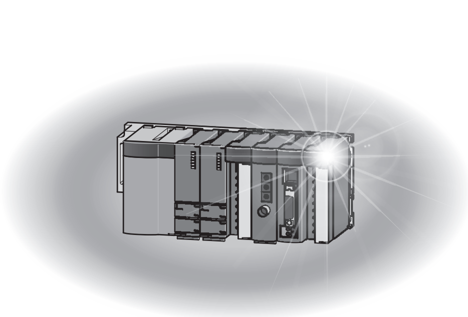
MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC Q series

MELSEC-Q Temperature Control Module User's Manual

-Q64TCTTN
-Q64TCTTBWN
-Q64TCRTN
-Q64TCRTBWN



●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: "⚠CAUTION" and "⚠WARNING".

⚠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

- Outputs may remain on or off due to a failure of a component such as a transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- Do not write any data to the "system area" and "write-protect area" (R) of the buffer memory in the intelligent function module. Also, do not use any "use prohibited" signal as an input or output signal from the intelligent function module to the programmable controller CPU.
  Doing so may cause malfunction of the programmable controller system.

⚠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.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used.
  Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place.
  Incorrect mounting may cause malfunction, failure or drop of the module.
  When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screw within the specified torque range.
  Undertightening can cause drop of the screw, short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module.
  Failure to do so may result in damage to the product.
  A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting the online module change function is used.
  Note that there are restrictions on the modules that can be replaced online, and each module has its predetermined replacement procedure.
  For details, refer to the relevant chapter in this manual.
- Do not directly touch any conductive parts and electronic components of the module.
  Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠CAUTION
● Individually ground the shielded cables of the programmable controller with a ground resistance of 100Ω or less. Failure to do so may result in electric shock or malfunction. ● Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure. ● Check the rated voltage and 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. ● Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction. ● A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation. ● 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. ● When disconnecting the cable from the module, do not pull the cable by the cable part. 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.

[Startup and Maintenance Precautions]

⚠CAUTION
● 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 screws or module fixing screws. Failure to do so may result in electric shock or cause the module to fail or malfunction. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction. ● Do not disassemble or modify the module. Doing so may cause failure, malfunction, injury, or a fire. ● Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction. A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting the online module change function is used. Note that there are restrictions on the modules that can be replaced online, and each module has its predetermined replacement procedure. For details, refer to the relevant chapter in this manual. ● After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit of 50 times may cause malfunction. ● Before handling the module, touch a grounded metal object to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[Disposal Precautions]

⚠CAUTION
● When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions; i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

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

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

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

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-Q series programmable controllers.
This manual describes the operating procedures, system configuration, parameter settings, functions, programming, and troubleshooting of the Q series temperature control module Q64TCTTN/Q64TCTTBWN/Q64TCRTN/Q64TCRTBWN (hereafter abbreviated as Q64TCN).

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

■ Relevant modules: Q64TCTTN, Q64TCTTBWN, Q64TCRTN, Q64TCRTBWN

Remark

- Operating procedures are explained using GX Works2. When using GX Developer or GX Configurator-CT, refer to the following.
  Page 385, Appendix 3
- In the Temperature Control Module User's Manual (SH-080121) for the Q64TCTT, Q64TCTTBW, Q64TCRT, and Q64TCRTBW, buffer memory addresses are written in hexadecimal. In this manual, the addresses are written in decimal using Intelligent function module device (Un\G□).
  - SH-080121: Temperature process value (PV) (buffer memory address: 9_H to C_H)
  - SH-080989ENG: CH□ Temperature process value (PV) (Un\G9 to Un\G12)

  Although differently expressed, the buffer memory areas have the same address as long as they are used for the same functions.

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)
- Safety Guidelines
  (This manual is included with the CPU module or base unit.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the manuals listed under (1).

RELEVANT MANUALS

(1) CPU module user's manual

<table>
<tr><th>Manual name
<manual number (model code)></th><th>Description</th></tr>
<tr><td>QCPU User's Manual
(Hardware Design, Maintenance and Inspection)
<SH-080483ENG, 13JR73></td><td>Specifications of the hardware (CPU modules, power supply modules, base units, extension cables, and memory cards), system maintenance and inspection, troubleshooting, and error codes</td></tr>
<tr><td>QnUCPU User's Manual
(Function Explanation, Program Fundamentals)
<SH-080807ENG, 13JZ27></td><td rowspan="2">Functions, methods, and devices for programming</td></tr>
<tr><td>Qn(H)/QnPH/QnPRHCPU User's Manual
(Function Explanation, Program Fundamentals)
<SH-080808ENG, 13JZ28></td></tr>
</table>

(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 (common to Simple project and Structured project) of GX Works2
GX Developer Version 8 Operating Manual <SH-080373E, 13JU41>	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

Memo

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.

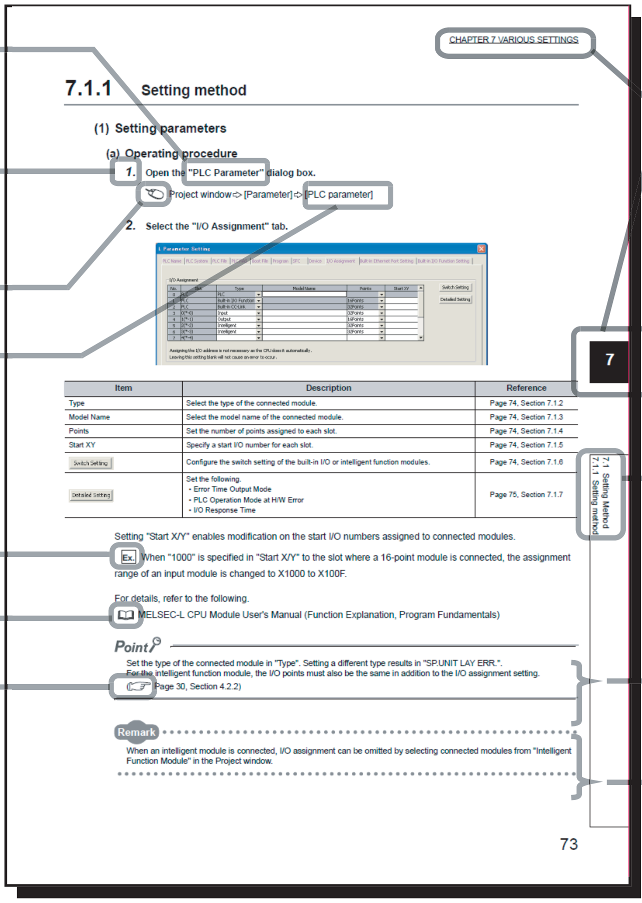
shows mouse operations.*1

[ ] 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...].

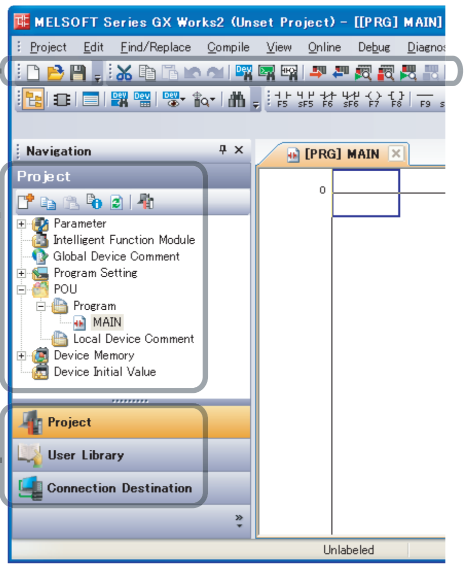
A window selected in the view selection area is displayed.

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

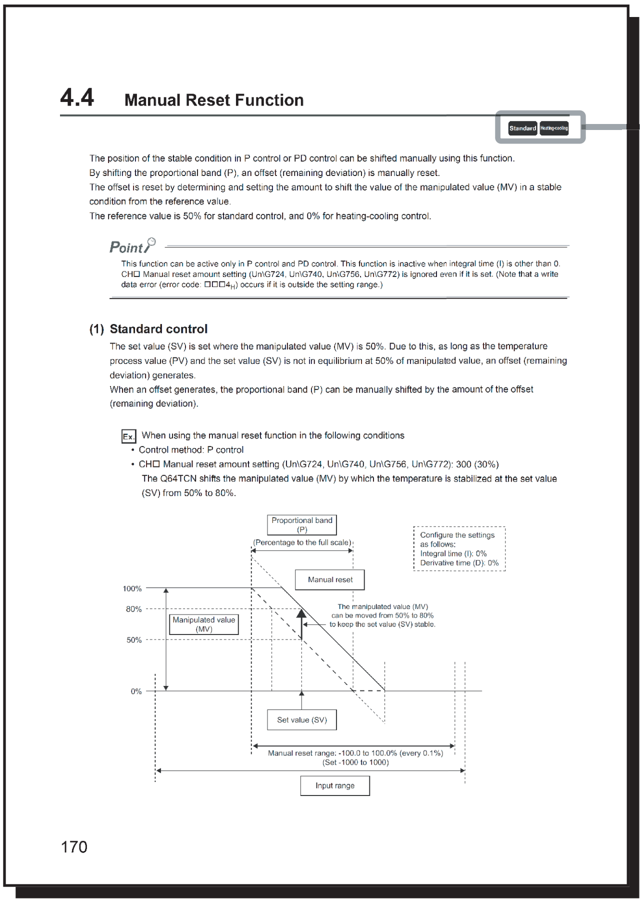
Select [Project] from the view selection area to open the Project window.

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

View selection area



Pages describing buffer memory areas and functions are organized as shown below.
The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.



4.4 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 (Un\G724, Un\G740, Un\G756, Un\G772) is ignored even if it is set. (Note that a write data error (error code: □□□4_H) 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, 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. When using the manual reset function in the following conditions
- Control method: P control
- CH□ Manual reset amount setting (Un\G724, Un\G740, Un\G756, Un\G772): 300 (30%)

The Q64TCN shifts the manipulated value (MV) by which the temperature is stabilized at the set value (SV) from 50% to 80%.

170

These icons indicate control modes that can be used.

The following table describes the meaning of each icon.

Icon	Meaning
Common	This icon means that the buffer memory area or function can be used in all control modes.
Standard	This icon means that the buffer memory area or function for temperature control can be used in the standard control. The buffer memory area and function can be used in the following control modes and channels: • 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	This icon means that the buffer memory or function for temperature control can be used in the heating-cooling control. The buffer memory area and function can be used in the following control modes and channels: • 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)

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Q64TCTTN	The abbreviation for the Q64TCTTN temperature control module
Q64TCTTBWN	The abbreviation for the Q64TCTTBWN temperature control module with the disconnection detection function
Q64TCRTN	The abbreviation for the Q64TCRTN temperature control module
Q64TCRTBWN	The abbreviation for the Q64TCRTBWN temperature control module with the disconnection detection function
Q64TCN	A generic term for the Q64TCTTN, Q64TCTTBWN, Q64TCRTN, and Q64TCRTBWN
AT point	The total of Set value (SV) setting and AT bias setting
PID constants	A generic term for the proportional band (P), integral time (I), and derivative time (D)
Temperature sensor	A generic term for thermocouples and platinum resistance thermometers
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 standard control, heating-cooling control (normal mode), heating-cooling control (expanded mode), mix control (normal mode), and mix control (expanded mode)
Fixed value action	The operating status of when the set value (SV) is fixed
Full scale	A full input range. For example, when the selected input range is -200.0°C to 400.0°C, the full scale is 600.0.
Ramp action	The operating status of when the set value (SV) is constantly changed
Number of loops	The number of feedback control systems (closed-loop control systems) that can be configured using one module. Under the standard control, one loop consists of one input and one output. Under the heating-cooling control, one loop consists of one input and two outputs.
QCPU	Another term for the MELSEC-Q series CPU module
Redundant CPU	A generic term for the Q12PRHCPU and Q25PRHCPU
External input	The abbreviation for input from connectors for external devices
External output	The abbreviation for output to connectors for external devices
Programming tool	A generic term for GX Works2 and GX Developer
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Developer	
GX Configurator-TC	A setting and monitoring tool added in GX Developer (for temperature control modules)
Buffer memory	The memory of an intelligent function module used to store data (such as setting values and monitored values) for communication with a CPU module

PACKING LIST

The following items are included in the package of this product.

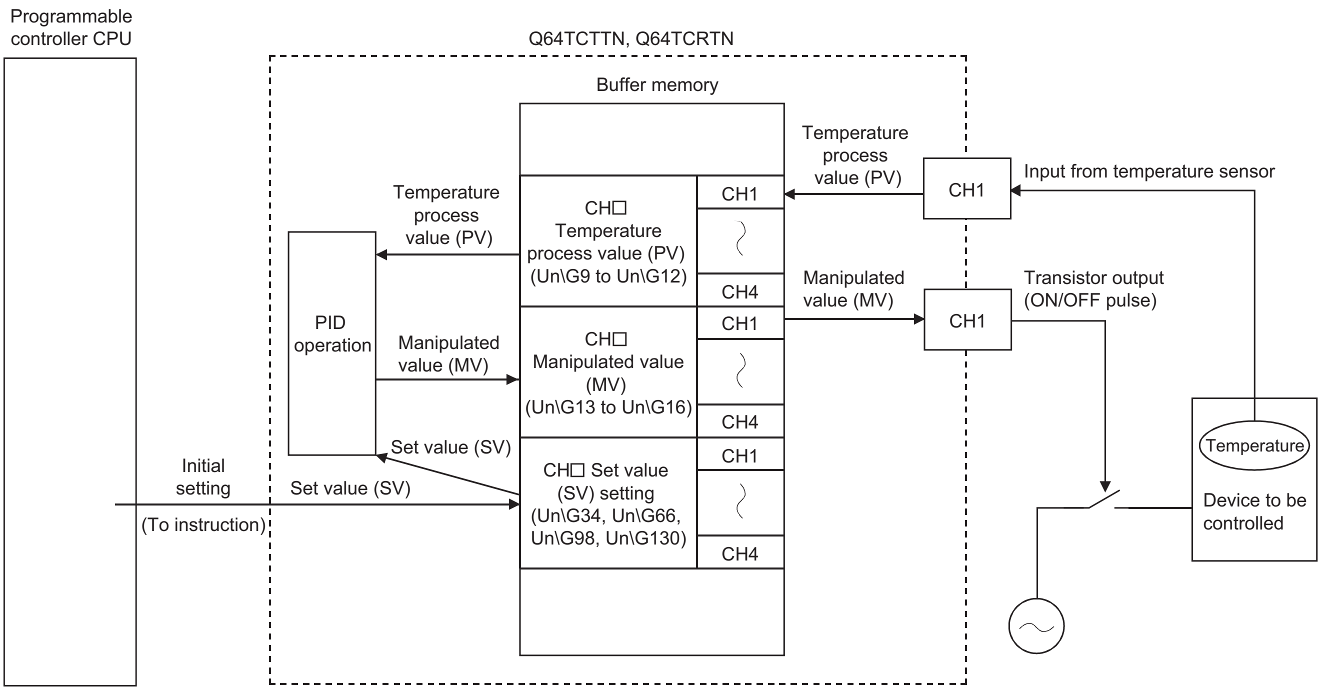
Model	Item name	Quantity
Q64TCTTN	Q64TCTTN temperature control module	1
Q64TCTTBWN	Q64TCTTBWN temperature control module with the disconnection detection function	1
Q64TCRTN	Q64TCRTN temperature control module	1
Q64TCRTBWN	Q64TCRTBWN temperature control module with the disconnection detection function	1
Q64TCTTN/RTN-U-HW	Before Using the Product	1

CHAPTER 1 OVERVIEW

This chapter describes the overview of the Q64TCN.

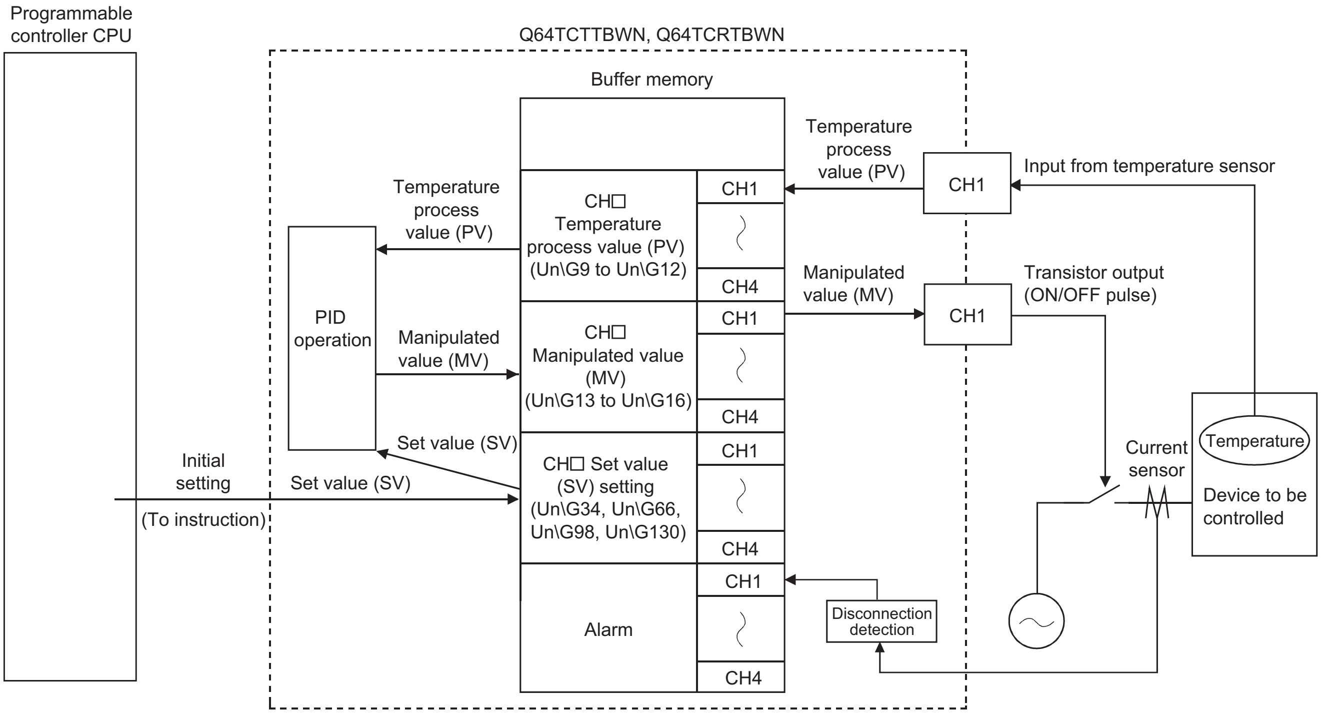
(1) The Q64TCTTN and Q64TCRTN

- The Q64TCTTN and Q64TCRTN perform PID operation to reach the target temperature based on input from an external temperature sensor. The modules control temperature by transistor output.
- The Q64TCTTN and Q64TCRTN possess the auto tuning function by which proportional band (P), integral time (I) and derivative time (D) for PID operation are automatically set.
- The Q64TCTTN accepts type K, J, T, B, S, E, R, N, U, L, PL II, and W5Re/W26Re thermocouples. The Q64TCRTN accepts type Pt100 and JPt100 platinum resistance thermometers.



(2) The Q64TCTTBWN and Q64TCRTBWN

The Q64TCTTBWN and Q64TCRTBWN are Q64TCTTN and Q64TCRTN-based modules which possess an additional function to detect heater disconnection using input from external current sensors.



1.1 Features

(1) Optimum temperature adjustment control (PID control)

- The Q64TCN performs temperature adjustment control automatically when the user simply sets PID constants necessary for PID operation: proportional band (P), integral time (I), derivative time (D), and temperature set value (SV). No special instruction is necessary to perform PID control.
- Using the auto tuning function or self-tuning function enables the PID constants to be set automatically. Complicated PID operational expressions to determine PID constants are not necessary.

(2) Selection of control mode

A control mode can be selected from the standard control (heating or cooling), heating-cooling control (heating and cooling), or mix control (combination of the standard control and heating-cooling control).

(3) Four loops on one module

The maximum of four loops of temperature adjustment control can be performed simultaneously. In addition, loop control can be performed using analog modules on the base unit or the network; input from an A/D converter module or output to a D/A converter module can be processed.

(4) Simultaneous temperature rise of multiple loops

Temperatures of multiple loops can be adjusted to simultaneously reach the set value of each; temperatures are controlled evenly without any partial heat exaggeration. This function saves energy and cost.

(5) Suppression of peak current

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

(6) RFB limiter function

The RFB (Reset feed back) limiter suppresses overshoot which is liable to occur at a startup or when a temperature process value (PV) is increased.

(7) Correction of temperature process value (PV)

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

- 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 line on the two points set in advance.
- Primary delay digital filter setting: Smoothens transient noise, and absorbs drastic change.

(8) E^{2}PROM for backing up set values

The set values in the buffer memory, such as the setting related to PID control, can be stored into E^{2}PROM for data backup. The values do not need to be reset after turning the power on from off or releasing the CPU module from its reset status.
Using the test function of the programming tool to write data directly to the buffer memory, the minimum sequence program required is "LD**" + "OUT Yn1".

(9) Detection of disconnection

Heater disconnection can be detected easily by the loop disconnection detection function.
The Q64TCTTBWN and Q64TCRTBWN can detect the disconnection of a heater accurately.

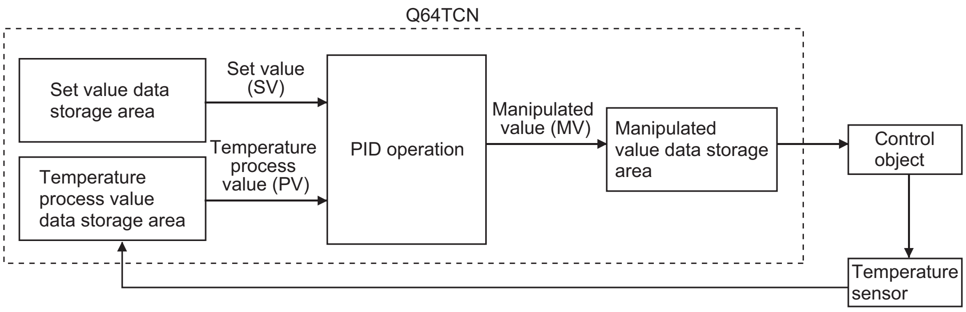
(10)Easy setting by GX Works2

Sequence program can be reduced by configuring the default setting or auto refresh setting on the screen. Also, the setting status or operating status of the module can be checked easily.

1.2 The PID Control System

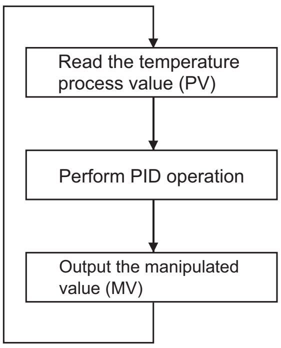
(1) PID control system

The following figure shows a system of when performing the PID control.



