction temperature compensation selection		Page 344, Appendix 3 (40)
Transistor output monitor ON delay time setting		Page 345, Appendix 3 (41)
CH☐ Scaling function	CH☐ Measured value_PV_scaling function_enable_disable setting	Page 345, Appendix 3 (42)
	CH☐ Measured value_PV_scaling lower limit value	Page 346, Appendix 3 (43)
	CH☐ Measured value_PV_scaling upper limit value	
CH☐ Warning setting	CH☐ Mode setting of warning 1	Page 346, Appendix 3 (44)
	CH☐ Mode setting of warning 2	
	CH☐ Mode setting of warning 3	
	CH☐ Mode setting of warning 4	
	CH☐ Warning setting value 1*2	Page 348, Appendix 3 (45)
	CH☐ Warning setting value 2*2	
	CH☐ Warning setting value 3*2	
	CH☐ Warning setting value 4*2	
Sensor correction value setting	CH☐ Sensor correction value setting	Page 352, Appendix 3 (51)
CH☐ Auto tuning setting	CH☐ Auto tuning mode selection	Page 354, Appendix 3 (56)
	CH☐ AT bias*3	Page 355, Appendix 3 (57)
Self tuning setting	CH☐ Self tuning setting	Page 356, Appendix 3 (58)
CH☐ Simultaneous temperature rise function setting	CH☐ Simultaneous temperature rise group setting	Page 357, Appendix 3 (59)
	CH☐ Simultaneous temperature rise lean data*4	Page 357, Appendix 3 (60)
	CH☐ Simultaneous temperature rise waste time	Page 358, Appendix 3 (61)
	CH☐ Simultaneous temperature rise AT mode selection	Page 359, Appendix 3 (62)

*1 For the NZ2GF2B-60TCTT4, "Setting Range" is already set to -2000 to 32000, which is the lower limit value of the setting range for Input range (Input range: 7, 10, 20, 29, 41) and the upper limit value (Input range: 205) (For the NZ2GF2B-60TCRT4, the lower limit value is -3000). When actually set the values, enter the values within the setting range for Input range.

*2 "Setting Range" is already set to -32000 to 32000, which is the lower limit value of the setting range (Input range: 205) and the upper limit value (Input range: 205). When actually set the values, enter the values within the setting range of the set alert mode.

*3 "Setting Range" is already set to -32000 to 32000, which is the full scale lower limit value for Input range (Input range: 205) and the full scale upper limit value (Input range: 205). When actually set the values, enter the values within the full scale range for Input range.

*4 "Setting Range" is already set to 0 to 32000. 32000 is the full scale upper limit value for Input range (Input range: 205). When actually set the values, enter the values within the full scale range for Input range.

(c) Setting items of when "Param write (H/C control (Normal))" or "Param write (H/C control (Extension))" is set

Setting item		Reference
CH☐ Basic setting	CH☐ Input range	Page 312, Appendix 3 (5)
	CH☐ Target value_SV_setting[*1]	Page 317, Appendix 3 (6)
CH☐ PID Constant setting	CH☐ Proportion belt_P_setting_CH☐ Heating proportion belt	Page 318, Appendix 3 (7)
	CH☐ Integration time_I_setting	Page 320, Appendix 3 (8)
	CH☐ Differentiation time_D_setting	Page 320, Appendix 3 (9)
CH☐ Limiter setting 1	CH☐ Heating upper limit output limiter	Page 321, Appendix 3 (10)
CH☐ Limiter setting 2	CH☐ Output change amount limiter	Page 323, Appendix 3 (11)
	CH☐ Setting change rate limiter or CH☐ Setting change rate limiter_temperature rise	Page 324, Appendix 3 (12)
	CH☐ Setting change rate limiter unit time setting	Page 325, Appendix 3 (13)
	CH☐ Upper limit setting limiter[*1]	Page 325, Appendix 3 (14)
	CH☐ Lower limit setting limiter[*1]	
CH☐ Control output cycle setting_CH☐ Heating control output cycle setting		Page 326, Appendix 3 (15)
CH☐ Primary delay digital filter setting		Page 328, Appendix 3 (16)
CH☐ Moving averaging count setting		Page 329, Appendix 3 (17)
CH☐ Temperature conversion setting		Page 338, Appendix 3 (29)
CH☐ Control response parameter		Page 329, Appendix 3 (18)
CH☐ Differentiation operation selection		Page 330, Appendix 3 (19)
CH☐ Adjustment sensitivity_non-inductive belt_setting		Page 331, Appendix 3 (20)
CH☐ Stop mode setting		Page 336, Appendix 3 (27)
CH☐ Automatic backup setting after auto tuning of PID constants		Page 337, Appendix 3 (28)
CH☐ Heating/Cooling_mix control setting	CH☐ Cooling proportion belt_Pc_setting	Page 318, Appendix 3 (7)
	CH☐ Cooling upper limit output limiter	Page 321, Appendix 3 (10)
	CH☐ Cooling control output cycle setting	Page 326, Appendix 3 (15)
	CH☐ Overlap_dead band setting	Page 339, Appendix 3 (30)
CH☐ Setting change rate limiter_temperature drop		Page 324, Appendix 3 (12)
Warning error control	Warning non-inductive belt setting	Page 339, Appendix 3 (31)
	Warning delay count	Page 340, Appendix 3 (32)
Temperature rise completion setting	Temperature rise completion range setting	Page 340, Appendix 3 (33)
	Temperature rise completion soak time setting	Page 341, Appendix 3 (34)
Sensor correction function selection	CH☐ Sensor correction function selection	Page 341, Appendix 3 (35)
Cooling system setting	CH☐ Cooling system setting	Page 344, Appendix 3 (39)
Manipulated value resolution switching for output with another analog module		Page 344, Appendix 3 (40)
Cold junction temperature compensation selection		Page 344, Appendix 3 (40)
Transistor output monitor ON delay time setting		Page 345, Appendix 3 (41)
CH☐ Scaling function	CH☐ Measured value_PV_scaling function_enable_disable setting	Page 345, Appendix 3 (42)
	CH☐ Measured value_PV_scaling lower limit value	Page 346, Appendix 3 (43)
	CH☐ Measured value_PV_scaling upper limit value	
CH☐ Warning setting	CH☐ Mode setting of warning 1	Page 346, Appendix 3 (44)
	CH☐ Mode setting of warning 2	
	CH☐ Mode setting of warning 3	
	CH☐ Mode setting of warning 4	
	CH☐ Warning setting value 1[*2]	Page 348, Appendix 3 (45)
	CH☐ Warning setting value 2[*2]	
	CH☐ Warning setting value 3[*2]	
	CH☐ Warning setting value 4[*2]	
Sensor correction value setting	CH☐ Sensor correction value setting	Page 352, Appendix 3 (51)

Setting item		Reference
CH☐ Auto tuning setting	CH☐ Auto tuning mode selection	Page 354, Appendix 3 (56)
	CH☐ AT bias*3	Page 355, Appendix 3 (57)

*1 For the NZ2GF2B-60TCTT4, "Setting Range" is already set to -2000 to 32000, which is the lower limit value of the setting range for Input range (Input range: 7, 10, 20, 29, 41) and the upper limit value (Input range: 205) (For the NZ2GF2B-60TCRT4, the lower limit value is -3000). When actually set the values, enter the values within the setting range for Input range.

*2 "Setting Range" is already set to -32000 to 32000, which is the lower limit value of the setting range (Input range: 205) and the upper limit value (Input range: 205). When actually set the values, enter the values within the setting range of the set alert mode.

*3 "Setting Range" is already set to -32000 to 32000, which is the full scale lower limit value for Input range (Input range: 205) and the full scale upper limit value (Input range: 205). When actually set the values, enter the values within the full scale range for Input range.

(d) Setting items of when "Param write (Mix control (Normal))" or "Param write (Mix control (Extension))" is set

Setting item		Reference
CH☐ Basic setting	CH☐ Input range	Page 312, Appendix 3 (5)
	CH☐ Target value_SV_setting*1	Page 317, Appendix 3 (6)
CH☐ PID Constant setting	CH☐ Proportion belt_P_setting_CH☐ Heating proportion belt	Page 318, Appendix 3 (7)
	CH☐ Integration time_I_setting	Page 320, Appendix 3 (8)
	CH☐ Differentiation time_D_setting	Page 320, Appendix 3 (9)
CH☐ Limiter setting 1	CH☐ Heating upper limit output limiter	Page 321, Appendix 3 (10)
CH☐ Limiter setting 2	CH☐ Output change amount limiter	Page 323, Appendix 3 (11)
	CH☐ Setting change rate limiter or CH☐ Setting change rate limiter_temperature rise	Page 324, Appendix 3 (12)
	CH☐ Setting change rate limiter unit time setting	Page 325, Appendix 3 (13)
	CH☐ Upper limit setting limiter*1	Page 325, Appendix 3 (14)
	CH☐ Lower limit setting limiter*1	
CH☐ Limiter setting	CH☐ Upper limit output limiter	Page 321, Appendix 3 (10)
	CH☐ Lower limit output limiter	
	CH☐ Output change amount limiter	Page 323, Appendix 3 (11)
	CH☐ Setting change rate limiter or CH☐ Setting change rate limiter_temperature rise	Page 324, Appendix 3 (12)
	CH☐ Setting change rate limiter unit time setting	Page 325, Appendix 3 (13)
	CH☐ Upper limit setting limiter*1	Page 325, Appendix 3 (14)
	CH☐ Lower limit setting limiter*1	
CH☐ Control output cycle setting_CH☐ Heating control output cycle setting		Page 326, Appendix 3 (15)
CH☐ Primary delay digital filter setting		Page 328, Appendix 3 (16)
CH☐ Moving averaging count setting		Page 329, Appendix 3 (17)
CH☐ Control response parameter		Page 329, Appendix 3 (18)
CH☐ Differentiation operation selection		Page 330, Appendix 3 (19)
CH☐ Adjustment sensitivity_non-inductive belt_setting		Page 331, Appendix 3 (20)
CH☐ Forward action_Reverse action setting		Page 334, Appendix 3 (24)
CH☐ Loop disconnection detection	CH☐ Loop disconnection detection judgment time	Page 334, Appendix 3 (25)
	CH☐ Loop disconnection detection dead band	Page 335, Appendix 3 (26)
CH☐ Stop mode setting		Page 336, Appendix 3 (27)
CH☐ Automatic backup setting after auto tuning of PID constants		Page 337, Appendix 3 (28)
CH☐ Temperature conversion setting		Page 338, Appendix 3 (29)
CH☐ Heating/Cooling_mix control setting	CH☐ Cooling proportion belt_Pc_setting	Page 318, Appendix 3 (7)
	CH☐ Cooling upper limit output limiter	Page 321, Appendix 3 (10)
	CH☐ Cooling control output cycle setting	Page 326, Appendix 3 (15)
	CH☐ Overlap_dead band setting	Page 339, Appendix 3 (30)

Setting item		Reference
CH☐ Setting change rate limiter_temperature drop		Page 324, Appendix 3 (12)
Warning error control	Warning non-inductive belt setting	Page 339, Appendix 3 (31)
	Warning delay count	Page 340, Appendix 3 (32)
Temperature rise completion setting	Temperature rise completion range setting	Page 340, Appendix 3 (33)
	Temperature rise completion soak time setting	Page 341, Appendix 3 (34)
Sensor correction function selection	CH☐ Sensor correction function selection	Page 341, Appendix 3 (35)
Cooling system setting	CH☐ Cooling system setting	Page 343, Appendix 3 (37)
AT loop disconnection detection function	CH☐ AT loop disconnection detection function enable_disable setting	Page 343, Appendix 3 (38)
Manipulated value resolution switching for output with another analog module		Page 344, Appendix 3 (39)
Cold junction temperature compensation selection		Page 344, Appendix 3 (40)
Transistor output monitor ON delay time setting		Page 345, Appendix 3 (41)
CH☐ Scaling function	CH☐ Measured value_PV_scaling function_enable_disable setting	Page 345, Appendix 3 (42)
	CH☐ Measured value_PV_scaling lower limit value	Page 346, Appendix 3 (43)
	CH☐ Measured value_PV_scaling upper limit value	
CH☐ Warning setting	CH☐ Mode setting of warning 1	Page 346, Appendix 3 (44)
	CH☐ Mode setting of warning 2	
	CH☐ Mode setting of warning 3	
	CH☐ Mode setting of warning 4	
	CH☐ Warning setting value 1*2	Page 348, Appendix 3 (45)
	CH☐ Warning setting value 2*2	
	CH☐ Warning setting value 3*2	
	CH☐ Warning setting value 4*2	
Sensor correction value setting	CH☐ Sensor correction value setting	Page 352, Appendix 3 (51)
CH☐ Auto tuning setting	CH☐ Auto tuning mode selection	Page 354, Appendix 3 (56)
	CH☐ AT bias*3	Page 355, Appendix 3 (57)
Self tuning setting	CH☐ Self tuning setting	Page 356, Appendix 3 (58)
CH☐ Simultaneous temperature rise function setting	CH☐ Simultaneous temperature rise group setting	Page 357, Appendix 3 (59)
	CH☐ Simultaneous temperature rise lean data*4	Page 357, Appendix 3 (60)
	CH☐ Simultaneous temperature rise waste time	Page 358, Appendix 3 (61)
	CH☐ Simultaneous temperature rise AT mode selection	Page 359, Appendix 3 (62)

*1 For the NZ2GF2B-60TCTT4, "Setting Range" is already set to -2000 to 32000, which is the lower limit value of the setting range for Input range (Input range: 7, 10, 20, 29, 41) and the upper limit value (Input range: 205) (For the NZ2GF2B-60TCRT4, the lower limit value is -3000). When actually set the values, enter the values within the setting range for Input range.

*2 "Setting Range" is already set to -32000 to 32000, which is the lower limit value of the setting range (Input range: 205) and the upper limit value (Input range: 205). When actually set the values, enter the values within the setting range of the set alert mode.

*3 "Setting Range" is already set to -32000 to 32000, which is the full scale lower limit value for Input range (Input range: 205) and the full scale upper limit value (Input range: 205). When actually set the values, enter the values within the full scale range for Input range.

*4 "Setting Range" is already set to 0 to 32000. 32000 is the full scale upper limit value for Input range (Input range: 205). When actually set the values, enter the values within the full scale range for Input range.

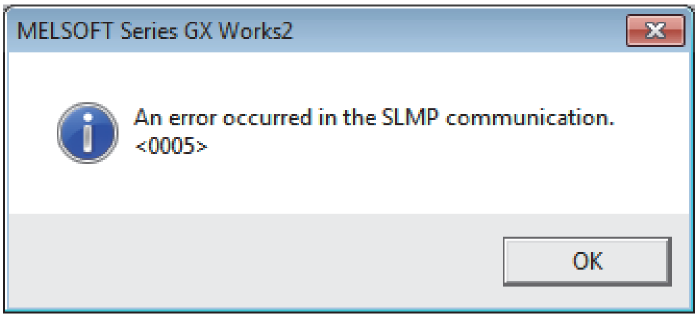
(e) Setting items of when "Param write (Temperature input mode)" is set

Temperature input		
Setting item		**Reference**
CH☐ Basic setting	CH☐ Input range	Page 312, Appendix 3 (5)
CH☐ Primary delay digital filter setting		Page 328, Appendix 3 (16)
CH☐ Moving averaging count setting		Page 329, Appendix 3 (17)
CH☐ Stop mode setting		Page 336, Appendix 3 (27)
Sensor correction function selection	CH☐ Sensor correction function selection	Page 341, Appendix 3 (35)
Cold junction temperature compensation selection		Page 344, Appendix 3 (40)
CH☐ Scaling function	CH☐ Measured value_PV_scaling function_enable_disable setting	Page 345, Appendix 3 (42)
	CH☐ Measured value_PV_scaling lower limit value	Page 346, Appendix 3 (43)
	CH☐ Measured value_PV_scaling upper limit value	
CH☐ Process alarm setting	CH☐ Process alarm warning output enable_disable setting	Page 349, Appendix 3 (46)
	CH☐ Process alarm lower lower limit value*1	Page 350, Appendix 3 (47)
	CH☐ Process alarm lower upper limit value*1	
	CH☐ Process alarm upper lower limit value*1	
	CH☐ Process alarm upper upper limit value*1	
CH☐ Rate alarm setting	CH☐ Rate alarm warning output enable_disable setting	Page 350, Appendix 3 (48)
	CH☐ Rate alarm warning detection cycle	Page 351, Appendix 3 (49)
	CH☐ Rate alarm upper limit value	Page 351, Appendix 3 (50)
	CH☐ Rate alarm lower limit value	
Sensor correction value setting	CH☐ Sensor correction value setting	Page 352, Appendix 3 (51)

*1 For the NZ2GF2B-60TCTT4, "Setting Range" is already set to -2000 to 32000, which is the lower limit value of the setting range for Input range (Input range: 7, 10, 20, 29, 41) and the upper limit value (Input range: 205) (For the NZ2GF2B-60TCRT4, the lower limit value is -3000). When actually set the values, enter the values within the setting range for Input range.

Point

- The parameter is checked when it is written to the temperature control module. When the following message is displayed during the writing, take corrective action for the error code in < >. For details on the error codes, refer to the list of error codes (☞ Page 271, Section 11.2) and the user's manual for the master/local module used.



- When the parameter write is performed after "Auto-setting at input range change" is set to "1: Enable" and "CH☐ Input range" is changed, the following parameters and remote buffer memory areas are overwritten according to the set input range.
  - "CH☐ Target value_SV_setting"
  - "CH☐ Upper limit setting limiter"
  - "CH☐ Lower limit setting limiter"
  - "CH☐ Loop disconnection detection dead band"
  - "CH☐ Warning setting value 1" to "CH☐ Warning setting value 4"
  - "CH☐ Process alarm lower lower limit value"
  - "CH☐ Process alarm lower upper limit value"
  - "CH☐ Process alarm upper lower limit value"
  - "CH☐ Process alarm upper upper limit value"
  - "CH☐ AT bias"
  - "CH☐ Simultaneous temperature rise lean data"
  - "CH☐ Simultaneous temperature rise waste time"
  - CH☐ Sensor two-point correction offset value (measured value) (address: 284H, 288H, 28CH, 290H)
  - CH☐ Sensor two-point correction offset value (corrected value) (address: 285H, 289H, 28DH, 291H)
  - CH☐ Sensor two-point correction gain value (measured value) (address: 286H, 28AH, 28EH, 292H)
  - CH☐ Sensor two-point correction gain value (corrected value) (address: 287H, 28BH, 28FH, 293H)
- If the parameter write is performed during the operation of temperature control module, an error occurs and "Write Value" is not reflected in the temperature control module. To perform the parameter write, stop operation for all channels. Note that the set values cannot be backed up to a non-volatile memory only by performing the parameter write. Back up the values at timing which is decided by the user.

7.2 Changing Parameters

This section describes the procedures to change parameters.
The precautions to take when changing parameters are same as the following.

- Precautions (☞ Page 109, Section 7.1 (1))

7.2.1 Changing the network configuration

When changing the network configuration using the created project, set the parameter in the following procedure.

1. **Power off the module.**

2. **Connect the modules again according to the desired network configuration.**

3. **Power on the module.**

4. **Display the CC IE Field Configuration window.**

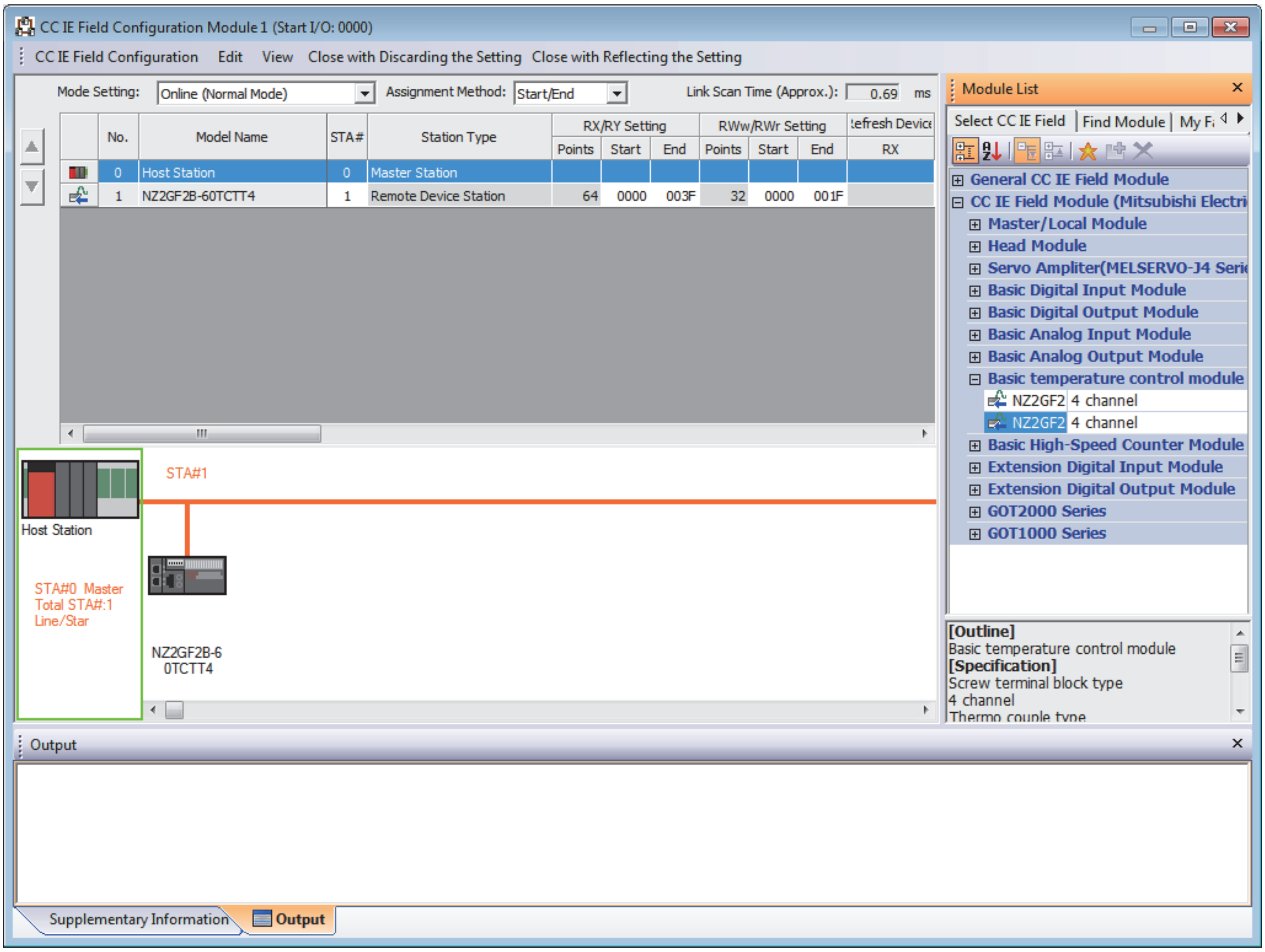
- When the master/local module is the QJ71GF11-T2

  Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET] ⇨ [CC IE Field Configuration Setting] button

- When the master/local module is the LJ71GF11-T2

  Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE Field] ⇨ [CC IE Field Configuration Setting] button

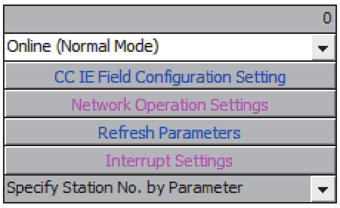
5. **Drag and drop a module to set the slave station. Input a numerical value to set the station number of the station. Change the value if necessary.**



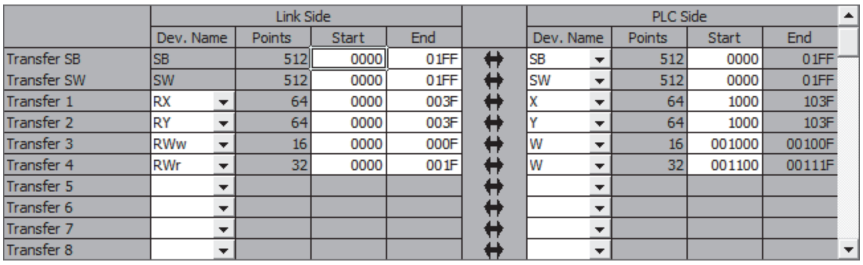
6. Set the module parameter by referring to the following.

☞ Page 110, Section 7.1 (2)

7. Click the [Refresh Parameters] button to display the refresh parameter setting window.

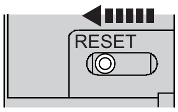


8. Set the refresh parameter. Change the value if necessary.



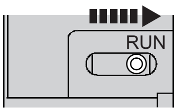
	Link Side					PLC Side			
	Dev. Name	Points	Start	End		Dev. Name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Transfer 1	RX	64	0000	003F	↔	X	64	1000	103F
Transfer 2	RY	64	0000	003F	↔	Y	64	1000	103F
Transfer 3	RWw	16	0000	000F	↔	W	16	001000	00100F
Transfer 4	RWr	32	0000	001F	↔	W	32	001100	00111F
Transfer 5					↔				
Transfer 6					↔				
Transfer 7					↔				
Transfer 8					↔				

9. Write the set parameter to the CPU module of the master station and reset the CPU module.



10. Change the state of the CPU module of the master station to RUN.

The network configuration setting is now completed.



7.2.2 Changing a parameter without changing the network configuration

To change only the created module parameter of the slave station without changing the network configuration, set the parameter in the following procedure.

1. Display the CC IE Field Configuration window.

- When the master/local module is the QJ71GF11-T2

  Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET] ⇨ [CC IE Field Configuration Setting] button

- When the master/local module is the LJ71GF11-T2

  Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE Field] ⇨ [CC IE Field Configuration Setting] button

2. Set the module parameter by referring to the following.

☞ Page 110, Section 7.1 (2)

CHAPTER 8 FUNCTIONS

This chapter explains the details of the temperature control module and how to set each function.

For details on remote I/O signal, remote register, remote buffer memory, refer to the following.

- Details of Remote I/O Signals (☞ Page 284, Appendix 1)
- Details of Remote Register Areas (☞ Page 301, Appendix 2)
- Details of Remote Buffer Memory Areas (☞ Page 309, Appendix 3)

Point

- For the functions indicated with the icons **Standard** and **Heating-cooling**, or with **Common**, the following terms are used, unless otherwise specified.
  - Proportional band (P): includes heating proportional band (Ph) and cooling proportional band (Pc).
  - Manipulated value (MV): includes manipulated value for heating (MVh) and manipulated value for cooling (MVc).
  - Manipulated value (MV) for output with another analog module: includes manipulated value of heating (MVh) for output with another analog module and manipulated value of cooling (MVc) for output with another analog module.
  - Transistor output: includes heating transistor output and cooling transistor output.
  - Upper limit output limiter value: includes heating upper limit output limiter value and cooling upper limit output limiter value.
  - Control output cycle: includes heating control output cycle and cooling control output cycle.
- In the description of the "Parameter Processing of Slave Station" window in this chapter, only window settings are described. To enable the settings, they need to be written to the module. For the method of writing the settings to the module, refer to the following.

  ☞ Page 108, Section 7.1

8.1 Common Functions

This section explains the common functions between the temperature input mode and temperature control mode.

8.1.1 Operation/stop function

Common

Whether to operate or stop the temperature conversion and the temperature control can be set for each channel. By stopping unused channels, unnecessary disconnection detection or alert output can be prevented.

(1) Setting method

Whether to operate or stop the temperature conversion and the temperature control of each channel can be set by CH☐ Operation request flag (RY11 to RY14) and CH☐ Stop request flag (RY18 to RY1B). For details, refer to the following.

- CH☐ Operation request flag (RY11 to RY14) (☞ Page 296, Appendix 1.2 (4))
- CH☐ Stop request flag (RY18 to RY1B) (☞ Page 298, Appendix 1.2 (7))

(2) When the check on whether or not the temperature process value is within the temperature measurement range is unnecessary

Setting CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H) to Stop (0) controls error detection. For details, refer to the following.

☞ Page 336, Appendix 3 (27)

8.1.2 Temperature conversion method

Common

A measured value is stored into CH□ Temperature process value (PV) (RWr8 to RWrB) in every sampling cycle. In addition, the use of the primary delay digital filter smoothens the temperature process value (PV), and its drastic change can be absorbed.

(1) Sampling cycle

A sampling cycle can be selected from 250ms or 500ms.

(a) How to set the sampling cycle

1. Set "Method selection" to "Param write (Station parameter)".

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

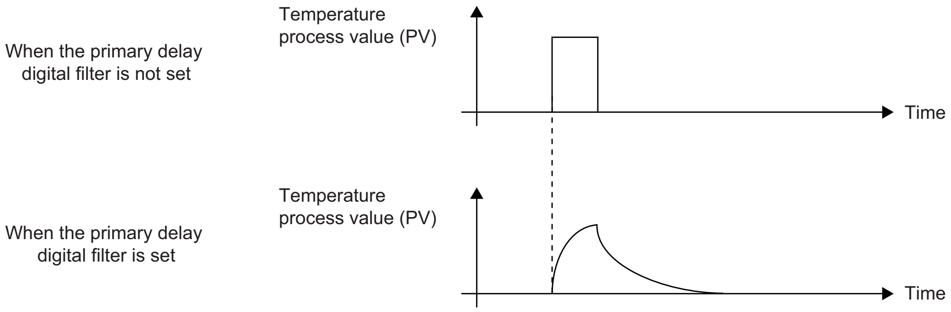
2. Set "Sampling cycle selection".

(b) How to check the sampling cycle

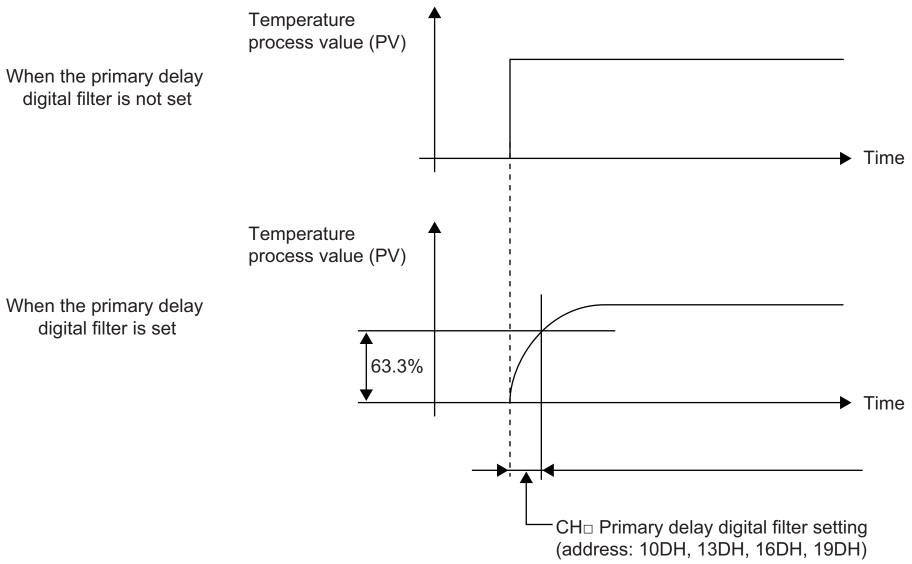
The sampling cycle in operation can be checked in Sampling cycle monitor (address: 604H).

(2) Primary delay digital filter

The primary delay digital filter smoothens transient noise before outputting the temperature process value (PV).



For the primary delay digital filter, set the time until the temperature process value (PV) changes by 63.3% (time constant).



(a) How to set the primary delay digital filter

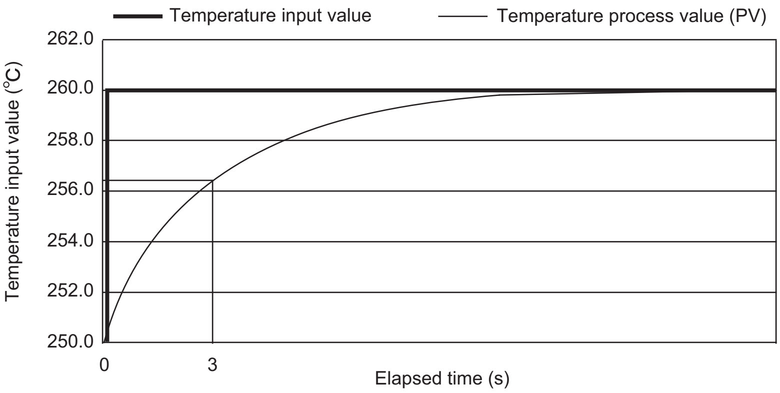
In "CH□ Primary delay filter setting", set the time until the temperature process value (PV) changes by 63.3% (time constant).

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH□ Primary delay filter setting".**

Ex. When 3 (3s) is set in "Primary delay filter setting"
The temperature reaches 256.3℃ which is 63.3% of the temperature process value (PV) three seconds after the temperature input value has reached 250.0℃.



8.1.3 Moving averaging process to a temperature process value (PV)

Common

Moving averaging process can be set to a temperature process value (PV). With this function, the fluctuation of temperature process values (PV) can be reduced in electrically noisy environments or in the environments where temperature process values (PV) fluctuate greatly. The moving averaging process can be disabled to hasten the response to the change of temperature process values (PV).

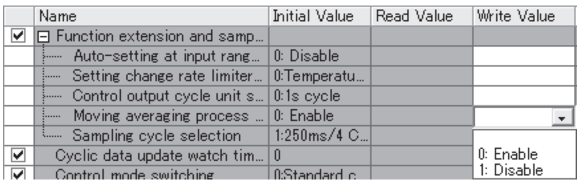
(1) Setting method

Follow the procedure below.

1. Set "Method selection" to "Param write (Station parameter)".

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "0: Enable" for "Moving averaging process setting" in "Switch Setting" to use the moving averaging process. Set "1: Disable" for "Moving averaging process setting" in "Switch Setting" when not using the moving averaging process.



3. Set "Method selection" to "Param write" of the control mode to be used.

4. Set "CH□ Moving averaging count setting".

Point

- When Disable (1) is set for "Moving averaging process setting", the setting value for CH□ Number of moving averaging (address: 10EH, 13EH, 16EH, 19EH) is ignored. When Enable (0) is set for "Moving averaging process setting" and the value out of the setting range is set to CH□ Number of moving averaging (address: 10EH, 13EH, 16EH, 19EH), a write data error (error code: 0004H) occurs.
- For the module, the moving averaging process is enabled and the number of moving averaging is 2 times as default. Change the settings if necessary.

8.1.4 Temperature process value (PV) scaling function

Common

The temperature process value (PV) is scaled up or down to the value in a set range, and can be stored into the remote register using this function. For example, the range of -100℃ to 100℃ can be scaled into the value range of 0 to 4000.

(1) Target for scaling

Although CH☐ Temperature process value (PV) (RWr8 to RWrB) is usually scaled, in the temperature control mode, the values of other analog modules (such as an A/D conversion module) in the system can be also scaled if CH☐ Input range (address: 100H, 130H, 160H, 190H) is set to a 200 number. (☞ Page 312, Appendix 3 (5))
For details, refer to the following.
☞ Page 181, Section 8.3.13 (1)

Point

This section describes the function using CH☐ Temperature process value (PV) (RWr8 to RWrB) as the target for scaling. To scale an input value from other analog modules (such as an A/D converter module), read the description replacing CH☐ Temperature process value (PV) (RWr8 to RWrB) with CH☐ Temperature process value for input with another analog module (PV) (RWw0 to RWw3).

(2) Monitoring the scaling value

The temperature process value (PV) after scaling processing is stored into the following remote register.

- CH☐ Process value (PV) scaling value (RWr8 to RWrB) (☞ Page 304, Appendix 2 (6))

The calculation method of a scaling value is as follows:

$$\text{CH}\square\ \text{Process value (PV) scaling value (RWr8 to RWrB)} = \frac{(S_H - S_L) \times (P_X - P_{Min})}{P_{Max} - P_{Min}} + S_L$$

P_X : CH□ Temperature process value (PV) (RWr8 to RWrB)

P_{Max}: Maximum value of CH□ Input range (address: 100H, 130H, 160H, 190H)

P_{Min} : Minimum value of CH□ Input range (address: 100H, 130H, 160H, 190H)

S_H : CH□ Process value (PV) scaling upper limit value (address: 202H, 205H, 208H, 20BH)

S_L : CH□ Process value (PV) scaling lower limit value (address: 201H, 204H, 207H, 20AH)

(a) Calculation example

A calculation example to scale the temperature process value (PV) into percentage is shown below.
Set the following remote buffer memory areas as below.

- CH☐ Input range (address: 100H, 130H, 160H, 190H): 38 (temperature measurement range -200.0℃ to 400.0℃)
- CH☐ Process value (PV) scaling lower limit value (address: 201H, 204H, 207H, 20AH): 0
- CH☐ Process value (PV) scaling upper limit value (address: 202H, 205H, 208H, 20BH): 100

When CH☐ Temperature process value (PV) is 3600 (360.0℃), the scaling value can be calculated as follows:

$$\text{CH}\square\ \text{Process value (PV) scaling value (RWr8 to RWrB)} = \frac{(100 - 0) \times (3600 - (-2000))}{4000 - (-2000)} + 0$$

$$= 93.333\cdots$$

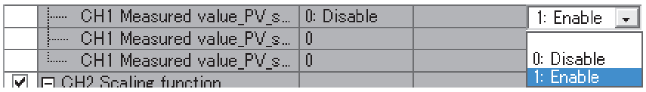
$$= 93 \text{ (The value is rounded off to an integer.)}$$

(3) Setting method

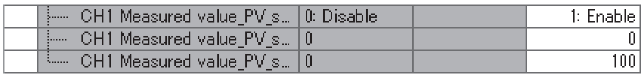
1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "1: Enable" for "CH☐ Measured value_PV_scaling function_enable_disable setting".



3. Set "CH☐ Measured value_PV_scaling lower limit value" and "CH☐ Measured value_PV_scaling upper limit value".



Point

- An error does not occur even though the areas above are set as follows: Lower limit value ≥ Upper limit value. The temperature process value (PV) is scaled according to the formula shown in the following.
  ☞ Page 130, Section 8.1.4 (2)
- If a value outside the temperature measurement range is measured, the value set as an upper limit or a lower limit is stored into the following remote register.
  - CH☐ Process value (PV) scaling value (RWr8 to RWrB) (☞ Page 304, Appendix 2 (6))

8.1.5 Sensor correction function

Common

When a difference occurs between the temperature process value (PV) and the actual temperature due to reasons such as a measuring condition, the difference can be corrected using this function. The following two types are available.

- Normal sensor correction (one-point correction) function (☞ Page 132, Section 8.1.5 (1))
- Sensor two-point correction function (☞ Page 133, Section 8.1.5 (2))

(1) Normal sensor correction (one-point correction) function

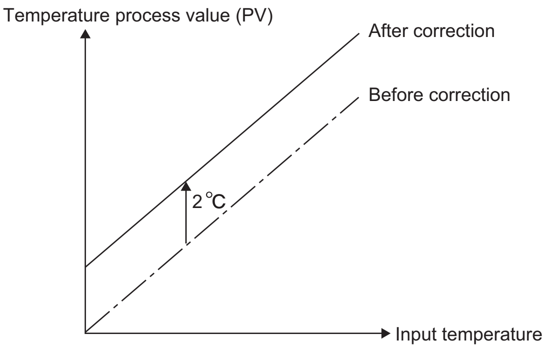
The percentage of the full scale of the set input range can be corrected as an error corrected value.
Set a correction value to CH☐ Sensor correction value setting (address: 280H to 283H).

Ex. When the temperature measurement range of input range is set to -200.0℃ to 200.0℃ with the actual temperature being 60℃ and the temperature process value (PV) being 58℃

$$\text{Sensor correction value setting} = 100 \times \frac{\text{(Actual temperature - Temperature process value (PV))}}{\text{Full scale}}$$

$$= 100 \times \frac{2}{400} = 0.5\ (\%)$$

Based on the above formula, set 50 (0.50%) to CH☐ Sensor correction value setting (address: 280H to 283H).

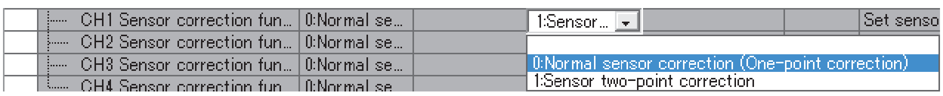


(a) How to execute normal sensor correction (one-point correction)

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

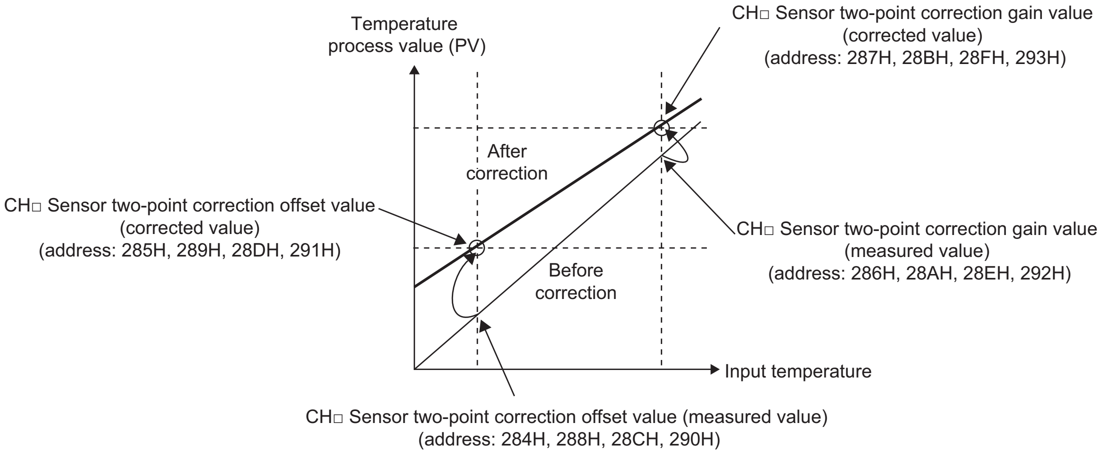
2. Set "0: Normal sensor correction (One-point correction)" to "CH☐ Sensor correction function selection".



3. Set "CH☐ Sensor correction value setting"

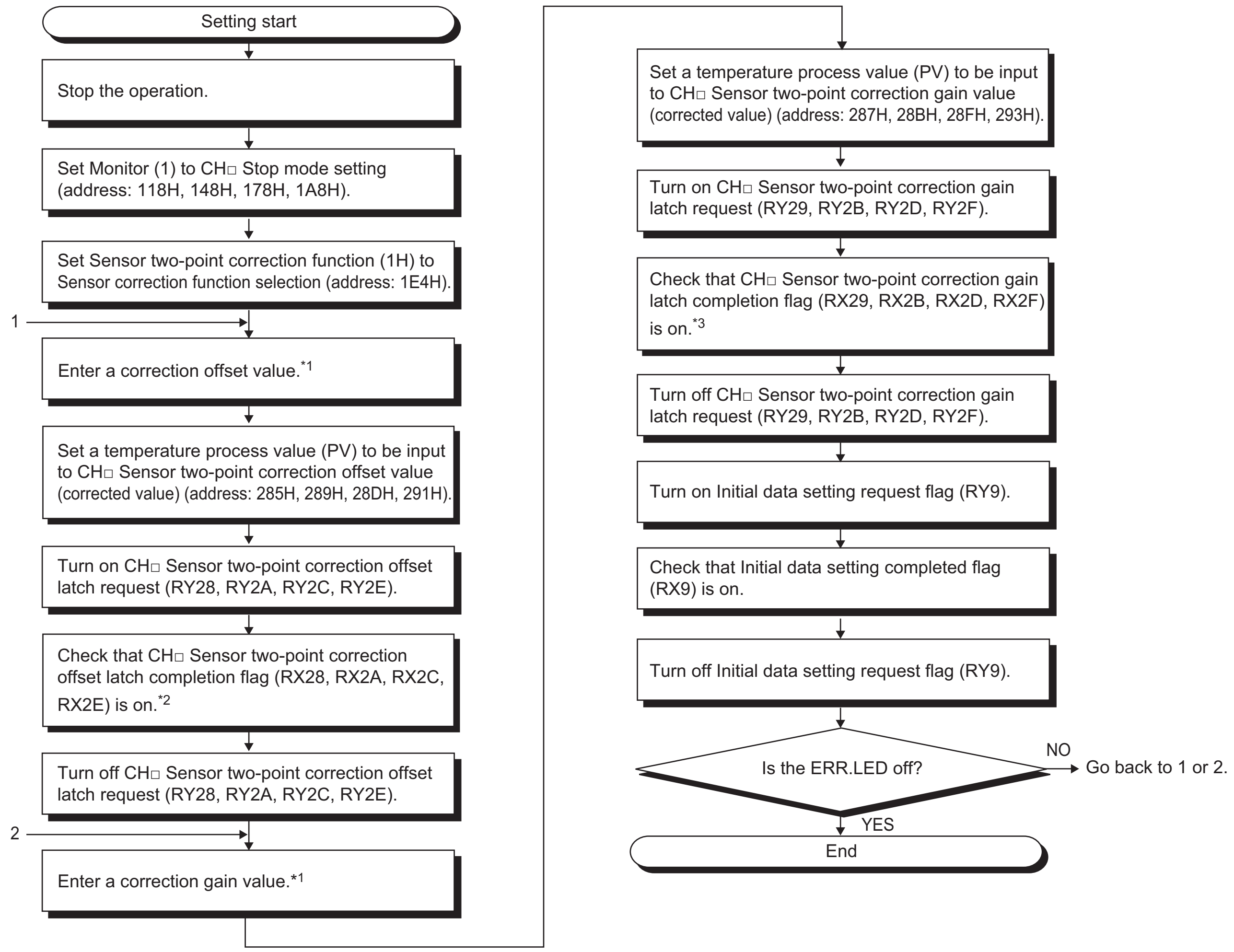
(2) Sensor two-point correction function

With this function, the difference between the temperature process value (PV) and the actual temperature between the two points selected in advance (a corrected offset value and a corrected gain value) is stored. Based on this gradient, the difference between a sensor and the actual temperature is corrected.
Carry out a sensor two-point correction when CH☐ Operation monitor (RX11 to RX14) is off. In addition, set CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H) to Monitor (1).



(a) How to execute sensor two-point correction

Follow the instructions below.



*1 Enter the value using devices such as a thermocouple, platinum resistance thermometer, and standard DC voltage generator, or based on a general resistance value.

*2 When the latch is completed, the temperature process value (PV) is stored in CH☐ Sensor two-point correction offset value (measured value) (address: 284H, 288H, 28CH, 290H). (☞ Page 352, Appendix 3 (52))

*3 When the latch is completed, the temperature process value (PV) is stored in CH☐ Sensor two-point correction gain value (measured value) (address: 286H, 28AH, 28EH, 292H). (☞ Page 353, Appendix 3 (54))

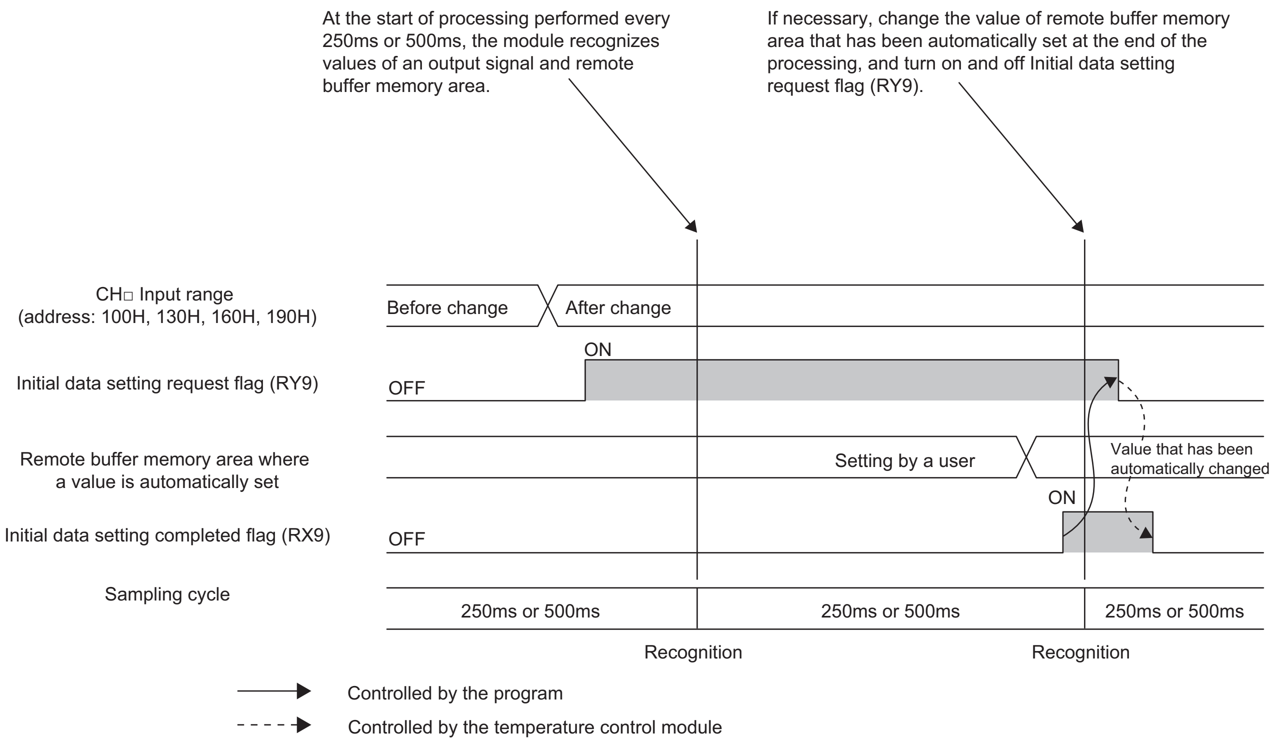
Point

- If a write data error (error code: 0007H) occurs during sensor two-point correction, correctly configure the setting for sensor two-point correction again. (The value set for sensor two-point correction of when an error occurred is not written in the temperature control module.)
- To use the value set for sensor two-point correction even after the power is turned off and on, back up the value with the following method.
  - Turn off and on Set value backup instruction (RY15). (☞ Page 296, Appendix 1.2 (5))

8.1.6 Auto-setting at input range change

Common

When an input range is changed, using this function automatically changes related parameter data to prevent an error outside the setting range. Set the function under Auto-setting at input range change (address: 1H. b0).
The following is the setting timing.



The sampling cycle differs depending on the setting of "Sampling cycle selection". (☞ Page 310, Section (1) (e))

(1) Remote buffer memory automatically set

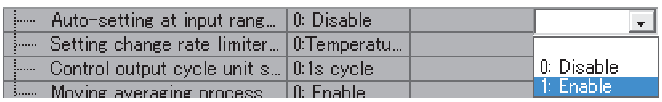
For the applicable remote buffer memory, refer to the following.
☞ Page 316, Appendix 3 (5) (d)

(2) Setting method

1. Set "Method selection" to "Param write (Station parameter)".

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "1: Enable" for "Auto-setting at input range change".



8.1 Common Functions
8

8.1.7 Set value backup

Common

This function allows remote buffer memory data to be stored in the non-volatile memory and backed up.
The backed-up data is transferred from the non-volatile memory to the remote buffer memory when the power is turned off and on. Therefore, temperature can be controlled without newly writing data when the power is turned off and on.

(1) Applicable remote buffer memory areas

For the applicable remote buffer memory, refer to the following.

☞ Page 49, Section 3.7

(2) Data write to non-volatile memory

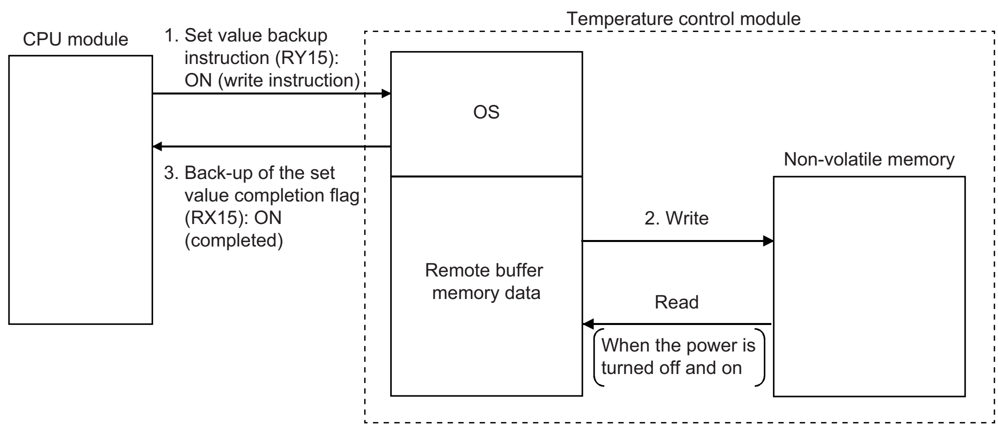
With this function, PID constants set by auto tuning can be backed up. When data is written to non-volatile memory and the power is turned off and on, the remote buffer memory setting value is not required to be set again.

Point

For the function that allows PID constants to be automatically backed up after auto tuning, refer to the following.

☞ Page 161, Section 8.3.7 (4)

To write data to non-volatile memory, turn off and on Set value backup instruction (RY15).
When data write to the non-volatile memory is completed, Back-up of the set value completion flag (RX15) turns on.



If data write to non-volatile memory does not complete, Back-up of the set value fail flag (RX17) turns on.

(a) Setting change

Change the settings for remote buffer memory areas when Back-up of the set value completion flag (RX15) is off.

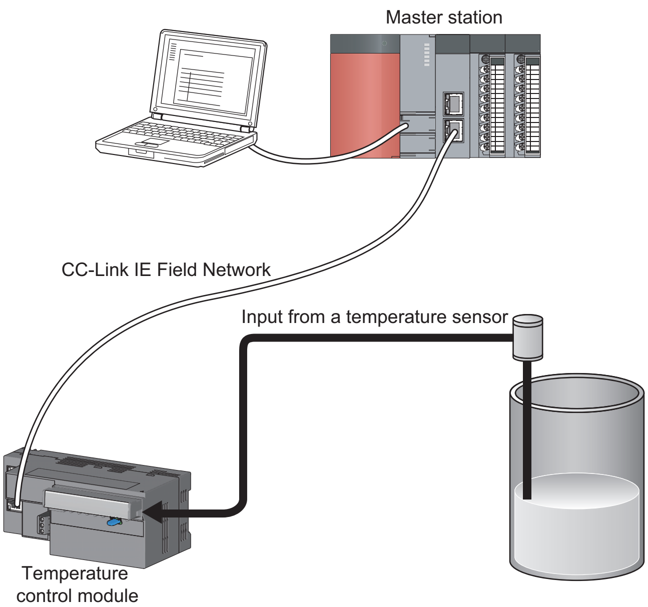
(3) Data read from non-volatile memory

Follow the instructions below.

- Turn off and on the power.
- Set CH☐ Memory's PID constants read instruction (address: 1100H to 1103H) to Requested (1). (☞ Page 365, Appendix 3 (72)) Data to be read are the PID constants and loop disconnection detection judgment time for the corresponding channel only. (☞ Page 334, Appendix 3 (25))

8.2 Temperature Input Mode

When using this module as a temperature input module, use this mode.

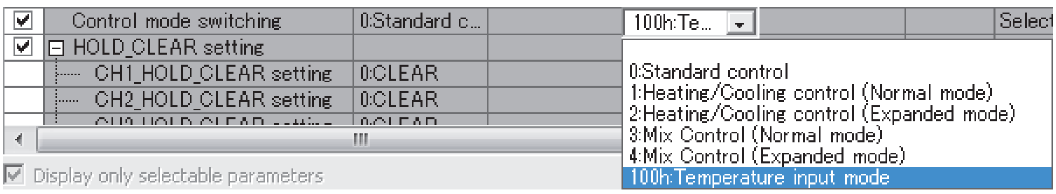


(1) Setting method

1. **Set "Method selection" to "Param write (Station parameter)".**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "100h:Temperature input mode" for "Control mode switching".**



(2) Precautions

When resolution is "1", the temperature process value (PV) of the temperature control module is rounded off from the actual temperature.

Ex. When the actual temperature is 1299.5℃, the temperature process value (PV) of the temperature control module is 1300℃.

To measure temperature by every 0.1℃, set resolution to "0.1". (☞ Page 312, Appendix 3 (5))

Note that the temperature process value (PV) is not rounded off for the process alarm and rate alarm.

(☞ Page 140, Section 8.2.1 (1) (d), Page 141, Section 8.2.1 (2) (d))

8.2.1 Alert output function

Temperature Input

An alert can be output when the temperature process value (PV) meets the condition set in advance using this function. Use this function to activate danger signals of devices or safety devices.
There are two types of alert: process alarm and rate alarm.

(1) Process alarm

An alert occurs when the temperature process value (PV) reaches the process alarm upper upper limit value or more, or the process alarm lower lower limit value or less.
The alert is cleared when the process value reaches a value less than the process alarm upper lower limit value, or a value more than the process alarm lower upper limit value. An alert is not cleared even by resetting the error.

(a) Checking the alert occurrence

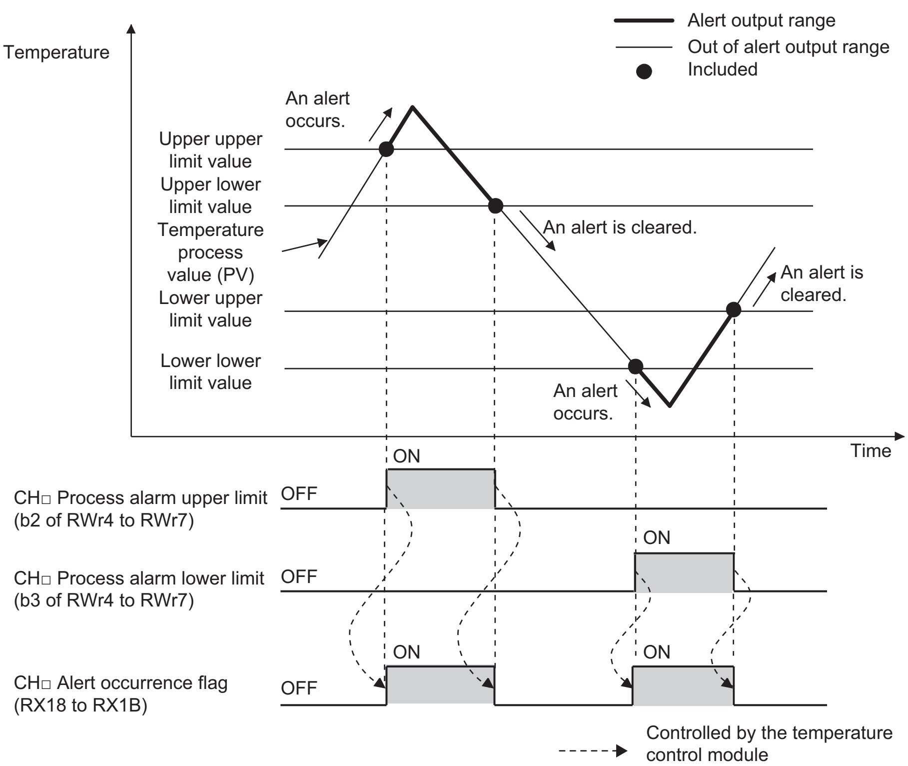
When an alert occurs, CH☐ Alert occurrence flag (RX18 to RX1B) turns on, and the ALM LED turns on.
In CH☐ Alert definition (RWr4 to RWr7), whether it is an upper limit alert or lower limit alert can be checked. (☞ Page 303, Appendix 2 (5))

(b) Checking the alert clearance

When the alert is cleared, CH☐ Process alarm upper limit (b2 of RWr4 to RWr7) or CH☐ Process alarm lower limit (b3 of RWr4 to RWr7) becomes 0 (OFF). Also, CH☐ Alert occurrence flag (RX18 to RX1B) turns off and the ALM LED turns off.

Point

In CH☐ Alert occurrence flag (RX18 to RX1B) and on the ALM LED, the alert is not cleared when an alert other than the process alarm is occurring.



(c) How to set process alarm

1. Set "Method selection" to "Param write(Temperature input mode)".

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "0: Enable" to "CH☐ Process alarm warning output enable_disable setting".

	CH1 Process alarm warnin...	1:Disable		0:Enable
	CH1 Process alarm lower l...	0		
	CH1 Process alarm lower ...	0		0:Enable
	CH1 Process alarm upper l...	1300		1:Disable

3. Set "CH☐ Process alarm lower lower limit value", "CH☐ Process alarm lower upper limit value", "CH☐ Process alarm upper lower limit value", and "CH☐ Process alarm upper upper limit value".

	CH1 Process alarm warnin...	1:Disable		0:Enable
	CH1 Process alarm lower l...	0		0
	CH1 Process alarm lower ...	0		100
	CH1 Process alarm upper l...	1300		900
	CH1 Process alarm upper ...	1300		1000

(d) Precautions

When resolution is "1", the temperature process value (PV) of the temperature control module is rounded off from the actual temperature. For the process alarm also, the temperature process value (PV) rounded off from the actual temperature determines the alert occurrence.

(2) Rate alarm

The temperature process value (PV) is monitored every rate alarm alert detection cycle. An alert occurs when the change from the previous monitoring is greater than the rate alarm upper limit value, or smaller than the rate alarm lower limit value. The rate alarm is helpful to monitor the change of the temperature process value (PV) in a limited range.

PV Present value - PV Previous value ≥ Rate alarm upper limit value
PV Present value - PV Previous value ≤ Rate alarm lower limit value

The alert is cleared when the temperature process value reaches within the range of the formulas above. An alert is not cleared even by resetting the error.

(a) Checking the alert occurrence

While the rate alarm is occurring, CH☐ Alert occurrence flag (RX18 to RX1B) turns on, and the ALM LED turns on.[*1]

In CH☐ Alert definition (RWr4 to RWr7), whether it is an upper limit alert or lower limit alert can be checked. (Page 303, Appendix 2 (5))

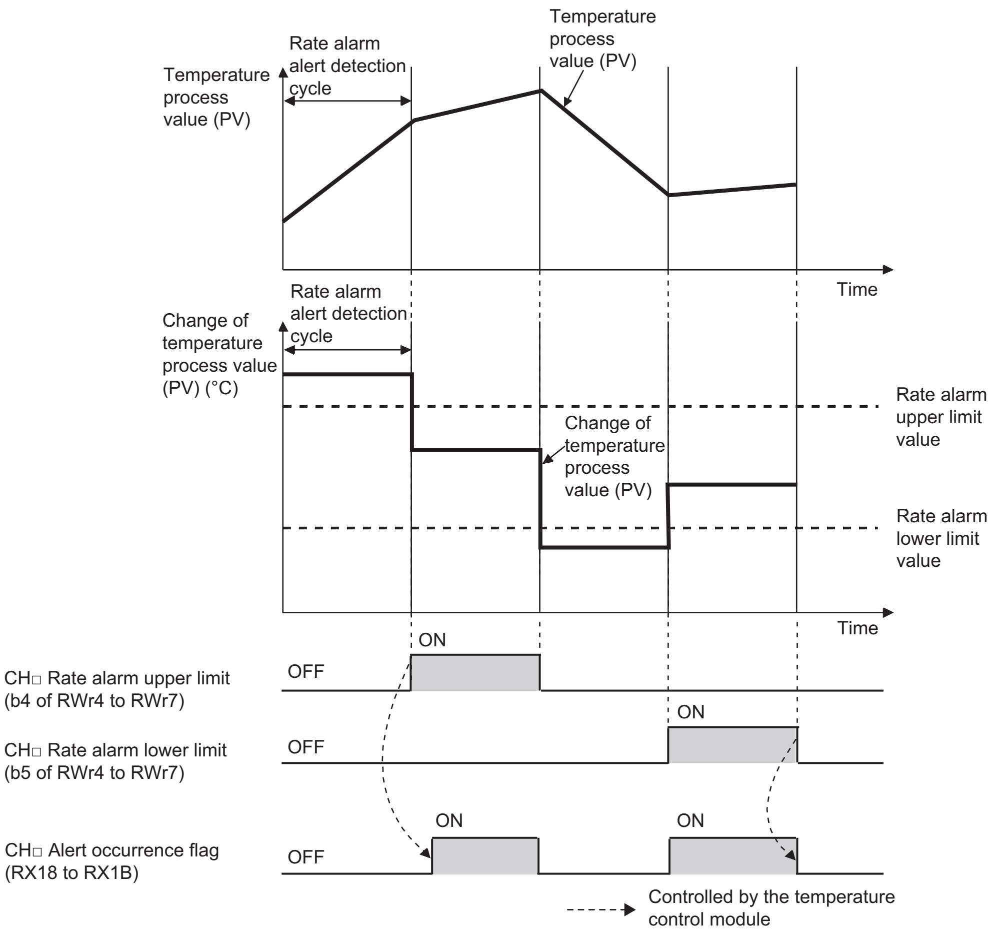
*1 The ALM LED prioritizes the detection of other errors for which the ALM LED flashes (such as the detection of loop disconnection).

(b) Checking the alert clearance

CH☐ Rate alarm upper limit (b4 of RWr4 to RWr7) or CH☐ Rate alarm lower limit (b5 of RWr4 to RWr7) becomes 0 (OFF). Also, CH☐ Alert occurrence flag (RX18 to RX1B) turns off and the ALM LED turns off.

Point

In CH☐ Alert occurrence flag (RX18 to RX1B) and on the ALM LED, the alert is not cleared when an alert other than the rate alarm is occurring.



(c) How to set rate alarm

1. **Set "Method selection" to "Param write(Temperature input mode)".**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "0: Enable" to "CH□ Rate alarm warning output enable_disable setting".**

	CH1 Rate alarm warning o...	1:Disable		0:Enable
	CH1 Rate alarm warning d...	1		0:Enable
	CH1 Rate alarm upper limi...	0		1:Disable
	CH1 Rate alarm lower limit	0		

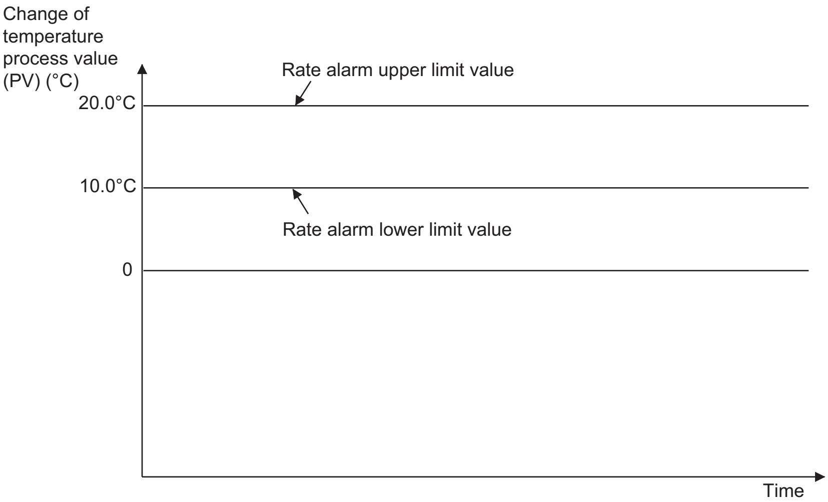
3. **Set "CH□ Rate alarm warning detection cycle", "CH□ Rate alarm upper limit value", and "CH□ Rate alarm lower limit value".**

	CH1 Rate alarm warning o...	1:Disable		0:Enable
	CH1 Rate alarm warning d...	1		1
	CH1 Rate alarm upper limi...	0		200
	CH1 Rate alarm lower limit...	0		10

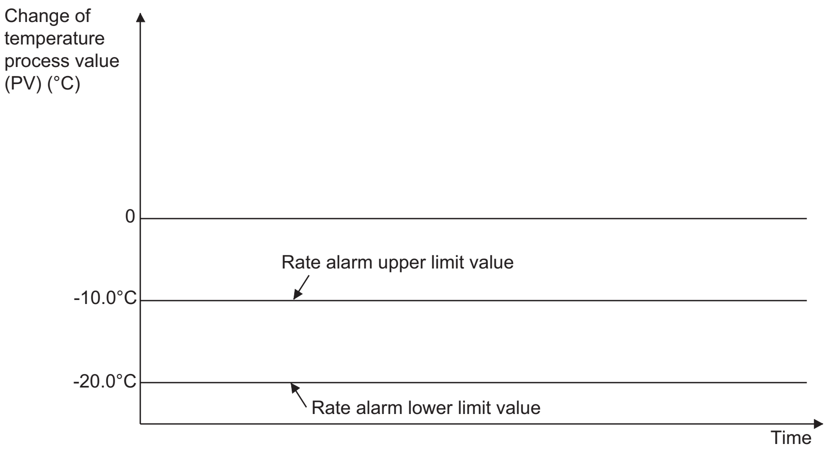
(d) Precautions

When resolution is "1", the temperature process value (PV) of the temperature control module is rounded off from the actual temperature. For the rate alarm also, the temperature process value (PV) rounded off from the actual temperature determines the alert occurrence.

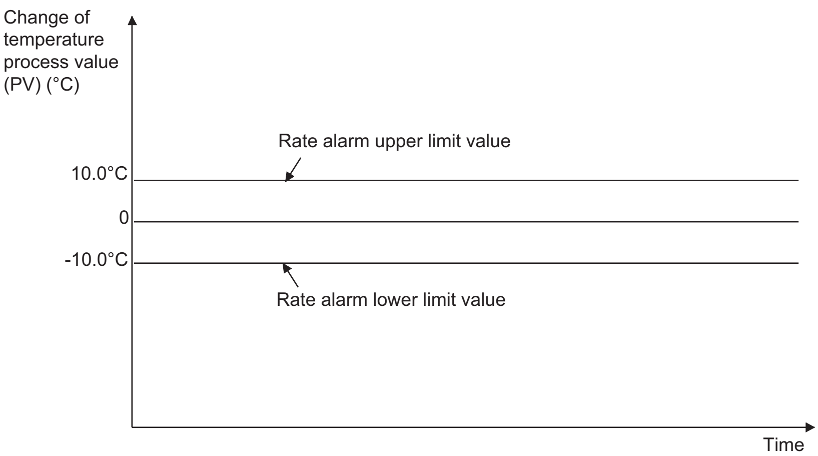
Ex. A setting of the rate alarm upper limit value and lower limit value to monitor that the temperature process value (PV) is rising within the specified range



Ex. A setting of the rate alarm upper limit value and lower limit value to monitor that the temperature process value (PV) is falling within the specified range



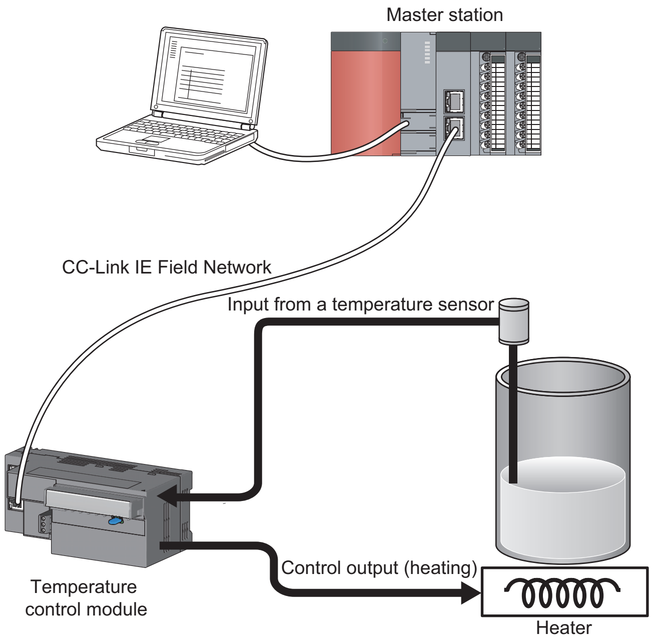
Ex. A setting of the rate alarm upper limit value and lower limit value to monitor that the temperature process value (PV) is changing within the specified range



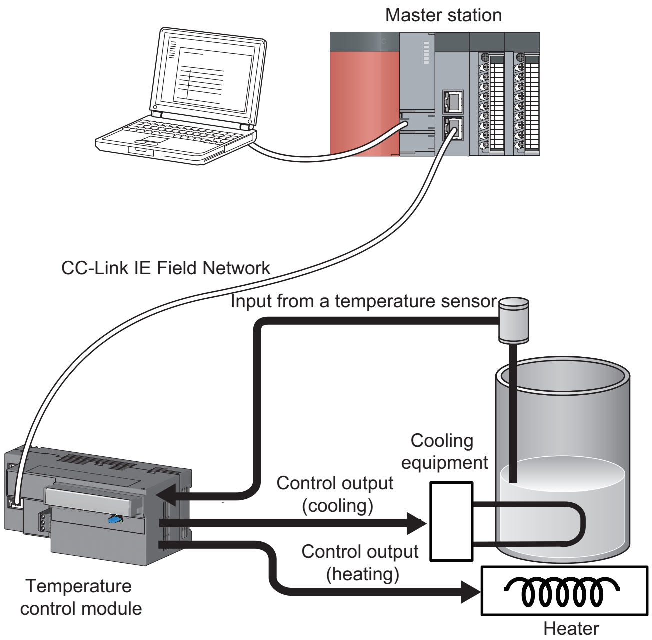
8.3 Temperature Control Mode

When using this module as a temperature control module, use this mode.

- Standard control (heating)



- Heating-cooling control (heating and cooling)

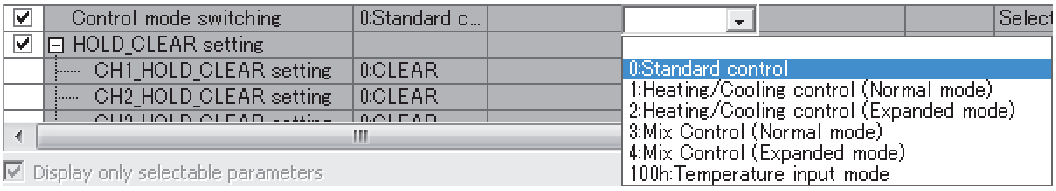


(1) Setting method

1. **Set "Method selection" to "Param write (Station parameter)".**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set any one of "0: Standard control", "1: Heating/Cooling control (Normal mode)", "2: Heating/Cooling control (Expanded mode)", "3: Mix Control (Normal mode)", and "4: Mix Control (Expanded mode)" to "Control mode switching".**



8.3.1 Control mode selection function

Standard Heating-cooling

A control mode can be selected using this function.
This section explains selectable control modes of the temperature control module.

(1) Standard control and heating-cooling control

There are two types of control modes in the temperature control module: standard control and heating-cooling control.

(a) Standard control

The control method is either one of heating (reverse action) or cooling (forward action). When the control method is heating, of a heater for example, cooling is controlled by simply turning off the heating. When the control method is cooling, of cold water for example, heating is controlled by simply turning off the cooling.

(b) Heating-cooling control

The control method is both heating and cooling. To heat up the target subject, its heating mean is turned on, and its cooling mean is turned off. To cool down the target subject, its heating mean is turned off, and its cooling mean is turned on.

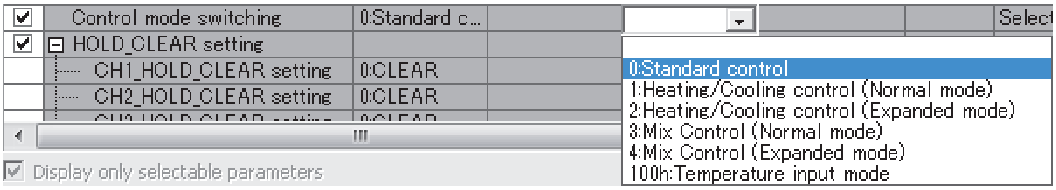
(2) Selectable control mode

A control mode can be selected from five modes.

1. **Set "Method selection" to "Param write (Station parameter)".**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set any one of "0: Standard control", "1: Heating/Cooling control (Normal mode)", "2: Heating/Cooling control (Expanded mode)", "3: Mix Control (Normal mode)", and "4: Mix Control (Expanded mode)" to "Control mode switching".**



Control mode	Contents	Number of control loops
Standard control	Performs the standard control of four channels.	Standard control 4 loops
Heating-cooling control (normal mode)	Performs the heating-cooling control. CH3 and CH4 cannot be used.	Heating-cooling control 2 loops
Heating-cooling control (expanded mode)	Performs the heating-cooling control. The number of loops is expanded using an output module and others in the system.	Heating-cooling control 4 loops
Mix control (normal mode)	Performs the standard control and the heating-cooling control. CH2 cannot be used.	Standard control 2 loops Heating-cooling control 1 loop
Mix control (expanded mode)	Performs the standard control and the heating-cooling control. The number of loops is expanded using an output module in the system.	Standard control 2 loops Heating-cooling control 2 loops

Control for each channel is as follows.

Channel	Standard control	Heating-cooling control		Mix control	
		Normal mode	Expanded mode	Normal mode	Expanded mode
CH1	Standard control	Heating-cooling control	Heating-cooling control	Heating-cooling control	Heating-cooling control
CH2	Standard control	Heating-cooling control	Heating-cooling control	—*1	Heating-cooling control*2
CH3	Standard control	—*1	Heating-cooling control*2	Standard control	Standard control
CH4	Standard control	—*1	Heating-cooling control*2	Standard control	Standard control

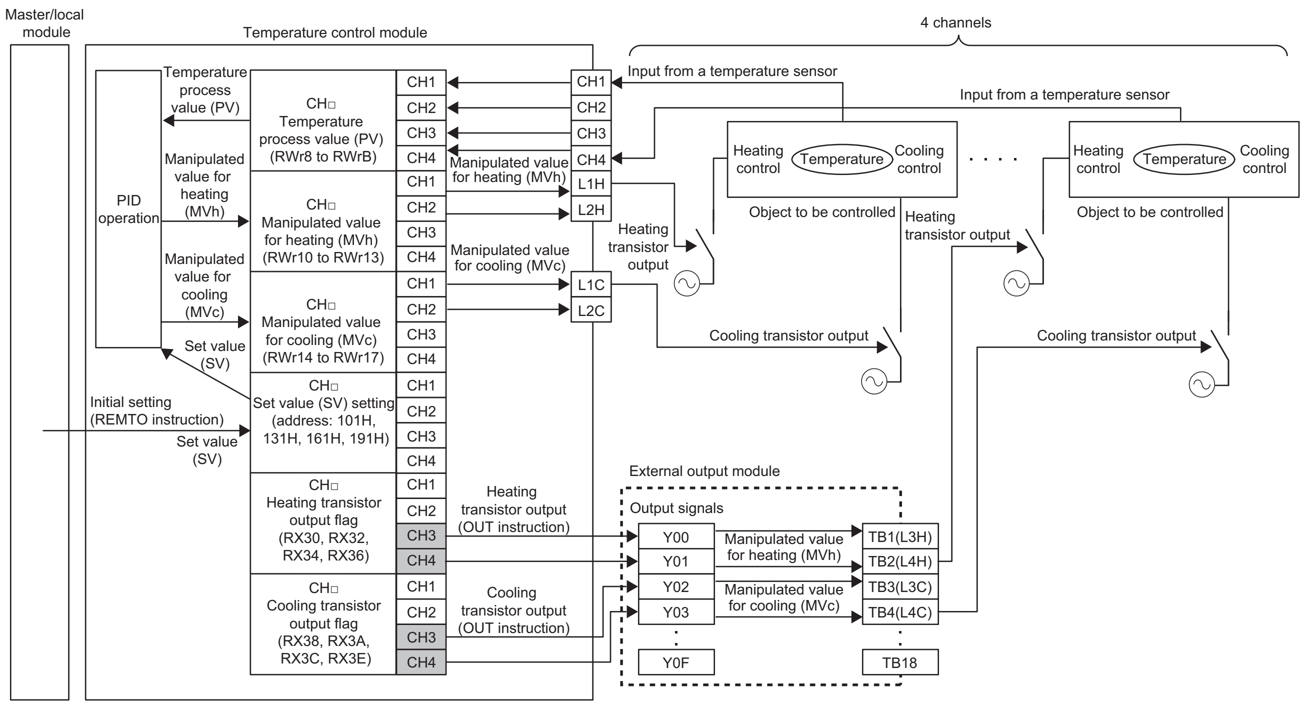
*1 Only temperature measurement using a temperature input terminal can be performed. (☞ Page 222, Section 8.3.24)
*2 Heating-cooling control is performed using an output module in the system. (☞ Page 147, Section 8.3.1 (3))

Point

Immediately after "Control mode switching" is changed, an error (error code: 000DH) occurs. To recover from the error status, turn on and off Set value backup instruction (RY15) and register the setting after the change to the temperature control module.

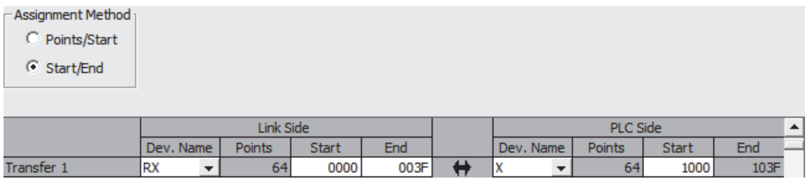
(3) Expanded mode

In the heating-cooling control (expanded mode) or the mix control (expanded mode), the number of loops for heating-cooling control can be expanded using an output module in the system. To use an expanded mode, construct a system such as the one shown below.



Ex. A program in which CH3 Heating transistor output flag (RX34) is assigned to Y0 of an output module

Assign a refresh parameter as shown below.



Create a program as shown below.

Point

When the heating-cooling control (expanded mode) is selected, heating/cooling transistor output of CH3 and CH4 are activated. Also, when the mix control (expanded mode) is selected, heating/cooling transistor output of CH2 is activated. These areas are activated only when an expanded mode is selected. When a normal mode is selected, these areas are used for the system.

8.3.2 HOLD/CLEAR function

Standard Heating-cooling

Whether to continue or stop the control when a stop error of the CPU module occurs or the communication is disconnected can be selected using this function.
The following table shows the correspondence between the setting of "CH☐_HOLD_CLEAR setting" and the operation of the temperature control module in cases when an error of the module occurs, when an error of the CPU module occurs/the operating status of the CPU module is STOP, and when the communication is disconnected.

Status		Processing		Reference
"CH☐_HOLD_CLEAR setting"		CLEAR	HOLD	
Error	Temperature control module write data error	Follow the operation of when an error occurs		Page 271, Section 11.2
	Temperature control module hardware error	Depends on the symptom of the hardware		—
	CPU stop error	Stops the operation and turns off external output	Continues the operation and performs external output	—
CPU operation	RUN → STOP	Follows the stop mode setting[*1*2]	Continues the operation and performs external output	—
Communication disconnection		Stops the operation and turns off external output	Continues the operation and performs external output	—

*1 CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H) (☞ Page 336, Appendix 3 (27))
*2 CH☐ Operation monitor (RX11 to RX14) turns off.

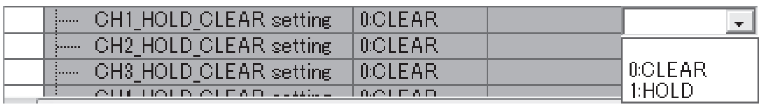
Important
By the failure of an output element or internal circuit, an abnormal output may occur. Construct a circuit to monitor output signals that could cause a serious accident.

(1) Setting method

1. Set "Method selection" to "Param write (Station parameter)".

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH☐_HOLD_CLEAR setting".



8.3.3 Control method

Standard Heating-cooling

The following control methods can be used with the settings of proportional band (P), integral time (I), and derivative time (D).

- Two-position control (☞ Page 149, Section 8.3.3 (1))
- P control (☞ Page 151, Section 8.3.3 (2))
- PI control (☞ Page 152, Section 8.3.3 (3))
- PD control (☞ Page 152, Section 8.3.3 (4))
- PID control (☞ Page 153, Section 8.3.3 (5))

Point

For P control and PD control, the manual reset function is activated. (☞ Page 155, Section 8.3.4)

(1) Two-position control

Two-position control is a control method that uses 0% manipulated value (MV) and 100% manipulated value (MV). Turning on and off the manipulated value (MV) repeatedly, the temperature process value comes close to the set value (SV), then is kept constant.

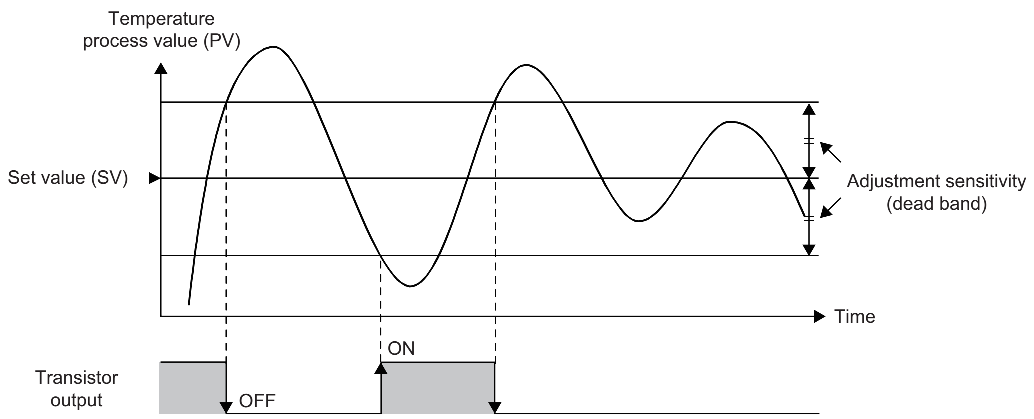
Point

By the setting in CH□ Adjustment sensitivity (dead band) setting (address: 111H, 141H, 171H, 1A1H) the chattering of transistor output under two-position control can be prevented. Set a dead band toward the set value (SV) in CH□ Adjustment sensitivity (dead band) setting (address: 111H, 141H, 171H, 1A1H). (☞ Page 331, Appendix 3 (20))

(a) Standard control

The module operates as follows outside the range of CH□ Adjustment sensitivity (dead band) setting (address: 111H, 141H, 171H, 1A1H).

Condition	Transistor output status
The temperature process value (PV) is below the lower limit of the adjustment sensitivity (dead band).	ON
The temperature process value (PV) is above the upper limit of the adjustment sensitivity (dead band).	OFF



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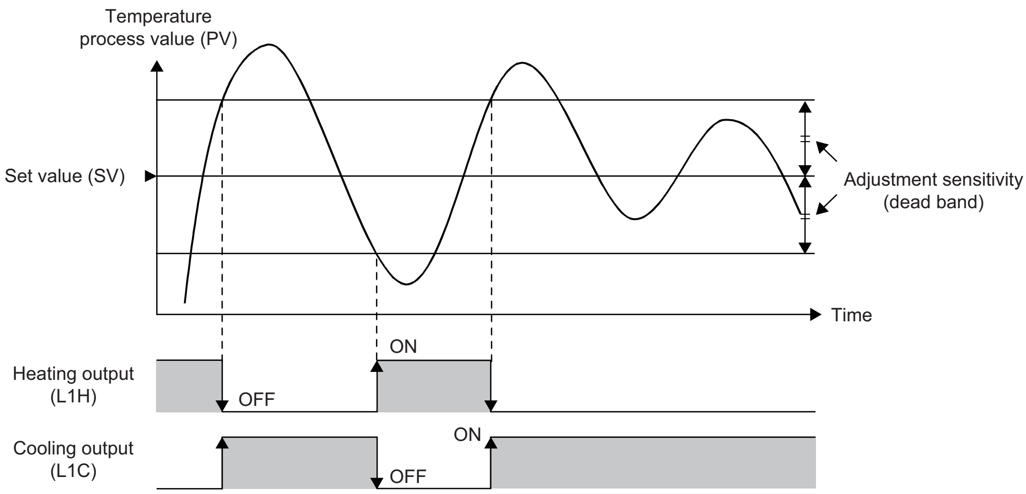
8.3 Temperature Control Mode

(b) Heating-cooling control

The module operates as follows outside the range of CH☐ Adjustment sensitivity (dead band) setting (address: 111H, 141H, 171H, 1A1H).

Condition	Heating transistor output status	Cooling transistor output status
The temperature process value (PV) is below the lower limit of the adjustment sensitivity (dead band).	ON	OFF
The temperature process value (PV) is above the upper limit of the adjustment sensitivity (dead band).	OFF	ON



(c) Three-position control

Three-position control can also be performed by setting a dead band.
For details, refer to the following.

☞ Page 221, Section 8.3.23 (3)

(d) Setting method

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH☐ Proportion belt_P_setting_CH☐ heating proportion belt" to 0.0%.**

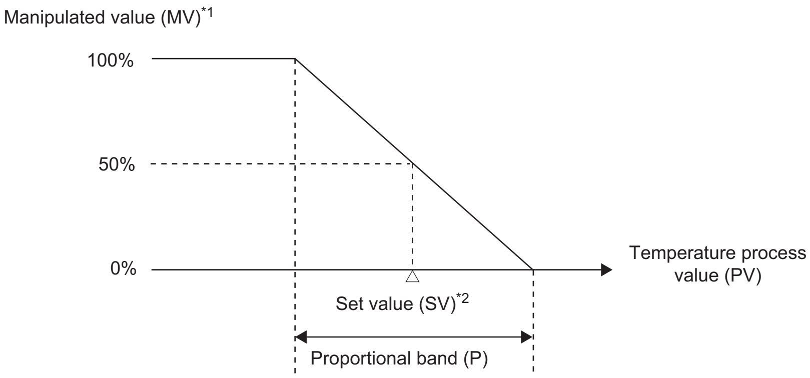
(2) P control

P control is a control method in which the manipulated value (MV) is determined proportional to the deviation (E) between the temperature process value (PV) and set value (SV).

(a) Standard control

The manipulated value (MV) is 50% in the following conditions.

- Temperature process value (PV) = Set value (SV)
- CH□ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H) is set to 0 (0.0%). (☞ Page 332, Appendix 3 (21))



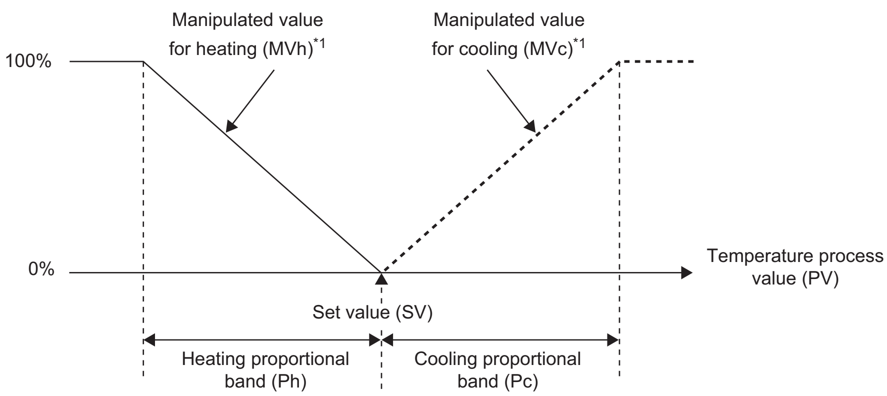
*1 The value actually output is within the output limiter range set in CH□ Upper limit output limiter (address: 105H, 135H, 165H, 195H) and CH□ Lower limit output limiter (address: 106H, 136H, 166H, 196H). (☞ Page 321, Appendix 3 (10))

*2 The set value (SV) is in the center of the proportional band (P).

(b) Heating-cooling control

The manipulated value for heating (MVh) and the manipulated value for cooling (MVc) are both 0% in the following conditions.

- Temperature process value (PV) = Set value (SV)
- CH□ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H) is set to 0 (0.0%). (☞ Page 332, Appendix 3 (21))



*1 The value actually output is within the output limiter range set in CH□ Heating upper limit output limiter (address: 105H, 135H, 165H, 195H) and CH□ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H). (☞ Page 321, Appendix 3 (10))

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8.3 Temperature Control Mode

(c) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. The following table lists the setting details.

- "CH□ Proportion belt_P_setting_CH□ heating proportion belt": any value
- "CH□ Integration time_I_setting": 0s
- "CH□ Differentiation time_D_setting": 0s

	CH1 Proportion belt_P_setti...	30		30
	CH1 Integration time_I_sett...	240		0
	CH1 Differentiation time_D...	60		0

(3) PI control

PI control is a control method in which integral elements are added to P control, thereby an offset (remaining deviation) is compensated. By setting the integral time (I) properly, the temperature process value (PV) matches with the set value (SV).

(a) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. The following table lists the setting details.

- "CH□ Proportion belt_P_setting_CH□ heating proportion belt": any value
- "CH□ Integration time_I_setting": any value
- "CH□ Differentiation time_D_setting": 0s

	CH1 Proportion belt_P_setti...	30		30
	CH1 Integration time_I_sett...	240		240
	CH1 Differentiation time_D...	60		0

(4) PD control

PD control is a control method in which the derivative time (D) is set in addition to PD control. The control mechanism is the same as P control.

(a) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. The following table lists the setting details.

- "CH□ Proportion belt_P_setting_CH□ heating proportion belt": any value
- "CH□ Integration time_I_setting": 0s
- "CH□ Differentiation time_D_setting": any value

	CH1 Proportion belt_P_setti...	30		30
	CH1 Integration time_I_sett...	240		0
	CH1 Differentiation time_D...	60		60

(5) PID control

PID control is a control method in which derivative elements are added to PI control, thereby the temperature shifts to a stable status in a short period of time even when a drastic change has occurred. By setting the derivative time (D) properly, the control subject shifts to a stable status in a short period of time.

(a) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. The following table lists the setting details.

- "CH☐ Proportion belt_P_setting_CH☐ heating proportion belt": any value
- "CH☐ Integration time_I_setting": any value
- "CH☐ Differentiation time_D_setting": any value

	CH1 Proportion belt_P_setti...	30		30
	CH1 Integration time_I_sett...	240		240
	CH1 Differentiation time_D...	60		60

(6) Items related to control method

The following table shows the setting items related to control method.

Name	Setting range				
	Two-position control	P control	PD control	PI control	PID control
CH☐ Input range	Thermocouple: 1 to 4, 11 to 28, 36 to 48, 49 to 52, 100 to 117, 130 to 132, 201 to 205 Platinum resistance thermometer: 5 to 8, 53, 54, 140 to 143, 201 to 205				
CH☐ Set value (SV) setting	Set a value within the temperature measurement range of the set input range.				
CH☐ Proportional band (P) setting	Fix the setting to 0.	Set the value within the range of 0 to 10000 (0.0% to 1000.0%) for the full scale of the set input range.			
CH☐ Heating proportional band (Ph) setting					
CH☐ Cooling proportional band (Pc) setting	The setting is ignored.[*1]	Set the value within the range of 1 to 10000 (0.1% to 1000.0%) for the full scale of the set input range.			
CH☐ Integral time (I) setting	The setting is ignored.[*1]	Fix the setting to 0.	Fix the setting to 0.	1 to 3600 (s)	1 to 3600 (s)
CH☐ Derivative time (D) setting	The setting is ignored.[*1]	Fix the setting to 0.	1 to 3600 (s)	Fix the setting to 0.	1 to 3600 (s)
CH☐ Upper limit output limiter	The setting is ignored.[*1]	-50 to 1050 (-5.0% to 105.0%)			
CH☐ Lower limit output limiter					
CH☐ Heating upper limit output limiter		0 to 1050 (0.0% to 105.0%)			
CH☐ Cooling upper limit output limiter					
CH☐ Output variation limiter setting	The setting is ignored.[*1]	1 to 1000 (0.1%/s to 100.0%/s)			
CH☐ Adjustment sensitivity (dead band) setting	Set the value within the range 1 to 100 (0.1% to 10.0%) of the full scale of the set input range.	The setting is ignored.[*1]			
CH☐ Control output cycle setting	The setting is ignored.[*1]	• When the control output cycle unit selection setting is set to the cycle of 1s: 1 to 100 (1s to 100s) • When the control output cycle unit selection setting is set to the cycle of 0.1s: 5 to 1000 (0.5s to 100.0s)			
CH☐ Heating control output cycle setting					
CH☐ Cooling control output cycle setting					
CH☐ Overlap/dead band setting	Set the value within the range -100 to 100 (-10.0% to 10.0%) of the full scale of the set input range.				
CH☐ Manual reset amount setting	The setting is ignored.[*1]	Set the value within the range of -1000 to 1000 (-100.0% to 100.0%) for the full scale of the set input range.		The setting is ignored.[*1]	

*1 When outside the setting range, a write data error (error code: 0004H) occurs.

Point

The temperature control module automatically sets optimum PID constants if the following functions are used.

- Auto tuning function (☞ Page 159, Section 8.3.7)
- Self-tuning function (☞ Page 184, Section 8.3.15)

8.3.4 Manual reset function

Standard Heating-cooling

The position of the stable condition in P control or PD control can be shifted manually using this function.
By shifting the proportional band (P), an offset (remaining deviation) is manually reset.
The offset is reset by determining and setting the amount to shift the value of the manipulated value (MV) in a stable condition from the reference value.
The reference value is 50% for standard control, and 0% for heating-cooling control.

Point

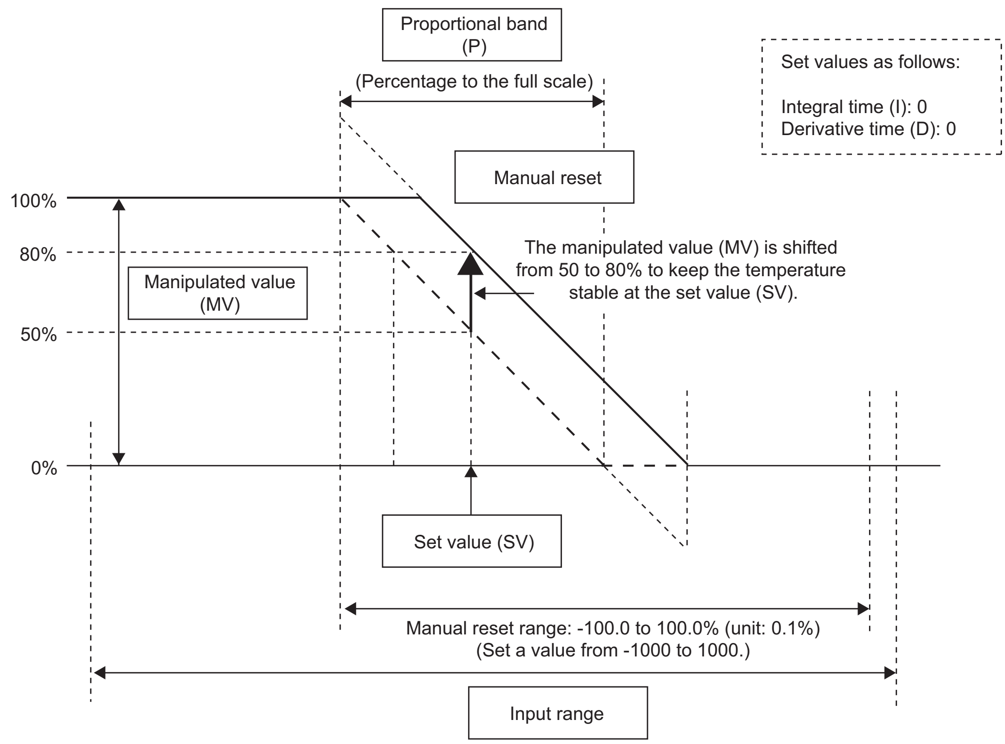
This function can be active only in P control and PD control. This function is inactive when integral time (I) is other than 0. CH☐ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H) is ignored even if it is set. (Note that a write data error (error code: 0004H) occurs if it is outside the setting range.)

(1) Standard control

The set value (SV) is set where the manipulated value (MV) is 50%. Due to this, as long as the temperature process value (PV) and the set value (SV) is not in equilibrium at 50% of manipulated value (MV), an offset (remaining deviation) generates.
When an offset generates, the proportional band (P) can be manually shifted by the amount of the offset (remaining deviation).

Ex. The temperature control module shifts the manipulated value (MV) by which the temperature is stabilized at the set value (SV) from 50% to 80% when the manual reset function is used under the following conditions.

- Control method: P control
- CH☐ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H): 300 (30%)



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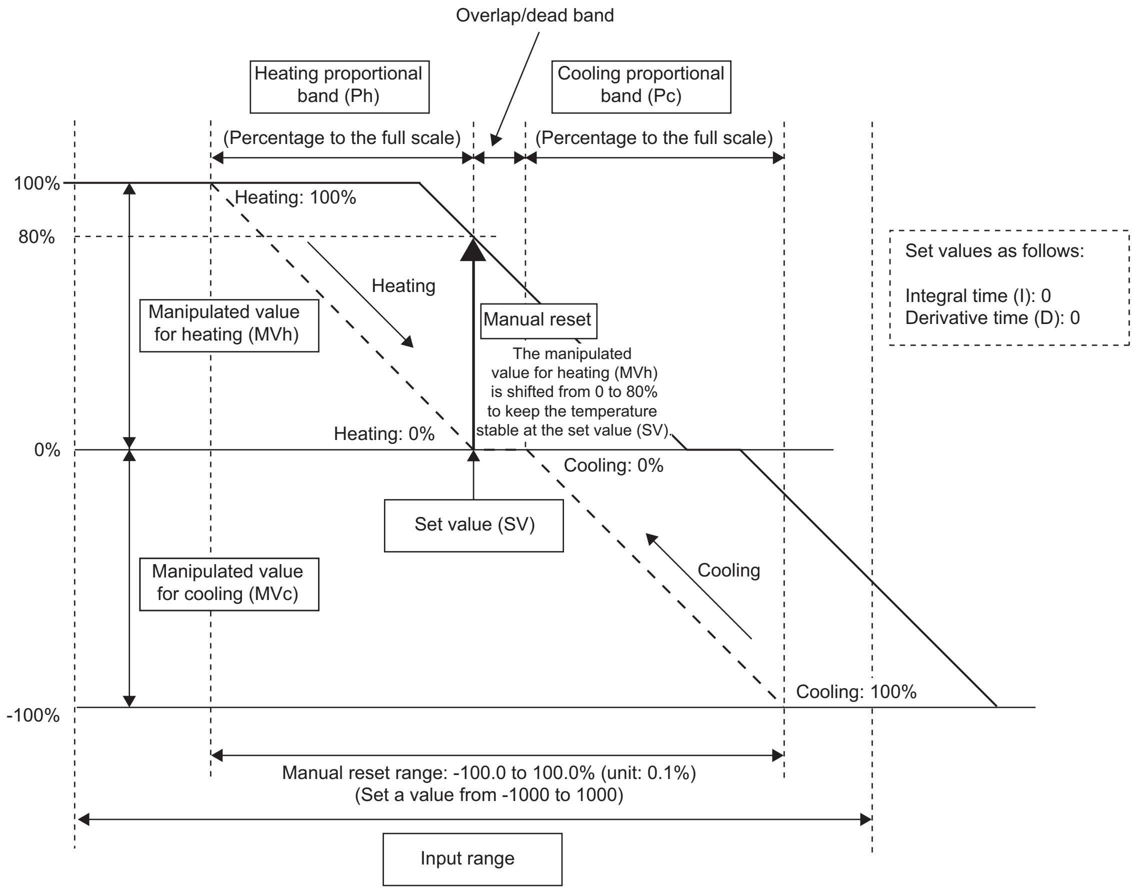
8.3 Temperature Control Mode

(2) Heating-cooling control

The set value (SV) is set where the manipulated value for heating (MVh)/manipulated value for cooling (MVc) is 0%. Due to this, as long as the temperature process value (PV) and the set value (SV) is not in equilibrium at 0% of manipulated value for heating (MVh)/manipulated value for cooling (MVc), an offset (remaining deviation) generates. When an offset generates, the heating proportional band (Ph)/cooling proportional band (Pc) can be manually shifted by the amount of the offset (remaining deviation).

Ex. The temperature control module shifts the manipulated value for heating (MVh) by which the temperature is stabilized at the set value (SV) from 0% to 80% when the manual reset function is used under the following conditions.

- Control method: P control
- CH□ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H): 800 (80%)



(3) Setting method

Set a value in the following remote buffer memory area.

- CH□ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H) (☞ Page 332, Appendix 3 (21))

8.3.5 Manual control

Standard Heating-cooling

Manual control is a form of control for which the user sets the manipulated value (MV) manually instead of obtaining it automatically by PID control.

The manipulated value (MV) is checked every 250ms or 500ms[*1], and is reflected to transistor output.

*1 This value differs depending on the setting under "Sampling cycle selection". (☞ Page 310, Appendix 3 (1) (e))

(1) Setting method

Follow the following procedure for setting.

1. **Shift to the MAN (manual) mode. (Set MAN (1) in CH□ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H).) (☞ Page 332, Appendix 3 (22))**
2. **Check that MAN mode shift completed (1) is stored in MAN mode (address: 601H). (☞ Page 360, Appendix 3 (64))**
3. **Set the manipulated value (MV) in CH□ MAN output setting (address: 114H, 144H, 174H, 1A4H)[*1]. (☞ Page 333, Appendix 3 (23))**

*1 The setting range differs for standard control and heating-cooling control. In standard control: -50 to 1050 (-5.0 to 105.0%) In heating-cooling control: -1050 to 1050 (-105.0 to 105.0%)

8.3.6 Control output cycle unit selection function

Standard Heating-cooling

The unit of the control output cycle can be selected from 1s or 0.1s using this function.
When the control output cycle is set in 0.1s, control can be more attentive.
The control output cycle is the ON/OFF cycle of transistor output for the temperature control function.
The cycle can be set in the following parameter setting screen.

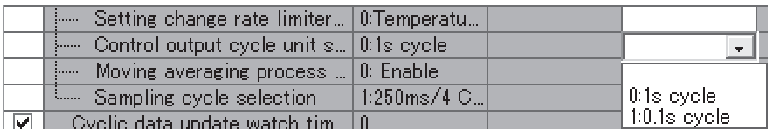
Control mode	Item
Standard control	CH☐ Control output cycle setting
Heating-cooling control	CH☐ Heating control output cycle setting
	CH☐ Cooling control output cycle setting

(1) Setting method

1. **Set "Method selection" to "Param write (Station parameter)".**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "Control output cycle unit switching setting".**



Point

An error (error code: 000EH) occurs right after changing this setting. To recover from the error status, turn on and off Set value backup instruction (RY15) and register the setting after the change to the temperature control module.

8.3.7 Auto tuning function

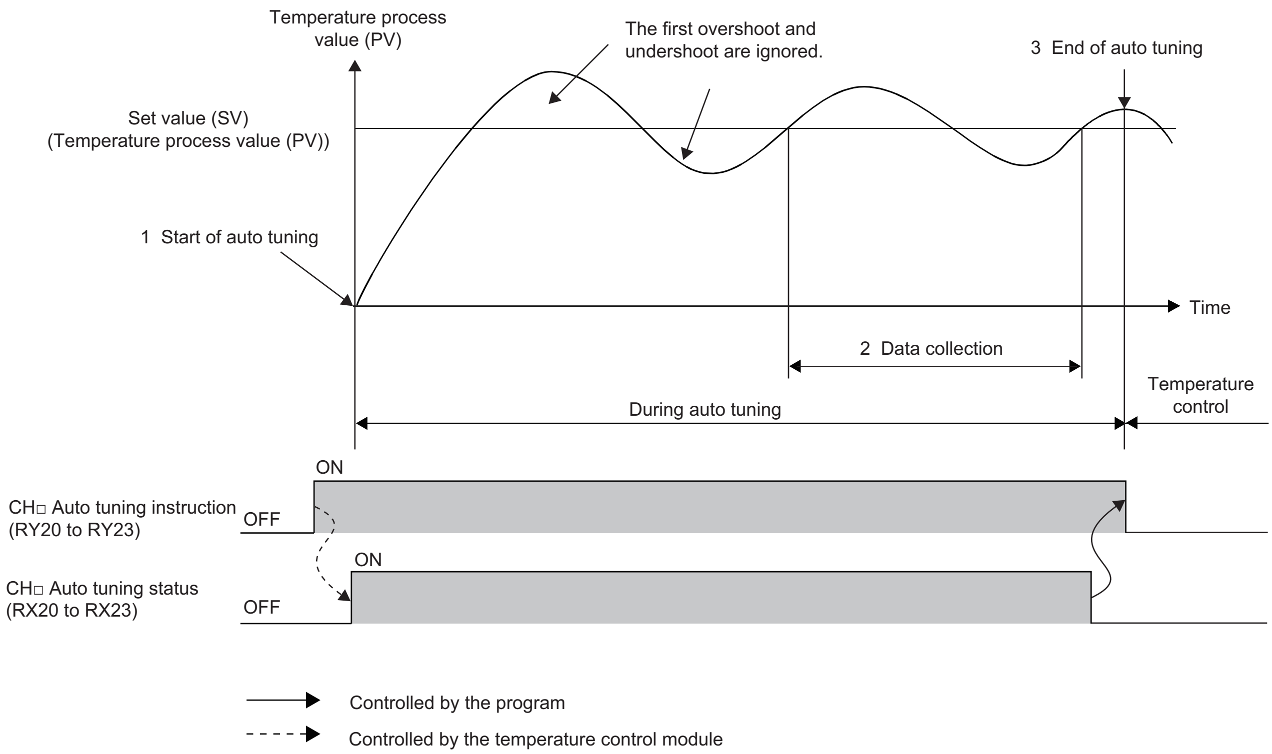
Standard Heating-cooling

The auto tuning function is designed for the temperature control module to set the optimum PID constants automatically. In auto tuning, the PID constants are calculated according to the hunting cycle and amplitude generated by repeated overshoot and undershoot of the temperature process value (PV) toward the set value (SV).

(1) Auto tuning operation

The temperature control module operates as follows.

	Operation of the temperature control module
1	Starts auto tuning.
2	Collects data from the point when the temperature process value (PV) reaches the set value (SV) after the first overshoot and undershoot.
3	After data collection, auto tuning ends when PID constants and loop disconnection detection judgment time are set.



Remark

The time takes for auto tuning depends on the control subject.

(2) Remote buffer memory areas related to auto tuning

To execute auto tuning, the following data need to be set in advance. Note that other data must be preset to the values used for actual operation since actual control starts on completion of auto tuning.

When "0" is set for the proportional band (P)/heating proportional band (Ph), auto tuning is not executed.
(☞ Page 318, Appendix 3 (7))

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Input range	100H	130H	160H	190H	Page 312, Appendix 3 (5)
CH☐ Set value (SV) setting	101H	131H	161H	191H	Page 317, Appendix 3 (6)
CH☐ Upper limit output limiter	105H	135H	165H	195H	Page 321, Appendix 3 (10)
CH☐ Lower limit output limiter	106H	136H	166H	196H	
CH☐ Heating upper limit output limiter	105H	135H	165H	195H	
CH☐ Cooling upper limit output limiter	1C5H	1CAH	1CFH	1D4H	
CH☐ Output variation limiter setting	107H	137H	167H	197H	Page 323, Appendix 3 (11)
CH☐ Sensor correction value setting	280H	281H	282H	283H	Page 352, Appendix 3 (51)
CH☐ Control output cycle setting	10CH	13CH	16CH	19CH	Page 326, Appendix 3 (15)
CH☐ Heating control output cycle setting	10CH	13CH	16CH	19CH	
CH☐ Cooling control output cycle setting	1C6H	1CBH	1D0H	1D5H	
CH☐ Primary delay digital filter setting	10DH	13DH	16DH	19DH	Page 328, Appendix 3 (16)
CH☐ AUTO/MAN mode shift	113H	143H	173H	1A3H	Page 332, Appendix 3 (22)
CH☐ AT bias setting	2A1H	2A3H	2A5H	2A7H	Page 355, Appendix 3 (57)
CH☐ Forward/reverse action setting	115H	145H	175H	1A5H	Page 334, Appendix 3 (24)
CH☐ Auto tuning mode selection	2A0H	2A2H	2A4H	2A6H	Page 354, Appendix 3 (56)

(3) Storing the calculated value after auto tuning

After auto tuning is completed, the calculated values are stored into the following remote buffer memory areas.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Proportional band (P) setting	102H	132H	162H	192H	Page 318, Appendix 3 (7)
CH☐ Heating proportional band (Ph) setting	102H	132H	162H	192H	
CH☐ Cooling proportional band (Pc) setting	1C4H	1C9H	1CEH	1D3H	
CH☐ Integral time (I) setting	103H	133H	163H	193H	Page 320, Appendix 3 (8)
CH☐ Derivative time (D) setting	104H	134H	164H	194H	Page 320, Appendix 3 (9)
CH☐ Loop disconnection detection judgment time*1	116H	146H	176H	1A6H	Page 334, Appendix 3 (25)

*1 A value twice greater than the one in CH☐ Integral time (I) setting (address: 103H, 133H, 163H, 193H) is automatically set. However, if this setting is 0 (s) when auto tuning is in process, the loop disconnection detection judgment time is not stored.

(4) Backup of the calculated value on completion of auto tuning

By setting the following remote buffer memory area to Enable (1) at the start of auto tuning, the calculated value (☞ Page 160, Section 8.3.7 (3)) is automatically backed up into a non-volatile memory on completion of auto tuning.

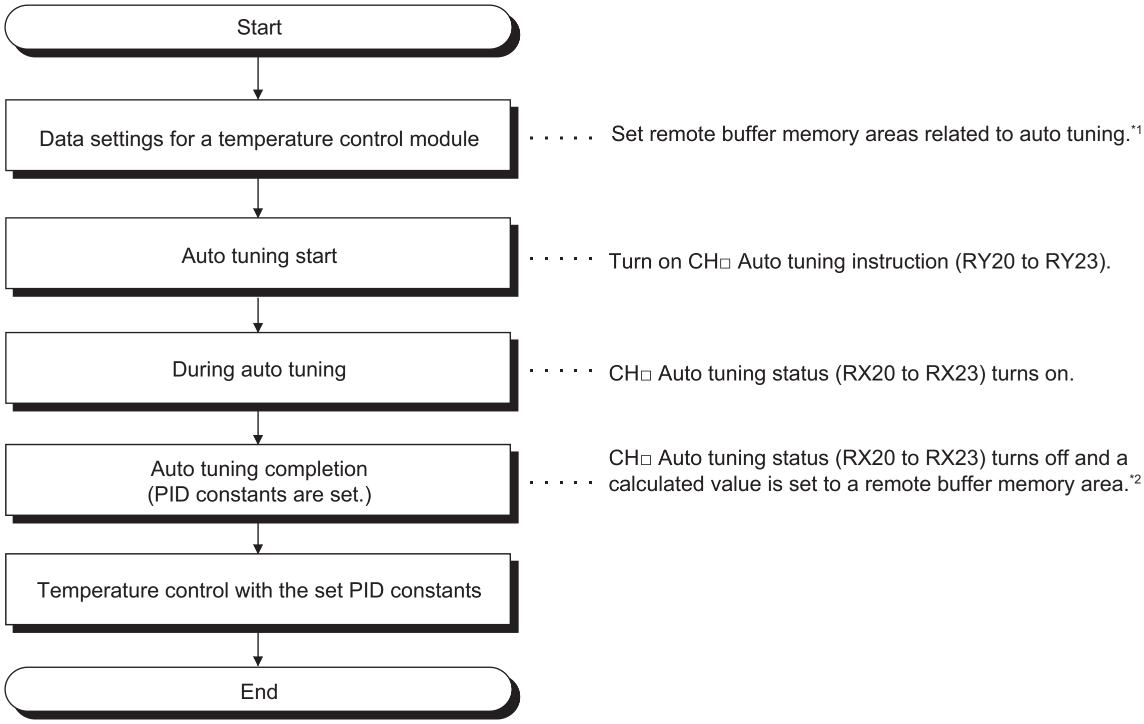
- CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H) (☞ Page 337, Appendix 3 (28))

To read the calculated value (☞ Page 160, Section 8.3.7 (3)) from the non-volatile memory, set the following remote buffer memory area to Requested (1).

- CH☐ Memory's PID constants read instruction (address: 1100H to 1103H) (☞ Page 366, Appendix 3 (73) (b))

(5) Procedure of auto tuning

Follow the instructions below.



*1 Set the following remote buffer memory areas.
☞ Page 160, Section 8.3.7 (2)

*2 The calculated value is set in the following remote buffer memory areas.
☞ Page 160, Section 8.3.7 (3)

(6) Conditions where auto tuning cannot be executed

If one of the following conditions applies, auto tuning cannot be executed.

	Conditions to start auto tuning	Reference
1	In standard control, CH☐ Proportional band (P) setting (address: 102H, 132H, 162H, 192H) is set to 0. (operating in two-position control)	Page 318, Appendix 3 (7)
	In heating-cooling control, CH☐ Heating proportional band (Ph) setting (address: 102H, 132H, 162H, 192H) is set to 0. (operating in two-position control)	
2	CH☐ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H) is set to MAN (1).	Page 332, Appendix 3 (22)
3	Hardware failure has occurred. (The ERR.LED is on.)	Page 281, Section 11.4 (9)
4	CH☐ Temperature process value (PV) (RWr8 to RWrB) has exceeded the temperature measurement range. (CH☐ Input range upper limit (b0 of RWr4 to RWr7) or CH☐ Input range lower limit (b1 of RWr4 to RWr7) is 1 (ON)).	Page 303, Appendix 2 (5)
5	CH☐ Memory's PID constants read instruction (address: 1100H to 1103H) is set to Requested (1).	Page 365, Appendix 3 (72)
6	CH☐ Write completion flag (address: b4 to b7 of 1104H) is on.	Page 366, Appendix 3 (73)
7	CH☐ Stop request flag (RY18 to RY1B) of a channel for auto tuning is on.	Page 298, Appendix 1.2 (7)

(a) When the condition 1 or 2 applies

Auto tuning starts when the condition no longer applies.

(b) When the condition 3, 4, or 7 applies

Even though the temperature process value (PV) goes back within the temperature measurement range, auto tuning does not start until CH☐ Auto tuning instruction (RY20 to RY23) is turned on from off once again.

(c) When the condition 5 or 6 applies

Even though the internal processing of auto tuning is completed and PID constants are stored, CH☐ Auto tuning status (RX20 to RX23) does not turn off, therefore the auto tuning is not completed.

Point

The request for auto tuning is received even when the operation status is stop (CH☐ Operation monitor (RX11 to RX14) is off.). In this case, the operation status is changed to run (CH☐ Operation monitor (RX11 to RX14)) when the auto tuning is completed.
For details, refer to the following.
☞ Page 299, Appendix 1.2 (8) (a)

(7) Conditions where auto tuning ends in failure

The conditions are described below.

(a) Change of the operation status to stop

When CH☐ Stop request flag (RY18 to RY1B) is turned off and on and CH☐ Operation monitor (RX11 to RX14) is turned STOP (OFF), the auto tuning ends in failure.

(b) Setting change of the remote buffer memory during the execution of auto tuning

If a setting in the following remote buffer memory areas is changed during the execution of auto tuning, the processing ends in failure.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Set value (SV) setting	101H	131H	161H	191H	Page 317, Appendix 3 (6)
CH☐ Upper limit output limiter	105H	135H	165H	195H	Page 321, Appendix 3 (10)
CH☐ Lower limit output limiter	106H	136H	166H	196H	
CH☐ Cooling upper limit output limiter	1C5H	1CAH	1CFH	1D4H	
CH☐ Control output cycle setting	10CH	13CH	16CH	19CH	Page 326, Appendix 3 (15)
CH☐ Heating control output cycle setting	10CH	13CH	16CH	19CH	
CH☐ Cooling control output cycle setting	1C6H	1CBH	1D0H	1D5H	
CH☐ Primary delay digital filter setting	10DH	13DH	16DH	19DH	Page 328, Appendix 3 (16)
CH☐ AUTO/MAN mode shift	113H	143H	173H	1A3H	Page 332, Appendix 3 (22)
CH☐ Forward/reverse action setting	115H	145H	175H	1A5H	Page 334, Appendix 3 (24)
Cold junction temperature compensation selection	1E9H				Page 344, Appendix 3 (40)
CH☐ Sensor correction value setting	280H	281H	282H	283H	Page 352, Appendix 3 (51)
CH☐ AT bias setting	2A1H	2A3H	2A5H	2A7H	Page 355, Appendix 3 (57)

(c) Out of the temperature measurement range

If CH☐ Temperature process value (PV) (RWr8 to RWrB) exceeds the temperature measurement range and either of the following conditions is satisfied, auto tuning ends in failure.

- CH☐ Input range upper limit (b0 of RWr4 to RWr7): 1 (ON)
- CH☐ Input range lower limit (b1 of RWr4 to RWr7): 1 (ON)

(d) Time until the temperature process value (PV) reaches the set value (SV) for the first time or a half the hunting cycle of the temperature process value (PV)

If the time below exceeds two hours, auto tuning ends in failure

- Time from the start of auto tuning until CH☐ Temperature process value (PV) (RWr8 to RWrB) reaches the set value (SV) for the first time
- A half the hunting cycle of CH☐ Temperature process value (PV) (RWr8 to RWrB)

(e) Calculated values of PID constants after auto tuning

If a calculated value of PID constants after auto tuning exceeds one of the following ranges, auto tuning ends in failure.

- CH☐ Proportional band (P) setting (address: 102H, 132H, 162H, 192H): 1 to 10000 (0.1% to 1000.0%)
- CH☐ Integral time (I) setting (address: 103H, 133H, 163H, 193H): 1 to 3600 (1s to 3600s)
- CH☐ Derivative time (D) setting (address: 104H, 134H, 164H, 194H): 0 to 3600 (0s to 3600s)

Point

If auto tuning ends in failure due to the calculated value of PID constants as described above, the system configuration needs to be reconsidered (such as selecting proper heater capacity).

(f) Change of the upper limit setting limiter or lower limit setting limiter and the set value (SV)

If the set value (SV) goes out of the setting range due to the change in one of the following remote buffer memory areas, auto tuning ends in failure.

- CH☐ Upper limit setting limiter (address: 10AH, 13AH, 16AH, 19AH)
- CH☐ Lower limit setting limiter (address: 10BH, 13BH, 16BH, 19BH)

(g) Other conditions

In addition to the conditions described up until here, if any of the following conditions applies, auto tuning ends in failure.

- Hardware failure has occurred.
- In standard control, CH☐ Proportional band (P) setting (address: 102H, 132H, 162H, 192H) is changed to 0. (has been set to two-position control) (☞ Page 318, Appendix 3 (7))
- In heating-cooling control, CH☐ Heating proportional band (Ph) setting (address: 102H, 132H, 162H, 192H) is changed to 0. (has been set to two-position control or three-position control) (☞ Page 318, Appendix 3 (7))

(8) Operation on completion of auto tuning

(a) Normal completion

The temperature control module operates as follows.

- Turns off CH☐ Auto tuning status (RX20 to RX23)
- Stores the PID constants in the remote buffer memory (☞ Page 160, Section 8.3.7 (3))
- Stores a value in CH☐ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H) (If this was set to 0 (s) at the start of auto tuning, the setting remains unchanged.)

(b) Abnormal completion

The temperature control module operates as follows.

- Turns off CH☐ Auto tuning status (RX20 to RX23)
- Does not store the PID constants in the remote buffer memory. (☞ Page 160, Section 8.3.7 (3))

(9) Checking the completion of auto tuning

The completion of auto tuning can be checked by the status change from on to off in CH☐ Auto tuning status (RX20 to RX23).

(10)Adjustment after auto tuning

To change the control response toward the PID constants calculated by auto tuning, change the setting in the following remote buffer memory area.

- CH☐ Control response parameter (address: 10FH, 13FH, 16FH, 19FH) (☞ Page 329, Appendix 3 (18))

Point

In the system where the temperature rise rapidly, auto tuning may not be performed properly due to the excessive temperature rise during the auto tuning. Therefore, for a sequence program to perform auto tuning, incorporate the alert function so that the auto tuning will be stopped if an alert occurs.
For details on the sequence program, refer to the following.
☞ Page 232, CHAPTER 9

(11)During auto tuning loop disconnection detection function

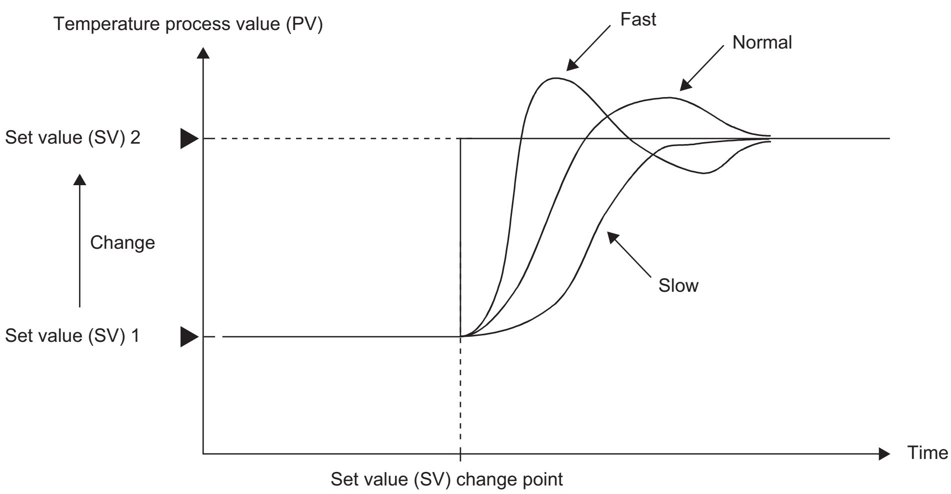
For details on the during AT loop disconnection detection function, refer to the following.
☞ Page 214, Section 8.3.20

8.3.8 Simple two-degree-of-freedom

Standard Heating-cooling

This is the simplified control form of the two-degree-of-freedom PID control. In this form of PID control, the temperature control module controls the target subject using not only PID constants but also the control response parameter. The response speed toward the change of the set value (SV) can be selected from three levels.
General PID control is called one-degree-of freedom PID control. In the one-degree-of freedom PID control, when PID constants that improve "response to the change of the set value (SV)" are set, "response to the disturbance" worsens. Conversely, when PID constants that improve "response to the disturbance" are set, "response to the change of the set value (SV)" worsens.
On the other hand, in the two-degree-of-freedom PID control, "response to the change of the set value (SV)" and "response to the disturbance" can be compatible with each other.
Note that required parameter settings increase and PID constants can hardly be auto-set by the auto tuning function for complete two-degree-of-freedom PID control. Therefore, the temperature control module operates in the simple two-degree-of-freedom PID control for which parameters are simplified.
The level of "response to the change of the set value (SV)" can be selected from the following, maintaining the PID constants that improve "response to the disturbance".

- Fast
- Normal
- Slow

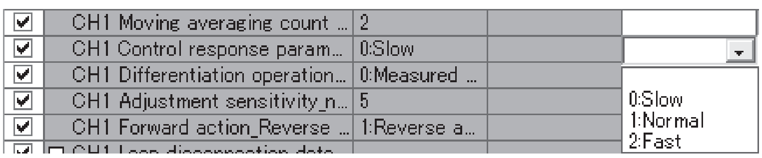


(1) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH□ Control response parameter".



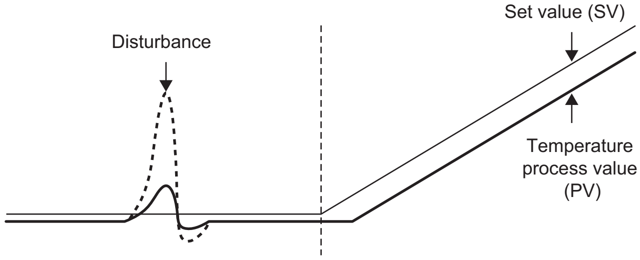
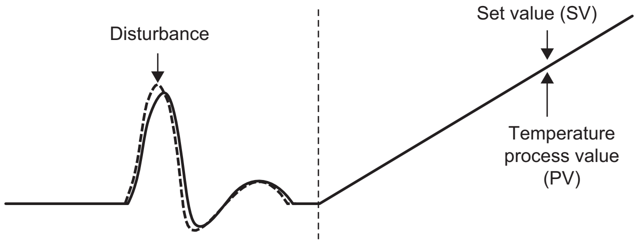
8.3.9 Derivative action selection function

Standard Heating-cooling

A derivative action appropriate for each of fixed value action and ramp action can be selected and the action characteristic can be improved using this function.

(1) Action

Each type of derivative action operates as shown below.

CH☐ Derivative action selection (address: 110H, 140H, 170H, 1A0H)	Action	
Measured value derivation (0)		This setting effectively prevents the temperature from being affected by disturbance, though the performance to follow the set value can be low.
Deviation derivation (1)		This setting allows the temperature to follow the set value well, though the disturbance effect is great.

(2) Setting method

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH☐ Differentiation operation selection".**

8.3.10 Setting change rate limiter setting function

Standard Heating-cooling

When the set value (SV) is changed, the change rate in the specified time unit can be set on "Setting Change Rate Limiter Setting". The user can select whether to set this rate for temperature rise and temperature drop individually or at once.

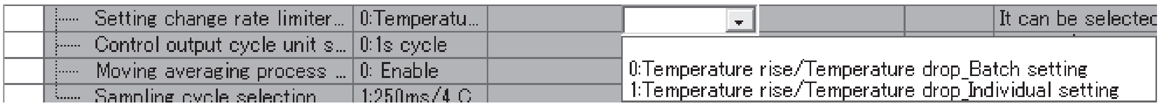
(1) Setting method

(a) Batch/individual setting of temperature rise and temperature drop

1. Set "Method selection" to "Param write (Station parameter)".

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Select the value on "Setting change rate limiter setting".



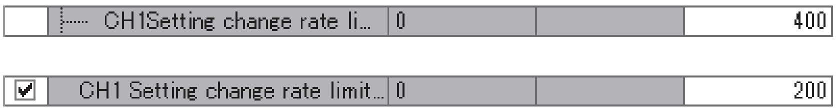
(b) Change rate setting

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. For batch-change, set "CH□ Setting change rate limiter or CH□ Setting change rate limiter_temperature rise" only.

3. For individual setting, set "CH□ Setting change rate limiter or CH□ Setting change rate limiter_temperature rise" and "CH□ Setting change rate limiter_temperature drop".



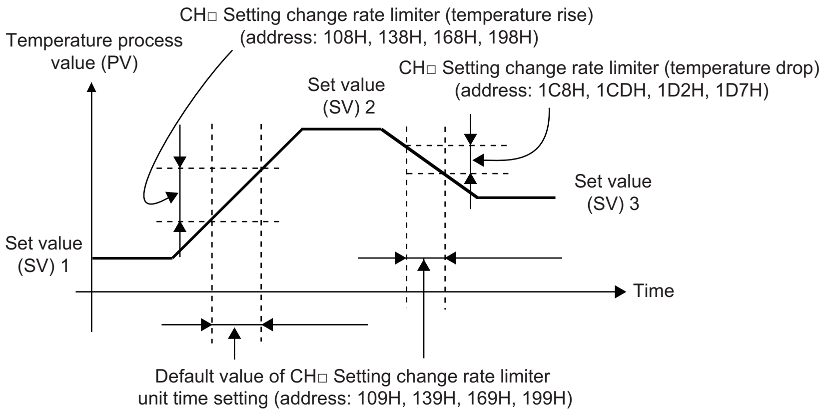
(c) Time unit setting

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH□ Setting change rate limiter unit time setting".**

Ex. Operation of when individual setting is selected



8.3.11 Alert function

Standard Heating-cooling

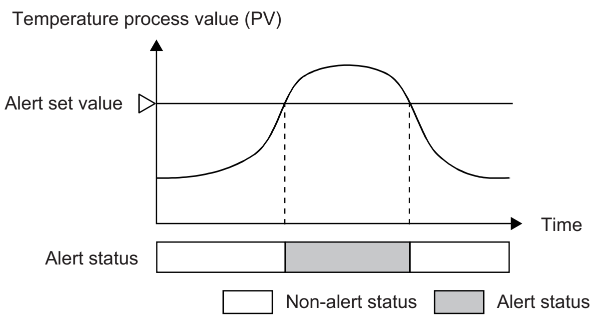
When the temperature process value (PV) or deviation (E) reaches the value set in advance, the system is set in an alert status. Use this function to activate danger signals of devices or safety devices.
The alert function is classified into input alerts and deviation alerts depending on the setting of the alert mode.

- Input alert: upper limit input alert, lower limit input alert (☞ Page 169, Section 8.3.11 (1))
- Deviation alert: upper limit deviation alert, lower limit deviation alert, upper lower limit deviation alert, within-range alert (☞ Page 170, Section 8.3.11 (2))

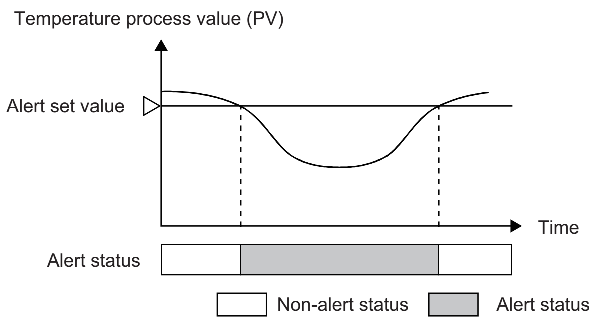
(1) Input alert

With the upper limit input alert, when the temperature process value (PV) is equal to or greater than the alert set value, the system is put in an alert status.
With the lower limit input alert, when the temperature process value (PV) is equal to or less than the alert set value, the system is put in an alert status.

Upper limit input alert



Lower limit input alert



(a) Setting method

Set the alert mode. (☞ Page 176, Section 8.3.11 (6))

- Upper limit input alert: Set the alert mode to "1: Upper limit input alert".
- Lower limit input alert: Set the alert mode to "2: Lower limit input alert".

(2) Deviation alert

With the deviation alert, when the deviation (E) between the temperature process value (PV) and the set value (SV) meets a particular condition, the system is put in an alert status.

The set value (SV) to be referred is either "set value (SV) monitor" or "set value (SV) setting" depending on the alert mode. When a setting change rate limiter is specified, "set value (SV) monitor" follows the set value (SV) by the specified change rate.

For details on the setting change rate limiter setting, refer to the following.

- ☞ Page 324, Appendix 3 (12)

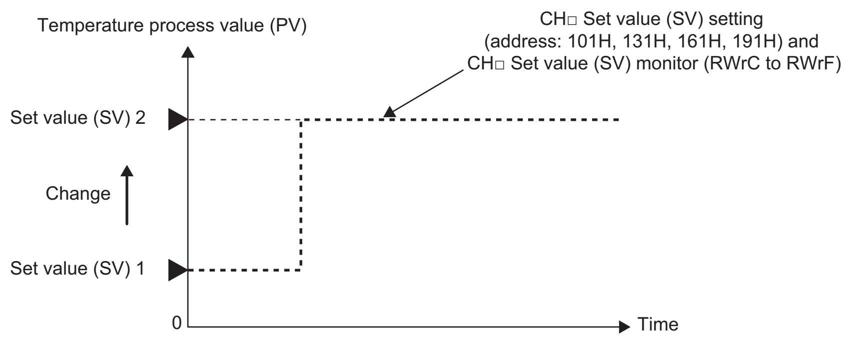
The following table describes the use of each set value (SV) of when a setting change rate limiter is specified, and can be referred to use a deviation alert.

Reference area of the set value (SV)	Use (when the set value (SV) is changed)
CH☐ Set value (SV) monitor (RWrC to RWrF)	This value is used when the temperature process value (PV) needs to follow the changing set value (SV) within a consistent deviation (E). If the temperature process value (PV) does not follow the set value (SV) and strays out of the set deviation range, an alert occurs.
CH☐ Set value (SV) setting (address: 101H, 131H, 161H, 191H)	This value is used for the alert occurrence to be determined only by the deviation (E) from the set value (SV). In this case, how well the temperature process value (PV) is following the changing set value (SV) does not matter. Even if the value in CH☐ Set value (SV) monitor (RWrC to RWrF) is changing, an alert can occur depending on the deviation (E) from the set value (SV).

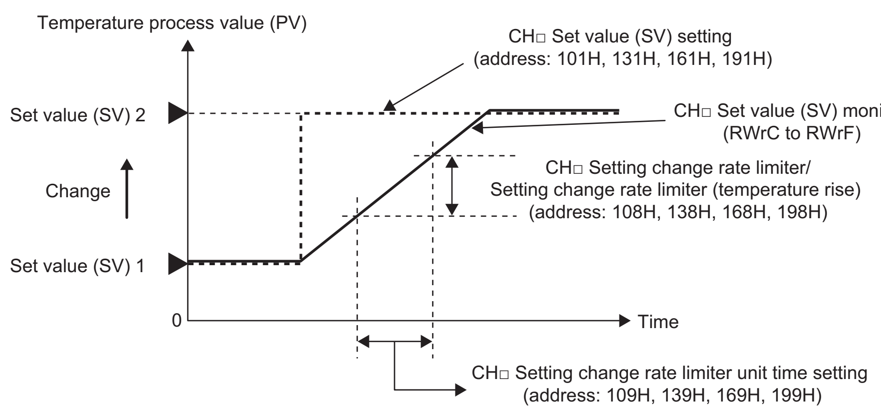
(a) Set value (SV) and the setting change rate limiter setting

The following figures show the relationships of two types of set value (SV) depending on whether the setting change rate limiter is specified or not.

- When the setting change rate limiter is not specified: The two types of set value (SV) are the same value.



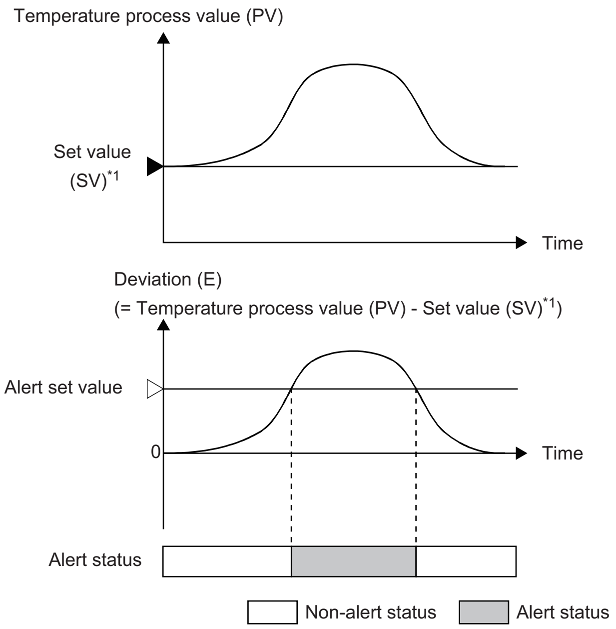
- When the setting change rate limiter is specified: The value in CH☐ Set value (SV) monitor (RWrC to RWrF) follows the set value (SV) of after the setting is reflected.

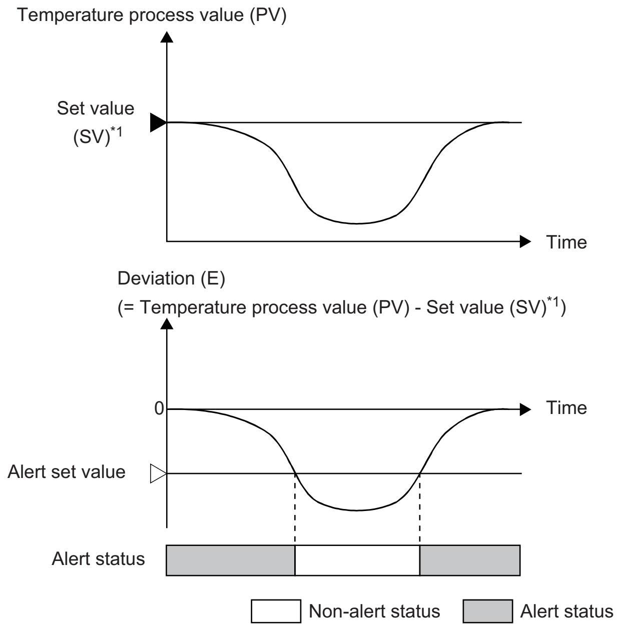


(b) Upper limit deviation alert

When the deviation (E) is equal to or greater than the alert set value, the system is put in an alert status.

When the alert set value is positive	When the alert set value is negative



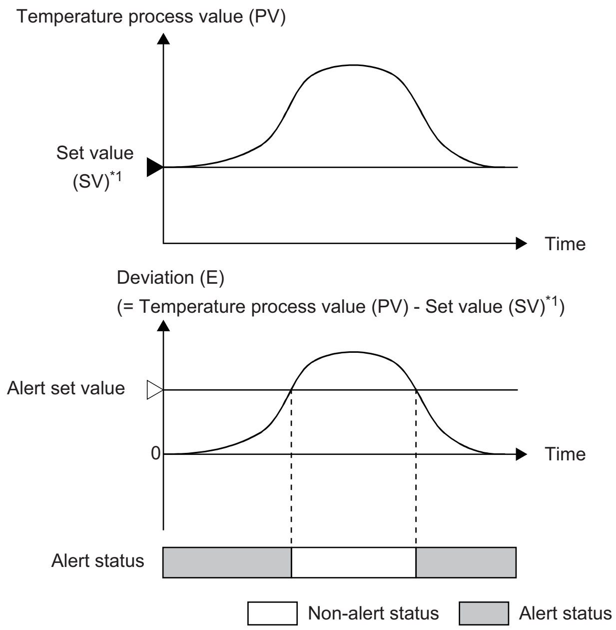


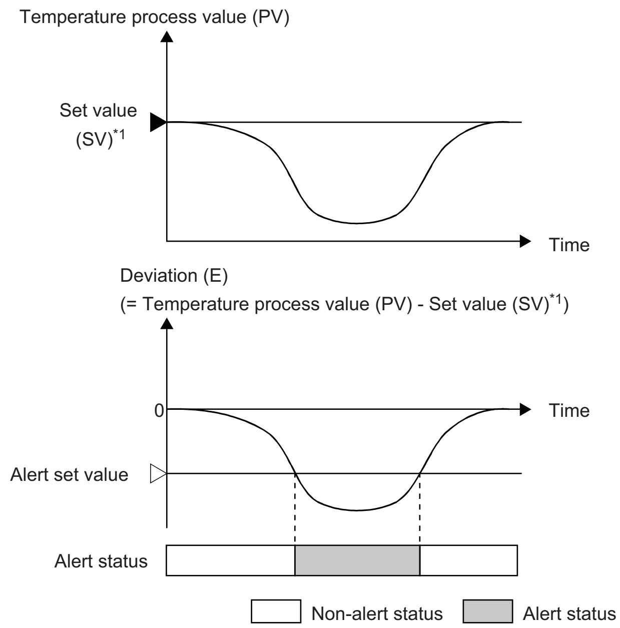
*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (☞ Page 170, Section 8.3.11 (2) (a))

(c) Lower limit deviation alert

When the deviation (E) is equal to or less than the alert set value, the system is put in an alert status.

When the alert set value is positive	When the alert set value is negative



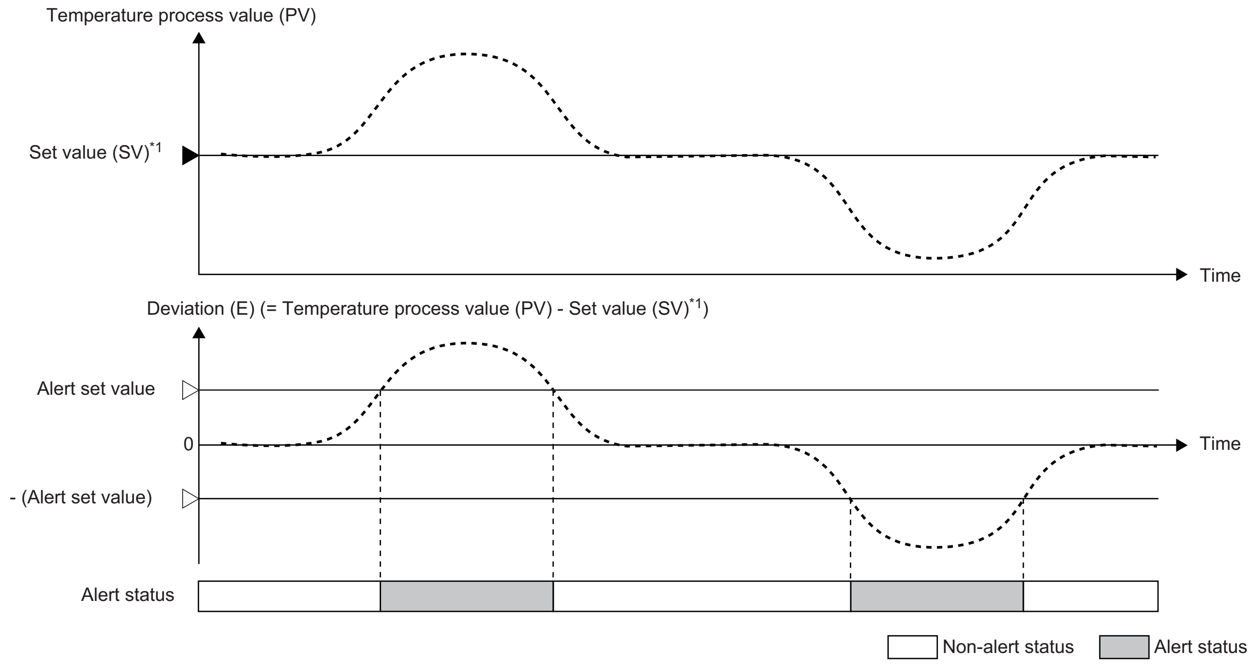


*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (☞ Page 170, Section 8.3.11 (2) (a))

(d) Upper lower limit deviation alert

When one of the following conditions is satisfied, the system is put in an alert status.

- Deviation (E) ≥ Alert set value
- Deviation (E) ≤ -(Alert set value)

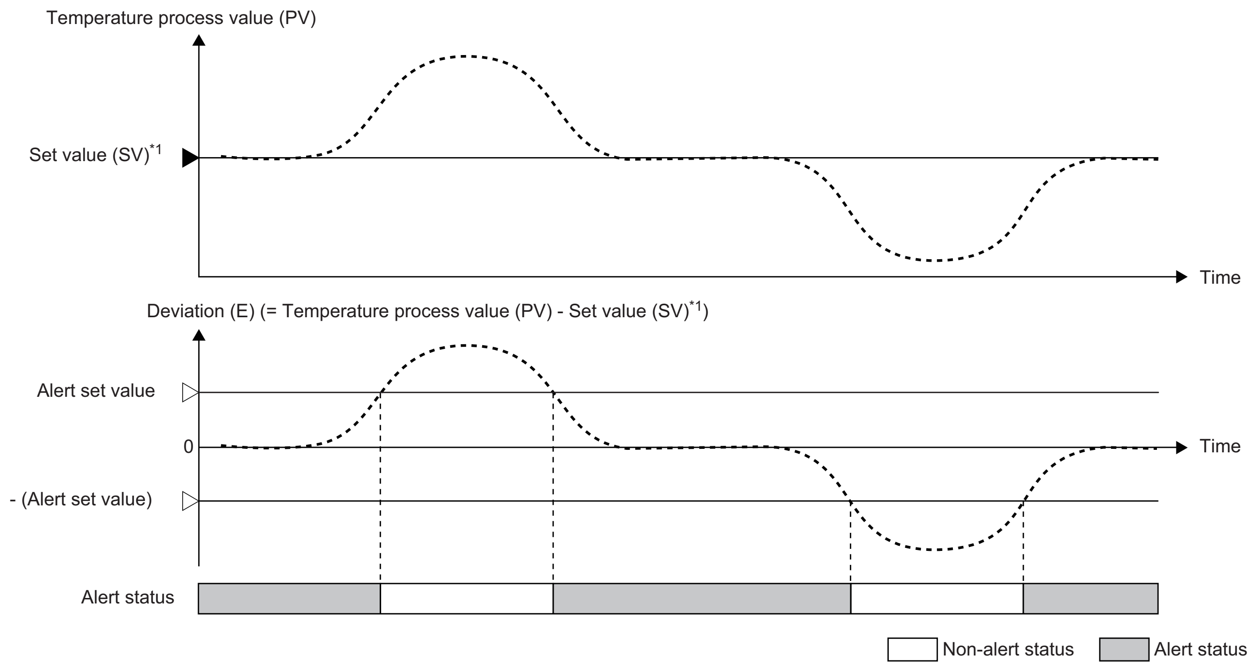


*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (☞ Page 170, Section 8.3.11 (2) (a))

(e) Within-range alert

When the following condition is satisfied, the system is put in an alert status.

- -(Alert set value) ≤ Deviation (E) ≤ Alert set value



*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (☞ Page 170, Section 8.3.11 (2) (a))

(f) Setting method (alert mode and the set value (SV) to be referred)

Select one of the two types of set value (SV) described in ☞ Page 170, Section 8.3.11 (2) by specifying an alert mode.

- When the alert judgment requires the value in CH☐ Set value (SV) monitor (RWrC to RWrF), set one of the following values.

Alert mode setting (☞ Page 176, Section 8.3.11 (6) (a))	
Setting value	**Alert mode name**
3	Upper limit deviation alert
4	Lower limit deviation alert
5	Upper lower limit deviation alert
6	Within-range alert
9	Upper limit deviation alert with standby
10	Lower limit deviation alert with standby
11	Upper lower limit deviation alert with standby
12	Upper limit deviation alert with standby (second time)
13	Lower limit deviation alert with standby (second time)
14	Upper lower limit deviation alert with standby (second time)

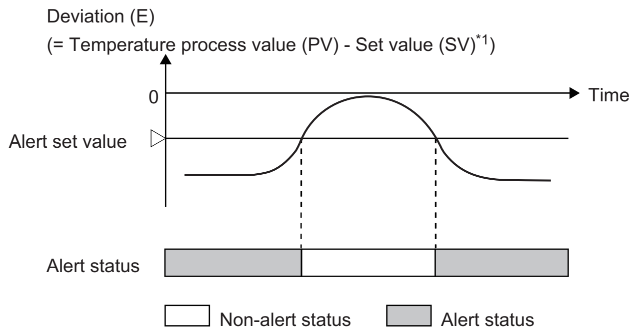
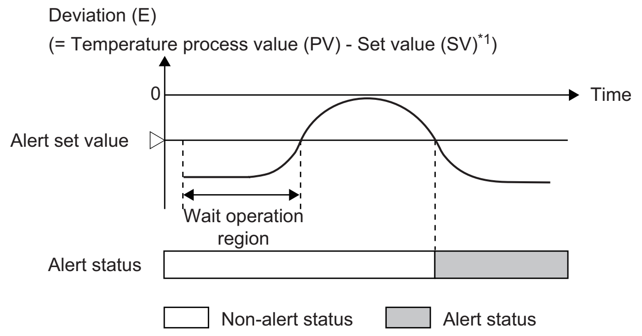
- When the alert judgment requires the value in CH☐ Set value (SV) setting (address: 101H, 131H, 161H, 191H), set one of the following values.

Alert mode setting (☞ Page 176, Section 8.3.11 (6) (a))	
Setting value	**Alert mode name**
15	Upper limit deviation alert (using the set value (SV))
16	Lower limit deviation alert (using the set value (SV))
17	Upper lower limit deviation alert (using the set value (SV))
18	Within-range alert (using the set value (SV))
19	Upper limit deviation alert with standby (using the set value (SV))
20	Lower limit deviation alert with standby (using the set value (SV))
21	Upper lower limit deviation alert with standby (using the set value (SV))
22	Upper limit deviation alert with standby (second time) (using the set value (SV))
23	Lower limit deviation alert with standby (second time) (using the set value (SV))
24	Upper lower limit deviation alert with standby (second time) (using the set value (SV))

(3) Alert with standby

Even if the temperature process value (PV) or deviation (E) is in a condition to be in an alert status when the operating status is changed from run to stop, the alert does not occur. The alert function can be disabled until the temperature process value (PV) or deviation (E) strays out of the condition to be in an alert status.

Ex. When the alert mode is set to "10: Lower limit deviation alert with wait"
The alert function is inactive until the deviation (E) exceeds the alert set value. (right figure below)

Lower limit deviation alert (☞ Page 171, Section 8.3.11 (2) (c))	Lower limit deviation alert with standby
	

*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (☞ Page 170, Section 8.3.11 (2) (a))

Point

When the system goes into the non-alert status even once after an alert judgment started following the setting of the alert mode, the alert with standby will be inactive even if the mode is changed to the one with standby.

(a) Setting method

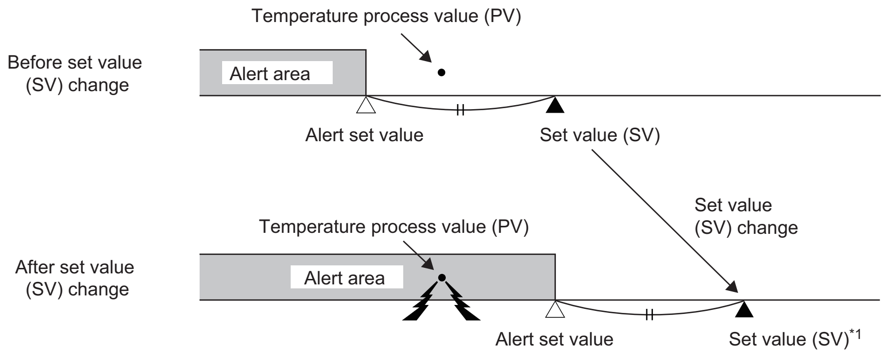
Select one of the following alert modes.

Alert mode setting (☞ Page 176, Section 8.3.11 (6) (a))	
Setting value	**Alert mode name**
7	Upper limit input alert with standby
8	Lower limit input alert with standby
9	Upper limit deviation alert with standby
10	Lower limit deviation alert with standby
11	Upper lower limit deviation alert with standby
19	Upper limit deviation alert with standby (using the set value (SV))
20	Lower limit deviation alert with standby (using the set value (SV))
21	Upper lower limit deviation alert with standby (using the set value (SV))

(4) Alert with standby (second time)

A function to deactivate the alert function once again when the set value (SV) is changed is added to an alert with standby. This is called an alert with standby (second time).
When control needs the set value (SV) change, the alert supposed to occur can be avoided when the set value is changed by selecting an alert with standby (second time).

Ex. When the temperature process value (PV) is on the position as below before the set value (SV) change



*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (☞ Page 170, Section 8.3.11 (2) (a))

For a deviation alert, when the set value (SV) is changed, the temperature process value (PV) goes into the alert area; therefore, the system goes into an alert status.
To prevent the case above, the alert output is put on standby.

(a) Setting method

Select one of the following alert modes.

Alert mode setting (☞ Page 176, Section 8.3.11 (6) (a))	
Setting value	**Alert mode name**
12	Upper limit deviation alert with standby (second time)
13	Lower limit deviation alert with standby (second time)
14	Upper lower limit deviation alert with standby (second time)
22	Upper limit deviation alert with standby (second time) (using the set value (SV))
23	Lower limit deviation alert with standby (second time) (using the set value (SV))
24	Upper lower limit deviation alert with standby (second time) (using the set value (SV))

Remark

If a setting change rate limiter is specified, an alert with standby (second time) is not active even though one of the following alert modes is selected.

Alert mode setting (☞ Page 176, Section 8.3.11 (6) (a))	
Setting value	**Alert mode name**
12	Upper limit deviation alert with standby (second time)
13	Lower limit deviation alert with standby (second time)
14	Upper lower limit deviation alert with standby (second time)

(5) Condition where CH☐ Alert occurrence flag (RX18 to RX1B) turns off

The condition where CH☐ Alert occurrence flag (RX18 to RX1B) turns off differs depending on the setting of the following remote buffer memory area.

- CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H) (☞ Page 336, Appendix 3 (27))

CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H)	Condition where CH☐ Alert occurrence flag (RX18 to RX1B) turns off
Stop (0)	When the cause of the alert is resolved, or when the operating status is changed from run to stop
Monitor (1)	
Alert (2)	When the cause of the alert is resolved

(6) Setting alert modes and alert set values

Settings of the alert mode and alert set value are described below.

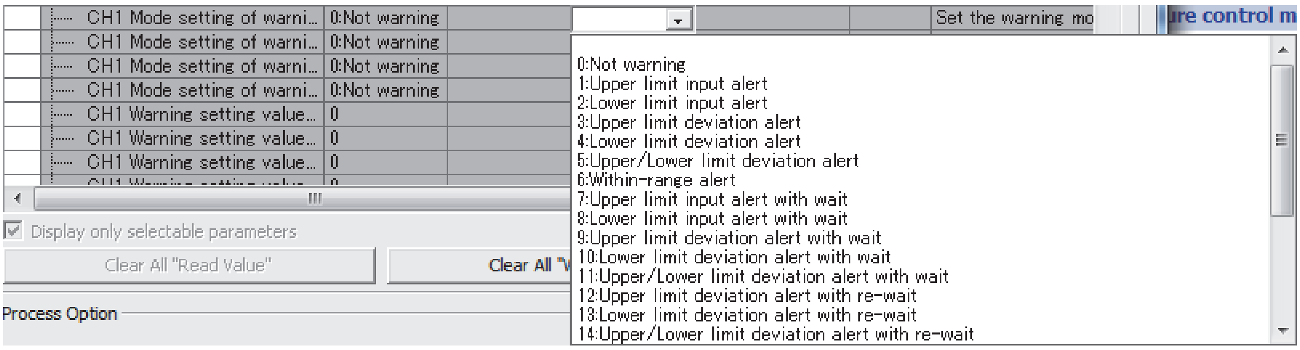
(a) Alert mode

Set the alert mode. Up to four modes can be set for each channel.

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH☐ Mode setting of warning 1" to "CH☐ Mode setting of warning 4". Each alert mode for alert 1 to 4 corresponds to alert set value 1 to 4.**



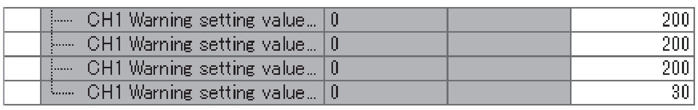
(b) Alert set value

Set the value where CH☐ Alert 1 (b8 of RWr4 to RWr7) to CH☐ Alert 4 (b11 of RWr4 to RWr7) turns on according to the set alert mode. Up to four modes can be set for each channel.

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH☐ Warning setting value 1" to "CH☐ Warning setting value 4" Alert set value 1 to 4 corresponds to each alert mode for alert 1 to 4.**



(7) Setting the alert dead band

When the temperature process value (PV) or deviation (E) is close to the alert set value, alert status and non-alert status may alternates repeatedly due to inconsistent input.
Such a case can be prevented by setting an alert dead band.

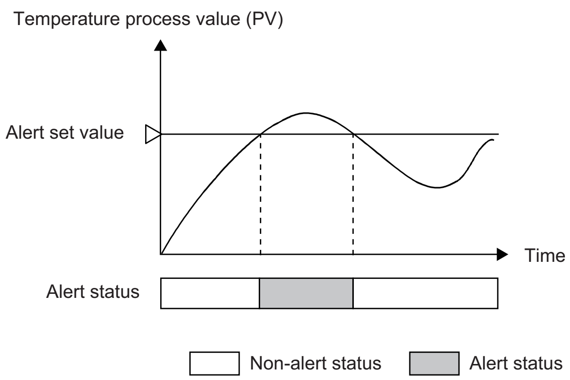
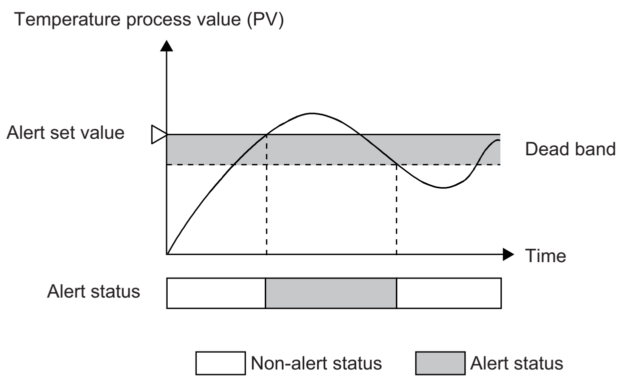
(a) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "Warning non-inductive belt setting".

Ex. When the alert mode is set to "1: Upper limit input alert" (☞ Page 169, Section 8.3.11 (1))
When a value other than 0 (0.0%) is set in Alert dead band setting (address: 1E0H), the system is put in the alert status when upper limit input becomes equal to or greater than the alert set value. The system is put in the non-alert status when the upper limit falls below the alert dead band. (right figure below)

When 0 (0.0%) is set in Alert dead band setting (address: 1E0H)	When a value other than 0 (0.0%) is set in Alert dead band setting (address: 1E0H)
	

(8) Setting the number of alert delay

Set the number of sampling to judge alert occurrence. The system is set in the alert status when the temperature process value (PV) that has reached the alert set value remains in the alert range until the number of sampling becomes equal to or greater than the preset number of alert delays.

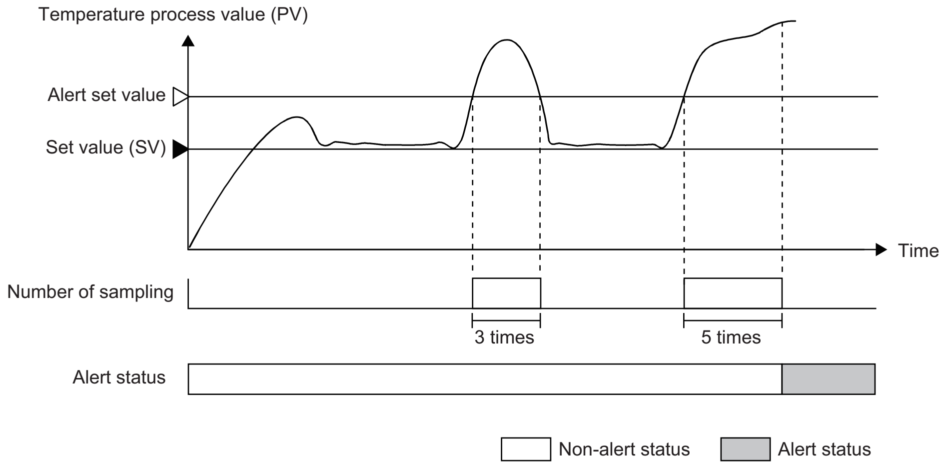
(a) Setting method

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "Warning delay count".**

Ex. When the alert mode is set to "1: Upper limit input alert" (☞ Page 169, Section 8.3.11 (1))
When 5 is set as the number of alert delay, the system is not put in the alert status if the number of sampling is 4 or less.



(9) Alert mode and settings

The following table shows the alert modes and validity/availability of related settings.
(Active/Yes: ○, Inactive/No: —)

Alert		Alert dead band setting (☞ Page 177, Section 8.3.11 (7))	Number of alert delay (☞ Page 178, Section 8.3.11 (8))	Alert with standby (☞ Page 174, Section 8.3.11 (3))	Alert with standby (second time) (☞ Page 175, Section 8.3.11 (4))
Input alert	Upper limit input alert (☞ Page 169, Section 8.3.11 (1))	○	○	○	—
	Lower limit input alert (☞ Page 169, Section 8.3.11 (1))	○	○	○	—
Deviation alert	Upper limit deviation alert (☞ Page 171, Section 8.3.11 (2))	○	○	○	○
	Upper limit deviation alert (using the set value (SV)) (☞ Page 171, Section 8.3.11 (2))	○	○	○	○
	Lower limit deviation alert (☞ Page 171, Section 8.3.11 (2))	○	○	○	○
	Lower limit deviation alert (using the set value (SV)) (☞ Page 171, Section 8.3.11 (2))	○	○	○	○
	Upper lower limit deviation alert (☞ Page 172, Section 8.3.11 (2))	○	○	○	○
	Upper lower limit deviation alert (using the set value (SV)) (☞ Page 172, Section 8.3.11 (2))	○	○	○	○
	Within-range alert (☞ Page 172, Section 8.3.11 (2))	○	○	—	—
	Within-range alert (using the set value (SV)) (☞ Page 172, Section 8.3.11 (2))	○	○	—	—

8.3.12 RFB limiter function

Standard Heating-cooling

The RFB (reset feed back) function operates when deviation (E) continues for a long period of time. In such an occasion, this function limits the PID operation result (manipulated value (MV)) from an integral action so that it does not exceed the valid range of the manipulated value (MV).
This function operates automatically on execution of PID control; therefore, a setting by the user is unnecessary.

Remark

When the PID operation result exceeds the upper limit output limiter value, the temperature control module operates as follows:

- The RFB function levels the manipulated value (MV) to the upper limit output limiter value by feeding back the exceeded value to the integral value.

When the PID operation result is below the lower limit output limiter value, the temperature control module operates as follows:

- The RFB function levels the manipulated value (MV) to the lower limit output limiter value by feeding back the lacking value to the integral value.

8.3.13 Input/output (with another analog module) function

Standard Heating-cooling

Input and output can be processed using other analog modules (such as an A/D converter module or D/A converter module) in the system.

(1) Input

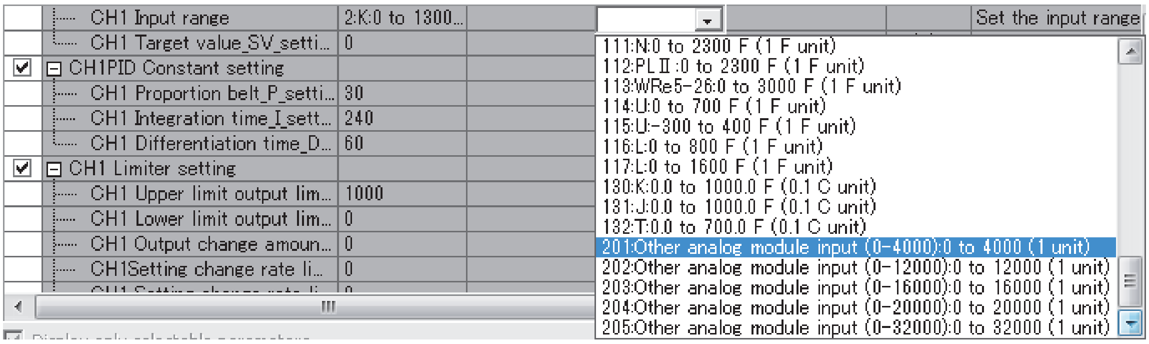
In general, a temperature control module uses the temperature measured through thermocouples or platinum resistance thermometers connected to the module as a temperature process value (PV). In the temperature control module, the digital input value of current or voltage converted by other analog modules (such as an A/D converter module) in the system can also be used as a temperature process value (PV).

(a) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Select any one of setting values from "201: Other analog module input (0-4000): 0 to 4000 (1 unit)" to "205: Other analog module input (0-32000): 0 to 32000 (1 unit)" for "CH☐ Input range".



3. Store the value of another analog module (such as an A/D converter module) into CH☐ Temperature process value for input with another analog module (PV) (RWw0 to RWw3).

Point

- If the second procedure above is executed ahead of the first procedure, a write data error (error code: 0004H) occurs.
- When this function is used, the value in the following remote register is used for the temperature process value (PV) scaling function.
  - CH☐ Temperature process value for input with another analog module (PV) (RWw0 to RWw3)

  For details on the temperature process value (PV) scaling function, refer to the following.
  ☞ Page 130, Section 8.1.4

(2) Output

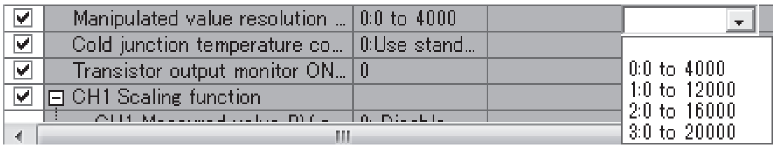
Instead of the transistor output from the temperature control module, analog output values from other analog modules (such as a D/A converter module) can be used as the manipulated value (MV).

(a) Setting method (for the standard control)

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Select the value on "Manipulated value resolution switching for output with another analog module".**



3. **Store the value in CH□ Manipulated value (MV) for output with another analog module (RWr18 to RWr1B) into the buffer memory in other analog module (such as a D/A converter module).**

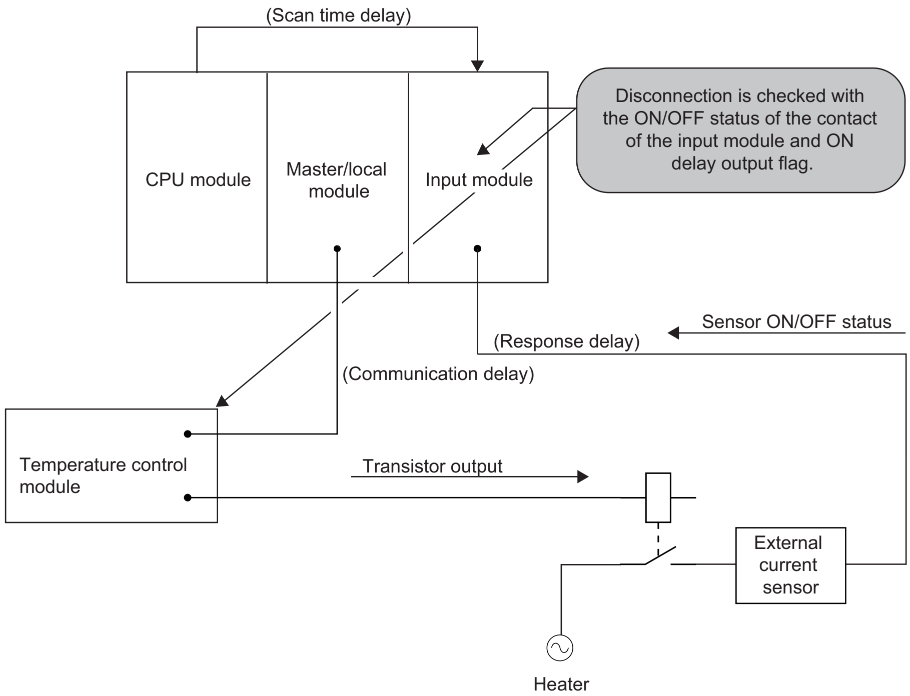
Point

- When the manipulated value (MV) is -5.0% to 0.0%, 0 is stored in Manipulated value (MV) for output with another analog module. When the manipulated value (MV) is 100.0% to 105.0%, 4000/12000/16000/20000 is stored in Manipulated value (MV) for output with another analog module.
- The manipulated value (MV) in a percentage value is stored into Manipulated value (MV) for output with another analog module (digital output value) in real time.

8.3.14 ON delay output function

Standard **Heating-cooling**

This function allows the user to set the delay (response/scan time delay/communication delay) of transistor output. By setting a delay, and monitoring the ON delay output flag and external output on the program, disconnection of external output can be determined. The following figure is an example using the ON delay output flag.



(1) Setting method

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set a value on "Transistor output monitor ON delay time setting".**

8.3.15 Self-tuning function

Standard

The temperature control module constantly monitors the control state. When the control system is oscillatory, this function allows PID constants to be automatically changed under the following situations such as: After the control has been just started, When the set value (SV) is changed, and When the characteristics of a controlled object fluctuates. Unlike the auto tuning function, a normal control response waveform is monitored and PID constants are automatically calculated and set. This allows an object to be controlled with the most suitable PID constants all the time without disturbance.

(1) Differences between auto tuning and self-tuning

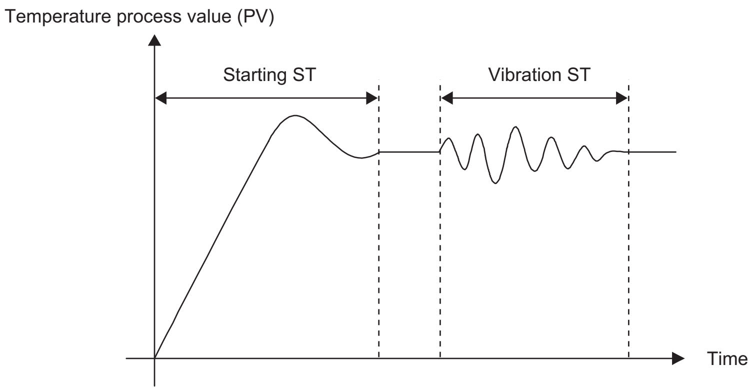
The following table lists the differences between auto tuning and self-tuning.

Item	Auto tuning	Self-tuning
PID constants calculation	The manipulated value (MV) is turned on/off and PID constants are calculated based on the hunting cycle and amplitude of the temperature process value (PV) for the set value (SV).	PID constants are calculated based on an oscillation occurred under situations such as after the control has been just started, the set value (SV) has been changed, and when a control response is oscillatory.
Execution method	Turning off and on CH☐ Auto tuning instruction (RY20 to RY23) starts auto tuning and changes PID constants upon completion.	The temperature control module constantly monitors the control response. PID constants are calculated and changed when the control response is slow.
Control response	PID constants are calculated based on the control response of when the manipulated value (MV) is turned on/off; therefore, the control may become unstable.	PID constants are calculated based on the control response during temperature control; therefore, the control is stable.
Calculation result	The optimum PID constants are calculated by one tuning. In the standard control, CH☐ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H) is also calculated.	The optimum PID constants may not be obtained by one tuning. CH☐ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H) is not calculated.
PID constants setting when the characteristics of a controlled object fluctuate	Users perform auto tuning again to change PID constants.	The temperature control module automatically changes PID constants.
Available control mode	The standard control and heating-cooling control	The standard control only

(2) Starting ST and vibration ST

Two types of self-tuning (ST) are available depending on the state of the control system: starting ST and vibration ST.

- Starting ST: Self-tuning is performed immediately after the control is started or when the set value (SV) is changed.
- Vibration ST: Self-tuning is performed when the control system in a stable state has become oscillatory due to reasons such as disturbance.



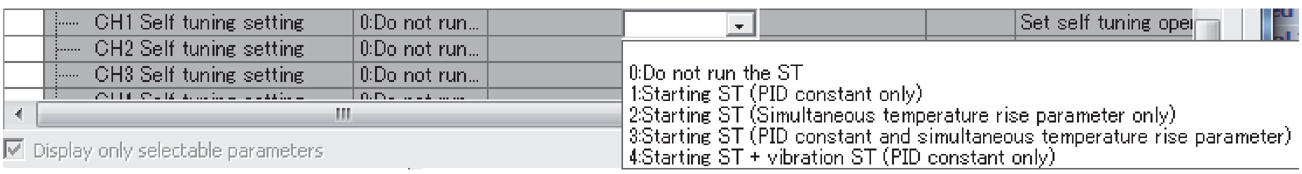
(a) How to set starting ST

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Select either of the following setting values for "CH□ Self tuning setting". (The default value is "0: Do not run the ST".)

- "1: Starting ST (PID constant only)"
- "2: Starting ST (Simultaneous temperature rise parameter only)"
- "3: Starting ST (PID constant and simultaneous temperature rise parameter)"
- "4: Starting ST + vibration ST (PID constant only)"

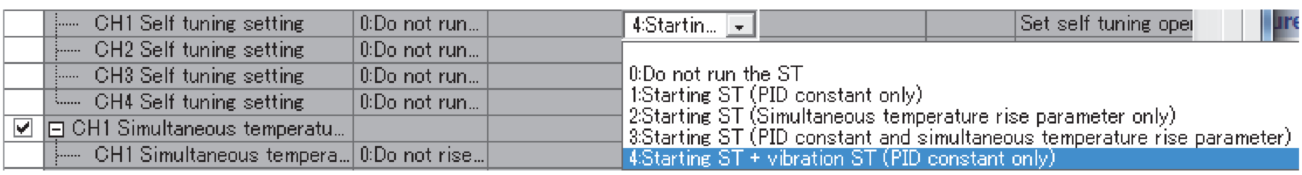


(b) How to set vibration ST

1. Set "Method selection" to "Param write" of the control mode to be used.

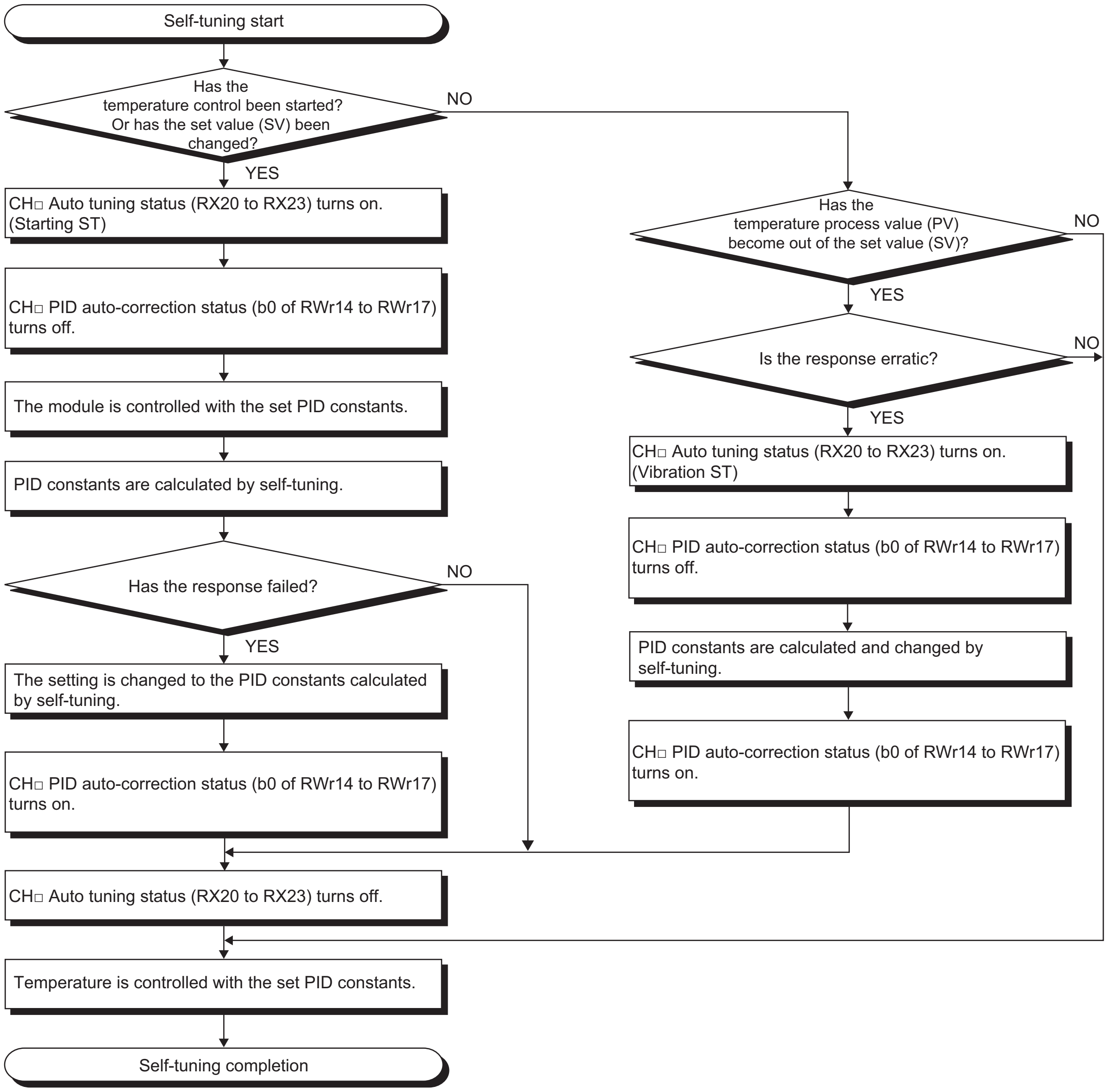
"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "4: Starting ST + vibration ST (PID constant only)" for "CH□ Self tuning setting".



(3) Procedure for the self-tuning control

The following is the flow chart for the control.

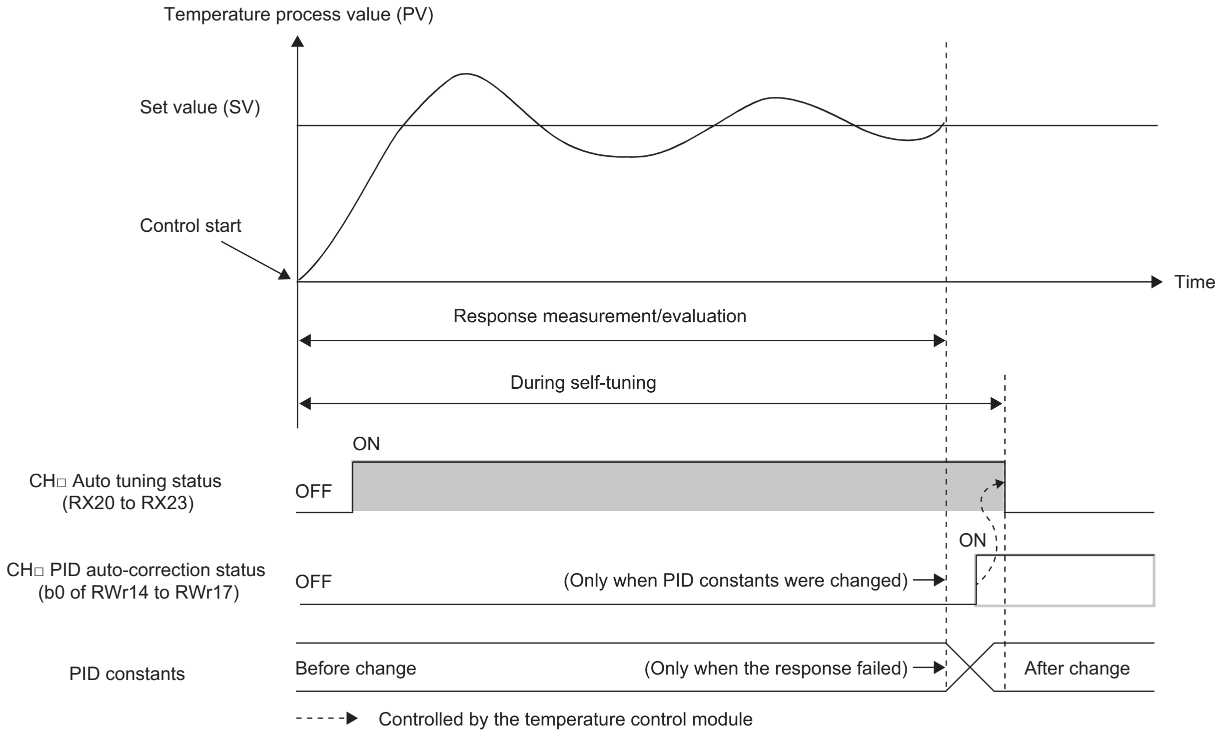


(4) Operation with starting ST

This section explains the operation of when the temperature control is started or the set value (SV) is changed (starting ST).

With starting ST, the module monitors the response waveform of the temperature process value (PV) of when the temperature control is started or when the set value (SV) is changed. Then PID constants are automatically corrected. The following table lists the operations of the module with starting ST.

	Operation with starting ST
1	CH☐ PID auto-correction status (b0 of RWr14 to RWr17) is turned 0 (OFF). In addition, CH☐ Auto tuning status (RX20 to RX23) is turned on.
2	Temperature is controlled using the PID constants set.
3	When a control response is poor, PID constants are calculated based on the response waveform and are set in the remote buffer memory. CH☐ PID auto-correction status (b0 of RWr14 to RWr17) is turned 1 (ON). When a control response is good, CH☐ PID auto-correction status (b0 of RWr14 to RWr17) remains 0 (OFF) and PID constants are not changed.
4	CH☐ Auto tuning status (RX20 to RX23) is turned off.



(a) Conditions for self-tuning

Starting ST is executed under the following conditions.

- The first change of the operating status from "stop" to "run" after power on
- The second and subsequent changes of the operating status from "stop" to "run" after power on (only when the temperature process value (PV) has been stable for two minutes or longer before the mode is shifted)
- When the set value (SV) is changed (only when the original (before set value change) temperature process value (PV) has been stable for two minutes or longer)

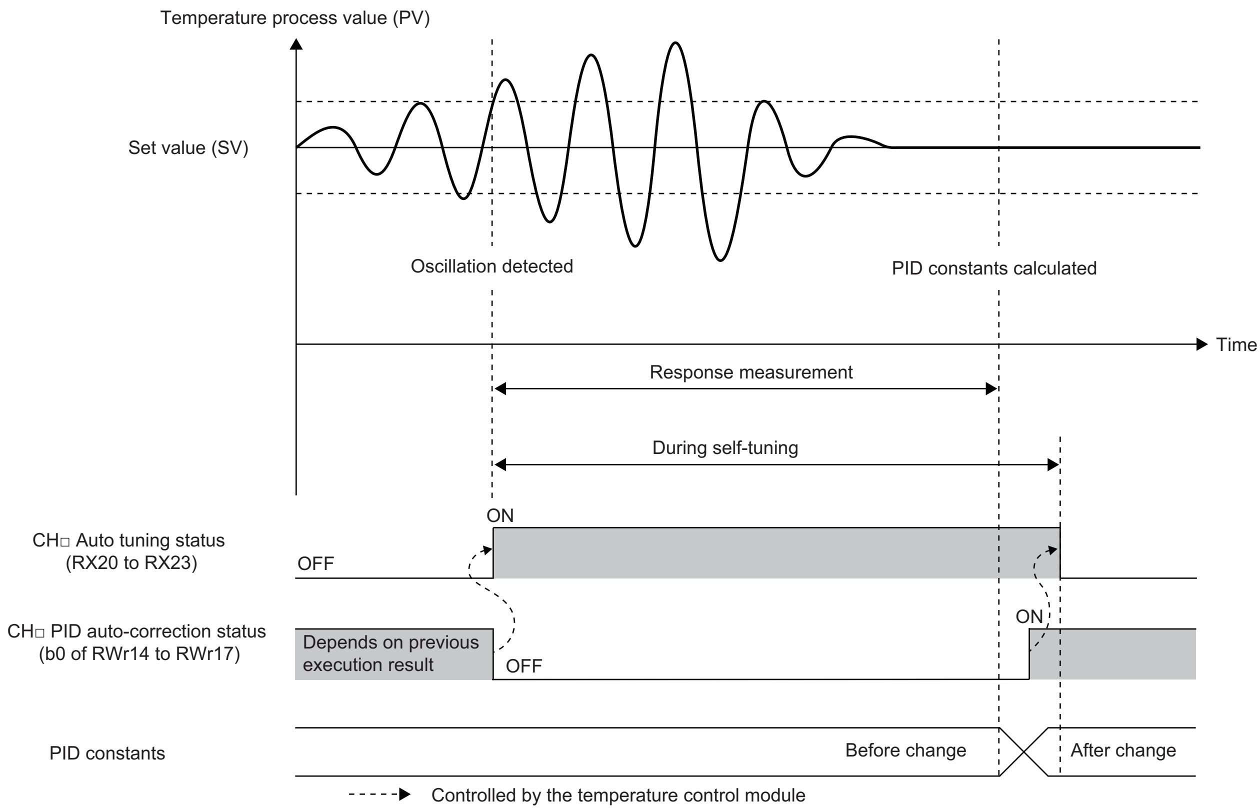
Point

If the starting ST is started when the temperature process value (PV) is not stable, incorrect PID constants may be determined. Execute the starting ST after the temperature process value (PV) has been stable for two minutes or longer.

(5) Operation with vibration ST

This section explains the operation of when a control response is oscillatory (vibration ST).
With vibration ST, PID constants are automatically corrected to settle a vibration when a control response becomes oscillatory due to reasons such as the change in the characteristic of a controlled object and conditions for operation.
The following table lists the operations of the module with vibration ST. (The listed operations are those under the state where temperature is being controlled with the PID constants set.)

Operation with vibration ST	
1	CH☐ PID auto-correction status (b0 of RWr14 to RWr17) is turned 0 (OFF). In addition, CH☐ Auto tuning status (RX20 to RX23) is turned on.
2	PID constants are calculated based on a response waveform.
3	PID constants are set in the remote buffer memory and CH☐ PID auto-correction status (b0 of RWr14 to RWr17) is turned 1 (ON).
4	CH☐ Auto tuning status (RX20 to RX23) is turned off.



(a) Conditions for self-tuning

Vibration ST is executed when the temperature process value (PV) goes outside the range that is judged as unstable.

(b) Precautions

If vibration ST is executed on the following objects, incorrect PID constants may be determined:

- Controlled objects where a disturbance periodically occurs
- Controlled objects with strong mutual interference

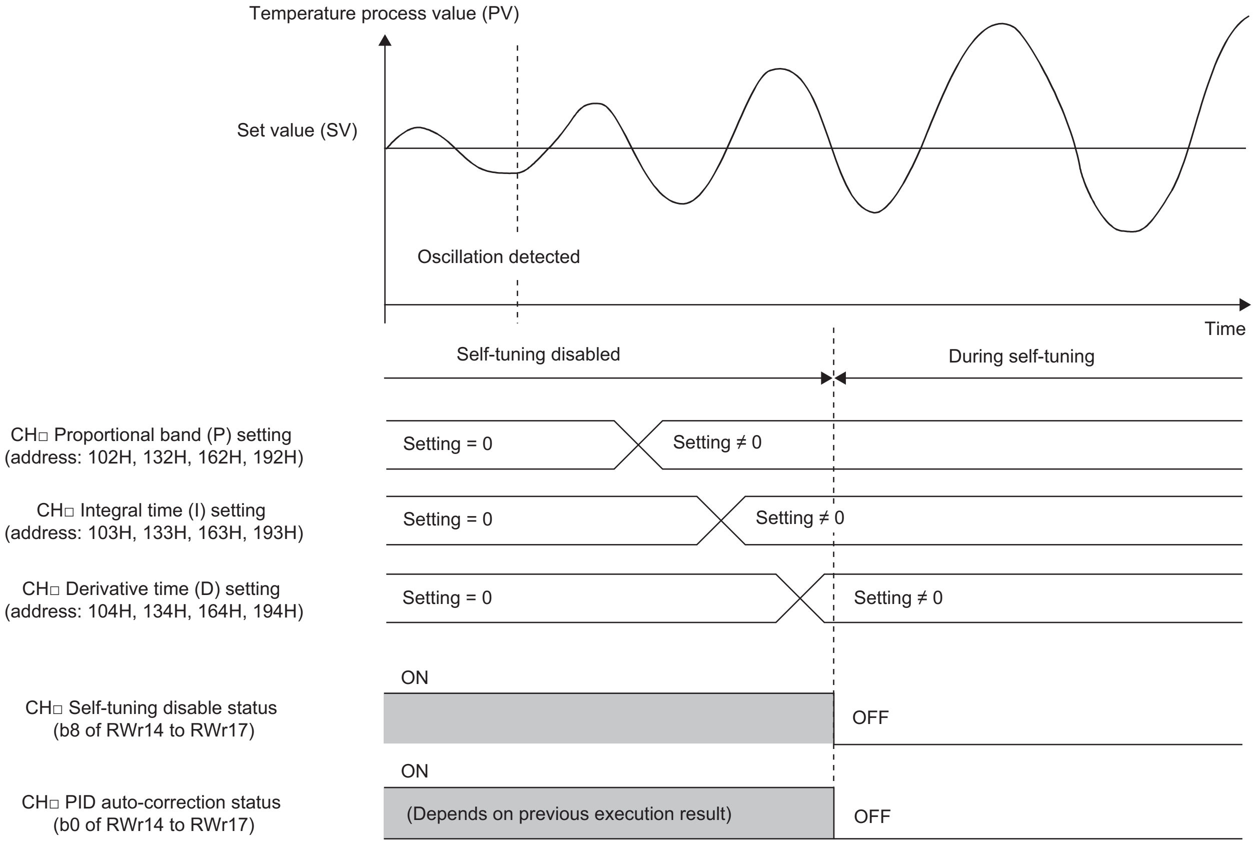
(6) Conditions where self-tuning is not executed

This section explains the conditions where self-tuning is not executed.

(a) The control method is not the PID control method.

When the control method is other than the PID control method, and any of the four methods (two-position control, P control, PI control, PD control), self-tuning is not executed. CH☐ Self-tuning disable status (b8 of RWr14 to RWr17) turns 1 (ON).

When all PID constants of target channels turn to a value other than 0, self-tuning is enabled.



(b) Auto tuning is being executed.

During auto tuning, self-tuning is not executed. (No error occurs.) At the time of when auto tuning is completed, self-tuning is enabled.

(c) The lower limit output limiter value is lower than the manipulated value (MV) and the manipulated value (MV) is lower than the upper limit output limiter value when the temperature control is started and the set value (SV) is changed.

The starting ST does not start. However, self-tuning is enabled at the time of when a control response becomes oscillatory under the following setting.

- CH☐ Self-tuning setting (address: 2C0H to 2C3H) is set to Starting ST plus vibration ST (4).

(d) The temperature process value (PV) is not within the temperature measurement range.

The self-tuning is not executed. CH☐ Self-tuning disable status (b8 of RWr14 to RWr17) turns 1 (ON).

(e) The value set in CH☐ Output variation limiter setting (address: 107H, 137H, 167H, 197H) is not 0.

The self-tuning is not executed. CH☐ Self-tuning disable status (b8 of RWr14 to RWr17) turns 1 (ON).
If the setting value is not 0, refer to the following.
☞ Page 323, Appendix 3 (11)

(f) CH☐ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H) is set to MAN (1).

The self-tuning is not executed. CH☐ Self-tuning disable status (b8 of RWr14 to RWr17) turns 1 (ON).
If the setting is MAN (1), refer to the following.
☞ Page 332, Appendix 3 (22)

(g) Values other than 0 (0.0%) have been set for the setting change rate limiter.

If the values other than 0 (0.0%) have been set to the following remote buffer memory areas, self-tuning is not executed. CH☐ Self-tuning disable status (b8 of RWr14 to RWr17) turns 1 (ON).

Remote buffer memory area name	Remote buffer memory address			
	CH1	CH2	CH3	CH4
CH☐ Setting change rate limiter/Setting change rate limiter (temperature rise)	108H	138H	168H	198H
CH☐ Setting change rate limiter (temperature drop)	1C8H	1CDH	1D2H	1D7H

If the setting value is other than 0 (0.0%), refer to the following.
☞ Page 325, Appendix 3 (13)

(h) The heating-cooling control has been selected for the control mode.

The self-tuning is not executed.
If the heating-cooling control has been selected, refer to the following.
☞ Page 311, Appendix 3 (3)

(7) Discontinuation of self-tuning

The following operation during self-tuning discontinues the self-tuning operation.

- The setting in CH☐ Self-tuning setting (address: 2C0H to 2C3H) has been changed to Do Not run the ST (0).

The self-tuning operation in process is discontinued and self-tuning is not performed anymore after that. (An error does not occur.)
Whether self-tuning is being executed can be checked in CH☐ Auto tuning status (RX20 to RX23). (☞ Page 291, Appendix 1.1 (12))

(8) Conditions where self-tuning does not complete due to errors

The following operations and conditions cause an abend of self-tuning. At the abend, CH☐ Self-tuning error (b10 of RWr14 to RWr17) turns 1 (ON).

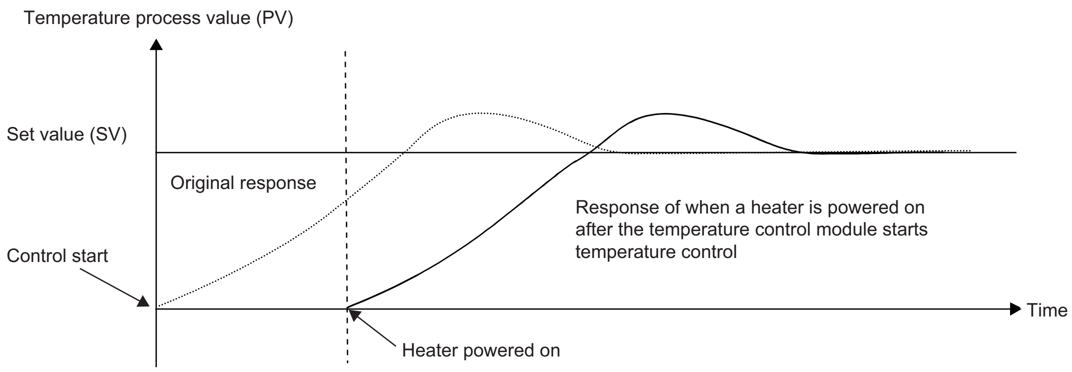
- When 6000s (1 hour and 40 minutes) or longer passes after the start of ST
- When the change rate of the temperature process value (PV) during ST is less than 1.125 (℃/minute)
- When CH☐ Temperature process value (PV) (RWr8 to RWrB) is outside the temperature measurement range (☞ Page 303, Appendix 2 (5))
- When the manipulated value (MV) does not reach the upper limit output limiter value or lower limit output limiter value before the measurement is completed and necessary measurement data is not obtained
- When self-tuning is started with the starting ST and the temperature process value (PV) that is supposed to rise drops by 1℃ (℉) or more
- When self-tuning is started with the starting ST and the temperature process value (PV) that is supposed to drop rises by 1℃ (℉) or more
- When the setting for the remote buffer memory areas in the following table is changed during self-tuning

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Set value (SV) setting*1	101H	131H	161H	191H	Page 317, Appendix 3 (6)
CH☐ Proportional band (P) setting	102H	132H	162H	192H	Page 318, Appendix 3 (7)
CH☐ Integral time (I) setting	103H	133H	163H	193H	Page 320, Appendix 3 (8)
CH☐ Derivative time (D) setting	104H	134H	164H	194H	Page 320, Appendix 3 (9)
CH☐ Upper limit output limiter	105H	135H	165H	195H	Page 321, Appendix 3 (10)
CH☐ Lower limit output limiter	106H	136H	166H	196H	
CH☐ Output variation limiter setting	107H	137H	167H	197H	Page 323, Appendix 3 (11)
CH☐ Setting change rate limiter	108H	138H	168H	198H	Page 324, Appendix 3 (12)
CH☐ Control output cycle setting	10CH	13CH	16CH	19CH	Page 326, Appendix 3 (15)
CH☐ Primary delay digital filter setting	10DH	13DH	16DH	19DH	Page 328, Appendix 3 (16)
CH☐ AUTO/MAN mode shift	113H	143H	173H	1A3H	Page 334, Appendix 3 (24)
CH☐ Forward/reverse action setting	115H	145H	175H	1A5H	Page 334, Appendix 3 (24)
CH☐ Sensor correction value setting	280H	281H	282H	283H	Page 352, Appendix 3 (51)

*1 Changing the setting causes an abend only during the activation of ST by start ST.

(9) Precautions

- Before starting the temperature control using the temperature control module, power on a controlled object such as a heater. If the temperature control is started with a heater powered off, PID constants are calculated based on a response that differs from the original characteristics using self-tuning.



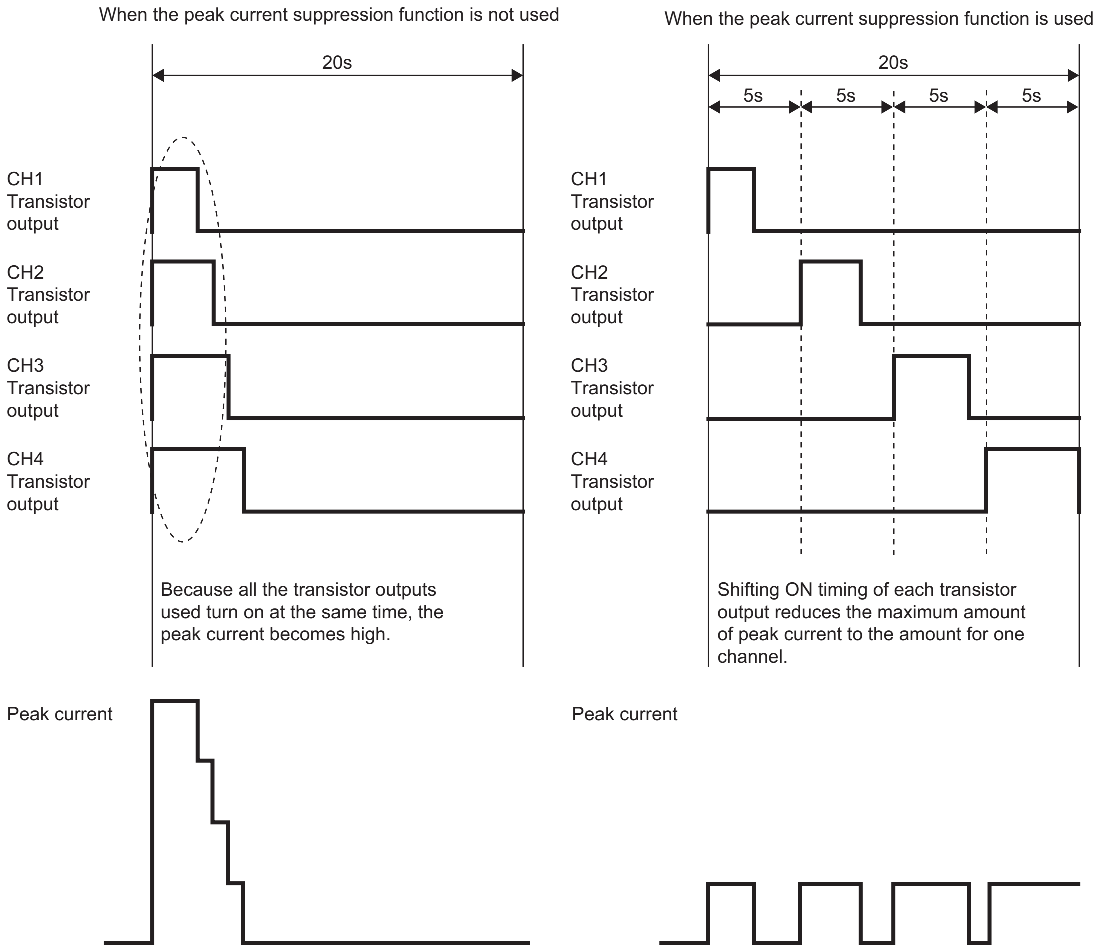
- Do not use the self-tuning function for controlled objects where a great disturbance (uncontrollable disturbance) occurs periodically. Doing so may cause improper PID constants to be determined by self-tuning. If the function is used for such objects, improper PID constants are set and the response for the set value (SV) change or disturbance becomes slow.

Ex. Temperature control for an injection mold, temperature control for a hot plate for a semiconductor manufacturing equipment

8.3.16 Peak current suppression function

Standard

The upper limit output limiter value for each channel is changed automatically and the peak current is suppressed by dividing timing for transistor outputs using this function. Timing can be divided into two to four timing.



(1) The number of timing divided and upper limit output limiter

Set the number of timing to be divided (setting in Peak current suppression control group setting (address: 1E5H)) during a halt in operation. At the time when the setting is enabled, the following remote buffer memory area is automatically set according to the number of timing divided.

- CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H) (☞ Page 321, Appendix 3 (10))

The following table lists the setting details.

Number of timing divided	CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H)
2	500 (50.0%)
3	333 (33.3%)
4	250 (25.0%)

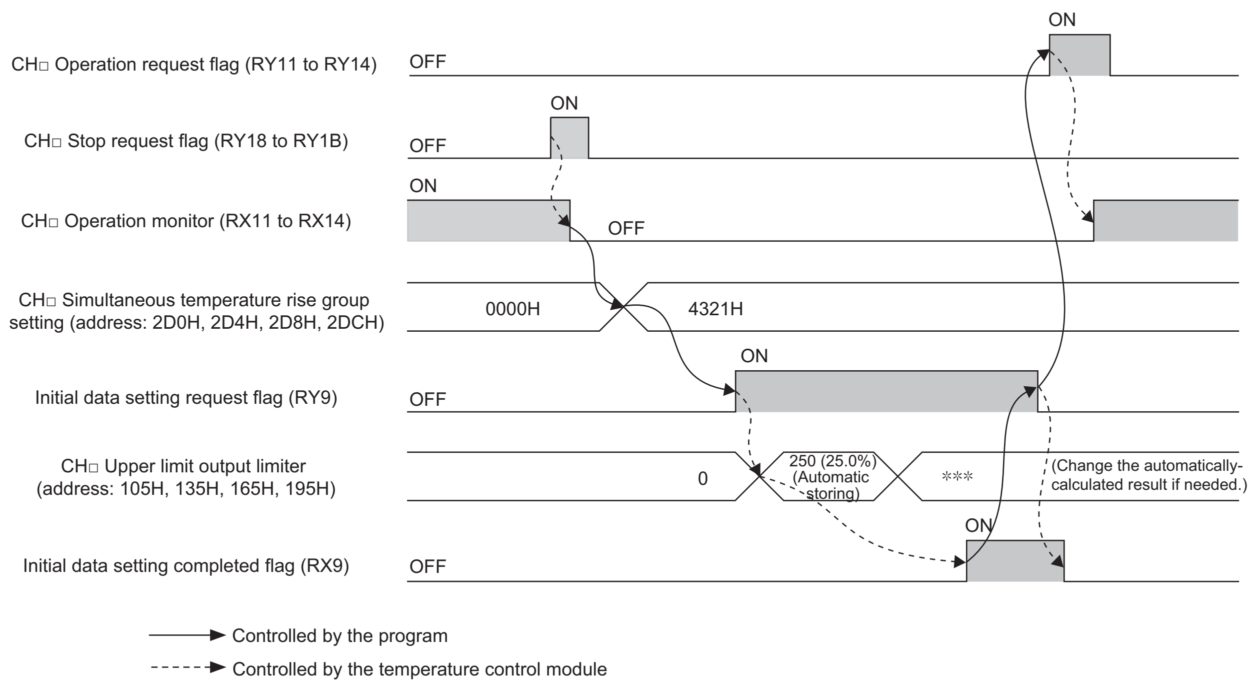
The following remote buffer memory area is set to 0.

- CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H) (☞ Page 321, Appendix 3 (10))

Point

- When using this function, set the control output cycles for target channels to the same value. Even if the following remote buffer memory area setting is different by each channel, an error does not occur. The module operates according to the value (%) of CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H) automatically set when this function is used.
  - CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) (☞ Page 326, Appendix 3 (15))
- When using this function, turn on CH☐ Operation request flag (RY11 to RY14) for the corresponding channel simultaneously.

Ex. Timing chart of when timing is divided into four timing



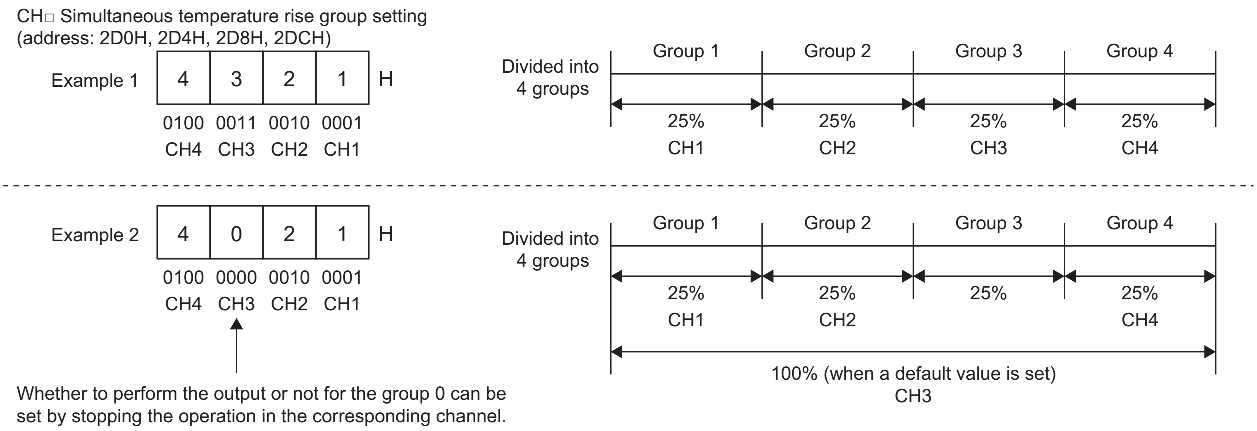
(2) Examples of dividing timing

(a) Four timing

The following table shows two examples.

Example	Channel	Group
Example 1	CH1	Group 1
	CH2	Group 2
	CH3	Group 3
	CH4	Group 4
Example 2	CH1	Group 1
	CH2	Group 2
	CH3	Not divided
	CH4	Group 4

The following shows the relationship between groups and the values (%) of CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H).



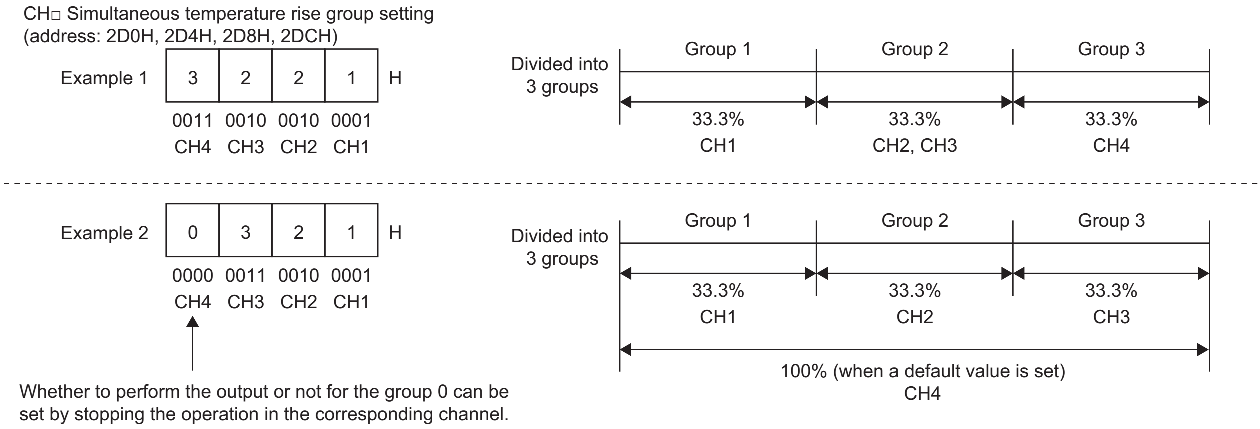
In Example 2, the maximum number of groups is four; therefore, timing is divided into four timing. Because no channel is set for Group 3, no channel starts transistor output at the timing for Group 3.

(b) Three timing

The following table shows two examples.

Example	Channel	Group
Example 1	CH1	Group 1
	CH2	Group 2
	CH3	Group 2
	CH4	Group 3
Example 2	CH1	Group 1
	CH2	Group 2
	CH3	Group 3
	CH4	Not divided

The following shows the relationship between groups and the values (%) of CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H).

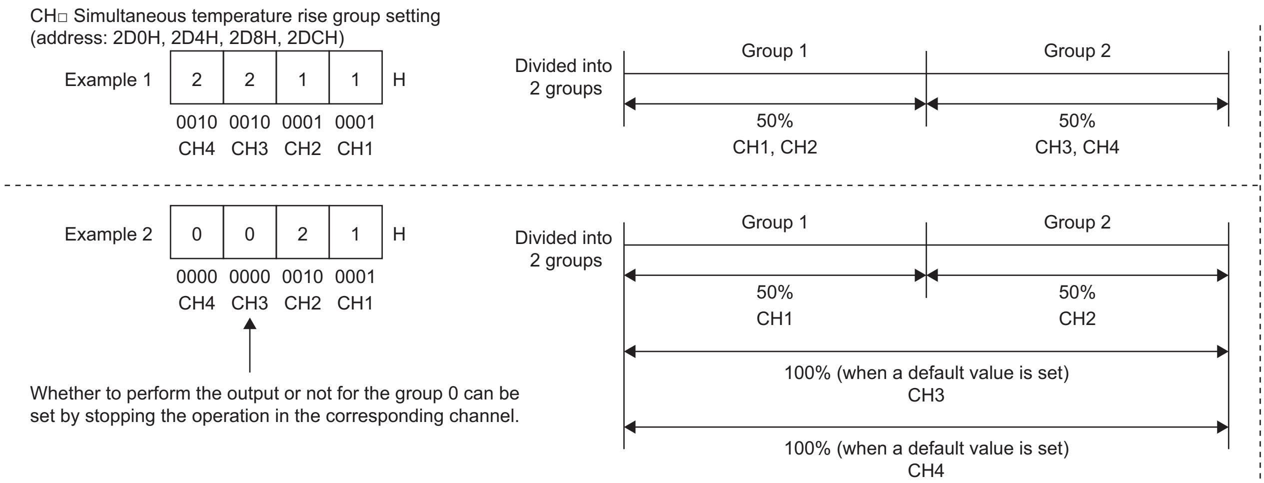


(c) Two timing

The following table shows two examples.

Example	Channel	Group
Example 1	CH1	Group 1
	CH2	Group 1
	CH3	Group 2
	CH4	Group 2
Example 2	CH1	Group 1
	CH2	Group 2
	CH3	Not divided
	CH4	Not divided

The following shows the relationship between groups and the values (%) of CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H).

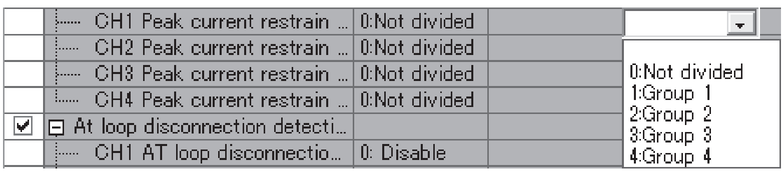


(3) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set the timing under "CH☐ Peak current restrain control _divide group setting".

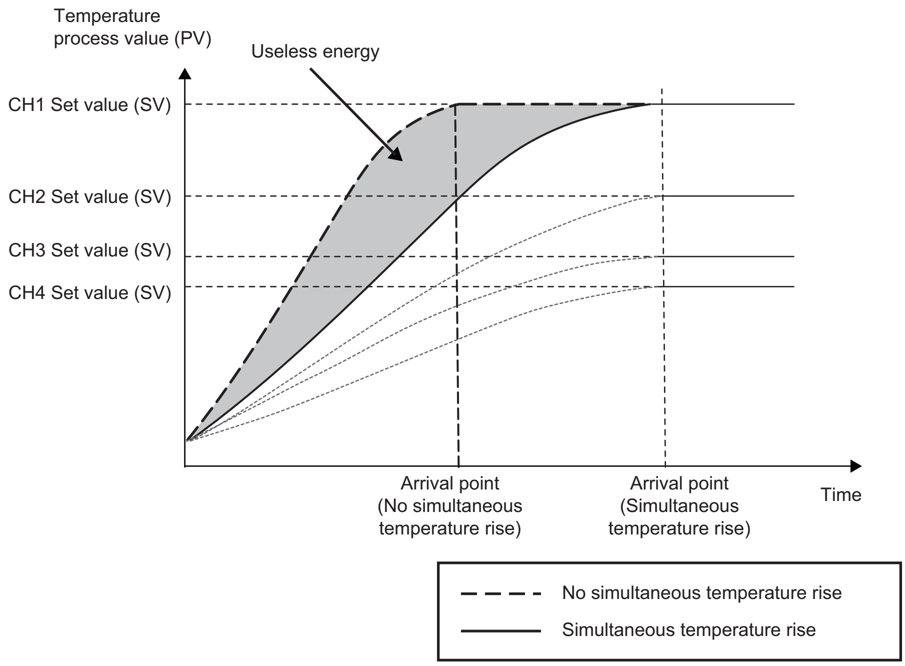


8.3.17 Simultaneous temperature rise function

Standard

This function allows several loops to reach the set value (SV) at the same time. Simultaneous temperature rise can be performed on up to two groups separately by setting a group of the channels where temperature rises at the same time. This function is effective for controlled objects where the temperature rise should complete at the same time. Aligning the time for temperature rise completion enables an even control of temperature without partial burning or partial heat expansion. In addition, the channel reaching the set value (SV) first does not need to be kept warm at the set value (SV) until the last channel reaches, leading to energy saving.

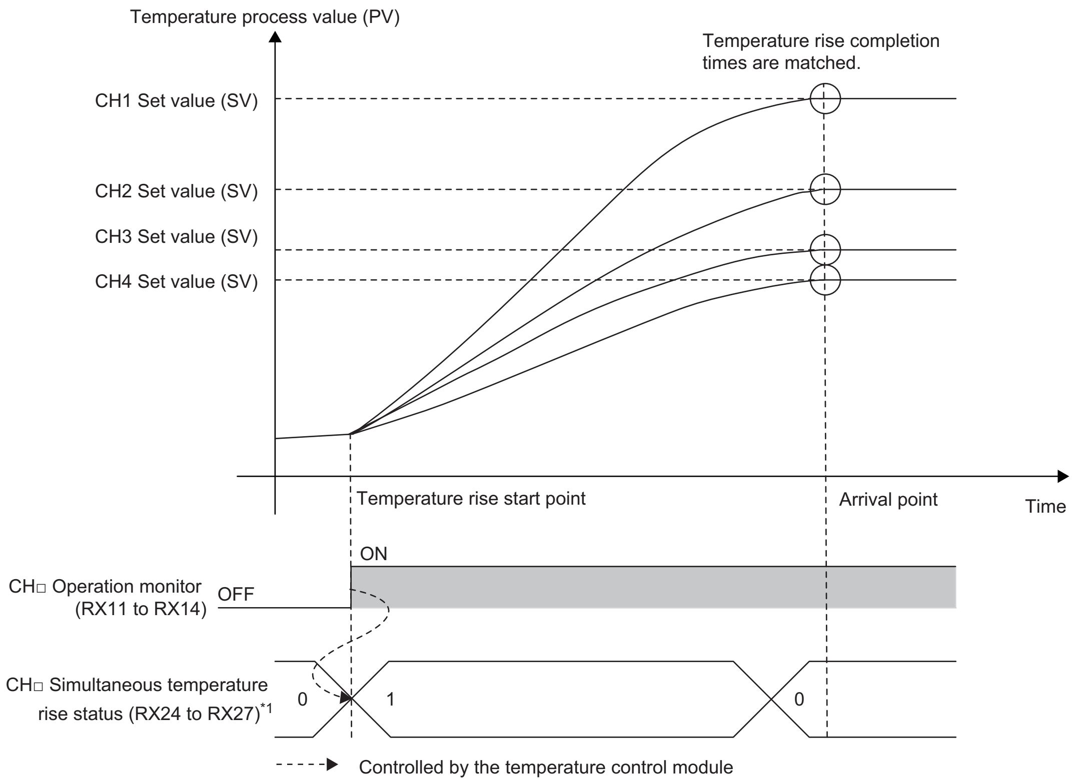
Ex. Comparison of temperature process values (PV) on CH1, one with the simultaneous temperature rise function in use and one without



(1) Operation of the simultaneous temperature rise function

The channel with the temperature rise reaching the set value (SV) last among channels satisfying the condition for start-up in the same group is used as a standard when the simultaneous temperature rise function is started up. The temperature of other channels rises following the temperature of the standard channel. The standard channel is determined based on the simultaneous temperature rise parameter and the deviation (E).

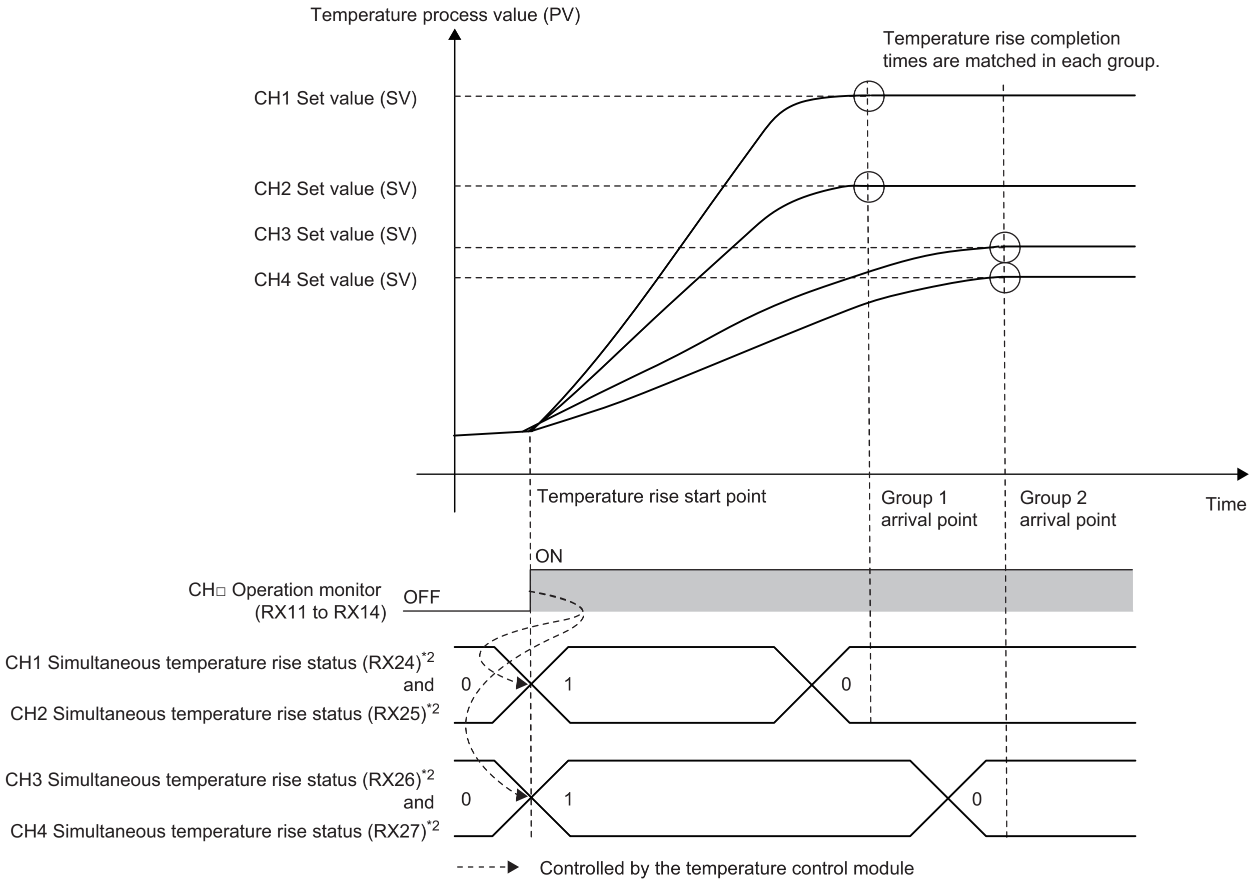
Ex. When all channels are selected for Group 1



*1 This becomes Simultaneous temperature rise in process (1) when the temperature rise starts; however, it becomes Simultaneous temperature rise not in process (0) before the temperature rise starts.

Ex. When channels are divided as following:

- CH1 and CH2: Group 1
- CH3 and CH4: Group 2



*2 This becomes Simultaneous temperature rise in process (1) when the temperature rise starts; however, it becomes Simultaneous temperature rise not in process (0) before the temperature rise starts.

Point

- When using the simultaneous temperature rise function, turn on CH☐ Operation request flag (RY11 to RY14) for the corresponding channels simultaneously.
- When the simultaneous temperature rise function is used, the setting change rate limiter cannot be used. (☞ Page 324, Appendix 3 (12))
- When the operating status is changed from stop to run during a simultaneous temperature rise, the simultaneous temperature rise function stops working and CH☐ Auto tuning status (RX20 to RX23) turns off. (No error occurs.)

(2) Conditions for the simultaneous temperature rise function

The simultaneous temperature rise function can be executed when all the following conditions are satisfied:

- When the control is started
- When the set value (SV) is larger than the temperature process value (PV)
- When the module is in the standard control (not executed in the heating-cooling control) (☞ Page 311, Appendix 3 (3))
- When the simultaneous temperature rise parameter has been determined (or has been set) and is not 0 (the default value)

When the following buffer memory area setting is less than 100%, reaching time may vary.

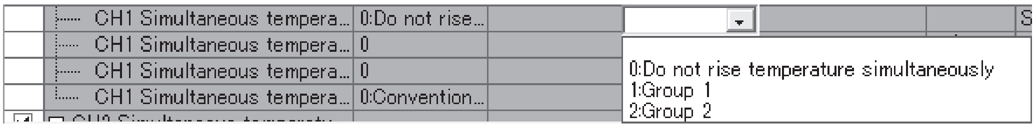
- CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H) (☞ Page 321, Appendix 3 (10))

(3) Setting method (dividing channels into groups)

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH☐ Simultaneous temperature rise group setting".



(4) Simultaneous temperature rise parameter

The simultaneous temperature rise parameter is classified into the following two remote buffer memory values.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Simultaneous temperature rise gradient data	2D1H	2D5H	2D9H	2DDH	Page 357, Appendix 3 (60)
CH☐ Simultaneous temperature rise dead time	2D2H	2D6H	2DAH	2DEH	Page 358, Appendix 3 (61)

Before executing the simultaneous temperature rise function, the simultaneous temperature rise parameter needs to be automatically calculated (or arbitrarily set).

(a) Automatic calculation

The simultaneous temperature rise parameter can be automatically calculated using the following two methods:

- Simultaneous temperature rise AT (☞ Page 202, Section 8.3.17 (5))
- The simultaneous temperature rise parameter setting using self-tuning (☞ Page 205, Section 8.3.17 (6))

Point

If the setting in Peak current suppression control group setting (address: 1E5H) is changed after the simultaneous temperature rise parameter is calculated, the intended control may not be performed. If so, calculate the simultaneous temperature rise parameter again.
For details on the peak current suppression function, refer to the following.
☞ Page 193, Section 8.3.16

(5) Simultaneous temperature rise AT

PID constants and the simultaneous temperature rise parameter are calculated. The waveform upon execution is the same as that for the auto tuning function.

For details on the auto tuning function, refer to the following.

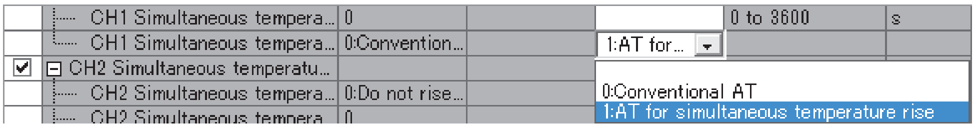
☞ Page 159, Section 8.3.7

(a) How to execute the simultaneous temperature rise AT function

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "1: AT for simultaneous temperature rise" under "CH☐ Simultaneous temperature rise AT mode selection".



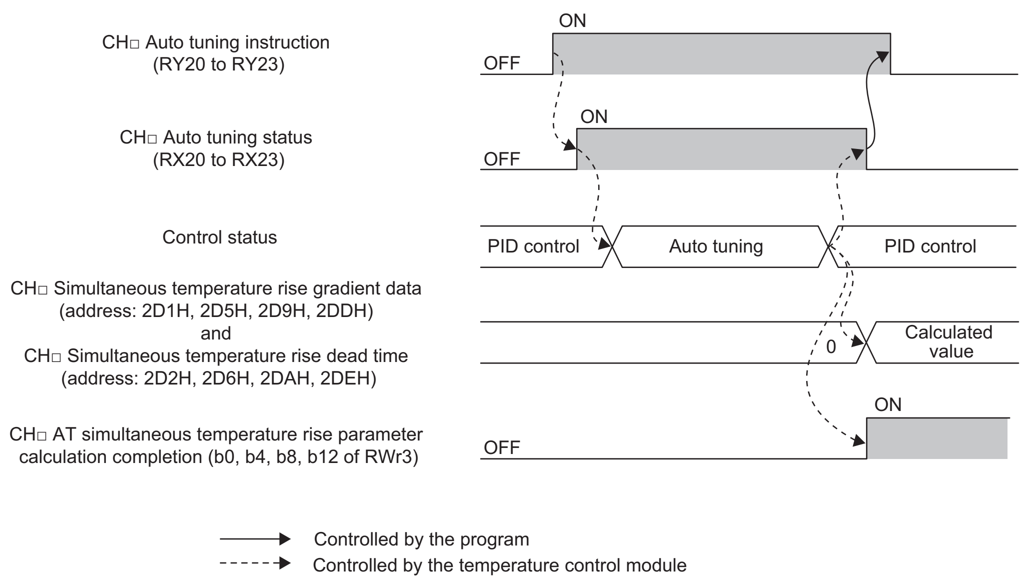
3. Turn off and on CH☐ Auto tuning instruction (RY20 to RY23).

4. When the operating status is changed from stop to run, simultaneous temperature rise AT starts.

(b) Operation with the simultaneous temperature rise AT function

After the procedure described on ☞ Page 202, Section 8.3.17 (5) (a) is executed, the temperature control module operates as following.

	Operation of the temperature control module
1	CH☐ Auto tuning status (RX20 to RX23) is turned on. Then normal auto tuning is performed and the simultaneous temperature rise parameter is calculated.
2	The calculated value is stored in the remote buffer memory when the simultaneous temperature rise parameter is normally calculated. In addition, CH☐ AT simultaneous temperature rise parameter calculation completion (b0, b4, b8, b12 of RWr3) is turned 1 (ON). After auto tuning is completed, CH☐ Auto tuning status (RX20 to RX23) is turned off and the module is shifted to the PID control.



(c) Conditions for the simultaneous temperature rise AT

The simultaneous temperature rise parameter is calculated when all the following conditions are satisfied after the procedure described on ☞ Page 202, Section 8.3.17 (5) (a) is executed:

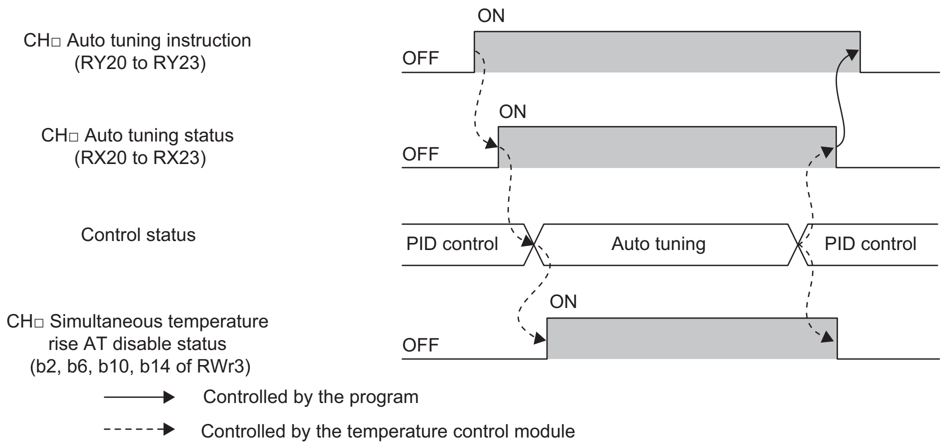
- When the module is in the PID control (all of the proportional band (P), integral time (I), and derivative time (D) are not 0)
- When the temperature process value (PV) has been stable for two minutes or longer just before the simultaneous temperature rise AT is executed
- When the temperature process value (PV) is within the temperature measurement range just before the simultaneous temperature rise AT is executed. If the temperature process value (PV) goes outside the range after the simultaneous temperature rise AT is executed, the auto tuning ends in failure. For the operation of the temperature control module carried out when this happens, refer to the following.

☞ Page 164, Section 8.3.7 (8) (b)

- When CH☐ Output variation limiter setting (address: 107H, 137H, 167H, 197H) is set to 0. (☞ Page 323, Appendix 3 (11))

If all the conditions described above are not satisfied, the simultaneous temperature rise parameter is not calculated. Only PID constants are calculated.

The following shows how the temperature control module operates when the simultaneous temperature rise AT has not been executed.



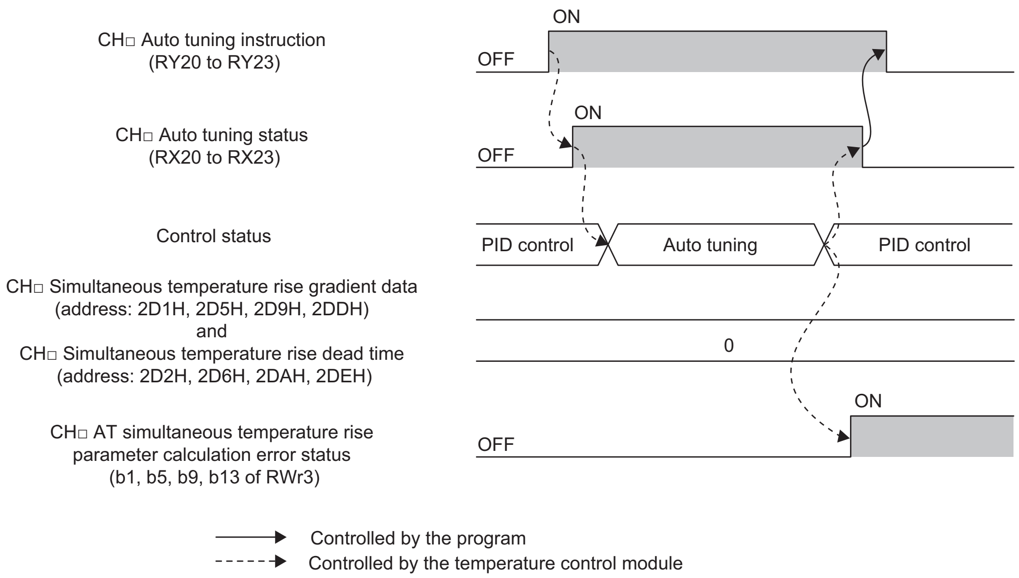
The temperature control module turns CH☐ Simultaneous temperature rise AT disable status (b2, b6, b10, b14 of Rwr3) to 1 (ON). With CH☐ Auto tuning status (RX20 to RX23) on, the module performs the same processing as normal auto tuning.