(2) PID control procedure

The PID control is performed in the following procedure.



Read the temperature process value (PV) ...... Import a signal from the temperature sensor and write it to the temperature process value data storage area as a temperature process value (PV).

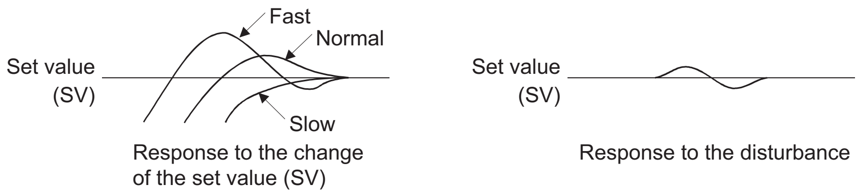
Perform PID operation ...... Perform PID operation using the Set value (SV)/temperature process value (PV) values in the set value/temperature process value data storage area.

Output the manipulated value (MV) ...... Convert manipulated value (MV) obtained by the PID operation to transistor-output on time and output it.

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

The Q64TCN operates in "simple two-degree-of-freedom". In this form of PID control, parameters are simplified compared to the two-degree-of-freedom PID control.

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. (Page 194, Section 4.7)



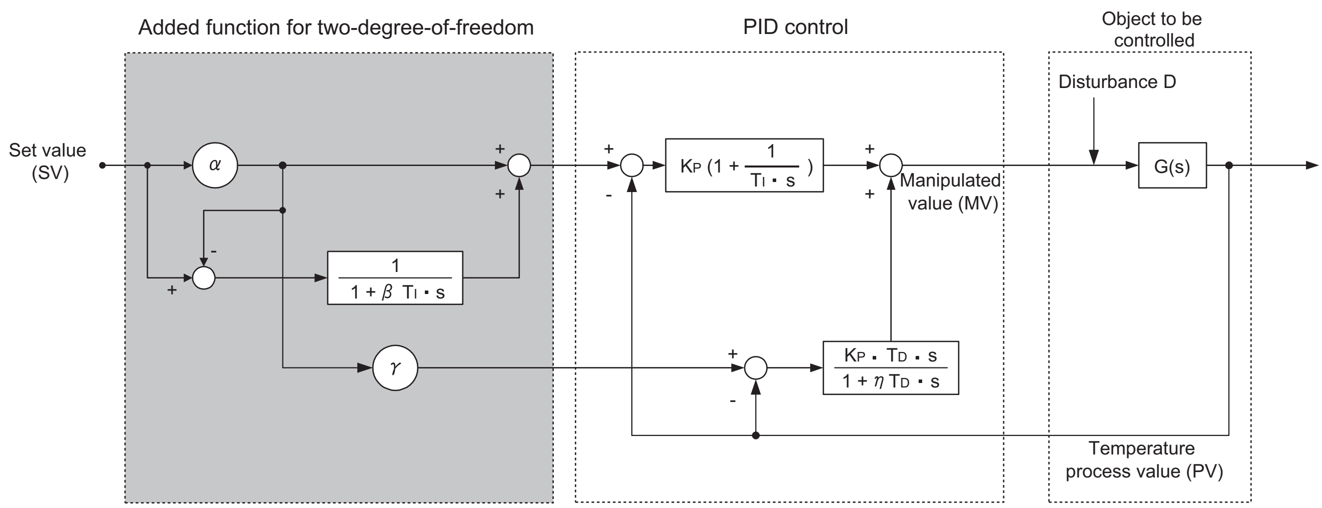
The following explains the difference between the one-degree-of-freedom PID control, two-degree-of-freedom PID control, and simple two-degree-of-freedom PID control.

(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 to improve "response to the change of the set value (SV)" are set, "response to the disturbance" degrades. Conversely, when PID constants to improve "response to the disturbance" are set, "response to the change of the set value (SV)" degrades.
- In the two-degree-of-freedom PID control, a manipulated value (MV) is determined considering the set value (SV) or 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.



By setting α, β, and γ above properly, optimum control can be achieved.

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 Q64TCN operates in the simple two-degree-of-freedom PID control for which parameters are simplified.

1.3 About the PID Operation

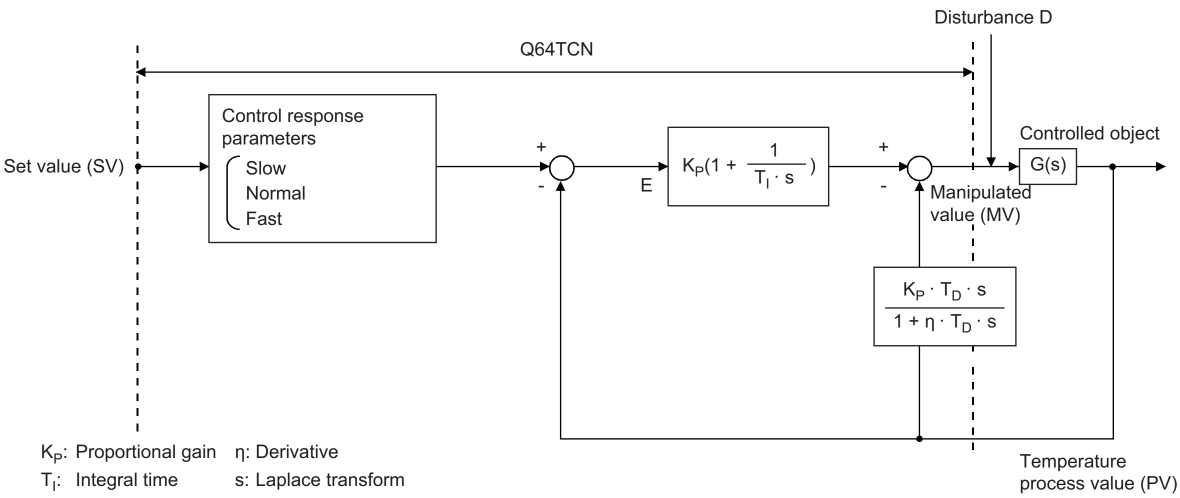
The Q64TCN can perform PID control in process-value incomplete derivation.

1.3.1 Operation method and formula

The PID control in process-value incomplete derivation is an operation method which puts a primary delay filter on input from a derivative action and eliminate high-frequency noise component in order to perform a PID operation on the deviation (E).

(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　η: Derivative
T_I: Integral time　s: Laplace transform
T_D: Derivative time　E: Deviation

(2) Formula

The formula used for the Q64TCN is shown below.

$$MV_n = K_P\left\{E_n + \left(\frac{\tau}{T_I}E_n + I_{n-1}\right) + \left(\frac{\eta T_D}{\tau + \eta T_D}D_{n-1} - \frac{T_D}{\tau + \eta T_D}\left(PV_n - PV_{n-1}\right)\right)\right\}$$

E: Deviation (SV-PV)
τ: Sampling cycle
MV: PID control in process-value incomplete derivation output
PV: Process value
K_P: Proportional gain
T_I: Integral time
T_D: Derivative time
η: Derivative
I: Integral value
D: Derivative value

Remark

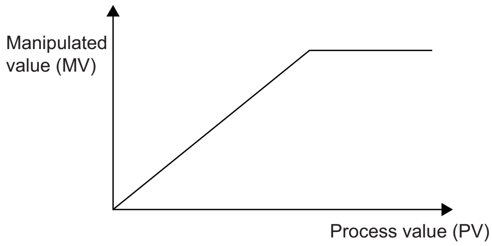
The PID control in process-value derivation is an operation method which uses the process value (PV) for the derivation section in order to perform a PID operation. Not using deviation for the derivation section, drastic output change due to a derivative action is reduced when deviation varies along with the setting value change.

1.3.2 The Q64TCN actions

The Q64TCN performs PID operations in forward actions and reverse actions.

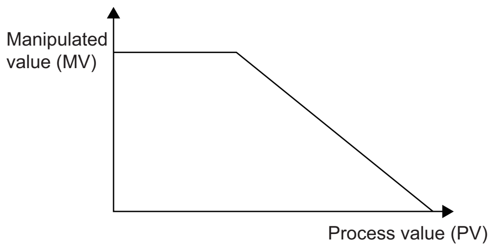
(1) Forward action

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.



(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.



1.3.3 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 can be expressed in the following formula:

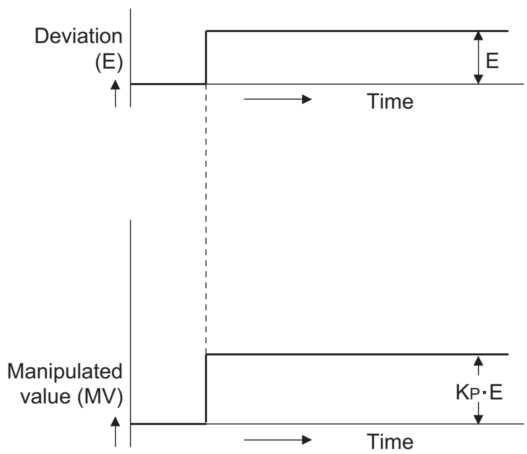
$MV = K_P \cdot E$

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 Kp, proportional gain.

Condition	Proportional action
Kp is a small value	The control action slows down.
Kp is a large value	The control action speeds up, though the temperature process value (PV) tends to fluctuate around the set value.

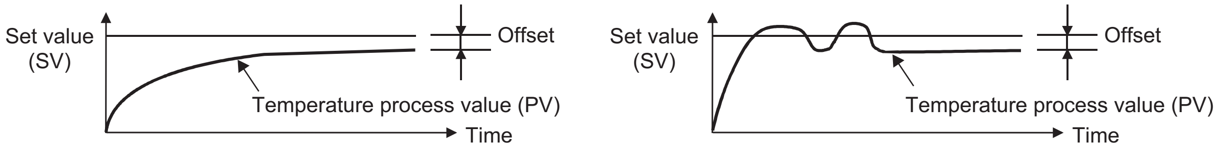
The following figure shows a proportional action of step responses where the deviation (E) is a fixed value.



(2) Offset

The certain amount of difference generates 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) generates.



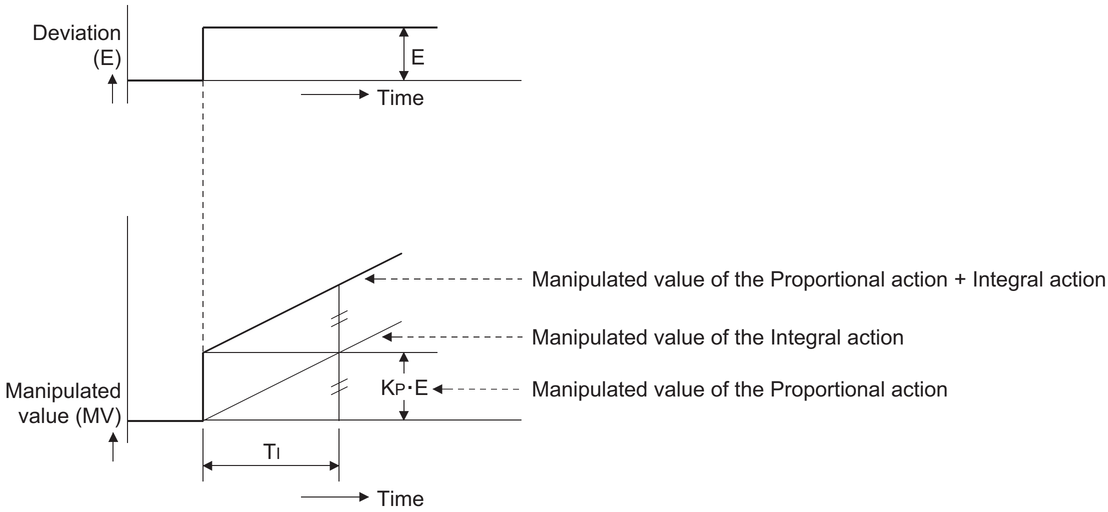
1.3.4 Integral action (I-action)

An integral action is an action which continuously changes the manipulated value (MV) to eliminate the deviation (E) when there is any.
The offset caused by a proportional action can be eliminated.

In an integral action, the time from a deviation occurrence until when the manipulated value (MV) of the integral action becomes equals to that of the proportional action is called integral time, and is indicated as T_I.
The following table describes the difference of actions depending on the value of T_I, integral time.

Condition	Integral action
T_I is a small value	The integral effect gets large, and time to eliminate the offset gets short. Though, the temperature process value (PV) tends to fluctuate around the set value.
T_I is a large value	The integral effect gets small, and time to eliminate the offset gets long.

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



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

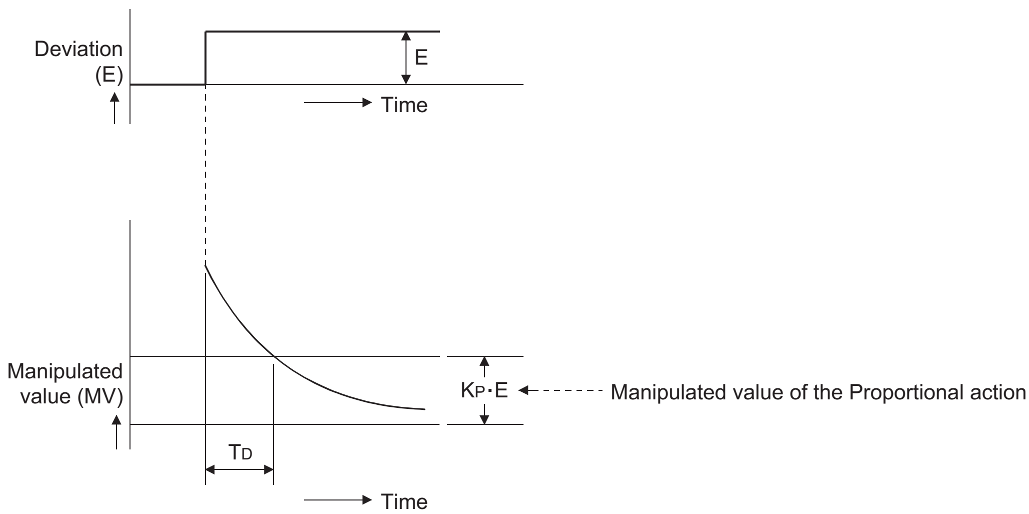
1.3.5 Derivative action (D-action)

A derivative action adds the manipulated value (MV) proportional to the rate of change to eliminate the deviation (E) when it occurs.
A derivative action can prevent the control target from changing significantly due to disturbance.

In a derivative action, the time from a deviation occurrence until when the manipulated value (MV) of the derivative action becomes equals to that of the proportional action is called derivative time, and is indicated as T_D.
The following table describes the difference of actions depending on the value of T_D, derivative time.

Condition	Derivative action
T_D is a small value	The derivative effect gets small.
T_D is a large value	The derivative effect gets large. Though, the temperature process value (PV) tends to fluctuate around the set value in short cycles.

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

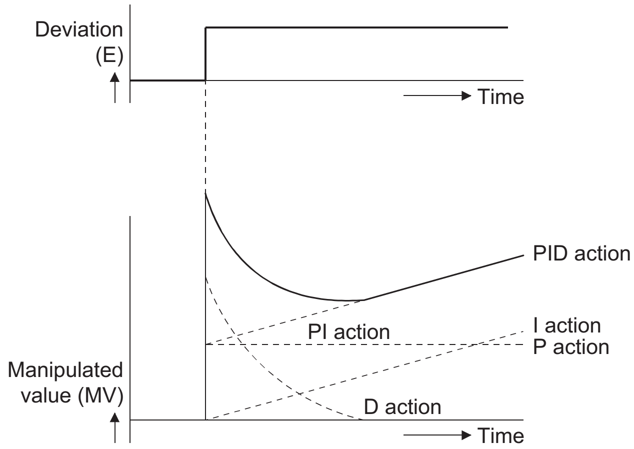


A derivative action is used as a PD action in combination with a proportional action, or PID action in combination with a proportional and integral actions.
A derivative action cannot be used by itself.

1.3.6 PID action

A PID action performs control using the manipulated value (MV) calculated by merging the proportional action, integral action, and derivative action.

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



CHAPTER 2 SYSTEM CONFIGURATION

This chapter describes the system configuration of the Q64TCN.

2.1 Applicable Systems

This section describes applicable systems.

(1) Applicable CPU modules and base units, and number of mountable modules

The following table lists CPU modules and base units applicable to the Q64TCN and the number of mountable Q64TCN.

Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient.

Select the power supply capacity according to the module to be used. If the power supply capacity is insufficient, change the combination of the modules.

Applicable CPU module			Number of modules*1		Applicable base unit*2	
CPU type		CPU model	Q64TCTTN/ Q64TCRTN	Q64TCTTBWN/ Q64TCRTBWN	Main base unit	Extension base unit
Programmable controller CPU	Basic model QCPU	Q00JCPU	Up to 16	Up to 8	○	○
		Q00CPU	Up to 24	Up to 12		
		Q01CPU				
	High Performance model QCPU	Q02CPU	Up to 64	Up to 32	○	○
		Q02HCPU				
		Q06HCPU				
		Q12HCPU				
		Q25HCPU				
	Process CPU	Q02PHCPU	Up to 64	Up to 32	○	○
		Q06PHCPU				
		Q12PHCPU				
		Q25PHCPU				
	Redundant CPU	Q12PRHCPU	Up to 53	Up to 26	×	○
		Q25PRHCPU				
	Universal model QCPU	Q00UJCPU	Up to 16	Up to 8	○	○
		Q00UCPU	Up to 24	Up to 12		
		Q01UCPU				
		Q02UCPU	Up to 36	Up to 18		
		Q03UDCPU	Up to 64	Up to 32		
		Q04UDHCPU				
		Q06UDHCPU				
		Q10UDHCPU				
		Q13UDHCPU				
		Q20UDHCPU				
		Q26UDHCPU				

Applicable CPU module			Number of modules*1		Applicable base unit*2	
CPU type		CPU model	Q64TCTTN/ Q64TCRTN	Q64TCTTBWN/ Q64TCRTBWN	Main base unit	Extension base unit
Programmable controller CPU	Universal model QCPU	Q03UDECPU	Up to 64	Up to 32	○	○
		Q04UDEHCPU				
		Q06UDEHCPU				
		Q10UDEHCPU				
		Q13UDEHCPU				
		Q20UDEHCPU				
		Q26UDEHCPU				
		Q50UDEHCPU				
		Q100UDEHCPU				
	Safety CPU	QS001CPU	N/A	N/A	×	×*3
C Controller module		Q06CCPU-V	Up to 64	Up to 32	○	○
		Q06CCPU-V-B				
		Q12DCCPU-V				

○: Applicable, ×: N/A

*1 Limited within the range of I/O points for the CPU module.
*2 Can be installed to any I/O slot of a base unit.
*3 Connection of an extension base unit is not available with any safety CPU.

Remark

To use a C controller module with the Q64TCN, refer to the C Controller Module User's Manual.

(a) When mounted on a MELSECNET/H remote I/O station

The following table lists the network modules and base units applicable to the Q64TCN and the number of mountable Q64TCN.
Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient.
Select the power supply capacity according to the module to be used. If the power supply capacity is insufficient, change the combination of the modules.

Applicable network module	Number of modules*1		Applicable base unit*2	
	Q64TCTTN/ Q64TCRTN	Q64TCTTBWN/Q 64TCRTBWN	Main base unit of remote I/O station	Extension base unit of remote I/O station
QJ72LP25-25	Up to 64	Up to 32	○	○
QJ72LP25G				
QJ72LP25GE				
QJ72BR15				

○: Applicable, ×: N/A

*1 Limited within the range of I/O points for the network module.
*2 Can be installed to any I/O slot of a base unit.

Remark

The Basic model QCPU or C Controller module cannot configure the MELSECNET/ H remote I/O net.

(2) For multiple CPU system

The function version of the first released Q64TCN is C, and the Q64TCN supports multiple CPU systems. When using the Q64TCN in a multiple CPU system, refer to the following.

QCPU User's Manual (Multiple CPU System)

(a) Intelligent function module parameters

Write intelligent function module parameters to only the control CPU of the Q64TCN.

(3) For online module change

The function version of the first released Q64TCN is C, and the Q64TCN supports online module change. For details, refer to the following.

- For GX Developer: Page 393, Appendix 4
- For GX Works2: Page 408, Appendix 5

(4) Applicable software packages

The following table lists relation between the system including the Q64TCN and software package.
A programming tool is required to use the Q64TCN.

Item		Software version		
		GX Works2	GX Developer	GX Configurator-TC*1
Q00J/Q00/Q01CPU	Single CPU system	Version 1.62Q or later	Version 7 or later	Version 1.10L or later (SW0D5C-QTCU 40E or earlier versions cannot be used.)
	Multiple CPU system		Version 8 or later	
Q02/Q02H/Q06H/Q12H/Q25HCPU	Single CPU system		Version 4 or later	SW0D5C-QTCU 00A or later
	Multiple CPU system		Version 6 or later	
Q02PH/Q06PHCPU	Single CPU system	Version 1.87R or later	Version 8.68W or later	Version 1.13P or later (SW0D5C-QTCU 40E or earlier versions cannot be used.)
	Multiple CPU system			
Q12PH/Q25PHCPU	Single CPU system		Version 7.10L or later	
	Multiple CPU system			
Q12PRH/Q25PRHCPU	Redundant system		Version 8.45X or later	Version 1.14Q or later (SW0D5C-QTCU 40E or earlier versions cannot be used.)
Q00UJ/Q00U/Q01UCPU	Single CPU system	Version 1.62Q or later	Version 8.76E or later	Version 1.23Z or later (SW0D5C-QTCU 40E or earlier versions cannot be used.)
	Multiple CPU system			
Q02U/Q03UD/Q04UDH/Q06UDHCPU	Single CPU system		Version 8.48A or later	
	Multiple CPU system			
Q10UDH/Q20UDHCPU	Single CPU system		Version 8.76E or later	
	Multiple CPU system			
Q13UDH/Q26UDHCPU	Single CPU system		Version 8.62Q or later	
	Multiple CPU system			
Q03UDE/Q04UDEH/Q06UDEH/Q13UDEH/Q26UDEHCPU	Single CPU system		Version 8.68W or later	
	Multiple CPU system			
Q10UDEH/Q20UDEHCPU	Single CPU system		Version 8.76E or later	
	Multiple CPU system			
Q50UDEH/Q100UDEHCPU	Single CPU system		N/A	N/A
	Multiple CPU system			
If installed in a MELSECNET/H remote I/O station			Version 6 or later	SW0D5C-QTCU 10B or later

*1 For the function available in GX Configurator-TC, refer to the following.
Page 390, Appendix 3.2 (2)

Point

Depending on the version of GX Configurator-TC, available systems and CPU modules are different.