(d) When the simultaneous temperature rise parameter cannot be calculated

The simultaneous temperature rise parameter cannot be calculated under the following conditions:

- When the maximum gradient is not determined
- When the saturation time for output is short

The temperature control module turns CH☐ AT simultaneous temperature rise parameter calculation error status (b1, b5, b9, b13 of RWr3) to 1 (ON).



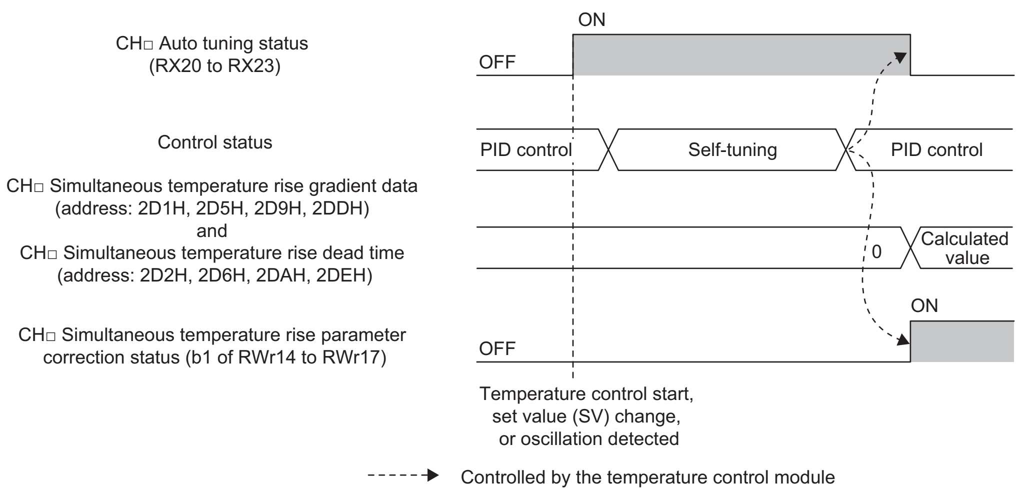
(6) The simultaneous temperature rise parameter setting using self-tuning

The control response at the time of temperature rise is constantly monitored during self-tuning and the simultaneous temperature rise parameter is calculated based on the characteristics of a controlled object.
For details on the self-tuning function, refer to the following.
☞ Page 184, Section 8.3.15

(a) Operation with the simultaneous temperature rise parameter setting using self-tuning

The temperature control module operates as follows.

Operation of the temperature control module	
1	When self-tuning is normally started up, CH☐ Auto tuning status (RX20 to RX23) is turned on and the simultaneous temperature rise parameter is calculated.
2	The calculated value is stored in the remote buffer memory when the simultaneous temperature rise parameter is normally calculated. Then CH☐ Simultaneous temperature rise parameter correction status (b1 of RWr14 to RWr17) is turned 1 (ON), CH☐ Auto tuning status (RX20 to RX23) is turned off, and the module is shifted to the PID control.

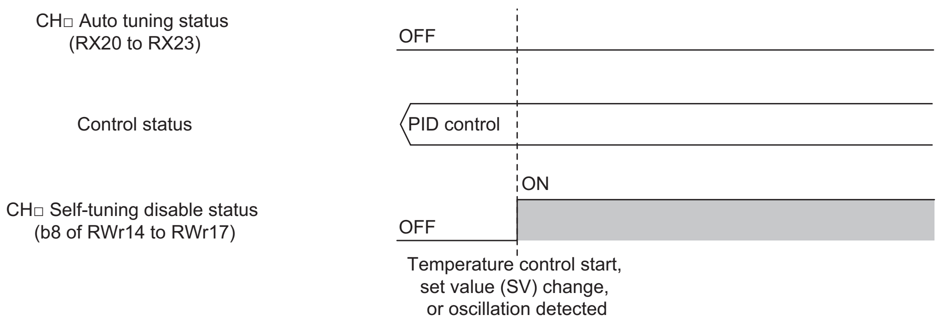


(b) Condition for the simultaneous temperature rise parameter setting using self-tuning

The condition is the same as that for the starting ST. (☞ Page 187, Section 8.3.15 (4) (a))
When the self-tuning cannot be started up, the temperature control module operates as following with the PID control continued.

- CH☐ Self-tuning disable status (b8 of RWr14 to RWr17) is turned 1 (ON).

The following shows how the temperature control module operates when self-tuning is not executed.



8

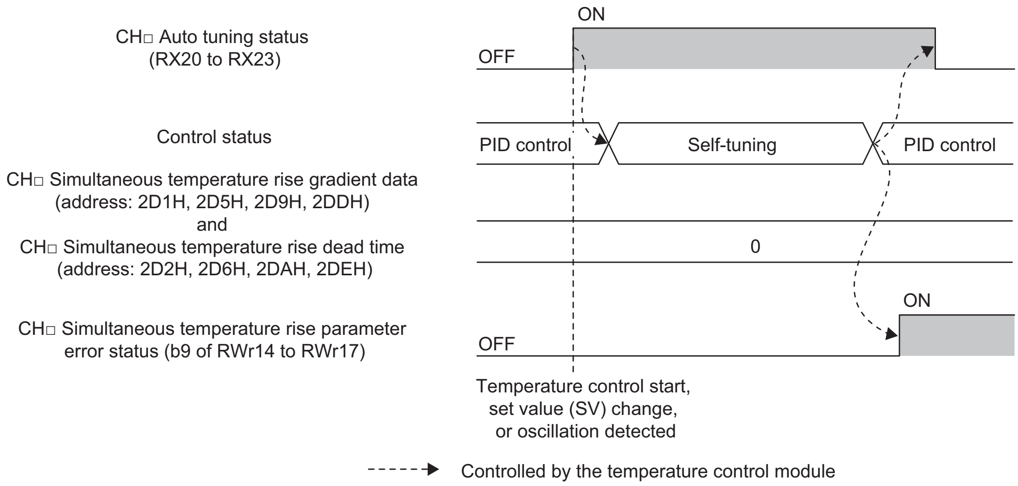
8.3 Temperature Control Mode

(c) When the simultaneous temperature rise parameter cannot be calculated

The simultaneous temperature rise parameter cannot be calculated under the following conditions:

- When the maximum gradient is not determined
- When the saturation time for output is short

The temperature control module turns CH☐ Simultaneous temperature rise parameter error status (b9 of RWr14 to RWr17) to 1 (ON).



Point

To restore CH☐ Simultaneous temperature rise parameter error status (b9 of RWr14 to RWr17) to 0 (OFF), set the following.

- Set CH☐ Self-tuning setting (address: 2C0H to 2C3H) to Do not run the ST (0).

To calculate the simultaneous temperature rise parameter, execute self-tuning again after the temperature has dropped.

(d) Stopping of calculation for the simultaneous temperature rise parameter

The optimum simultaneous temperature rise parameter may not be able to be calculated depending on the characteristics of a controlled object. In addition, when a self-tuning has been completed with an error, the temperature control module will stop calculation. For the conditions where a self-tuning completes with an error, refer to the following.

(☞ Page 191, Section 8.3.15 (8))

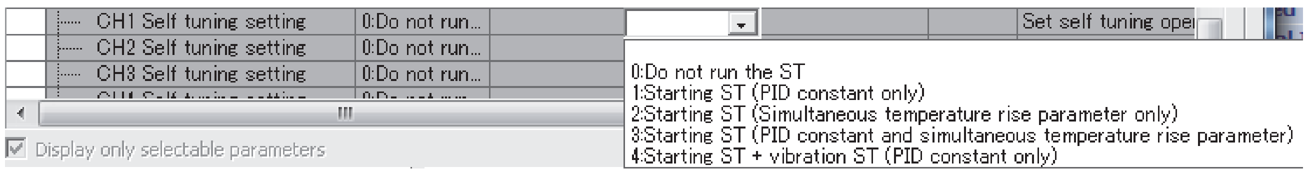
(e) How to set the simultaneous temperature rise parameter using self-tuning

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Select either of the following setting values for "CH☐ Self tuning setting".

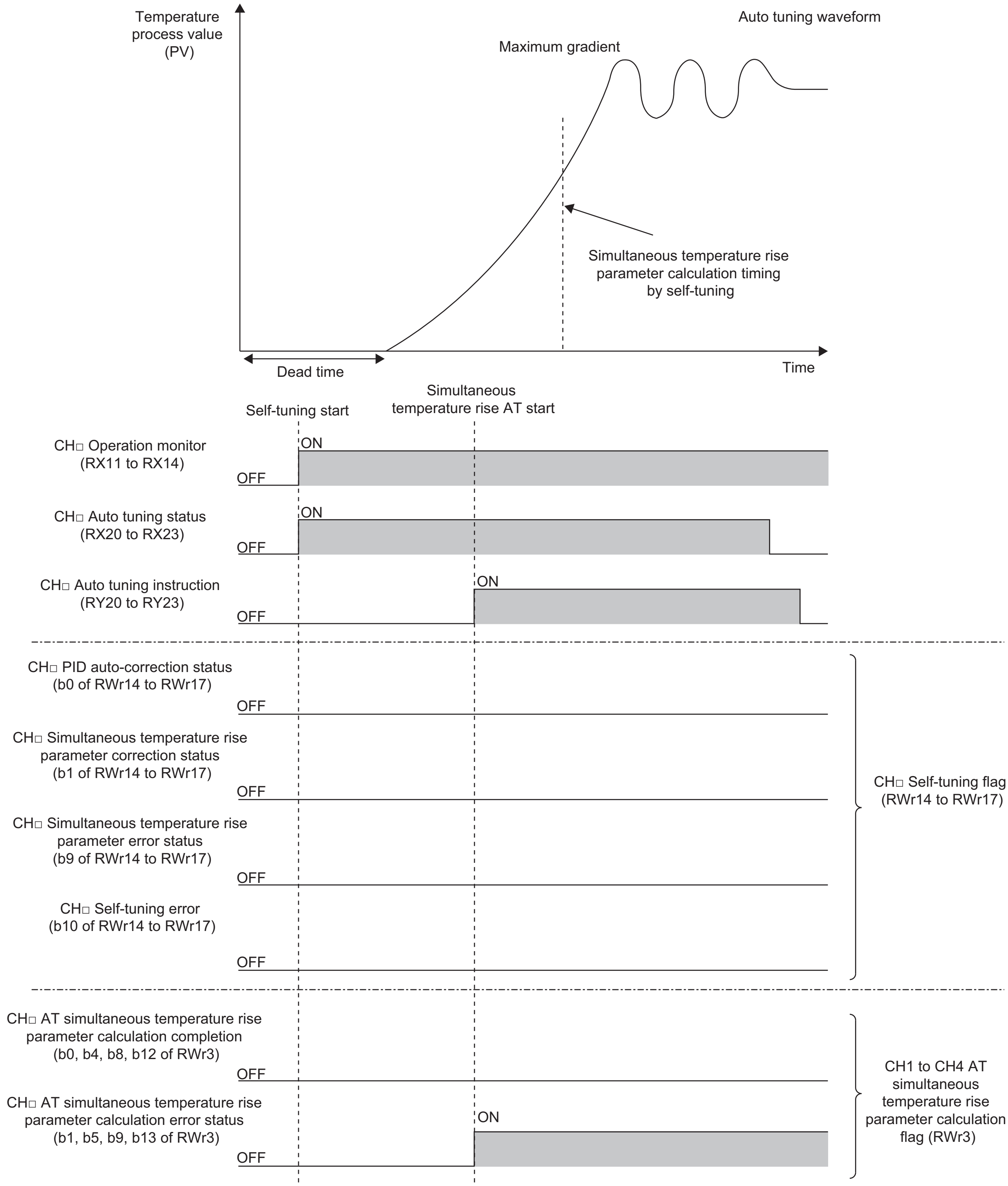
- "2: Starting ST (Simultaneous temperature rise parameter only)"
- "3: Starting ST (PID constant and simultaneous temperature rise parameter)"



(7) Operation when the simultaneous temperature rise parameter is calculated with self-tuning and auto tuning

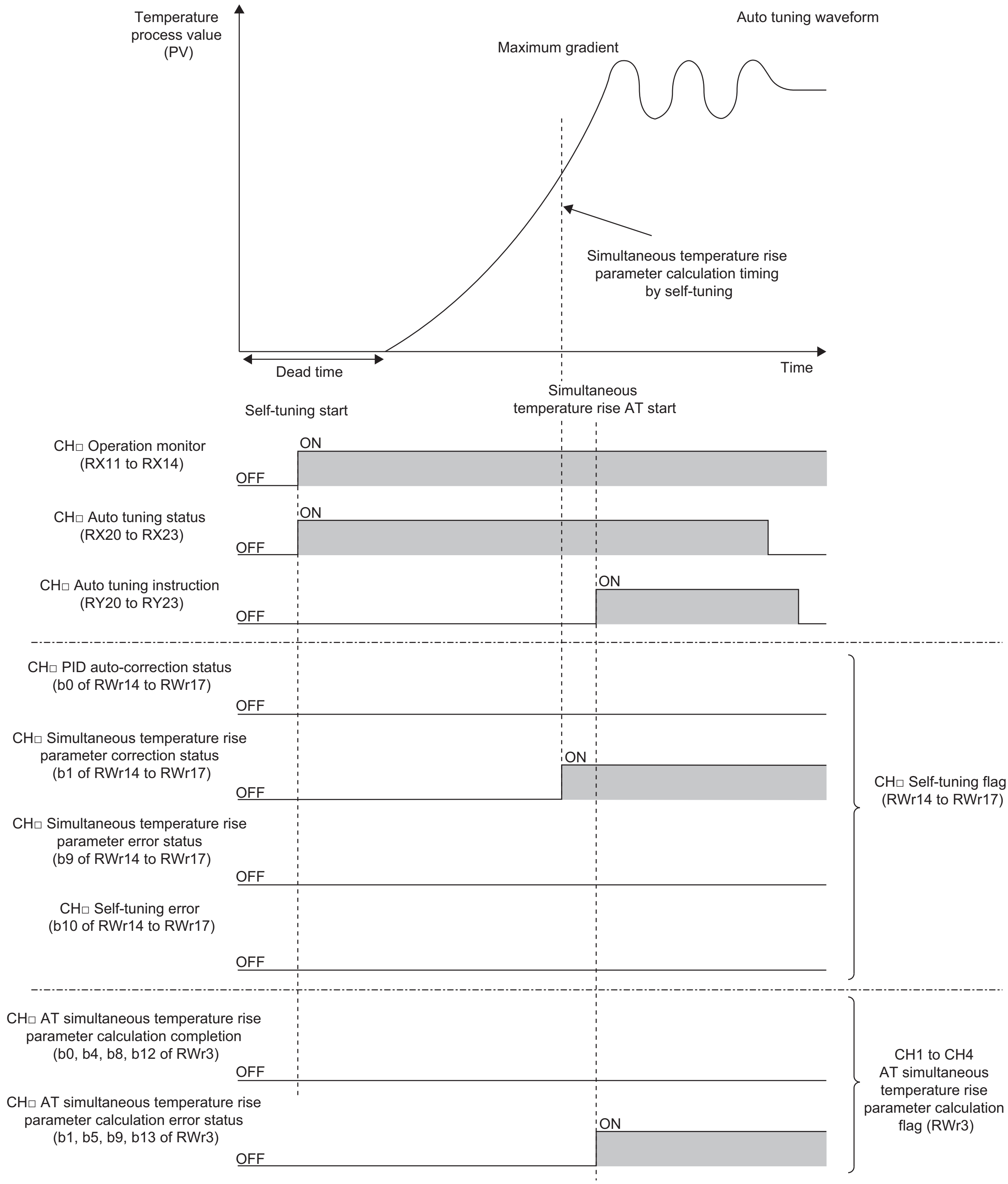
(a) When the simultaneous temperature rise AT is started before the simultaneous temperature rise parameter is calculated with self-tuning

The simultaneous temperature rise parameter is not calculated neither with self-tuning nor auto tuning. PID constants are changed.



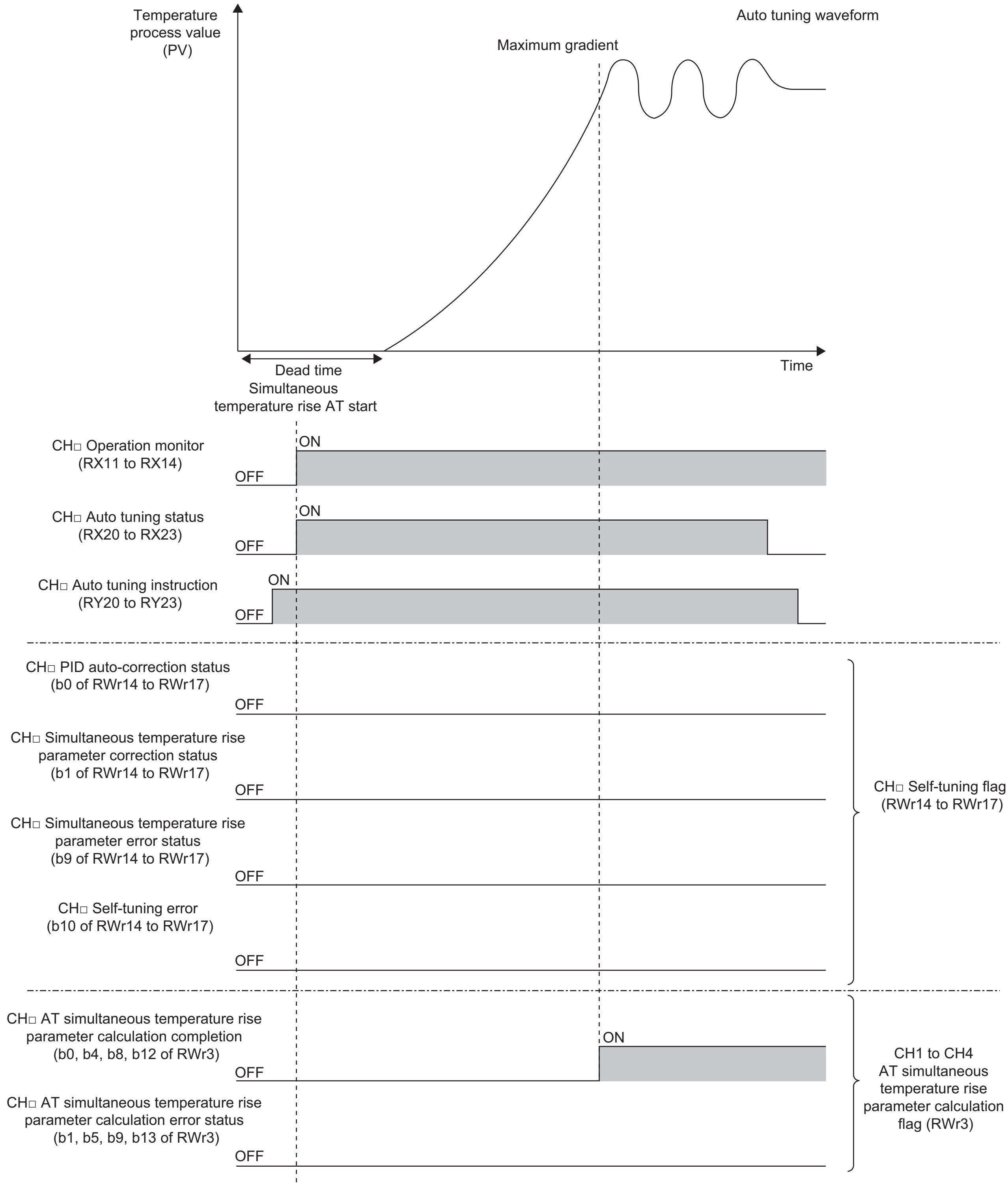
(b) When the simultaneous temperature rise AT is started after the simultaneous temperature rise parameter is calculated with self-tuning

The simultaneous temperature rise parameter calculated with self-tuning is effective. Then PID constants are changed with auto tuning.



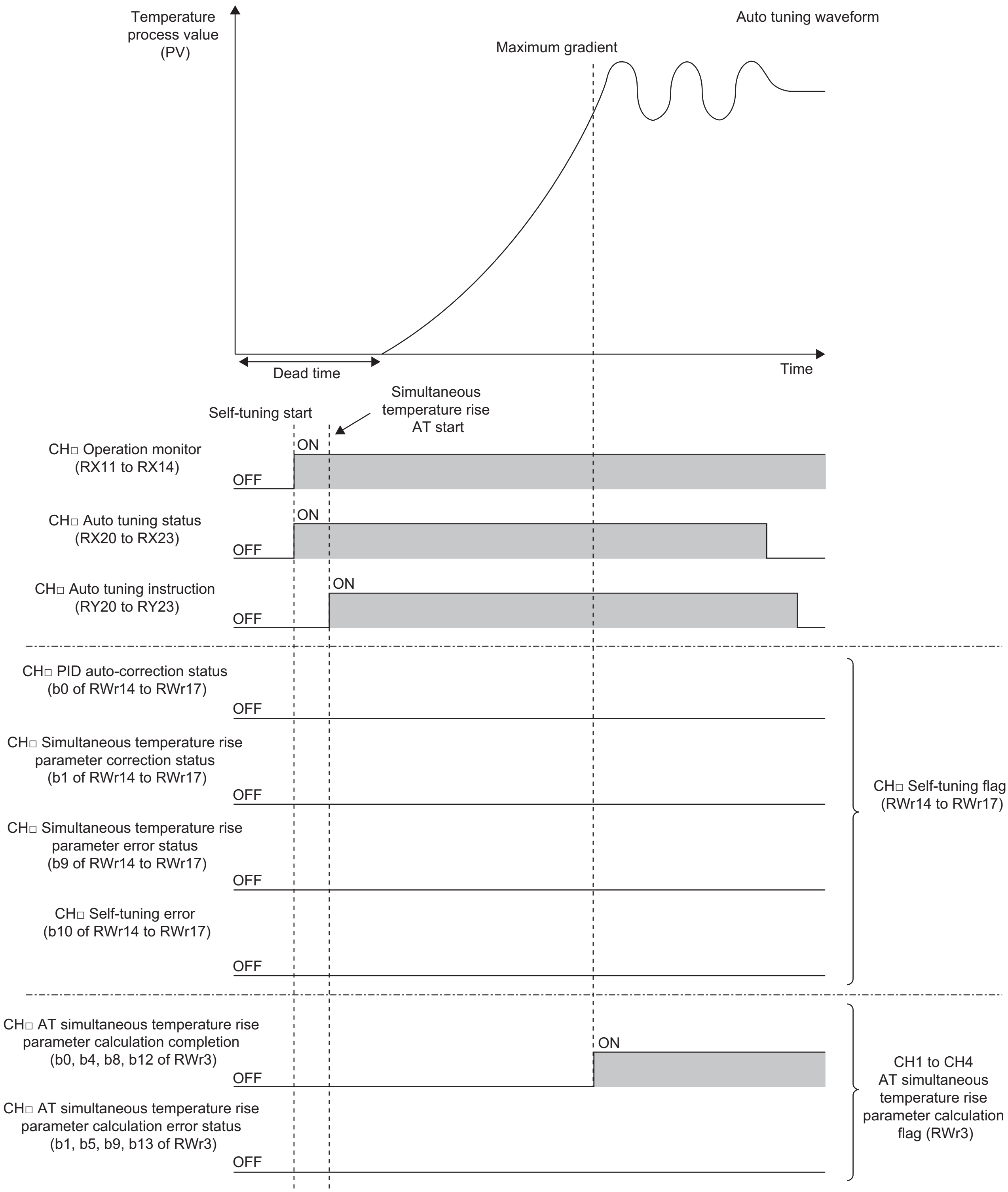
(c) When CH□ Auto tuning instruction (RY20 to RY23) is turned off and on during a halt in operation, and the operating status is changed to run

After the operating status is changed to run, the simultaneous temperature rise parameter and PID constants are changed with auto tuning.



(d) When auto tuning is started with the temperature process value (PV) within the stable judgment width (1℃ (℉)) after the operating status is changed from stop to run

Until the temperature process value (PV) goes outside the stable judgment width (1℃ (℉)), the data measured after the operating status is changed to run can be used. Therefore, the simultaneous temperature rise parameter can be calculated with auto tuning.



8.3.18 Forward/reverse action selection function

Standard

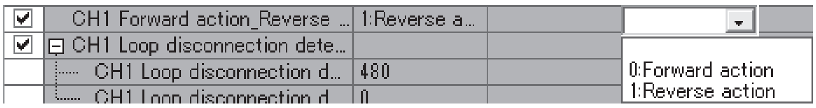
Whether PID operation is performed with forward action or reverse action can be selected using this function.
This function can be used in all the control methods (two-position control, P control, PI control, PD control, and PID control). (☞ Page 149, Section 8.3.3)
For details on the operation, refer to the following.
☞ Page 26, Section 1.4.2

(1) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH□ Forward action_Reverse action setting".



8.3.19 Loop disconnection detection function

Standard

Using this function detects an error occurring within a control system (control loop) due to reasons such as a load (heater) disconnection, an externally-operable device (such as a magnetic relay) failure, and input disconnection.

(1) How an error is detected

From the point where the control output has reached upper limit output limiter value or lower limit output limiter value, the amount of changes in the temperature process value (PV) is monitored every unit time set and disconnection of a heater and input is detected.

(2) Examples of the errors detected

The following are the examples of the errors detected.

(a) When control output is being performed

The temperature control module detects an error because the temperature does not rise even when control output is being performed under the following conditions:

- When a heater is disconnected
- When input is disconnected or short-circuited
- When the contact point of an externally-operable device does not turn on

After the control output has reached upper limit output limiter value, if the temperature does not rise by 2℃ (℉) or more within the loop disconnection detection judgment time set, an alert is output. (The operation is reversed for forward action. (☞ Page 211, Section 8.3.18))

(b) When control output is not being performed

The temperature control module detects an error because the temperature rises even when control output is not being performed under the following conditions:

- When input is disconnected
- When the contact point of an externally-operable device was bonded

After the control output has reached lower limit output limiter value, if the temperature does not drop by 2℃ (℉) or more within the loop disconnection detection judgment time set, an alert is output. (The operation is reversed for forward action. (☞ Page 211, Section 8.3.18))

(3) Setting method

Two settings are available for the loop disconnection detection function.

(a) Setting for the unit time to monitor the amount of changes in the temperature process value (PV)

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH□ Loop disconnection detection judgment time".

Point

When not using this function, set "CH□ Loop disconnection detection judgment time" to 0.

(b) Setting for the dead band

To prevent an error alert of loop disconnection detection, set a non-alert band (temperature band in which the loop disconnection is not detected) where the set value (SV) is at the center. If the temperature process value (PV) is within the loop disconnection detection dead band, an alert is not output even though the alert conditions of loop disconnection are met.

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH□ Loop disconnection detection dead band".

Point

If this function is not necessary, set 0 to "CH□ Loop disconnection detection dead band".

8.3.20 During AT loop disconnection detection function

A loop disconnection can be detected during auto tuning (AT) using this function. With this function, a channel that is not controlled can be detected during AT, thus the error channel is detected more than 2 hours before the AT error occurs. The AT continues even if an alert is output for the loop disconnection detection. For details on the loop disconnection detection function, refer to the following.

☞ Page 212, Section 8.3.19

Point

- This function is enabled even when the peak current suppression function or the simultaneous temperature rise function is used.
- The loop disconnection detection dead band setting is disabled for loop disconnection detection during AT. (The dead band is not set.)

(1) Conditions to start the during AT loop disconnection detection function

- Enable (1) is set to During AT loop disconnection detection function enable/disable setting (address: 1E7H).
- A value other than 0 is set to CH☐ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H).
- The standard control is set for the control mode. (The function can be used for CH3 or CH4 where the mix control is set.)

The during AT loop disconnection detection function does not operate if the above conditions are not met. An error or alarm does not occur even though the conditions are not met.

(2) Setting method

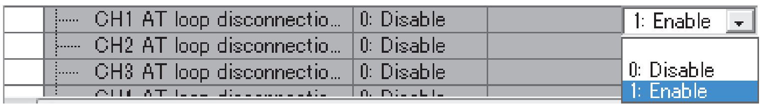
1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH☐ Loop disconnection detection judgment time"*1.

*1 It takes time before the temperature starts rising due to the dead time of the controlled object. Consider the dead time of each object and set the value.

3. Set "1: Enable" to "CH☐ AT loop disconnection detection function enable_disable setting".



4. Turn off and on CH☐ Auto tuning instruction (RY20 to RY23).

Remark

- Setting example for the control to rise the temperature by 200℃ for 40 minutes
  It takes approx. 24 seconds to rise the temperature by 2℃. It also takes time before the temperature starts rising due to the dead time of the controlled object. Consider the dead time of the object and set the value. Therefore, when assuming the dead time of the controlled object is 6 seconds, set 30 (24 seconds + dead time of the controlled object) to CH☐ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H).

(3) When an alert occurs, or does not occur

If an alert for the loop disconnection detection occurs, CH□ Alert occurrence flag (RX18 to RX1B) and CH□ Loop disconnection detection (b13 of RWr4 to RWr7) turn on and Alarm code (03□AH) is stored in Latest warning code (RWr2). (☞ Page 271, Section 11.2)

Point

The occurrence of loop disconnection alert may due to an error in the control loop. Therefore, even if AT is normally completed, check the control loop and that the current Loop disconnection detection judgment time is correct.

(4) To clear the alert status

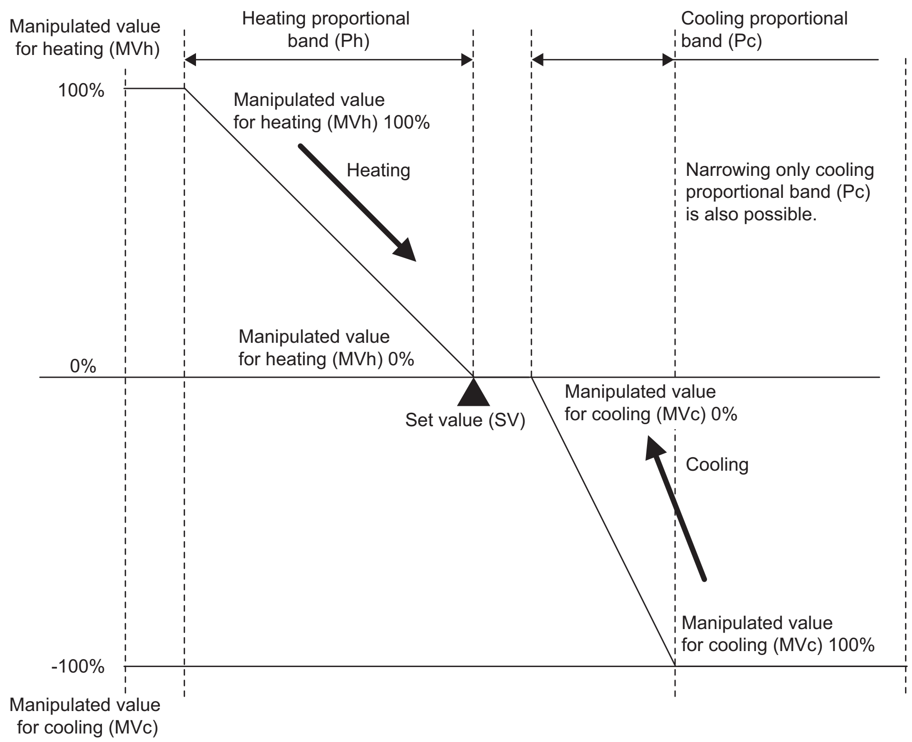
If any of the following conditions is met, CH□ Alert occurrence flag (RX18 to RX1B) and CH□ Loop disconnection detection (b13 of RWr4 to RWr7) turn off.

- When the operating status is changed from run to stop
- A manipulated value (MV) becomes greater than the lower limit output limiter value and smaller than the upper limit output limiter value.
- Disable (0) is set to During AT loop disconnection detection function enable/disable setting (address: 1E7H).
- 0 is set to CH□ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H).
- MAN (1) is set to CH□ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H).

8.3.21 Proportional band setting function

Heating-cooling

Proportional band (P) values can be set for heating and cooling separately using this function. Different gradients can be set by using different proportional band (P) values in a heating and cooling area.



(1) Setting method

(a) For heating

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH☐ Proportion belt_P_setting_CH☐ heating proportion belt".**

(b) For cooling

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

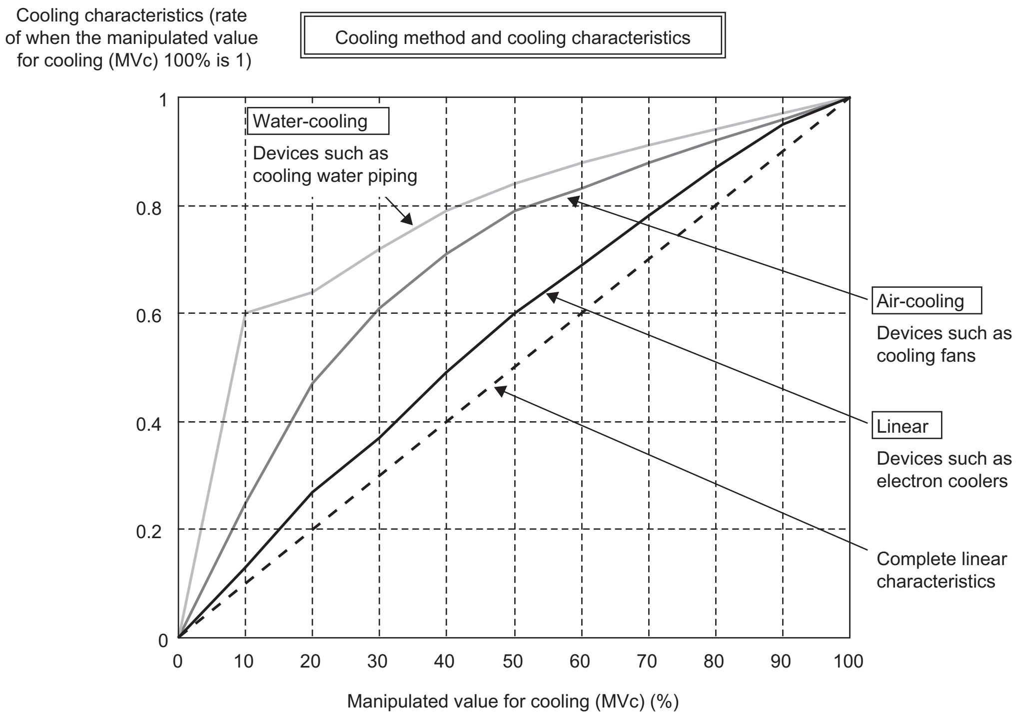
2. **Set "CH☐ Cooling proportion belt_Pc_setting".**

8.3.22 Cooling method setting function

Heating-cooling

An auto tuning calculation formula is automatically selected according to the selected cooling method during auto tuning and the operation is started using this function.
Select one of the following characteristics:

- Air cooled: The cooling characteristic is nonlinear and cooling ability is low.
- Water cooled: The cooling characteristic is nonlinear and cooling ability is high.
- Linear: The cooling characteristic is close to the linear shape.



PID constants are calculated and executed based on this setting during auto tuning; therefore, more appropriate PID constants can be found by setting more applicable cooling characteristic of a device.
For details on the auto tuning function, refer to the following.

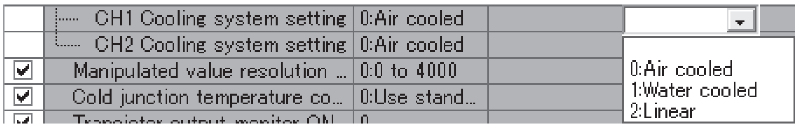
☞ Page 159, Section 8.3.7

(1) Setting method

1. **Set "Method selection" to "Param write" of the control mode to be used.**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set "CH□ Cooling system setting".**



Point

- An auto tuning calculation formula to find PID constants is determined based on this setting; therefore, configure this setting before executing auto tuning.
- "Air Cooled" and "Water Cooled" roughly indicate the level of the cooling ability. When a device is too cooled even if it is set to air cooled, set the module to Water cooled (1H). When a device is not very cooled even if it is set to water cooled, set the module to Air cooled (0H).
- In general, the ability of water cooling is higher than that of air cooling and cooling may be too strong if the same PID constants as air cooling are used. Some time is required until the control becomes stable upon the initial start-up, disturbance, or setting change. Therefore, in auto tuning, PID constants for when the module is set to Water cooled (1H) become larger than those for when the module is set to Air cooled (0H).

8.3.23 Overlap/dead band function

Heating-cooling

In heating-cooling control, the temperature process value (PV) significantly changes due to slight heating or cooling control output when the heat produced by a controlled object and natural cooling are being balanced. Consequently, excessive output may be performed.
The temperature where the cooling control output starts can be shifted using this function; therefore, whether control stability is prioritized or energy saving is prioritized can be selected.

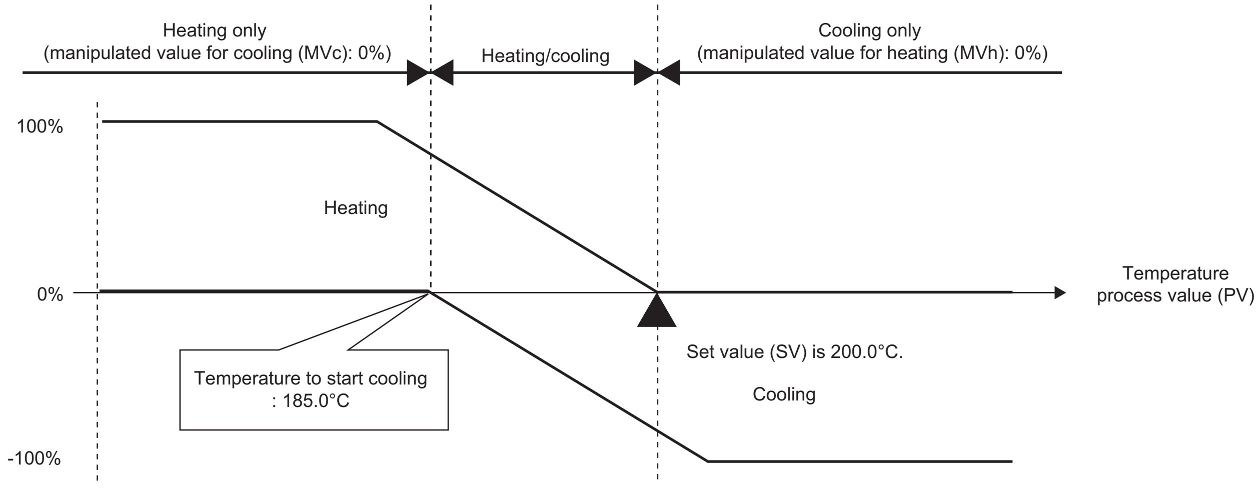
(1) Overlap

Overlap refers to the temperature area where both of heating control and cooling control are performed. In the temperature area where both heating and cooling output overlap, both of the output negate each other, thus the control gain becomes moderate. Consequently, the change amount in the temperature process value (PV) for the output becomes small, improving control stability.

Ex. When remote buffer memory values are set as follows:

- CH☐ Input range (address: 100H, 130H, 160H, 190H): 38 (temperature measurement range -200.0℃ to 400.0℃)
- CH☐ Set value (SV) setting (address: 101H, 131H, 161H, 191H): 2000 (200.0℃)
- CH☐ Overlap/dead band setting (address: 1C7H, 1CCH, 1D1H, 1D6H): -25 (-2.5%)

185.0℃ to 200.0℃ is the overlapping area.
(Full scale) × (Overlap setting) = (400.0℃ - (-200.0℃)) × -0.025 = -15.0℃
The temperature where cooling operation starts = (Set value (SV)) - 15.0℃ = 185.0℃
As shown below, shifting the temperature where cooling operation starts to the lower temperature side of the set value (SV) produces an overlapping area. (The following is an example of when the module is in P control.)



(2) Dead band

Dead band refers to the temperature area where neither heating control output nor cooling control output is performed. When the temperature process value (PV) is stable within this area, output is not performed for the slight change in the temperature, resulting in energy saving.

Ex. When remote buffer memory values are set as follows:

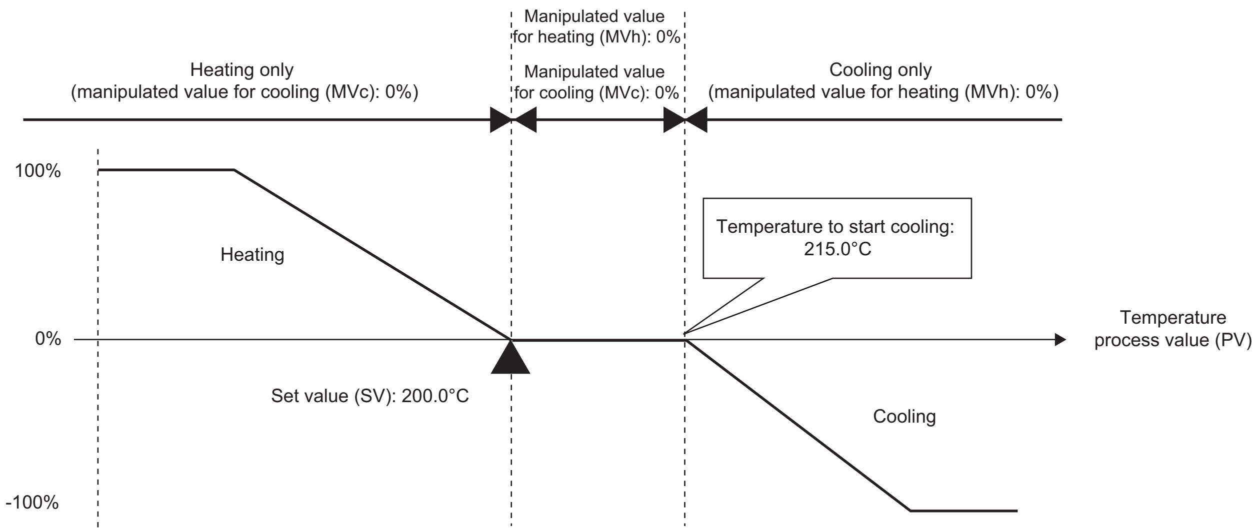
- CH☐ Input range (address: 100H, 130H, 160H, 190H): 38 (temperature measurement range -200.0℃ to 400.0℃)
- CH☐ Set value (SV) setting (address: 101H, 131H, 161H, 191H): 2000 (200.0℃)
- CH☐ Overlap/dead band setting (address: 1C7H, 1CCH, 1D1H, 1D6H): 25 (2.5%)

200.0℃ to 215.0℃ is the area for dead band.

(Full scale) × (Dead band setting) = (400.0℃ - (-200.0℃)) × 0.025 = 15.0℃

The temperature where cooling operation starts = (Set value (SV)) + 15.0℃ = 215.0℃

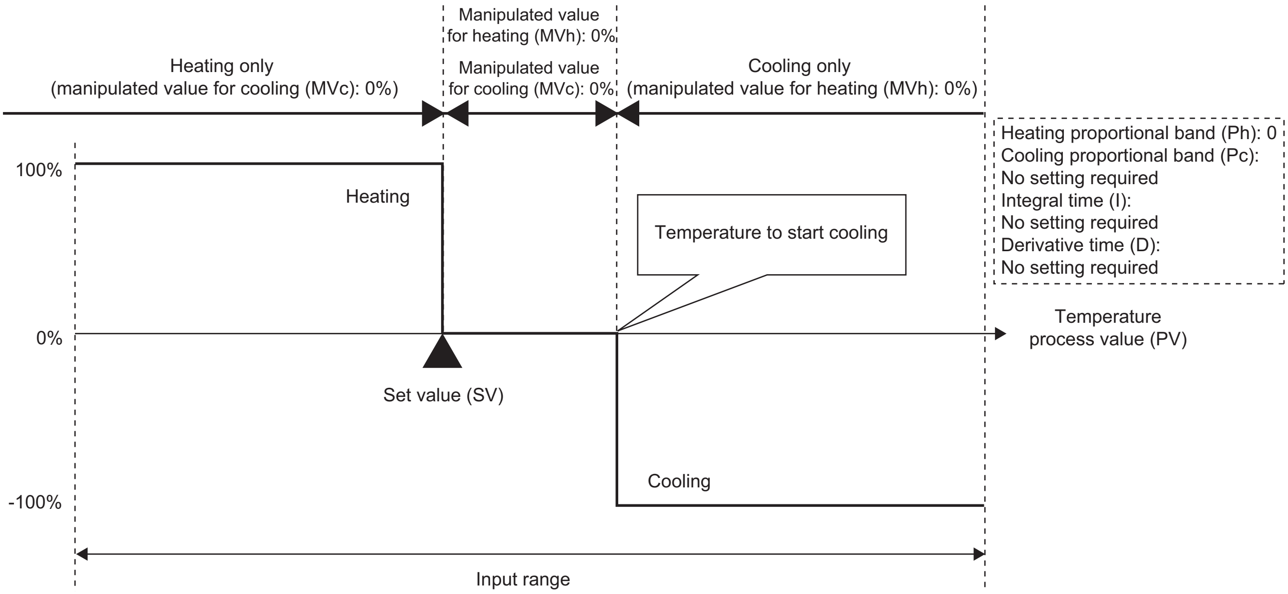
As shown below, shifting the temperature where cooling operation starts to the higher temperature side of the set value (SV) produces a dead band area. (The following is an example of when the module is in P control.)



(3) Dead band setting in two-position control (three-position control)

Set the dead band in two-position control.

Three-position control can be achieved by setting a dead band area in addition to areas for the manipulated value for heating (MVh) 100% and the manipulated value for cooling (MVc) 100%.



(4) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH□ Overlap_dead band setting".

8.3.24 Temperature conversion function (using unused channels)

Heating-cooling

In heating-cooling control (normal mode) and mix control (normal mode), only temperature measurement can be performed by using unused temperature input terminals. When this function is used, temperature control and alert judgment are not performed.

(1) Temperature input terminals that can be used

Temperature input terminals that can be used for this function differ depending on the control mode.
Use the terminals indicating MT2☐ (Monitor CH2), MT3☐ (Monitor CH3), and MT4☐ (Monitor CH4) in the following table.

Terminal No.	Terminal symbol			
	NZ2GF2B-60TCTT4		NZ2GF2B-60TCRT4	
	Heating-cooling control (normal mode)	Mix control (normal mode)	Heating-cooling control (normal mode)	Mix control (normal mode)
1	L1H	L1H	L1H	L1H
2	L1C	L1C	L1C	L1C
3	L2H	L3	L2H	L3
4	L2C	L4	L2C	L4
5	COM -	COM -	COM -	COM -
6	Unused	Unused	Unused	Unused
7	CH1 +	CH1 +	CH1 A	CH1 A
8	CH2 +	MT2 +	CH2 A	MT2 A
9	CH1 -	CH1 -	CH1 B	CH1 B
10	CH2 -	MT2 -	CH2 B	MT2 B
11	Unused	Unused	CH1 b	CH1 b
12	CJ	CJ	CH2 b	MT2 b
13	Unused	Unused	MT3A	CH3 A
14	CJ	CJ	MT4A	CH4 A
15	MT3 +	CH3 +	MT3B	CH3 B
16	MT4 +	CH4 +	MT4B	CH4 B
17	MT3 -	CH3 -	MT3B	CH3 b
18	MT4 -	CH4 -	MT4b	CH4 b

(2) Remote I/O signals, remote registers, and remote buffer memory areas that can be used

The following table lists the remote I/O signals, remote registers, and remote buffer memory areas that can be used with this function. (The table below shows the correspondences between the terminals used and the remote I/O signals/remote registers/remote buffer memory areas.)

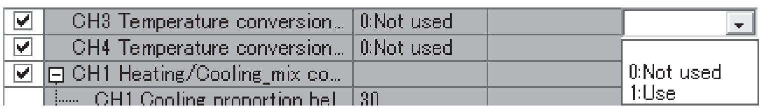
Item name	Remote I/O signal, remote register, remote buffer memory			Reference
	MT2 (CH2)	MT3 (CH3)	MT4 (CH4)	
CH☐ Operation monitor	RX12	RX13	RX14	Page 287, Appendix 1.1 (6)
CH☐ Sensor two-point correction offset latch completion	RX28	RX2A	RX2C	Page 293, Appendix 1.1 (14)
CH☐ Sensor two-point correction gain latch completion	RX29	RX2B	RX2D	Page 293, Appendix 1.1 (15)
CH☐ Sensor two-point correction offset latch request	RY28	RY2A	RY2C	Page 300, Appendix 1.2 (9)
CH☐ Sensor two-point correction gain latch request	RY29	RY2B	RY2D	Page 300, Appendix 1.2 (10)
CH☐ Alert definition	RWr5	RWr6	RWr7	Page 303, Appendix 2 (5)
CH☐ Temperature process value (PV)	RWr9	RWrA	RWrB	Page 304, Appendix 2 (6)
CH☐ Input range	130H	160H	190H	Page 312, Appendix 3 (5)
CH☐ Primary delay digital filter setting	13DH	16DH	19DH	Page 328, Appendix 3 (16)
CH☐ Temperature conversion setting	1C1H	1C2H	1C3H	Page 338, Appendix 3 (29)
Sensor correction function selection	1E4H			Page 341, Appendix 3 (35)
Cold junction temperature compensation selection	1E9H			Page 344, Appendix 3 (40)
CH☐ Sensor correction value setting	281H	282H	283H	Page 352, Appendix 3 (51)
CH☐ Sensor two-point correction offset value (measured value)	288H	28CH	290H	Page 352, Appendix 3 (52)
CH☐ Sensor two-point correction offset value (corrected value)	289H	28DH	291H	Page 353, Appendix 3 (53)
CH☐ Sensor two-point correction gain value (measured value)	28AH	28EH	292H	Page 353, Appendix 3 (54)
CH☐ Sensor two-point correction gain value (corrected value)	28BH	28FH	293H	Page 354, Appendix 3 (55)
Cold junction temperature process value	600H			Page 359, Appendix 3 (63)
Control switching monitor	602H			Page 360, Appendix 3 (65)
CH☐ Decimal point position	621H	622H	623H	Page 362, Appendix 3 (68)
Error code	A00H			Page 363, Appendix 3 (69)

(3) Setting method

1. Set "Method selection" to "Param write" of the control mode to be used.

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. Set "CH☐ Temperature conversion setting".



Point

- When heating-cooling control (expanded mode) or mix control (expanded mode) is selected, "CH☐ Temperature conversion setting" is ignored.
- When the setting for the Temperature conversion setting is changed from "0: Not used" to "1: Use", temperature conversion starts. The completion of the first temperature conversion does not turn on CH☐ Operation monitor (RX11 to RX14).

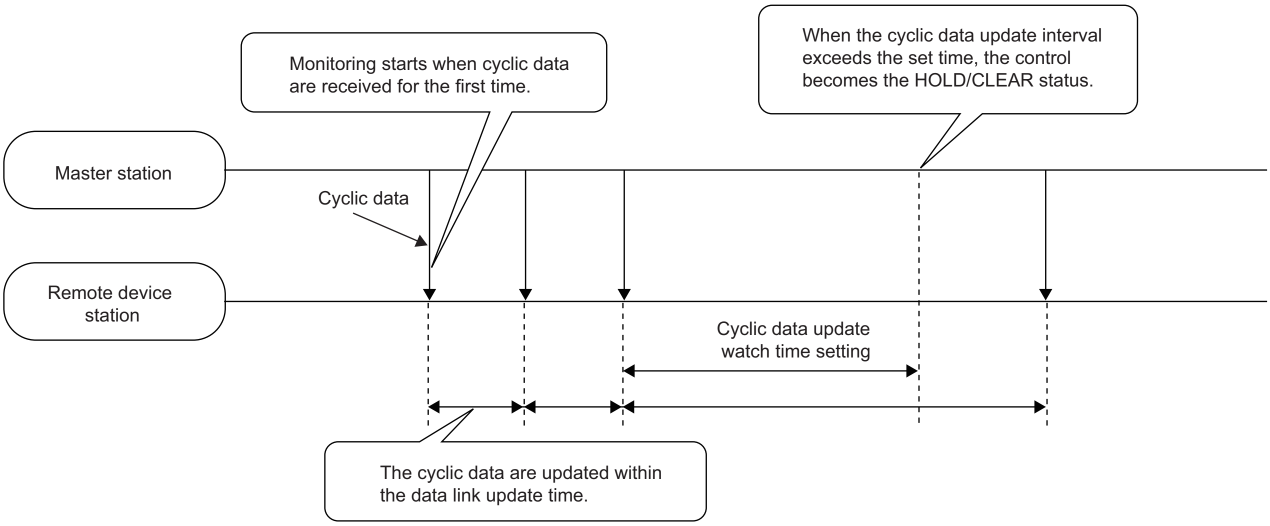
8.4 CC-Link IE Field Network Function

8.4.1 Cyclic data update watch function

Common

This function is used to watch the time interval between updates on cyclic data. When an update by cyclic transmission remains to be done for a set period of time for watching, the module "continues its operation and produces external outputs (HOLD)" or "stops its operation and external outputs (CLEAR)".
A halt in cyclic transmission is indicated by the status of the D LINK LED, flashing (data link established (cyclic transmission stopped)) or off (data link not established (disconnected)).
Set either HOLD or CLEAR with the control output setting at CPU stop error.
For the control output setting at CPU stop error, refer to the following.

- HOLD/CLEAR function (☞ Page 148, Section 8.3.2)



(1) Setting method

1. **Set "Method selection" to "Param write (Station parameter)".**

"CC IE Field Configuration" window⇨Select the temperature control module from "List of stations"⇨[CC IE Field Configuration]⇨[Online]⇨[Parameter Processing of Slave Station]

2. **Set a time period for watching for "Cyclic data update watch time setting".**

Item	Setting range
Cyclic data update watch time setting	• 0 (no watch) • 1 to 20 (0.1 to 2 seconds, in steps of 100ms)

Point

When setting the cyclic data update watch time setting, set a time period longer than the link scan time.

8.4.2 Error notification function

Common

When an error, warning, or alarm occurs, the temperature control module notifies the master station of it using remote input signals and remote registers.

Remark

The notification of the error, warning, or alarm can be checked on the LED on the front of the module.
For details, refer to the following.

- PART NAMES (☞ Page 31, CHAPTER 2)

(1) Notification of an error

The temperature control module notifies the master station of an error in the following method.

Item	Description	Reference
Error flag (RXA)	Turns on when a moderate error or major error occurs.	Page 285, Appendix 1.1 (3)
Latest error code (RWr0)	An error code is stored when a moderate error or major error (except hardware failures) occurs.	Page 301, Appendix 2 (1)
Error occurrence address (RWr1)	The address of remote buffer memory area where an error has occurred is stored.	Page 301, Appendix 2 (2)

(a) Method for clearing an error

The method for clearing an error depends on the error type.
For details, refer to the following.
Lists of Error Codes (☞ Page 271, Section 11.2)

(2) Notification of a warning or alarm

The temperature control module notifies that a warning or alarm occurs to the master station in the following method.

Item	Description	Reference
Warning flag (RX7)	Turns on when a minor error occurs.	Page 284, Appendix 1.1 (1)
Latest warning code (RWr2)	The error code or alarm code is stored when a minor error occurs.	Page 301, Appendix 2 (3)

(a) Method for clearing a warning or alarm

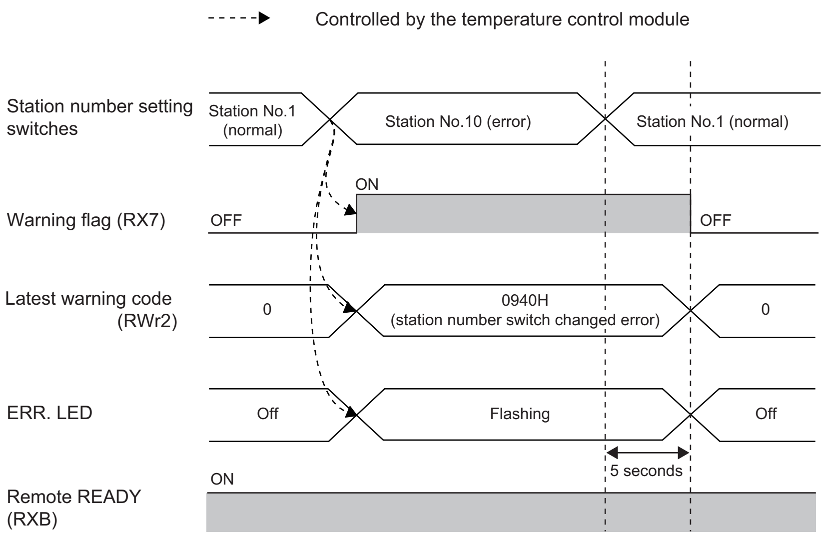
The method for clearing an error depends on the error type.

Error type			Clearing an error
Minor error[*2]	Warning		A warning is cleared five seconds after the error cause is removed.[*1]
	Alarm	Temperature process value excess of upper limit of PV range	When the temperature process value (PV) returns to somewhere within the input range, the alarm is automatically turned off.
		Temperature process value fall short of lower limit of PV range	
		Loop disconnection detection	When the cause of the loop disconnection is eliminated, the alarm is automatically turned off.
		Occurrence of alert 1	When the temperature process value (PV) returns to somewhere within the setting range of alert, the alarm is automatically turned off.
		Occurrence of alert 2	
		Occurrence of alert 3	
		Occurrence of alert 4	
		Occurrence of process alarm upper limit alert	The error is automatically cleared when the temperature process value (PV) returns within the set range between the process alarm upper lower limit value and the process alarm lower upper limit value.
		Occurrence of process alarm lower limit alert	
		Occurrence of rate alarm upper limit alert	When the temperature process value (PV) increases by a set value or smaller, or decreases by a set value or larger, the alarm is automatically turned off.
		Occurrence of rate alarm upper limit alert	

*1 A warning results in the following state five seconds after the error cause is removed.
- Warning flag (RX7) turns off.
- Latest warning code (RWr2) is cleared.
- The ERR. LED turns off.

*2 Latest warning code is stored in Latest warning code (RWr2). For example, when a minor error occurs and is eliminated after a process alarm occurs, Latest warning code (RWr2) is cleared to 0 regardless of the occurrence of the alarm. The warning codes can be checked in the error history on GX Works2. For the error history, refer to the following.
- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Error history ☐ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

Ex. Operation to clear Station number switch changing error (error code: 0940H)

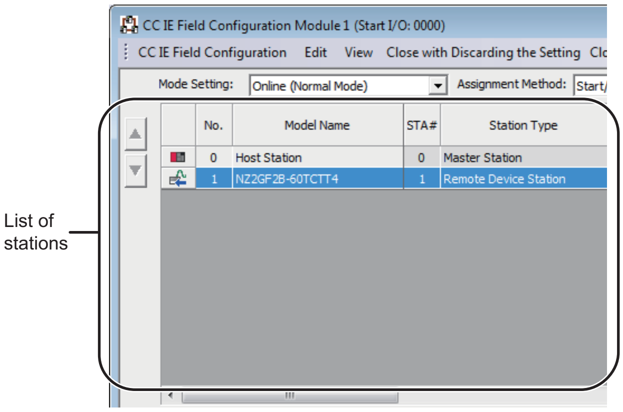


For the method for clearing an alarm, refer to the following.

- List of Alarm Codes (☞ Page 277, Section 11.3)

(3) Method for clearing an error by executing the command of the slave station

The following shows how to clear an error by executing the command of the slave station.

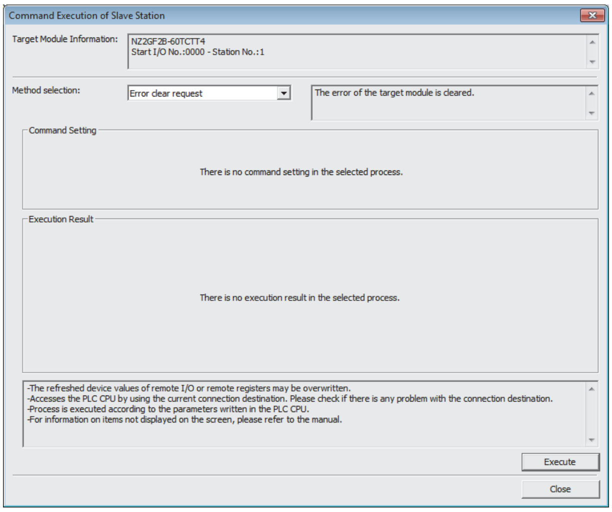


1. **Select the temperature control module in "List of stations" on the CC IE Field Configuration window.**

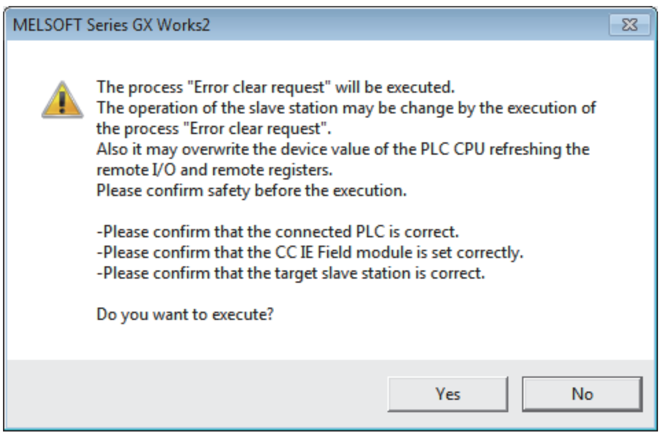
2. **Open the "Command Execution of Slave Station" window.**

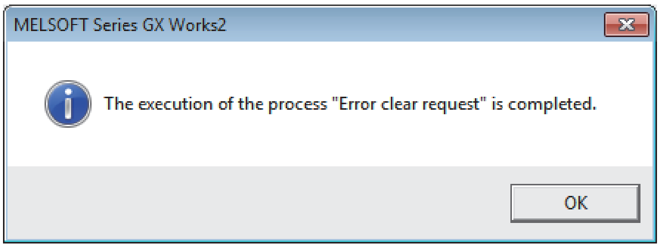
[CC IE Field Configuration] ⇨ [Online] ⇨ [Command Execution of Slave Station]

3. **Set "Method selection”" to "Error clear request" and click the [Execute] button.**



4. **When the window shown on the left is displayed, click the [Yes] button.**



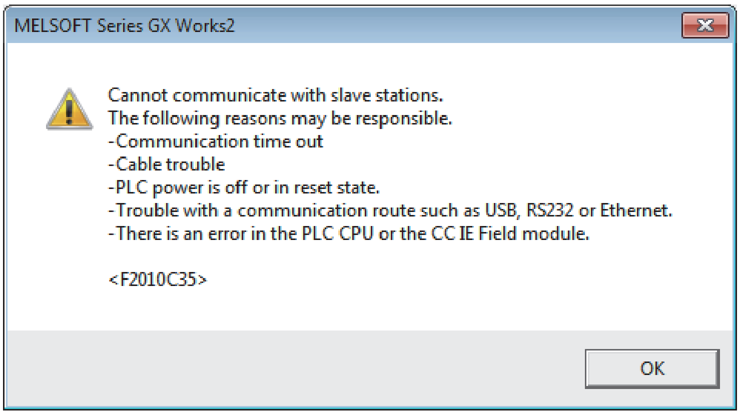


5. **When the window shown on the left is displayed, click the [OK] button.**

6. **The error for the temperature control module is cleared.**

Point

When the following window appears at the elimination of an error, take corrective actions on the problems described in the window.



8.4.3 CC-Link IE Field Network diagnostic function

Common

With this function, whether any network error occurs or not can be checked through the engineering tool connected to the CPU module.

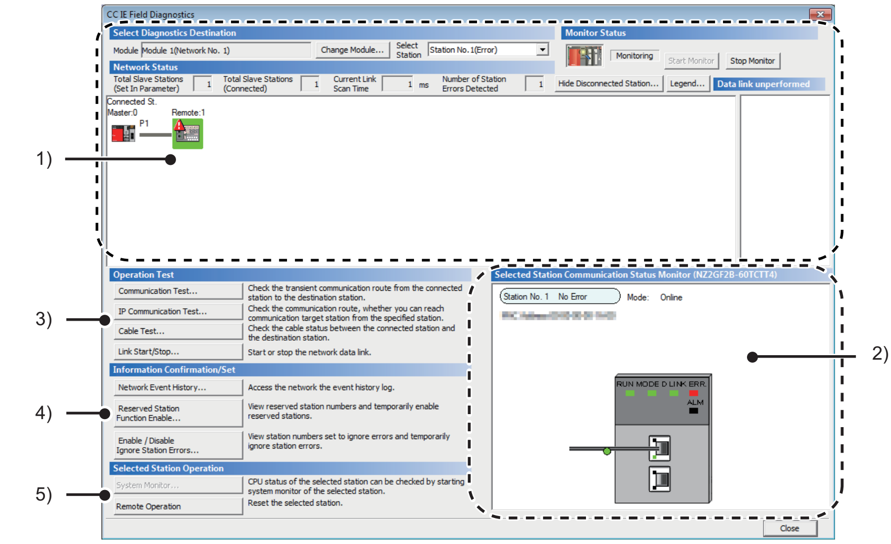
(1) How to use

The following instructions assume the use of GX Works2 as the engineering tool.

1. Connect GX Works2 to the CPU module.

2. Start CC-Link IE Field Network diagnostics from the menu of GX Works2.

[Diagnostics]⇨[CC IE Field Diagnostics]



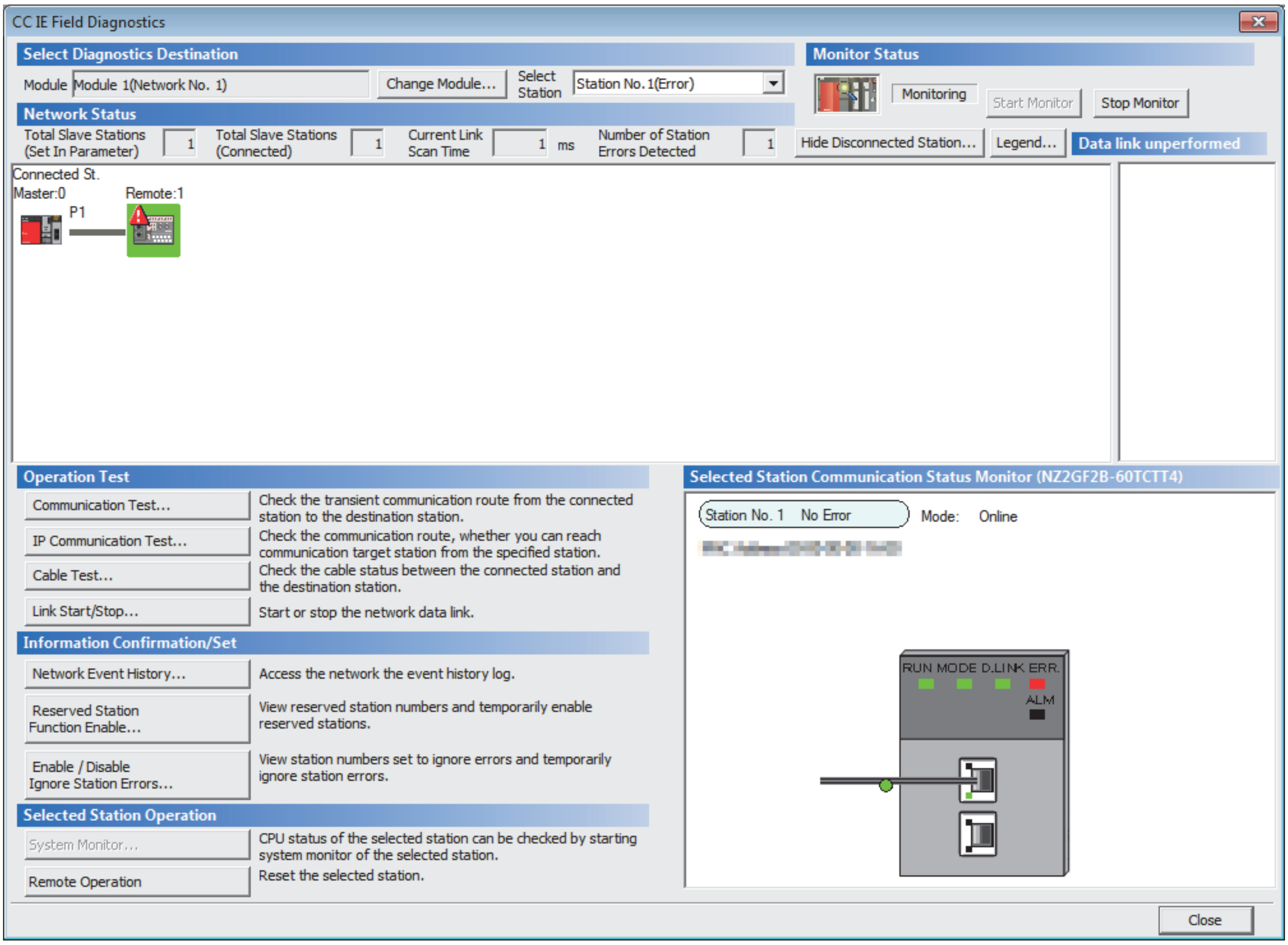
	Item to be diagnosed	Description	Reference
1)	Display of network configuration diagram and error status	The status of the CC-Link IE Field Network can be checked. When an error arises or a warning is issued from the temperature control module, the status of the station is indicated on the icon.	User's manual for the master/local module used
2)	Display of selected-station status and error details	The communication status of the station selected in "Network Status" can be checked.*1	
3)	Communication Test	The transient communication route and whether the communication is established from the connected station to the destination station can be checked.	
	IP Communication Test	The reaching time and the route of the IP communication from the connected station to the target station can be checked. This function is unavailable for the temperature control module.	
	Cable Test	The cable status between the connected station and the destination station can be checked.	
	Link Start/Stop	The network data link can be started and stopped.	
4)	Network Event History	The history of various events that occurred in the network can be checked. This function is unavailable for the temperature control module.	
	Reserved Station Function Enable	A reservation for a station can be temporarily cancelled, and the cancellation can be disabled. Also, the station numbers for the modules set as reserved stations can be checked on a list.	
	Enable/Disable Ignore Station Errors	A station not set as an error invalid station can be temporarily set as an error invalid station, and the error invalid station setting can be disabled. Also, the station numbers for the modules set as (temporarily) error ignore stations can be checked on a list.	
5)	System Monitor	The system monitor on the selected station is activated and the status of the module can be checked. This function is unavailable for the temperature control module.	
	Remote Operation	The selected station can be reset through the remote operation.	Page 230, Section 8.4.3 (1) (a)

*1 "Selected Station Communication Status Monitor", which appears at the bottom right in the window, indicates the communication status of the temperature control module. For the error and alarm for the temperature control module, refer to the following.

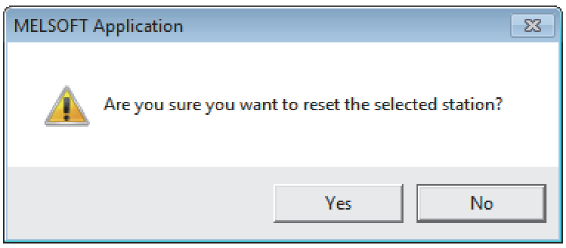
- Checking for Error Codes and Alarm Codes (☞ Page 267, Section 11.1)

(a) Remote operation

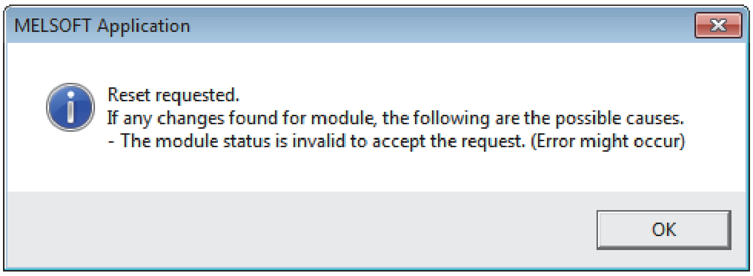
1. Select a slave station to be reset and click the [Remote Operation] button.



2. Clicking the [Yes] button on the following window starts the remote reset.



3. **Click the [OK] button on the following window.**



CHAPTER 9 PROGRAMMING

This chapter describes the programming of a temperature control module.

9.1 Precautions for Programming

This section describes precautions to create CC-Link IE Field Network programs.

(1) Cyclic transmission program

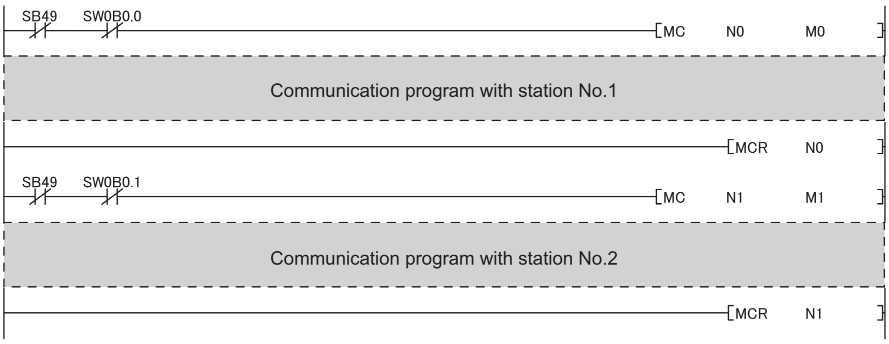
For a cyclic transmission program, interlock with the following link special relay (SB) and link special register (SW).

- Own station data link status (master station) (SB0049)
- Data link status (each station) (SW00B0 to SW00B7)

For the link special relay (SB) and link special register (SW), refer to the following.

User's manual for the master/local module used

Ex. Interlock example



(2) Transient transmission program

For a transient transmission program, interlock with the following link special relay (SB) and link special register (SW).

- Own station baton pass status (master station) (SB0047)
- Baton pass status (each station) (SW00A0 to SW00A7)

For the link special relay (SB) and link special register (SW), refer to the following.

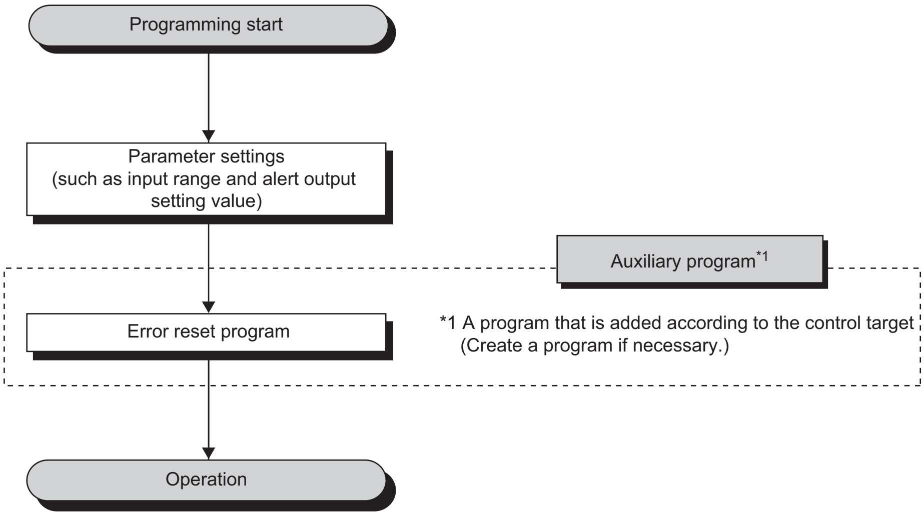
User's manual for the master/local module used

Ex. Interlock example

9.2 Procedures for Programming

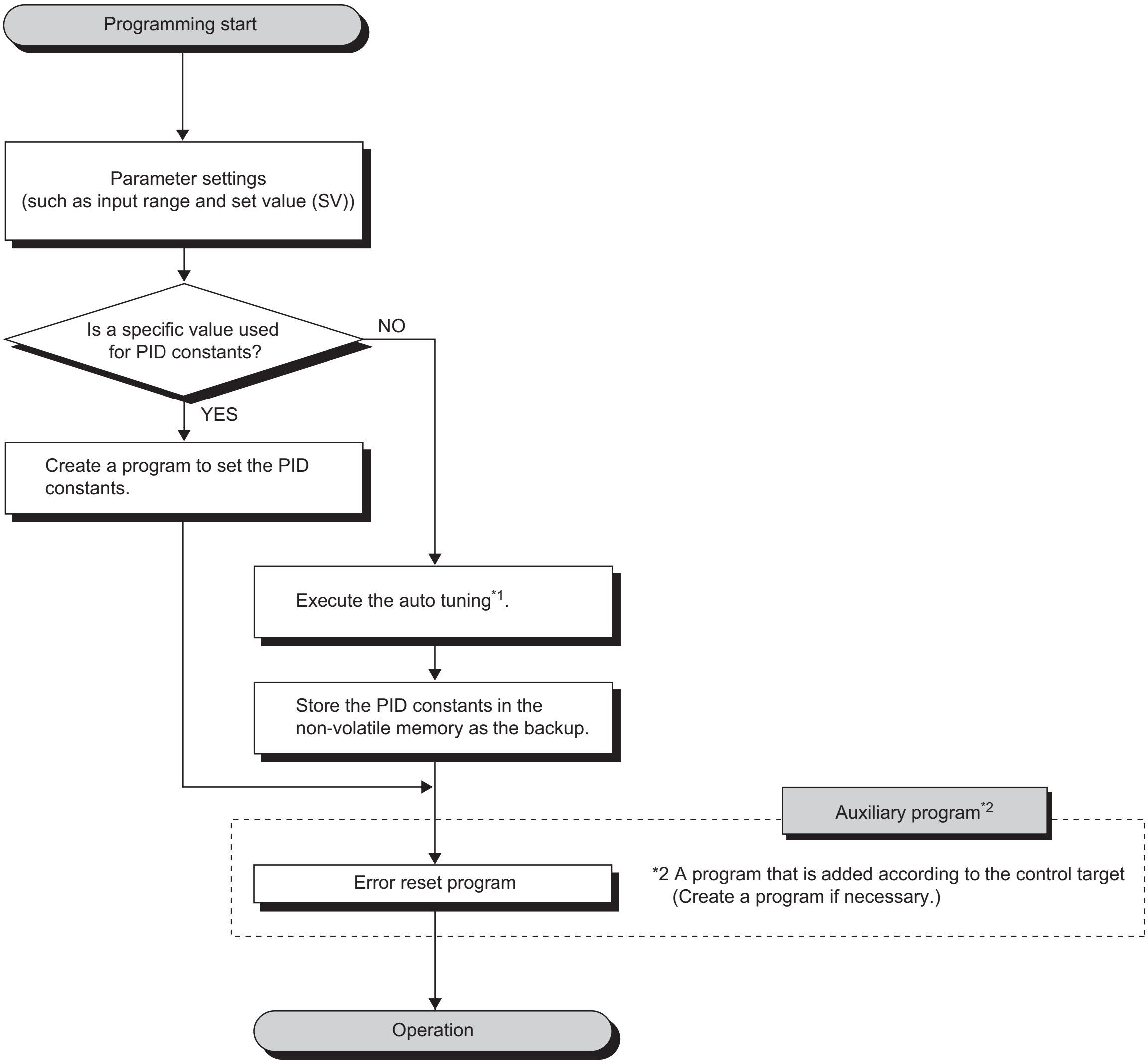
(1) Temperature input mode

Create a program that performs temperature conversion in the temperature control module using the following procedure.



(2) Temperature control mode

Create a program that performs temperature control in the temperature control module using the following procedure.



*1 In the standard control, the self-tuning can be selected if necessary.

9.3 Program Examples

This section describes the following program examples.

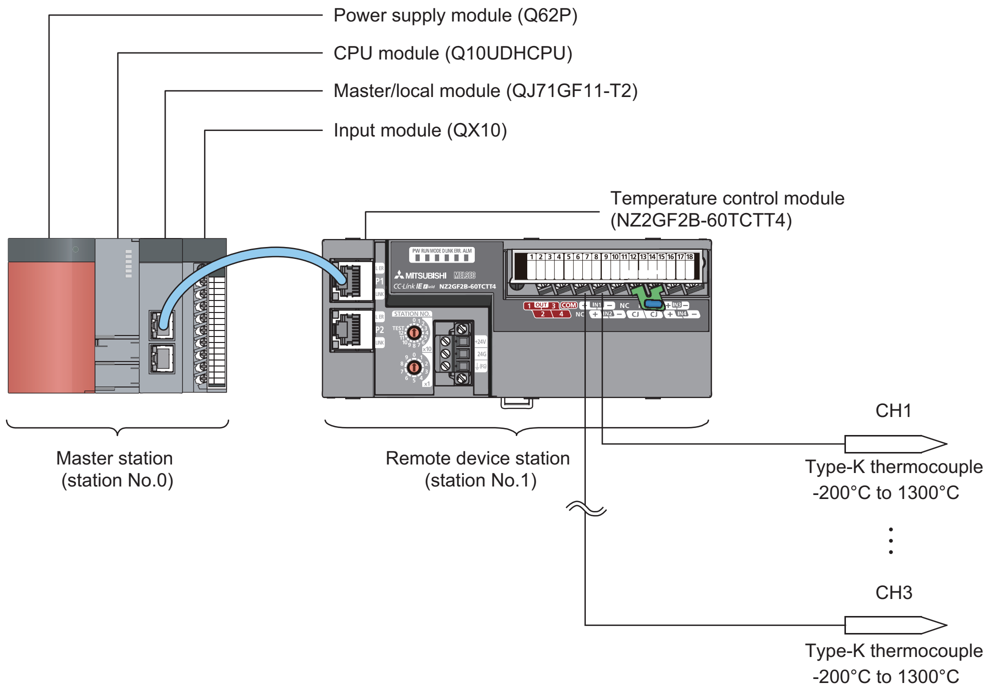
Mode		Overview of the program example	Reference
Temperature input mode		This is a program example where this module is used as a temperature input module.	Page 235, Section 9.3.1
Temperature control mode	Standard Control	This is a program example for operations such as the auto tuning, self-tuning, and error code read.	Page 244, Section 9.3.2
		This is a program example where the peak current suppression function and the simultaneous temperature rise function are used for the control.	Page 254, Section 9.3.3

Point

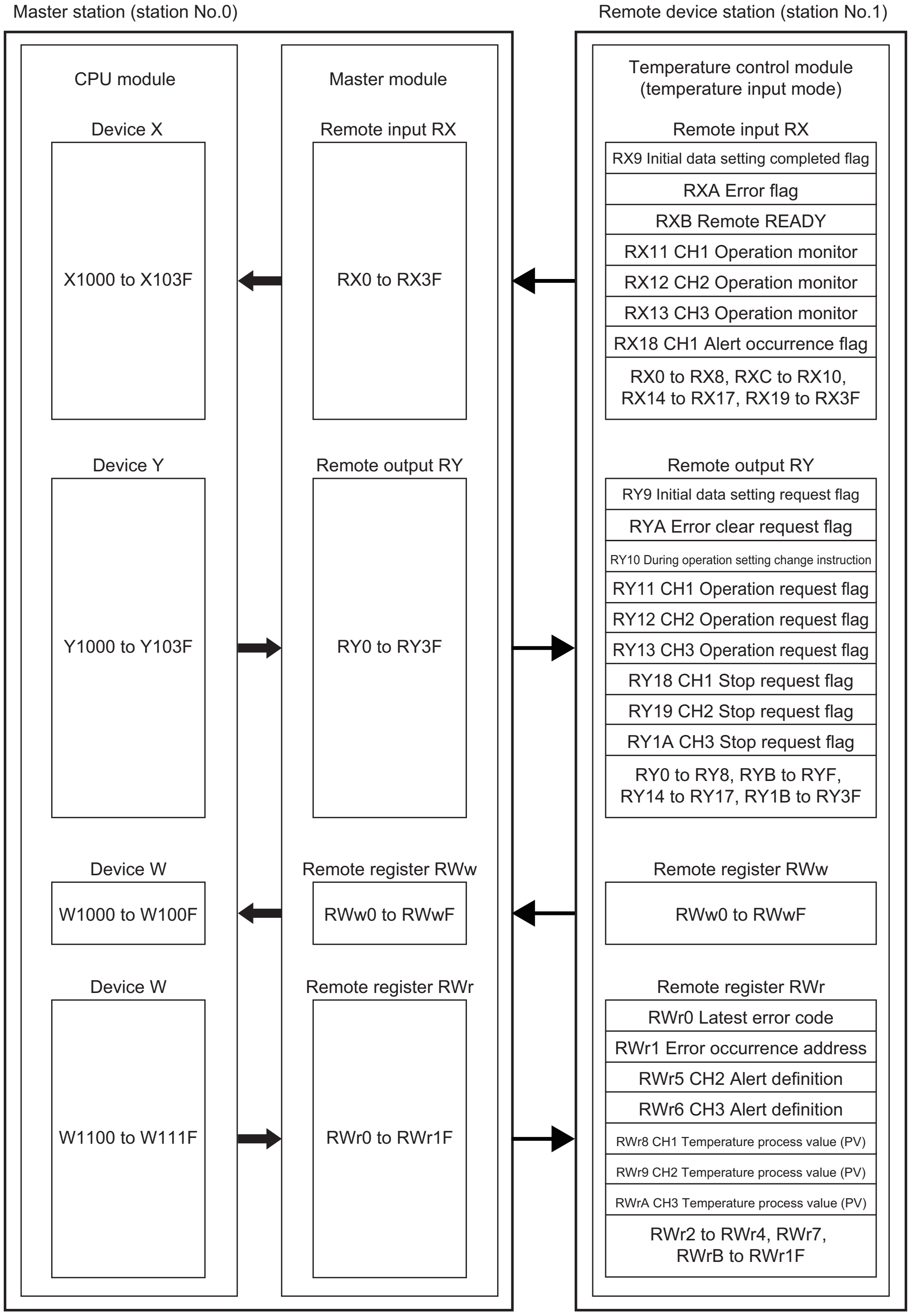
For the settings using the engineering tool, the procedure is described based on the use of GX Works2.

9.3.1 When the module is used as a temperature input module

(1) System configuration



(a) Link device assignment



(2) Programming condition

This program is designed to read the temperatures measured with the thermocouple (K type, -200.0 to 1300.0℃) connected to CH1 to CH3.

An error code can be read and reset.

The following table lists other programming conditions.

Item	Description		
	CH1	CH2	CH3
Sampling cycle	250ms		
Temperature conversion method	Sampling processing	Sampling processing	Primary delay digital filter (time constant 1s)
Alert output function	—	• Process alarm lower lower limit value: 2000 (200.0℃) • Process alarm lower upper limit value: 2050 (205.0℃) • Process alarm upper lower limit value: 2950 (295.0℃) • Process alarm upper upper limit value: 3000 (300.0℃)	• Rate alarm warning detection cycle: 4 times (1s) • Rate alarm upper limit value: 50 (+5.0℃) • Rate alarm lower limit value: -50 (-5.0℃)

(3) Contents of the initial setting

(a) Station-based parameter

Setting item		Set value
Control mode switching		100h: Temperature input mode
Function extension and sampling cycle selection	Sampling cycle selection	1: 250ms/4 Channel

Set the initial values for the parameters other than the above.

(b) Temperature input mode parameter

Setting item		Set value
CH1 Basic setting	CH1 Input range	49: K: -200.0 to 1300.0℃ (in increments of 0.1℃)
CH2 Basic setting	CH2 Input range	49: K: -200.0 to 1300.0℃ (in increments of 0.1℃)
CH3 Basic setting	CH3 Input range	49: K: -200.0 to 1300.0℃ (in increments of 0.1℃)
CH2 Primary delay digital filter setting		2
CH2 Process alarm setting	CH2 Process alarm warning output enable_disable setting	0: Enable
	CH2 Process alarm lower lower limit value	2000
	CH2 Process alarm lower upper limit value	2050
	CH2 Process alarm upper lower limit value	2950
	CH2 Process alarm upper upper limit value	3000
CH3 Rate alarm setting	CH3 Rate alarm warning output enable_disable setting	0: Enable
	CH3 Rate alarm warning detection cycle	4
	CH3 Rate alarm upper limit value	50
	CH3 Rate alarm lower limit value	-50

Set the initial values for the parameters other than the above.

(4) Device for user

Device	Description	
X20	Error reset signal	QX10 (X20 to X2F)
X21	CH1 Operation request instruction	
X22	CH2 Operation request instruction	
X23	CH3 Operation request instruction	
X25	Temperature process value read instruction	
X100A	Error flag	NZ2GF2B-60TCTT4 (X1000 to X103F)
X100B	Remote READY	
X1011	CH1 Operation monitor	
X1012	CH2 Operation monitor	
X1013	CH3 Operation monitor	
Y1009	Initial data setting request flag	NZ2GF2B-60TCTT4 (Y1000 to Y103F)
Y100A	Error clear request flag	
Y1010	During operation setting change instruction	
Y1011	CH1 Operation request flag	
Y1012	CH2 Operation request flag	
Y1013	CH3 Operation request flag	
Y1018	CH1 Stop request flag	
Y1019	CH2 Stop request flag	
Y101A	CH3 Stop request flag	
D2000	Latest error code	
D2001	Error occurrence address	
D2005	CH2 Alert definition	
D2006	CH3 Alert definition	
D2008	CH1 Temperature process value (PV)	
D2009	CH2 Temperature process value (PV)	
D2010	CH3 Temperature process value (PV)	
W1100	Latest error code	Device to be written by link refresh
W1101	Error occurrence address	
W1105	CH2 Alert definition	
W1106	CH3 Alert definition	
W1108	CH1 Temperature process value (PV)	
W1109	CH2 Temperature process value (PV)	
W110A	CH3 Temperature process value (PV)	
SM400	Always ON	
SB47	Baton pass status (own station) (master station)	
SB49	Data link status (own station) (master station)	
SWA0.0	Baton pass status (each station) (station number 1)	
SWB0.0	Data link status (each station) (station number 1)	
N0	Nesting (station number 1)	

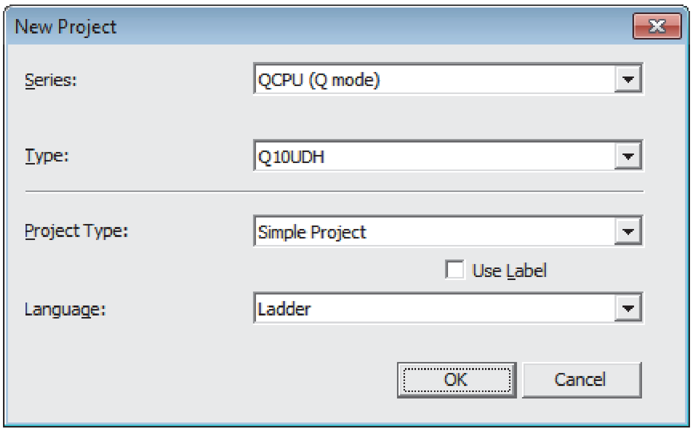
(5) Setting procedure

Connect GX Works2 to the master station to configure the setting.

1. Create a project on GX Works2.

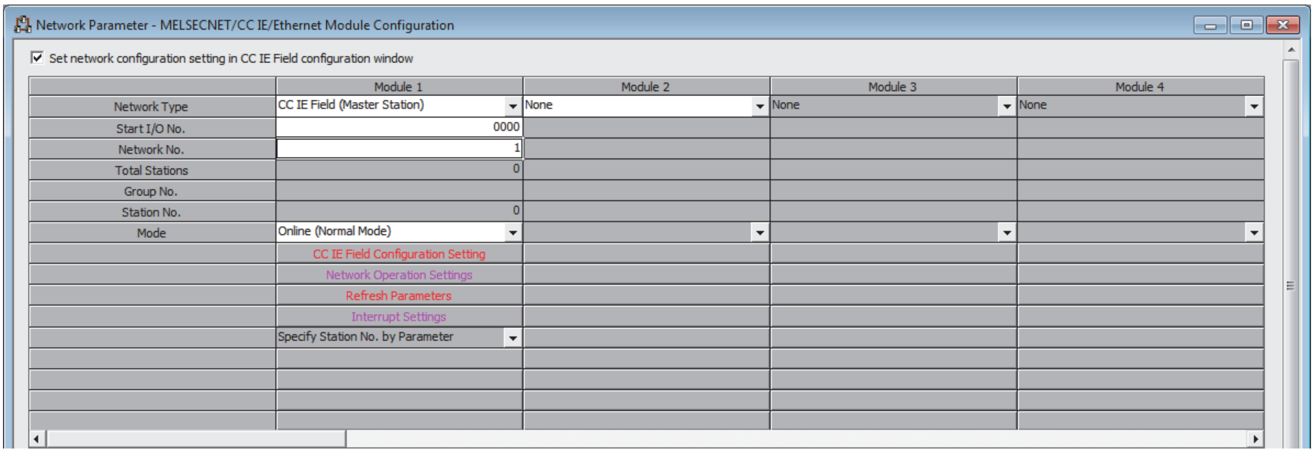
Select "QCPU (Q mode)" for "Series" and select "Q10UDH" for "Module Type".

[Project] ⇨ [New...]



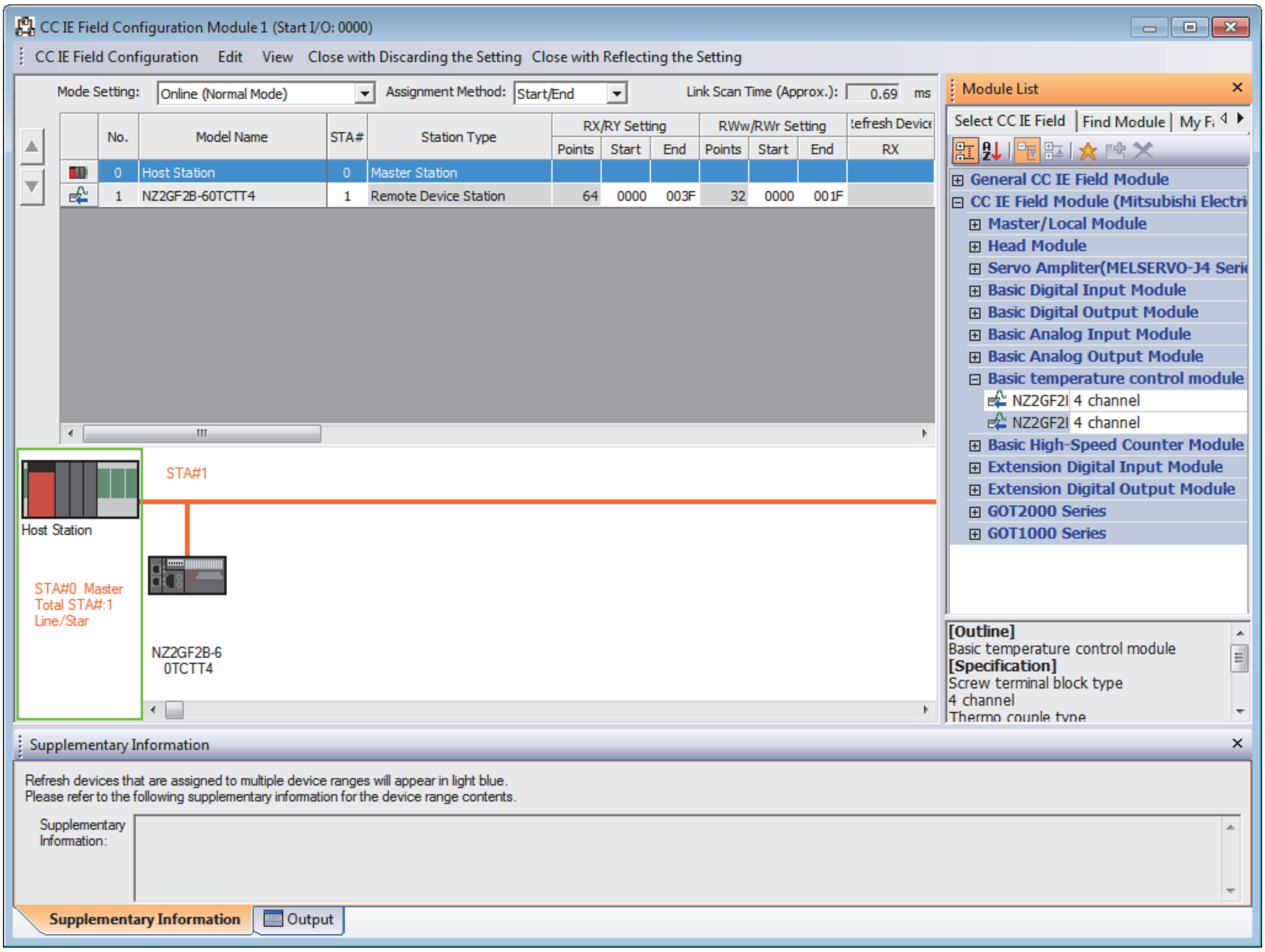
2. Display the network parameter setting window and configure the setting as follows.

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]



3. **Display the CC IE Field Configuration window and configure the configuration and station number of the slave station as follows.**

[CC IE Field Configuration Setting] button



4. **Close the CC IE Field Configuration window.**

[CC IE Field Configuration] ⇨ [Close with Reflecting the Setting]

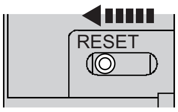
5. **Display the refresh parameter setting window and configure the setting as follows.**

[Refresh Parameters] button

	Link Side					PLC Side			
	Dev. Name	Points	Start	End		Dev. Name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Transfer 1	RX	64	0000	003F	↔	X	64	1000	103F
Transfer 2	RY	64	0000	003F	↔	Y	64	1000	103F
Transfer 3	RWw	16	0000	000F	↔	W	16	001000	00100F
Transfer 4	RWr	32	0000	001F	↔	W	32	001100	00111F
Transfer 5					↔				
Transfer 6					↔				
Transfer 7					↔				
Transfer 8					↔				

6. **Write the set parameter to the CPU module of the master station and reset the CPU module, or turn off and on the power supply.**

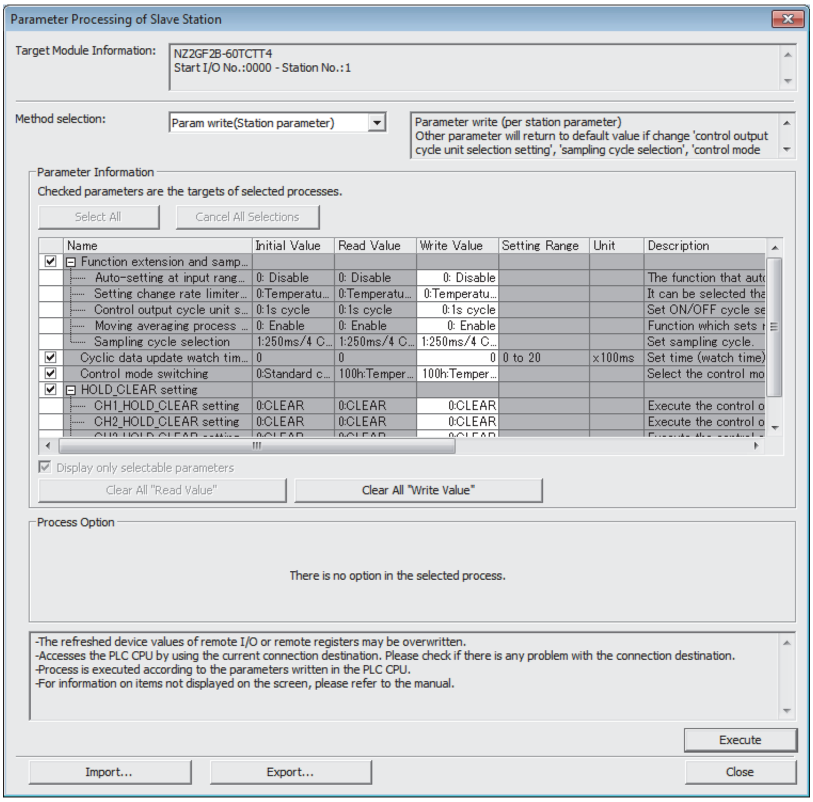
[Online] ⇨ [Write to PLC...]



or Turn off and on the power.

7. **Display the "Parameter Processing of Slave Station" window, set "Method selection" to "Param write (Station parameter)" or "Param write (Temperature input mode)", and set the items described in the contents of the initial setting.**

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET] ⇨ [CC IE Field Configuration Setting] button ⇨ Select the temperature control module in "List of stations". ⇨ [CC IE Field Configuration] ⇨ [Online] ⇨ [Parameter Processing of Slave Station]



For the contents of the initial setting, refer to the following.

☞ Page 237, Section 9.3.1 (3)

For how to write the station-based parameter and temperature input mode parameter to the temperature control module, refer to the following.

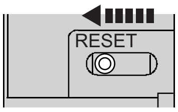
☞ Page 108, Section 7.1

(6) Programming and writing data

1. **Create the following programs with GX Works2 depending on the functions used.**

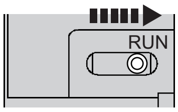
☞ Page 242, Section 9.3.1 (6) (a)

2. **Write the program to the CPU module of the master station and reset the CPU module, or turn off and on the power supply.**



or Turn off and on the power.

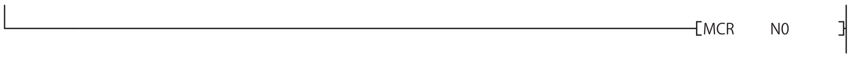
3. **Change the state of the CPU module of the master station to RUN.**



(a) Program examples

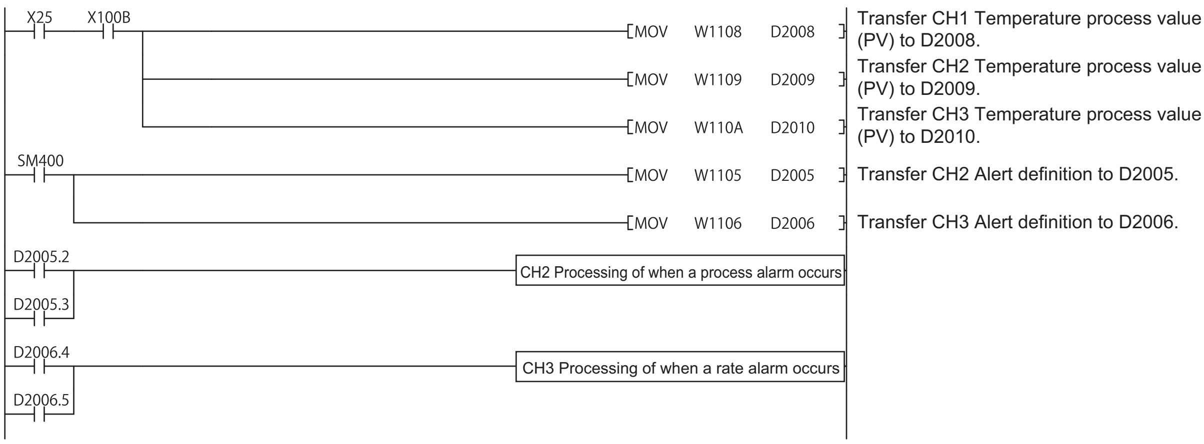
- Common program

*1 Add the following MCR instruction to the end of the program.

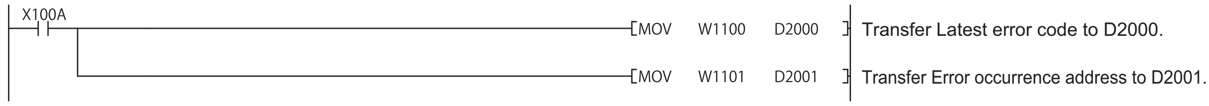


- Operation shift program for CH1 to CH3

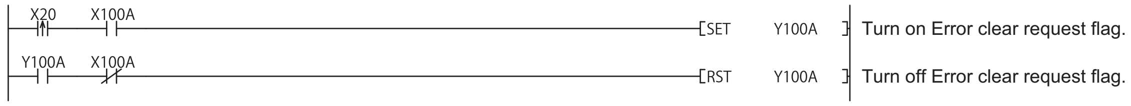
- Program that reads the temperature process value (PV) and takes action when a process alarm or a rate alarm occurs



- Program that reads Latest error code and Error occurrence address

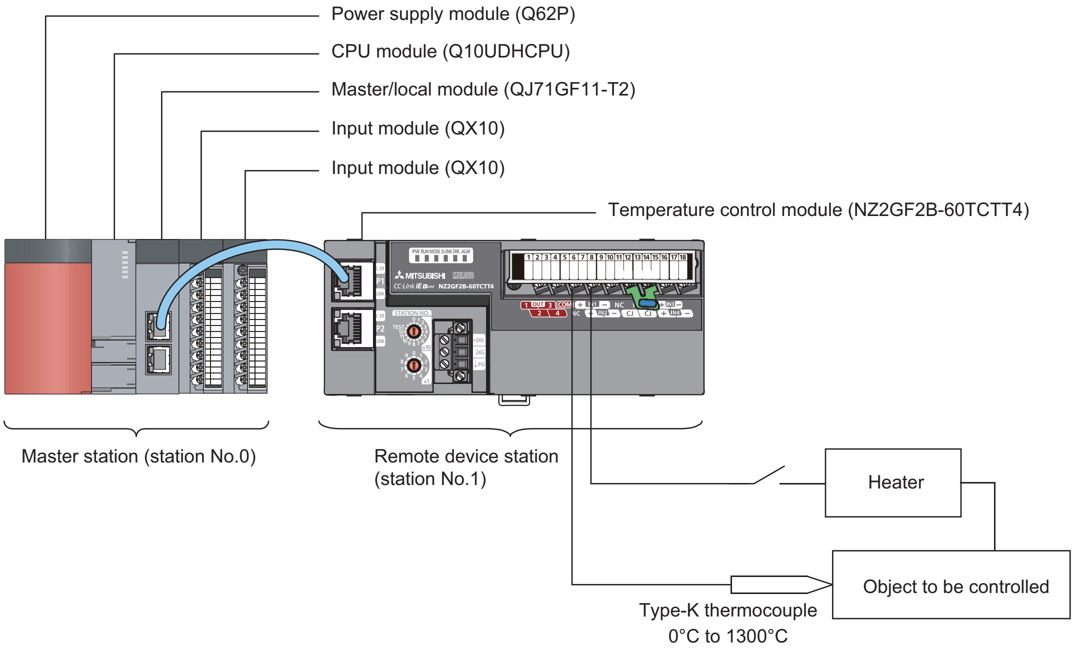


- Program that clears an error

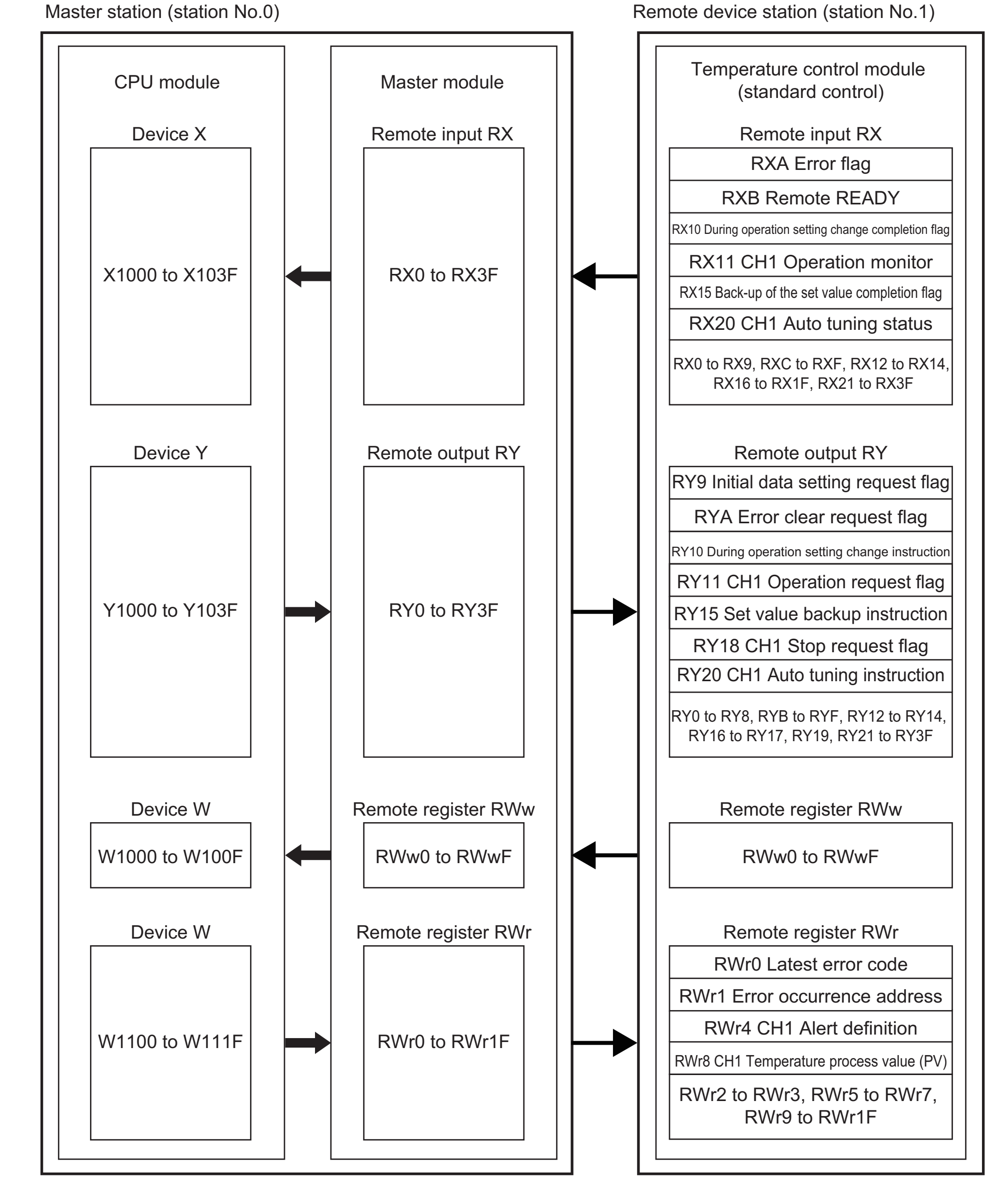


9.3.2 Standard control (such as auto tuning, self-tuning, and error code read)

(1) System configuration



(a) Link device assignment



(2) Programming condition

This program is designed to read the temperatures measured with the thermocouple (K type, 0 to 1300℃) connected to CH1.

An error code can be read and reset.

The self-tuning function automatically sets the PID constants optimal to CH1.

(3) Contents of the initial setting

(a) Station-based parameter

Setting item		Set value
Control mode switching		0: Standard control
Function extension and sampling cycle selection	Sampling cycle selection	1: 250ms/4 Channel

Set the initial values for the parameters other than the above.

(b) Standard control mode parameter

Setting item		Set value
CH1 Basic setting	CH1 Input range	2: K: 0 to 1300℃ (in increments of 1℃)
	CH1 Target value_SV_setting	2000 (200℃)
CH1 Limiter setting	CH1 Upper limit setting limiter	4000 (400℃)
	CH1 Lower limit setting limiter	0 (0℃)
CH1 Control output cycle setting_CH1 Heating control output cycle setting		30 (30s)
CH1 Warning setting	CH1 Mode setting of warning 1	1: Upper limit input alert
	CH1 Warning setting value 1	2500 (250℃)
Self tuning setting*1	CH1 Self tuning setting	1: Starting ST (PID constant only)

Set the initial values for the parameters other than the above.

*1 This setting is necessary only when the self-tuning function is used.

(4) Device for user

Device	Description	
X20	Error reset signal	QX10 (X20 to X2F)
X21	CH1 Operation request instruction	
X26	CH1 Set value (SV) change instruction	
X2B	CH1 Setting change instruction	
X30	CH1 Auto tuning execute instruction	QX10 (X30 to X3F)
X100A	Error flag	NZ2GF2B-60TCTT4 (X1000 to X103F)
X100B	Remote READY	
X1010	During operation setting change completion flag	
X1011	CH1 Operation monitor	
X1015	Back-up of the set value completion flag	
X1020	CH1 Auto tuning status	
Y1009	Initial data setting request flag	NZ2GF2B-60TCTT4 (Y1000 to Y103F)
Y100A	Error clear request flag	
Y1010	During operation setting change instruction	
Y1011	CH1 Operation request flag	
Y1015	Set value backup instruction	
Y1018	CH1 Stop request flag	
Y1020	CH1 Auto tuning instruction	
D2000	Latest error code	
D2001	Error occurrence address	
D2004	CH1 Alert definition	
D2008	CH1 Temperature process value (PV)	
D2012	CH1 Set value	
D2013	CH1 Alert set value 1	
W1100	Latest error code	Device to be written by link refresh
W1104	CH1 Alert definition	
W1108	CH1 Temperature process value (PV)	
M1 to M2	Contact for parameter setting	
M10	CH1 Auto tuning completion flag	
M300, M302	REMTO instruction completion flag	
M301, M303	REMTO instruction error completion flag	
SM400	Always ON	
SB47	Baton pass status (own station) (master station)	
SB49	Data link status (own station) (master station)	
SWA0.0	Baton pass status (each station) (station number 1)	
SWB0.0	Data link status (each station) (station number 1)	
N0	Nesting (station number 1)	

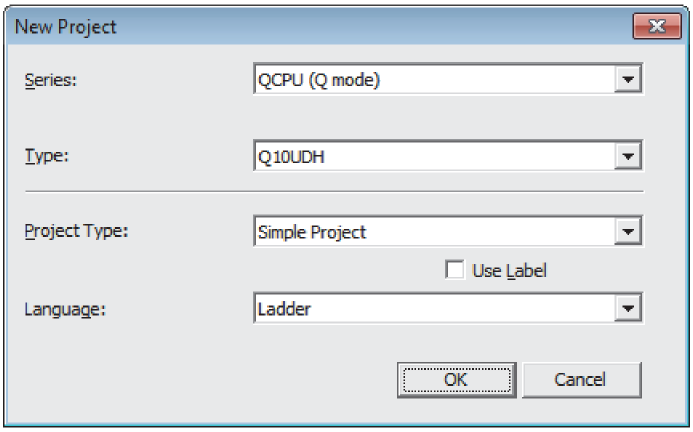
(5) Setting procedure

Connect GX Works2 to the master station to configure the setting.

1. Create a project on GX Works2.

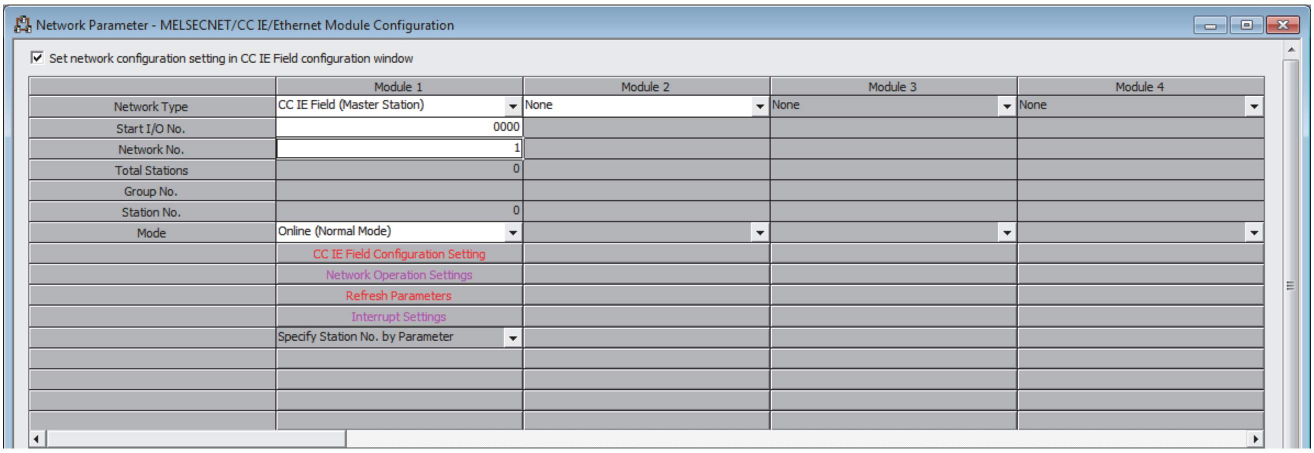
Select "QCPU (Q mode)" for "Series" and select "Q10UDH" for "Module Type".

[Project] ⇨ [New...]



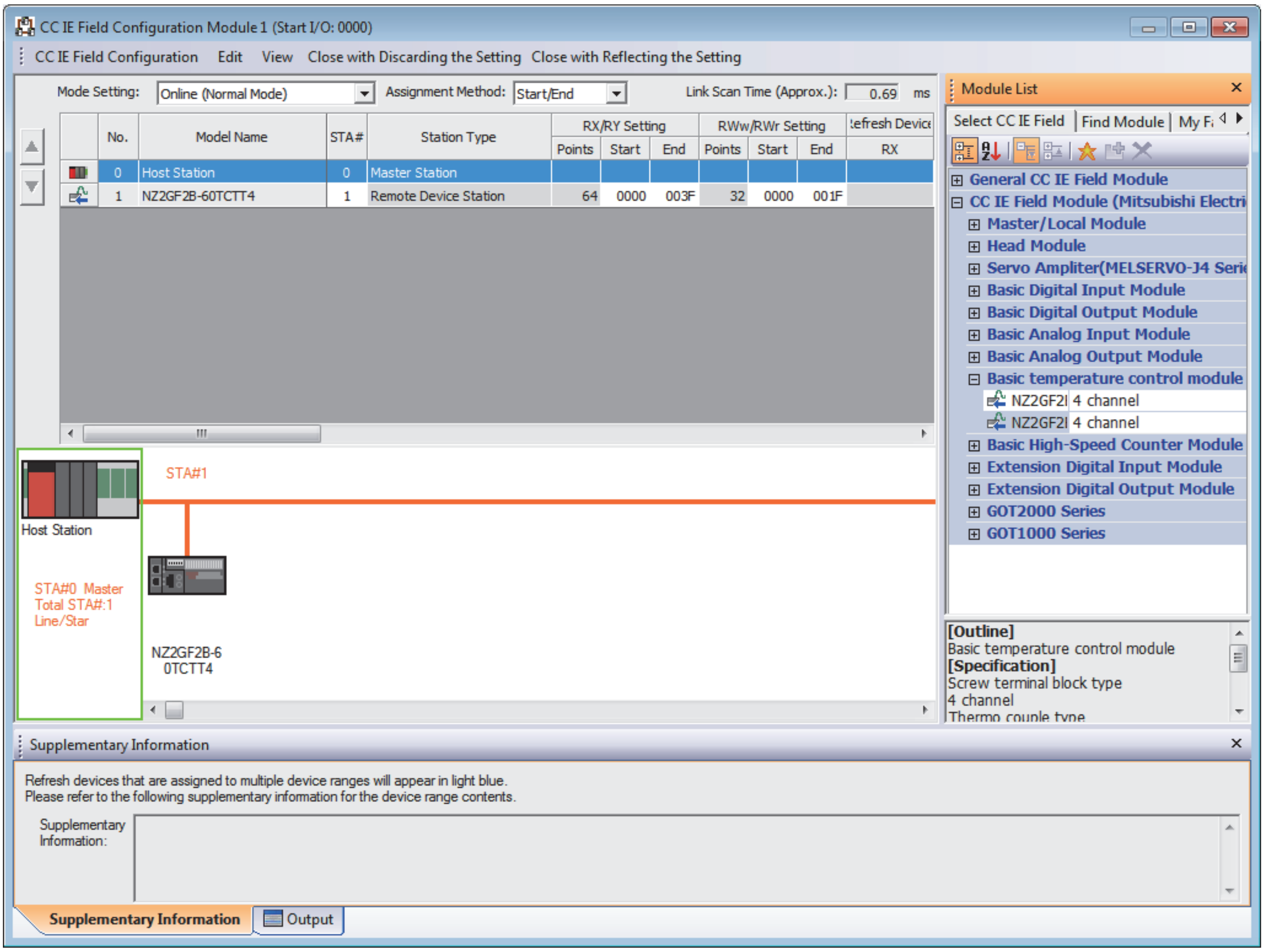
2. Display the network parameter setting window and configure the setting as follows.

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]



3. **Display the CC IE Field Configuration window and configure the configuration and station number of the slave station as follows.**

[CC IE Field Configuration Setting] button



4. **Close the CC IE Field Configuration window.**

[CC IE Field Configuration] ⇨ [Close with Reflecting the Setting]

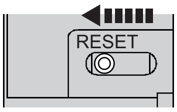
5. **Display the refresh parameter setting window and configure the setting as follows.**

[Refresh Parameters] button

	Link Side					PLC Side			
	Dev. Name	Points	Start	End		Dev. Name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Transfer 1	RX	64	0000	003F	↔	X	64	1000	103F
Transfer 2	RY	64	0000	003F	↔	Y	64	1000	103F
Transfer 3	RWw	16	0000	000F	↔	W	16	001000	00100F
Transfer 4	RWr	32	0000	001F	↔	W	32	001100	00111F
Transfer 5					↔				
Transfer 6					↔				
Transfer 7					↔				
Transfer 8					↔				

6. **Write the set parameter to the CPU module of the master station and reset the CPU module, or turn off and on the power supply.**

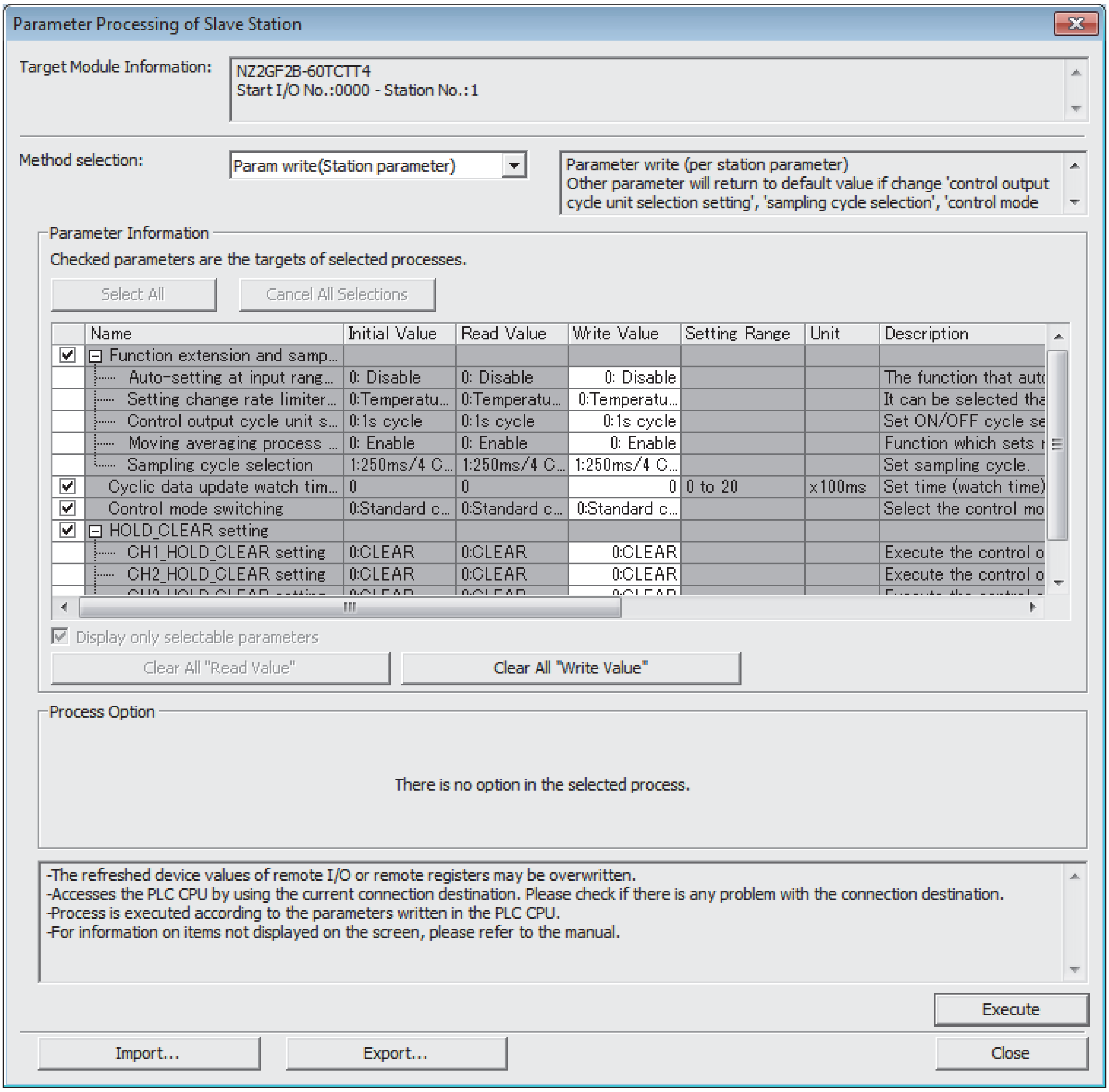
[Online] ⇨ [Write to PLC...]



or Turn off and on the power.

7. **Display the "Parameter Processing of Slave Station" window, set "Method selection" to "Param write (Station parameter)" or "Param write (Standard control)", and set the items described in the contents of the initial setting.**

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET] ⇨ [CC IE Field Configuration Setting] button ⇨ Select the temperature control module in "List of stations". ⇨ [CC IE Field Configuration] ⇨ [Online] ⇨ [Parameter Processing of Slave Station]



For the contents of the initial setting, refer to the following.

☞ Page 246, Section 9.3.2 (3)

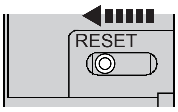
For how to write the station-based parameter and standard control mode parameter to the temperature control module, refer to the following.

☞ Page 108, Section 7.1

(6) Programming and writing data

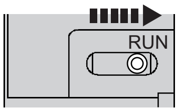
1. **Create the following programs with GX Works2 depending on the functions used.**
☞ Page 252, Section 9.3.2 (6) (a)

2. **Write the program to the CPU module of the master station and reset the CPU module, or turn off and on the power supply.**



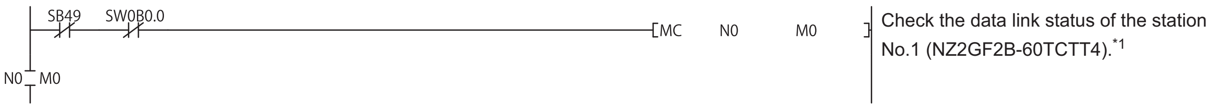
or Turn off and on the power.

3. **Change the state of the CPU module of the master station to RUN.**

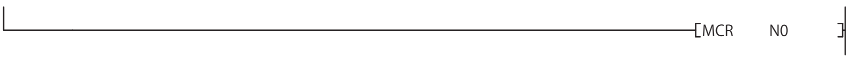


(a) Program examples

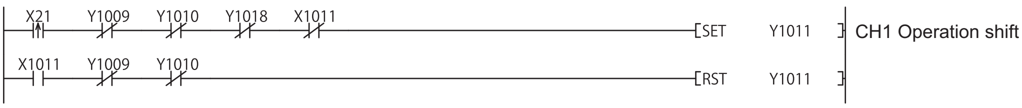
- Common program



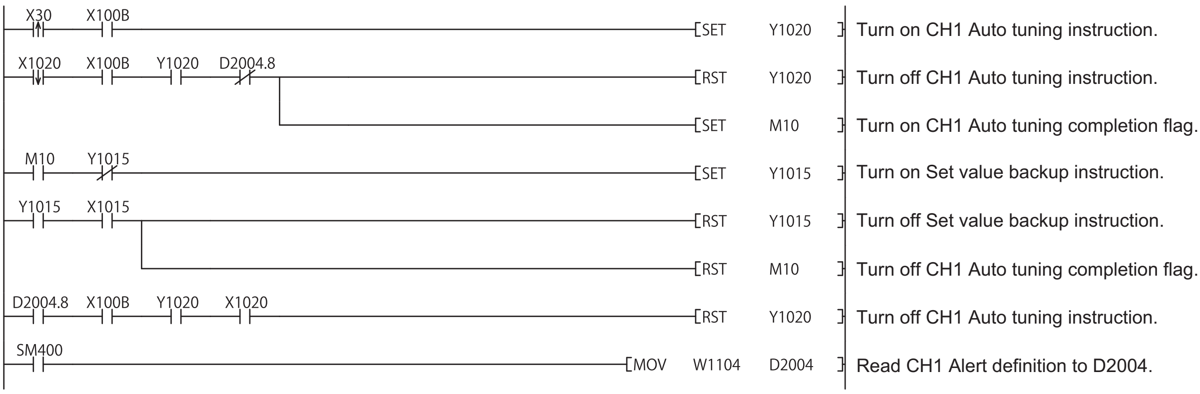
*1 Add the following MCR instruction to the end of the program.



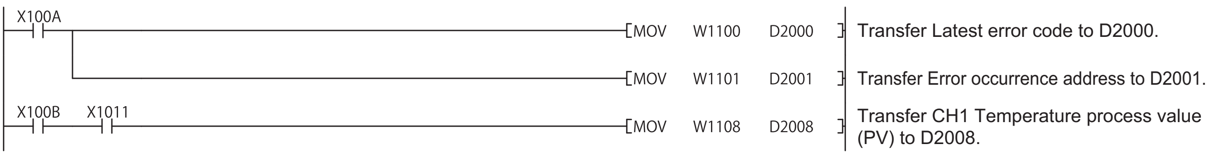
- Operation shift program for CH1



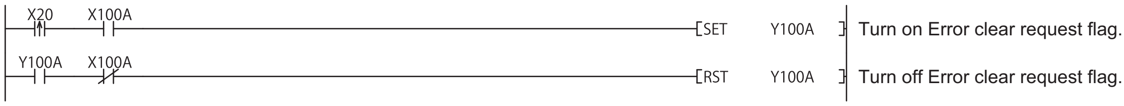
- Program that executes the auto tuning and backs up the PID constants in the non-volatile memory if the auto tuning is normally completed (program that stops the auto tuning when an alert is detected)



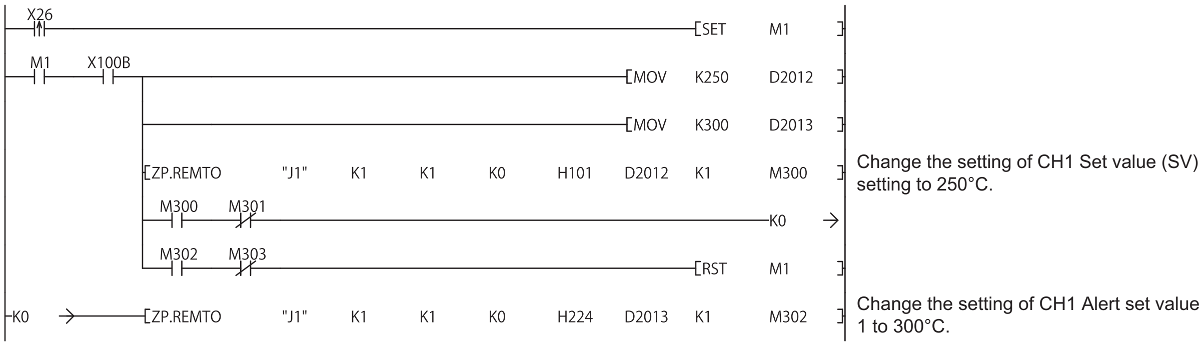
- Program that reads Latest error code, Error occurrence address, and Temperature process value (PV)



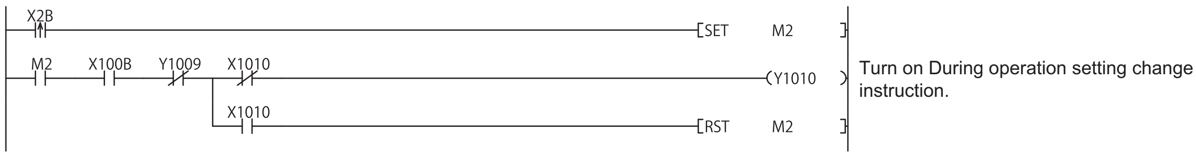
- Program that clears an error



- Program that changes Set value (SV) setting and Alert set value 1 (The changed values are not reflected to the parameters.)

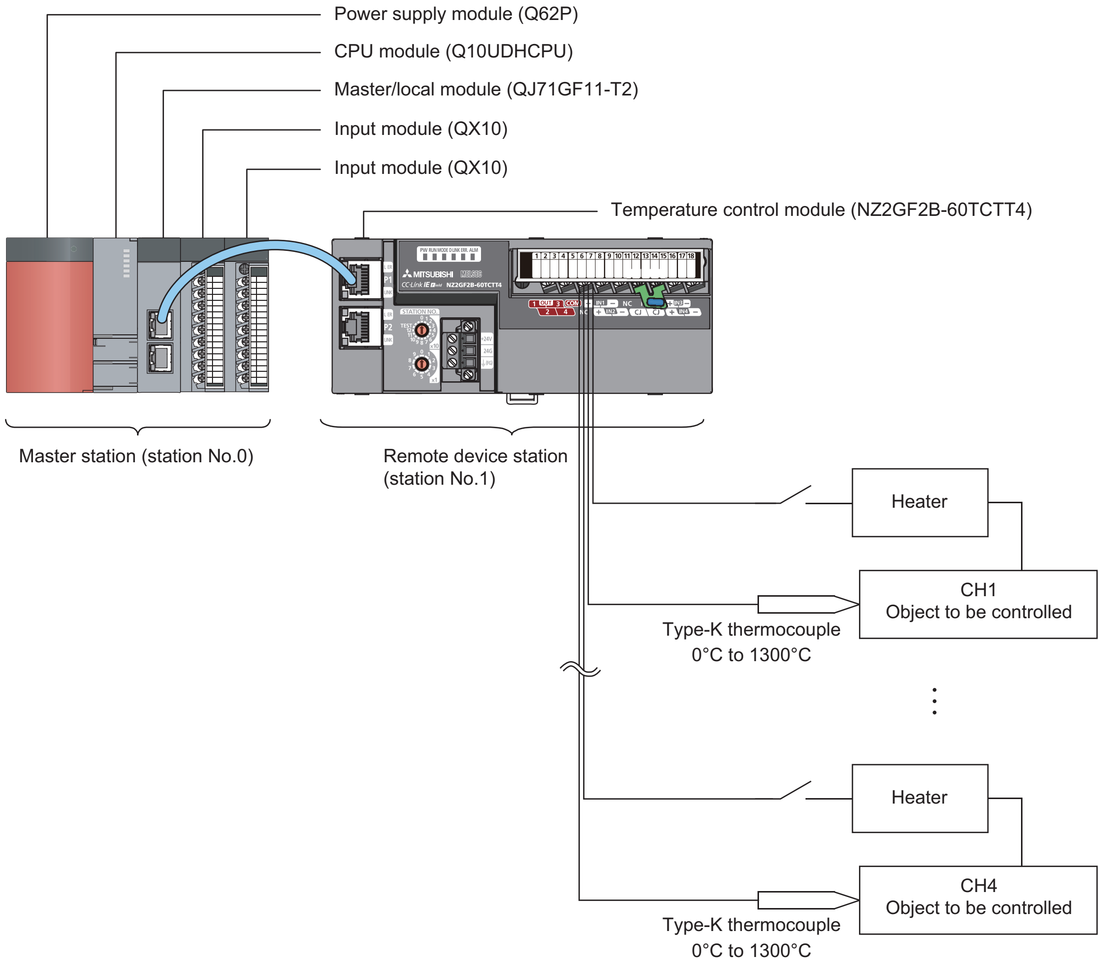


- Program that changes a setting during the operation of CH1

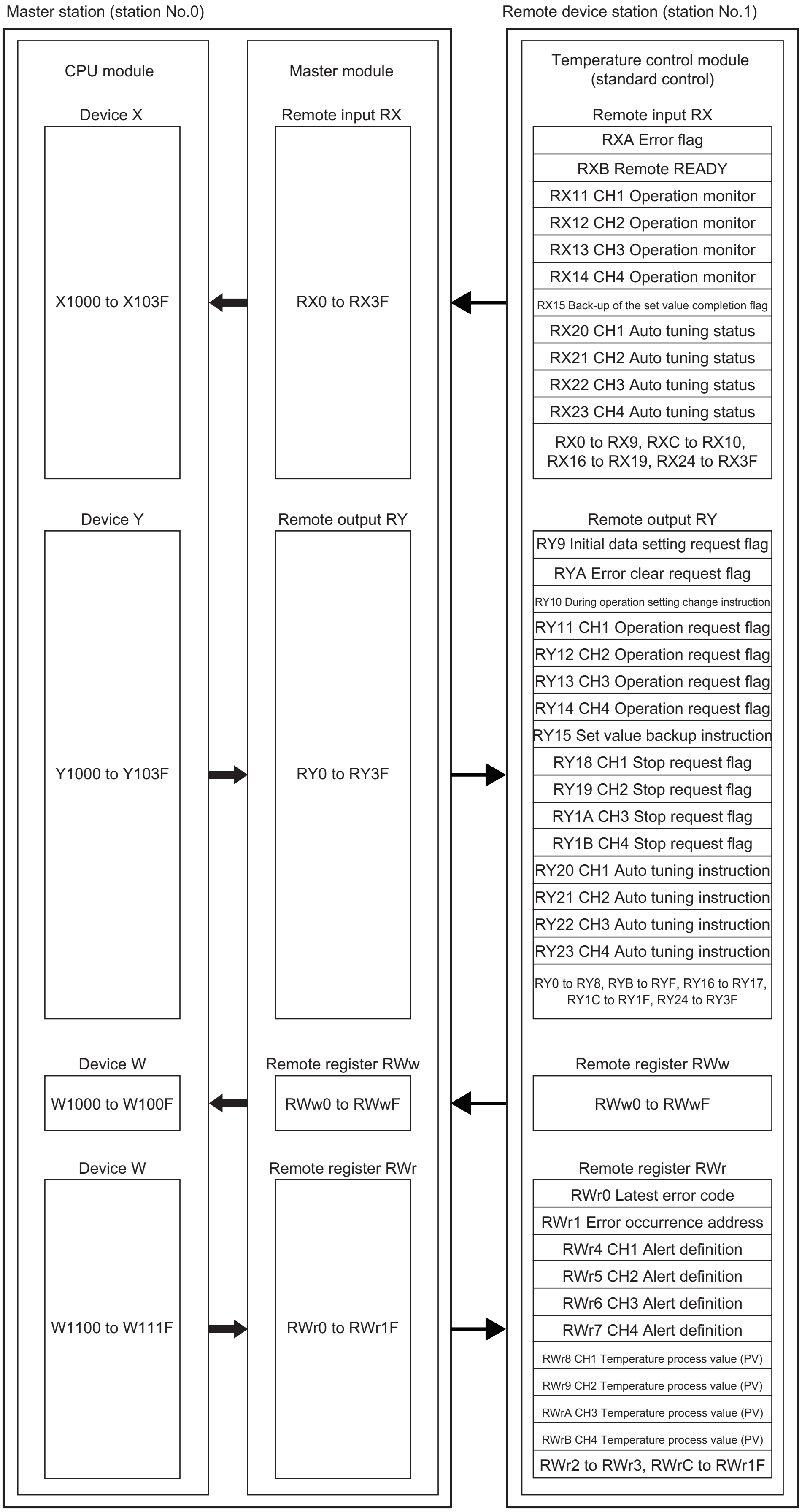


9.3.3 Standard control (peak current suppression function, simultaneous temperature rise function)

(1) System configuration



(a) Link device assignment



(2) Programming condition

- The program using the peak current suppression function is designed to suppress the peak current by automatically changing the values of the upper limit output limiter of CH1 to CH4 and dividing the timing of the transistor output into four timing.
- The program using the simultaneous temperature rise function is designed to classify the CH1 and CH2 into group 1 and CH3 and CH4 into group 2 so that the channels in each group reach the set values (SV) simultaneously.

(3) Contents of the initial setting

(a) Station-based parameter

Setting item		Set value
Control mode switching		0: Standard control
Function extension and sampling cycle selection	Sampling cycle selection	1: 250ms/4 Channel

Set the initial values for the parameters other than the above.

(b) Standard control mode parameter

Setting item		Set value
CH1 Basic setting	CH1 Input range	2: K: 0 to 1300℃ (in increments of 1℃)
	CH1 Target value_SV_setting	200 (200℃)
CH1 Control output cycle setting_CH1 Heating control output cycle setting		20 (20s)
CH2 Basic setting	CH2 Input range	2: K: 0 to 1300℃ (in increments of 1℃)
	CH2 Target value_SV_setting	250 (250℃)
CH2 Control output cycle setting_CH2 Heating control output cycle setting		20 (20s)
CH3 Basic setting	CH3 Input range	2: K: 0 to 1300℃ (in increments of 1℃)
	CH3 Target value_SV_setting	300 (300℃)
CH3 Control output cycle setting_CH3 Heating control output cycle setting		20 (20s)
CH4 Basic setting	CH4 Input range	2: K: 0 to 1300℃ (in increments of 1℃)
	CH4 Target value_SV_setting	350 (350℃)
CH4 Control output cycle setting_CH4 Heating control output cycle setting		20 (20s)
Peak current control function*1	CH1 Peak current restrain control_divide group setting	1: Group 1
	CH2 Peak current restrain control_divide group setting	2: Group 2
	CH3 Peak current restrain control_divide group setting	3: Group 3
	CH4 Peak current restrain control_divide group setting	4: Group 4
CH1 Warning setting	CH1 Mode setting of warning 1	1: Upper limit input alert
	CH1 Warning setting value 1	250 (250℃)
CH2 Warning setting	CH2 Mode setting of warning 1	1: Upper limit input alert
	CH2 Warning setting value 1	300 (300℃)
CH3 Warning setting	CH3 Mode setting of warning 1	1: Upper limit input alert
	CH3 Warning setting value 1	350 (350℃)
CH4 Warning setting	CH4 Mode setting of warning 1	1: Upper limit input alert
	CH4 Warning setting value 1	400 (400℃)
CH1 Simultaneous temperature rise function setting*2	CH1 Simultaneous temperature rise group setting	1: Group 1
	CH1 Simultaneous temperature rise AT mode selection	1: AT for simultaneous temperature rise

Setting item		Set value
CH2 Simultaneous temperature rise function setting*2	CH2 Simultaneous temperature rise group setting	1: Group 1
	CH2 Simultaneous temperature rise AT mode selection	1: AT for simultaneous temperature rise
CH3 Simultaneous temperature rise function setting*2	CH3 Simultaneous temperature rise group setting	2: Group 2
	CH3 Simultaneous temperature rise AT mode selection	1: AT for simultaneous temperature rise
CH4 Simultaneous temperature rise function setting*2	CH4 Simultaneous temperature rise group setting	2: Group 2
	CH4 Simultaneous temperature rise AT mode selection	1: AT for simultaneous temperature rise

Set the initial values for the parameters other than the above.

*1 Configure this setting only when the peak current suppression function is used.
*2 Configure this setting only when the simultaneous temperature rise function is used.

(4) Device for user

Device	Description	
X20	Error reset signal	QX10 (X20 to X2F)
X21	CH1 Operation request instruction	
X22	CH2 Operation request instruction	
X23	CH3 Operation request instruction	
X24	CH4 Operation request instruction	
X30	Auto tuning execute instruction	QX10 (X30 to X3F)
X100A	Error flag	NZ2GF2B-60TCTT4 (X1000 to X103F)
X100B	Remote READY	
X1011	CH1 Operation monitor	
X1012	CH2 Operation monitor	
X1013	CH3 Operation monitor	
X1014	CH4 Operation monitor	
X1015	Back-up of the set value completion flag	
X1020	CH1 Auto tuning status	
X1021	CH2 Auto tuning status	
X1022	CH3 Auto tuning status	
X1023	CH4 Auto tuning status	
Y1009	Initial data setting request flag	NZ2GF2B-60TCTT4 (Y1000 to Y103F)
Y100A	Error clear request flag	
Y1010	During operation setting change instruction	
Y1011	CH1 Operation request flag	
Y1012	CH2 Operation request flag	
Y1013	CH3 Operation request flag	
Y1014	CH4 Operation request flag	
Y1015	Set value backup instruction	
Y1018	CH1 Stop request flag	
Y1019	CH2 Stop request flag	
Y101A	CH3 Stop request flag	
Y101B	CH4 Stop request flag	
Y1020	CH1 Auto tuning instruction	
Y1021	CH2 Auto tuning instruction	
Y1022	CH3 Auto tuning instruction	
Y1023	CH4 Auto tuning instruction	
D2000	Latest error code	
D2001	Error occurrence address	
D2004	CH1 Alert definition	
D2005	CH2 Alert definition	

<table>
<tr><th>Device</th><th colspan="2">Description</th></tr>
<tr><td>D2006</td><td colspan="2">CH3 Alert definition</td></tr>
<tr><td>D2007</td><td colspan="2">CH4 Alert definition</td></tr>
<tr><td>D2008</td><td colspan="2">CH1 Temperature process value (PV)</td></tr>
<tr><td>D2009</td><td colspan="2">CH2 Temperature process value (PV)</td></tr>
<tr><td>D2010</td><td colspan="2">CH3 Temperature process value (PV)</td></tr>
<tr><td>D2011</td><td colspan="2">CH4 Temperature process value (PV)</td></tr>
<tr><td>W1100</td><td>Latest error code</td><td rowspan="10">Device to be written by link refresh</td></tr>
<tr><td>W1101</td><td>Error occurrence address</td></tr>
<tr><td>W1104</td><td>CH1 Alert definition</td></tr>
<tr><td>W1105</td><td>CH2 Alert definition</td></tr>
<tr><td>W1106</td><td>CH3 Alert definition</td></tr>
<tr><td>W1107</td><td>CH4 Alert definition</td></tr>
<tr><td>W1108</td><td>CH1 Temperature process value (PV)</td></tr>
<tr><td>W1109</td><td>CH2 Temperature process value (PV)</td></tr>
<tr><td>W110A</td><td>CH3 Temperature process value (PV)</td></tr>
<tr><td>W110B</td><td>CH4 Temperature process value (PV)</td></tr>
<tr><td>M10</td><td colspan="2">CH1 Auto tuning completion flag</td></tr>
<tr><td>M11</td><td colspan="2">CH2 Auto tuning completion flag</td></tr>
<tr><td>M12</td><td colspan="2">CH3 Auto tuning completion flag</td></tr>
<tr><td>M13</td><td colspan="2">CH4 Auto tuning completion flag</td></tr>
<tr><td>SM400</td><td colspan="2">Always ON</td></tr>
<tr><td>SB47</td><td colspan="2">Baton pass status (own station) (master station)</td></tr>
<tr><td>SB49</td><td colspan="2">Data link status (own station) (master station)</td></tr>
<tr><td>SWA0.0</td><td colspan="2">Baton pass status (each station) (station number 1)</td></tr>
<tr><td>SWB0.0</td><td colspan="2">Data link status (each station) (station number 1)</td></tr>
<tr><td>N0</td><td colspan="2">Nesting (station number 1)</td></tr>
</table>

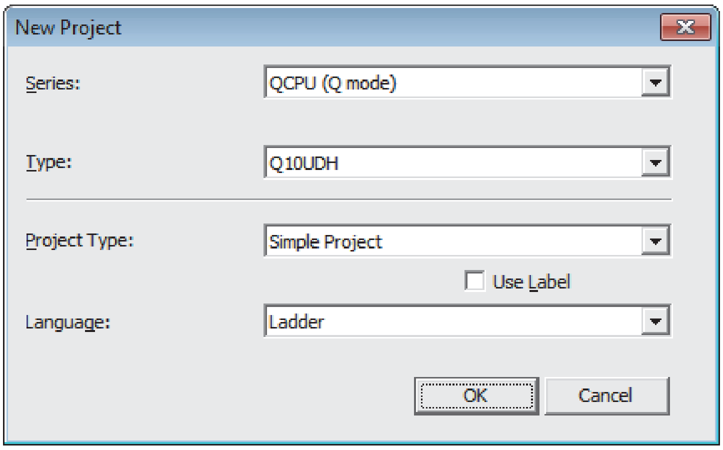
(5) Setting procedure

Connect GX Works2 to the master station to configure the setting.

1. Create a project on GX Works2.

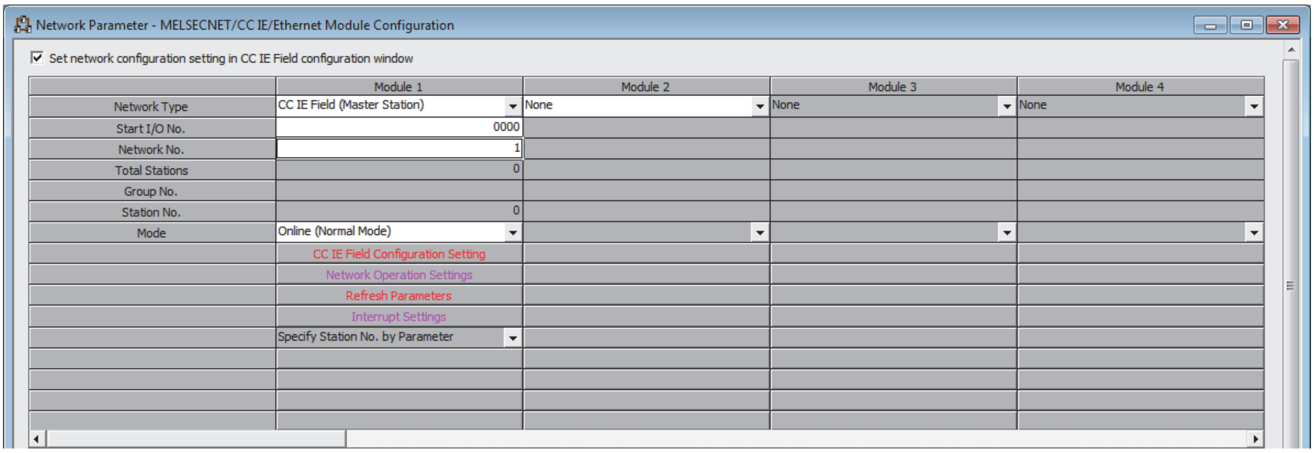
Select "QCPU (Q mode)" for "Series" and select "Q10UDH" for "Module Type".

[Project] ⇨ [New...]



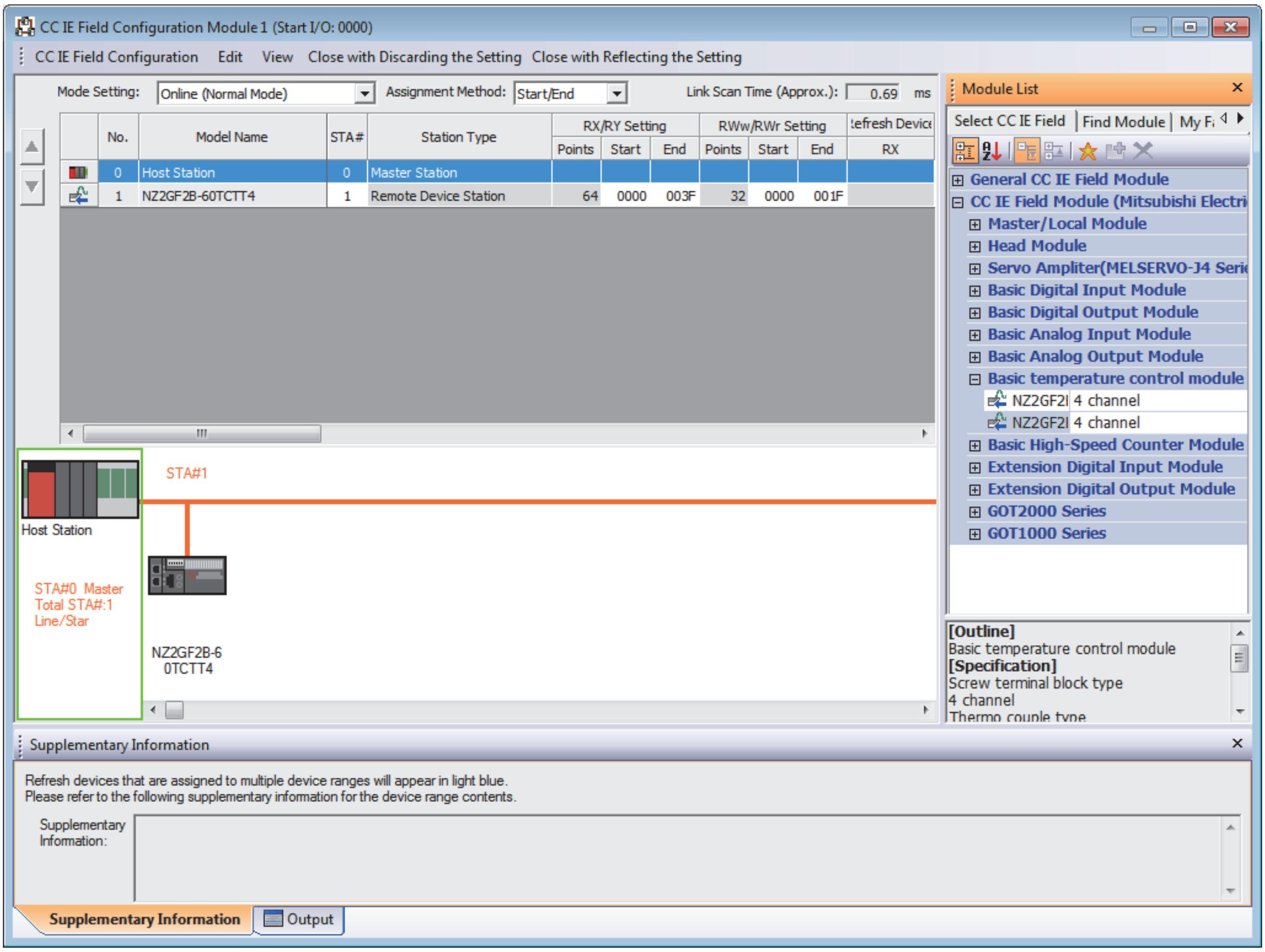
2. Display the network parameter setting window and configure the setting as follows.