(5) Temperature sensor

For usable temperature sensors, refer to the following.

☞Page 42, Section 3.1.1

(6) Current sensor for heater disconnection detection

The following table lists current sensors for heater disconnection detection available with the Q64TCTTBWN or Q64TCRTBWN.

Model name	Remarks	Manufacturer
CTL-12-S36-8 (0.0 to 100.0A)*1	-	U.R.D.Co., LTD. www.u-rd.com/english
CTL-12-S36-10 (0.0 to 100.0A)		
CTL-12-S56-10 (0.0 to 100.0A)		
CTL-6-P (0.00 to 20.00A)*1		
CTL-6-P-H (0.00 to 20.00A)		

*1 The CTL-12-S36-8 and CTL-6-P can be used although they have been discontinued.

For how to select current sensors for heater disconnection detection, refer to the following.

☞Page 142, Section 3.4.2 (55)
☞Page 143, Section 3.4.2 (57)

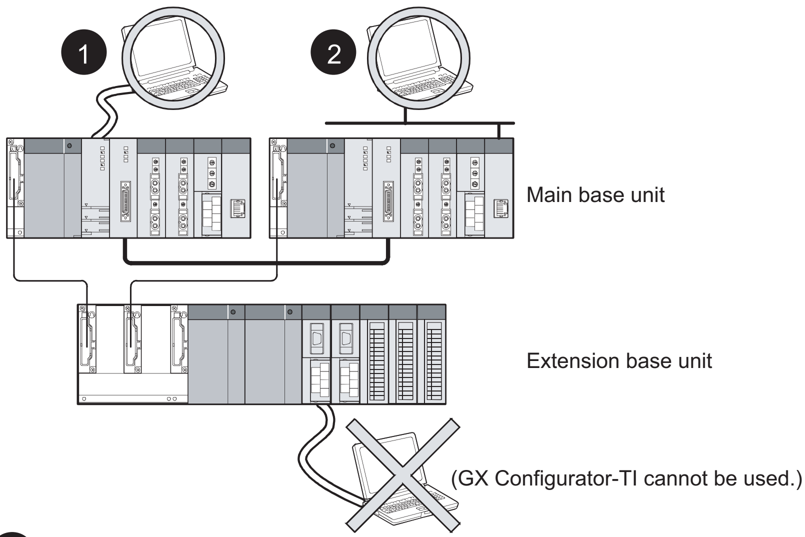
2.2 Using the Q64TCN with Redundant CPU

This section describes the use of the Q64TCN with the redundant CPU.

(1) GX Configurator-TC

GX Configurator-TC cannot be used when the redundant CPU accessed via an intelligent function module on an extension base unit from GX Developer. Consider a communication path which does not go through the intelligent function modules on the extension base unit.

Connect a personal computer with a redundant CPU using a communication path shown below.



1 Direct connection to use the CPU

2 Connection through an intelligent function module on the main base unit
(Through Ethernet module, MELSECNET/H module, or CC-Link module)

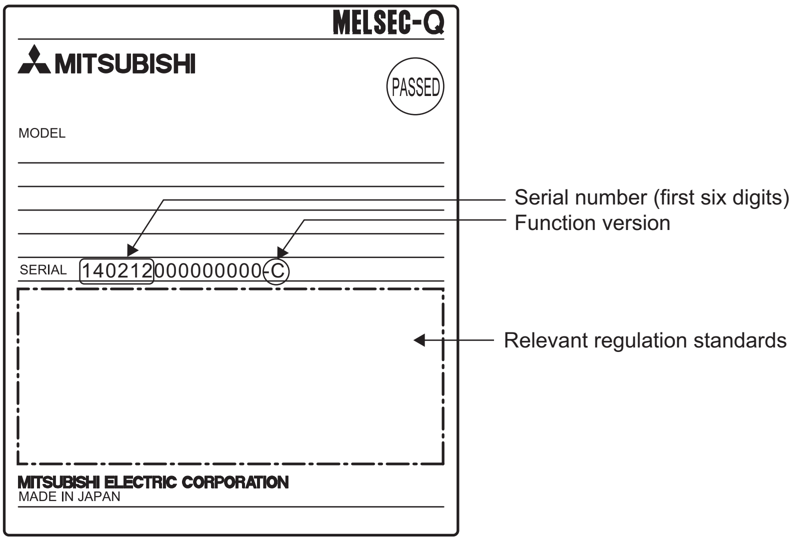
2.3 How to Check the Function Version and Serial Number

The function version and serial number of the Q64TCN can be checked on the rating plate, front part of a module, or system monitor of a programming tool.

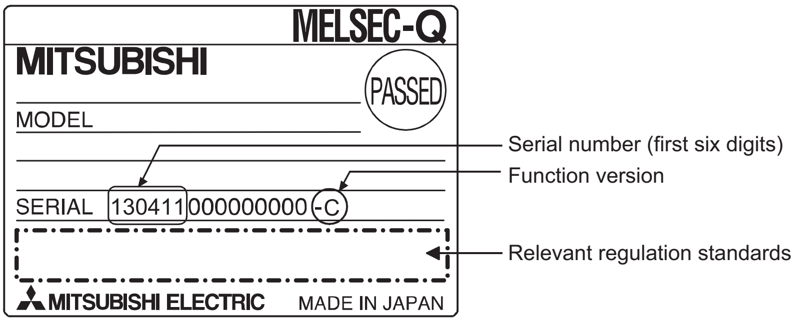
(1) Checking on rating plate

The rating plate is on the side of the Q64TCN.

(a) For the Q64TCTTN and Q64TCRTN

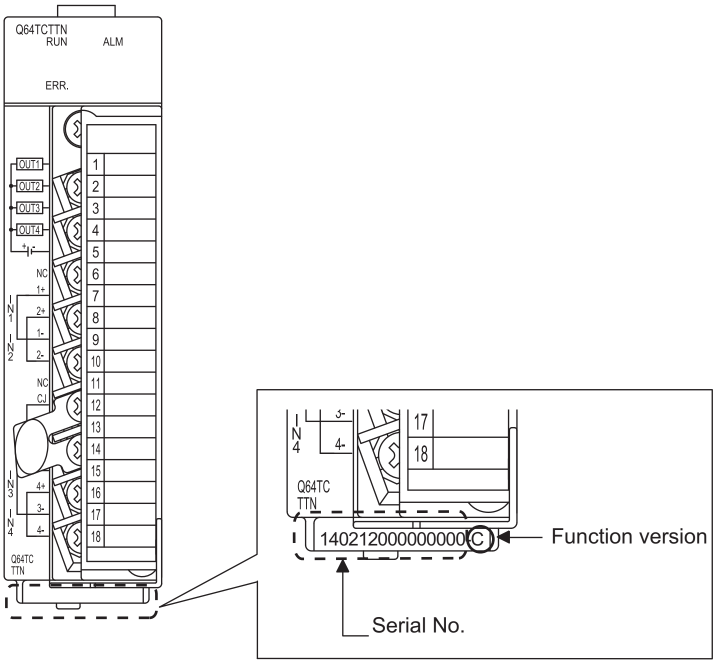


(b) For the Q64TCTTBWN and Q64TCRTBWN



(2) Checking on the front part (bottom part) of module

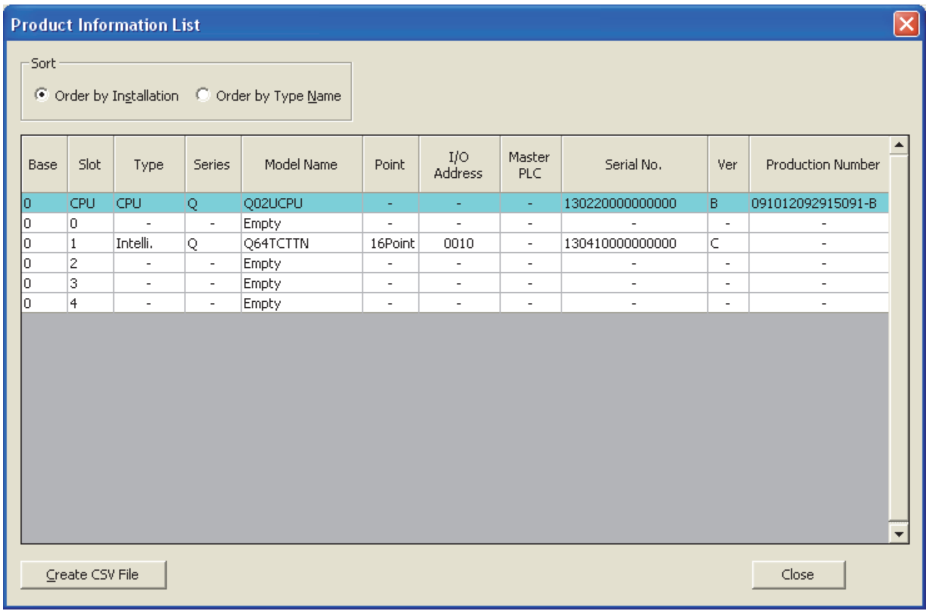
The function version and serial number on the rating plate are also shown on the front part (bottom part) of the module.



(3) Checking on the system monitor

The function version and serial number can be checked on the "Product Information List" window.

[Diagnostics] ⇨ [System Monitor...] ⇨ Product Information List



Base	Slot	Type	Series	Model Name	Point	I/O Address	Master PLC	Serial No.	Ver	Production Number
0	CPU	CPU	Q	Q02UCPU	-	-	-	130220000000000	B	091012092915091-B
0	0	-	-	Empty	-	-	-	-	-	-
0	1	Intelli.	Q	Q64TCTTN	16Point	0010	-	130410000000000	C	-
0	2	-	-	Empty	-	-	-	-	-	-
0	3	-	-	Empty	-	-	-	-	-	-
0	4	-	-	Empty	-	-	-	-	-	-

(a) Displaying production number

For the Q64TCN, "-" is displayed since the production number display is not supported.

Point

The serial number displayed on the product information list of a programming tool may differ from that on the rating plate and on the front part of the module.

- The serial number on the rating plate and front part of the module indicates the management information of the product.
- The serial number displayed on the product information list of a programming tool indicates the function information of the product.
  The function information of the product is updated when a new function is added.

2.4 Precautions for System Configuration

The Q64TCN measures temperature based on the temperature of the terminal block. Therefore, depending on the system configuration, temperature distribution of the terminal block can be uneven due to the effect of heat generated from modules, and the measured temperature may differ from actual temperature (especially when two or more Q64TCN modules are mounted next to each other or the Q64TCN is mounted next to the power supply module or CPU module).
In this case, the difference between measured value and actual temperature can be reduced by the following methods.

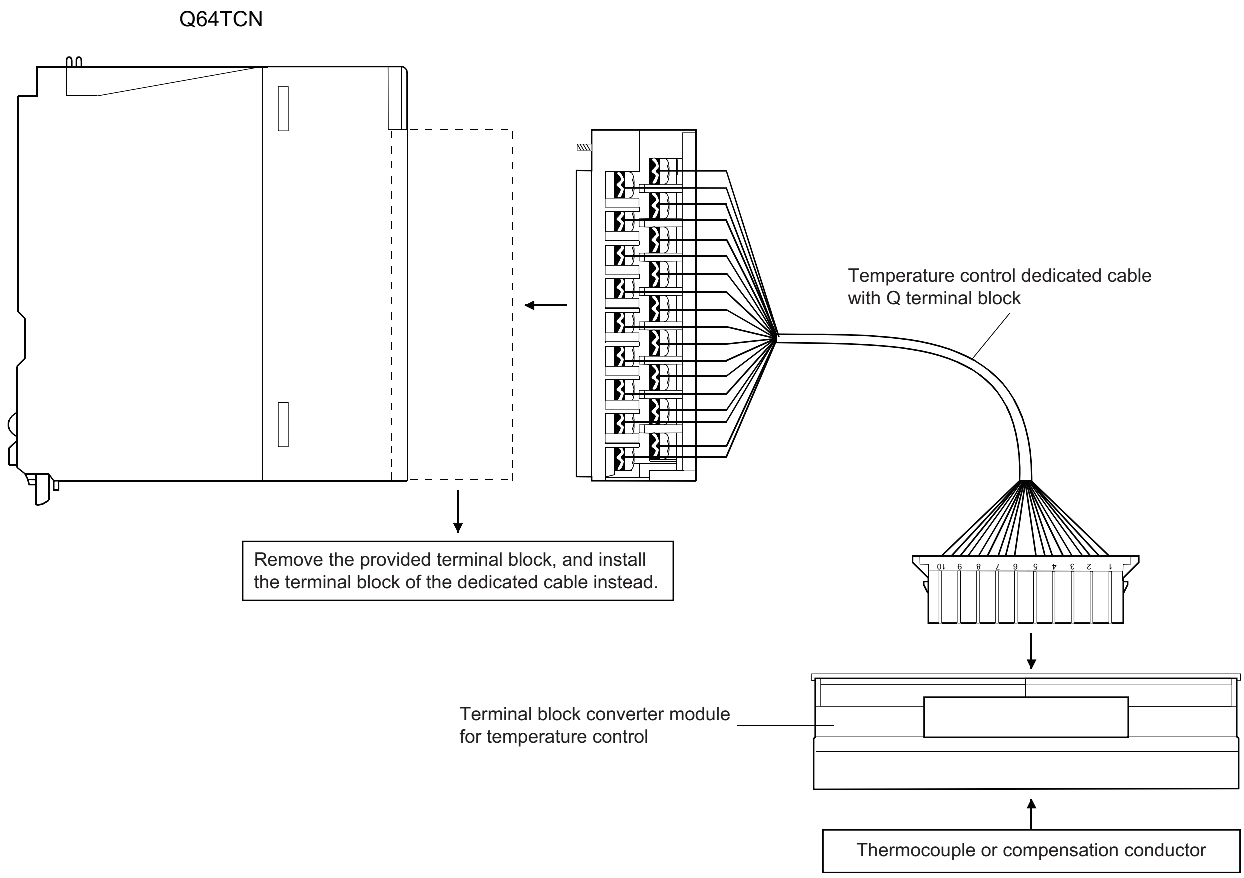
(1) Using the sensor correction function

The measured temperature can be corrected to the actual temperature by this function.
For details on the sensor correction function, refer to the following.

Page 215, Section 4.14

(2) Using terminal block converter module and dedicated cables

The Q64TCN measures temperatures based on the temperature of the terminal block. Thus, depending on the system configuration used, the temperature distribution of the terminal block is not uniform due to the effects of heat generated from modules, and the measured temperature may greatly differ from the actual temperature. (especially when two or more Q64TCN are connected next to each other or the Q64TCN is mounted next to the power supply module or CPU module).
In such cases, using the following terminal block converter module and dedicated cables reduces an error caused by the heat generated.



The following table lists the dedicated cable and the terminal block converter module.

Product name	Model	Manufacturer
Temperature control dedicated cable with Q terminal block	FA-CBLQ64TC** (**: Cable length)	Mitsubishi Electric Engineering Co., Ltd.
Terminal block converter module for temperature control	FA-TB20TC	

For inquiries related to the products or your order, please consult your local Mitsubishi Electric sales office or representative.

CHAPTER 3 SPECIFICATIONS

This chapter describes the performance specifications of the Q64TCN, I/O signals transferred to/from the CPU module, and the specifications of the buffer memory.
For the general specifications of the Q64TCN, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

3.1 Performance Specifications

The following table lists the performance specifications of the Q64TCN.

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="4">Specifications</th></tr>
<tr><th>Q64TCTTN</th><th>Q64TCRTN</th><th>Q64TCTTBWN</th><th>Q64TCRTBWN</th></tr>
<tr><td colspan="3">Control output</td><td colspan="4">Transistor output</td></tr>
<tr><td colspan="3">Number of temperature input points</td><td colspan="4">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="4">Page 42, Section 3.1.1</td></tr>
<tr><td rowspan="5">Accuracy[*1]</td><td rowspan="2">Indication accuracy</td><td>Ambient temperature: 25±5°C</td><td colspan="4">Full scale × (±0.3%)</td></tr>
<tr><td>Ambient temperature: 0 to 55°C</td><td colspan="4">Full scale × (±0.7%)</td></tr>
<tr><td rowspan="3">Cold junction temperature compensation accuracy: (ambient temperature: 0 to 55°C)</td><td>Temperature process value (PV): -100°C or more</td><td>Within ±1.0°C</td><td rowspan="3">—</td><td>Within ±1.0°C</td><td rowspan="3">—</td></tr>
<tr><td>Temperature process value (PV): -150 to -100°C</td><td>Within ±2.0°C</td><td>Within ±2.0°C</td></tr>
<tr><td>Temperature process value (PV): -200 to -150°C</td><td>Within ±3.0°C</td><td>Within ±3.0°C</td></tr>
<tr><td colspan="3">Sampling cycle</td><td colspan="4">500ms/4 channels (constant independently of the number of channels used)</td></tr>
<tr><td colspan="3">Control output cycle</td><td colspan="4">1 to 100s</td></tr>
<tr><td colspan="3">Input impedance</td><td colspan="4">1MΩ</td></tr>
<tr><td colspan="3">Input filter</td><td colspan="4">0 to 100s (0: Input filter OFF)</td></tr>
<tr><td colspan="3">Sensor correction value setting</td><td colspan="4">-50.00 to 50.00%</td></tr>
<tr><td colspan="3">Operation at sensor input disconnection</td><td colspan="4">Upscale processing</td></tr>
<tr><td colspan="3">Temperature control method</td><td colspan="4">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="4">Can be set by auto tuning.</td></tr>
<tr><td>Proportional band (P)</td><td colspan="4">0.0 to 1000.0% (0: Two-position control)</td></tr>
<tr><td>Integral time (I)</td><td colspan="4">0 to 3600s (set 0 for P control and PD control.)</td></tr>
<tr><td>Derivative time (D)</td><td colspan="4">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="4">Within the temperature range set in the used thermocouple/platinum resistance thermometer to be used</td></tr>
<tr><td colspan="3">Dead band setting range</td><td colspan="4">0.1 to 10.0%</td></tr>
</table>

Item		Specifications			
		Q64TCTTN	Q64TCRTN	Q64TCTTBWN	Q64TCRTBWN
Transistor output	Output signal	ON/OFF pulse			
	Rated load voltage	10 to 30VDC			
	Max. load current	0.1A/point, 0.4A/common			
	Max. inrush current	0.4A 10ms			
	Leakage current at OFF	0.1mA or less			
	Max. voltage drop at ON	1.0VDC (TYP) at 0.1A 2.5VDC (MAX) at 0.1A			
	Response time	OFF→ON: 2ms or less, ON→OFF: 2ms or less			
Number of accesses to non-volatile memory		Max. 10^{12} times			
Insulation method		Between input terminal and programmable controller power supply: Transformer insulation Between input channels: Transformer insulation			
Dielectric withstand voltage		Between input terminal and programmable controller power supply: 500VAC for 1 minute Between input channels: 500VAC for 1 minute			
Insulation resistance		Between input terminal and programmable controller power supply: 500VDC 20MΩ or more Between input channels: 500VDC 20MΩ or more			
Heater disconnection detection specifications	Current sensor	—		Page 33, Section 2.1 (6)	
	Input accuracy			Full scale × (±1.0%)	
	Number of alert delay			3 to 255	
I/O occupied points*2		16 points/slot (I/O assignment: 16 intelligent points)		32 points/2 slots (I/O assignment: Vacancy for 16 points + 16 intelligent points)	
External interface		18-point terminal block		Two 18-point terminal blocks	
Applicable wire size		$0.3mm^2$ to $0.75mm^2$			
Applicable solderless terminal		R1.25-3 (Crimping terminal with sleeve is unavailable.)			
Internal current consumption		0.29A		0.33A	
Weight		0.20kg		0.30kg	
Outline dimensions		27.4(W)mm × 98(H)mm × 112(D)mm		55.2(W)mm × 98(H)mm × 112(D)mm	

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

Ex. Accuracy at the input range of 38 (-200.0 to 400.0°C), the operating ambient temperature of 35°C, and the temperature process value (PV) of 300°C

(Full scale) × (indication accuracy) + cold junction temperature compensation accuracy
= (400.0°C- (-200.0°C)) × (±0.007) + (±1.0°C)
= ± 5.2°C

*2 When the Q64TCTTBWN or Q64TCRTBWN is used, the device numbers of the I/O signals increase by 16 points depending on how many free points the left-hand side slots have. Hence, as I/O signals are given as indicated below in this manual, read them according to the module used.

Ex. When 0 is set as the start I/O number, Yn1 is assigned as follows.
When the Q64TCTTN or Q64TCRTN is used: Y1
When the Q64TCTTBWN or Q64TCRTBWN is used: Y11

For the noise immunity, dielectric withstand voltage, insulation resistance and others of the programmable controller system which uses the Q64TCN, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

3.1.1 Type of usable temperature sensors, temperature measurement range, resolution, and effect from wiring resistance of 1 ohm

This section describes types of temperature sensors that can be used with the Q64TCN, the temperature measurement range, the resolution, and the effect from wiring resistance of 1Ω.
Set the used temperature sensor in the following buffer memory area.

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) (☞ Page 98, Section 3.4.2 (12))

(1) Q64TCTTN, Q64TCTTBWN

The following table lists the types of thermocouples that can be used with the Q64TCTTN and Q64TCTTBWN, the temperature measurement range, the resolution, and the effect from wiring resistance of 1Ω.

Thermocouple type	°C			°F		
	Temperature measurement range	Resolution	Effect from wiring resistance of 1Ω (°C/Ω)*1	Temperature measurement range	Resolution	Effect from wiring resistance of 1Ω (°F /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 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
	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
	0.0 to 700.0	0.1		—	—	—
N	0 to 1300	1	0.006	0 to 2300	1	0.011
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		—	—	—

Thermocouple type	°C			°F		
	Temperature measurement range	Resolution	Effect from wiring resistance of 1Ω (°C/Ω)*1	Temperature measurement range	Resolution	Effect from wiring resistance of 1Ω (°F/Ω)*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 Ω 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 215, Section 4.14)

*2 While temperature can be measured within less than 400°C/800°F, the accuracy cannot be guaranteed.

(2) Q64TCRTN, Q64TCRTBWN

The following table lists the types of platinum resistance thermometers that can be used with the Q64TCRTN and Q64TCRTBWN and temperature measurement range.

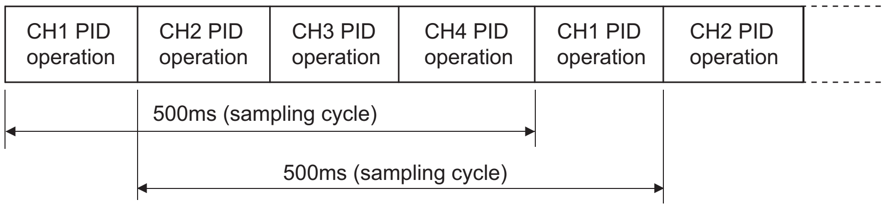
Platinum resistance thermometer type	°C		°F	
	Temperature measurement range	Resolution	Temperature measurement range	Resolution
Pt100	-200.0 to 600.0 -200.0 to 200.0	0.1	-300 to 1100	1
			-300.0 to 300.0	0.1
JPt100	-200.0 to 500.0 -200.0 to 200.0	0.1	-300 to 900	1
			-300.0 to 300.0	0.1

3.1.2 Sampling cycle and control output cycle

This section describes the sampling cycle and control output cycle of the Q64TCN.