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]



3. **Display the CC IE Field Configuration window and configure the configuration and station number of the slave station as follows.**

[CC IE Field Configuration Setting] button



4. **Close the CC IE Field Configuration window.**

[CC IE Field Configuration] ⇨ [Close with Reflecting the Setting]

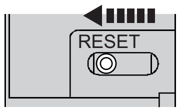
5. **Display the refresh parameter setting window and configure the setting as follows.**

[Refresh Parameters] button

	Link Side					PLC Side			
	Dev. Name	Points	Start	End		Dev. Name	Points	Start	End
Transfer SB	SB	512	0000	01FF	⇔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	⇔	SW	512	0000	01FF
Transfer 1	RX	64	0000	003F	⇔	X	64	1000	103F
Transfer 2	RY	64	0000	003F	⇔	Y	64	1000	103F
Transfer 3	RWw	16	0000	000F	⇔	W	16	001000	00100F
Transfer 4	RWr	32	0000	001F	⇔	W	32	001100	00111F
Transfer 5					⇔				
Transfer 6					⇔				
Transfer 7					⇔				
Transfer 8					⇔				

6. **Write the set parameter to the CPU module of the master station and reset the CPU module, or turn off and on the power supply.**

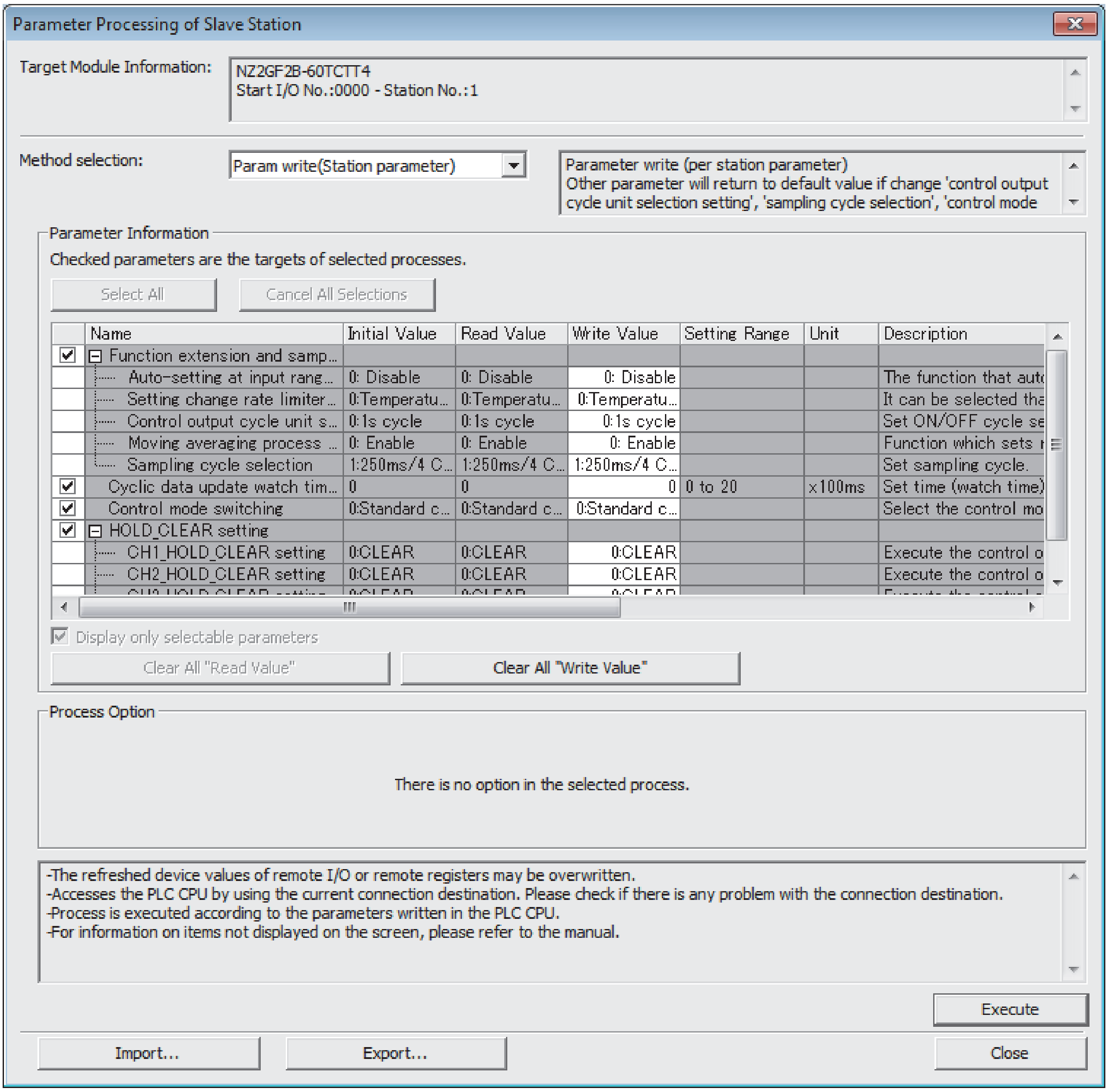
[Online] ⇨ [Write to PLC...]



or Turn off and on the power.

7. **Display the "Parameter Processing of Slave Station" window, set "Method selection" to "Param write (Station parameter)" or "Param write (Standard control)", and set the items described in the contents of the initial setting.**

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET] ⇨ [CC IE Field Configuration Setting] button ⇨ Select the temperature control module in "List of stations". ⇨ [CC IE Field Configuration] ⇨ [Online] ⇨ [Parameter Processing of Slave Station]



For the contents of the initial setting, refer to the following.

☞ Page 256, Section 9.3.3 (3)

For how to write the station-based parameter and standard control mode parameter to the temperature control module, refer to the following.

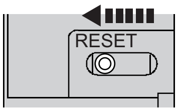
☞ Page 108, Section 7.1

(6) Programming and writing data

1. **Create the following programs with GX Works2 depending on the functions used.**

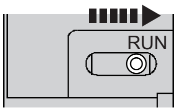
☞ Page 263, Section 9.3.3 (6) (a)

2. **Write the program to the CPU module of the master station and reset the CPU module, or turn off and on the power supply.**



or Turn off and on the power.

3. **Change the state of the CPU module of the master station to RUN.**

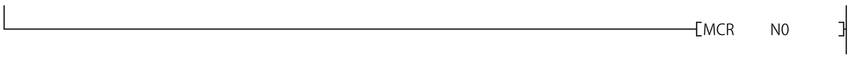


(a) Program examples

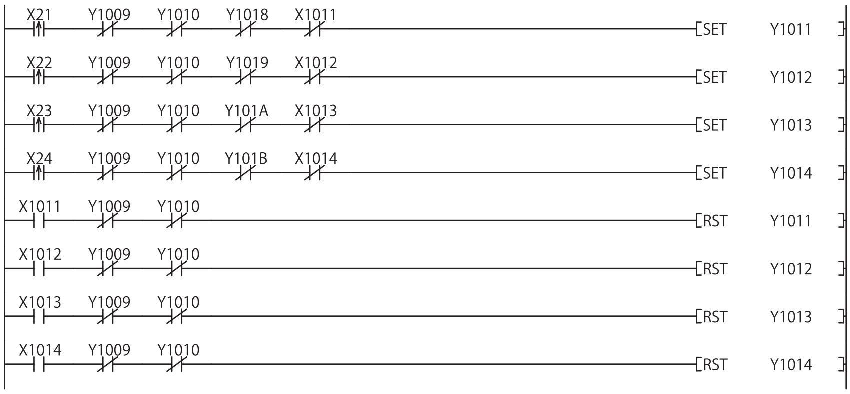
- Common program

Check the data link status of the station No.1 (NZ2GF2B-60TCTT4).*1

*1 Add the following MCR instruction to the end of the program.

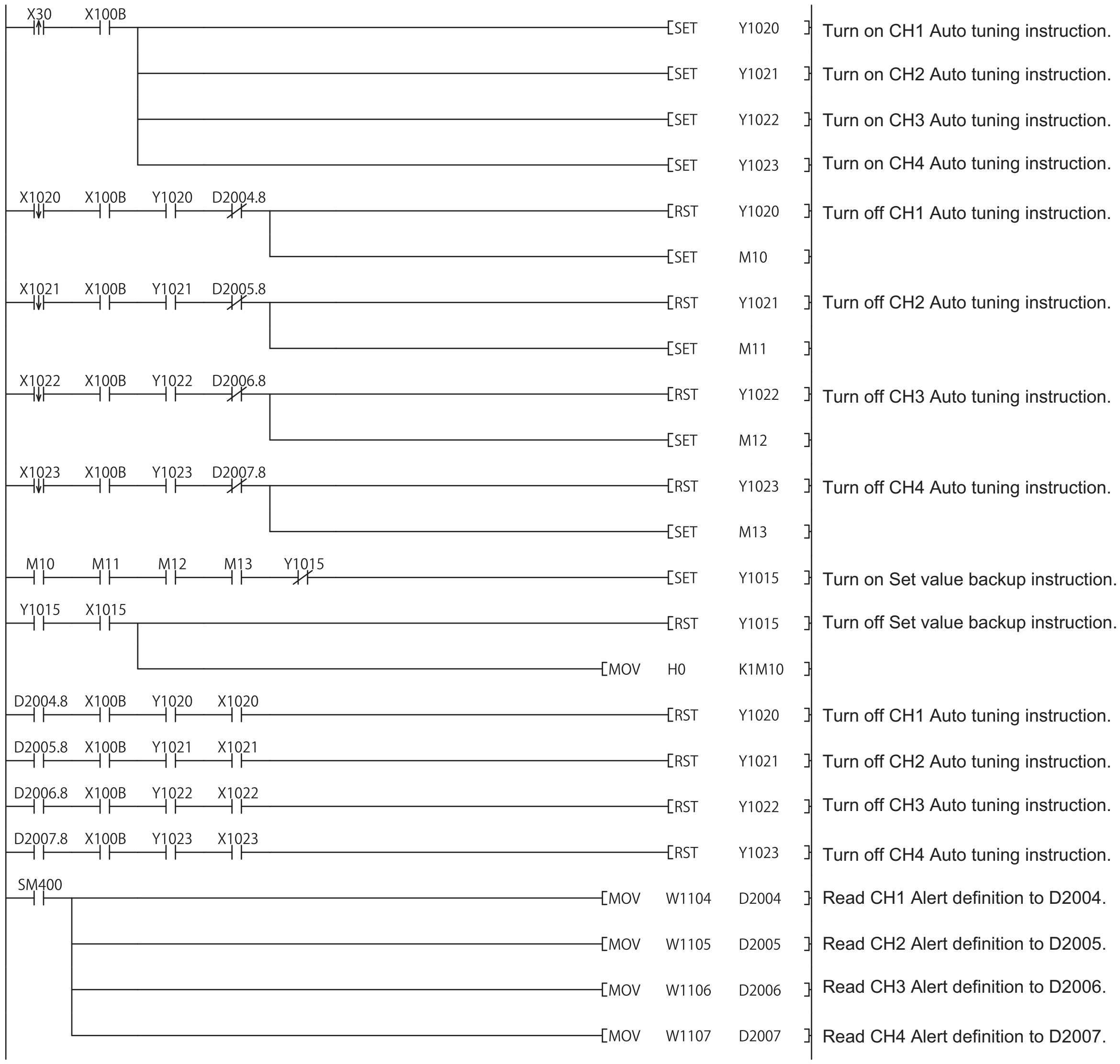


- Operation shift program for CH1 to CH4

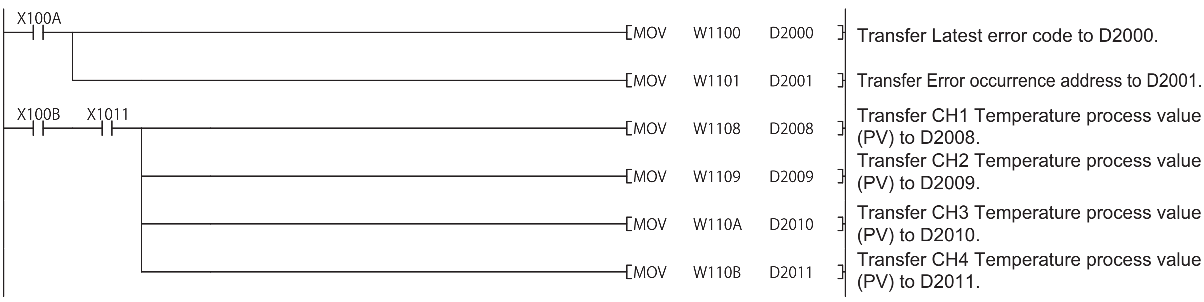


CH1 Operation shift
CH2 Operation shift
CH3 Operation shift
CH4 Operation shift

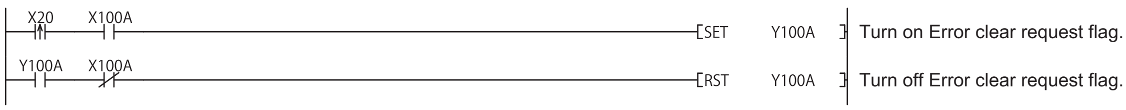
- Program that executes the auto tuning and backs up the PID constants in the non-volatile memory if the auto tuning is normally completed (program that stops the auto tuning when an alert is detected)



- Program that reads Latest error code, Error occurrence address, and Temperature process value (PV)



- Program that clears an error



CHAPTER 10 MAINTENANCE AND INSPECTION

The temperature control module has no special item to be inspected. However, to maintain the best condition of the system, perform the inspection in accordance with the items described in the user's manual for the CPU module used. In addition, to use CC-Link IE Field Network in the best condition, refer to the user's manual for the master/local module used as well.

CHAPTER 11 TROUBLESHOOTING

This chapter describes errors that may occur when the temperature control module is used, and those troubleshooting.

11.1 Checking for Error Codes and Alarm Codes

Error codes can be checked by any of the following methods:

- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Checking with Latest error code (RWr0) and Error occurrence address (RWr1) (☞ Page 270, Section 11.1 (2))
- Checking with Latest warning code (RWr2) (☞ Page 270, Section 11.1 (3))

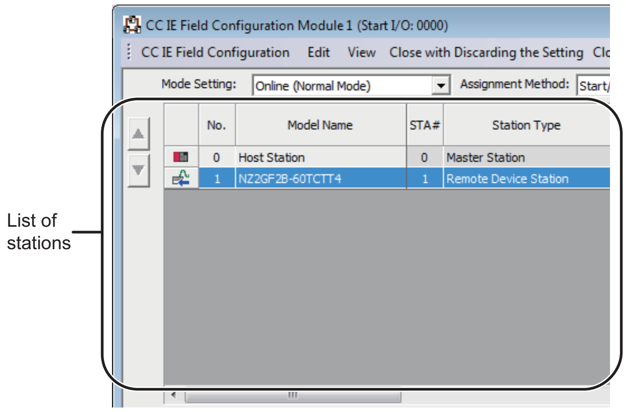
Alarm codes can be checked by any of the following methods:

- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Checking with Latest warning code (RWr2) (☞ Page 270, Section 11.1 (3))

(1) Checking with the command execution of slave station

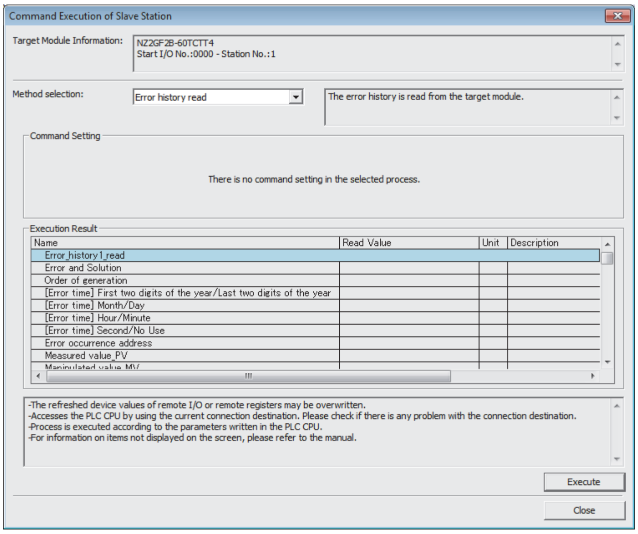
The following shows how to check errors with the command execution of slave station.

1. Select the temperature control module in "List of stations" on the CC IE Field Configuration window.

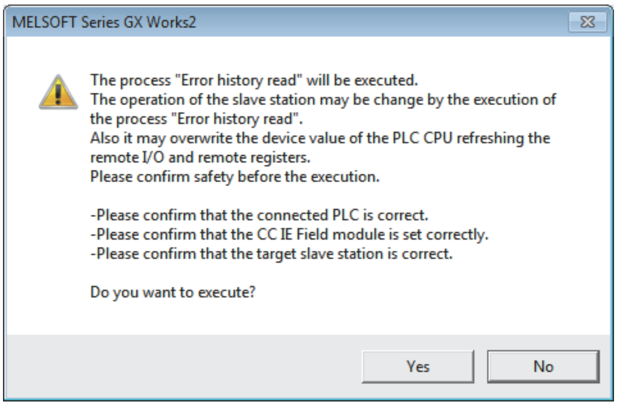


2. Open the "Command Execution of Slave Station" window.

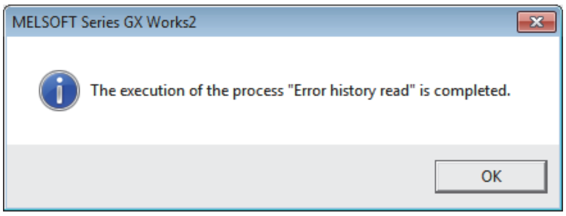
[CC IE Field Configuration] ⇨ [Online] ⇨ [Command Execution of Slave Station]



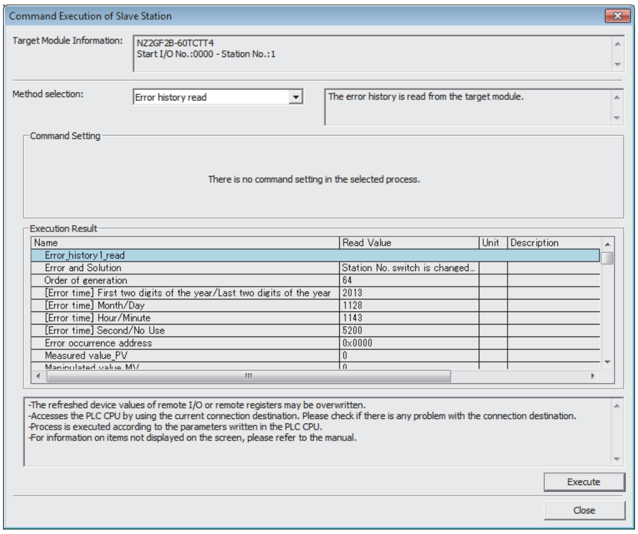
3. Set "Method selection" to "Error history read" and click the [Execute] button.



4. When the window shown on the left is displayed, click the [Yes] button.



5. When the window shown on the left is displayed, click the [OK] button.

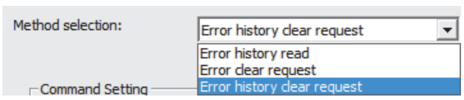


6. **The error history of the temperature control module is displayed in "Execution Result".**

Item	Contents
Error and Solution	The descriptions of the error is displayed.
Order of generation	The order of error occurrence is displayed.
[Error time] First two digits of the year/Last two digits of the year	The date and time of error occurrence is displayed. (When the tens place of Month, Hour, and Second is "0", the date and time are displayed without "0".)
[Error time] Month/Day	
[Error time] Hour/Minute	
[Error time] Second/No Use	
Error occurrence address	The details of the error is stored.
Measured value PV	
Manipulated value MV	
Target value SV	

Point

- The error history registers 15 errors at a maximum. If 16 or more errors occur, errors are deleted from the oldest.
- Even after the power of the module is turned off and on, the error history remains.
- The clock information of the error that occurred is based on the clock information acquired from the CPU module of the master station. To obtain accurate date and time of the error, synchronize the clock information of the CPU module with actual time.
- Read the error history of the module with the CPU module in the STOP state. The history cannot be read in the RUN state.
- To initialize the error history, set "Method selection" to "Error history clear request" on the "Command Execution of Slave Station" window and click the [Execute] button.

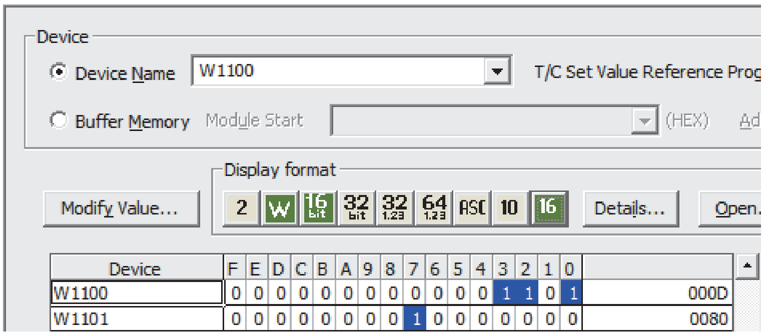


(2) Checking with Latest error code (RWr0) and Error occurrence address (RWr1)

Check the error with the remote register of the master/local module.

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

Ex. When the refresh target device for Latest error code (RWr0) is W1100 and the refresh target device for Error occurrence address (RWr1) is W1101

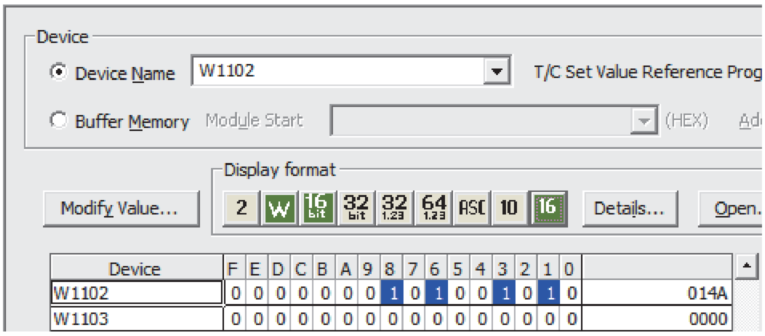


(3) Checking with Latest warning code (RWr2)

Check the error with the remote register of the master/local module.

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

Ex. When the refresh target device for Latest warning code (RWr2) is W1102



11.2 Lists of Error Codes

This section describes error codes.
Error codes are classified by error number as follows.

Error code	Classification	Reference
0000H to 3FFFH, D529H, D52BH	Temperature control module error	Page 271, Section 11.2 (1)
D000H to DFFFH (D529H and D52BH excluded)	CC-Link IE Field Network error (communication system error)	Page 276, Section 11.2 (2)

(1) List of error codes (0000H to 3FFFH, D529H, D52BH)

The errors are classified into the following three types.

Classification	Description
Major error	An error where the module cannot be recovered. The RUN LED turns off.
Moderate error	An error where the module cannot continue to operate. The ERR. LED turns on. However, with some moderate errors, the module keeps operating using the setting value of normal operation.
Minor error	An error where the module can continue to operate. The ERR. LED flashes.

If an error has occurred, check that the D LINK LED is on and take actions as listed below.

(a) List of error codes (0000H to 015FH)

Error code (hexadecimal)	Classification	Cause	Operation at error occurrence	Error details*1	Action
0001H	Major error	Hardware error	The operation differs depending on the symptom.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	• Check that the terminal block or the cold junction temperature compensation resistor is not disconnected or loose. (Check the cold junction temperature compensation resistor only for the NZ2GF2B-60TCTT4.) • Turn off and on the power of the system. If the same error occurs again, the possible cause is a module failure. Please consult your local Mitsubishi representative.
0003H	Moderate error	Either of the following operations is being performed. • While the module is operating, data is being written to the area where data can be written only during the module stop*2. • Initial data setting request flag (RY9) was turned on during the module operation.	• The data written is retained. • The operating status remains same as before the error occurrence.	• The address of remote buffer memory area where an error has occurred is stored in Error occurrence address. (If the parameter has not been changed, FFFFH is stored in Error occurrence address. In addition, 0 is stored in Process value (PV), Manipulated value (MV), and Set value (SV). • The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Follow the instructions below and clear the error. 1. Stop operation for all channels. 2. Set a correct value and turn on and off Initial data setting request flag (RY9). If the changed parameter is the changeable one during operation and an error (0003H) has occurred, the error also can be cleared by following the instructions below. 1. Turn off Initial data setting request flag (RY9). 2. Turn on and off During operation setting change instruction (RY10). If FFFFH is stored in Error occurrence address, the error also can be cleared by following the instructions below. 1. Turn off Initial data setting request flag (RY9). 2. Turn on and off Error clear request flag (RYA).

Error code (hexadecimal)	Classification	Cause	Operation at error occurrence	Error details[*1]	Action
0004H	Moderate error	Data out of the setting range is being written.	• The data written is retained. • If temperature, time, or percentage settings exceed upper limit value/lower limit value, the control is performed with the upper limit value/lower limit value.	• The address of remote buffer memory area where an error has occurred is stored in Error occurrence address.[*3] • The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Set the data within the setting range.
0005H	Moderate error	The setting of the upper/lower limit output limiter or the upper/lower limit setting limiter is invalid.	• The data written is retained. • The control is performed with the upper/lower limit value within the setting range.	• The address of remote buffer memory area where an error has occurred is stored in Error occurrence address.[*3] • The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Set the value where the upper limit value is greater than the lower limit value.
0006H	Moderate error	The setting value is being changed while Default setting registration instruction (RY16) is on.	• The data written is ignored. • The setting value cannot be changed until the error is cleared. • The content of Latest error code (RWr0) does not change even if another write error occurs.	• The address of remote buffer memory area where an error has occurred is stored in Error occurrence address.[*3] • The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Turn on and off Error clear request flag (RYA) and change the setting value.
0007H	Moderate error	The sensor two-point correction setting is invalid.	• The data written is retained. • The control is performed with the data of before the setting. • If both the offset value and gain value are within the input range and the offset value is greater than or equal to the gain value, the gain value address is stored in Error occurrence address.	• The address of remote buffer memory area where an error has occurred is stored in Error occurrence address.[*3] • The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	• Enter the temperature within the input range. • Set the values so that the sensor two-point correction offset value (measured value) is smaller than the sensor two-point correction gain value (measured value) and the sensor two-point correction offset value (corrected value) is smaller than the sensor two-point correction gain value (corrected value).

Error code (hexadecimal)	Classification	Cause	Operation at error occurrence	Error details[*1]	Action
0008H	Moderate error	The set values meet one of the following conditions. • The process alarm upper upper limit value is smaller than the upper lower limit value. • The process alarm upper lower limit value is smaller than the lower upper limit value. • The process alarm lower upper limit value is smaller than the lower lower limit value.	• The data written is retained. • The control is performed with the data of before the setting.	• The address of remote buffer memory area where an error has occurred is stored in Error occurrence address.[*3] • The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Set the values that meet the following conditions. • The process alarm upper upper limit value is smaller than the upper lower limit value. • The process alarm upper lower limit value is smaller than the lower upper limit value. • The process alarm lower upper limit value is smaller than the lower lower limit value.
00□9H[*4]	Moderate error	CH□ Sensor two-point correction offset latch request (RY28, RY2A, RY2C, RY2E) or CH□ Sensor two-point correction gain latch request (RY29, RY2B, RY2D, RY2F) was turned on while a channel was operating.	The latch request is ignored.	• The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Turn off CH□ Sensor two-point correction offset latch request (RY28, RY2A, RY2C, RY2E) or CH□ Sensor two-point correction gain latch request (RY29, RY2B, RY2D, RY2F) of the error channel.
000DH	Moderate error	The current set value and the set value backed up in the non-volatile memory are different due to the shift of control mode.	Remote buffer memory areas (100H or later) are overwritten with default values.	0080H is stored in Error occurrence address.	Turn on Set value backup instruction (RY15).
000EH	Moderate error	The current set value and the set value backed up in the non-volatile memory are different due to the change of control output cycle unit.	The control output cycle setting, heating control output cycle setting, and cooling control output cycle setting are overwritten with default values.	0001H is stored in Error occurrence address.	Turn on Set value backup instruction (RY15).
000FH	Moderate error	The current set value and the set value backed up in the non-volatile memory are different due to the change of sampling cycle.	Remote buffer memory areas (100H or later) are overwritten with default values.	0001H is stored in Error occurrence address.	Turn on Set value backup instruction (RY15).

Error code (hexadecimal)	Classification	Cause	Operation at error occurrence	Error details*1	Action
001□H*4	Moderate error	When either of CH□ Operation request flag (RY11 to RY14) or CH□ Stop request flag (RY18 to RY1B) was on, the other signal was also turned on.	The operating status remains same as before the error occurrence.	• The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Turn off CH□ Operation request flag (RY11 to RY14) or CH□ Stop request flag (RY18 to RY1B) of the error channel.
002□H*4	Moderate error	The value written to CH□ Temperature process value for input with another analog module (PV) (RWw0 to RWw3) is invalid.	• The data written is retained. • The control is performed with the upper/lower limit value within the setting range.	• The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	Set the value within the setting range to CH□ Temperature process value for input with another analog module (PV) (RWw0 to RWw3) of the error channel.

*1 The error details written here are for the case when Error history is A06H to A09H (for Error history 1 (address: A00H to A0FH)). The following information of when an error has occurred are stored in this area.
- Error occurrence address
- Process value (PV)
- Manipulated value (MV)
- Set value (SV)

For details on Error history, refer to the following.
☞ Page 363, Appendix 3 (69)

*2 For the area where data can be written only during the module stop, refer to Lists of Remote Buffer Memory Areas.
☞ Page 49, Section 3.7

*3 If the following values are stored in Error occurrence address, 0 is stored in Process value (PV), Manipulated value (MV), and Set value (SV) of Error history.
0001H, 0007H, 0080H, 0081H, 01E0H to 01EAH, 1000H

*4 □ represents the channel number where an error has occurred.

Point

When multiple errors have occurred, only the latest error code is stored in Latest error code (RWr0) or Latest warning code (RWr2).
The errors that occurred in the past can be checked with the error history of the engineering tool.
For the error history, refer to the following.
- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Error history □ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

(b) List of error codes (0160H to 3FFFH, D529H, D52BH)

Error code (hexadecimal)	Classification	Error name	Description and cause	Error details[*1]	Action
0160H	Minor error	Remote buffer memory access error	A buffer memory area other than the remote buffer memory areas has been accessed using the REMFR/REMTO instruction.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	Correct the setting data of the REMFR/REMTO instruction to access the remote buffer memory.
0930H	Moderate error	Cyclic data update watch time setting outside the range	The value set in Cyclic data update watch time (address: 7H) is outside the range of 0 to 20.	• 0007H is stored in Error occurrence address. • 0 is stored in Process value (PV), Manipulated value (MV), and Set value (SV).	Set a value within the range of 0 to 20 in Cyclic data update watch time (address: 7H).
0940H	Minor error	Station number switch changed error	The station number setting switch has been changed while the module power is on.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	Set the switch again to the same station number that was set while the module power was on.
0950H	Moderate error	Clock data outside the range	The clock data acquired from the CPU module is invalid.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	The possible cause is an affect of noise or a hardware failure. If the same error has occurred even after measures have been taken against noise, please consult your local Mitsubishi representative.
0960H	Major error	Network No. changed through the network	Invalid change of a network number has been detected.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	The possible cause is an affect of noise or a hardware failure. If the same error has occurred even after measures have been taken against noise, please consult your local Mitsubishi representative.
0970H	Major error	Station No. changed through the network	Invalid change of a station number has been detected.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	The possible cause is an affect of noise or a hardware failure. If the same error has occurred even after measures have been taken against noise, please consult your local Mitsubishi representative.
D529H	Major error	Communication error 1	A communication error has occurred.	0 is stored in Error occurrence address, Process value (PV), Manipulated value (MV), and Set value (SV).	• The possible cause is malfunction due to noise. Check the cable distance or grounding condition of each device and take measures against noise. • Execute a unit test for the module. If the same error has occurred, the possible cause is a hardware failure of the module. Please consult your local Mitsubishi representative.
D52BH	Major error	Communication error 2			

*1 The error details written here are for the case when Error history is A06H to A09H (for Error history 1 (address: A00H to A0FH)). The following information of when an error has occurred are stored in this area.
- Error occurrence address
- Process value (PV)
- Manipulated value (MV)
- Set value (SV)

For details on Error history, refer to the following.
☞ Page 363, Appendix 3 (69)

Point

When multiple errors have occurred, only the latest error code is stored in Latest error code (RWr0) or Latest warning code (RWr2).
The errors that occurred in the past can be checked with the error history of the engineering tool.
For the error history, refer to the following.
- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Error history □ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

(2) List of error codes (D000H to DFFFH (D529H and D52BH excluded))

While any of these errors occurs, the ERR. LED does not turn on. Based on the behavior of the D LINK LED at the occurrence of an error, the errors are classified into two types, each of which requires different troubleshooting.

(a) Communication errors where the D LINK LED flashes or turns off

This type of communication error results in the D LINK LED flashing or being turned off. Troubleshoot the problem with the CC-Link IE Field Network diagnostics. (☞ Page 229, Section 8.4.3)

Error code (hexadecimal)	Error name	Description and cause	Action
D0E0H	Station type mismatch	The network parameter is invalid or outside the range.	Change the station type of the module to the remote device station in the network configuration settings of the master station.
D0E1H	Own station reserved	The network parameter is invalid or outside the range.	• Cancel the reserved station specification in the network configuration settings of the master station. • Change the station number of the module to a station number that is not reserved.
D0E2H	Station No. already in use (own station)	The network parameter is invalid or outside the range.	• Set a unique station number. • After taking the above action, turn off and on or reset all the stations where this error has been detected.
D0E3H	Own station No. out of range	The network parameter is invalid or outside the range.	Add the station information of the module in the network configuration settings of the master station.
D72AH	Station number switch out of range (a value other than 1 to 120)	A value other than 1 to 120.is set as a station number.	Set a station number in the range of 1 to 120.

(b) Communication errors where the D LINK LED does not change

This type of communication error results in no change of the D LINK LED. These errors are not shown in CC-Link IE Field Network diagnostics because they are automatically recovered after the occurrence. Troubleshooting them requires the error history to be read out. (☞ Page 267, Section 11.1 (1))

Error code (hexadecimal)	Error name	Description and cause	Action
D217H	Transient data command error	The transient data request command is invalid.	Correct the request command at the request source, and retry the operation.
D2A0H	Receive buffer full	The transient transmission is overloaded and the receive buffer of the own station is full.	• Check the network status using the CC-Link IE Field Network diagnostics of the engineering tool. • Send transient data to the own station at intervals.

Point

When multiple errors have occurred, only the latest error code is stored in Latest error code (RWr0) or Latest warning code (RWr2).
The errors that occurred in the past can be checked with the error history of the engineering tool.
For the error history, refer to the following.

- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Error history □ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

11.3 List of Alarm Codes

This section lists alarm codes.

Alarm code (hexadecimal)*1	Classification	Cause	Operation at alarm occurrence	Alarm details*2	Action
01□AH	Minor error	The temperature process value (PV) has exceeded the temperature measurement range that was set as the input range.	• The ALM LED flashes. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Input range upper limit (b0 of RWr4 to RWr7) turns on.	• The process value of the error channel is stored in Process value (PV). • The manipulated value of the error channel is stored in Manipulated value (MV). • The set value of the error channel is stored in Set value (SV).	When the temperature process value (PV) has returned within the setting range, the corresponding bit of CH□ Alert definition (RWr4 to RWr7) and CH□ Alert occurrence flag (RX18 to RX1B) automatically turns off. Latest warning code (RWr2) is automatically cleared when the temperature process value (PV) has returned within the setting range.
02□AH	Minor error	The temperature process value (PV) is below the temperature measurement range that was set as the input range.	• The ALM LED flashes. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Input range lower limit (b1 of RWr4 to RWr7) turns on.		
03□AH	Minor error	A loop disconnection has been detected.	• The ALM LED flashes. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Loop disconnection detection (b13 of RWr4 to RWr7) turns on.		When the system has been restored to the state before disconnection, CH□ Loop disconnection detection (b13 of RWr4 to RWr7) and CH□ Alert occurrence flag (RX18 to RX1B) automatically turn off. Latest warning code (RWr2) is automatically cleared.
06□AH	Minor error	Alert 1 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Alert 1 (b8 of RWr4 to RWr7) turns on.		When the temperature process value (PV) has returned within the setting range, the corresponding bit of CH□ Alert definition (RWr4 to RWr7) and CH□ Alert occurrence flag (RX18 to RX1B) automatically turns off. Latest warning code (RWr2) is automatically cleared when the temperature process value (PV) has returned within the setting range.
07□AH	Minor error	Alert 2 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Alert 2 (b9 of RWr4 to RWr7) turns on.		
08□AH	Minor error	Alert 3 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Alert 3 (b10 of RWr4 to RWr7) turns on.		
09□AH	Minor error	Alert 4 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (RX18 to RX1B) turns on. • CH□ Alert 4 (b11 of RWr4 to RWr7) turns on.		

<table>
<tr><th>Alarm code (hexadecimal)*1</th><th>Classification</th><th>Cause</th><th>Operation at alarm occurrence</th><th>Alarm details*2</th><th>Action</th></tr>
<tr><td>0A□AH</td><td>Minor error</td><td>A process alarm upper limit alert has occurred.</td><td>• The ALM LED turns on.
• CH□ Alert occurrence flag (RX18 to RX1B) turns on.
• CH□ Process alarm upper limit (b2 of RWr4 to RWr7) turns on.</td><td rowspan="4">• The process value of the error channel is stored in Process value (PV).
• The manipulated value of the error channel is stored in Manipulated value (MV).
• The set value of the error channel is stored in Set value (SV).</td><td rowspan="2">When the temperature process value (PV) has returned within the setting range, the corresponding bit of CH□ Alert definition (RWr4 to RWr7) and CH□ Alert occurrence flag (RX18 to RX1B) automatically turns off. Latest warning code (RWr2) is automatically cleared when the temperature process value (PV) has returned within the setting range.</td></tr>
<tr><td>0B□AH</td><td>Minor error</td><td>A process alarm lower limit alert has occurred.</td><td>• The ALM LED turns on.
• CH□ Alert occurrence flag (RX18 to RX1B) turns on.
• CH□ Process alarm lower limit (b3 of RWr4 to RWr7) turns on.</td></tr>
<tr><td>0C□AH</td><td>Minor error</td><td>A rate alarm upper limit alert has occurred.</td><td>• The ALM LED turns on.
• CH□ Alert occurrence flag (RX18 to RX1B) turns on.
• CH□ Rate alarm upper limit (b4 of RWr4 to RWr7) turns on.</td><td rowspan="2">When the temperature process value (PV) has returned within the setting range, the corresponding bit of CH□ Alert definition (RWr4 to RWr7) and CH□ Alert occurrence flag (RX18 to RX1B) automatically turns off. Latest warning code (RWr2) is automatically cleared when the temperature process value (PV) has returned within the setting range.</td></tr>
<tr><td>0D□AH</td><td>Minor error</td><td>A rate alarm lower limit alert has occurred.</td><td>• The ALM LED turns on.
• CH□ Alert occurrence flag (RX18 to RX1B) turns on.
• CH□ Rate alarm lower limit (b5 of RWr4 to RWr7) turns on.</td></tr>
</table>

*1 □ represents the channel number where an error has occurred.

*2 The error details written here are for the case when Error history is A06H to A09H (for Error history 1 (address: A00H to A0FH)). The following information of when an error has occurred are stored in this area.

- Error occurrence address
- Process value (PV)
- Manipulated value (MV)
- Set value (SV)

For details on Error history, refer to the following.
☞ Page 363, Appendix 3 (69)

11.4 Checks Using LEDs

This section describes how to troubleshoot the system using the LEDs.

(1) The PW LED has turned off

Check the following items.

Check item	Action
LEDs other than the PW LED is on.	When LEDs other than the PW LED is on, the possible cause is a hardware failure. Please consult your local Mitsubishi representative.
The module power supply (24VDC) is not wired.	Wire the module power supply (24VDC).
The module power supply (24VDC) is off.	Turn on the module power supply (24VDC).
The voltage of the module power supply (24VDC) is out of the specified range.	Set the voltage value within the range of performance specifications.

(2) The RUN LED has turned off

Check the following item.

Check item	Action
The voltage of the module power supply (24VDC) is out of the specified range.	Check that the voltage of the module power supply (external power supply) is within the range of performance specifications. (☞ Page 34, Section 3.2) After the check, turn on the module power supply.

If the RUN LED does not turn on even after the above-mentioned action has been taken, the possible cause is a module failure. Please consult your local Mitsubishi representative.

(3) The MODE LED flashes

Check the following item.

Check item	Action
The temperature control module is in execution of the unit test.	When the temperature control module is in execution of the unit test, the D LINK LED turns on after the unit test is completed. Take actions according to the result of the unit test. (☞ Page 282, Section 11.5)

(4) The MODE LED has turned off

Check the following item.

Check item	Action
The MODE LED does not turn on even after the module power supply has been turned on.	The possible cause is a hardware failure. Please consult your local Mitsubishi representative.

(5) The D LINK LED has turned off

Check the following items.

Check item	Action
The own station on the network is not operating normally.	Connect GX Works2 to the master station, and check that the own station is performing data link with CC-Link IE Field Network diagnostics. (User's manual for the master/local module used)
A 1000BASE-T-compliant Ethernet cable is not used.	Replace the cable with a 1000BASE-T-compliant Ethernet cable. (User's manual for the master/local module used)
The station-to-station distance exceeds 100m.	Change the station-to-station distance to 100m or less.
The cabling condition (bend radius) does not meet the specifications.	Refer to the manual for the Ethernet cable used, and correct the bend radius.
An Ethernet cable is disconnected.	Replace the Ethernet cable.
Other stations connected to the temperature control module are not operating normally.	Check that the power supplies of the other stations are on.
The switching hub is not operating normally.	• Check that a 1000BASE-T-compliant switching hub is used. (User's manual for the master/local module used) • Check that the power supply of the switching hub is on.
The same station number is used for multiple modules on the network.	Check that a unique station number is used for the temperature control module. If the same number is used, change the settings so that all of the modules on the network have different station numbers.

(6) The D LINK LED flashes

Check the following items.

Check item	Action
The actual station number of the temperature control module differs from the one set in the network configuration settings of the master station or in the CC IE Field configuration.	Match the station number of the temperature control module with the one set in the network configuration settings of the master station or in the CC IE Field configuration.
The station type is not the remote device station.	Change the station type of the module to the remote device station in the network configuration settings of the master station.
The temperature control module is set to a reserved station.	Change the setting of reserved/error invalid station to other than the reserved station in the network configuration settings of the master station.
The data link stop was checked with CC-Link IE Field Network diagnostics.	If the data link stop was checked with CC-Link IE Field Network diagnostics, start the link again.
A value other than 1 to 120.is set as a station number.	The setting range of the station number is 1 to 120. Set the number between 1 and 120.
Has the connection been changed to the other master station with a different network number?	• Correct the connection to the previous master station. • To communicate with the master station with a different network number, power off and on the temperature control module.

(7) The L ER LED has turned on

Check the following items.

Check item	Action
Ethernet cables have some problem.	• Check that 1000BASE-T-compliant Ethernet cables are used. (User's manual for the master/local module used) • Check that the station-to-station distance is 100m or less. • Check that the Ethernet cables are not disconnected.
The switching hub in the system is not operating normally.	• Check that a 1000BASE-T-compliant switching hub is used. (User's manual for the master/local module used) • Check that the power supply of the switching hub is on.
Other stations connected to the temperature control module are not operating normally.	Check that the power supplies of the other stations are on.
The mode of the module on the master station is set to other than Online.	Change the mode of the module to Online.
The system is affected by noise.	Check the wiring condition of the Ethernet cables.
Port connections are not correct to use the loopback function for the master station.	If the loopback function is enabled for the master station, check that the ring topology is correctly configured for the port where the L ER LED is on. (User's manual for the master/local module used)

(8) The LINK LED has turned off

Check the following items.

Check item	Action
Ethernet cables have some problem.	• Check that 1000BASE-T-compliant Ethernet cables are used. (User's manual for the master/local module used) • Check that the station-to-station distance is 100m or less. • Check that the Ethernet cables are not disconnected.
The switching hub in the system is not operating normally.	Check that the power supplies of the switching hub and other stations are on.

Point

If link-up processing is repeated due to a condition of a device on the line, it may take a longer time for the LINK LED to turn on. This phenomenon may be eliminated by changing the module PORT into which the Ethernet cable is connected (example: PORT1 → PORT2).
For the wiring of Ethernet cable, refer to the following.
☞ Page 93, Section 6.5

(9) The ERR.LED has turned on or flashes

Check the following item.

Check item	Action
An error has occurred.	Check the error code with the engineering tool and take actions according to the descriptions in the lists of error codes. (☞ Page 271, Section 11.2)

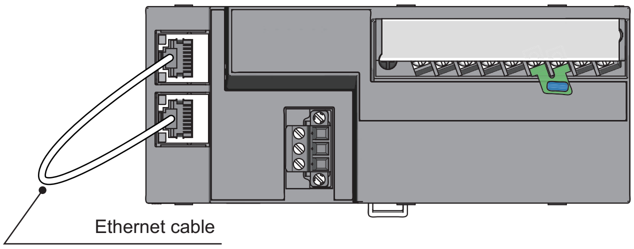
(10)The ALM LED has turned on or flashes

Check the following items.

Check item	Action
An alarm has occurred.	Check the alarm code with the engineering tool and take actions according to the descriptions in the list of alarm codes. (☞ Page 277, Section 11.3)
Some channels are not connected to a temperature sensor.	Set Stop (0) to CH□ Stop mode setting (address: 118H, 148H, 178H, 1A8H) for the channels that are not connected to a temperature sensor. (☞ Page 336, Appendix 3 (27))
A loop disconnection has been detected.	Check for a load disconnection, external device failure, and sensor disconnection.

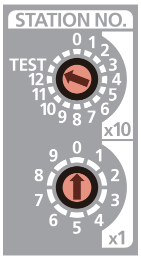
11.5 Unit Test

Execute a unit test to check that the hardware of the temperature control module is normal.



1. **Power off the module.**

2. **Connect the PORT1 and PORT2 of the temperature control module with an Ethernet cable.**



3. **Set the station number setting switches as follows.**

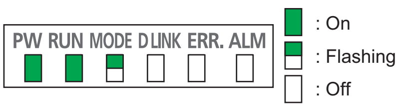
· ×10: TEST

· ×1: 0

4. **Power on the module.**

5. **The unit test begins.**

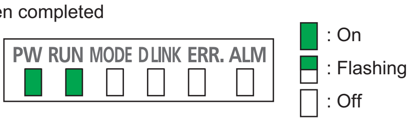
The MODE LED flashes while the unit test is being executed.



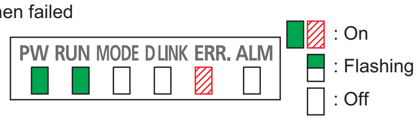
6. **The MODE LED turns off when the unit test is completed.**

- When the test is completed, the ERR. LED remains off.
- When the test fails, the ERR. LED turns on. If the test fails, replace the Ethernet cable and execute the test again. If the test fails again, the possible cause is a hardware failure of the temperature control module. Please consult your local Mitsubishi representative.

When completed



When failed



Remark

When unit test fails, the error details can be checked in the error history.
To check the error history, change the station number back from TEST and connect the temperature control module to the master station with an Ethernet cable.
For the error history, refer to the following.

- Checking with the command execution of slave station (☞ Page 267, Section 11.1 (1))
- Error history □ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

11.6 Troubleshooting by Symptom

This section describes troubleshooting by symptom.
Perform troubleshooting by symptom when the temperature control module does not operate normally with no error.
When an error has occurred in the temperature control module, identify the error cause with the engineering tool.

(1) The temperature process value (PV) is abnormal

Check the following item.

Check item	Action
The thermocouple wiring resistance value is too high.	• Check the thermocouple wiring resistance value and check whether a difference in the temperatures was caused by the wiring resistance. (☞ Page 36, Section 3.2 (1)) • Use the sensor correction function to correct the difference in the temperatures caused by the wiring resistance. (☞ Page 132, Section 8.1.5)

(2) Parameters cannot be read or written with the engineering tool and CC-Link IE Field Network diagnostics cannot be performed

Check the following items.

Check item	Action
The D LINK LED of the main module is off or flashing.	Check if the D LINK LED of the main module is off or flashing, and perform troubleshooting by referring to the following. • The D LINK LED has turned off (☞ Page 280, Section 11.4 (5)) • The D LINK LED flashes (☞ Page 280, Section 11.4 (6))
The status of LEDs other than the D LINK LED (on, flashing, or off) is indicating an error.	Check the status of LEDs other than the D LINK LED (on, flashing, or off). If the status is indicating an error, perform troubleshooting by referring to the following. • Checks Using LEDs (☞ Page 279, Section 11.4)
An applicable module is not used for the master station.	Check the first five digits of serial number of the module used for the master station, and if it is not applicable, replace it with an applicable module. For the module used for the master station, refer to the following. • Applicable master station (☞ Page 82, Section 5.1 (1))
The version of the engineering tool used is not applicable.	Check the version of the engineering tool, and if it is a version prior to the applicable one, update the engineering tool. For the applicable version of the engineering tool, refer to the following. • Software package (☞ Page 82, Section 5.1 (3))
Network parameter settings differ from the settings of the CPU module.	Perform "Verify with PLC" and check that network parameter settings match the settings of the CPU module. If they differ, match the settings by performing "Read from PLC" and "Write to PLC", and write the parameters to modules on slave stations.
Online processing with the engineering tool cannot be performed even after all of the checks (checks of the above-mentioned items, LEDs of the module, CC-Link IE Field Network diagnostics of the engineering tool, and error codes) have been done.	The possible cause is a module failure. Please consult your local Mitsubishi representative.

APPENDICES

Appendix 1 Details of Remote I/O Signals

This section describes the details of remote I/O signals assigned to the master/local module.
The assignment of each device number is for the case when the remote I/O signals of the main module are assigned as follows.

- Remote input signal: RX0 to RX3F
- Remote output signal: RY0 to RY3F

Point

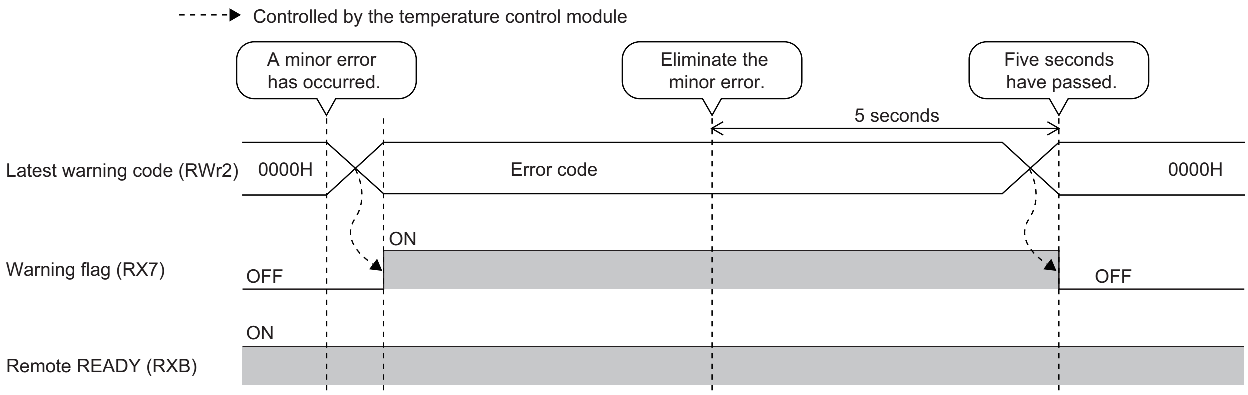
For I/O signals indicated with the icons **Standard** and **Heating-cooling**, or with **Common**, the following terms are used, unless otherwise specified.

- Proportional band (P): includes heating proportional band (Ph) and cooling proportional band (Pc).
- Manipulated value (MV): includes manipulated value for heating (MVh) and manipulated value for cooling (MVc).
- Transistor output: includes heating transistor output and cooling transistor output.
- Control output cycle: includes heating control output cycle and cooling control output cycle.

Appendix 1.1 Remote input signals

(1) Warning flag (RX7) Common

This signal turns on when a minor error occurs.
Five seconds after the cause of the minor error is eliminated, the value in Latest warning code (RWr2) is cleared (0000H is stored) and Warning flag (RX7) turns off.



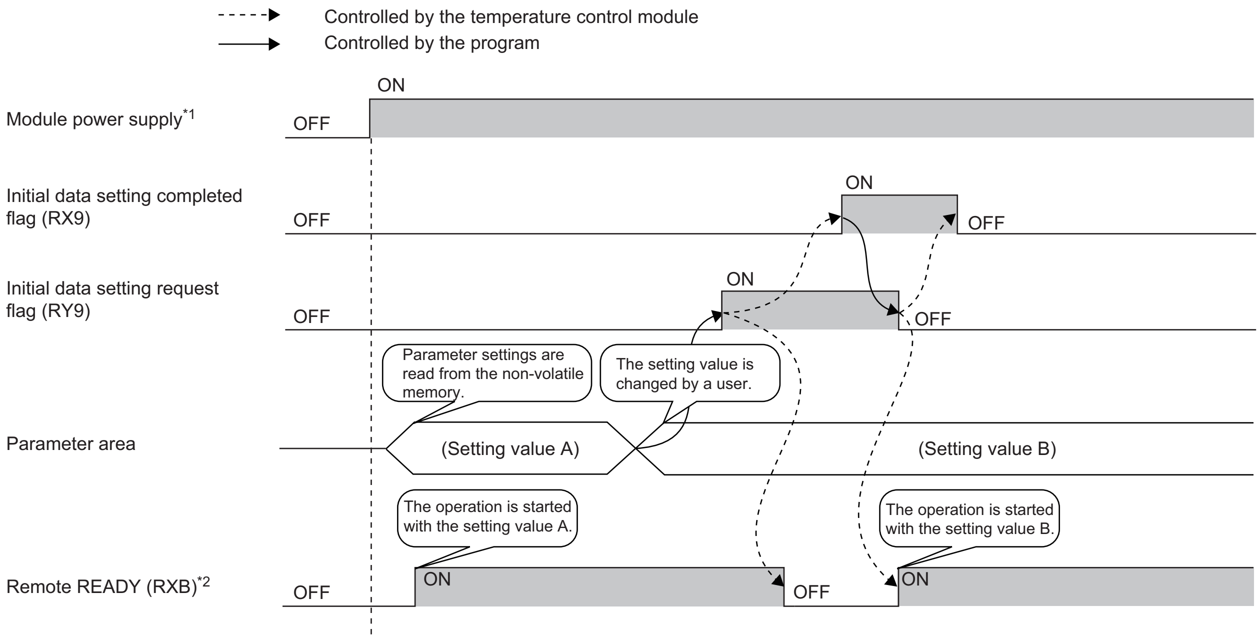
(2) Initial data setting completed flag (RX9) Common

After writing parameter data to the remote buffer memory using the REMTO instruction, turn on Initial data setting request flag (RY9).

This signal turns on when the operating condition is changed.

When the values of remote buffer memory areas are changed, the signal is used as an interlock condition to turn on and off Initial data setting request flag (RY9). For the remote buffer memory areas where the changed values are enabled by turning on and off Initial data setting request flag (RY9), refer to the following.

- Lists of Remote Buffer Memory Areas (☞ Page 49, Section 3.7)



*1 When data link is started at the turning on of the module power supply

*2 After turning on and off Initial data setting request flag (RY9), check that Remote READY (RXB) has turned on and start the control.

(3) Error flag (RXA) Common

This signal turns on when a moderate or major error occurs.

The signal turns off when the error cause is eliminated. For the action for the error, refer to the following.

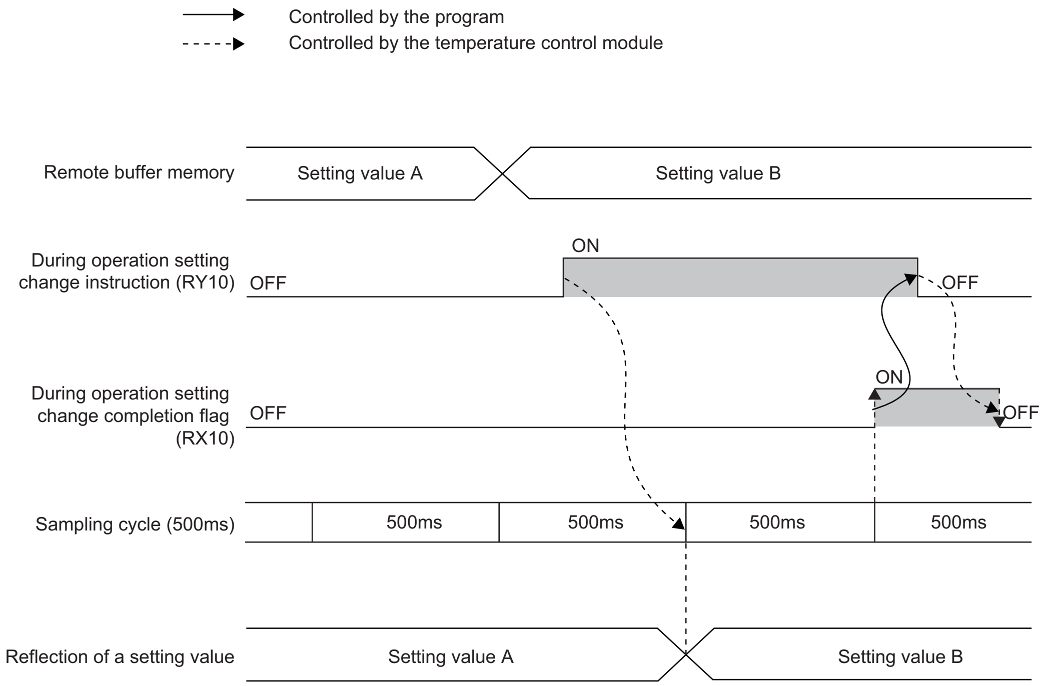
- Lists of Error Codes (☞ Page 271, Section 11.2)

(4) Remote READY (RXB) Common

This signal is used as an interlock condition when the master station reads/writes data from/to the remote register or remote buffer memory areas of the temperature control module.
The signal turns on when the module power supply is turned on.
When Error flag (RXA) turns on, the signal turns off.

(5) During operation setting change completion flag (RX10) Common

If parameters are changed during operation of the temperature control module and During operation setting change instruction (RY10) is turned on, this signal turns on at the normal completion of the setting change.
The signal turns off when During operation setting change instruction (RY10) is turned off.



For parameters that can be changed during operation, refer to the following.

- Lists of Remote Buffer Memory Areas (☞ Page 49, Section 3.7)

(6) CH□ Operation monitor (RX11 to RX14) Common

This signal monitors the condition of CH1 to CH4 of the temperature control module (operating or stopped). The signal turns on during the operation and turns off when the operation is stopped.

(a) In the temperature input mode

When CH□ Operation request flag (RY11 to RY14) is turned on, the signal turns on at the timing when first conversion is completed and the temperature process value is stored in the remote register area.

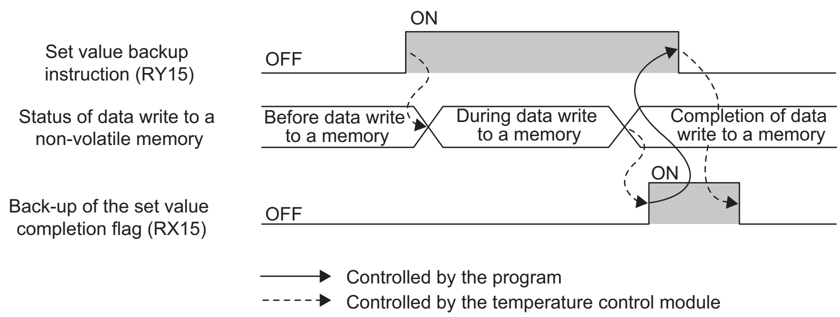
(b) In the standard control mode, heating-cooling control mode, or mix control mode

When CH□ Operation request flag (RY11 to RY14) is turned on, the signal turns on at the timing when the shift to the control mode is completed.
For the timing of turning on and off CH□ Operation request flag (RY11 to RY14) and the signal, refer to the following.

- CH□ Operation request flag (RY11 to RY14) (☞ Page 296, Appendix 1.2 (4))
- CH□ Stop request flag (RY18 to RY1B) (☞ Page 298, Appendix 1.2 (7))

(7) Back-up of the set value completion flag (RX15) Common

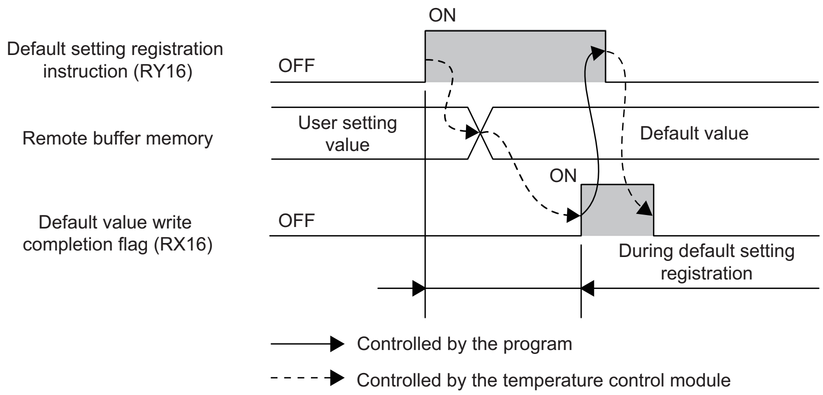
Turning on Set value backup instruction (RY15) starts the writing of the remote buffer memory data to the non-volatile memory. After the data writing is completed, this signal turns on. Turning off Set value backup instruction (RY15) also turns off the signal.



For details on the data writing to the non-volatile memory, refer to the following.
☞ Page 136, Section 8.1.7

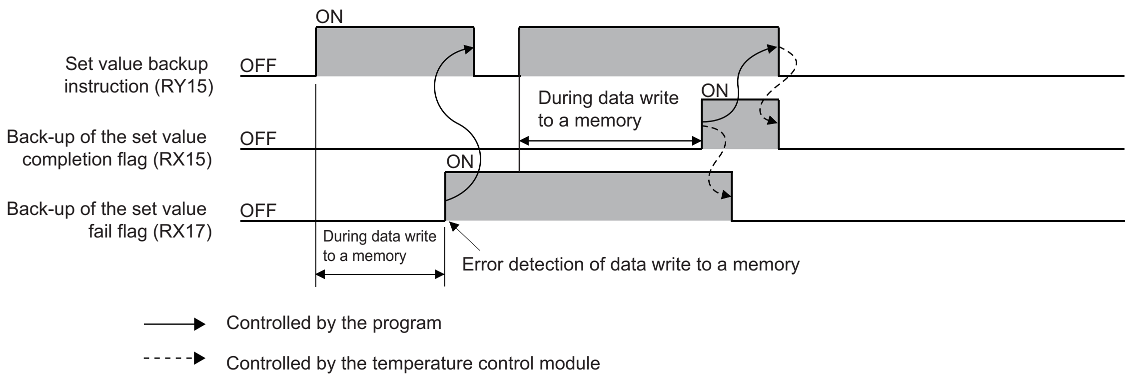
(8) Default value write completion flag (RX16) Common

Turning on Default setting registration instruction (RY16) starts the writing of the default value of the temperature control module to the remote buffer memory area. After the data writing is completed, this signal turns on. Turning off Default setting registration instruction (RY16) also turns off the signal.



(9) Back-up of the set value fail flag (RX17) Common

Turning on Set value backup instruction (RY15) starts the writing of the remote buffer memory data to the non-volatile memory. This signal turns on when the writing failed.



The signal turns off when Set value backup instruction (RY15) is turned on again and the data writing to the non-volatile memory is normally completed.
For details on the data writing to the non-volatile memory, refer to the following.
☞ Page 136, Section 8.1.7

Point

When the error of the read data is detected at the power-on, Back-up of the set value fail flag (RX17) turns on and the temperature control module operates with the default value. In that case, turn on Set value backup instruction (RY15) and write the data to the non-volatile memory. When the writing fails, the possible cause is a hardware failure. Please consult your local Mitsubishi representative.

(10)CH☐ Alert occurrence flag (RX18 to RX1B) Standard Heating-cooling

When an alert occurs, the alert definition is stored in CH☐ Alert definition (RWr4 to RWr7), and this signal turns on.

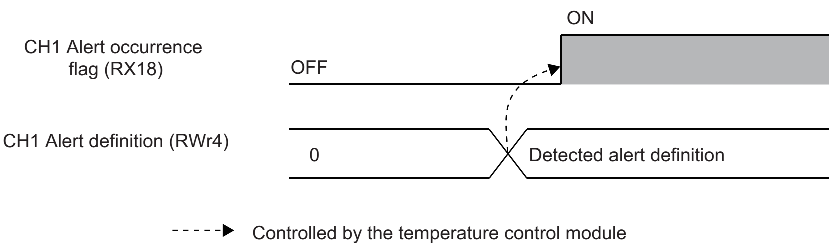
For conditions where this signal turns off, refer to the following.

☞ Page 176, Section 8.3.11 (5)

The following table lists the signals and remote register areas corresponding to each channel.

Channel	Alert occurrence flag	ON/OFF status	Alert definition
CH1	RX18	OFF: An alert does not occur. ON: An alert occurs.	RWr4
CH2	RX19		RWr5
CH3	RX1A		RWr6
CH4	RX1B		RWr7

Ex. Time chart for CH1



(a) Condition where CH☐ Alert occurrence flag (RX18 to RX1B) turns off

The conditions differ depending on the setting of CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H).

CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H)	Condition where CH☐ Alert occurrence flag (RX18 to RX1B) turns off
Stop (0)	When either of the following conditions is met • The cause of an alert was eliminated. • The module shifted from operating status to stop status (when CH☐ Operation monitor (RX11 to RX14) turned off).
Monitor (1)	
Alert (2)	The cause of an alert was eliminated.

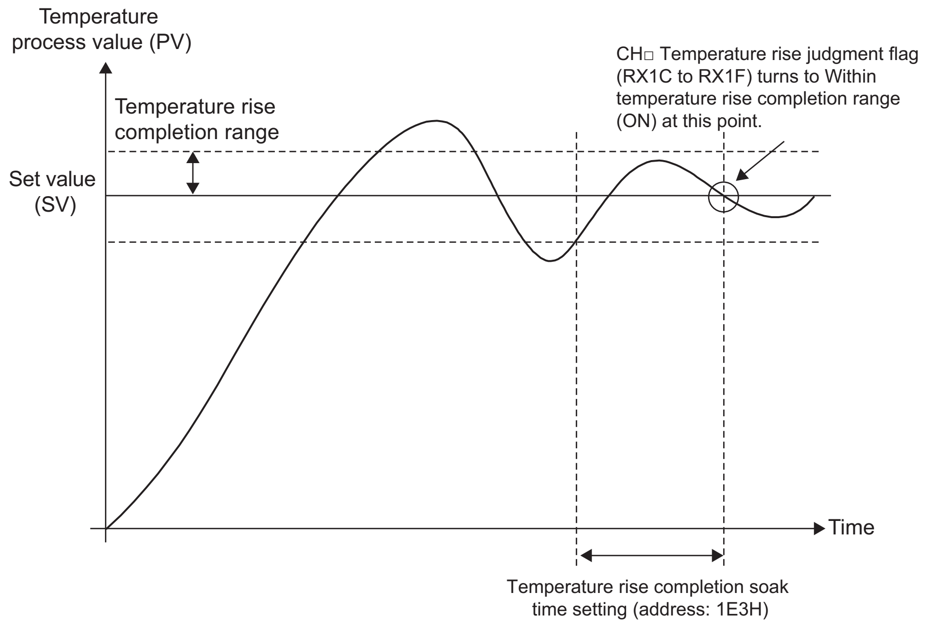
(11) CH□ Temperature rise judgment flag (RX1C to RX1F) Standard Heating-cooling

This signal is for checking whether the temperature process value (PV) is in the temperature rise completion range or not.

The signal turns on when the temperature process value is within the temperature rise completion range. The signal is enabled only during module operation.

- OFF: Out of temperature rise completion range
- ON: Within temperature rise completion range

When the temperature process value (PV) stays within the temperature rise completion range during the set temperature rise completion soak time, this signal turns to Within temperature rise completion range (ON).



Set the temperature rise completion range and temperature rise completion soak time in the following remote buffer memory areas.

- Temperature rise completion range setting (address: 1E2H) (☞ Page 340, Appendix 3 (33))
- Temperature rise completion soak time setting (address: 1E3H) (☞ Page 341, Appendix 3 (34))

(12)CH□ Auto tuning status (RX20 to RX23) Standard Heating-cooling

This signal turns on when auto tuning of each channel is executed with the program or when the temperature control module executes self-tuning.

Channel	Auto tuning status			ON/OFF status
	Standard control	Heating-cooling control	Mix control	
CH1	RX20	RX20	RX20	ON: During auto tuning/self-tuning OFF: The auto tuning/self-tuning has not been executed or is completed.
CH2	RX21	RX21	RX21[*2]	
CH3	RX22	RX22[*1]	RX22	
CH4	RX23	RX23[*1]	RX23	

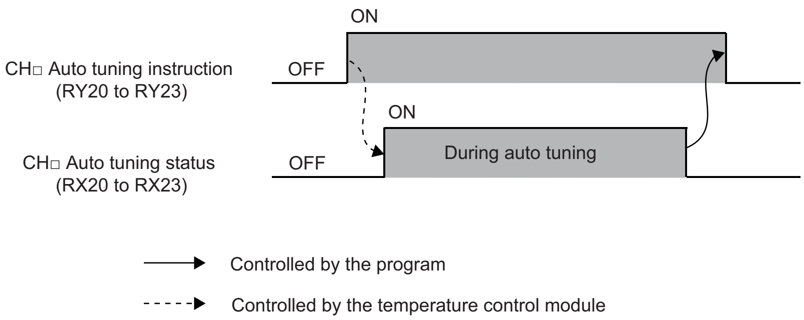
*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to the following. (☞ Page 147, Section 8.3.1 (3))

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to the following. (☞ Page 147, Section 8.3.1 (3))

(a) Execution of auto tuning

To execute auto tuning, turn on CH□ Auto tuning instruction (RY20 to RY23).

This signal is on during auto tuning, and automatically turns off at the completion of the auto tuning.



For details on the auto tuning function, refer to the following.

☞ Page 159, Section 8.3.7

(b) Self-tuning

This signal turns on when self-tuning starts. The signal automatically turns off at the completion of the self-tuning.

Set self-tuning timings in CH□ Self-tuning setting (address: 2C0H to 2C3H). (☞ Page 356, Appendix 3 (58))

Self-tuning can be executed only in the standard control.

For details on the self-tuning function, refer to the following.

☞ Page 184, Section 8.3.15

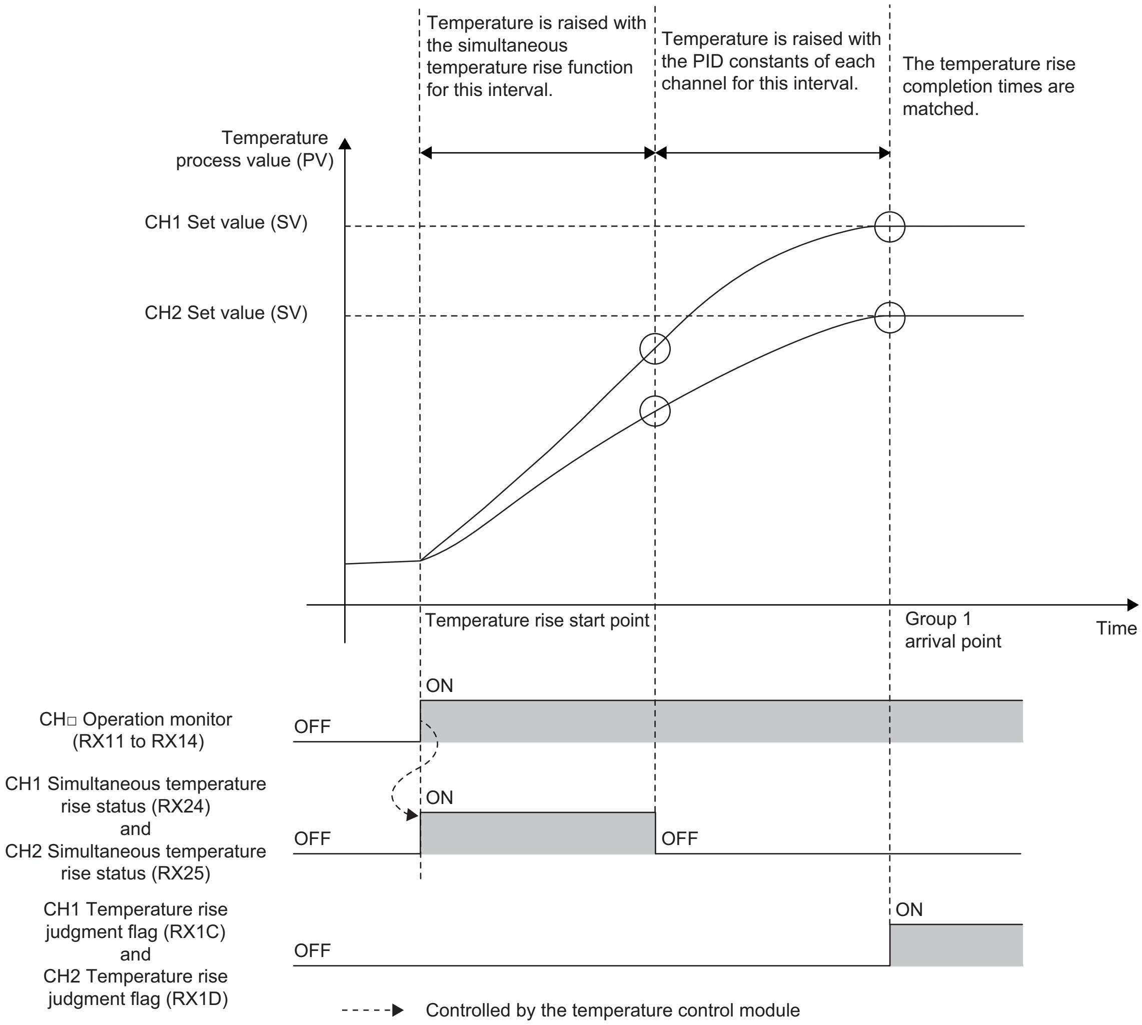
(13)CH□ Simultaneous temperature rise status (RX24 to RX27) Standard

The execution state of the simultaneous temperature rise can be monitored with this signal.

- OFF: Simultaneous temperature rise not in process
- ON: Simultaneous temperature rise in process

During control with the simultaneous temperature rise function, this signal turns to Simultaneous temperature rise in process (ON).

The following figure shows the timing when the signal turns to Simultaneous temperature rise not in process (OFF). (In the figure, CH1 and CH2 are set to group 1. (☞ Page 357, Appendix 3 (59)))



The signal does not turn to Simultaneous temperature rise not in process (OFF) at the completion of the temperature rise. As in the figure above, the temperature is raised to a certain point with the simultaneous temperature rise function, and the signal remains Simultaneous temperature rise in process (ON) for that interval. After that the temperature is raised with the PID constants of each channel, and the signal turns to Simultaneous temperature rise not in process (OFF).

For details on the simultaneous temperature rise function, refer to the following.

☞ Page 198, Section 8.3.17

(14)CH□ Sensor two-point correction offset latch completion flag (RX28, RX2A, RX2C, RX2E) Common

When a sensor two-point correction offset value is stored in a remote buffer memory area, this signal turns to Latch completed (ON).

When CH□ Sensor two-point correction offset latch request (RY28, RY2A, RY2C, RY2E) is turned to No request (OFF), the signal turns to No request (OFF). (☞ Page 300, Appendix 1.2 (9))

For details on the sensor two-point correction function, refer to the following.

☞ Page 133, Section 8.1.5 (2)

(15)CH□ Sensor two-point correction gain latch completion flag (RX29, RX2B, RX2D, RX2F) Common

When a sensor two-point correction gain value is stored in a remote buffer memory area, this signal turns to Latch completed (ON).

When CH□ Sensor two-point correction gain latch request (RY29, RY2B, RY2D, RY2F) is turned to No request (OFF), the signal turns to No request (OFF). (☞ Page 300, Appendix 1.2 (10))

For details on the sensor two-point correction function, refer to the following.

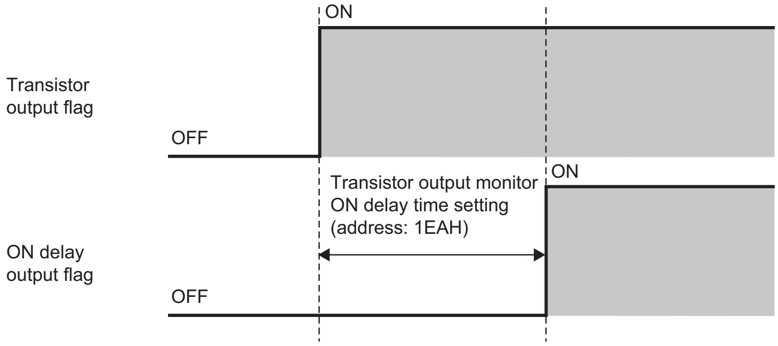
☞ Page 133, Section 8.1.5 (2)

(16)CH□ Transistor output flag (RX30, RX32, RX34, RX36) Standard, CH□ Heating transistor output flag (RX30, RX32, RX34, RX36) Heating-cooling, CH□ ON delay output flag (RX31, RX33, RX35, RX37) Standard, CH□ Heating ON delay output flag (RX31, RX33, RX35, RX37) Heating-cooling, CH□ Cooling transistor output flag (RX38, RX3A, RX3C, RX3E) Heating-cooling, CH□ Cooling ON delay output flag (RX39, RX3B, RX3D, RX3F) Heating-cooling

ON/OFF status of transistor output and ON delay output are stored in these signals. In the heating-cooling control, ON/OFF status of transistor output/ON delay output for heating are stored in RX38 to RX3F.

(a) Relationship with ON delay output flag

Relationship between transistor output flag and ON delay output flag is shown in the following.



Transistor output monitor ON delay time setting (address: 1EAH) enables setting considering delay time (response/scan time delay) of actual transistor output. (☞ Page 345, Appendix 3 (41)) Transistor output monitor ON delay time setting (address: 1EAH) can be used to create a program to monitor the ON delay output flag and external output and judge the disconnection of transistor output.

For details on the ON delay output function, refer to the following.

☞ Page 183, Section 8.3.14

Appendix 1.2 Remote output signals

(1) Initial data setting request flag (RY9) Common

Write parameter data to the remote buffer memory area and turn on this signal to set or change the operating condition of the temperature control module with the program.
Initial data setting completed flag (RX9) turns on when the operating condition is changed.
For the parameters which the temperature control module can change with this signal, refer to the following.

- Lists of Remote Buffer Memory Areas (☞ Page 49, Section 3.7)

Point

The temperature control module accepts the signal only when all channels are stopped. Therefore, stop operations of all channels and turn on the signal.
If the signal is turned on while even one channel is operating, an error occurs (error code: 0003H) and the signal is not accepted.

(2) Error clear request flag (RYA) Common

If this signal is turned on and off when the following errors have occurred, Error flag (RXA) turns off.

- Error code: 0003H, and Error occurrence address: FFFFH
- Error code: 0006H

(a) To clear an error history

An error history is not cleared by turning on this signal. To clear an error history, use Error history clear command (address: 1000H). For Error history clear command (address: 1000H), refer to the following.

- Error history clear command (address: 1000H) (☞ Page 364, Appendix 3 (70))

(3) During operation setting change instruction (RY10) Common

Turn on this signal to change parameters during operation of the temperature control module. If the setting changes are normally completed, During operation setting change completion flag (RX10) turns on.
Changed values of parameters are enabled for channels where the operations are stopped.
The following table lists signals to be used for the parameter changes. (○ indicates that the parameter changes are enabled, and — indicates that the parameter changes are disabled.)

Item	All channels are stopped.		Stopped channels and operating channels are mixed.				All channels are operating.	
			Stopped channel		Operating channel			
	Stop parameter*1	Operation parameter*2	Stop parameter*1	Operation parameter*2	Stop parameter*1	Operation parameter*2	Stop parameter*1	Operation parameter*2
Initial data setting request flag (RY9)	○	○	Error (0003H)	Error (0003H)	Error (0003H)	Error (0003H)	Error (0003H)	Error (0003H)
During operation setting change instruction (RY10)	—	○	—	○	—	○	—	○

*1 Parameters that can be changed only when all channels are stopped
*2 Parameters that can be changed during channel operation as well

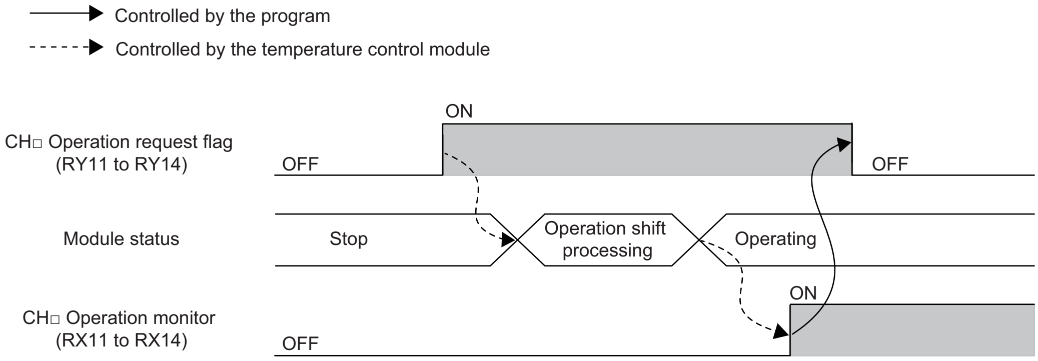
For changeable parameters when all channels are stopped or during channel operation, refer to the following.

- Lists of Remote Buffer Memory Areas (☞ Page 49, Section 3.7)

(4) CH□ Operation request flag (RY11 to RY14) Common

Turn on this signal to start operation for each channel.

- If the signal is turned on during the temperature control module stop, operation is started for the corresponding channel and CH□ Operation monitor (RX11 to RX14) turns on. Check that CH□ Operation monitor (RX11 to RX14) is on, and turn off the signal.



- If the signal is turned on during the module operation, the module keeps operating (CH□ Operation monitor (RX11 to RX14) remains on). An error or an alarm is not output.
- If the signal is turned on when an error has occurred, the module operation is not started. Eliminate the error cause and turn on the signal again.
- If CH□ Stop request flag (RY18 to RY1B) is turned on while the signal is on, an error occurs (error code: 001□H).

(5) Set value backup instruction (RY15) Common

Use this signal to write the remote buffer memory data to the non-volatile memory. Turning on the signal starts the data writing to the non-volatile memory.

For the remote buffer memory areas whose data is to be backed up, refer to the following.

☞ Page 49, Section 3.7

(a) When data writing to the non-volatile memory has been normally completed

Back-up of the set value completion flag (RX15) turns on.

(b) When data writing to the non-volatile memory has not been normally completed

Back-up of the set value fail flag (RX17) turns on. When Back-up of the set value fail flag (RX17) turns on, turn on this signal to write the data to the non-volatile memory again.

(c) Timings when this signal cannot be accepted

In the following timings, this signal cannot be accepted.

- 1: While PID constants are being written automatically after auto tuning
- 2: While PID constants are being read from the non-volatile memory
- 3: When a setting error has occurred
- 4: While a setting is being changed with Initial data setting request flag (RY9)
- 5: While a setting is being changed with During operation setting change instruction (RY10)

For 1 to 3 above, turn on this signal again after each condition is resolved. For 4 and 5, the data writing to the non-volatile memory automatically starts after the condition is resolved.

For details on the data writing to the non-volatile memory, refer to the following.

☞ Page 136, Section 8.1.7

(6) Default setting registration instruction (RY16) Common

By turning on this signal, a value in remote buffer memory areas returns to a default value according to the control output cycle unit selection setting and control mode setting.
Target data of the default return are module-based parameter data in parameter area (address: 100H to 4FFH), and station-based control data and module based control data in module control data area (address 1000H to 14FFH). For details, refer to the following.

- ☞ Page 49, Section 3.7

After the data writing is completed, Default value write completion flag (RX16) turns on.

(a) Execution timing of this signal

Turn on the signal while the module is stopped (when CH□ Operation monitor (RX11 to RX14) is off). The value does not return to the default even if the signal is turned on during module operation (when CH□ Operation monitor (RX11 to RX14) is on). (An error does not occur.)

(b) Timing of setting change to a default

The setting is automatically changed to the default by turning on the signal.

Point

After setting changes of remote buffer memory areas, turning on Initial data setting request flag (RY9) or During operation setting change instruction (RY10) is required to reflect the change. However, if Default setting registration instruction (RY16) is turned on, the change is reflected without turning on these signals.
Therefore, after the setting change to the default, check that a set value is correct and start the control.

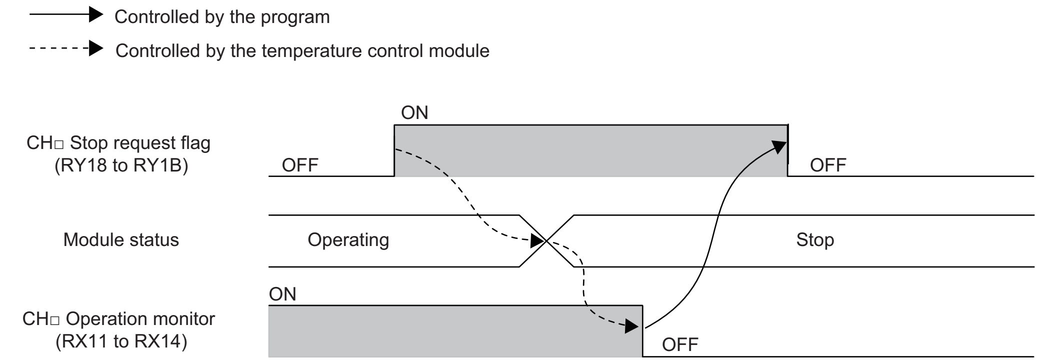
(c) When a control mode change error has occurred (error code: 000DH)

Default setting registration is performed according to the value stored in Control switching monitor (address: 602H).

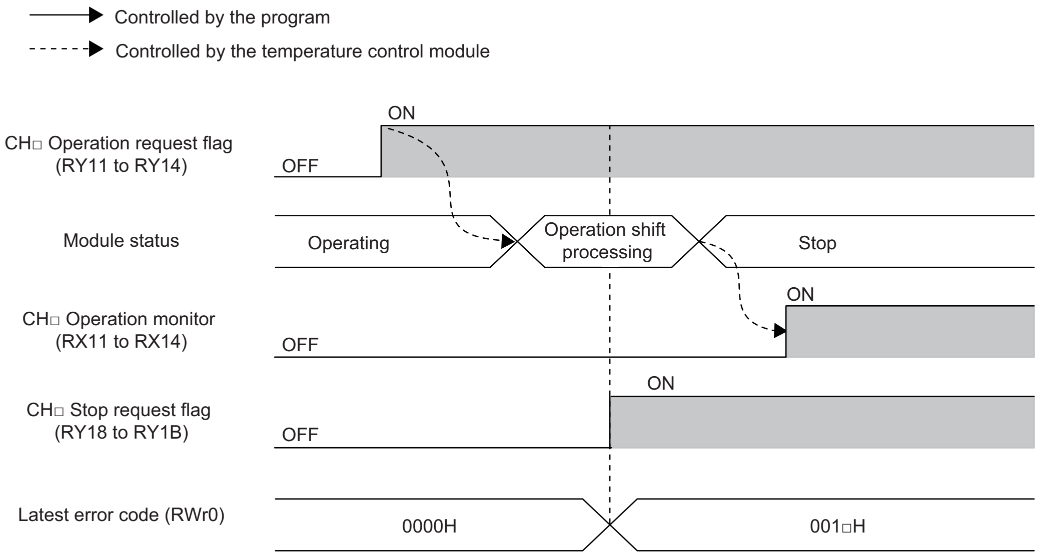
(7) CH☐ Stop request flag (RY18 to RY1B) **Common**

Turn on this signal to stop operation in a channel.

- If this signal is turned on during the operation of temperature control module, operation is stopped for the corresponding channel and CH☐ Operation monitor (RX11 to RX14) turns off. (The operation is stopped according to the setting of CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H).) Check that CH☐ Operation monitor (RX11 to RX14) is off, and turn off the signal.



- If the signal is turned on during the temperature control module stop, the module remains stopped (CH→ Operation monitor (RX11 to RX14) remains off). An error or an alarm is not output.
- If the signal is turned on while CH☐ Operation request flag (RY11 to RY14) is on, an error occurs (error code: 001☐H).



A

(8) CH□ Auto tuning instruction (RY20 to RY23) Standard Heating-cooling

Use this signal to start auto tuning for each channel. Turning on the signal starts auto tuning and CH□ Auto tuning status (RX20 to RX23) turns on. After auto tuning is completed, CH□ Auto tuning status (RX20 to RX23) turns off.

Keep the signal on during auto tuning and turn it off at the completion of the auto tuning. If the signal is turned off during auto tuning, the auto tuning is stopped. If the auto tuning is stopped, PID constants in the remote buffer memory area do not change.

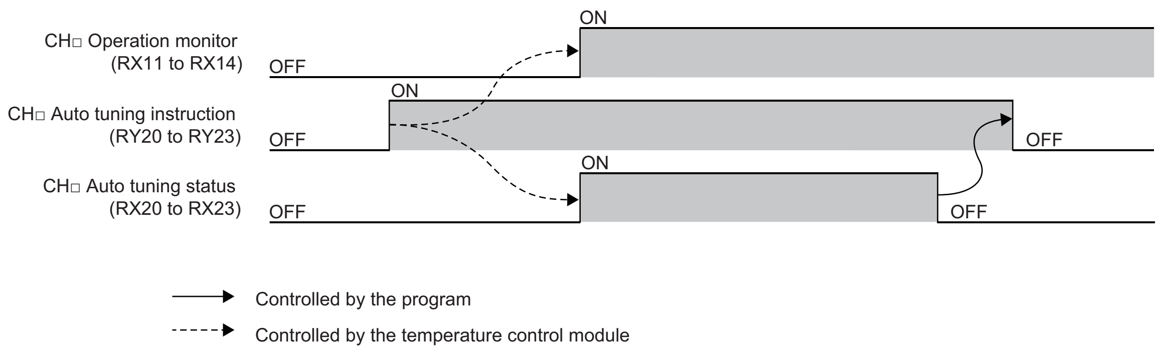
Point

- If proportional band (P)/heating proportional band (Ph) is set to 0, auto tuning cannot be executed. (☞ Page 318, Appendix 3 (7))
- If CH□ Stop request flag (RY18 to RY1B) is turned on during auto tuning and CH□ Operation monitor (RX11 to RX14) turns off (stop status), the auto tuning is stopped. After that, if CH□ Operation request flag (RY11 to RY14) is turned on and CH□ Operation monitor (RX11 to RX14) turns on (operating status), the auto tuning is not resumed. To resume the auto tuning, turn off CH□ Auto tuning instruction (RY20 to RY23), and turn it on again.

For details on the auto tuning function, refer to the following.
☞ Page 159, Section 8.3.7

(a) Auto tuning during stop status

The auto tuning instruction is also accepted during stop status. The following are the operations.
1: Turn on CH□ Auto tuning instruction (RY20 to RY23).
2: CH□ Operation monitor (RX11 to RX14) turns on (operating status).
3: Auto tuning is started.
4: Check that the auto tuning is completed (CH□ Auto tuning status (RX20 to RX23) is off), and turn off CH□ Auto tuning instruction (RY20 to RY23).
5: CH□ Operation monitor (RX11 to RX14) remains on after the operation 4 is executed.
CH□ Operation monitor (RX11 to RX14) also remains on if CH□ Auto tuning instruction (RY20 to RY23) is turned off during auto tuning.



(9) CH□ Sensor two-point correction offset latch request (RY28, RY2A, RY2C, RY2E) Common

This signal is to request for storing the temperature process value (PV) as a sensor two-point correction offset value in the following remote buffer memory area.

- CH□ Sensor two-point correction offset value (measured value) (address: 284H, 288H, 28CH, 290H) (☞ Page 352, Appendix 3 (52))

For details on the sensor two-point correction function, refer to the following.

☞ Page 133, Section 8.1.5 (2)

(a) Setting range

- OFF: No request
- ON: Latch request

(10) CH□ Sensor two-point correction gain latch request (RY29, RY2B, RY2D, RY2F) Common

This signal is to request for storing the temperature process value (PV) as a sensor two-point correction gain value in the following remote buffer memory area.

- CH□ Sensor two-point correction gain value (measured value) (address: 286H, 28AH, 28EH, 292H) (☞ Page 353, Appendix 3 (54))

For details on the sensor two-point correction function, refer to the following.

☞ Page 133, Section 8.1.5 (2)

(a) Setting range

- OFF: No request
- ON: Latch request

Appendix 2 Details of Remote Register Areas

This section describes details of remote register areas assigned to the master/local module.
The assignment of each device number is for the case when the remote register areas of the main module are assigned to RWr0 to RWr1F and RWw0 to RWw1F.

Point

For remote register areas indicated with the icons Standard and Heating-cooling, or with Common, the following terms are used, unless otherwise specified.

- Proportional band (P): includes heating proportional band (Ph) and cooling proportional band (Pc).
- Manipulated value (MV): includes manipulated value for heating (MVh) and manipulated value for cooling (MVc).
- Transistor output: includes heating transistor output and cooling transistor output.
- Control output cycle: includes heating control output cycle and cooling control output cycle.

(1) Latest error code (RWr0) Common

An error code is stored when a moderate error or major error has occurred.
Turning on Error clear request flag (RYA) after eliminating the cause of the error clears the error code.
Errors that occurred in the past can be checked with Error history □ (address: A00H to FFFH). For the error history, refer to the following.

- Error history □ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

(2) Error occurrence address (RWr1) Common

The address of remote buffer memory area where an error has occurred is stored.
The contents of Error occurrence address (RWr1) differs depending on the error type. For details, refer to the following.

- Lists of Error Codes (☞ Page 271, Section 11.2)

(3) Latest warning code (RWr2) Common

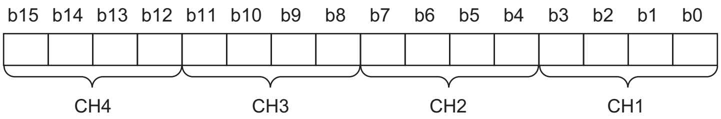
An error code is stored when a minor error has occurred or an alarm code is stored when an alarm has occurred.
If a minor error has occurred, the error code is automatically cleared five seconds after the cause of the error is eliminated.
If an alarm has occurred, the alarm code is automatically cleared after the cause of the alarm is eliminated.
Errors or alarms that occurred in the past can be checked with Error history □ (address: A00H to FFFH). For the error history, refer to the following.

- Error history □ (address: A00H to FFFH) (☞ Page 363, Appendix 3 (69))

(4) CH1 to CH4 AT simultaneous temperature rise parameter calculation flag (RWr3) Standard

The status when simultaneous temperature rise AT (auto tuning) calculates simultaneous temperature rise parameter is stored in this area.

- 0: OFF
- 1: ON



Bit	Flag name	Description
b0	CH1 AT simultaneous temperature rise parameter calculation completion	This flag turns to 1 (ON) when the simultaneous temperature rise parameter*1 has been calculated by simultaneous temperature rise AT.
b1	CH1 AT simultaneous temperature rise parameter calculation error status	This flag turns to 1 (ON) when the simultaneous temperature rise parameter*1 has not been calculated by simultaneous temperature rise AT.
b2	CH1 Simultaneous temperature rise AT disable status	This flag turns to 1 (ON) when the simultaneous temperature rise AT was not able to be executed.
b3	— (fixed to 0)	— (Unused)
b4	CH2 AT simultaneous temperature rise parameter calculation completion	
b5	CH2 AT simultaneous temperature rise parameter calculation error status	Same description as CH1
b6	CH2 Simultaneous temperature rise AT disable status	
b7	— (fixed to 0)	— (Unused)
b8	CH3 AT simultaneous temperature rise parameter calculation completion	
b9	CH3 AT simultaneous temperature rise parameter calculation error status	Same description as CH1
b10	CH3 Simultaneous temperature rise AT disable status	
b11	— (fixed to 0)	— (Unused)
b12	CH4 AT simultaneous temperature rise parameter calculation completion	
b13	CH4 AT simultaneous temperature rise parameter calculation error status	Same description as CH1
b14	CH4 Simultaneous temperature rise AT disable status	
b15	— (fixed to 0)	— (Unused)

*1 The parameter indicates the values in CH☐ Simultaneous temperature rise gradient data (address: 2D1H, 2D5H, 2D9H, 2DDH) and CH☐ Simultaneous temperature rise dead time (address: 2D2H, 2D6H, 2DAH, 2DEH).

Point

This area is enabled only for the following channels.

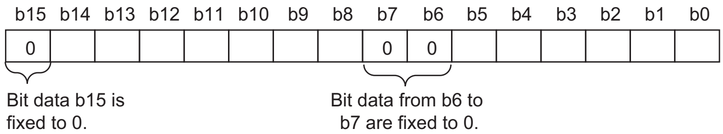
- CH1 to CH4 when the standard control is used
- CH3 and CH4 when mix control (normal mode) or mix control (expanded mode) is used

For details on the simultaneous temperature rise function, refer to the following.

☞ Page 198, Section 8.3.17

(5) CH□ Alert definition (RWr4 to RWr7) Common

Bits corresponding to alerts detected in each channel become 1.



Target bit number	Flag name	Alert definition
b0	CH□ Input range upper limit	Temperature process value (PV) has exceeded the temperature measurement range*1 of the set input range.
b1	CH□ Input range lower limit	Temperature process value (PV) has fallen below the temperature measurement range*1 of the set input range.
b2	CH□ Process alarm upper limit	Temperature process value (PV) has reached the process alarm upper upper limit value or more.
b3	CH□ Process alarm lower limit	Temperature process value (PV) has reached the process alarm lower lower limit value or lower.
b4	CH□ Rate alarm upper limit	The variation of temperature process value (PV) has reached the rate alarm upper limit value or more.
b5	CH□ Rate alarm lower limit	The variation of temperature process value (PV) has reached the rate alarm lower limit value or lower.
b6 to b7	— (fixed to 0)	— (Unused)
b8	CH□ Alert 1	Alert 1 has occurred. (☞ Page 169, Section 8.3.11)
b9	CH□ Alert 2	Alert 2 has occurred. (☞ Page 169, Section 8.3.11)
b10	CH□ Alert 3	Alert 3 has occurred. (☞ Page 169, Section 8.3.11)
b11	CH□ Alert 4	Alert 4 has occurred. (☞ Page 169, Section 8.3.11)
b12	— (fixed to 0)	— (Unused)
b13	CH□ Loop disconnection detection	Loop disconnection has been detected. (☞ Page 212, Section 8.3.19)
b14	— (fixed to 0)	— (Unused)
b15	— (fixed to 0)	— (Unused)

*1 For the temperature measurement range, refer to the following.
☞ Page 303, Appendix 2 (5) (a)

Point

Bit data from b6 to b15 become Unused in the temperature input mode.

(a) Temperature measurement range

The temperature measurement range is as follows.

- (Input range lower limit - 5% of full scale) to (Input range upper limit + 5% of full scale)

Ex. Calculation for the case when CH□ Input range (address: 100H, 130H, 160H, 190H) is 38 and the temperature measurement range is -200.0 to 400.0℃

- Input range lower limit - 5% of full scale = -200 - ((400.0 - (-200.0)) × 0.05) = -230.0
- Input range upper limit + 5% of full scale = 400 + ((400.0 - (-200.0)) × 0.05) = 430.0

Therefore, the temperature measurement range is -230.0 to 430.0℃.

The temperature control module checks whether the input temperature is within temperature measurement range of the input range. If the input temperature is out of the temperature measurement range, CH□ Input range upper limit (b0 of RWr4 to RWr7) or CH□ Input range lower limit (b1 of RWr4 to RWr7) turns to 1 (ON).

The conditions which the temperature control module uses to judge whether the measured temperature is within the temperature measurement range or not differ depending on the following settings.

- CH□ Stop mode setting (address: 118H, 148H, 178H, 1A8H) (☞ Page 336, Appendix 3 (27))

(6) CH□ Temperature process value (PV) or CH□ Process value (PV) scaling value (RWr8 to RWrB) Common

The detected temperature value where sensor correction has been performed is stored in this area.
The value to be stored differs depending on the stored value in CH□ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): The value is stored as it is.
- One decimal place (1): The value is stored after being multiplied by 10.

(a) When the scaling function is enabled

If the scaling function is set to be enabled with CH□ Process value (PV) scaling function enable/disable setting (address: 200H, 203H, 206H, 209H), the value is stored in CH□ Process value (PV) scaling value (RWr8 to RWrB).
The value is stored as it is regardless of the value in CH□ Decimal point position (address: 620H, 621H, 622H, 623H).

Point

When a value measured by a temperature sensor exceeds the temperature measurement range, the following value is stored.

- When the measured value exceeds temperature measurement range: Input range upper limit + 5% of full scale
- When the measured value falls below temperature measurement range: Input range lower limit - 5% of full scale

(7) CH□ Set value (SV) monitor (RWrC to RWrF) Standard Heating-cooling

Set value (SV) of each unit time set in CH□ Setting change rate limiter unit time setting (address: 109H, 139H, 169H, 199H) is stored in this area. (☞ Page 325, Appendix 3 (13))
The set value (SV) can be monitored in real time.

(8) CH☐ Manipulated value (MV) (RWr10 to RWr13) Standard, CH☐ Manipulated value for heating (MVh) (RWr10 to RWr13) Heating-cooling, CH☐ Manipulated value for cooling (MVc) (RWr14 to RWr17) Heating-cooling

The result of PID operation performed on the basis of temperature process value (PV) is stored in these areas. RWr10 to RWr13 are used for heating in the heating-cooling control. The following table lists the range of values to be stored.

Storage contents	Store range in control	Stored value when control stops
Manipulated value (MV)	-50 to 1050 (-5.0% to 105.0%)	-50 (-5.0%)
Manipulated value for heating (MVh)	0 to 1050 (0.0% to 105.0%)	-50 (-5.0%)
Manipulated value for cooling (MVc)		

However, values are output in the range of 0 to 100%. For 0% or less and 100% or more, refer to the following.

- For 0% or less: 0%
- For 100% or more: 100%

(a) Manipulated value (MV) and control output cycle

- Manipulated value (MV) indicates ON time of CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) in percentage. (☞ Page 326, Appendix 3 (15))
- Manipulated value for heating (MVh) indicates ON time of CH☐ Heating control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) in percentage. (☞ Page 326, Appendix 3 (15))
- Manipulated value for cooling (MVc) indicates ON time of CH☐ Cooling control output cycle setting (address: 1C6H, 1CBH, 1D0H, 1D5H) in percentage. (☞ Page 326, Appendix 3 (15))

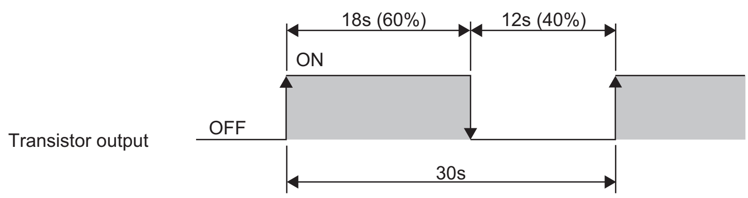
Ex. When 600 (60.0%) is stored in CH☐ Manipulated value (MV) (RWr10 to RWr13) and the value of the remote buffer memory area is set as follows

- CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH): 30s

ON time of transistor output = Control output cycle setting (s) × Manipulated value (MV) (%) = 30 × 0.6 = 18 (s)

ON time of transistor output is 18s.

Transistor output is pulse of ON for 18s, OFF for 12s.



(9) CH☐ Self-tuning flag (RWr14 to RWr17) **Standard**

The execution state of self-tuning can be monitored in this area.

For details on the self-tuning function, refer to the following.

☞ Page 184, Section 8.3.15

b15		to			b10	b9	b8	b7		to			b2	b1	b0
0	0	0	0	0				0	0	0	0	0	0		
		Fixed to 0								Fixed to 0					

The following contents are stored in each bit.

- 0: OFF
- 1: ON

Bit	Flag name	Condition on which a flag turns to 1 (ON)	Condition on which a flag turns to 0 (OFF)
b0	PID auto-correction status	This flag turns to 1 (ON) when PID constants are corrected by the self-tuning.	This flag turns to 0 (OFF) when any of the following operations was performed. • The corresponding channel shifted from operating status to stop status (when CH☐ Operation monitor (RX11 to RX14) turned off). • Do not run the ST (0) is set to CH☐ Self-tuning setting (address: 2C0H to 2C3H). This flag also turns to 0 (OFF) in the following cases. • When the self-tuning has started by the change of the set value (SV) • When the temperature process value (PV) moved out of the stable condition and the vibration ST has started
b1	Simultaneous temperature rise parameter correction status	This flag turns to 1 (ON) when simultaneous temperature rise parameter*1 has been corrected by self-tuning.	
b2 to b7	— (fixed to 0)	— (Unused)	—
b8	Self-tuning disable status	This flag turns to 1 (ON) when the self-tuning was not able to be executed.	This flag turns to 0 (OFF) when any of the following operations was performed. • The corresponding channel shifted from operating status to stop status (when CH☐ Operation monitor (RX11 to RX14) turned off). • Do not run the ST (0) is set to CH☐ Self-tuning setting (address: 2C0H to 2C3H). This flag also turns to 0 (OFF) when all causes of the self-tuning disable were eliminated. For the causes, refer to the following. ☞ Page 189, Section 8.3.15 (6)

Bit	Flag name	Condition on which a flag turns to 1 (ON)	Condition on which a flag turns to 0 (OFF)
b9	Simultaneous temperature rise parameter error status	This flag turns to 1 (ON) when simultaneous temperature rise parameter*1 has not been calculated by self-tuning.	This flag turns to 0 (OFF) when any of the following operations was performed. • The corresponding channel shifted from operating status to stop status (when CH☐ Operation monitor (RX11 to RX14) turned off). • Do not run the ST (0) is set to CH☐ Self-tuning setting (address: 2C0H to 2C3H). This flag also turns to 0 (OFF) in the following cases. • When the self-tuning has started by the change of the set value (SV) • When the temperature process value (PV) moved out of the stable condition and the vibration ST has started
b10	Self-tuning error	This flag turns to 1 (ON) when any of the following operations was performed during the self-tuning.*2 • Set value (SV) setting change (only for the start-up) • PID constants change • Setting change rate limiter change • Output limiter change • Output variation limiter setting change • Control output cycle change • Sensor correction change • Primary delay digital filter change • AUTO to MAN mode shift • Forward/reverse action shift This flag also turns to 1 (ON) in the following cases. • 6000 seconds (1 hour and 40 minutes) or longer has passed after the ST start. • The change rate of the temperature process value (PV) during ST is less than 1.125 (℃/minute). • The temperature process value (PV) became out of the temperature measurement range. • Required measurement data was not obtained because the manipulated value (MV) did not reach the upper limit output limiter value or the lower limit output limiter value until the measurement was completed. • The temperature process value (PV), which was supposed to increase after self-tuning was started with the starting ST, decreased by 1℃ (℉) or more instead. • The temperature process value (PV), which was supposed to decrease after self-tuning was started with the starting ST, increased by 1℃ (℉) or more instead.	
b11 to b15	— (fixed to 0)	— (Unused)	—

*1 The parameter indicates the values in CH☐ Simultaneous temperature rise gradient data (address: 2D1H, 2D5H, 2D9H, 2DDH) and CH☐ Simultaneous temperature rise dead time (address: 2D2H, 2D6H, 2DAH, 2DEH).
For details on the simultaneous temperature rise function, refer to the following. (☞ Page 198, Section 8.3.17)

*2 If the flag turns to 1 (ON) on the other conditions, check the following contents according to the setting of CH☐ Self-tuning setting (address: 2C0H to 2C3H).

CH☐ Self-tuning setting (address: 2C0H to 2C3H)	Check contents
1: Starting ST (PID Constants Only)	• Check that wiring is correct in control loop. • Set 4: Starting ST plus vibration ST to CH☐ Self-tuning setting (address: 2C0H to 2C3H) and start control.
3: Starting ST (PID constants and Simultaneous Temperature Rise Parameter)	• Check that wiring is correct in control loop. • If the simultaneous temperature rise parameter has been calculated, save the parameter. After that, set 4: Starting ST plus vibration ST to CH☐ Self-tuning setting (address: 2C0H to 2C3H) and start control. If the simultaneous temperature rise parameter has not been calculated, check that wiring is correct in control loop.

Point

This area is enabled only for the following channels.

- CH1 to CH4 when the standard control is used
- CH3 and CH4 when mix control (normal mode) or mix control (expanded mode) is used

(10)CH☐ Manipulated value (MV) for output with another analog module (RWr18 to RWr1B) Standard, CH☐ Manipulated value of heating (MVh) for output with another analog module (RWr18 to RWr1B) Heating-cooling, CH☐ Manipulated value of cooling (MVc) for output with another analog module (RWr1C to RWr1F) Heating-cooling

The values stored in the following remote register areas are converted for other analog modules in the system (such as a D/A converter module) and stored in these areas.

Remote register area	Remote register address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Manipulated value (MV)	RWr10	RWr11	RWr12	RWr13	Page 303, Appendix 2 (5)
CH☐ Manipulated value for heating (MVh)	RWr10	RWr11	RWr12	RWr13	
CH☐ Manipulated value for cooling (MVc)	RWr14	RWr15	RWr16	RWr17	

RWr18 to RWr1B are used for heating in the heating-cooling control.

The store range differs depending on the resolution set in the following remote buffer memory area. (0 to 4000/0 to 12000/0 to 16000/0 to 20000)

- Resolution of the manipulated value for output with another analog module (address: 1E8H) (☞ Page 344, Appendix 3 (39))

For details, refer to the following.

☞ Page 182, Section 8.3.13 (2)

Point

When the device which performs heating or cooling can receive only the analog input, use other analog modules (such as D/A converter module) to convert the digital output to the analog input.

(11)CH☐ Temperature process value for input with another analog module (PV) (RWw0 to RWw3) Standard Heating-cooling

A digital input value of the current or voltage converted with other analog modules in the system (such as A/D converter module) can be used as a temperature process value (PV).

Store digital input values of the current or voltage converted with other analog modules (such as A/D converter module) in this area.

For details, refer to the following.

☞ Page 181, Section 8.3.13 (1)

Point

If a value out of the input range is stored, an error occurs (error code: 002☐H). A value used for control is fixed to the upper limit value or lower limit value of the input range.

Appendix 3 Details of Remote Buffer Memory Areas

This chapter describes details of the remote buffer memory areas.
The remote buffer memory has four sections: parameter area, monitoring area, error history area, and module control data area. For details, refer to the following.

- ☞ Page 49, Section 3.7

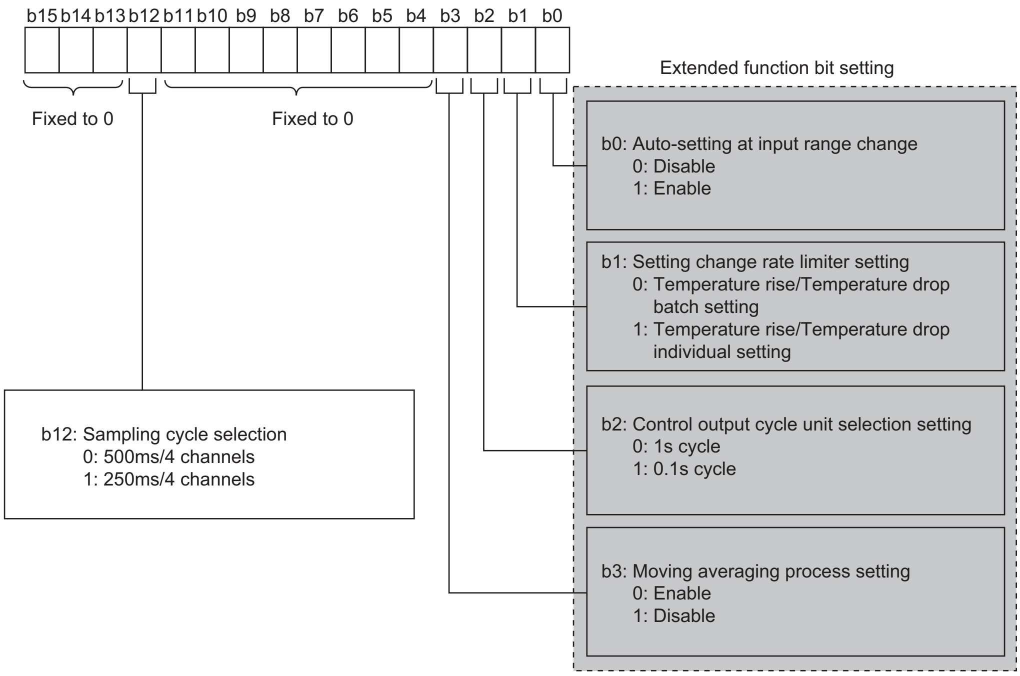
Point

For remote buffer memory areas indicated with the icons Standard and Heating-cooling, or with Common, the following terms are used, unless otherwise specified.

- Proportional band (P): includes heating proportional band (Ph) and cooling proportional band (Pc).
- Manipulated value (MV): includes manipulated value for heating (MVh) and manipulated value for cooling (MVc).
- Transistor output: includes heating transistor output and cooling transistor output.
- Control output cycle: includes heating control output cycle and cooling control output cycle.

(1) Sampling cycle and function extension setting (address: 1H) Common

Set auto-setting at input range change, setting change rate limiter setting, control output cycle unit selection setting, moving averaging process setting, and sampling cycle selection.



To enable these settings, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(a) Auto-setting at input range change (address: 1H. b0)

This function initializes only a related parameter when the input range is changed.

- 0: Disable (default)
- 1: Enable

For the parameter initialized when the function is enabled, refer to the following.

- CH☐ Input range (address: 100H, 130H, 160H, 190H) (☞ Page 312, Appendix 3 (5))

(b) Setting change rate limiter setting (address: 1H. b1)

With this setting, the change rate of the set value (SV) per time unit in cases when the set value (SV) is changed can be set. Select "batch" setting or "individual" setting for the variation limiter set value at temperature rise and drop.

- 0: Disable (Temperature rise/Temperature drop batch setting) (default)
- 1: Enable (Temperature rise/Temperature drop individual setting)

For details, refer to the following.

- Setting change rate limiter setting function (☞ Page 167, Section 8.3.10)

(c) Control output cycle unit selection setting (address: 1H. b2)

The control output cycle is the ON/OFF cycle of transistor output for the temperature control function.
The control output cycle is set in the following remote buffer memory areas.

- CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) (standard control)
- CH☐ Heating control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) (heating control)
- CH☐ Cooling control output cycle setting (address: 1C6H, 1CBH, 1D0H, 1D5H) (heating-cooling control)

The unit of the above control output cycle can be selected from 1s or 0.1s using this bit.
The following shows the setting values.

- 0: 1s cycle (default)
- 1: 0.1s cycle

For details, refer to the following.

- Control output cycle unit selection function (☞ Page 158, Section 8.3.6)

(d) Moving averaging process setting (address: 1H. b3)

Moving averaging process setting is the function to enable/disable the moving averaging process.
The following shows the setting values.

- 0: Enable (default)
- 1: Disable

For details, refer to the following.

- Moving averaging process to a temperature process value (PV) (☞ Page 129, Section 8.1.3)

(e) Sampling cycle selection (address: 1H. b12)

The sampling cycle is the time period from the instant when a conversion starts on a channel to the instant when the next conversion starts on the same channel.
The following shows the setting values.

- 0: 500ms/4CH
- 1: 250ms/4CH (default)

For details, refer to the following.

- Sampling cycle (☞ Page 37, Section 3.2 (2) (a))

Point

When the setting of Sampling cycle selection (address: 1H. b12) is changed, the remote buffer memory areas of address 100H and the following addresses are overwritten to their default value.
Also, an error (error code: 000FH) occurs immediately after the setting of Sampling cycle selection (address: 1H. b12) is changed. To eliminate the error, turn on and off Set value backup instruction (RY15), and register a newly set parameter to the non-volatile memory.

(2) Cyclic data update watch time setting (address: 7H) Common

This signal is used to set the time to watch the data update interval of the cyclic transmission (watch time). When an update by cyclic transmission remains to be done for a set period of time for watching, the temperature control module is regarded as disconnected. Then the module "continues its operation and produces external outputs (HOLD)" or "stops its operation and external outputs (CLEAR)", according to HOLD/CLEAR setting (address: 81H).

- ☞ Page 312, Appendix 3 (4)

(a) Setting range

Setting range is Not monitor (0) or 1 to 20 (0.1 to 2 seconds). Set the value in increments of 100ms (1).

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default value is set to Not monitor (0).

Point

If a value out of the setting range is set, the error code (0930H) is stored in Latest error code (RWr0), Error flag (RXA) turns on, and the ERR. LED turns on.

(3) Control mode shift (address: 80H) Common

Select the control mode. According to the setting, the control method for each channel changes as the following.

Set value	Control mode	Number of control loops	Number of channels dedicated for temperature Input
0H (default)	Standard control	Standard control 4 loops	—
1H	Heating-cooling control (normal mode)	Heating-cooling control 2 loops	2
2H	Heating-cooling control (expanded mode)	Heating-cooling control 4 loops	—
3H	Mix control (normal mode)	Heating-cooling control 1 loops Standard control 2 loops	1
4H	Mix control (expanded mode)	Heating-cooling control 2 loops Standard control 2 loops	—
100H	Temperature input mode	—	4

(a) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

Point

When the setting of Control mode shift (address: 80H) is changed, the remote buffer memory areas of address 100H and the following addresses are overwritten to their default value.
Immediately after Control mode shift (address: 80H) is changed, an error (error code: 000DH) occurs. To eliminate the error, turn on and off Set value backup instruction (RY15), and register a newly set parameter to the non-volatile memory.

(4) HOLD/CLEAR setting (address: 81H) Common

Make the HOLD/CLEAR setting for control output.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

- 0: CLEAR (default)
- Other than 0: HOLD

The following table shows the correspondence between the setting of HOLD/CLEAR setting (address: 81H) and the operation of the temperature control module in cases when an error of the module occurs, when an error of the CPU module occurs/the operating status of the CPU module is STOP, and when the communication is disconnected.

Status		Processing	
HOLD/CLEAR setting (address: 81H)		CLEAR	HOLD
Error	Temperature control module write data error	Follow the operation carried out when an error occurs, as described in the error code list.	
	Temperature control module hardware error	Depends on the symptom of the hardware	
	CPU stop error	Stops the operation and turns off external output	Continues the operation and performs external output
CPU operation	RUN → STOP	Follows the stop mode setting[*1,*2]	Continues the operation and performs external output
Communication disconnection		Stops the operation and turns off external output	Continues the operation and performs external output

*1 CH□ Stop mode setting (address: 118H, 148H, 178H, 1A8H) (☞ Page 336, Appendix 3 (27))
*2 CH□ Operation monitor (RX11 to RX14) turns off.

(a) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(5) CH□ Input range (address: 100H, 130H, 160H, 190H) Common

Select the set value according to temperature sensor, temperature measurement range[*1], output temperature unit (Celsius (℃)/Fahrenheit (℉)/digit) and resolution (1/0.1) which are used with the temperature control module.

*1 In the case of input from other analog modules (such as an A/D converter module) also, set these values.

Ex. When using NZ2GF2B-60TCTT4 and selecting the following thermocouple, set 1 for CH□ Input range (address: 100H, 130H, 160H, 190H).

- Thermocouple type: R
- Temperature measurement range: 0 to 1700℃
- Resolution: 1

When using NZ2GF2B-60TCTT4, refer to ☞ Page 313, Appendix 3 (5) (a).
When using NZ2GF2B-60TCRT4, refer to ☞ Page 315, Appendix 3 (5) (b).

(a) Setting range of NZ2GF2B-60TCTT4

The relation between the set value of CH☐ Input range (address: 100H, 130H, 160H, 190H) and temperature unit is as the following.

CH☐ Input range (address: 100H, 130H, 160H, 190H)	Item	
1 to 99	Thermocouple is used. (No input from other analog modules (such as an A/D converter module)) (1 to 199)	Output temperature unit is Celsius (℃).
100 to 199		Output temperature unit is Fahrenheit (℉).
200 to 299	Other analog modules (such as an A/D converter module) are used. (200 to 299)	Unit is digit.

Set CH☐ Input range (address: 100H, 130H, 160H, 190H) according to the thermocouple type.

Thermocouple type	Temperature measurement range	Celsius (℃) /Fahrenheit (℉)/digit	Resolution	CH☐ Input range (address: 100H, 130H, 160H, 190H)	Auto-setting at input range change*1	
					CH☐ Upper limit setting limiter, CH☐ Process alarm upper lower limit value, CH☐ Process alarm upper upper limit value	CH☐ Lower limit setting limiter, CH☐ Process alarm lower lower limit value, CH☐ Process alarm lower upper limit value
R	0 to 1700	℃	1	1	1700	0
	0 to 3000	℉	1	105	3000	0
K	-200.0 to 400.0	℃	0.1	38	4000	-2000
	0.0 to 400.0	℃	0.1	36	4000	0
	0 to 1300	℃	1	2 (Default value)	1300	0
	0 to 500	℃	1	11	500	0
	0.0 to 500.0	℃	0.1	40	5000	0
	0 to 800	℃	1	12	800	0
	0.0 to 800.0	℃	0.1	41	8000	0
	-200.0 to 1300.0	℃	0.1	49	13000	-2000
	0 to 1000	℉	1	100	1000	0
	0.0 to 1000.0	℉	0.1	130	10000	0
	0 to 2400	℉	1	101	2400	0
J	0.0 to 400.0	℃	0.1	37	4000	0
	0 to 500	℃	1	13	500	0
	0.0 to 500.0	℃	0.1	42	5000	0
	0 to 800	℃	1	14	800	0
	0.0 to 800.0	℃	0.1	43	8000	0
	-200.0 to 1000.0	℃	0.1	50	10000	-2000
	0 to 1200	℃	1	3	1200	0
	0 to 1000	℉	1	102	1000	0
	0.0 to 1000.0	℉	0.1	131	10000	0
	0 to 1600	℉	1	103	1600	0
	0 to 2100	℉	1	104	2100	0
T	-200 to 400	℃	1	4	400	-200
	-200 to 200	℃	1	21	200	-200
	-200.0 to 400.0	℃	0.1	39	4000	-2000
	0 to 200	℃	1	19	200	0
	0 to 400	℃	1	20	400	0
	0.0 to 400.0	℃	0.1	45	4000	0
	-300 to 400	℉	1	110	400	-300
	0 to 700	℉	1	109	700	0
	0.0 to 700.0	℉	0.1	132	7000	0

Thermocouple type	Temperature measurement range	Celsius (℃) /Fahrenheit (℉)/digit	Resolution	CH□ Input range (address: 100H, 130H, 160H, 190H)	Auto-setting at input range change[*1]	
					CH□ Upper limit setting limiter, CH□ Process alarm upper lower limit value, CH□ Process alarm upper upper limit value	CH□ Lower limit setting limiter, CH□ Process alarm lower lower limit value, CH□ Process alarm lower upper limit value
S	0 to 1700	℃	1	15	1700	0
	0 to 3000	℉	1	106	3000	0
B	0 to 1800	℃	1	16	1800	0
	0 to 3000	℉	1	107	3000	0
E	0 to 400	℃	1	17	400	0
	0.0 to 700.0	℃	0.1	44	7000	0
	0 to 1000	℃	1	18	1000	0
	-200.0 to 1000.0	℃	0.1	51	10000	-2000
	0 to 1800	℉	1	108	1800	0
N	0 to 1300	℃	1	22	1300	0
	0.0 to 1000.0	℃	0.1	52	10000	0
	0 to 2300	℉	1	111	2300	0
U	-200 to 200	℃	1	26	200	-200
	0 to 400	℃	1	25	400	0
	0.0 to 600.0	℃	0.1	46	6000	0
	-300 to 400	℉	1	115	400	-300
	0 to 700	℉	1	114	700	0
L	0 to 400	℃	1	27	400	0
	0.0 to 400.0	℃	0.1	47	4000	0
	0 to 900	℃	1	28	900	0
	0.0 to 900.0	℃	0.1	48	9000	0
	0 to 800	℉	1	116	800	0
	0 to 1600	℉	1	117	1600	0
PLII	0 to 1200	℃	1	23	1200	0
	0 to 2300	℉	1	112	2300	0
W5Re/W26Re	0 to 2300	℃	1	24	2300	0
	0 to 3000	℉	1	113	3000	0
Input from other analog modules (0 to 4000)[*2]	0 to 4000	digit	1	201	4000	0
Input from other analog modules (0 to 12000)[*2]	0 to 12000	digit	1	202	12000	0
Input from other analog modules (0 to 16000)[*2]	0 to 16000	digit	1	203	16000	0
Input from other analog modules (0 to 20000)[*2]	0 to 20000	digit	1	204	20000	0
Input from other analog modules (0 to 32000)[*2]	0 to 32000	digit	1	205	32000	0

*1 When the input range is changed, the set values in some remote buffer memory areas are initialized automatically and return to the default value (0). (☞ Page 316, Appendix 3 (5) (d))

*2 Same as the NZ2GF2B-60TCRT4.

A

Remark

For the following mode and channel, CH□ Input range (address: 100H, 130H, 160H, 190H) cannot be set to 201 to 205. If these values are set, a write data error (error code: 0004H) occurs.

Mode		Corresponding channel
Temperature input mode		CH1 to CH4
Temperature control mode	Heating-cooling control (normal mode)	CH3, CH4
	Mix control (normal mode)	CH2

(b) Setting range of NZ2GF2B-60TCRT4

Set CH□ Input range (address: 100H, 130H, 160H, 190H) according to the platinum resistance thermometer type.

Platinum resistance thermometer type	Temperature measurement range	Celsius (℃) /Fahrenheit (℉)/digit	Resolution	CH□ Input range (address: 100H, 130H, 160H, 190H)	Auto-setting at input range change*1	
					CH□ Upper limit setting limiter, CH□ Process alarm upper lower limit value, CH□ Process alarm upper upper limit value	CH□ Lower limit setting limiter, CH□ Process alarm lower lower limit value, CH□ Process alarm lower upper limit value
Pt100	-200.0 to 600.0	℃	0.1	7 (Default value)	6000	-2000
	-200.0 to 200.0	℃	0.1	8	2000	-2000
	-200.0 to 850.0	℃	0.1	54	8500	-2000
	-300 to 1100	℉	1	141	1100	-300
	-300.0 to 300.0	℉	0.1	143	3000	-3000
JPt100	-200.0 to 500.0	℃	0.1	5	5000	-2000
	-200.0 to 200.0	℃	0.1	6	2000	-2000
	-200.0 to 640.0	℃	0.1	53	6400	-2000
	-300 to 900	℉	1	140	900	-300
	-300.0 to 300.0	℉	0.1	142	3000	-3000
Input from other analog modules (0 to 4000) *2	0 to 4000	digit	1	201	4000	0
Input from other analog modules (0 to 12000) *2	0 to 12000	digit	1	202	12000	0
Input from other analog modules (0 to 16000) *2	0 to 16000	digit	1	203	16000	0
Input from other analog modules (0 to 20000) *2	0 to 20000	digit	1	204	20000	0
Input from other analog modules (0 to 32000) *2	0 to 32000	digit	1	205	32000	0

*1 When the input range is changed, the set values in some remote buffer memory areas are initialized automatically and return to the default value (0). (☞ Page 316, Appendix 3 (5) (d))
*2 Same as the NZ2GF2B-60TCTT4.

Remark

For the following mode and channel, CH□ Input range (address: 100H, 130H, 160H, 190H) cannot be set to 201 to 205. If these values are set, a write data error (error code: 0004H) occurs.

Mode		Corresponding channel
Temperature input mode		CH1 to CH4
Temperature control mode	Heating-cooling control (normal mode)	CH3, CH4
	Mix control (normal mode)	CH2

(c) Resolution

The resolution is applied to the stored values and the set values of particular remote buffer memory areas as described in the following table.

Resolution	Stored value	Set value
1	Value in 1℃ (℉ or digit) unit is stored.	Set a value in 1℃ (℉ or digit) unit.
0.1	Value in 0.1℃ (℉) unit (tenfold value) is stored.	Value in 0.1℃ (℉) unit (tenfold value).

For applicable remote buffer memory areas, refer to the following.

☞ Page 362, Appendix 3 (68)

(d) When Auto-setting at input range change (address: 1H. b0) is Enable (1)

When the input range is changed, the following remote buffer memory areas are set automatically according to selected temperature sensor. Set the remote buffer memory areas again if necessary.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Upper limit setting limiter	10AH	13AH	16AH	19AH	Page 325, Appendix 3 (14)
CH☐ Lower limit setting limiter	10BH	13BH	16BH	19BH	
CH☐ Process alarm lower lower limit value	251H	25AH	263H	26CH	Page 350, Appendix 3 (47)
CH☐ Process alarm lower upper limit value	252H	25BH	264H	26DH	
CH☐ Process alarm upper lower limit value	253H	25CH	265H	26EH	
CH☐ Process alarm upper upper limit value	254H	25DH	266H	26FH	

At the same time, the following remote buffer memory areas related to the input range is initialized to the default value (0) automatically. Set the remote buffer memory areas again if necessary.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Set value (SV) setting	101H	131H	161H	191H	Page 317, Appendix 3 (6)
CH☐ Loop disconnection detection dead band	117H	147H	177H	1A7H	Page 335, Appendix 3 (26)
CH☐ Alert set value 1	224H	22CH	234H	23CH	Page 348, Appendix 3 (45)
CH☐ Alert set value 2	225H	22DH	235H	23DH	
CH☐ Alert set value 3	226H	22EH	236H	23EH	
CH☐ Alert set value 4	227H	22FH	237H	23FH	
CH☐ Sensor two-point correction offset value (measured value)	284H	288H	28CH	290H	Page 352, Appendix 3 (52)
CH☐ Sensor two-point correction offset value (corrected value)	285H	289H	28DH	291H	Page 353, Appendix 3 (53)
CH☐ Sensor two-point correction gain value (measured value)	286H	28AH	28EH	292H	Page 353, Appendix 3 (54)
CH☐ Sensor two-point correction gain value (corrected value)	287H	28BH	28FH	293H	Page 354, Appendix 3 (55)
CH☐ AT bias setting	2A1H	2A3H	2A5H	2A7H	Page 355, Appendix 3 (57)
CH☐ Simultaneous temperature rise gradient data	2D1H	2D5H	2D9H	2DDH	Page 357, Appendix 3 (60)
CH☐ Simultaneous temperature rise dead time	2D2H	2D6H	2DAH	2DEH	Page 358, Appendix 3 (61)

The remote buffer memory areas listed above are automatically set when CH☐ Input range (address: 100H, 130H, 160H, 190H) is changed and Initial data setting request flag (RY9) is turned on and off.

(e) When Auto-setting at input range change (address: 1H. b0) is Disable (0)

Sometimes the setting value of remote buffer memory (☞ Page 316, (5) (d)) might be out of setting range. (When the setting range changes according to the change of the input range, the set value before the change can turn out of the range.) In this case, a write data error (error code: 0004H) occurs in the remote buffer memory area where the value turns out of the setting range. Change the input range after setting each remote buffer memory area with values within the setting range after the input range change.

(f) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(6) CH□ Set value (SV) setting (address: 101H, 131H, 161H, 191H) Standard Heating-cooling

Set the target temperature value of PID control.

(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (☞ Page 313, Appendix 3 (5))

When a value which is out of the setting range is set, a write data error (error code: 0004H) and the following situations occur.

- Error flag (RXA) turns on.
- The error code is stored to Latest error code (RWr0).

(b) Setting unit

The value to be set differs depending on the stored value in CH□ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 0 in all channels.

(7) CH□ Proportional band (P) setting (address: 102H, 132H, 162H, 192H) Standard, CH□ Heating proportional band (Ph) setting (address: 102H, 132H, 162H, 192H) Heating-cooling, CH□ Cooling proportional band (Pc) setting (address: 1C4H, 1C9H, 1CEH, 1D3H) Heating-cooling

Set proportional band (P), heating proportional band (Ph), and cooling proportional band (Pc) to perform PID control. (In the heating-cooling control, set heating proportional band (Ph) to 102H, 132H, 162H, 192H.)

(a) Setting range

Set the value within the following ranges for the full scale of the set input range. (☞ Page 313, Appendix 3 (5))

- Proportional band (P) setting: 0 to 10000 (0.0% to 1000.0%)
- Heating proportional band (Ph) setting: 0 to 10000 (0.0% to 1000.0%)
- Cooling proportional band (Pc) setting: 1 to 10000 (0.1% to 1000.0%)

Ex. When remote buffer memory values are set as shown below, the proportional band (P) is 60℃.

- CH□ Input range (address: 100H, 130H, 160H, 190H): 38 (temperature measurement range -200.0℃ to 400.0℃)
- CH□ Proportional band (P) setting (address: 102H, 132H, 162H, 192H): 100 (10.0%)

(Full scale) × (Proportional band (P) setting) = (400.0℃ - (-200.0℃)) × 0.1 = 60℃

(b) Two-position control

Set the proportional band (P) and heating proportional band (Ph) to 0.

For details on Two-position control, refer to the following.

☞ Page 149, Section 8.3.3

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 30 (3.0%) in all channels.

Point

If the proportional band (P)/heating proportional band (Ph) is set to 0 (0.0%), the auto tuning cannot be performed. To perform the auto tuning, set proportional band (P)/heating proportional band (Ph) to other than 0.

For details on the auto tuning function, refer to the following.

☞ Page 159, Section 8.3.7

Remark

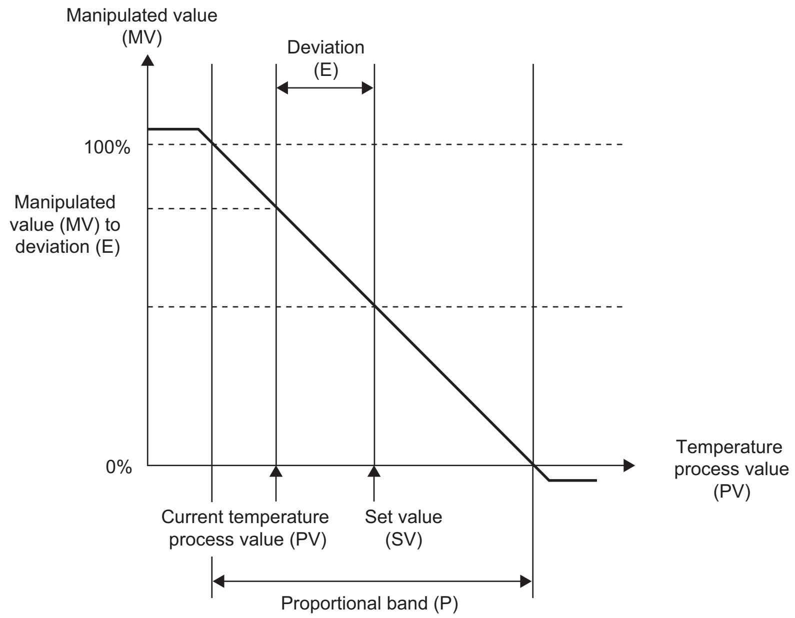
The proportional band (P) is the variation width of deviation (E) necessary for manipulated value (MV) to vary 0% to 100%.
The following formula shows the relationship between deviation (E) and manipulated value (MV) in proportional action.

$$MV = Kp \cdot E$$

Kp is proportional gain. The following formula shows proportional band (P) in this case.

$$P = \frac{1}{Kp} \cdot 100$$

When the value of the proportional band (P) is increased, the proportional gain (Kp) decreases. Therefore, the manipulated value (MV) for variation of the deviation (E) becomes small.
When the value of proportional band (P) is decreased, the proportional gain (Kp) increases. Therefore, the manipulated value (MV) for variation of the deviation (E) becomes large. The following figure shows the proportional band (P) in reverse action.



(8) CH□ Integral time (I) setting (address: 103H, 133H, 163H, 193H) Common

Set integral time (I) to perform PID control.

(a) Setting range

The setting range is 0 to 3600 (0 to 3600s).

(b) In the P control or PD control

Set this setting to 0.

For details on control methods, refer to the following.

☞ Page 149, Section 8.3.3

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 240 (240s) in all channels.

(9) CH□ Derivative time (D) setting (address: 104H, 134H, 164H, 194H) Common

Set derivative time (D) to perform PID control.

(a) Setting range

The setting range is 0 to 3600 (0 to 3600s).

(b) In the P control or PI control

Set this setting to 0.

For details on control methods, refer to the following.

☞ Page 149, Section 8.3.3

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 60 (60s) in all channels.

(10)CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H) Standard, CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H) Standard, CH☐ Heating upper limit output limiter (address: 105H, 135H, 165H, 195H) Heating-cooling, CH☐ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H) Heating-cooling

In the standard control, set upper limit value/lower limit value for actual output of manipulated value (MV) calculated by the PID operation to an external device. In the heating-cooling control, set upper limit value of heating/cooling for actual output of manipulated value for heating (MVh)/manipulated value for cooling (MVc) calculated by the PID operation to an external device. 105H, 135H, 165H, and 195H are used for heating in the heating-cooling control. During the auto tuning, setting of Heating upper limit output limiter and Cooling upper limit output limiter are disabled.

(a) Setting range

The following table lists setting range of each remote buffer memory area.

Remote buffer memory	Setting range	Remarks
CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H)	-50 to 1050 (-5.0% to 105.0%)	Set the values to lower limit output limiter value < upper limit output limiter value. When lower limit output limiter value ≥ upper limit output limiter value, a write data error (error code: 0005H) occurs. In addition, if the setting is out of the setting value, a write data error (error code: 0004H) occurs. When the error occurs, the following situations occur. • Error flag (RXA) turns on. • The error code is stored to Latest error code (RWr0).
CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H)		
CH☐ Heating upper limit output limiter (address: 105H, 135H, 165H, 195H)	0 to 1050 (0.0% to 105.0%)	If the setting is out of the setting value, a write data error (error code: 0004H) occurs. When the error occurs, the following situations occur. • Error flag (RXA) turns on. • The error code is stored to Latest error code (RWr0).
CH☐ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H)		

Point

- In the standard control, CH☐ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H) is invalid even if it is set.
- In the heating-cooling control, lower limit value is not used.

(b) Two-position control

The following table lists Enable/Disable of the setting.

Remote buffer memory	Enable/Disable of the setting in the two-position control
CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H)	Disable
CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H)	
CH☐ Heating upper limit output limiter (address: 105H, 135H, 165H, 195H)	Enable
CH☐ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H)	

For details on the two-position control, refer to the following.

☞ Page 149, Section 8.3.3 (1)

(c) Manual control

The following table lists Enable/Disable of the setting.

Remote buffer memory	Enable/Disable of the setting in the manual control	Remarks
CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H)	Enable	When an output exceeds the upper limit output limiter value, the manipulated value (MV) of the manual control is fixed (clipped) to the upper limit output limiter value that is set. When an output falls below the lower limit output limiter value, the manipulated value (MV) of the manual control is fixed (clipped) to the lower limit output limiter value that is set.
CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H)		
CH☐ Heating upper limit output limiter (address: 105H, 135H, 165H, 195H)	Disable	—
CH☐ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H)		

For details on the manual control, refer to the following.

☞ Page 157, Section 8.3.5

(d) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(e) Default value

The following table lists the default value of each remote buffer memory area.

Remote buffer memory	Default value
CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H)	1000 (100.0%)
CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H)	0 (0.0%)
CH☐ Heating upper limit output limiter (address: 105H, 135H, 165H, 195H)	1000 (100.0%)
CH☐ Cooling upper limit output limiter (address: 1C5H, 1CAH, 1CFH, 1D4H)	

A

(11)CH□ Output variation limiter setting (address: 107H, 137H, 167H, 197H)

Standard Heating-cooling

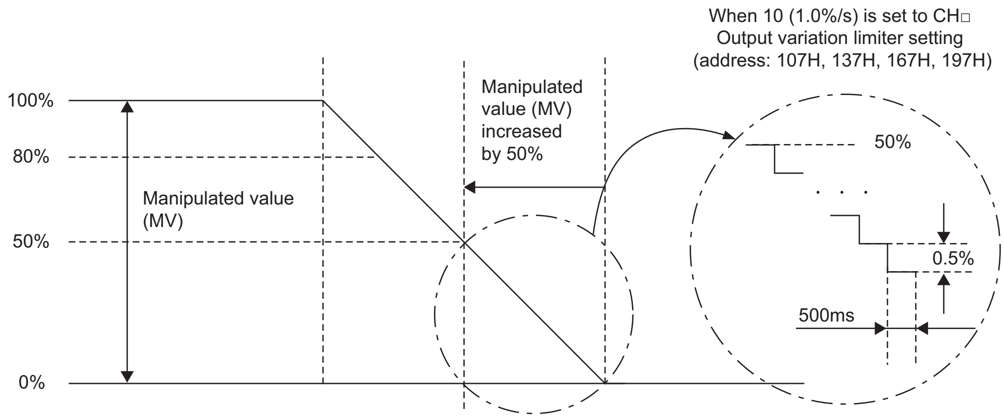
Set the limit of an output variation per 1s to regulate a rapid change of the manipulated value (MV).

(a) Setting range

The setting range is 0 or 1 to 1000 (0.1%/s to 100.0%/s). When 0 is set, an output variation is not regulated.

Ex. When remote buffer memory values are set as follows:

- CH□ Output variation limiter setting (address: 107H, 137H, 167H, 197H): 10 (1.0%/s) The output changes by 0.5% per 500ms, and by 0.2% or 0.3% per 250ms respectively when the sampling cycle is 500ms and 250ms. If the manipulated value (MV) rapidly changes by 50%, the variation is regulated to 1%/s. Therefore, it takes 50s until the output actually changes by 50%.



(b) Two-position control

The setting is ignored.

For details on the two-position control, refer to the following.

☞ Page 149, Section 8.3.3 (1)

(c) Manual control

The setting is enabled.

For details on the manual control, refer to the following.

☞ Page 157, Section 8.3.5

(d) Auto tuning function execution

The setting is enabled. PID constants may not be calculated properly during auto tuning when the output variation limiter setting is changed while auto tuning function is being executed. Therefore, adjusting output variation during auto tuning is not recommended.

For details on the auto tuning function execution, refer to the following.

☞ Page 159, Section 8.3.7

(e) Enabling the setting

Enable the setting contents by either of the following.

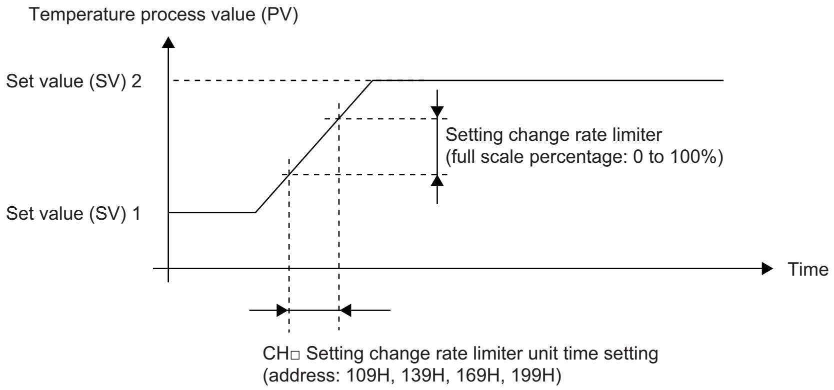
- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(f) Default value

The default values are set to 0 in all channels.

(12)CH☐ Setting change rate limiter (address: 108H, 138H, 168H, 198H) Standard Heating-cooling, CH☐ Setting change rate limiter (temperature rise) (address: 108H, 138H, 168H, 198H) Standard Heating-cooling, CH☐ Setting change rate limiter (temperature drop) (address: 1C8H, 1CDH, 1D2H, 1D7H) Standard Heating-cooling

Set the change rate of the set value (SV) per a set time unit when the set value (SV) is changed. This setting can regulate a rapid change of the manipulated value (MV). Set a time unit in CH☐ Setting change rate limiter unit time setting (address: 109H, 139H, 169H, 199H). (☞ Page 325, Appendix 3 (13))



(a) Batch/individual setting of temperature rise and temperature drop

Setting change rate limiter for the temperature rise and the temperature drop can be set in a batch or individually. Select the value on Setting change rate limiter setting (address: 1H. b1).
For details on the setting method, refer to the following.
☞ Page 310, Appendix 3 (1) (b)
When setting change rate limiter is set individually, 108H, 138H, 168H, 198H is for the temperature rise. The following table lists the remote buffer memory areas to be referred to.

Batch/Individual	Remote buffer memory area name	Remote buffer memory address			
		CH1	CH2	CH3	CH4
Batch	CH☐ Setting change rate limiter	108H	138H	168H	198H
Individual	CH☐ Setting change rate limiter (temperature rise)	108H	138H	168H	198H
	CH☐ Setting change rate limiter (temperature drop)	1C8H	1CDH	1D2H	1D7H

For details on the function, refer to the following.
☞ Page 167, Section 8.3.10

(b) Setting range

The setting range is Disable (0), 0.1% to 100.0% (1 to 1000). Set the percentage of the full scale of the set input range.)

- 0: Disable
- 1 to 10000 (0.1% to 100.0%. Set the percentage of the full scale of the set input range.)

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 0 in all channels.

(13) CH□ Setting change rate limiter unit time setting (address: 109H, 139H, 169H, 199H) Standard Heating-cooling

Set the time unit of setting change rate limiter.
For details on the setting change rate limiter time unit setting function, refer to the following.
☞ Page 167, Section 8.3.10

(a) Setting range

- 0 (Not use time unit setting)
- 1 to 3600 (1 to 3600s)

When 0 is set, the operation is the same as the case when 60, a variation per minute, is set.

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to 0 (Not use time unit setting) in all channels.

(14)CH□ Upper limit setting limiter (address: 10AH, 13AH, 16AH, 19AH) Standard Heating-cooling, CH□ Lower limit setting limiter (address: 10BH, 13BH, 16BH, 19BH) Standard Heating-cooling

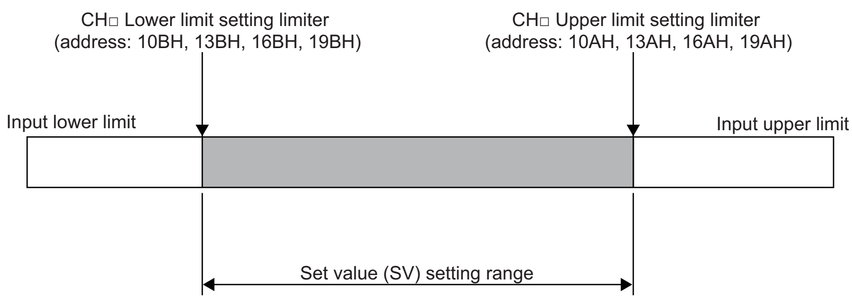
Upper/lower limit value of the set value (SV) can be set.

(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (☞ Page 312, Appendix 3 (5))
The setting should meet the following conditions.

- CH□ Lower limit setting limiter < CH□ Upper limit setting limiter

If the above conditions are not met, a write data error (error code: 0005H) occurs.



(b) Setting unit

The value to be set differs depending on the stored value in CH□ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

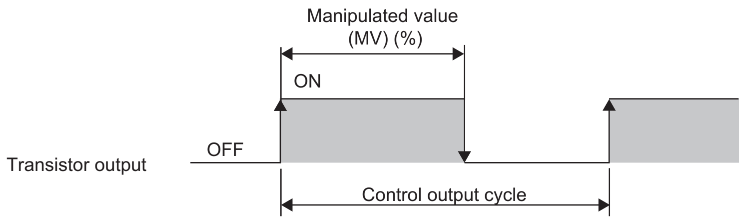
(d) Default value

A default value differs depending on modules to be used.

Remote buffer memory	Default value	
	NZ2GF2B-60TCTT4	NZ2GF2B-60TCRT4
CH☐ Upper limit setting limiter (address: 10AH, 13AH, 16AH, 19AH)	1300	6000
CH☐ Lower limit setting limiter (address: 10BH, 13BH, 16BH, 19BH)	0	-2000

(15)CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) Standard, CH☐ Heating control output cycle setting (address: 10CH, 13CH, 16CH, 19CH) Heating-cooling, CH☐ Cooling control output cycle setting (address: 1C6H, 1CBH, 1D0H, 1D5H) Heating-cooling

Set the pulse cycle (ON/OFF cycle) of the transistor output. In the heating-cooling control, the output cycle of the heating control and cooling control can be set individually. 10CH, 13CH, 16CH, and 19CH are used for heating in the heating-cooling control.

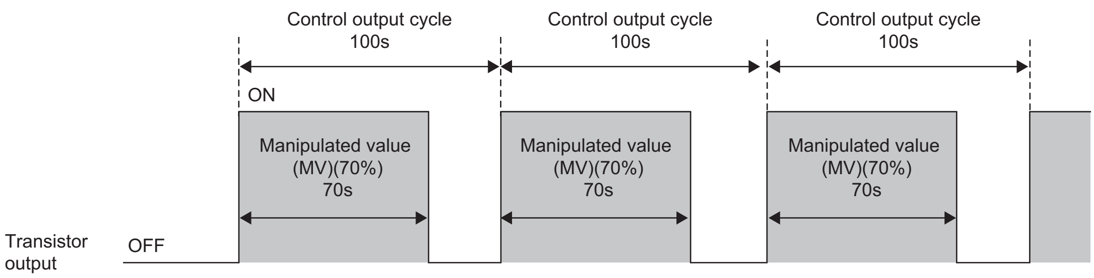


The ON time of the control output cycle is determined by multiplying the control output cycle by the manipulated value (MV)*1 (%) calculated by PID operation. If the manipulated value (MV)*1 is constant, a pulse of the same cycle is output repeatedly.

*1 For the heating control output cycle, the manipulated value for heating (MVh) is used. For the cooling control output cycle, manipulated value for cooling (MVc) is used.

Ex. When 700 (70%) is stored in CH☐ Manipulated value (MV) (RWr10 to RWr13) and 100 (100s) is set to CH☐ Control output cycle setting (address: 10CH, 13CH, 16CH, 19CH)
The following calculation shows that the transistor output turns on for 70s and off for 30s per 100s.

- 100s × 0.7 (70%) = 70s (ON time is 70s.)



(a) Setting range

- When Control output cycle unit selection setting (address: 1H. b2) is set to the cycle of 1s: 1 to 100 (1s to 100s)
- When Control output cycle unit selection setting (address: 1H. b2) is set to the cycle of 0.1s: 5 to 1000 (0.5s to 100.0s)

For details on the control output cycle unit selection setting function, refer to the following.

☞ Page 158, Section 8.3.6

(b) Two-position control

The setting is ignored.

For details on the two-position control, refer to the following.

☞ Page 149, Section 8.3.3 (1)

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

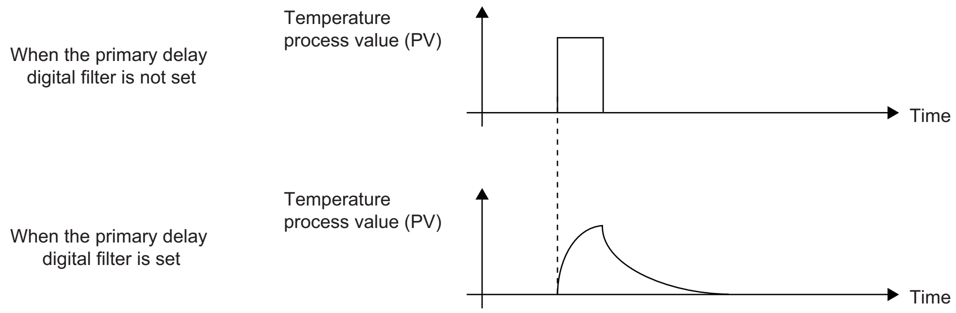
(d) Default value

- When Control output cycle unit selection setting (address: 1H. b2) is set to the cycle of 1s: 30 (30s)
- When Control output cycle unit selection setting (address: 1H. b2) is set to the cycle of 0.1s: 300 (30.0s)

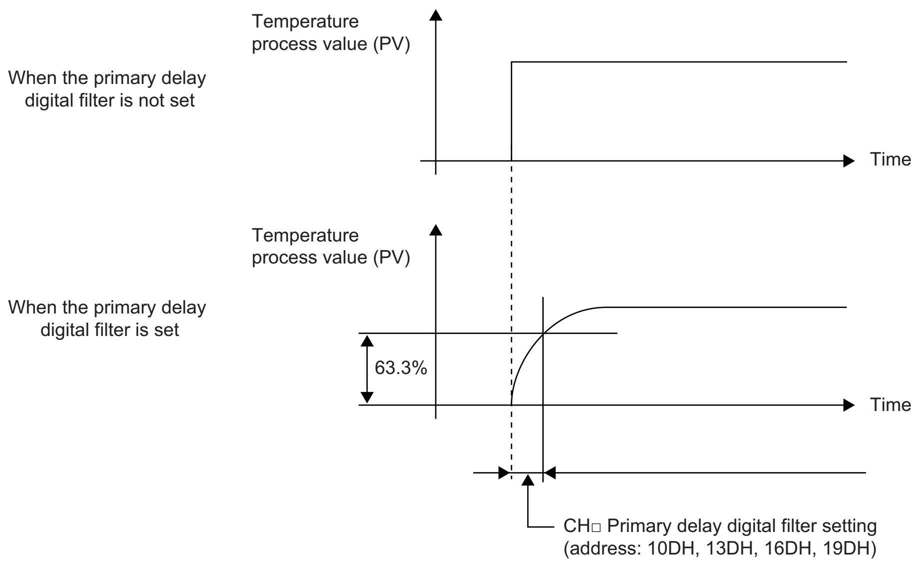
(16)CH□ Primary delay digital filter setting (address: 10DH, 13DH, 16DH, 19DH)

Common

The temperature process values (PV) are smoothed and sudden changes are absorbed by using the primary delay digital filter.



The time for the temperature process value (PV) to change by 63.3% can be set by the primary delay digital filter setting (filter setting time).



(a) Setting range

The setting range is 0 or 1 to 100 (1s to 100s). When 0 is set, the primary delay digital filter processing is not performed.

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default value is 0 (the primary delay digital filter is disabled) for all channels.

A

(17)CH□ Number of moving averaging (address: 10EH, 13EH, 16EH, 19EH) Common

For each channel, set the number of moving averaging to be performed to temperature process values (PV).
For details on the moving averaging process to temperature process values (PV), refer to the following.
☞ Page 129, Section 8.1.3
This setting is enabled only when Enable (0) is set to Moving averaging process setting (address: 1H. b3). If Disable (1) is set to Moving averaging process setting (address: 1H. b3), this setting is ignored.
For details on Moving averaging process setting (address: 1H. b3), refer to the following.
☞ Page 310, Appendix 3 (1) (d)

(a) Setting range

2 to 10 (times)

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

2 (times) are set in all channels as default values.

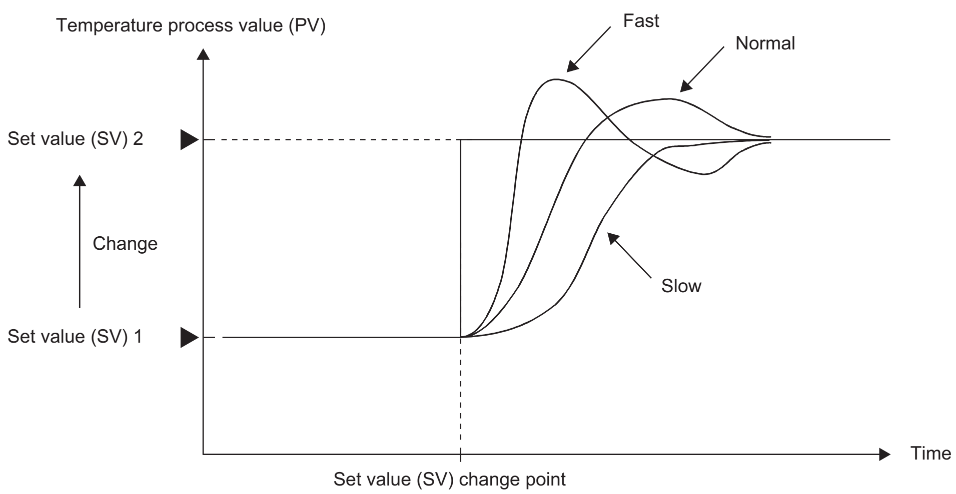
(18)CH□ Control response parameter (address: 10FH, 13FH, 16FH, 19FH)

Standard Heating-cooling

In the simple two-degree-of-freedom PID control, select the response speed to the change of the set value (SV) from the following three levels: Slow, Normal, and Fast.
For details on the simple two-degree-of-freedom, refer to the following.
☞ Page 165, Section 8.3.8

(a) Setting range

Setting value	Setting contents	Description
0	Slow	Set Slow when reducing an overshoot and undershoot to the change of the set value (SV). However, the settling time is the longest of the three settings.
1	Normal	Normal has features between Slow and Fast.
2	Fast	Set Fast when speeding up the response to the change of the set value (SV). However, an overshoot and undershoot is the largest of the three settings.