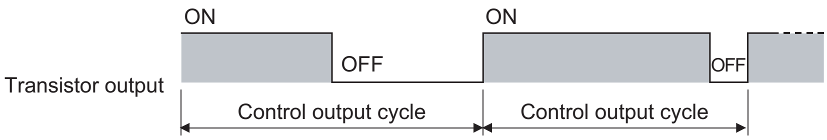
(1) Sampling cycle

The Q64TCN 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. The sampling cycle is 500ms.
The number of used channels and the settings of unused channels do not affect the sampling cycle.



(2) 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. (Page 91, Section 3.4.2 (5))
Set the control output cycle in the following buffer memory area in the range 1 to 100s.

- CH☐ Control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143) (Page 116, Section 3.4.2 (23))

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

Data type	Buffer memory area name	Buffer memory address				Reference
		CH1	CH2	CH3	CH4	
Manipulated value (MV)	Manipulated value for heating (MVh)	Un\G13	Un\G14	Un\G15	Un\G16	Page 91, Section 3.4.2 (5)
	Manipulated value for cooling (MVc)	Un\G704	Un\G705	Un\G706	Un\G707	
Control output cycle	Heating control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	Page 116, Section 3.4.2 (23)
	Cooling control output cycle setting	Un\G722	Un\G738	Un\G754	Un\G770	

3.1.3 Number of parameters to be set

The total number of the parameters of the initial setting and of the auto refresh setting of the Q64TCN must be within the number of parameters which can be set in the CPU module including the number of other intelligent function module parameters. For the maximum number of parameters which can be set in a CPU module (maximum number of set parameter), refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(1) Number of parameters of the Q64TCN

The following table lists the number of parameters that can be set for one Q64TCN.

Target module	Initial setting	Auto refresh setting	
		Normal mode	Setting item reduction mode
Q64TCTTN	54	103 (Max.)	35 (Max.)
Q64TCRTN	53		
Q64TCTTBWN	55	115 (Max.)	36 (Max.)
Q64TCRTBWN	54		

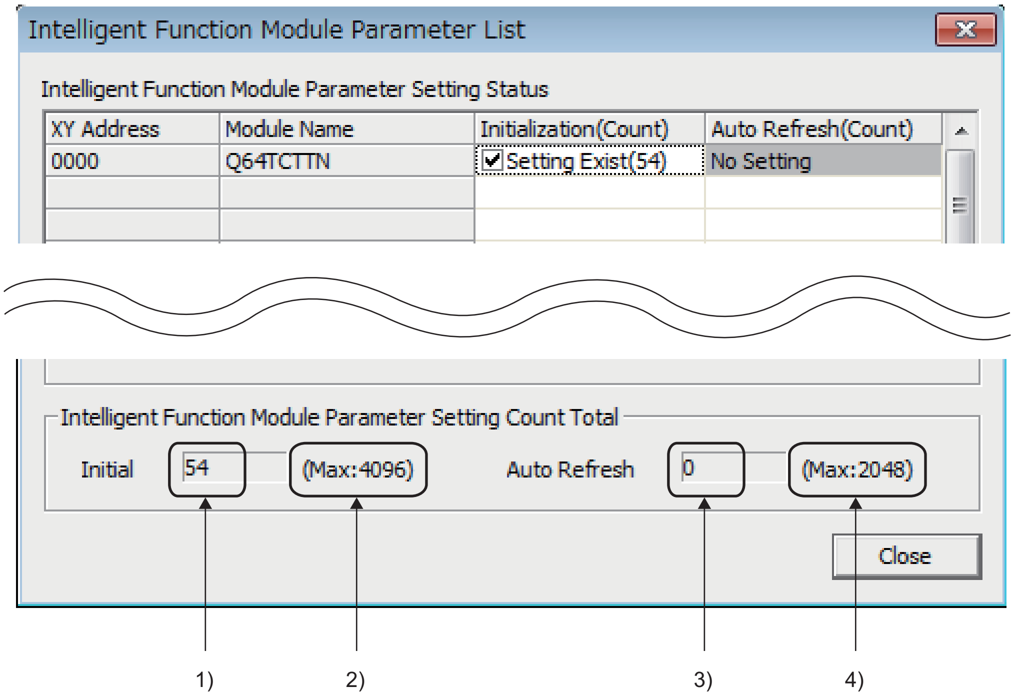
Number of parameters of the auto refresh setting can be reduced by changing the normal mode to the setting item reduction mode. For the setting item reduction mode, refer to the following:

Page 309, Section 6.4

(2) Checking method

The current number and maximum number of the set parameters in the intelligent function module can be checked by the following operation.

Project window ➪ [Intelligent Function Module] ➪ Right-click ➪ [Intelligent Function Module Parameter List...]



No.	Description
1)	Total number of the parameters of the initial setting that is checked on the window
2)	Maximum number of parameters of the initial setting
3)	Total number of the parameters of the auto refresh setting that is checked on the window
4)	Maximum number of parameters of the auto refresh setting

3.2 Function List

This section lists the Q64TCN functions.

○: Enable, ×: Disable

Item	Description	Enable or disable		Reference
		Standard control	Heating-cooling control	
Control mode selection function	The control mode can be selected from the following modes. • Standard control • Heating-cooling control (normal mode) • Heating-cooling control (expanded mode) • Mix control (normal mode) • Mix control (expanded mode)	○	○	Page 168, Section 4.1
Control output setting at CPU stop error	Whether to clear or hold the transistor output status when a CPU stop error occurs or when a CPU module is turned from RUN to STOP can be selected.	○	○	Page 171, Section 4.2
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 172, Section 4.3
Manual reset function	The stable status position in the P control or PD control can be moved manually.	○	○	Page 179, Section 4.4
Manual control	The manipulated value (MV) can be set manually by users without automatic calculation by the PID control.	○	○	Page 181, Section 4.5
Auto tuning function	The Q64TCN sets the optimal PID constants automatically.	○	○	Page 182, Section 4.6
Simple two-degree-of-freedom	In addition to the PID control, the response speed responding to the change of the set value (SV) can be selected from three levels. The simple two-degree-of-freedom PID control can be realized.	○	○	Page 194, Section 4.7
Derivative action selection function	Dynamic performance can be improved by selecting the suitable derivative action for the fixed value action and the ramp action.	○	○	Page 195, Section 4.8
Setting change rate limiter setting function	Change rate setting of the set value (SV) per set time unit when this value is changed. The batch setting or individual setting can be selected for the temperature rise and drop.	○	○	Page 196, Section 4.9
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 197, Section 4.10
Temperature process value (PV) scaling function	The temperature process value (PV) can be converted to the set width and this value can be imported into the buffer memory.	○	○	Page 198, Section 4.11
Alert function	The modules goes to the alert status when the temperature process value (PV) or deviation (E) meets the condition set in advance.	○	○	Page 200, Section 4.12

Item	Description	Enable or disable		Reference
		Standard control	Heating-cooling control	
RFB limiter function	When the deviation (E) continues for a long time, the PID operation result (manipulated value (MV)) by the integral action can be prevented from exceeding the effective range of the manipulated value (MV).	○	○	Page 214, Section 4.13
Sensor correction function	If a difference between a temperature process value (PV) and an actual temperature occurs due to the measurement status, the error can be corrected. Select a correction method from the following two types. • 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: An error is corrected by setting any two points (corrected offset value and corrected gain value).	○	○	Page 215, Section 4.14
Auto-setting at input range change	When the input range is changed, the related buffer memory data is changed automatically so that errors outside the setting range does not occur.	○	○	Page 226, Section 4.15
Input/output (with another analog module) function	Data can be input/output using another analog module (A/D conversion module or D/A conversion module) on the system.	○	○	Page 227, Section 4.16
ON delay output function	Setting with considering delay time (response/scan time delay) of actual transistor output is possible.	○	○	Page 228, Section 4.17
Self-tuning function	The Q64TCN monitors the control status constantly. If the control system oscillates due to a status soon after the control starts, a change of the set value (SV), and property fluctuation of a controlled object, PID constants are changed automatically.	○	×	Page 229, Section 4.18
Peak current suppression function	Changing automatically the upper limit output limiter value of each channel and dividing the timing of transistor output can suppress the peak current.	○	×	Page 239, Section 4.19
Simultaneous temperature rise function	This function allows several loops to reach the set value (SV) at the same time.	○	×	Page 244, Section 4.20
Forward/reverse action selection function	Whether to perform PID operations in the forward action or reverse action can be selected.	○	×	Page 258, Section 4.21
Loop disconnection detection function	Errors in the control system (control loop) can be detected.	○	×	Page 259, Section 4.22
During AT loop disconnection detection function	A loop disconnection can be detected during auto tuning.	○	×	Page 261, Section 4.23
Proportional band setting function	The proportional band (P) can be individually set for heating or cooling.	×	○	Page 263, Section 4.24
Cooling method setting function	When the auto tuning is executed, an auto tuning formula is automatically selected according to the selected cooling method and the operation starts.	×	○	Page 264, Section 4.25
Overlap/dead band function	By changing the temperature where the cooling transistor output is started, whether control stability is prioritized or energy saving is prioritized can be selected.	×	○	Page 265, Section 4.26
Temperature conversion function (using unused channels)	In heating-cooling control (normal mode) and mix control (normal mode), only temperature measurement is allowed by using unused temperature input terminals.	×	○	Page 268, Section 4.27
Heater disconnection detection function	The current which flows in the heater main circuit can be measured and disconnections can be detected.	○	○	Page 271, Section 4.28

Item	Description	Enable or disable		Reference
		Standard control	Heating-cooling control	
Output off-time current error detection function	An error of when the transistor output is off can be detected.	○	○	Page 275, Section 4.29
Buffer memory data backup function	A set value in a buffer memory area can be backed up to the E^2PROM. Because the backed up value is restored at the next startup of the module, an initial setting program is not required once this function is executed.	○	○	Page 276, Section 4.30
Error history function	Up to 16 errors and alarms that occur on the Q64TCN are stored in the buffer memory as history.	○	○	Page 278, Section 4.31
Module error history collection function	Error contents can be notified to the CPU module when errors and alarms occur on the Q64TCN. Error information is held in the memory inside of the CPU module as module error history.	○	○	Page 280, Section 4.32
Error clear function	When an error occurs, the error can be cleared on the system monitor.	○	○	Page 281, Section 4.33

3.3 I/O Signals Transferred to/from the CPU Module

This section describes the I/O signals of the Q64TCN.

3.3.1 I/O signal list

This section describes the assignment and applications of the Q64TCN input signals.
When the Q64TCTTBWN or Q64TCRTBWN is used, the device numbers of the I/O signals increase by 16 points depending on how many empty points the left-hand side slots have. Therefore, I/O signals are given as indicated below in this manual. Read them according to the module used.

Ex. When 0 is set as the start I/O number, Yn1 is assigned as follows.
When the Q64TCTTN or Q64TCRTN is used: Y1
When the Q64TCTTBWN or Q64TCRTBWN is used: Y11

(1) Input signal list

Input signal (Signal direction: CPU module ← Q64TCN)			
Device No.	**Standard control**	**Heating-cooling control**	**Mix control**
Xn0	Module READY flag	Module READY flag	Module READY flag
Xn1	Setting/operation mode status	Setting/operation mode status	Setting/operation mode status
Xn2	Write error flag	Write error flag	Write error flag
Xn3	Hardware error flag	Hardware error flag	Hardware error flag
Xn4	CH1 Auto tuning status	CH1 Auto tuning status	CH1 Auto tuning status
Xn5	CH2 Auto tuning status	CH2 Auto tuning status	CH2 Auto tuning status*2
Xn6	CH3 Auto tuning status	CH3 Auto tuning status*1	CH3 Auto tuning status
Xn7	CH4 Auto tuning status	CH4 Auto tuning status*1	CH4 Auto tuning status
Xn8	E^2PROM write completion flag	E^2PROM write completion flag	E^2PROM write completion flag
Xn9	Default value write completion flag	Default value write completion flag	Default value write completion flag
XnA	E^2PROM write failure flag	E^2PROM write failure flag	E^2PROM write failure flag
XnB	Setting change completion flag	Setting change completion flag	Setting change completion flag
XnC	CH1 Alert occurrence flag	CH1 Alert occurrence flag	CH1 Alert occurrence flag
XnD	CH2 Alert occurrence flag	CH2 Alert occurrence flag	CH2 Alert occurrence flag
XnE	CH3 Alert occurrence flag	CH3 Alert occurrence flag	CH3 Alert occurrence flag
XnF	CH4 Alert occurrence flag	CH4 Alert occurrence flag	CH4 Alert occurrence flag

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to Page 170, Section 4.1 (3).

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to Page 170, Section 4.1 (3).

(2) Output signal list

Output signal (signal direction: CPU module → Q64TCN)			
Device No.	**Standard control**	**Heating-cooling control**	**Mix control**
Yn0	N/A	N/A	N/A
Yn1	Setting/operation mode instruction	Setting/operation mode instruction	Setting/operation mode instruction
Yn2	Error reset instruction	Error reset instruction	Error reset instruction
Yn3	N/A	N/A	N/A
Yn4	CH1 Auto tuning instruction	CH1 Auto tuning instruction	CH1 Auto tuning instruction
Yn5	CH2 Auto tuning instruction	CH2 Auto tuning instruction	CH2 Auto tuning instruction*2
Yn6	CH3 Auto tuning instruction	CH3 Auto tuning instruction*1	CH3 Auto tuning instruction
Yn7	CH4 Auto tuning instruction	CH4 Auto tuning instruction*1	CH4 Auto tuning instruction
Yn8	E^2PROM backup instruction	E^2PROM backup instruction	E^2PROM backup instruction
Yn9	Default setting registration instruction	Default setting registration instruction	Default setting registration instruction
YnA	N/A	N/A	N/A
YnB	Setting change instruction	Setting change instruction	Setting change instruction
YnC	CH1 PID control forced stop instruction	CH1 PID control forced stop instruction	CH1 PID control forced stop instruction
YnD	CH2 PID control forced stop instruction	CH2 PID control forced stop instruction	CH2 PID control forced stop instruction*2
YnE	CH3 PID control forced stop instruction	CH3 PID control forced stop instruction*1	CH3 PID control forced stop instruction
YnF	CH4 PID control forced stop instruction	CH4 PID control forced stop instruction*1	CH4 PID control forced stop instruction

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to Page 170, Section 4.1 (3).

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to Page 170, Section 4.1 (3).

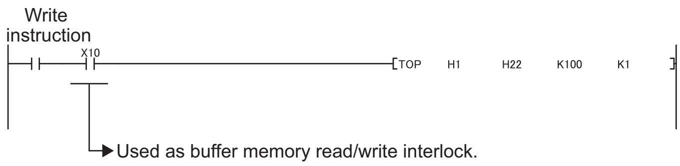
Point

The functions of the Q64TCN cannot be guaranteed if any of the unavailable areas is turned on/off in a sequence program.

3.3.2 Details of input signals

(1) Module READY flag (Xn0)

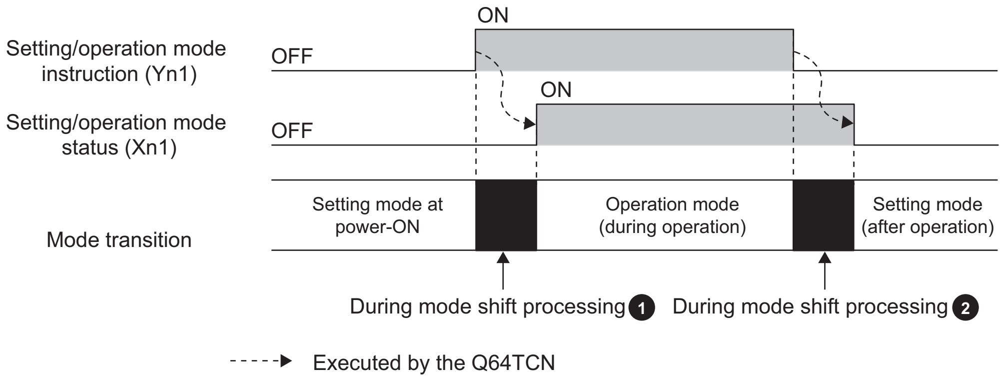
This flag turns on to indicate that the preparation for the Q64TCN is completed when the module is turned on from off or when the CPU module's reset is released.
Make sure that this flag is on when reading/writing data from/in the buffer memory of the Q64TCN from the CPU module. The following shows an example of a program. (In the following example, the start I/O number of the Q64TCN is set to 10.)



If the watchdog timer error is detected, this flag turns off. The Q64TCN stops controlling the temperature and the transistor output turns off. (The RUN LED turns off and ERR. LED turns on.)

(2) Setting/operation mode status (Xn1)

This signal turns on at the operation mode, off at the setting mode.



(a) Precautions during the mode shifting

The mode shifting means the following timings.

- From Setting/operation mode instruction (Yn1) OFF → ON to Setting/operation mode status (Xn1) ON (above figure 1)
- From Setting/operation mode instruction (Yn1) ON → OFF to Setting/operation mode status (Xn1) OFF (above figure 2)

During the mode shifting, do not change the set values. If the set values are changed during the mode shifting, the module operation cannot be guaranteed. Use Setting/operation mode status (Xn1) as an interlock condition for Setting/operation mode instruction (Yn1) when changing the setting.

Point

The conditions whether to perform the temperature judgment, PID control, and alert judgment by the Q64TCN differ among the following timings.

- Setting mode at power-ON
- Operation mode (in operation)
- Setting mode (after operation)

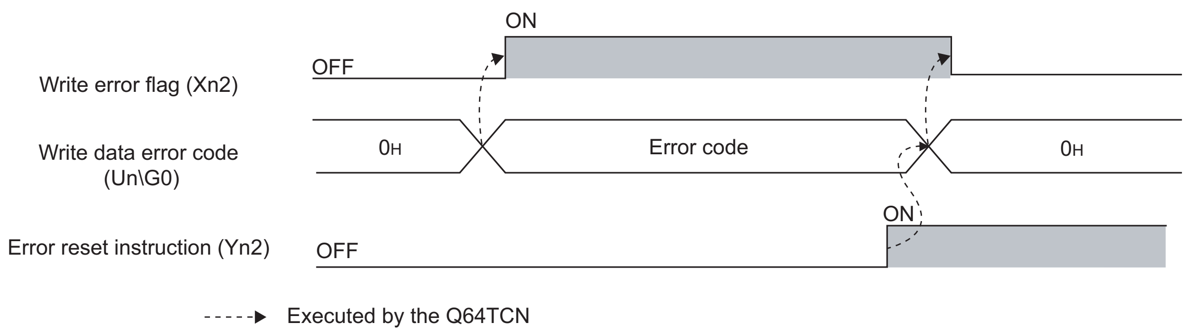
For each detail on the temperature judgment, PID control, and alert judgment, refer to the following.

- Temperature judgment:Page 89, Section 3.4.2 (3)
- PID control:Page 176, Section 4.3 (6)
- Alert judgment:Page 209, Section 4.12 (5)

(3) Write error flag (Xn2)

The write data error occurs in the Q64TCN when the data is set to the buffer memory in the area where data cannot be written or the timing when data cannot be written.
After a write data error occurs and the error code is stored in Write data error code (Un\G0), this flag turns on.
A write data error occurs under the following conditions.

- When data is set in the buffer memory of the system area
- When the setting of the area which can be written only during the setting mode (Setting/operation mode status (Xn1): OFF) is changed during the operation mode (Setting/operation mode status (Xn1): ON) (Page 52, Section 3.3.2 (2))
- When the data which cannot be set is set
- When the setting of the buffer memory is changed during the default setting registration (Page 60, Section 3.3.3 (5))
- When the current control mode and the control mode backed up in the E^2PROM are different due to the change of the control mode selection.



(4) Hardware error flag (Xn3)

This flag turns on when hardware error occurs in the Q64TCN.

(5) CH☐ Auto tuning status (Xn4 to Xn7)

This signal turns on when auto tuning of each channel is set by the user or when the Q64TCN performs self-tuning.

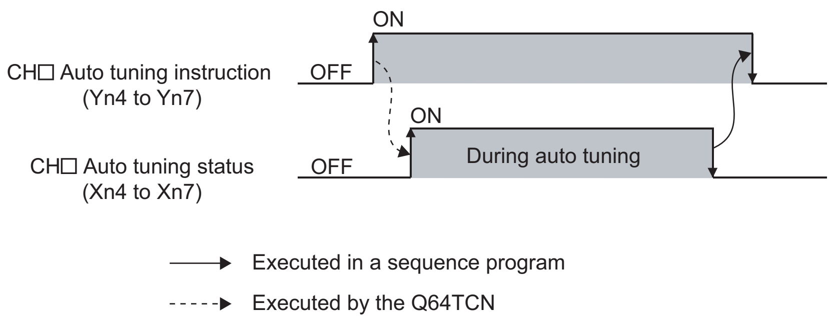
Channel	Auto tuning status			ON/OFF status
	Standard control	Heating-cooling control	Mix control	
CH1	Xn4	Xn4	Xn4	ON: The auto tuning/self-tuning is being performed. OFF: The auto tuning/self-tuning is not being performed or is completed.
CH2	Xn5	Xn5	Xn5*2	
CH3	Xn6	Xn6*1	Xn6	
CH4	Xn7	Xn7*1	Xn7	

*1 Available only under the heating-cooling control (expanded mode). For details on the expanded mode, refer to Page 170, Section 4.1 (3).

*2 Available only under the mix control (expanded mode). For details on the expanded mode, refer to Page 170, Section 4.1 (3).

(a) Performing auto tuning

To perform auto tuning, turn CH☐ Auto tuning instruction (Yn4 to Yn7) on from off.
While auto tuning is in process, this signal is on, and turns off at the completion of the auto tuning.



For details on the auto tuning function, refer to the following.

Page 182, Section 4.6

(b) Self-tuning

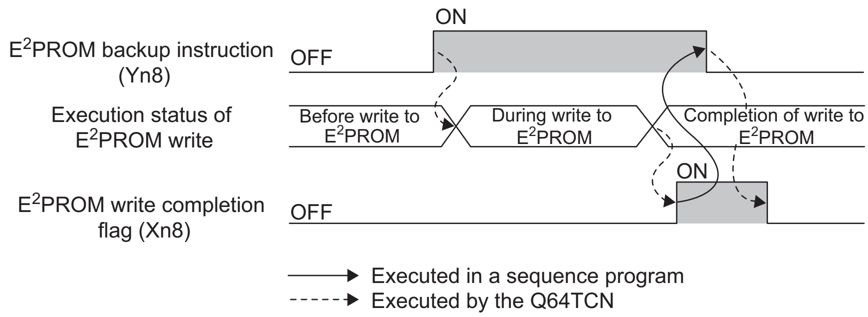
This signal turns on when self-tuning starts. This signal automatically turns off at the completion of the self-tuning.

Set a self-tuning option in CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670). (Page 148, Section 3.4.2 (68))Self-tuning can be executed only in the standard control.
For details on the self-tuning function, refer to the following.

Page 229, Section 4.18

(6) E^{2}PROM write completion flag (Xn8)

Turning E^{2}PROM backup instruction (Yn8) on from off starts the writing of the buffer memory data to the E^{2}PROM. After the data writing is completed, this flag turns on. Turning E^{2}PROM backup instruction (Yn8) off from on also turns off this flag.

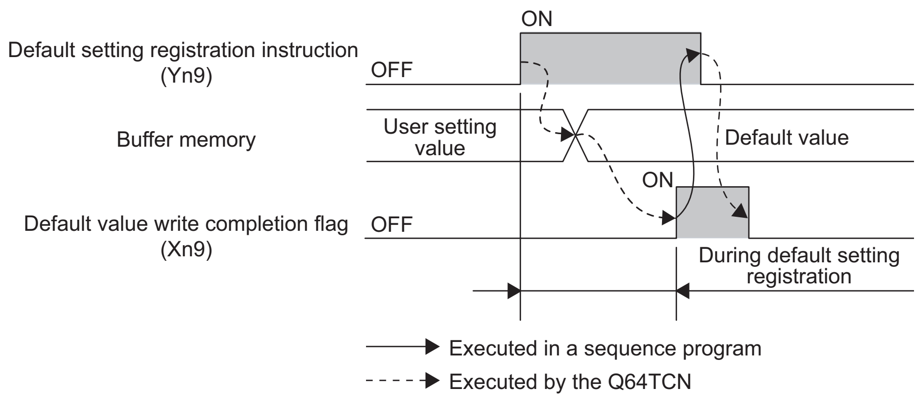


For details on the data writing to the E^{2}PROM, refer to the following.

Page 276, Section 4.30

(7) Default value write completion flag (Xn9)

Turning Default setting registration instruction (Yn9) on from off starts the writing of the default value of the Q64TCN to the buffer memory. After the data writing is completed, this flag turns on. Turning Default setting registration instruction (Yn9) off from on also turns off this flag.



(a) Unused channel

For unused channels (which temperature sensors are not connected to), CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) must be set to Unused (1) after the completion of the writing of the default value.

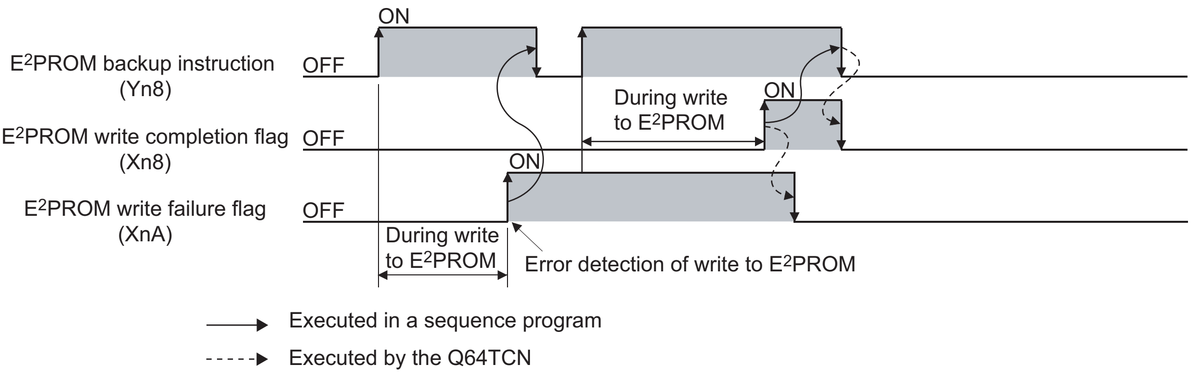
If not, the ALM LED blinks.

For details on the unused channel setting, refer to the following.

Page 303, Section 5.5

(8) E^2PROM write failure flag (XnA)

Turning E^2PROM backup instruction (Yn8) on from off starts the writing of the buffer memory data to the E^2PROM. This flag turns on when the writing failed.



This flag turns off when E^2PROM backup instruction (Yn8) is turned on from off again to complete the data writing to the E^2PROM.

For details on the data writing to the E^2PROM, refer to the following.

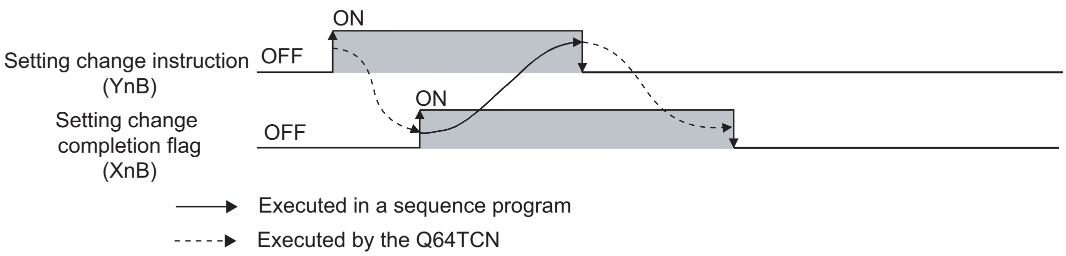
Page 276, Section 4.30

Point

When an error of the data read from E^2PROM is detected at power-on, E^2PROM write failure flag (XnA) turns on and the Q64TCN operates by default. In this case, turn E^2PROM backup instruction (Yn8) on from off to write data to the E^2PROM. If the data writing to the E^2PROM fails, hardware failure is a likely cause. Please consult your local Mitsubishi representative.

(9) Setting change completion flag (XnB)

Turning Setting change instruction (YnB) on from off during the setting mode (Setting/operation mode status (Xn1): OFF) reflects the set contents of each buffer memory to the control. After the data is reflected, this flag turns on. Turning Setting change instruction (YnB) off from on also turns off this flag.



This flag can be used as an interlock condition for Setting/operation mode instruction (Yn1).

(10)CH□ Alert occurrence flag (XnC to XnF)

When an alert occurs, the alert definition is stored in CH□ Alert definition (Un\G5 to Un\G8), and this flag turns on.

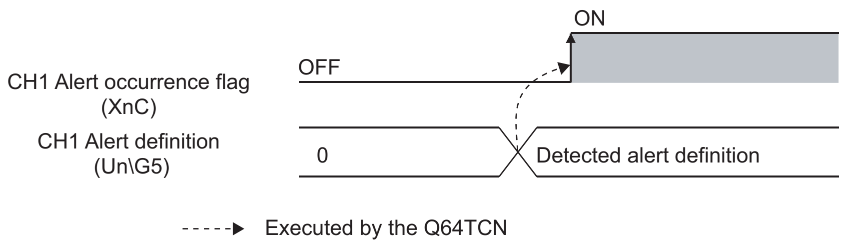
For conditions where this flag turns off, refer to the following.

☞Page 209, Section 4.12 (6)

The following table lists the particular flag and buffer memory addresses of alert definitions for each channel.

Channel	Alert occurrence flag	ON/OFF status	CH□ Alert definition (buffer memory address) (☞Page 89, Section 3.4.2 (3))
CH1	XnC	OFF: Alert does not occur. ON: Alert occurs.	Un\G5
CH2	XnD		Un\G6
CH3	XnE		Un\G7
CH4	XnF		Un\G8

Ex. Time chart for CH1



3.3.3 Details of output signals

(1) Setting/operation mode instruction (Yn1)

Use this signal to select the setting mode or the operation mode.

- OFF: Setting mode
- ON: Operation mode

Some buffer memory areas can be set only in the setting mode.

(a) Buffer memory areas that can be set only in the setting mode

The following settings can be changed only when Setting/operation mode instruction (Yn1) is off. If the settings are changed in the operation mode, a write data error (error code: □□□ 3_H) occurs.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Input range	Un\G32	Un\G64	Un\G96	Un\G128	Page 98, Section 3.4.2 (12)
Resolution of the manipulated value for output with another analog module	Un\G181				Page 136, Section 3.4.2 (48)
CH□ Alert 1 mode setting	Un\G192	Un\G208	Un\G224	Un\G240	Page 139, Section 3.4.2 (52)
CH□ Alert 2 mode setting	Un\G193	Un\G209	Un\G225	Un\G241	
CH□ Alert 3 mode setting	Un\G194	Un\G210	Un\G226	Un\G242	
CH□ Alert 4 mode setting	Un\G195	Un\G211	Un\G227	Un\G243	
CT□ CT selection	Un\G272 to Un\G279 (set for each current sensor (CT))				Page 142, Section 3.4.2 (55)
CH□ Sensor two-point correction offset value (measured value)	Un\G544	Un\G576	Un\G608	Un\G640	Page 144, Section 3.4.2 (58)
CH□ Sensor two-point correction offset value (corrected value)	Un\G545	Un\G577	Un\G609	Un\G641	Page 144, Section 3.4.2 (59)
CH□ Sensor two-point correction gain value (measured value)	Un\G546	Un\G578	Un\G610	Un\G642	Page 145, Section 3.4.2 (60)
CH□ Sensor two-point correction gain value (corrected value)	Un\G547	Un\G579	Un\G611	Un\G643	Page 145, Section 3.4.2 (61)
CH□ Sensor two-point correction offset latch request	Un\G548	Un\G580	Un\G612	Un\G644	Page 146, Section 3.4.2 (62)
CH□ Sensor two-point correction gain latch request	Un\G550	Un\G582	Un\G614	Un\G646	Page 146, Section 3.4.2 (64)
CH□ Number of moving averaging	Un\G698	Un\G699	Un\G700	Un\G701	Page 153, Section 3.4.2 (72)
Cooling method setting	Un\G719				Page 153, Section 3.4.2 (73)
CH□ Process value (PV) scaling function enable/disable setting	Un\G725	Un\G741	Un\G757	Un\G773	Page 154, Section 3.4.2 (76)
CH□ Process value (PV) scaling lower limit value	Un\G726	Un\G742	Un\G758	Un\G774	Page 155, Section 3.4.2 (77)
CH□ Process value (PV) scaling upper limit value	Un\G727	Un\G743	Un\G759	Un\G775	
CH□ Derivative action selection	Un\G729	Un\G745	Un\G761	Un\G777	Page 155, Section 3.4.2 (79)
CH□ Simultaneous temperature rise group setting	Un\G730	Un\G746	Un\G762	Un\G778	Page 156, Section 3.4.2 (80)
CH□ Setting change rate limiter unit time setting	Un\G735	Un\G751	Un\G767	Un\G783	Page 159, Section 3.4.2 (85)
Peak current suppression control group setting	Un\G784				Page 160, Section 3.4.2 (86)
Sensor correction function selection	Un\G785				Page 161, Section 3.4.2 (87)

(2) Error reset instruction (Yn2)

Use this signal to turn off Write error flag (Xn2) and to reset Write data error code (Un\G0). For the method to reset an error, refer to Write error flag (Xn2). (Page 53, Section 3.3.2 (3))

(3) CH☐ Auto tuning instruction (Yn4 to Yn7)

Use this signal to start auto tuning per channel. Turning this signal on from off starts auto tuning and turns on CH☐ Auto tuning status (Xn4 to Xn7). After auto tuning is completed, CH☐ Auto tuning status (Xn4 to Xn7) turns off.
Keep this instruction ON during auto tuning and turn it off from on at the completion of the auto tuning. If this instruction is turned off from on during auto tuning, the auto tuning stops. If the auto tuning stops, PID constants in the buffer memory do not change.

Point

- If proportional band (P)/heating proportional band (Ph) is set to 0, auto tuning cannot be performed. (Page 107, Section 3.4.2 (15))
- If Setting/operation mode instruction (Yn1) is turned off from on and the operation status shifts to the setting mode during auto tuning, the auto tuning stops. After that, even if Setting/operation mode instruction (Yn1) is turned on from off and the operation status shifts back to the operation mode, the auto tuning does not resume. To resume the auto tuning, turn Auto tuning instruction (Yn4 to Yn7) off from on, and turn it on from off again.

For details on the auto tuning function, refer to the following.
Page 182, Section 4.6

(4) E²PROM backup instruction (Yn8)

Use this signal to write the buffer memory data to the E²PROM. Turning this instruction on from off starts the data writing to the E²PROM.
For the buffer memory areas whose data is to be backed up, refer to the following.
Page 61, Section 3.4.1

(a) When data writing to the E²PROM has completed normally

E²PROM write completion flag (Xn8) turns on.

(b) When data writing to the E²PROM has not completed normally

E²PROM write failure flag (XnA) turns on. When E²PROM write failure flag (XnA) turns on, turn E²PROM write failure flag (XnA) on from off to write the data to the E²PROM again.

(c) Timings when this instruction cannot be received

In the following timings, this instruction cannot be received.
- 1: While PID constants are written after auto tuning
- 2: While PID constants are read from the E²PROM
- 3: While a setting error is occurring
- 4: While a setting is being changed by Setting change instruction (YnB)

For 1 to 3 above, turn this instruction on from off after each condition is resolved.
For 4, data writing to the non-volatile memory automatically starts if the factor is resolved.
For details on the data writing to the E²PROM, refer to Page 276, Section 4.30.

(5) Default setting registration instruction (Yn9)

Turning Default setting registration instruction (Yn9) on from off sets the data in the buffer memory areas back to the default values according to control mode selection.
After the data writing is completed, Default value write completion flag (Xn9) turns on.

(a) When Setting/operation mode status (Xn1) is on (in operation mode)

Turning this instruction on from off does not set data back to the default value. Turn on this instruction when Setting/operation mode status (Xn1) is off (in the setting mode).

(6) Setting change instruction (YnB)

Use this instruction to confirm the set value of the buffer memory (the buffer memory areas that can be set only in the setting mode (Setting/operation mode status (Xn1): OFF)). (☞Page 58, Section 3.3.3 (1))

(a) Reflection of set value

Even though the set values are written into the buffer memory, they cannot be reflected to the Q64TCN's operation immediately. To confirm the set values, turn this instruction OFF → ON → OFF after the set values are written into the buffer memory. Doing so lets the Q64TCN operate according to the setting in each buffer memory area.

(7) CH☐ PID control forced stop instruction (YnC to YnF)

Use this signal to temporarily stop PID control forcibly.

(a) Mode when PID control stops

The mode depends on the setting of CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129).
For details on CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129), refer to the following.
☞Page 105, Section 3.4.2 (13)

3.4 Buffer Memory Assignment

This section describes the Q64TCN buffer memory assignment.

3.4.1 Q64TCN buffer memory assignment list

This section lists the Q64TCN buffer memory areas.

For details on the buffer memory, refer to Page 88, Section 3.4.2.

Point

Do not write data in the system area or the write-protect area in a sequence program in the buffer memory. Doing so may cause malfunction.

(1) Buffer memory address by control mode

This section describes the buffer memory assignments by control mode.

For details on the control mode, refer to Page 168, Section 4.1.

Point

Depending on the control mode, some channels cannot be used for control.

The channels which cannot be used for control are the following.

- For heating-cooling control (normal mode): CH3, CH4
- For mix control (normal mode): CH2

The channels which cannot be used for control can be used only for temperature measurement. For details, refer to Page 268, Section 4.27.

○: Enable, ×: Disable

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
$0(0_H)$	All CHs	Write data error code			0	R	×	×	Page 88, Section 3.4.2 (1)
$1(1_H)$	CH1	Decimal point position			0(TT) 1(RT) *5	R	×	×	Page 88, Section 3.4.2 (2)
$2(2_H)$	CH2	Decimal point position							
$3(3_H)$	CH3	Decimal point position							
$4(4_H)$	CH4	Decimal point position							
$5(5_H)$	CH1	Alert definition			0	R	×	×	Page 89, Section 3.4.2 (3)
$6(6_H)$	CH2	Alert definition							
$7(7_H)$	CH3	Alert definition							
$8(8_H)$	CH4	Alert definition							
$9(9_H)$	CH1	Temperature process value (PV)			0	R	×	×	Page 91, Section 3.4.2 (4)
$10(A_H)$	CH2	Temperature process value (PV)							
$11(B_H)$	CH3	Temperature process value (PV)							
$12(C_H)$	CH4	Temperature process value (PV)							
$13(D_H)$	CH1	Manipulated value (MV)	Manipulated value for heating (MVh)	Manipulated value for heating (MVh)	0	R	×	×	Page 91, Section 3.4.2 (5)
$14(E_H)$	CH2	Manipulated value (MV)	Manipulated value for heating (MVh)	Manipulated value for heating (MVh)*7					
$15(F_H)$	CH3	Manipulated value (MV)	Manipulated value for heating (MVh)*6	Manipulated value (MV)					
$16(10_H)$	CH4	Manipulated value (MV)	Manipulated value for heating (MVh)*6	Manipulated value (MV)					
$17(11_H)$	CH1	Temperature rise judgment flag	Temperature rise judgment flag	Temperature rise judgment flag	0	R	×	×	Page 93, Section 3.4.2 (6)
$18(12_H)$	CH2	Temperature rise judgment flag	Temperature rise judgment flag	Temperature rise judgment flag*7					
$19(13_H)$	CH3	Temperature rise judgment flag	Temperature rise judgment flag*6	Temperature rise judgment flag					
$20(14_H)$	CH4	Temperature rise judgment flag	Temperature rise judgment flag*6	Temperature rise judgment flag					

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
21(15_H)	CH1	Transistor output flag	Heating transistor output flag	Heating transistor output flag	0	R	×	×	Page 94, Section 3.4.2 (7)
22(16_H)	CH2	Transistor output flag	Heating transistor output flag	Heating transistor output flag*7					
23(17_H)	CH3	Transistor output flag	Heating transistor output flag*6	Transistor output flag					
24(18_H)	CH4	Transistor output flag	Heating transistor output flag*6	Transistor output flag					
25(19_H)	CH1	Set value (SV) monitor			0	R	×	×	Page 95, Section 3.4.2 (8)
26($1A_H$)	CH2	Set value (SV) monitor	Set value (SV) monitor	Set value (SV) monitor*7					
27($1B_H$)	CH3	Set value (SV) monitor	Set value (SV) monitor*6	Set value (SV) monitor					
28($1C_H$)	CH4	Set value (SV) monitor	Set value (SV) monitor*6	Set value (SV) monitor					
29($1D_H$)	All CHs	Cold junction temperature process value*8			0	R	×	×	Page 95, Section 3.4.2 (9)
30($1E_H$)	All CHs	MAN mode shift completion flag			0	R	×	×	Page 95, Section 3.4.2 (10)
31($1F_H$)	All CHs	E^2PROM's PID constants read/write completion flag			0	R	×	×	Page 96, Section 3.4.2 (11)
32(20_H)	CH1	Input range*9			2(TT) 7(RT) *5	R/W	×	○	Page 98, Section 3.4.2 (12)
33(21_H)	CH1	Stop mode setting			1	R/W	×	○	Page 105, Section 3.4.2 (13)
34(22_H)	CH1	Set value (SV) setting			0	R/W	○	○	Page 106, Section 3.4.2 (14)
35(23_H)	CH1	Proportional band (P) setting	Heating proportional band (Ph) setting	Heating proportional band (Ph) setting	30	R/W	×	○	Page 107, Section 3.4.2 (15)
36(24_H)	CH1	Integral time (I) setting			240	R/W	×	○	Page 109, Section 3.4.2 (16)
37(25_H)	CH1	Derivative time (D) setting			60	R/W	×	○	Page 109, Section 3.4.2 (17)
38(26_H)	CH1	Alert set value 1			0	R/W	○	○	Page 110, Section 3.4.2 (18)
39(27_H)	CH1	Alert set value 2			0	R/W	○	○	
40(28_H)	CH1	Alert set value 3			0	R/W	○	○	
41(29_H)	CH1	Alert set value 4			0	R/W	○	○	