(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to Slow (0) in all channels.

(19)CH☐ Derivative action selection (address: 110H, 140H, 170H, 1A0H) Standard Heating-cooling

Select the type of derivative action. Dynamic performance can be improved by selecting the suitable derivative action for the fixed value action and the ramp action. For details on the derivative action selection function, refer to the following.

☞ Page 166, Section 8.3.9

(a) Setting range

- 0: Measured value derivation
- 1: Deviation derivation

(b) Enabling the setting

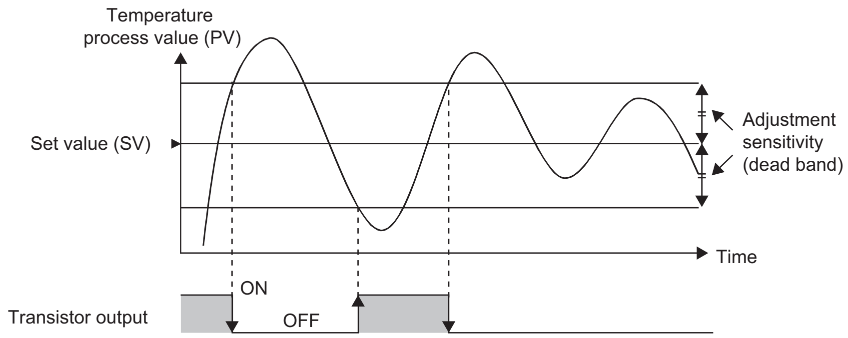
To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

All channels are set to Measured value derivation (0).

(20)CH□ Adjustment sensitivity (dead band) setting (address: 111H, 141H, 171H, 1A1H) Standard Heating-cooling

To prevent a chattering in the two-position control, set the adjustment sensitivity (dead band) for the set value (SV).



For details on the two-position control, refer to the following.

☞ Page 149, Section 8.3.3

(a) Setting range

Set the value within the range 1 to 100 (0.1% to 10.0%) of the full scale of the set input range.

For details on the input range, refer to the following.

☞ Page 312, Appendix 3 (5)

Ex. When the value of the remote buffer memory is set as follows; CH□ Input range (address: 100H, 130H, 160H, 190H): 38 (temperature measurement range: -200.0 to 400.0℃), CH□ Adjustment sensitivity (dead band) setting (address: 111H, 141H, 171H, 1A1H): 10 (1.0%)

The following calculation shows that the dead band is the range of 6.0℃ with the set value (SV) being set as the center of the range.

- (Full scale) × (Adjustment sensitivity (dead band) setting) = (400.0℃ - (-200.0℃)) × 0.01 = 6.0℃

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to 5 (0.5%) in all channels.

(21)CH☐ Manual reset amount setting (address: 112H, 142H, 172H, 1A2H)

Standard Heating-cooling

Set the amount of the proportional band (P) to be moved.

For details on the manual reset function, refer to the following.

☞ Page 155, Section 8.3.4

(a) Setting range

Set the value within the range -1000 to 1000 (-100.0% to 100.0%) of the full scale of the set input range. For details on the input range, refer to the following.

☞ Page 312, Appendix 3 (5)

The setting range is the same between the standard control and heating-cooling control.

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to 0 (0.0%) in all channels. The default value is the same between the standard control and the heating-cooling control.

(22)CH☐ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H) Standard Heating-cooling

Select whether to calculate the manipulated value (MV) by PID operation or to set it manually by the user.

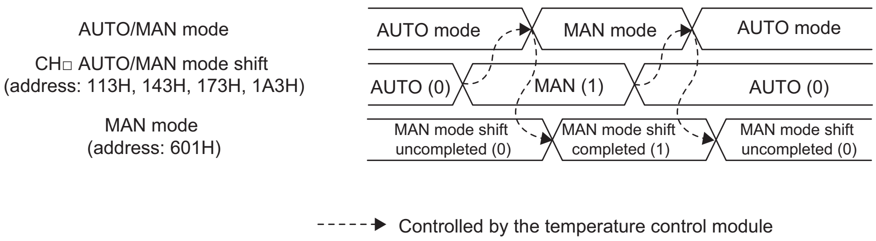
(a) Setting range

Setting value	Setting contents	Description
0	AUTO	Activates the AUTO mode. The manipulated value (MV) calculated by PID operation is used to calculate the ON time of the control cycle.
1	MAN	Activates the MAN mode. The manipulated value (MV) written in CH☐ MAN output setting (address: 114H, 144H, 174H, 1A4H) is used to calculate the ON time of the control output cycle.

(b) When AUTO mode is shifted to MAN mode

The following operation is performed.

- The manipulated value (MV) calculated by PID operation is transferred to CH☐ MAN output setting (address: 114H, 144H, 174H, 1A4H). (For preventing a rapid change of the manipulated value (MV))
- When the shift to the MAN mode is completed, bits of the corresponding channel of MAN mode (address: 601H) are set to MAN mode shift completed (1).



Point

Set the manipulated value (MV) in MAN mode after confirming completion of the mode shift.

(c) When performing auto tuning

Set to AUTO (0). If MAN (1) is set, the auto tuning is not performed.

(d) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(e) Default value

The default values are set to AUTO (0) in all channels.

(23)CH☐ MAN output setting (address: 114H, 144H, 174H, 1A4H) Standard Heating-cooling

This remote buffer memory area is used for setting the manipulated value (MV) in the MAN mode.

(a) How to shift the mode

Shift the mode by the following remote buffer memory area.

- CH☐ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H) (☞ Page 332, Appendix 3 (22))

(b) Setting range

The setting range is different between the standard control and the heating-cooling control.

- In standard control: -50 to 1050 (-5.0 to 105.0%)
- In heating-cooling control: -1050 to 1050 (-105.0 to 105.0%)

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

Make sure the corresponding bit of MAN mode (address: 601H) has been set to 1 (ON) and write a value in the MAN output setting. A value that is written when the corresponding bit of MAN mode (address: 601H) is 0 (OFF) will be replaced with the manipulated value (MV) calculated by PID operation by the system.

(d) Default value

The default values are set to 0 (0.0%) in all channels.

(24)CH☐ Forward/reverse action setting (address: 115H, 145H, 175H, 1A5H) Standard

Select whether to use channels in the forward action or reverse action.

Select the forward action for the cooling control. Select the reverse action for the heating control.

For details on the forward/reverse action selection function, refer to the following.

☞ Page 211, Section 8.3.18

(a) Setting range

- 0: Forward action
- 0: Reverse action

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to Reverse action (1) in all channels.

(25)CH☐ Loop disconnection detection judgment time (address: 116H, 146H, 176H, 1A6H) Standard

Errors such as disconnection of resistors, malfunction of an external controller, and errors of the control system due to troubles such as disconnection of the sensor can be detected by the loop disconnection detection function.

If temperature does not change by 2℃ (℉) or more in the Loop disconnection detection judgment time, a loop disconnection is detected.

For details on the loop disconnection detection function, refer to the following.

☞ Page 212, Section 8.3.19

(a) Setting range

The setting range is 0 to 7200 (s).

Set a value that exceeds the time in which temperature changes by 2℃ (℉).

(b) When performing auto tuning

For this setting, the twice value of that of CH☐ Integral time (I) setting (address: 103H, 133H, 163H, 193H) is automatically set. (☞ Page 320, Appendix 3 (8)) However, when this setting is set to 0 (s) at the start of the auto tuning, Loop disconnection detection judgment time is not stored.

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

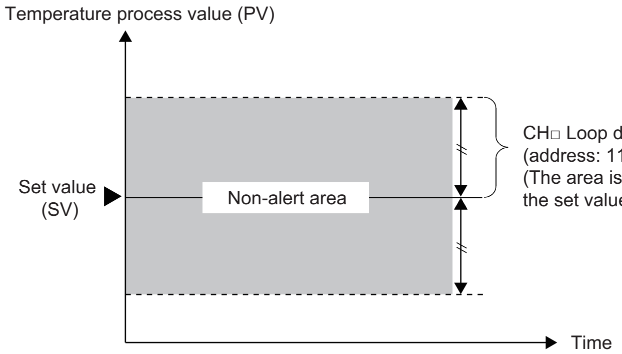
(d) Default value

The default values are set to 480 (s) in all channels.

A

(26)CH☐ Loop disconnection detection dead band (address: 117H, 147H, 177H, 1A7H) Standard

To prevent an error alert of loop disconnection detection, set a non-alert band (temperature band in which the loop disconnection is not detected) where the set value (SV) is at the center.



For details on the loop disconnection detection function, refer to the following.

☞ Page 212, Section 8.3.19

(a) Setting range

The setting range is 0 to full scale.

Ex. When the value of the remote buffer memory is set as follows; CH☐ Input range (address: 100H, 130H, 160H, 190H): 38 (Resolution: 0.1), CH☐ Loop disconnection detection dead band (address: 117H, 147H, 177H, 1A7H): 50

The following calculation shows that within the range of the set value (SV) ±5.0℃, Loop disconnection is not detected.

- (Loop disconnection detection dead band set value) × (resolution) = 50 × 0.1 = 5.0℃

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 0 in all channels.

(27)CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H) Common

Set the mode when PID control stops.

(a) Setting range and action of the temperature control module

The following table lists the relationship.

Stop mode	Set value of CH☐ Stop mode setting (address: 118H, 148H, 178H, 1A8H)	Action*1		
		PID control	Temperature judgment*2	Alert judgment
Stop	0	×	×	×
Monitor	1	×	○	×
Alert	2	×	○	○

*1 ○: Executed, ×: Not executed

*2 Means that the temperature control module checks whether the input temperature is in the temperature measurement range set in the input range.

For details on the operation shown above, refer to the following.

- PID control: ☞ Page 153, Section 8.3.3 (5)
- Temperature judgment: ☞ Page 303, Appendix 2 (5)
- Alert judgment: ☞ Page 169, Section 8.3.11

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default value depends on the mode used.

- Temperature input mode: Stop (0) in all channels.
- Temperature control mode: Monitor (1) in all channels.

(28)CH□ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H) Standard Heating-cooling

The set value to be stored in the remote buffer memory is automatically backed up to a non-volatile memory by using this function. By reading the set value that is backed up, when the power is turned off and on, another auto tuning can be omitted.

For details on the auto tuning function, refer to the following.

☞ Page 159, Section 8.3.7

(a) Remote buffer memory areas whose set value is backed up to a non-volatile memory

The following table lists the remote buffer memory areas whose setting is backed up.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Proportional band (P) setting	102H	132H	162H	192H	Page 318, Appendix 3 (7)
CH□ Heating proportional band (Ph) setting	102H	132H	162H	192H	
CH□ Cooling proportional band (Pc) setting	1C4H	1C9H	1CEH	1D3H	
CH□ Integral time (I) setting	103H	133H	163H	193H	Page 320, Appendix 3 (8)
CH□ Derivative time (D) setting	104H	134H	164H	194H	Page 320, Appendix 3 (9)
CH□ Loop disconnection detection judgment time	116H	146H	176H	1A6H	Page 334, Appendix 3 (25)

(b) Setting range

- 0: Disable
- 1: Enable

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to Disable (0) in all channels.

(e) Precautions

When Enable (1) is set, do not perform the following operations. An incorrect value may be stored in the non-volatile memory.

- Changing the set value of the remote buffer memory
- Memory back up (☞ Page 136, Section 8.1.7)
- Default setting registration (☞ Page 297, Appendix 1.2 (6))
- Change to Disable (0) during the auto tuning

(29)CH☐ Temperature conversion setting (address: 1C1H to 1C3H) Heating-cooling

In the heating-cooling control (normal mode) or the mix control (normal mode), only the temperature measurement can be performed using temperature input terminals of unused channels.
The following table lists the settable remote buffer memory addresses for each control mode selection.

Channel	Control mode				
	Standard control	Heating-cooling control (normal mode)	Heating-cooling control (expanded mode)	Mix control (normal mode)	Mix control (expanded mode)
CH1	—	—	—	—	—
CH2	—	—	—	1C1H	—
CH3	—	1C2H	—	—	—
CH4	—	1C3H	—	—	—

When the combination of the control mode and the remote buffer memory address is not the setting target in the above list, the combination is invalid even if it is set.

(a) Setting range

- 0: Not use
- 1: Use

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to Not use (0) in all channels.

Point

- When CH☐ Temperature conversion setting (address: 1C1H to 1C3H) is set to Use (1), the temperature conversion starts. This function does not turn on CH2 to CH4 Operation monitor (RX12 to RX14).
- When the following control mode is selected, this setting is invalid.
  - Standard control
  - Heating-cooling control (expanded mode)
  - Mix control (expanded mode)

(30)CH☐ Overlap/dead band setting (address: 1C7H, 1CCH, 1D1H, 1D6H) Heating-cooling

Configure the overlap/dead band setting.
For details on the overlap/dead band function, refer to the following.
☞ Page 219, Section 8.3.23

(a) Setting range

Set the value within the following ranges for the full scale of the set input range. (☞ Page 312, Appendix 3 (5))

- -100 to -1 (-10.0% to -0.1%): Overlap
- 0 (0.0%): None
- 1 to 100 (0.1% to 10.0%): Dead band

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to 0 (0.0%) in all channels.

(31)Alert dead band setting (address: 1E0H) Standard Heating-cooling

This setting is for using the alarm function.
For details on the alert function, refer to the following.
☞ Page 169, Section 8.3.11

(a) Setting range

Set the value within the range 0 to 100 (0.0% to 10.0%) of the full scale of the set input range.
For details on the input range, refer to the following.
☞ Page 312, Appendix 3 (5)

Ex. When the value of the remote buffer memory is set as follows; CH☐ Input range (address: 100H, 130H, 160H, 190H): 2 (temperature measurement range: 0 to 1300℃), Alert dead band setting (address: 1E0H): 5 (0.5%)
The following calculation shows that the dead band is the range of 6.5℃ with the alert set value being set as the center of the range.

- (Full scale) × (Alert dead band) = (1300℃ - 0℃) × 0.005 = 6.5℃

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default value is set to 5 (0.5%).

(32)Number of alert delay (address: 1E1H) Standard Heating-cooling

Set the number of sampling to judge alert occurrence.
By setting number of sampling, when the temperature process value (PV) stays within the alert area until the number of sampling exceeds the number of alert delay, the alert status will be active.
For details on the alert function, refer to the following.

☞Page 169, Section 8.3.11

(a) Setting range

The setting range is 0 to 255 (times).
If Number of alert delay (address: 1E1H) is set to 0 (time) and the temperature process value (PV) falls within the alert range, an alert is instantly raised (alert status).

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

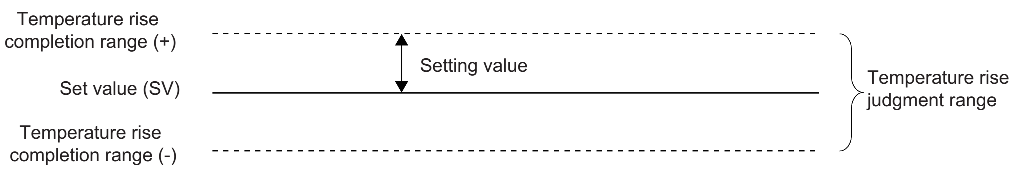
(c) Default value

The default value is set to 0 (time).

(33)Temperature rise completion range setting (address: 1E2H) Standard Heating-cooling

Set the vertical range of the temperature rise completion range.
When the temperature process value (PV) meets the following conditions, the temperature rise is completed.

- (Set value (SV) - Temperature rise completion range (-)) ≤ Temperature process value (PV) ≤ (Set value (SV) + Temperature rise completion range (+))



When CH☐ Temperature process value (PV) or CH☐ Process value (PV) scaling value (RWr8 to RWrB) falls within the temperature rise judgment range, CH☐ Temperature rise judgment flag (RX1C to RX1F) turns on. (Set the time taken to change the status from off to on with Temperature rise completion soak time setting (address: 1E3H).)

(a) Setting range

- When the temperature unit of the input range is ℃: 1 to 10 (℃)
- When the temperature unit of the input range is ℉: 1 to 10 (℉)
- Other than above: 1 to 10 (%) of the full scale

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default value is set to 1.

(34)Temperature rise completion soak time setting (address: 1E3H) Standard Heating-cooling

Set the time for CH□ Temperature rise judgment flag (RX1C to RX1F) (☞ Page 290, Appendix 1.1 (11)) to turn on after the completion of temperature rise.

(a) Setting range

The setting range is 0 to 3600 (min).

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default value is set to 0 (min).

(35)Sensor correction function selection (address: 1E4H) Common

Select the method of the sensor correction for each channel.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

For details on the sensor correction function, refer to the following.

☞ Page 132, Section 8.1.5

(a) Setting range

- 0H: Normal sensor correction (one-point correction)
- 1H: Sensor two-point correction

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

Default value is set to Normal sensor correction (one-point correction) (0H).

(36)Peak current suppression control group setting (address: 1E5H) Standard

Set the target channels for the peak current suppression function and the gap of the control output cycle between channels.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

For details on the peak current suppression function, refer to the following.

☞Page 193, Section 8.3.16

(a) Setting range

- 0H: Not divide
- 1H: Group 1
- 2H: Group 2
- 3H: Group 3
- 4H: Group 4

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default value is set to Not divide (0H).

Point

The upper limit output limiter value is automatically set since the division number depends on this setting.
The following table lists the upper limit output limiter values which are set when this setting is enabled.

Division Number	CH☐ Upper limit output limiter (address: 105H, 135H, 165H, 195H) (☞Page 321, Appendix 3 (10))
2	500 (50.0%)
3	333 (33.3%)
4	250 (25.0%)

CH☐ Lower limit output limiter (address: 106H, 136H, 166H, 196H) is set to 0.

(37)Cooling method setting (address: 1E6H) Heating-cooling

Set the method for the cooling control in the heating-cooling control. Select the suitable cooling method for cooling characteristics of devices.

The following figure shows the channel assignment of the remote buffer memory area.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

For details on the cooling method setting function, refer to the following.

☞ Page 217, Section 8.3.22

(a) Setting range

- 0H: Air cooled
- 1H: Water cooled
- 2H: Linear

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default value is set to Air cooled (0H).

(38)During AT loop disconnection detection function enable/disable setting (address: 1E7H) Standard

Set whether to enable or disable the loop disconnection detection function during auto tuning (AT).

For details on the during AT loop disconnection detection function, refer to the following.

☞ Page 214, Section 8.3.20

b15					to						b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Bit data from b4 to b15 are fixed to 0.

(a) Setting range

- 0: Disable
- 1: Enable

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to Disable (0) in all channels.

(39)Resolution of the manipulated value for output with another analog module (address: 1E8H) Standard Heating-cooling

Set the resolution of the following remote registers. (☞ Page 305, Appendix 2 (8))

- CH□ Manipulated value (MV) (RWr10 to RWr13)
- CH□ Manipulated value for heating (MVh) (RWr10 to RWr13)
- CH□ Manipulated value for cooling (MVc) (RWr14 to RWr17)

For details, refer to the following.

☞ Page 182, Section 8.3.13 (2)

(a) Setting range

- 0: 0 to 4000
- 1: 0 to 12000
- 2: 0 to 16000
- 3: 0 to 20000

The manipulated value (MV) reflecting the resolution is stored in the following remote registers. (☞ Page 308, Appendix 2 (10))

- CH□ Manipulated value (MV) for output with another analog module (RWr18 to RWr1B)
- CH□ Manipulated value of heating (MVh) for output with another analog module (RWr18 to RWr1B)
- CH□ Manipulated value of cooling (MVc) for output with another analog module (RWr1C to RWr1F)

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default value is set to 0 to 4000 (0).

(40)Cold junction temperature compensation selection (address: 1E9H) Common

Select the method of the cold junction temperature compensation.

(a) Supported modules

Only NZ2GF2B-60TCTT4 can be used.

(b) Setting range

- 0: Use Standard Terminal Block
- 1: Use prohibited
- 2: Not use cold junction temperature compensation

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default value is set to Use Standard Terminal Block (0).

(41)Transistor output monitor ON delay time setting (address: 1EAH) Standard Heating-cooling

Set the delay time of the ON delay output flag.
Set this remote buffer memory area to perform the heater disconnection detection with an input module the system involves.
For ON delay output flag, refer to the following.
☞ Page 293, Appendix 1.1 (16)
For details on the ON delay output function, refer to the following.
☞ Page 183, Section 8.3.14

(a) Setting range

The setting range is 0 or 1 to 50 (10 to 500ms).
When 0 is set, ON delay output flag is not set to 1 (ON).

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default value is set to 0.

(42)CH□ Process value (PV) scaling function enable/disable setting (address: 200H, 203H, 206H, 209H) Common

Set enable/disable of the temperature process value (PV) scaling function.
For details on the temperature process value (PV) scaling function, refer to the following.
☞ Page 130, Section 8.1.4

(a) Setting range

- 0: Disable
- 1: Enable

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default values are set to Disable (0) in all channels.

(43)CH☐ Process value (PV) scaling lower limit value (address: 201H, 204H, 207H, 20AH) Common, CH☐ Process value (PV) scaling upper limit value (address: 202H, 205H, 208H, 20BH) Common

Set the upper limit value/lower limit value of the temperature process value (PV) scaling function.
For details on the temperature process value (PV) scaling function, refer to the following.
☞ Page 130, Section 8.1.4

(a) Setting range

The setting is -32000 to 32000.

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default values are set to 0 in all channels.

Point

The setting where the lower limit value is not less than the upper limit value does not cause an error. The temperature process value (PV) is scaled according to the formula of ☞ Page 130, Section 8.1.4 (2).

(44)CH☐ Alert 1 mode setting (address: 220H, 228H, 230H, 238H) Standard Heating-cooling, CH☐ Alert 2 mode setting (address: 221H, 229H, 231H, 239H) Standard Heating-cooling, CH☐ Alert 3 mode setting (address: 222H, 22AH, 232H, 23AH) Standard Heating-cooling, CH☐ Alert 4 mode setting (address: 223H, 22BH, 233H, 23BH) Standard Heating-cooling

Set the alert mode of alert 1 to 4.
For details on the alert function, refer to the following.
☞ Page 169, Section 8.3.11

(a) Alert mode and alert set value

Any alert set value can be set in each alert mode of alert 1 to 4 selected in this setting. Set the alert set value 1 to 4 in the following remote buffer memory areas. Alert set values 1 to 4 respectively correspond to alert modes of alert 1 to 4.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Alert set value 1	224H	22CH	234H	23CH	Page 348, Appendix 3 (45)
CH☐ Alert set value 2	225H	22DH	235H	23DH	
CH☐ Alert set value 3	226H	22EH	236H	23EH	
CH☐ Alert set value 4	227H	22FH	237H	23FH	

(b) Setting range

The following table lists set values and setting ranges which are available for alert set values set in each alert mode.

Setting value	Alert mode	Setting range of alert set value
0	— (no alert)	—
1	Upper limit input alert	Within the temperature measurement range of the set input range (☞ Page 312, Appendix 3 (5))
2	Lower limit input alert	
3	Upper limit deviation alert	(-(full scale)) to full scale
4	Lower limit deviation alert	
5	Upper lower limit deviation alert	0 to full scale
6	Within-range alert	
7	Upper limit input alert with standby	Within the temperature measurement range of the set input range (☞ Page 312, Appendix 3 (5))
8	Lower limit input alert with standby	
9	Upper limit deviation alert with standby	(-(full scale)) to full scale
10	Lower limit deviation alert with standby	
11	Upper lower limit deviation alert with standby	0 to full scale
12	Upper limit deviation alert with standby (second time)	(-(full scale)) to full scale
13	Lower limit deviation alert with standby (second time)	
14	Upper lower limit deviation alert with standby (second time)	0 to full scale
15	Upper limit deviation alert (using the set value (SV))	(-(full scale)) to full scale
16	Lower limit deviation alert (using the set value (SV))	
17	Upper lower limit deviation alert (using the set value (SV))	0 to full scale
18	Within-range alert (using the set value (SV))	
19	Upper limit deviation alert with standby (using the set value (SV))	(-(full scale)) to full scale
20	Lower limit deviation alert with standby (using the set value (SV))	
21	Upper lower limit deviation alert with standby (using the set value (SV))	0 to full scale
22	Upper limit deviation alert with standby (second time) (using the set value (SV))	(-(full scale)) to full scale
23	Lower limit deviation alert with standby (second time) (using the set value (SV))	
24	Upper lower limit deviation alert with standby (second time) (using the set value (SV))	0 to full scale

(c) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.
When the set value is out of the range, a write data error (error code: 0004H) occurs, and the temperature control module operates with the previous set value.

(d) Default value

The default values are set to 0 in all channels.

(45)CH☐ Alert set value 1 (address: 224H, 22CH, 234H, 23CH) Standard Heating-cooling, CH☐ Alert set value 2 (address: 225H, 22DH, 235H, 23DH) Standard Heating-cooling, CH☐ Alert set value 3 (address: 226H, 22EH, 236H, 23EH) Standard Heating-cooling, CH☐ Alert set value 4 (address: 227H, 22FH, 237H, 23FH) Standard Heating-cooling

Set temperature values where CH☐ Alert 1 (b8 of RWr4 to RWr7) to CH☐ Alert 4 (b11 of RWr4 to RWr7) turn on according to selected alert mode of alert 1 to 4.

For CH☐ Alert definition (RWr4 to RWr7), refer to the following.

☞ Page 303, Appendix 2 (5)

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

☞ Page 169, Section 8.3.11

(a) Alert mode

Set the alert mode of alert 1 to 4 in the following remote buffer memory areas. Each alert mode for alert 1 to 4 corresponds to alert set value 1 to 4.

(b) Setting range

Remote buffer memory	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Alert 1 mode setting	220H	228H	230H	238H	Page 346, Appendix 3 (44)
CH☐ Alert 2 mode setting	221H	229H	231H	239H	
CH☐ Alert 3 mode setting	222H	22AH	232H	23AH	
CH☐ Alert 4 mode setting	223H	22BH	233H	23BH	

The setting range differs depending on the setting of the following remote buffer memory area. (each full scale differs)

- CH☐ Input range (address: 100H, 130H, 160H, 190H) (☞ Page 312, Appendix 3 (5))

Also, the setting range differs depending on alert mode to be set. (☞ Page 348, Appendix 3 (45) (a))

Alert mode	Setting range of alert set value	Remarks
No alert	—	—
Upper limit input alert, lower limit input alert	Temperature measurement range of the input range	Same as with standby
Upper limit deviation alert, lower limit deviation alert, upper limit deviation alert (using the set value (SV)), lower limit deviation alert (using the set value (SV))	(-(full scale)) to full scale	Same as with standby and standby (second time)
Upper lower limit deviation alert, within-range alert, upper lower limit deviation alert (using the set value (SV)), within-range alert (using the set value (SV))	0 to full scale	Same as with standby and standby (second time)

When a value which is out of the setting range is set, a write data error (error code: 0004H) and the following situations occur.

- Error flag (RXA) turns on.
- The error code is stored to Latest error code (RWr0).

(c) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(d) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(e) Default value

The default values are set to 0 in all channels.

(46)CH□ Process alarm alert output enable/disable setting (address: 250H, 259H, 262H, 26BH) Temperature Input

Set whether to enable or disable alert output of process alarm. For details on the process alarm, refer to the following.

☞ Page 139, Section 8.2.1 (1)

(a) Setting range

- 0: Enable
- 1: Disable

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default values are set to Disable (1) in all channels.

(47)CH☐ Process alarm lower lower limit value (address: 251H, 25AH, 263H, 26CH) Temperature Input, CH☐ Process alarm lower upper limit value (address: 252H, 25BH, 264H, 26DH) Temperature Input, CH☐ Process alarm upper lower limit value (address: 253H, 25CH, 265H, 26EH) Temperature Input, CH☐ Process alarm upper upper limit value (address: 254H, 25DH, 266H, 26FH) Temperature Input

Set the lower lower limit value, lower upper limit value, upper lower value, and upper upper limit of process alarm.

(a) Setting range

The setting range should meet the both of the following. If the setting is out of the setting value, out of range error (error code: 0008H) occurs.

- Within the temperature measurement range of set input range (☞ Page 312, Appendix 3 (5))
- Process alarm lower lower limit value ≤ Process alarm lower upper limit value ≤ Process alarm upper lower limit value ≤ Process alarm upper upper limit value

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(d) Default value

Item	Default value	
	NZ2GF2B-60TCTT4	NZ2GF2B-60TCRT4
CH☐ Process alarm lower lower limit value	0	-2000
CH☐ Process alarm lower upper limit value	0	-2000
CH☐ Process alarm upper lower limit value	1300	6000
CH☐ Process alarm upper upper limit value	1300	6000

(48)CH☐ Rate alarm alert output enable/disable setting (address: 255H, 25EH, 267H, 270H) Temperature Input

Set whether to enable or disable alert output of rate alarm. For details on the rate alarm, refer to the following.
☞ Page 140, Section 8.2.1 (2)

(a) Setting range

- 0: Enable
- 1: Disable

(b) Enabling the setting

To enable the setting, turn on and off Initial data setting request flag (RY9) while the operation is stopped.

(c) Default value

The default values are set to Disable (1) in all channels.

(49)CH☐ Rate alarm alert detection cycle (address: 256H, 25FH, 268H, 271H) Temperature Input

Set the check cycle of the temperature process value (PV) for the rate alarm. Set the frequency of checks in the unit of sampling cycles.
The check cycle can be calculated from the following formula.

- Rate alarm alert detection cycle = Set value of Rate alarm alert detection cycle × Sampling cycle

(a) Setting range

The setting range is 1 to 6000 (times).

(b) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(c) Default value

The default values are set to Every sampling cycle (1) in all channels.

(50)CH☐ Rate alarm upper limit value (address: 257H, 260H, 269H, 272H) Temperature Input, CH☐ Rate alarm lower limit value (address: 258H, 261H, 26AH, 273H) Temperature Input

Set the rate alarm upper limit value and lower limit value.

(a) Setting range

The setting is -32768 to 32767.

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(d) Default value

The default values are set to 0 in all channels.

(51)CH☐ Sensor correction value setting (address: 280H to 283H) Common

Set the correction value when measured temperature and actual temperature are different.

For details on the sensor correction function, refer to the following.

☞ Page 132, Section 8.1.5

(a) Setting range

- Set the value within the range -5000 to 5000 (-50.00% to 50.00%) of the full scale of the set input range. For details on the input range, refer to ☞ Page 312, Appendix 3 (5).
- When Normal sensor correction (one-point correction) (0H) is set in Sensor correction function selection (address: 1E4H), the setting content is enabled. (☞ Page 341, Appendix 3 (35))

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to 0 (0.00%) in all channels.

(52)CH☐ Sensor two-point correction offset value (measured value) (address: 284H, 288H, 28CH, 290H) Common

The measured value of temperature corresponding to the offset value of the sensor two-point correction is stored in this remote buffer memory area.

The value to be stored differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): The value is stored as it is.
- One decimal place (1): The value is stored after being multiplied by 10.

For details on the sensor two-point correction function, refer to the following.

☞ Page 133, Section 8.1.5 (2)

(a) Enabling the stored value

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(53)CH☐ Sensor two-point correction offset value (corrected value) (address: 285H, 289H, 28DH, 291H) Common

Set the temperature of the offset value of the sensor two-point correction.
For details on the sensor two-point correction function, refer to the following.
☞ Page 133, Section 8.1.5 (2)

(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (☞ Page 312, Appendix 3 (5))

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(d) Default value

The default values are set to 0 in all channels.

(54)CH☐ Sensor two-point correction gain value (measured value) (address: 286H, 28AH, 28EH, 292H) Common

The measured value of temperature corresponding to the gain value of the sensor two-point correction is stored in this remote buffer memory area.
The value to be stored differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): The value is stored as it is.
- One decimal place (1): The value is stored after being multiplied by 10.

For details on the sensor two-point correction function, refer to the following.
☞ Page 133, Section 8.1.5 (2)

(a) Enabling the stored value

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(55)CH□ Sensor two-point correction gain value (corrected value) (address: 287H, 28BH, 28FH, 293H) Common

Set temperature of gain value of the sensor two-point correction.
For details on the sensor two-point correction function, refer to the following.
☞ Page 133, Section 8.1.5 (2)

(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (☞ Page 312, Appendix 3 (5))

(b) Setting unit

The value to be set differs depending on the stored value in CH□ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(d) Default value

The default values are set to 0 in all channels.

(56)CH□ Auto tuning mode selection (address: 2A0H, 2A2H, 2A4H, 2A6H)

Standard Heating-cooling

Select the auto tuning mode from the following two modes according to the controlled object to be used.

Auto tuning mode	Description
Standard mode	The standard mode is appropriate for most controlled objects. This mode is especially suitable for controlled objects that have an extremely slow response speed or can be affected by noise or disturbance. However, PID constants of slow response (low gain) may be calculated from controlled objects whose ON time or OFF time in the auto tuning is only around 10s. In this case, PID constants of fast response can be calculated by selecting the high response mode and performing the auto tuning.
High response mode	This mode is suitable for controlled objects whose ON time or OFF time in the auto tuning is only around 10s. PID constants of fast response (high gain) can be calculated. However, the temperature process value (PV) may oscillate near the set value (SV) because of the too high gain of the PID constants calculated. In this case, select the normal mode and perform the auto tuning.

For details on the auto tuning function, refer to the following.
☞ Page 159, Section 8.3.7

(a) Setting range

- 0: Standard mode
- 1: High response mode

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

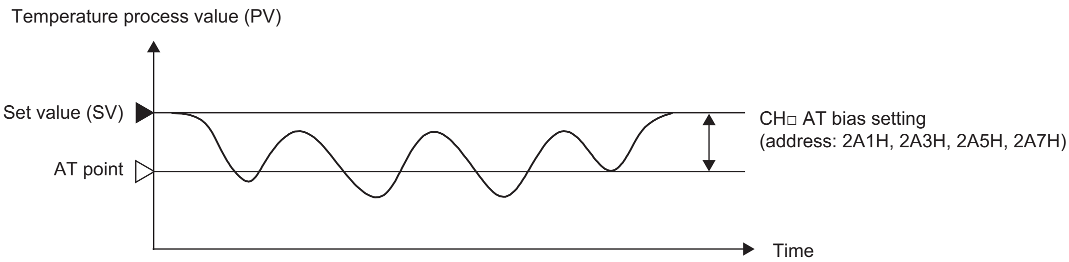
(c) Default value

The default values are set to Standard mode (0) in all channels.

(57)CH☐ AT bias setting (address: 2A1H, 2A3H, 2A5H, 2A7H) Standard Heating-cooling

The point set as the set value (SV) in the auto tuning can be rearranged by using this remote buffer memory area. The auto tuning function determines each PID constant by performing the two-position control toward the set value (SV) and making a temperature process value (PV) hunting.
Set CH☐ AT bias setting (address: 2A1H, 2A3H, 2A5H, 2A7H) when an overshoot caused by the hunting is improper.
The auto tuning is performed with having the AT point (the point rearranged by the setting) as its center. When the auto tuning is completed, AT bias is not added and a control is performed toward the set value (SV).
For details on the auto tuning function, refer to the following.
☞ Page 159, Section 8.3.7

Ex. When AT bias is set to minus value (reverse action)



(a) Setting range

The setting range is from (-(full scale)) to full scale. The setting range depends on the input range setting. (☞ Page 312, Appendix 3 (5))

Ex. When remote buffer memory values are set as following, the setting range is -6000 to 6000.
- CH☐ Input range (address: 100H, 130H, 160H, 190H): 38 (temperature measurement range -200.0 to 400.0℃, resolution: 0.1)

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))
- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

Enable the setting contents by either of the following.
- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 0 in all channels.

(e) Precautions

For CH☐ AT bias setting (address: 2A1H, 2A3H, 2A5H, 2A7H), set the range where PID operation fluctuates slightly and the control result get no effect.
Depending on the controlled object, accurate PID constants may not be obtained.

(58)CH☐ Self-tuning setting (address: 2C0H to 2C3H) Standard

Perform operation setting of self-tuning with this remote buffer memory area.

For details on the self-tuning function, refer to the following.

☞ Page 184, Section 8.3.15

(a) Setting range

- 0: Do not run the ST
- 1: Starting ST (PID constants only)
- 2: Starting ST (Simultaneous temperature rise parameter only*1)
- 3: Starting ST (PID constants and simultaneous temperature rise parameter*1)
- 4: Starting ST plus vibration ST (PID constants only)

*1 Indicates the values of CH☐ Simultaneous temperature rise gradient data (address: 2D1H, 2D5H, 2D9H, 2DDH) and CH☐ Simultaneous temperature rise dead time (address: 2D2H, 2D6H, 2DAH, 2DEH) to be used in the simultaneous temperature rise function.

For details on the simultaneous temperature rise function, refer to the following.

☞ Page 198, Section 8.3.17

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to Do not run the ST (0) in all channels.

Point

This area is enabled only for the following channels.

- CH1 to CH4 when the standard control is used
- CH3 and CH4 when mix control (normal mode) or mix control (expanded mode) is used

(59)CH☐ Simultaneous temperature rise group setting (address: 2D0H, 2D4H, 2D8H, 2DCH) Standard

Set a group to perform the simultaneous temperature rise function for each channel. The simultaneous temperature rise function enables channels in the same group to complete the rise of temperature simultaneously. When the control mode is the heating-cooling control, this setting is invalid.
For details on the simultaneous temperature rise function, refer to the following.
☞ Page 198, Section 8.3.17

(a) Setting range of the standard control

- 0: No simultaneous temperature rise
- 1: Group 1 selection
- 2: Group 2 selection

(b) Setting range of the mix control

- 0: No simultaneous temperature rise
- 1: Simultaneous temperature rise

The setting range in the mix control does not include group selection because the mix control has only two channels for the standard control.

(c) Enabling the setting

To enable the setting, turn off and on Initial data setting request flag (RY9) while the operations of all channels are stopped.

(d) Default value

The default values are set to No simultaneous temperature rise (0) in all channels.

(60)CH☐ Simultaneous temperature rise gradient data (address: 2D1H, 2D5H, 2D9H, 2DDH) Standard

Set Simultaneous temperature rise gradient data (temperature rising per minute).
For details on the simultaneous temperature rise function, refer to the following.
☞ Page 198, Section 8.3.17

(a) Setting range

The setting range is 0 to full scale.

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (address: 620H, 621H, 622H, 623H). (☞ Page 362, Appendix 3 (68))

- No decimal place (0): Set a value in 1℃ (℉ or digit) unit.
- One decimal place (1): Set a value in 0.1℃ (℉) unit (tenfold value).

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to 0 in all channels.

Point

This setting can not only be set manually but also be calculated automatically. Automatic calculation is performed when the simultaneous temperature rise AT (auto tuning) or self-tuning (when the automatic calculation of the temperature rise parameter is set) is normally completed.

(61)CH□ Simultaneous temperature rise dead time (address: 2D2H, 2D6H, 2DAH, 2DEH) Standard

Set Simultaneous temperature rise dead time (time taken for the temperature to start rising after the output is turned on).

For details on the simultaneous temperature rise function, refer to the following.

☞ Page 198, Section 8.3.17

(a) Setting range

The setting range is 0 to 3600 (s).

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to 0 in all channels.

Point

This setting can not only be set manually but also be calculated automatically. Automatic calculation is performed when the simultaneous temperature rise AT (auto tuning) or self-tuning (when the automatic calculation of the temperature rise parameter is set) is normally completed.

(62)CH□ Simultaneous temperature rise AT mode selection (address: 2D3H, 2D7H, 2DBH, 2DFH) Standard

Select mode of the auto tuning.

For details on the auto tuning function, refer to the following.

☞ Page 159, Section 8.3.7

For details on the simultaneous temperature rise function, refer to the following.

☞ Page 198, Section 8.3.17

(a) Setting range

- 0: Select normal auto tuning
- 1: Simultaneous temperature rise AT

(b) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(c) Default value

The default values are set to Select normal auto tuning (0) in all channels.

Point

- This setting can be used with the setting of CH□ Auto tuning mode selection (address: 2A0H, 2A2H, 2A4H, 2A6H). (☞ Page 354, Appendix 3 (56))
- If this setting is changed during the auto tuning, it is enabled in the next auto tuning.

(63)Cold junction temperature process value (address: 600H) Common

The measured temperature of cold junction temperature compensation resistor is stored in this remote buffer memory area.

Values to be stored*1 vary depending on the temperature unit set in CH1 Input range (address: 100H). (☞ Page 312, Appendix 3 (5))

- For other than ℉: -10 to 100
- For ℉: 14 to 212

*1 The operation of the temperature control module is guaranteed in the ambient temperature of 0 to 55℃.
For the general specifications of the temperature control module, refer to the following.
☞ Page 33, Section 3.1

(a) Usable modules

- NZ2GF2B-60TCTT4

(64)MAN mode (address: 601H) Standard Heating-cooling

This area is for checking completion of the mode shift when shifting AUTO (auto) mode to MAN (manual) mode.

The following values are stored in this remote buffer memory area.

- 0: MAN mode shift uncompleted
- 1: MAN mode shift completed

The following figure shows bits of the remote buffer memory area that correspond to 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	0	0	0	0	CH4	CH3	CH2	CH1

Bit data from b4 to b15 are fixed to 0.

When shift to MAN mode is completed, bits corresponding to appropriate channel become MAN mode shift completed (1).

(a) How to shift the mode

Shift the mode by the following remote buffer memory area.

- CH☐ AUTO/MAN mode shift (address: 113H, 143H, 173H, 1A3H) (☞ Page 332, Appendix 3 (22))

(b) Setting manipulated value (MV) in MAN mode

Set the manipulated value (MV) in the following remote buffer memory area.

- CH☐ MAN output setting (address: 114H, 144H, 174H, 1A4H) (☞ Page 333, Appendix 3 (23))

Set the manipulated value (MV) after confirming MAN mode (address: 601H) has become MAN mode shift completed (1).

(65)Control switching monitor (address: 602H) Common

The value set in Control mode shift (address: 80H) is stored. The mode in operation can be confirmed.

The following table lists the stored values and the contents.

Stored value	Control mode	
0H	Temperature control mode	Standard Control
1H	Temperature control mode	Heating-cooling control (normal mode)
2H	Temperature control mode	Heating-cooling control (expanded mode)
3H	Temperature control mode	Mix control (normal mode)
4H	Temperature control mode	Mix control (expanded mode)
100H	Temperature input mode	

Select a mode with Control mode shift (address: 80H).

For details, refer to the following.

☞ Page 311, Appendix 3 (3)

For details on the modes, refer to the following.

☞ Page 138, Section 8.2, Page 145, Section 8.3.1

(66)Function extension bit monitor (address: 603H) Common

The following settings set with Sampling cycle and function extension setting (address: 1H) are stored.

- Auto-setting at input range change (address: 1H. b0)
- Setting change rate limiter setting (address: 1H. b1)
- Control output cycle unit selection setting (address: 1H. b2)
- Moving averaging process setting (address: 1H. b3)

For details on Sampling cycle and function extension setting (address: 1H), refer to the following.

☞ Page 309, Appendix 3 (1)

The following figure and table show how the setting is stored.

b15					to						b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0				

Bit data from b4 to b15 are fixed to 0.

Bit	Flag name (Function extension bit monitor)	Description
b0	Auto-setting at input range change	When the input range is changed, the related remote buffer memory data is automatically changed to prevent the values in those remote buffer memory areas from being out of the setting range. (☞ Page 316, Appendix 3 (5) (d)) 0: Disable 1: Enable
b1	Setting change rate limiter setting	Select whether the setting change rate limiter to be set in a batch or individually. (☞ Page 167, Section 8.3.10) 0: Temperature Rise/Temperature Drop Batch Setting 1: Temperature Rise/Temperature Drop Individual Setting
b2	Control output cycle unit selection setting	Select 0.1s or 1s as a unit for the cycle of turning on/off the transistor output. (☞ Page 158, Section 8.3.6) 0: 1s Cycle 1: 0.1s Cycle
b3	Moving averaging process setting	Select whether the moving averaging process setting is used. (☞ Page 129, Section 8.1.3) 0: Enable 1: Disable
b4 to b15	— (fixed to 0)	— (unused)

(67)Sampling cycle monitor (address: 604H) Common

Current sampling cycle is stored.

- 0: 500ms/4 channels
- 1: 250ms/4 channels

Set the sampling cycle on Sampling cycle selection (address: 1H. b12).

For details, refer to the following.

☞ Page 309, Appendix 3 (1)

(68)CH☐ Decimal point position (address: 620H, 621H, 622H, 623H) Common

According to the setting of CH☐ Input range (address: 100H, 130H, 160H, 190H), the decimal point position applicable in the following items is stored in this remote buffer memory area.

Item name	Remote register address/Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Temperature process value (PV)	RWr8	RWr9	RWrA	RWrB	Page 304, Appendix 2 (6)
CH☐ Set value (SV) setting	101H	131H	161H	191H	Page 317, Appendix 3 (6)
CH☐ Alert set value 1	224H	22CH	234H	23CH	Page 348, Appendix 3 (45)
CH☐ Alert set value 2	225H	22DH	235H	23DH	
CH☐ Alert set value 3	226H	22EH	236H	23EH	
CH☐ Alert set value 4	227H	22FH	237H	23FH	
CH☐ AT bias	2A1H	2A3H	2A5H	2A7H	Page 355, Appendix 3 (57)
CH☐ Upper limit setting limiter	10AH	13AH	16AH	19AH	Page 325, Appendix 3 (14)
CH☐ Lower limit setting limiter	10BH	13BH	16BH	19BH	
CH☐ Loop disconnection detection dead band	117H	147H	177H	1A7H	Page 335, Appendix 3 (26)
CH☐ Process alarm lower lower limit value	251H	25AH	263H	26CH	Page 350, Appendix 3 (47)
CH☐ Process alarm lower upper limit value	252H	25BH	264H	26DH	
CH☐ Process alarm upper lower limit value	253H	25CH	265H	26EH	
CH☐ Process alarm upper upper limit value	254H	25DH	266H	26FH	
CH☐ Rate alarm upper limit value	257H	260H	269H	272H	Page 351, Appendix 3 (50)
CH☐ Rate alarm lower limit value	258H	261H	26AH	273H	
CH☐ Sensor two-point correction offset value (measured value)	284H	288H	28CH	290H	Page 352, Appendix 3 (52)
CH☐ Sensor two-point correction offset value (corrected value)	285H	289H	28DH	291H	Page 353, Appendix 3 (53)
CH☐ Sensor two-point correction gain value (measured value)	286H	28AH	28EH	292H	Page 353, Appendix 3 (54)
CH☐ Sensor two-point correction gain value (corrected value)	287H	28BH	28FH	293H	Page 354, Appendix 3 (55)
CH☐ Simultaneous temperature rise gradient data	2D1H	2D5H	2D9H	2DDH	Page 357, Appendix 3 (60)

Stored values differ depending on the setting in CH☐ Input range (address: 100H, 130H, 160H, 190H).

CH☐ Input range (address: 100H, 130H, 160H, 190H) ☞ Page 312, Appendix 3 (5)	Stored value	Setting contents
Resolution is 1.	0	Nothing after decimal point
Resolution is 0.1.	1	First decimal place

(69)Error history □ (address: A00H to FFFH) Common

Up to 15 errors generated in the module are recorded.

The following table and figure show the storage contents for Error history 1 (address: A00H to A0FH).

	b15 to b8	b7 to b0
0A00H	Error code	
0A01H	Order of generation	
0A02H	First two digits of the year	Last two digits of the year
0A03H	Month	Date
0A04H	Hour	Minute
0A05H	Second	00H (Fixed)
0A06H	Error occurrence address	
0A07H	Process value (PV)	
0A08H	Manipulated value (MV)	
0A09H	Set value (SV)	
0A0AH to 0A0FH	System area	

Item	Contents	Storage example[*1]
Error code	The error code of the error that occurred is stored.	000DH
Order of generation	The order of error occurrence is stored.	2H
First two digits of the year/Last two digits of the year[*2]	The items on the left are stored in BCD code.	2012H
Month/Date[*2]		0901H
Hour/Minute[*2]		1330H
Second/00H (Fixed)[*2]		5000H
Error occurrence address	The details of the error is stored.	80H
Process value (PV)		0H
Manipulated value (MV)		0H
Set value (SV)		0H

*1 Those are values when the second error (control mode change error) occurs at 13:30:50, September 1st, 2012.

*2 The clock information of the error that occurred is based on the clock information acquired from the CPU module of the master station. When an error has occurred before the clock information is acquired from the CPU module, the error time is not recorded.

Error history 2 to Error history 15 (address: A10H to AEFH) are stored in the same format as that of Error history 1 (address: A00H to A0FH).

For the error code, refer to the following.

- Lists of Error Codes (☞ Page 271, Section 11.2)

(a) Storage order of the error history

The latest error is stored in Error history 1 (address: A00H to A0FH).

Errors that occurred in the past are stored in Error history 2 to Error history 15 (address: A10H to AEFH) in reverse chronological order.

If 16 or more errors occur, errors are deleted from the oldest.

(70)Error history clear command (address: 1000H) Common

This command is used to clear the error history stored in the nonvolatile memory.

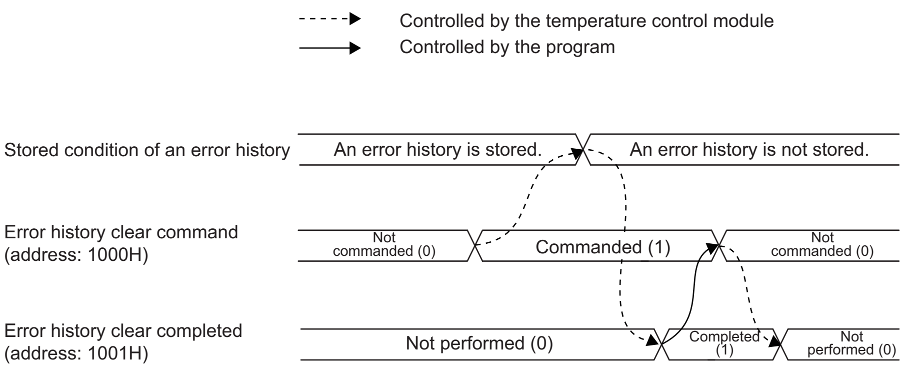
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Bit data from b1 to b15 are fixed to 0.

0: Not commanded
1: Commanded

(a) Operation of error history clear

When Error history clear command (address: 1000H) is set to Commanded (1), an error history is cleared.



(b) Default value

The default value is Not commanded (0).

(71)Error history clear completed (address: 1001H) Common

This remote buffer memory shows the error history clear completed status stored in the nonvolatile memory.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Bit data from b1 to b15 are fixed to 0.

0: Not performed
1: Completed

(a) Operation of error history clear

When the error history clear is completed, Error history clear completed (address: 1001H) is turned to Completed (1).

For the on and off timing, refer to the following.

- Error history clear command (address: 1000H) (☞ Page 364, Appendix 3 (70))

(b) Default value

The default value is Not performed (0).

(72)CH☐ Memory's PID constants read instruction (address: 1100H to 1103H)

Standard Heating-cooling

PID constants are read from a non-volatile memory and stored in the remote buffer memory by using this instruction. Setting this remote buffer memory area to Requested (1) stores the value backed up in the non-volatile memory in the remote buffer memory.

(a) Remote buffer memory areas to store set value of non-volatile memory

The following table lists the remote buffer memory areas whose set value is read.

Remote buffer memory area name	Remote buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Proportional band (P) setting	102H	132H	162H	192H	Page 318, Appendix 3 (7)
CH☐ Heating proportional band (Ph) setting	102H	132H	162H	192H	
CH☐ Cooling proportional band (Pc) setting	1C4H	1C9H	1CEH	1D3H	
CH☐ Integral time (I) setting	103H	133H	163H	193H	Page 320, Appendix 3 (8)
CH☐ Derivative time (D) setting	104H	134H	164H	194H	Page 320, Appendix 3 (9)
CH☐ Loop disconnection detection judgment time	116H	146H	176H	1A6H	Page 334, Appendix 3 (25)

(b) Setting range

- 0: Not requested
- 1: Requested

(c) Enabling the setting

Enable the setting contents by either of the following.

- Turning off and on Initial data setting request flag (RY9) while the operations of all channels are stopped
- Turning off and on During operation setting change instruction (RY10)

(d) Default value

The default values are set to Not requested (0) in all channels.

(e) Precautions

When Requested (1) is set, do not perform the following operations. An incorrect value may be stored in the non-volatile memory.

- Change of the set value of the remote buffer memory read from the non-volatile memory by this instruction (☞ Page 333, Appendix 3 (23) (d))
- Memory back up (☞ Page 136, Section 8.1.7)
- Default setting registration (☞ Page 297, Appendix 1.2 (6))
- Auto tuning (☞ Page 159, Section 8.3.7)

Point

- When the parameter is set and auto tuning is carried out, it is recommended that the PID constants should be backed up to the non-volatile memory after the auto tuning. Turning on this instruction at the next start-up can omits the auto tuning.
- This instruction is enabled whether the operating status is stop or run. However, the instruction is disabled when CH☐ Auto tuning instruction (RY20 to RY23) is on. (☞ Page 299, Appendix 1.2 (8))

(73)Memory's PID constants read/write completion flag (address: 1104H)

Standard Heating-cooling

This flag indicates whether a read/write operation for the non-volatile memory is completed normally or fails. A read/write operation is carried out when the following remote buffer memory areas are set.

- CH☐ Memory's PID constants read instruction (address: 1100H to 1103H) (☞ Page 365, Appendix 3 (72))
- CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H) (☞ Page 337, Appendix 3 (28))

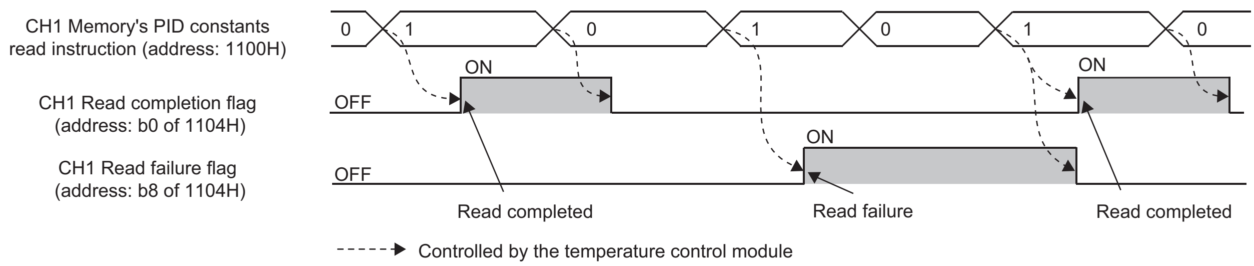
(a) Correspondence between each bit and flag

The following table lists flags correspond to bits of this remote buffer memory area.

Bit number	Flag description	Bit number	Flag description
b0	CH1 Read completion flag	b8	CH1 Read failure flag
b1	CH2 Read completion flag	b9	CH2 Read failure flag
b2	CH3 Read completion flag	b10	CH3 Read failure flag
b3	CH4 Read completion flag	b11	CH4 Read failure flag
b4	CH1 Write completion flag	b12	CH1 Write failure flag
b5	CH2 Write completion flag	b13	CH2 Write failure flag
b6	CH3 Write completion flag	b14	CH3 Write failure flag
b7	CH4 Write completion flag	b15	CH4 Write failure flag

(b) ON/OFF timing for CH☐ Memory's PID constants read instruction (address: 1100H to 1103H)

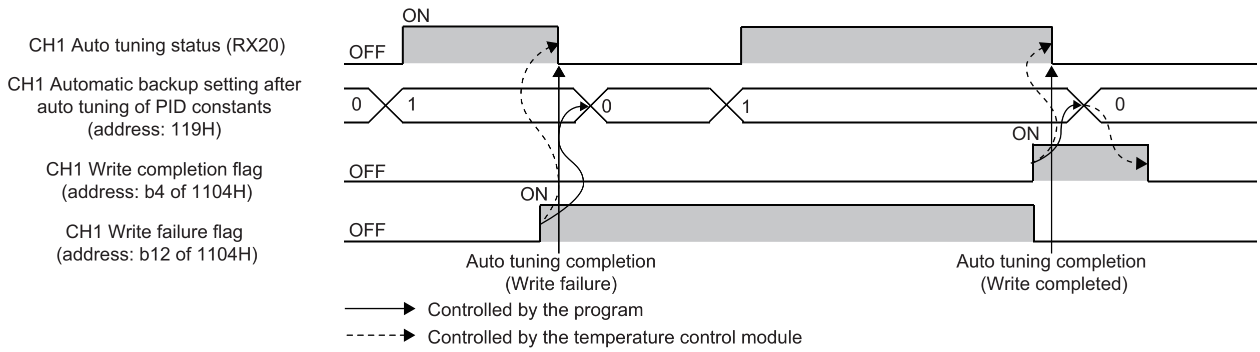
The following figure shows the ON/OFF timing of this flag for CH☐ Memory's PID constants read instruction (address: 1100H to 1103H). (For CH1)



When the data reading from the non-volatile memory is completed normally, CH☐ Read completion flag (address: b0 to b3 of 1104H) of the corresponding channel turns on.
CH☐ Read completion flag (address: b0 to b3 of 1104H) turns off when CH☐ Memory's PID constants read instruction (address: 1100H to 1103H) is turned off from on.
When the data reading from the non-volatile memory fails, CH☐ Read failure flag (address: b8 to b11 of 1104H) of the corresponding channel turns on and the temperature control module operates with PID constants before the data reading. (The LED status remains.)
CH☐ Read failure flag (address: b8 to b11 of 1104H) turns off when the data reading of the corresponding channel is completed normally.
When the data reading fails, try again by turning CH☐ Memory's PID constants read instruction (address: 1100H to 1103H) turn off and on.
For details on the ON/OFF timing for CH☐ Memory's PID constants read instruction (address: 1100H to 1103H), refer to the following.
☞ Page 365, Appendix 3 (72)

(c) ON/OFF timing for CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H)

The following figure shows ON/OFF timing of this flag for CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H). (For CH1)



When the data writing to the non-volatile memory is completed normally, CH☐ Write completion flag (address: b4 to b7 of 1104H) turns on.
CH☐ Write completion flag (address: b4 to b7 of 1104H) turns off when CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H) is set to Disable (0) from Enable (1).

When the data writing to the non-volatile memory fails, CH☐ Write failure flag (address: b12 to b15 of 1104H) of the corresponding channel turns on and the temperature control module operates with PID constants calculated in the previous auto tuning. (The LED status remains.)
CH☐ Write failure flag (address: b12 to b15 of 1104H) turns off when the data writing of the corresponding channel is completed normally.
When the data writing fails, perform auto tuning again by turning off and on CH☐ Auto tuning instruction (RY20 to RY23). If the data writing fails even after executing auto tuning again, a hardware error can be the reason. Please consult your local Mitsubishi representative.
For details on the ON/OFF timing for CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H)
☞Page 337, Appendix 3 (28)

Point

- By referring to this flag at the completion of auto tuning, whether the automatic data backup is completed normally or not can be checked.
- After confirming that the following flags are on, set CH☐ Automatic backup setting after auto tuning of PID constants (address: 119H, 149H, 179H, 1A9H) to Disable (0).
  - CH☐ Write completion flag (address: b4 to b7 of 1104H) (when automatic data backup is completed normally)
  - CH☐ Write failure flag (address: b12 to b15 of 1104H) (when automatic data backup fails)

  If auto tuning is executed under Enable (1), although PID constants are stored after auto tuning is complete, CH☐ Auto tuning status (RX20 to RX23) does not turn off.

For details on the auto tuning function, refer to the following.
☞Page 159, Section 8.3.7

Appendix 4 EMC and Low Voltage Directives

In each country, laws and regulations concerning electromagnetic compatibility (EMC) and electrical safety are enacted. For the products sold in the European countries, compliance with the EU's EMC Directive has been a legal obligation as EMC regulation since 1996, as well as the EU's Low Voltage Directive as electrical safety regulation since 1997.
Manufacturers who recognize their products are compliant with the EMC and Low Voltage Directives are required to attach a "CE marking" on their products in European countries.
In some other countries and regions, manufacturers are required to make their products compliant with applicable laws or regulations and attach a certification mark on the products as well (such as UK Conformity Assessed (UKCA) marking in the UK, and Korea Certification (KC) marking in South Korea).
Each country works to make their regulatory requirements consistent across countries based on international standards. When the requirements are consistent, measures to comply with the EMC and electrical safety regulations become common across countries.
The UK and South Korea have enacted EMC regulations whose requirements are consistent with those of the EMC Directive.
The UK has also enacted electrical safety regulations whose requirements are consistent with those of the Low Voltage Directive. In this section, the requirements of the EMC and Low Voltage Directives are described as examples of those of the EMC and electrical safety regulations.

Appendix 4.1 Measures to comply with the EMC Directive

The EMC Directive specifies that "products placed on the market must be so constructed that they do not cause excessive electromagnetic interference (emissions) and are not unduly affected by electromagnetic interference (immunity)".
This section summarizes the precautions on compliance with the EMC Directive of the machinery constructed with the module.
These precautions are based on the requirements and the standards of the regulation, however, it does not guarantee that the entire machinery constructed according to the descriptions will comply with abovementioned directives.
The method and judgement for complying with the EMC Directive must be determined by the person who constructs the entire machinery.

(1) EMC Directive related standards

(a) Emission requirements

Specifications	Test item	Test details	Standard value
EN61131-2: 2007	CISPR16-2-3 Radiated emission*2	Radio waves from the product are measured.	• 30 to 230MHz, QP: 40dBμV/m (measured at 10m distance)*1 • 230 to 1000MHz, QP: 47dBμV/m (measured at 10m distance)
	CISPR16-2-1, CISPR16-1-2 Conducted emission*2	Noise from the product to the power line is measured.	• 0.15 to 0.5MHz, QP: 79dB, Mean: 66dB*1 • 0.5 to 30MHz, QP: 73dB, Mean: 60dB

*1 QP: Quasi-peak value, Mean: Average value
*2 The module is an open type device (a device designed to be housed in other equipment) and must be installed inside a conductive control panel. The tests were conducted with the module installed in a control panel.

(b) Immunity requirements

Specifications	Test item	Test details	Standard value
EN61131-2: 2007	EN61000-4-2 Electrostatic discharge immunity*1	Immunity test in which electrostatic is applied to the cabinet of the equipment	• 8kV Air discharge • 4kV Contact discharge
	EN61000-4-3 Radiated, radio-frequency, electromagnetic field immunity*1	Immunity test in which electric fields are irradiated to the product	80% AM modulation@1kHz • 80M-1000MHz: 10V/m • 1.4G-2.0GHz: 3V/m • 2.0G-2.7GHz: 1V/m
	EN61000-4-4 Electrical fast transient/burst immunity*1	Immunity test in which burst noise is applied to the power supply line and signal line	• AC/DC main power, I/O power, AC I/O (unshielded): 2kV • DC I/O, analog, communication: 1kV
	EN61000-4-5 Surge immunity*1	Immunity test in which lightning surge is applied to the power supply line and signal line	• AC power line, AC I/O power, AC I/O (unshielded): 2kV CM, 1kV DM • DC power line, DC I/O power: 0.5kV CM, DM • DC I/O, AC I/O (shielded), analog*2, communication: 1kV CM
	EN61000-4-6 Immunity to conducted disturbances, induced by radio-frequency fields*1	Immunity test in which high frequency noise is applied to the power line and signal line	0.15M-80MHz, 80% AM modulation @1kHz, 10Vrms
	EN61000-4-8 Power-frequency magnetic field immunity*1	Immunity test in which the product is installed in inductive magnetic field	50Hz/60Hz, 30A/m
	EN61000-4-11 Voltage dips and interruption immunity*1	Immunity test in which power supply voltage is momentarily interrupted	• 0%, 0.5 cycle, starts at zero crossing • 0%, 250/300 cycle (50/60Hz) • 40%, 10/12 cycle (50/60Hz) • 70%, 25/30 cycle (50/60Hz)

*1 The module is an open type device (a device designed to be housed in other equipment) and must be installed inside a conductive control panel. The tests were conducted with the module installed in a control panel.
*2 The accuracy of an analog-digital converter module may temporarily vary within ±10%.

(2) Installation in a control panel

The module is open type devices and must be installed inside a control panel.
This ensures safety as well as effective shielding of programmable controller-generated electromagnetic noise.

(a) Control panel

- Use a conductive control panel.
- When securing the top or bottom plate using bolts, cover the grounding part on the control panel so that the part will not be painted.
- To ensure electrical contact between the inner plate and control panel, take measures such as covering the bolts so that conductivity can be ensured in the largest possible area.
- Ground the control panel with a thick ground cable so that low impedance can be ensured even at high frequencies.
- Holes in the control panel must be 10cm diameter or less. A hole with a diameter of 10cm or more may cause leakage of radio waves. In addition, because radio waves leak through a clearance between the control panel and its door, reduce the clearance as much as possible. The leakage of radio waves can be suppressed by the direct application of an EMI gasket on the paint surface.

Our tests have been carried out on a control panel having the attenuation characteristics of 37dB (max.) and 30dB (mean) (measured by 3m method, 30 to 300MHz).

(b) Wiring of power cables and ground cables

- Near the power supply part, provide a ground point to the control panel. Ground the FG terminal with the thickest and shortest possible ground cable (30cm or shorter).

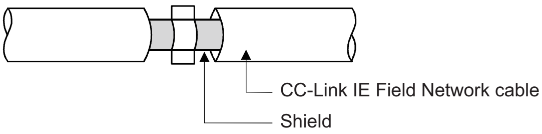
(3) Cables

Use shielded cables for the cables which are connected to the module and run out from the control panel. If a shielded cable is not used or not grounded correctly, the noise immunity will not meet the specified value.

(a) Cables for the CC-Link IE Field Network

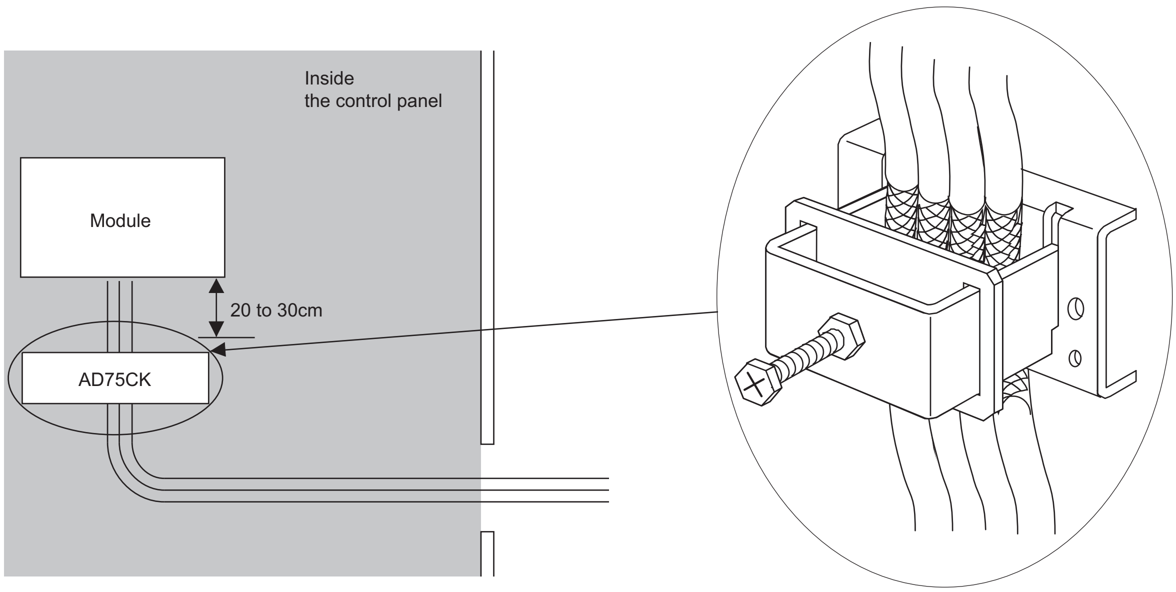
The precautions for using CC-Link IE Field Network cables are described below.

- Shielded cables should be used for the CC-Link IE Field Network. Strip a part of the jacket as shown below and ground the exposed shield in the largest possible area.



(b) Grounding the cable clamp

Use shielded cables for external wiring and ground the shields of the external wiring cables to the control panel with the AD75CK-type cable clamp (Mitsubishi). (Ground the shield section 20 to 30cm away from the module.)



For details of the AD75CK, refer to the following.

📖 AD75CK-type Cable Clamping Instruction Manual

(4) External power supply

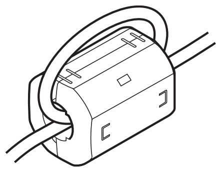
- Use a CE-marked product for an external power supply and always ground the FG terminal. (External power supply used for the tests conducted by Mitsubishi: TDK-Lambda DLP-120-24-1, IDEC PS5R-SF24, PS5R-F24)
- Use a power cable of 10m or shorter when connecting it to the module power supply terminal.

(5) Others

(a) Ferrite core

A ferrite core has the effect of reducing radiated noise in the 30MHz to 100MHz band.
It is recommended to attach ferrite cores if shielded cables coming out of the control panel do not provide sufficient shielding effects.
Note that the ferrite cores must be attached at the position closest to the cable hole inside the control panel. If attached at an improper position, the ferrite core will not produce any effect.
For the FG terminal on a main module that is connected to the external power supply, the external power supply of an extension module, and CC-Link IE Field Network cables, attach a ferrite core 4cm away from the module.
(Ferrite core used for the tests conducted by Mitsubishi: NEC TOKIN ESD-SR-250, TDK ZCAT3035-1330)

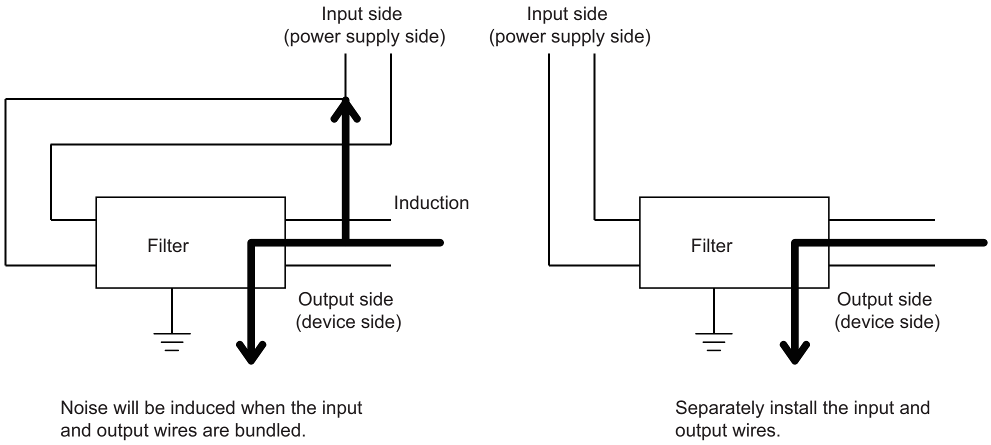
- Example



(b) Noise filter (power supply line filter)

A noise filter is a component which has an effect on conducted noise. Attaching the filter can suppress more noise. (The noise filter has the effect of reducing conducted noise of 10MHz or less.)
Connect a noise filter to the external power supply of a main module and the external power supply of an extension module. Use a noise filter with the damping characteristics equivalent to those of MA1206 (manufactured by TDK-Lambda Corporation). Note that a noise filter is not required if the module is used in Zone A defined in EN61131-2.
The precautions for attaching a noise filter are described below.

- Do not bundle the cables on the input side and output side of the noise filter. If bundled, the output side noise will be induced into the input side cables from which the noise was filtered.



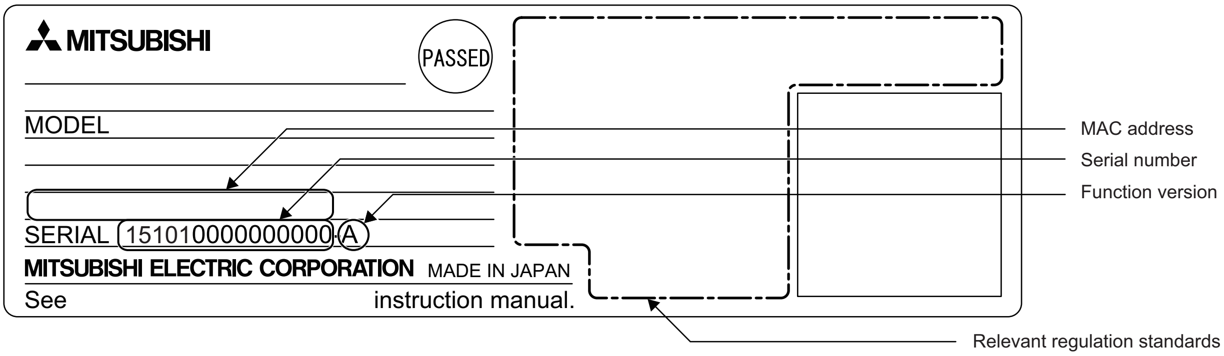
- Ground the noise filter grounding terminal to the control panel with the shortest cable possible (approx. 10cm).

Appendix 4.2 Requirements to compliance with the Low Voltage Directive

The module operates at the rated voltage of 24VDC.
The Low Voltage Directive is not applied to the modules that operate at the rated voltage of less than 50VAC and 75VDC.

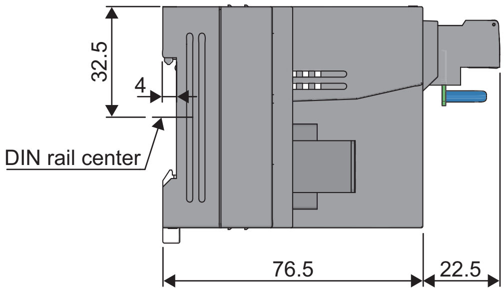
Appendix 5 Checking a Serial Number and Function Version

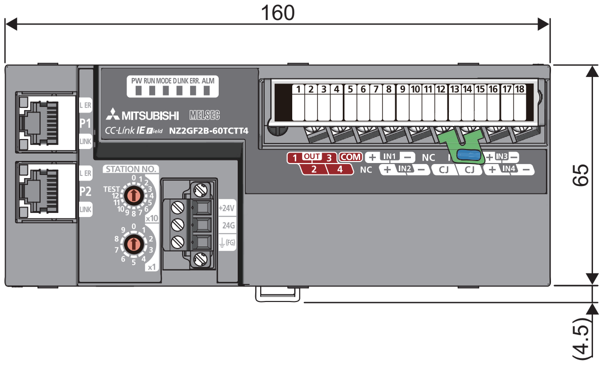
The serial number and function version of the temperature control module can be found on the rating plate.



Appendix 6 External Dimensions

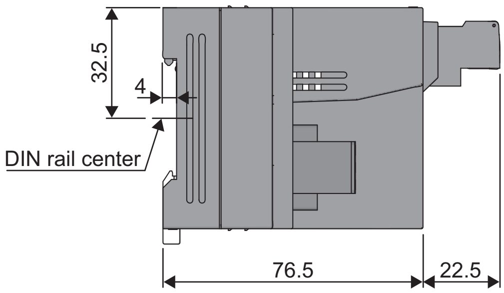
(1) NZ2GF2B-60TCTT4

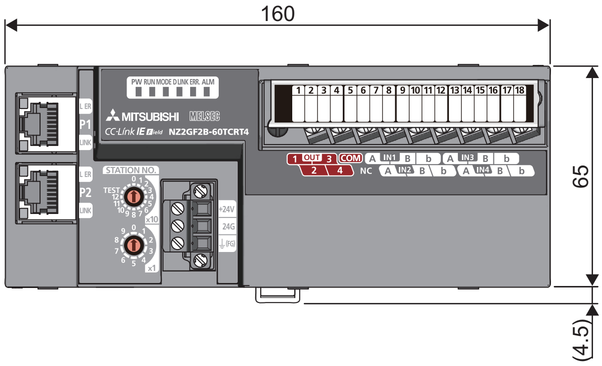




(Unit: mm)

(2) NZ2GF2B-60TCRT4





(Unit: mm)

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REVISIONS

*The manual number is given on the bottom left of the back cover.

Print date	*Manual number	REVISIONS
January 2014	SH(NA)-081211ENG-A	First edition
March 2016	SH(NA)-081211ENG-B	Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, Section 1.2, CHAPTER 2, Section 3.3, 3.7, 5.1, 6.5, 7.1, 7.2.1, 8.4.2, 9.3, 9.3.1 to 9.3.3, 11.1, 11.2, 11.4, 12.6
November 2022	SH(NA)-081211ENG-C	Added or modified parts SAFETY PRECAUTIONS, CONDITIONS OF USE FOR THE PRODUCT, Appendix 4

Japanese manual version SH-081210-D

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

Ethernet is a registered trademark of Fuji Xerox Corporation in Japan.

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.

In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

SH(NA)-081211ENG-C(2211)MEE
MODEL: CCIEF-TC-U-E
MODEL CODE: 13JZ89

MITSUBISHI ELECTRIC CORPORATION

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