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
42(2A$_H$)	CH1	Upper limit output limiter	Heating upper limit output limiter	Heating upper limit output limiter	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
43(2B$_H$)	CH1	Lower limit output limiter	System area	System area	0	R/W	×	○	
44(2C$_H$)	CH1	Output variation limiter setting			0	R/W	×	○	Page 114, Section 3.4.2 (20)
45(2D$_H$)	CH1	Sensor correction value setting			0	R/W	×	○	Page 115, Section 3.4.2 (21)
46(2E$_H$)	CH1	Adjustment sensitivity (dead band) setting			5	R/W	×	○	Page 115, Section 3.4.2 (22)
47(2F$_H$)	CH1	Control output cycle setting	Heating control output cycle setting	Heating control output cycle setting	30	R/W	×	○	Page 116, Section 3.4.2 (23)
48(30$_H$)	CH1	Primary delay digital filter setting			0	R/W	×	○	Page 117, Section 3.4.2 (24)
49(31$_H$)	CH1	Control response parameters			0	R/W	×	○	Page 118, Section 3.4.2 (25)
50(32$_H$)	CH1	AUTO/MAN mode shift			0	R/W	×	○	Page 119, Section 3.4.2 (26)
51(33$_H$)	CH1	MAN output setting			0	R/W	×	○	Page 120, Section 3.4.2 (27)
52(34$_H$)	CH1	Setting change rate limiter/Setting change rate limiter (temperature rise)*10			0	R/W	×	○	Page 121, Section 3.4.2 (28)
53(35$_H$)	CH1	AT bias			0	R/W	○	○	Page 122, Section 3.4.2 (29)
54(36$_H$)	CH1	Forward/reverse action setting	System area	System area	1	R/W	×	○	Page 123, Section 3.4.2 (30)
55(37$_H$)	CH1	Upper limit setting limiter			1300 (TT) 6000 (RT)*5	R/W	○	○	Page 124, Section 3.4.2 (31)
56(38$_H$)	CH1	Lower limit setting limiter			0(TT) -2000 (RT)*5	R/W	○	○	
57(39$_H$)	CH1	System area			—	—	—	—	—
58(3A$_H$)	CH1	Heater disconnection alert setting*11			0	R/W	×	○	Page 125, Section 3.4.2 (32)
59(3B$_H$)	CH1	Loop disconnection detection judgment time	System area	System area	480	R/W	×	○	Page 126, Section 3.4.2 (33)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
$60(3C_H)$	CH1	Loop disconnection detection dead band	System area	System area	0	R/W	○	○	Page 127, Section 3.4.2 (34)
$61(3D_H)$	CH1	Unused channel setting			0	R/W	×	○	Page 128, Section 3.4.2 (35)
$62(3E_H)$	CH1	E^2PROM's PID constants read instruction			0	R/W	×	×	Page 129, Section 3.4.2 (36)
$63(3F_H)$	CH1	Automatic backup setting after auto tuning of PID constants			0	R/W	×	×	Page 130, Section 3.4.2 (37)
$64(40_H)$	CH2	Input range*9			2(TT) 7(RT) *5	R/W	×	○	Page 98, Section 3.4.2 (12)
$65(41_H)$	CH2	Stop mode setting	Stop mode setting	Stop mode setting*7	1	R/W	×	○	Page 105, Section 3.4.2 (13)
$66(42_H)$	CH2	Set value (SV) setting	Set value (SV) setting	Set value (SV) setting*7	0	R/W	○	○	Page 106, Section 3.4.2 (14)
$67(43_H)$	CH2	Proportional band (P) setting	Heating proportional band (Ph) setting	Heating proportional band (Ph) setting*7	30	R/W	×	○	Page 107, Section 3.4.2 (15)
$68(44_H)$	CH2	Integral time (I) setting	Integral time (I) setting	Integral time (I) setting*7	240	R/W	×	○	Page 109, Section 3.4.2 (16)
$69(45_H)$	CH2	Derivative time (D) setting	Derivative time (D) setting	Derivative time (D) setting*7	60	R/W	×	○	Page 109, Section 3.4.2 (17)
$70(46_H)$	CH2	Alert set value 1	Alert set value 1	Alert set value 1*7	0	R/W	○	○	Page 110, Section 3.4.2 (18)
$71(47_H)$	CH2	Alert set value 2	Alert set value 2	Alert set value 2*7	0	R/W	○	○	
$72(48_H)$	CH2	Alert set value 3	Alert set value 3	Alert set value 3*7	0	R/W	○	○	
$73(49_H)$	CH2	Alert set value 4	Alert set value 4	Alert set value 4*7	0	R/W	○	○	
$74(4A_H)$	CH2	Upper limit output limiter	Heating upper limit output limiter	Heating upper limit output limiter*7	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
$75(4B_H)$	CH2	Lower limit output limiter	System area	System area	0	R/W	×	○	
$76(4C_H)$	CH2	Output variation limiter setting	Output variation limiter setting	Output variation limiter setting*7	0	R/W	×	○	Page 114, Section 3.4.2 (20)
$77(4D_H)$	CH2	Sensor correction value setting			0	R/W	×	○	Page 115, Section 3.4.2 (21)
$78(4E_H)$	CH2	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting*7	5	R/W	×	○	Page 115, Section 3.4.2 (22)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
79(4F$_H$)	CH2	Control output cycle setting	Heating control output cycle setting	Heating control output cycle setting*7	30	R/W	×	○	Page 116, Section 3.4.2 (23)
80(50$_H$)	CH2	Primary delay digital filter setting			0	R/W	×	○	Page 117, Section 3.4.2 (24)
81(51$_H$)	CH2	Control response parameters	Control response parameters	Control response parameters*7	0	R/W	×	○	Page 118, Section 3.4.2 (25)
82(52$_H$)	CH2	AUTO/MAN mode shift	AUTO/MAN mode shift	AUTO/MAN mode shift *7	0	R/W	×	○	Page 119, Section 3.4.2 (26)
83(53$_H$)	CH2	MAN output setting	MAN output setting	MAN output setting*7	0	R/W	×	○	Page 120, Section 3.4.2 (27)
84(54$_H$)	CH2	Setting change rate limiter/Setting change rate limiter (temperature rise) *10			0	R/W	×	○	Page 121, Section 3.4.2 (28)
85(55$_H$)	CH2	AT bias	AT bias	AT bias*7	0	R/W	○	○	Page 122, Section 3.4.2 (29)
86(56$_H$)	CH2	Forward/reverse action setting	System area	System area	1	R/W	×	○	Page 123, Section 3.4.2 (30)
87(57$_H$)	CH2	Upper limit setting limiter	Upper limit setting limiter	Upper limit setting limiter*7	1300 (TT) 6000 (RT) *5	R/W	○	○	Page 124, Section 3.4.2 (31)
88(58$_H$)	CH2	Lower limit setting limiter	Lower limit setting limiter	Lower limit setting limiter*7	0(TT) -2000 (RT) *5	R/W	○	○	
89(59$_H$)	CH2	System area			—	—	—	—	—
90(5A$_H$)	CH2	Heater disconnection alert setting*11	Heater disconnection alert setting*11	Heater disconnection alert setting*7*11	0	R/W	×	○	Page 125, Section 3.4.2 (32)
91(5B$_H$)	CH2	Loop disconnection detection judgment time	System area	System area	480	R/W	×	○	Page 126, Section 3.4.2 (33)
92(5C$_H$)	CH2	Loop disconnection detection dead band	System area	System area	0	R/W	○	○	Page 127, Section 3.4.2 (34)
93(5D$_H$)	CH2	Unused channel setting	Unused channel setting	Unused channel setting*7	0	R/W	×	○	Page 128, Section 3.4.2 (35)
94(5E$_H$)	CH2	E^2PROM's PID constants read instruction	E^2PROM's PID constants read instruction	E^2PROM's PID constants read instruction*7	0	R/W	×	×	Page 129, Section 3.4.2 (36)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
95(5F$_H$)	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*7	0	R/W	×	×	Page 130, Section 3.4.2 (37)
96(60$_H$)	CH3	Input range*9			2(TT) 7(RT) *5	R/W	×	○	Page 98, Section 3.4.2 (12)
97(61$_H$)	CH3	Stop mode setting	Stop mode setting*6	Stop mode setting	1	R/W	×	○	Page 105, Section 3.4.2 (13)
98(62$_H$)	CH3	Set value (SV) setting	Set value (SV) setting*6	Set value (SV) setting	0	R/W	○	○	Page 106, Section 3.4.2 (14)
99(63$_H$)	CH3	Proportional band (P) setting	Heating proportional band (Ph) setting*6	Proportional band (P) setting	30	R/W	×	○	Page 107, Section 3.4.2 (15)
100(64$_H$)	CH3	Integral time (I) setting	Integral time (I) setting*6	Integral time (I) setting	240	R/W	×	○	Page 109, Section 3.4.2 (16)
101(65$_H$)	CH3	Derivative time (D) setting	Derivative time (D) setting*6	Derivative time (D) setting	60	R/W	×	○	Page 109, Section 3.4.2 (17)
102(66$_H$)	CH3	Alert set value 1	Alert set value 1*6	Alert set value 1	0	R/W	○	○	Page 110, Section 3.4.2 (18)
103(67$_H$)	CH3	Alert set value 2	Alert set value 2*6	Alert set value 2	0	R/W	○	○	
104(68$_H$)	CH3	Alert set value 3	Alert set value 3*6	Alert set value 3	0	R/W	○	○	
105(69$_H$)	CH3	Alert set value 4	Alert set value 4*6	Alert set value 4	0	R/W	○	○	
106(6A$_H$)	CH3	Upper limit output limiter	Heating upper limit output limiter*6	Upper limit output limiter	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
107(6B$_H$)	CH3	Lower limit output limiter	System area	Lower limit output limiter	0	R/W	×	○	
108(6C$_H$)	CH3	Output variation limiter setting	Output variation limiter setting*6	Output variation limiter setting	0	R/W	×	○	Page 114, Section 3.4.2 (20)
109(6D$_H$)	CH3	Sensor correction value setting			0	R/W	×	○	Page 115, Section 3.4.2 (21)
110(6E$_H$)	CH3	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting*6	Adjustment sensitivity (dead band) setting	5	R/W	×	○	Page 115, Section 3.4.2 (22)
111(6F$_H$)	CH3	Control output cycle setting	Heating control output cycle setting*6	Control output cycle setting	30	R/W	×	○	Page 116, Section 3.4.2 (23)
112(70$_H$)	CH3	Primary delay digital filter setting			0	R/W	×	○	Page 117, Section 3.4.2 (24)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
113(71_H)	CH3	Control response parameters	Control response parameters*6	Control response parameters	0	R/W	×	○	Page 118, Section 3.4.2 (25)
114(72_H)	CH3	AUTO/MAN mode shift	AUTO/MAN mode shift*6	AUTO/MAN mode shift	0	R/W	×	○	Page 119, Section 3.4.2 (26)
115(73_H)	CH3	MAN output setting	MAN output setting*6	MAN output setting	0	R/W	×	○	Page 120, Section 3.4.2 (27)
116(74_H)	CH3	Setting change rate limiter/Setting change rate limiter (temperature rise) *10			0	R/W	×	○	Page 121, Section 3.4.2 (28)
117(75_H)	CH3	AT bias	AT bias*6	AT bias	0	R/W	○	○	Page 122, Section 3.4.2 (29)
118(76_H)	CH3	Forward/reverse action setting	System area	Forward/ reverse action setting	1	R/W	×	○	Page 123, Section 3.4.2 (30)
119(77_H)	CH3	Upper limit setting limiter	Upper limit setting limiter*6	Upper limit setting limiter	1300 (TT) 6000 (RT)*5	R/W	○	○	Page 124, Section 3.4.2 (31)
120(78_H)	CH3	Lower limit setting limiter	Lower limit setting limiter*6	Lower limit setting limiter	0(TT) -2000 (RT)*5	R/W	○	○	
121(79_H)	CH3	System area			—	—	—	—	—
122($7A_H$)	CH3	Heater disconnection alert setting*11	Heater disconnection alert setting*6*11	Heater disconnection alert setting*11	0	R/W	×	○	Page 125, Section 3.4.2 (32)
123($7B_H$)	CH3	Loop disconnection detection judgment time	System area	Loop disconnection detection judgment time	480	R/W	×	○	Page 126, Section 3.4.2 (33)
124($7C_H$)	CH3	Loop disconnection detection dead band	System area	Loop disconnection detection dead band	0	R/W	○	○	Page 127, Section 3.4.2 (34)
125($7D_H$)	CH3	Unused channel setting	Unused channel setting*6	Unused channel setting	0	R/W	×	○	Page 128, Section 3.4.2 (35)
126($7E_H$)	CH3	E^2PROM's PID constants read instruction	E^2PROM's PID constants read instruction*6	E^2PROM's PID constants read instruction	0	R/W	×	×	Page 129, Section 3.4.2 (36)
127($7F_H$)	CH3	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants*6	Automatic backup setting after auto tuning of PID constants	0	R/W	×	×	Page 130, Section 3.4.2 (37)
128(80_H)	CH4	Input range*9			2(TT) 7(RT) *5	R/W	×	○	Page 98, Section 3.4.2 (12)
129(81_H)	CH4	Stop mode setting	Stop mode setting*6	Stop mode setting	1	R/W	×	○	Page 105, Section 3.4.2 (13)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
130(82_H)	CH4	Set value (SV) setting	Set value (SV) setting*6	Set value (SV) setting	0	R/W	○	○	Page 106, Section 3.4.2 (14)
131(83_H)	CH4	Proportional band (P) setting	Heating proportional band (Ph) setting*6	Proportional band (P) setting	30	R/W	×	○	Page 107, Section 3.4.2 (15)
132(84_H)	CH4	Integral time (I) setting	Integral time (I) setting*6	Integral time (I) setting	240	R/W	×	○	Page 109, Section 3.4.2 (16)
133(85_H)	CH4	Derivative time (D) setting	Derivative time (D) setting*6	Derivative time (D) setting	60	R/W	×	○	Page 109, Section 3.4.2 (17)
134(86_H)	CH4	Alert set value 1	Alert set value 1*6	Alert set value 1	0	R/W	○	○	Page 110, Section 3.4.2 (18)
135(87_H)	CH4	Alert set value 2	Alert set value 2*6	Alert set value 2	0	R/W	○	○	
136(88_H)	CH4	Alert set value 3	Alert set value 3*6	Alert set value 3	0	R/W	○	○	
137(89_H)	CH4	Alert set value 4	Alert set value 4*6	Alert set value 4	0	R/W	○	○	
138($8A_H$)	CH4	Upper limit output limiter	Heating upper limit output limiter*6	Upper limit output limiter	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
139($8B_H$)	CH4	Lower limit output limiter	System area	Lower limit output limiter	0	R/W	×	○	
140($8C_H$)	CH4	Output variation limiter setting	Output variation limiter setting*6	Output variation limiter setting	0	R/W	×	○	Page 114, Section 3.4.2 (20)
141($8D_H$)	CH4	Sensor correction value setting			0	R/W	×	○	Page 115, Section 3.4.2 (21)
142($8E_H$)	CH4	Adjustment sensitivity (dead band) setting	Adjustment sensitivity (dead band) setting*6	Adjustment sensitivity (dead band) setting	5	R/W	×	○	Page 115, Section 3.4.2 (22)
143($8F_H$)	CH4	Control output cycle setting	Heating control output cycle setting*6	Control output cycle setting	30	R/W	×	○	Page 116, Section 3.4.2 (23)
144(90_H)	CH4	Primary delay digital filter setting			0	R/W	×	○	Page 117, Section 3.4.2 (24)
145(91_H)	CH4	Control response parameters	Control response parameters*6	Control response parameters	0	R/W	×	○	Page 118, Section 3.4.2 (25)
146(92_H)	CH4	AUTO/MAN mode shift	AUTO/MAN mode shift*6	AUTO/MAN mode shift	0	R/W	×	○	Page 119, Section 3.4.2 (26)
147(93_H)	CH4	MAN output setting	MAN output setting*6	MAN output setting	0	R/W	×	○	Page 120, Section 3.4.2 (27)
148(94_H)	CH4	Setting change rate limiter/Setting change rate limiter (temperature rise)*10			0	R/W	×	○	Page 121, Section 3.4.2 (28)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
149(95_H)	CH4	AT bias	AT bias*6	AT bias	0	R/W	○	○	Page 122, Section 3.4.2 (29)
150(96_H)	CH4	Forward/reverse action setting	System area	Forward/reverse action setting	1	R/W	×	○	Page 123, Section 3.4.2 (30)
151(97_H)	CH4	Upper limit setting limiter	Upper limit setting limiter*6	Upper limit setting limiter	1300 (TT) 6000 (RT)*5	R/W	○	○	Page 124, Section 3.4.2 (31)
152(98_H)	CH4	Lower limit setting limiter	Lower limit setting limiter*6	Lower limit setting limiter	0(TT) -2000 (RT)*5	R/W	○	○	
153(99_H)	CH4	System area			—	—	—	—	—
154($9A_H$)	CH4	Heater disconnection alert setting*11	Heater disconnection alert setting*6*11	Heater disconnection alert setting*11	0	R/W	×	○	Page 125, Section 3.4.2 (32)
155($9B_H$)	CH4	Loop disconnection detection judgment time	System area	Loop disconnection detection judgment time	480	R/W	×	○	Page 126, Section 3.4.2 (33)
156($9C_H$)	CH4	Loop disconnection detection dead band	System area	Loop disconnection detection dead band	0	R/W	○	○	Page 127, Section 3.4.2 (34)
157($9D_H$)	CH4	Unused channel setting	Unused channel setting*6	Unused channel setting	0	R/W	×	○	Page 128, Section 3.4.2 (35)
158($9E_H$)	CH4	E^2PROM's PID constants read instruction	E^2PROM's PID constants read instruction*6	E^2PROM's PID constants read instruction	0	R/W	×	×	Page 129, Section 3.4.2 (36)
159($9F_H$)	CH4	Automatic backup setting after auto tuning of PID constants	Automatic backup setting after auto tuning of PID constants*6	Automatic backup setting after auto tuning of PID constants	0	R/W	×	×	Page 130, Section 3.4.2 (37)
160($A0_H$) to 163($A3_H$)	—	System area			—	—	—	—	—
164($A4_H$)	All CHs	Alert dead band setting			5	R/W	×	○	Page 131, Section 3.4.2 (38)
165($A5_H$)	All CHs	Number of alert delay			0	R/W	×	○	Page 131, Section 3.4.2 (39)
166($A6_H$)	All CHs	Heater disconnection/output off-time current error detection delay count *11			3	R/W	×	○	Page 132, Section 3.4.2 (40)
167($A7_H$)	All CHs	Temperature rise completion range setting			1	R/W	×	○	Page 132, Section 3.4.2 (41)
168($A8_H$)	All CHs	Temperature rise completion soak time setting			0	R/W	×	○	Page 133, Section 3.4.2 (42)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
169($A9_H$)	All CHs	PID continuation flag			0	R/W	×	○	Page 133, Section 3.4.2 (43)
170(AA_H)	All CHs	Heater disconnection compensation function selection*11			0	R/W	×	○	Page 133, Section 3.4.2 (44)
171(AB_H) to 174(AE_H)	—	System area			—	—	—	—	—
175(AF_H)	All CHs	Transistor output monitor ON delay time setting			0	R/W	×	○	Page 134, Section 3.4.2 (45)
176($B0_H$)	All CHs	CT monitor method switching*11			0	R/W	×	○	Page 134, Section 3.4.2 (46)
177($B1_H$)	CH1	Manipulated value (MV) for output with another analog module	Manipulated value of heating (MVh) for output with another analog module	Manipulated value of heating (MVh) for output with another analog module	0	R	×	×	Page 135, Section 3.4.2 (47)
178($B2_H$)	CH2	Manipulated value (MV) for output with another analog module	Manipulated value of heating (MVh) for output with another analog module	Manipulated value of heating (MVh) for output with another analog module*7	0	R	×	×	
179($B3_H$)	CH3	Manipulated value (MV) for output with another analog module	Manipulated value of heating (MVh) for output with another analog module*6	Manipulated value (MV) for output with another analog module	0	R	×	×	
180($B4_H$)	CH4	Manipulated value (MV) for output with another analog module	Manipulated value of heating (MVh) for output with another analog module*6	Manipulated value (MV) for output with another analog module	0	R	×	×	
181($B5_H$)	All CHs	Resolution of the manipulated value for output with another analog module			0	R/W	×	○	Page 136, Section 3.4.2 (48)
182($B6_H$)	All CHs	Cold junction temperature compensation selection*8			0	R/W	×	○	Page 137, Section 3.4.2 (49)
183($B7_H$)	All CHs	Control switching monitor			0	R	×	×	Page 137, Section 3.4.2 (50)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^{2}PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
184(B8$_H$)	CH1	Auto tuning mode selection			0	R/W	×	○	Page 138, Section 3.4.2 (51)
185(B9$_H$)	CH2	Auto tuning mode selection	Auto tuning mode selection	Auto tuning mode selection*7	0	R/W	×	○	
186(BA$_H$)	CH3	Auto tuning mode selection	Auto tuning mode selection*6	Auto tuning mode selection	0	R/W	×	○	
187(BB$_H$)	CH4	Auto tuning mode selection	Auto tuning mode selection*6	Auto tuning mode selection	0	R/W	×	○	
188(BC$_H$) to 191(BF$_H$)	—	System area			—	—	—	—	—
192(C0$_H$)	CH1	Alert 1 mode setting*9			0	R/W	×	○	Page 139, Section 3.4.2 (52)
193(C1$_H$)	CH1	Alert 2 mode setting*9			0	R/W	×	○	
194(C2$_H$)	CH1	Alert 3 mode setting*9			0	R/W	×	○	
195(C3$_H$)	CH1	Alert 4 mode setting*9			0	R/W	×	○	
196(C4$_H$) to 207(CF$_H$)	—	System area			—	—	—	—	—
208(D0$_H$)	CH2	Alert 1 mode setting*9	Alert 1 mode setting*9	Alert 1 mode setting*7*9	0	R/W	×	○	Page 139, Section 3.4.2 (52)
209(D1$_H$)	CH2	Alert 2 mode setting*9	Alert 2 mode setting*9	Alert 2 mode setting*7*9	0	R/W	×	○	
210(D2$_H$)	CH2	Alert 3 mode setting*9	Alert 3 mode setting*9	Alert 3 mode setting*7*9	0	R/W	×	○	
211(D3$_H$)	CH2	Alert 4 mode setting*9	Alert 4 mode setting*9	Alert 4 mode setting*7*9	0	R/W	×	○	
212(D4$_H$) to 223(DF$_H$)	—	System area			—	—	—	—	—
224(E0$_H$)	CH3	Alert 1 mode setting*9	Alert 1 mode setting*6*9	Alert 1 mode setting*9	0	R/W	×	○	Page 139, Section 3.4.2 (52)
225(E1$_H$)	CH3	Alert 2 mode setting*9	Alert 2 mode setting*6*9	Alert 2 mode setting*9	0	R/W	×	○	
226(E2$_H$)	CH3	Alert 3 mode setting*9	Alert 3 mode setting*6*9	Alert 3 mode setting*9	0	R/W	×	○	
227(E3$_H$)	CH3	Alert 4 mode setting*9	Alert 4 mode setting*6*9	Alert 4 mode setting*9	0	R/W	×	○	
228(E4$_H$) to 239(EF$_H$)	—	System area			—	—	—	—	—

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
240(F0$_H$)	CH4	Alert 1 mode setting*9	Alert 1 mode setting*6*9	Alert 1 mode setting*9	0	R/W	×	○	Page 139, Section 3.4.2 (52)
241(F1$_H$)	CH4	Alert 2 mode setting*9	Alert 2 mode setting*6*9	Alert 2 mode setting*9	0	R/W	×	○	
242(F2$_H$)	CH4	Alert 3 mode setting*9	Alert 3 mode setting*6*9	Alert 3 mode setting*9	0	R/W	×	○	
243(F3$_H$)	CH4	Alert 4 mode setting*9	Alert 4 mode setting*6*9	Alert 4 mode setting*9	0	R/W	×	○	
244(F4$_H$) to 255(FF$_H$)	—	System area			—	—	—	—	—
256(100$_H$)	CT1	Heater current process value*11			0	R	×	×	Page 140, Section 3.4.2 (53)
257(101$_H$)	CT2	Heater current process value*11							
258(102$_H$)	CT3	Heater current process value*11							
259(103$_H$)	CT4	Heater current process value*11							
260(104$_H$)	CT5	Heater current process value*11							
261(105$_H$)	CT6	Heater current process value*11							
262(106$_H$)	CT7	Heater current process value*11							
263(107$_H$)	CT8	Heater current process value*11							
264(108$_H$)	CT1	CT input channel process setting*11			0	R/W	×	○	Page 141, Section 3.4.2 (54)
265(109$_H$)	CT2	CT input channel process setting*11							
266(10A$_H$)	CT3	CT input channel process setting*11							
267(10B$_H$)	CT4	CT input channel process setting*11							
268(10C$_H$)	CT5	CT input channel process setting*11							
269(10D$_H$)	CT6	CT input channel process setting*11							
270(10E$_H$)	CT7	CT input channel process setting*11							
271(10F$_H$)	CT8	CT input channel process setting*11							
272(110$_H$)	CT1	CT selection*9*11			0	R/W	×	○	Page 142, Section 3.4.2 (55)
273(111$_H$)	CT2	CT selection*9*11							
274(112$_H$)	CT3	CT selection*9*11							
275(113$_H$)	CT4	CT selection*9*11							
276(114$_H$)	CT5	CT selection*9*11							
277(115$_H$)	CT6	CT selection*9*11							
278(116$_H$)	CT7	CT selection*9*11							
279(117$_H$)	CT8	CT selection*9*11							
280(118$_H$)	CT1	Reference heater current value*11			0	R/W	×	○	Page 143, Section 3.4.2 (56)
281(119$_H$)	CT2	Reference heater current value*11							
282(11A$_H$)	CT3	Reference heater current value*11							
283(11B$_H$)	CT4	Reference heater current value*11							
284(11C$_H$)	CT5	Reference heater current value*11							
285(11D$_H$)	CT6	Reference heater current value*11							
286(11E$_H$)	CT7	Reference heater current value*11							
287(11F$_H$)	CT8	Reference heater current value*11							

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents: Standard control	Setting contents: Heating-cooling control	Setting contents: Mix control	Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
288(120$_H$)	CT1	CT ratio setting*11			800	R/W	×	○	Page 143, Section 3.4.2 (57)
289(121$_H$)	CT2	CT ratio setting*11							
290(122$_H$)	CT3	CT ratio setting*11							
291(123$_H$)	CT4	CT ratio setting*11							
292(124$_H$)	CT5	CT ratio setting*11							
293(125$_H$)	CT6	CT ratio setting*11							
294(126$_H$)	CT7	CT ratio setting*11							
295(127$_H$)	CT8	CT ratio setting*11							
296(128$_H$) to 543(21F$_H$)	—	System area			—	—	—	—	—
544(220$_H$)	CH1	Sensor two-point correction offset value (measured value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (58)
545(221$_H$)	CH1	Sensor two-point correction offset value (corrected value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (59)
546(222$_H$)	CH1	Sensor two-point correction gain value (measured value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (60)
547(223$_H$)	CH1	Sensor two-point correction gain value (corrected value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (61)
548(224$_H$)	CH1	Sensor two-point correction offset latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (62)
549(225$_H$)	CH1	Sensor two-point correction offset latch completion			0	R	×	×	Page 146, Section 3.4.2 (63)
550(226$_H$)	CH1	Sensor two-point correction gain latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (64)
551(227$_H$)	CH1	Sensor two-point correction gain latch completion			0	R	×	×	Page 147, Section 3.4.2 (65)
552(228$_H$) to 563(233$_H$)	—	System area			—	—	—	—	—
564(234$_H$)	CH1	Setting change rate limiter (temperature drop)*12			0	R/W	×	○	Page 121, Section 3.4.2 (28)
565(235$_H$) to 570(23A$_H$)	—	System area			—	—	—	—	—
571(23B$_H$)	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 147, Section 3.4.2 (66)
572(23C$_H$)	—	System area			—	—	—	—	—

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
573(23D$_H$)	CH1	AT simultaneous temperature rise parameter calculation flag	System area	System area	0	R	×	×	Page 147, Section 3.4.2 (67)
574(23E$_H$)	CH1	Self-tuning setting	System area	System area	0	R/W	×	○	Page 148, Section 3.4.2 (68)
575(23F$_H$)	CH1	Self-tuning flag	System area	System area	0	R	×	×	Page 149, Section 3.4.2 (69)
576(240$_H$)	CH2	Sensor two-point correction offset value (measured value)*9			0	R/W	○	×	Page 144, Section 3.4.2 (58)
577(241$_H$)	CH2	Sensor two-point correction offset value (corrected value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (59)
578(242$_H$)	CH2	Sensor two-point correction gain value (measured value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (60)
579(243$_H$)	CH2	Sensor two-point correction gain value (corrected value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (61)
580(244$_H$)	CH2	Sensor two-point correction offset latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (62)
581(245$_H$)	CH2	Sensor two-point correction offset latch completion			0	R	×	×	Page 146, Section 3.4.2 (63)
582(246$_H$)	CH2	Sensor two-point correction gain latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (64)
583(247$_H$)	CH2	Sensor two-point correction gain latch completion			0	R	×	×	Page 147, Section 3.4.2 (65)
584(248$_H$) to 595(253$_H$)	—	System area			—	—	—	—	—
596(254$_H$)	CH2	Setting change rate limiter (temperature drop)*12			0	R/W	×	○	Page 121, Section 3.4.2 (28)
597(255$_H$) to 604(25C$_H$)	—	System area			—	—	—	—	—
605(25D$_H$)	CH2	AT simultaneous temperature rise parameter calculation flag	System area	System area	0	R	×	×	Page 147, Section 3.4.2 (67)
606(25E$_H$)	CH2	Self-tuning setting	System area	System area	0	R/W	×	○	Page 148, Section 3.4.2 (68)
607(25F$_H$)	CH2	Self-tuning flag	System area	System area	0	R	×	×	Page 149, Section 3.4.2 (69)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
608(260_H)	CH3	Sensor two-point correction offset value (measured value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (58)
609(261_H)	CH3	Sensor two-point correction offset value (corrected value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (59)
610(262_H)	CH3	Sensor two-point correction gain value (measured value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (60)
611(263_H)	CH3	Sensor two-point correction gain value (corrected value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (61)
612(264_H)	CH3	Sensor two-point correction offset latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (62)
613(265_H)	CH3	Sensor two-point correction offset latch completion			0	R	×	×	Page 146, Section 3.4.2 (63)
614(266_H)	CH3	Sensor two-point correction gain latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (64)
615(267_H)	CH3	Sensor two-point correction gain latch completion			0	R	×	×	Page 147, Section 3.4.2 (65)
616(268_H) to 627(273_H)	—	System area			—	—	—	—	—
628(274_H)	CH3	Setting change rate limiter (temperature drop)*12			0	R/W	×	○	Page 121, Section 3.4.2 (28)
629(275_H) to 636($27C_H$)	—	System area			—	—	—	—	—
637($27D_H$)	CH3	AT simultaneous temperature rise parameter calculation flag	System area	AT simultaneous temperature rise parameter calculation flag	0	R	×	×	Page 147, Section 3.4.2 (67)
638($27E_H$)	CH3	Self-tuning setting	System area	Self-tuning setting	0	R/W	×	○	Page 148, Section 3.4.2 (68)
639($27F_H$)	CH3	Self-tuning flag	System area	Self-tuning flag	0	R	×	×	Page 149, Section 3.4.2 (69)
640(280_H)	CH4	Sensor two-point correction offset value (measured value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (58)
641(281_H)	CH4	Sensor two-point correction offset value (corrected value)*9			0	R/W	○	○	Page 144, Section 3.4.2 (59)
642(282_H)	CH4	Sensor two-point correction gain value (measured value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (60)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
643(283H)	CH4	Sensor two-point correction gain value (corrected value)*9			0	R/W	○	○	Page 145, Section 3.4.2 (61)
644(284H)	CH4	Sensor two-point correction offset latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (62)
645(285H)	CH4	Sensor two-point correction offset latch completion			0	R	×	×	Page 146, Section 3.4.2 (63)
646(286H)	CH4	Sensor two-point correction gain latch request*9			0	R/W	×	×	Page 146, Section 3.4.2 (64)
647(287H)	CH4	Sensor two-point correction gain latch completion			0	R	×	×	Page 147, Section 3.4.2 (65)
648(288H) to 659(293H)	—	System area			—	—	—	—	—
660(294H)	CH4	Setting change rate limiter (temperature drop)*12			0	R/W	×	○	Page 121, Section 3.4.2 (28)
661(295H) to 668(29CH)	—	System area			—	—	—	—	—
669(29DH)	CH4	AT simultaneous temperature rise parameter calculation flag	System area	AT simultaneous temperature rise parameter calculation flag	0	R	×	×	Page 147, Section 3.4.2 (67)
670(29EH)	CH4	Self-tuning setting	System area	Self-tuning setting	0	R/W	×	○	Page 148, Section 3.4.2 (68)
671(29FH)	CH4	Self-tuning flag	System area	Self-tuning flag	0	R	×	×	Page 149, Section 3.4.2 (69)
672(2A0H) to 688(2B0H)	—	System area			—	—	—	—	—

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
689(2B1$_H$)	CH1	Temperature process value (PV) for input with another analog module			0	R/W	×	×	Page 152, Section 3.4.2 (70)
690(2B2$_H$)	CH2	Temperature process value (PV) for input with another analog module	Temperature process value (PV) for input with another analog module	Temperature process value (PV) for input with another analog module*7	0	R/W	×	×	
691(2B3$_H$)	CH3	Temperature process value (PV) for input with another analog module	Temperature process value (PV) for input with another analog module*6	Temperature process value (PV) for input with another analog module	0	R/W	×	×	
692(2B4$_H$)	CH4	Temperature process value (PV) for input with another analog module	Temperature process value (PV) for input with another analog module*6	Temperature process value (PV) for input with another analog module	0	R/W	×	×	
693(2B5$_H$)	—	System area			—	—	—	—	—
694(2B6$_H$)	—	System area			—	—	—	—	—
695(2B7$_H$)	CH2	System area	System area	Temperature conversion setting*14	0	R/W	×	○	Page 152, Section 3.4.2 (71)
696(2B8$_H$)	CH3	System area	Temperature conversion setting *13	System area	0	R/W	×	○	
697(2B9$_H$)	CH4	System area	Temperature conversion setting *13	System area	0	R/W	×	○	
698(2BA$_H$)	CH1	Number of moving averaging			2	R/W	×	○	Page 153, Section 3.4.2 (72)
699(2BB$_H$)	CH2	Number of moving averaging			2	R/W	×	○	
700(2BC$_H$)	CH3	Number of moving averaging			2	R/W	×	○	
701(2BD$_H$)	CH4	Number of moving averaging			2	R/W	×	○	
702(2BE$_H$)	—	System area			—	—	—	—	—
703(2BF$_H$)	—	System area			—	—	—	—	—
704(2C0$_H$)	CH1	System area	Manipulated value for cooling (MVc)	Manipulated value for cooling (MVc)	0	R	×	×	Page 91, Section 3.4.2 (5)
705(2C1$_H$)	CH2	System area	Manipulated value for cooling (MVc)	Manipulated value for cooling (MVc)*7	0	R	×	×	
706(2C2$_H$)	CH3	System area	Manipulated value for cooling (MVc)*6	System area	0	R	×	×	
707(2C3$_H$)	CH4	System area	Manipulated value for cooling (MVc)*6	System area	0	R	×	×	

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
708(2C4H)	CH1	System area	Manipulated value of cooling (MVc) for output with another analog module	Manipulated value of cooling (MVc) for output with another analog module	0	R	×	×	Page 135, Section 3.4.2 (47)
709(2C5H)	CH2	System area	Manipulated value of cooling (MVc) for output with another analog module	Manipulated value of cooling (MVc) for output with another analog module*7	0	R	×	×	
710(2C6H)	CH3	System area	Manipulated value of cooling (MVc) for output with another analog module*6	System area	0	R	×	×	
711(2C7H)	CH4	System area	Manipulated value of cooling (MVc) for output with another analog module*6	System area	0	R	×	×	
712(2C8H)	CH1	System area	Cooling transistor output flag	Cooling transistor output flag	0	R	×	×	Page 94, Section 3.4.2 (7)
713(2C9H)	CH2	System area	Cooling transistor output flag	Cooling transistor output flag*7	0	R	×	×	
714(2CAH)	CH3	System area	Cooling transistor output flag*6	System area	0	R	×	×	
715(2CBH)	CH4	System area	Cooling transistor output flag*6	System area	0	R	×	×	
716(2CCH) to 718(2CEH)	—	System area			—	—	—	—	—
719(2CFH)	All CHs	System area	Cooling method setting *9	Cooling method setting *9	0	R/W	×	○	Page 153, Section 3.4.2 (73)
720(2D0H)	CH1	System area	Cooling proportional band (Pc) setting	Cooling proportional band (Pc) setting	30	R/W	×	○	Page 107, Section 3.4.2 (15)
721(2D1H)	CH1	System area	Cooling upper limit output limiter	Cooling upper limit output limiter	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
722(2D2H)	CH1	System area	Cooling control output cycle setting	Cooling control output cycle setting	30	R/W	×	○	Page 116, Section 3.4.2 (23)
723(2D3H)	CH1	System area	Overlap/dead band setting	Overlap/dead band setting	0	R/W	×	○	Page 154, Section 3.4.2 (74)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
724(2D4$_H$)	CH1	Manual reset amount setting			0	R/W	×	○	Page 154, Section 3.4.2 (75)
725(2D5$_H$)	CH1	Process value (PV) scaling function enable/disable setting*9			0	R/W	×	○	Page 154, Section 3.4.2 (76)
726(2D6$_H$)	CH1	Process value (PV) scaling lower limit value*9			0	R/W	×	○	Page 155, Section 3.4.2 (77)
727(2D7$_H$)	CH1	Process value (PV) scaling upper limit value*9			0	R/W	×	○	
728(2D8$_H$)	CH1	Process value (PV) scaling value			0	R	×	×	Page 155, Section 3.4.2 (78)
729(2D9$_H$)	CH1	Derivative action selection*9			0	R/W	×	○	Page 155, Section 3.4.2 (79)
730(2DA$_H$)	CH1	Simultaneous temperature rise group setting*9	System area	System area	0	R/W	×	○	Page 156, Section 3.4.2 (80)
731(2DB$_H$)	CH1	Simultaneous temperature rise gradient data	System area	System area	0	R/W	○	○	Page 156, Section 3.4.2 (81)
732(2DC$_H$)	CH1	Simultaneous temperature rise dead time	System area	System area	0	R/W	○	○	Page 157, Section 3.4.2 (82)
733(2DD$_H$)	CH1	Simultaneous temperature rise AT mode selection	System area	System area	0	R/W	×	○	Page 157, Section 3.4.2 (83)
734(2DE$_H$)	CH1	Simultaneous temperature rise status	System area	System area	0	R	×	×	Page 158, Section 3.4.2 (84)
735(2DF$_H$)	CH1	Setting change rate limiter unit time setting*9			0	R/W	×	○	Page 159, Section 3.4.2 (85)
736(2E0$_H$)	CH2	System area	Cooling proportional band (Pc) setting	Cooling proportional band (Pc) setting*7	30	R/W	×	○	Page 107, Section 3.4.2 (15)
737(2E1$_H$)	CH2	System area	Cooling upper limit output limiter	Cooling upper limit output limiter*7	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
738(2E2$_H$)	CH2	System area	Cooling control output cycle setting	Cooling control output cycle setting*7	30	R/W	×	○	Page 116, Section 3.4.2 (23)
739(2E3$_H$)	CH2	System area	Overlap/dead band setting	Overlap/dead band setting*7	0	R/W	×	○	Page 154, Section 3.4.2 (74)
740(2E4$_H$)	CH2	Manual reset amount setting	Manual reset amount setting	Manual reset amount setting*7	0	R/W	×	○	Page 154, Section 3.4.2 (75)
741(2E5$_H$)	CH2	Process value (PV) scaling function enable/disable setting*9	Process value (PV) scaling function enable/disable setting*9	Process value (PV) scaling function enable/disable setting*7*9	0	R/W	×	○	Page 154, Section 3.4.2 (76)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
742(2E6$_H$)	CH2	Process value (PV) scaling lower limit value*9	Process value (PV) scaling lower limit value*9	Process value (PV) scaling lower limit value*7*9	0	R/W	×	○	Page 155, Section 3.4.2 (77)
743(2E7$_H$)	CH2	Process value (PV) scaling upper limit value*9	Process value (PV) scaling upper limit value*9	Process value (PV) scaling upper limit value*7*9	0	R/W	×	○	
744(2E8$_H$)	CH2	Process value (PV) scaling value	Process value (PV) scaling value	Process value (PV) scaling value*7	0	R	×	×	Page 155, Section 3.4.2 (78)
745(2E9$_H$)	CH2	Derivative action selection*9	Derivative action selection*9	Derivative action selection*7*9	0	R/W	×	○	Page 155, Section 3.4.2 (79)
746(2EA$_H$)	CH2	Simultaneous temperature rise group setting*9	System area	System area	0	R/W	×	○	Page 156, Section 3.4.2 (80)
747(2EB$_H$)	CH2	Simultaneous temperature rise gradient data	System area	System area	0	R/W	○	○	Page 156, Section 3.4.2 (81)
748(2EC$_H$)	CH2	Simultaneous temperature rise dead time	System area	System area	0	R/W	○	○	Page 157, Section 3.4.2 (82)
749(2ED$_H$)	CH2	Simultaneous temperature rise AT mode selection	System area	System area	0	R/W	×	○	Page 157, Section 3.4.2 (83)
750(2EE$_H$)	CH2	Simultaneous temperature rise status	System area	System area	0	R	×	×	Page 158, Section 3.4.2 (84)
751(2EF$_H$)	CH2	Setting change rate limiter unit time setting*9	Setting change rate limiter unit time setting*9	Setting change rate limiter unit time setting*7*9	0	R/W	×	○	Page 159, Section 3.4.2 (85)
752(2F0$_H$)	CH3	System area	Cooling proportional band (Pc) setting*6	System area	30	R/W	×	○	Page 107, Section 3.4.2 (15)
753(2F1$_H$)	CH3	System area	Cooling upper limit output limiter*6	System area	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
754(2F2$_H$)	CH3	System area	Cooling control output cycle setting*6	System area	30	R/W	×	○	Page 116, Section 3.4.2 (23)
755(2F3$_H$)	CH3	System area	Overlap/dead band setting*6	System area	0	R/W	×	○	Page 154, Section 3.4.2 (74)
756(2F4$_H$)	CH3	Manual reset amount setting	Manual reset amount setting*6	Manual reset amount setting	0	R/W	×	○	Page 154, Section 3.4.2 (75)
757(2F5$_H$)	CH3	Process value (PV) scaling function enable/disable setting*9	Process value (PV) scaling function enable/disable setting*6*9	Process value (PV) scaling function enable/disable setting*9	0	R/W	×	○	Page 154, Section 3.4.2 (76)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
758(2F6$_H$)	CH3	Process value (PV) scaling lower limit value*9	Process value (PV) scaling lower limit value*6*9	Process value (PV) scaling lower limit value*9	0	R/W	×	○	Page 155, Section 3.4.2 (77)
759(2F7$_H$)	CH3	Process value (PV) scaling upper limit value*9	Process value (PV) scaling upper limit value*6*9	Process value (PV) scaling upper limit value*9	0	R/W	×	○	
760(2F8$_H$)	CH3	Process value (PV) scaling value	Process value (PV) scaling value *6	Process value (PV) scaling value	0	R	×	×	Page 155, Section 3.4.2 (78)
761(2F9$_H$)	CH3	Derivative action selection*9	Derivative action selection*6*9	Derivative action selection*9	0	R/W	×	○	Page 155, Section 3.4.2 (79)
762(2FA$_H$)	CH3	Simultaneous temperature rise group setting*9	System area	Simultaneous temperature rise group setting*9	0	R/W	×	○	Page 156, Section 3.4.2 (80)
763(2FB$_H$)	CH3	Simultaneous temperature rise gradient data	System area	Simultaneous temperature rise gradient data	0	R/W	○	○	Page 156, Section 3.4.2 (81)
764(2FC$_H$)	CH3	Simultaneous temperature rise dead time	System area	Simultaneous temperature rise dead time	0	R/W	○	○	Page 157, Section 3.4.2 (82)
765(2FD$_H$)	CH3	Simultaneous temperature rise AT mode selection	System area	Simultaneous temperature rise AT mode selection	0	R/W	×	○	Page 157, Section 3.4.2 (83)
766(2FE$_H$)	CH3	Simultaneous temperature rise status	System area	Simultaneous temperature rise status	0	R	×	×	Page 158, Section 3.4.2 (84)
767(2FF$_H$)	CH3	Setting change rate limiter unit time setting*9	Setting change rate limiter unit time setting*6*9	Setting change rate limiter unit time setting*9	0	R/W	×	○	Page 159, Section 3.4.2 (85)
768(300$_H$)	CH4	System area	Cooling proportional band (Pc) setting*6	System area	30	R/W	×	○	Page 107, Section 3.4.2 (15)
769(301$_H$)	CH4	System area	Cooling upper limit output limiter*6	System area	1000	R/W	×	○	Page 112, Section 3.4.2 (19)
770(302$_H$)	CH4	System area	Cooling control output cycle setting*6	System area	30	R/W	×	○	Page 116, Section 3.4.2 (23)
771(303$_H$)	CH4	System area	Overlap/dead band setting*6	System area	0	R/W	×	○	Page 154, Section 3.4.2 (74)
772(304$_H$)	CH4	Manual reset amount setting	Manual reset amount setting*6	Manual reset amount setting	0	R/W	×	○	Page 154, Section 3.4.2 (75)

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
773(305_H)	CH4	Process value (PV) scaling function enable/disable setting*9	Process value (PV) scaling function enable/disable setting*6*9	Process value (PV) scaling function enable/disable setting*9	0	R/W	×	○	Page 154, Section 3.4.2 (76)
774(306_H)	CH4	Process value (PV) scaling lower limit value*9	Process value (PV) scaling lower limit value*6*9	Process value (PV) scaling lower limit value*9	0	R/W	×	○	Page 155, Section 3.4.2 (77)
775(307_H)	CH4	Process value (PV) scaling upper limit value*9	Process value (PV) scaling upper limit value*6*9	Process value (PV) scaling upper limit value*9	0	R/W	×	○	
776(308_H)	CH4	Process value (PV) scaling value	Process value (PV) scaling value*6	Process value (PV) scaling value	0	R	×	×	Page 155, Section 3.4.2 (78)
777(309_H)	CH4	Derivative action selection*9	Derivative action selection*6*9	Derivative action selection*9	0	R/W	×	○	Page 155, Section 3.4.2 (79)
778($30A_H$)	CH4	Simultaneous temperature rise group setting*9	System area	Simultaneous temperature rise group setting*9	0	R/W	×	○	Page 156, Section 3.4.2 (80)
779($30B_H$)	CH4	Simultaneous temperature rise gradient data	System area	Simultaneous temperature rise gradient data	0	R/W	○	○	Page 156, Section 3.4.2 (81)
780($30C_H$)	CH4	Simultaneous temperature rise dead time	System area	Simultaneous temperature rise dead time	0	R/W	○	○	Page 157, Section 3.4.2 (82)
781($30D_H$)	CH4	Simultaneous temperature rise AT mode selection	System area	Simultaneous temperature rise AT mode selection	0	R/W	×	○	Page 157, Section 3.4.2 (83)
782($30E_H$)	CH4	Simultaneous temperature rise status	System area	Simultaneous temperature rise status	0	R	×	×	Page 158, Section 3.4.2 (84)
783($30F_H$)	CH4	Setting change rate limiter unit time setting*9	Setting change rate limiter unit time setting*6*9	Setting change rate limiter unit time setting*9	0	R/W	×	○	Page 159, Section 3.4.2 (85)
784(310_H)	All CHs	Peak current suppression control group setting*9	System area	System area	0	R/W	×	○	Page 160, Section 3.4.2 (86)
785(311_H)	All CHs	Sensor correction function selection*9			0	R/W	×	○	Page 161, Section 3.4.2 (87)
786(312_H)	All CHs	Temperature conversion completion flag			0	R	×	×	Page 161, Section 3.4.2 (88)
787(313_H)	All CHs	Function extension bit monitor			0	R	×	×	Page 162, Section 3.4.2 (89)
788(314_H)	—	System area			—	—	—	—	—

Address (decimal (hexadecimal))	Target channel or current sensor (CT)	Setting contents			Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
		Standard control	Heating-cooling control	Mix control					
789(315_H)	CH1	AT error status monitor			0	R	×	×	Page 163, Section 3.4.2 (90)
790(316_H)	CH2	AT error status monitor	AT error status monitor	AT error status monitor*7	0	R	×	×	
791(317_H)	CH3	AT error status monitor	AT error status monitor*6	AT error status monitor	0	R	×	×	
792(318_H)	CH4	AT error status monitor	AT error status monitor*6	AT error status monitor	0	R	×	×	
793(319_H) to 1278($4FE_H$)	—	System area			—	—	—	—	—
1279($4FF_H$) to 4095(FFF_H)	Buffer memory for error history (Page 85, Section 3.4.1 (2))								
4096(1000_H) to 53247($CFFF_H$)	—	System area			—	—	—	—	—

*1 This value is stored when Default setting registration instruction (Yn9) is turned on. The default value varies depending on the mode. For details on the default values, refer to the following.
Page 88, Section 3.4.2

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

*3 This column indicates whether the setting in the buffer memory area is automatically changed when the input range is changed. Enable/disable of automatic change can be set on Switch Setting. For details, refer to Page 226, Section 4.15.

*4 Whether writing to the E^2PROM by turning off and on E^2PROM backup instruction (Yn8) is enabled is indicated in this column. For details, refer to Page 276, Section 4.30.

*5 (TT) indicates the Q64TCTTN and Q64TCTTBWN. (RT) indicates the Q64TCRTN and Q64TCRTBWN.

*6 Available only when the heating-cooling control (expanded mode) is set on Switch Setting. With other models, this area is handled as a system area.

*7 Available only when the mix control (expanded mode) is set on Switch Setting. With other models, this area is handled as a system area.

*8 Available only when the Q64TCTTN or Q64TCTTBWN is used. With other models, this area is handled as a system area.

*9 Available only in the setting mode. To enable the setting contents, turn off, on, and on Setting change instruction (YnB) when Setting/operation mode instruction (Yn1) is off (during setting mode). Note that a write data error (error code: $\square\square\square 3_H$) occurs if the setting is changed during the operation mode.

*10 By using the setting change rate limiter, whether to set temperature rise/temperature drop in a batch or individually can be selected on Switch Setting. 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 Page 196, Section 4.9.

*11 Available only when the Q64TCTTBWN or Q64TCRTBWN is used. With other models, this area is handled as a system area.

*12 By using the setting change rate limiter, whether to set temperature rise/temperature drop in a batch or individually can be selected on Switch Setting. 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 Page 196, Section 4.9.

*13 Available only when the heating-cooling control (normal mode) is set on Switch Setting. With other models, this area is handled as a system area.

*14 Available only when the mix control (normal mode) is set on Switch Setting. With other models, this area is handled as a system area.

(2) Buffer memory address for error history

Address (decimal (hexadecimal))	Target channel	Setting contents				Default value *1	Read/ Write *2	Automatic setting *3	E^{2}PROM write availability *4	Reference
1279($4FF_H$)	All CHs	Latest address of error history				0	R	×	×	Page 166, Section 3.4.2 (91)
1280(500_H)	All CHs	History 1	Error code			0	R	×	×	Page 166, Section 3.4.2 (92)
1281(501_H)			Error occurrence time	Upper 2 digits of year	Lower 2 digits of year					
1282(502_H)				Month	Day					
1283(503_H)				Hour	Minute					
1284(504_H)				Second	Day of the week					
1285(505_H) to 1287(507_H)	—	System area				—	—	—	—	—
1288(508_H) to 1292($50C_H$)	All CHs	History 2	Error code, error occurrence time (Data structure is the same as that of History 1.)			0	R	×	×	Page 166, Section 3.4.2 (92)
1293($50D_H$) to 1295($50F_H$)	—	System area				—	—	—	—	—
1296(510_H) to 1300(514_H)	All CHs	History 3	Error code, error occurrence time (Data structure is the same as that of History 1.)			0	R	×	×	Page 166, Section 3.4.2 (92)
1301(515_H) to 1303(517_H)	—	System area				—	—	—	—	—
1304(518_H) to 1308($51C_H$)	All CHs	History 4	Error code, error occurrence time (Data structure is the same as that of History 1.)			0	R	×	×	Page 166, Section 3.4.2 (92)
1309($51D_H$) to 1311($51F_H$)	—	System area				—	—	—	—	—
1312(520_H) to 1316(524_H)	All CHs	History 5	Error code, error occurrence time (Data structure is the same as that of History 1.)			0	R	×	×	Page 166, Section 3.4.2 (92)
1317(525_H) to 1319(527_H)	—	System area				—	—	—	—	—
1320(528_H) to 1324($52C_H$)	All CHs	History 6	Error code, error occurrence time (Data structure is the same as that of History 1.)			0	R	×	×	Page 166, Section 3.4.2 (92)
1325($52D_H$) to 1327($52F_H$)	—	System area				—	—	—	—	—

Address (decimal (hexadecimal))	Target channel	Setting contents		Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
1328(530H) to 1332(534H)	All CHs	History 7	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1333(535H) to 1335(537H)	—	System area		—	—	—	—	—
1336(538H) to 1340(53CH)	All CHs	History 8	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1341(53DH) to 1343(53FH)	—	System area		—	—	—	—	—
1344(540H) to 1348(544H)	All CHs	History 9	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1349(545H) to 1351(547H)	—	System area		—	—	—	—	—
1352(548H) to 1356(54CH)	All CHs	History 10	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1357(54DH) to 1359(54FH)	—	System area		—	—	—	—	—
1360(550H) to 1364(554H)	All CHs	History 11	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1365(555H) to 1367(557H)	—	System area		—	—	—	—	—
1368(558H) to 1372(55CH)	All CHs	History 12	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1373(55DH) to 1375(55FH)	—	System area		—	—	—	—	—
1376(560H) to 1380(564H)	All CHs	History 13	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1381(565H) to 1383(567H)	—	System area		—	—	—	—	—
1384(568H) to 1388(56CH)	All CHs	History 14	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)

Address (decimal (hexadecimal))	Target channel	Setting contents		Default value *1	Read/ Write *2	Automatic setting *3	E^2PROM write availability *4	Reference
1389(56D$_H$) to 1391(56F$_H$)	—	System area		—	—	—	—	—
1392(570$_H$) to 1396(574$_H$)	All CHs	History 15	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1397(575$_H$) to 1399(577$_H$)	—	System area		—	—	—	—	—
1400(578$_H$) to 1404(57C$_H$)	All CHs	History 16	Error code, error occurrence time (Data structure is the same as that of History 1.)	0	R	×	×	Page 166, Section 3.4.2 (92)
1405(57D$_H$) to 4095(FFF$_H$)	—	System area		—	—	—	—	—

*1 This default value is set after the module is turned off and on or after the CPU module is reset and the reset is cancelled.
*2 This column indicates whether data can be read from or written to the buffer memory area through sequence programs.
R: Reading enabled
W: Writing enabled
*3 This column indicates whether the setting in the buffer memory area is automatically changed when the input range is changed. Enable/disable of automatic change can be set on Switch Setting. For details, refer to Page 226, Section 4.15.
*4 Whether writing to the E^2PROM by turning off and on E^2PROM backup instruction (Yn8) is enabled is indicated in this column. For details, refer to Page 276, Section 4.30

3.4.2 Details of the buffer memory

This chapter describes details on the buffer memory of the Q64TCN.

Point

For buffer memory areas indicated with the icon 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) Write data error code (Un\G0) Common

An error code or alarm code is stored in this buffer memory area.
For error codes and alarm codes, refer to the following.

Page 373, Section 8.6, Page 376, Section 8.7

(2) CH☐ Decimal point position (Un\G1 to Un\G4) Common

According to the setting of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128), the decimal point position applicable in the following buffer memory areas is stored in this buffer memory area.

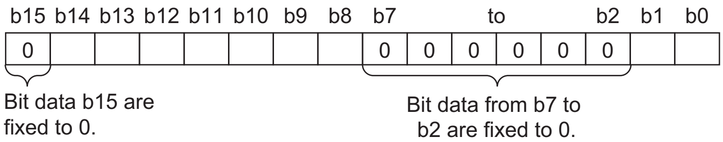
Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Temperature process value (PV)	Un\G9	Un\G10	Un\G11	Un\G12	Page 91, Section 3.4.2 (4)
CH☐ Set value (SV) setting	Un\G34	Un\G66	Un\G98	Un\G130	Page 106, Section 3.4.2 (14)
CH☐ Alert set value 1	Un\G38	Un\G70	Un\G102	Un\G134	Page 110, Section 3.4.2 (18)
CH☐ Alert set value 2	Un\G39	Un\G71	Un\G103	Un\G135	
CH☐ Alert set value 3	Un\G40	Un\G72	Un\G104	Un\G136	
CH☐ Alert set value 4	Un\G41	Un\G73	Un\G105	Un\G137	
CH☐ AT bias setting	Un\G53	Un\G85	Un\G117	Un\G149	Page 122, Section 3.4.2 (29)
CH☐ Upper limit setting limiter	Un\G55	Un\G87	Un\G119	Un\G151	Page 124, Section 3.4.2 (31)
CH☐ Lower limit setting limiter	Un\G56	Un\G88	Un\G120	Un\G152	
CH☐ Loop disconnection detection dead band	Un\G60	Un\G92	Un\G124	Un\G156	Page 127, Section 3.4.2 (34)
CH☐ Sensor two-point correction offset value (measured value)	Un\G544	Un\G576	Un\G608	Un\G640	Page 144, Section 3.4.2 (58)
CH☐ Sensor two-point correction offset value (corrected value)	Un\G545	Un\G577	Un\G609	Un\G641	Page 144, Section 3.4.2 (59)
CH☐ Sensor two-point correction gain value (measured value)	Un\G546	Un\G578	Un\G610	Un\G642	Page 145, Section 3.4.2 (60)
CH☐ Sensor two-point correction gain value (corrected value)	Un\G547	Un\G579	Un\G611	Un\G643	Page 145, Section 3.4.2 (61)
CH☐ Simultaneous temperature rise gradient data	Un\G731	Un\G747	Un\G763	Un\G779	Page 156, Section 3.4.2 (81)

Stored values differ depending on the setting in CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128).

Setting of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) (Page 98, Section 3.4.2 (12))	Stored value	Setting contents
Resolution is 1.	0	Nothing after decimal point
Resolution is 0.1.	1	First decimal place

(3) CH☐ Alert definition (Un\G5 to Un\G8) 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 to b7	— (fixed to 0)	— (Unused)
b8	CH☐ Alert 1	Alert 1 has occurred. (Page 200, Section 4.12)
b9	CH☐ Alert 2	Alert 2 has occurred. (Page 200, Section 4.12)
b10	CH☐ Alert 3	Alert 3 has occurred. (Page 200, Section 4.12)
b11	CH☐ Alert 4	Alert 4 has occurred. (Page 200, Section 4.12)
b12	CH☐ Heater disconnection detection	Heater disconnection has been detected. (Page 271, Section 4.28)
b13	CH☐ Loop disconnection detection	Loop disconnection has been detected. (Page 259, Section 4.22)
b14	CH☐ Output off-time current error	Output off-time current error has been detected. (Page 275, Section 4.29)
b15	— (fixed to 0)	— (Unused)

*1 For the temperature measurement range, refer to Page 90, Section 3.4.2 (3) (a).

(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. A calculation example when CH□ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (temperature measurement range: -200.0 to 400.0°C)

- 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°C.
The Q64TCN checks whether the input temperature is in temperature measurement range of the input range. When the input temperature is out of the temperature measurement range, CH□ Input range upper limit (b0 of Un\G5 to Un\G8), or CH□ Input range lower limit (b1 of Un\G5 to Un\G8) become 1 (ON). The conditions which the Q64TCN uses to judge whether the measured temperature is within the temperature measurement range differ depending on the following settings.

- Setting/operation mode instruction (Yn1) (☞Page 58, Section 3.3.3 (1))
- PID continuation flag (Un\G169) (☞Page 133, Section 3.4.2 (43))
- CH□ PID control forced stop instruction (YnC to YnF) (☞Page 60, Section 3.3.3 (7))
- CH□ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) (☞Page 105, Section 3.4.2 (13))

Point

The following table lists the conditions whether to perform the temperature judgment.

○: Executed ×: Not executed

Setting/operation mode instruction (Yn1)*1	PID continuation flag (Un\G169)	CH□ PID control forced stop instruction (YnC to YnF)	CH□ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129)	Temperature judgment
Setting mode at power-ON	Stop (0)/Continue (1)	OFF/ON	Stop (0)	×
			Monitor (1)	○
			Alert (2)	○
Operation mode (in operation)	Stop (0)/Continue (1)	OFF	Stop (0)/Monitor (1)/Alert (2)	○
		ON	Stop (0)	×
			Monitor (1)	○
			Alert (2)	○
Setting mode (after operation)	Stop (0)	OFF/ON	Stop (0)	×
			Monitor (1)	○
			Alert (2)	○
	Continue (1)	OFF	Stop (0)/Monitor (1)/Alert (2)	○
		ON	Stop (0)	×
			Monitor (1)	○
			Alert (2)	○

*1 Refer to ☞Page 52, Section 3.3.2 (2) for each timing.
If CH□ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Disable (1), temperature judgment is not executed even though the condition above is satisfied. (☞Page 128, Section 3.4.2 (35))

(4) CH☐ Temperature process value (PV) (Un\G9 to Un\G12) Common

The detected temperature value where sensor correction is performed is stored in this buffer memory area. The value to be stored differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4). (Page 88, Section 3.4.2 (2))

- No decimal place (0): Stored as it is.
- One decimal place (1): Stored after a multiplication by 10.

Point

When value measured by a temperature sensor exceeds the temperature measurement range, the following value is stored.

- When measured value exceeds temperature measurement range: Input range upper limit + 5% of full scale
- When measured value falls below temperature measurement range: Input range lower limit - 5% of full scale

(5) CH☐ Manipulated value (MV) (Un\G13 to Un\G16) Standard

CH☐ Manipulated value for heating (MVh) (Un\G13 to Un\G16) Heating-cooling

CH☐ Manipulated value for cooling (MVc) (Un\G704 to Un\G707) Heating-cooling

The result of PID operation based on temperature process value (PV) is stored in these buffer memory areas. The area Un\G13 to Un\G16 are used for heating in the case of the heating-cooling control. The following table lists the range of value to be stored.

Store description	Store range in control	Stored value when control stops
Manipulated value (MV)	-50 to 1050 (-5% 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 (Un\G47, Un\G79, Un\G111, Un\G143) in percentage. (Page 116, Section 3.4.2 (23))
- Manipulated value for heating (MVh) indicates ON time of CH□ Heating control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143) in percentage. (Page 116, Section 3.4.2 (23))
- Manipulated value for cooling (MVc) indicates ON time of CH□ Cooling control output cycle setting (Un\G722, Un\G738, Un\G754, Un\G770) in percentage. (Page 116, Section 3.4.2 (23))

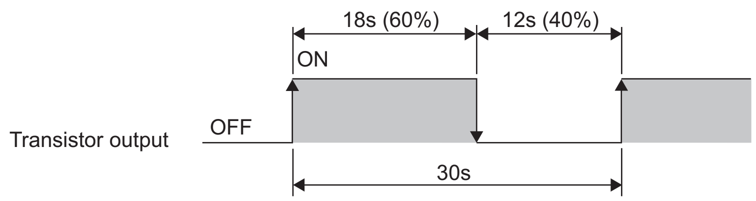
Ex. When 600 (60.0%) is stored in CH□ Manipulated value (MV) (Un\G13 to Un\G16) and the value of the buffer memory is set as shown in the following.

- CH□ Control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143): 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.



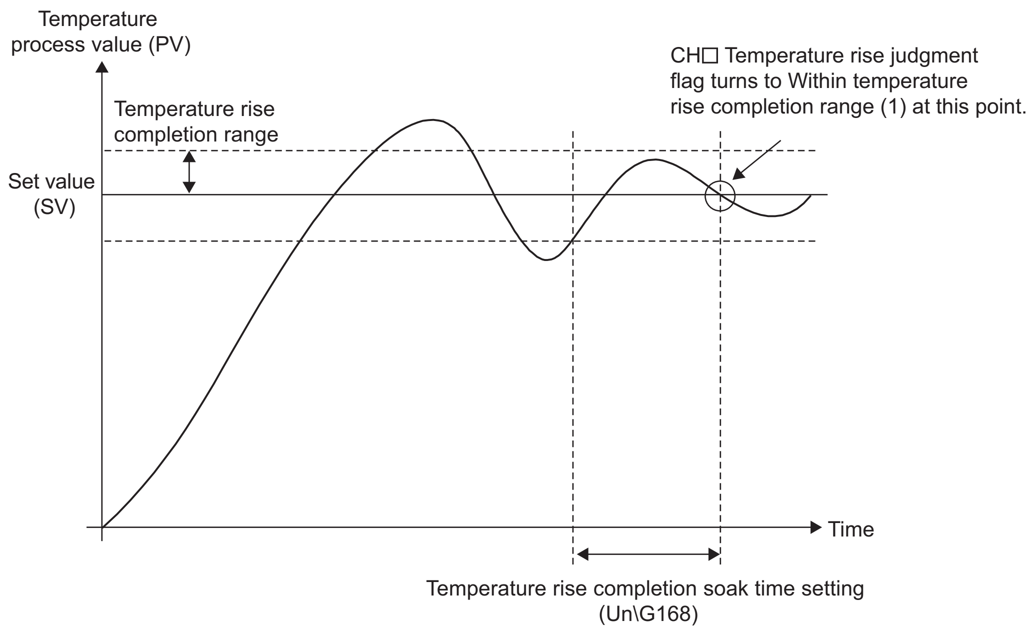
(6) CH□ Temperature rise judgment flag (Un\G17 to Un\G20) Common

This flag is for checking whether the temperature process value (PV) is in the temperature rise completion range or not.

The following values are stored in this buffer memory area.

- 0: Out of temperature rise completion range
- 1: Within temperature rise completion range

When the temperature process value (PV) stays in the temperature rise completion range during the set temperature rise completion soak time, 1 is stored in this buffer memory area, which is within temperature rise completion range (1).



Set the temperature rise completion range and temperature rise completion soak time in the following buffer memory areas.

- Temperature rise completion range setting (Un\G167) (Page 132, Section 3.4.2 (41))
- Temperature rise completion soak time setting (Un\G168) (Page 133, Section 3.4.2 (42))

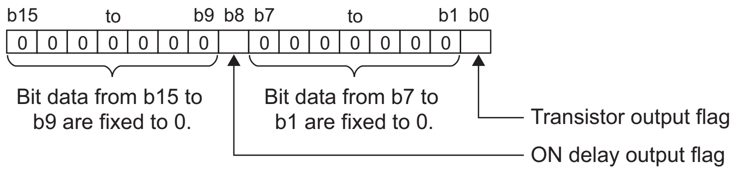
(7) CH□ Transistor output flag (Un\G21 to Un\G24) Standard

CH□ Heating transistor output flag (Un\G21 to Un\G24) Heating-cooling

CH□ Cooling transistor output flag (Un\G712 to Un\G715) Heating-cooling

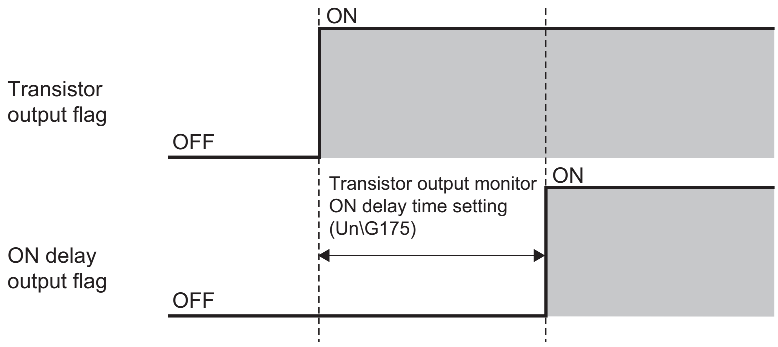
ON/OFF status of transistor output and ON delay output are stored in these flags. In the heating-cooling control, ON/OFF status of transistor output/ON delay output for heating are stored in Un\G21 to Un\G24.

- OFF: 0
- ON: 1



(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 (Un\G175) enables setting considering delay time (response/scan time delay) of actual transistor output. (Page 134, Section 3.4.2 (45))

By monitoring the ON delay output flag and external output on the program, disconnection of external output can be judged.

For details on the ON delay output function, refer to the following.

Page 228, Section 4.17

(8) CH☐ Set value (SV) monitor (Un\G25 to Un\G28) Common

Set value (SV) of each time unit set in CH☐ Setting change rate limiter time unit setting (Un\G735, Un\G751, Un\G767, Un\G783) is stored in this buffer memory area. (Page 159, Section 3.4.2 (85))
The set value (SV) can be monitored in real time.

(9) Cold junction temperature process value (Un\G29) Common

The measured temperature of cold junction temperature compensation resistor is stored in this buffer memory area.

Values to be stored*1 vary depending on the temperature unit set in CH1 Input range (Un\G32). (Page 98, Section 3.4.2 (12))

- For other than °F : -10 to 100
- For °F : 14 to 212

*1 The operation of the Q64TCN is guaranteed in the ambient temperature of 0 to 55°C.
For the general specifications of the Q64TCN, refer to the following.
QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(a) Usable modules

- Q64TCTTN
- Q64TCTTBWN

(10)MAN mode shift completion flag (Un\G30) Common

This flag is for checking completion of the mode shift when shifting AUTO (auto) mode to MAN (manual) mode.
The following values are stored in this buffer memory area.

- 0: MAN mode shift uncompleted
- 1: MAN mode shift completed

The following figure shows bits of the 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 b15 to b4 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 in the following buffer memory area.

- CH☐ AUTO/MAN mode shift (Un\G50, Un\G82, Un\G114, Un\G146) (Page 119, Section 3.4.2 (26))

(b) Setting manipulated value (MV) in MAN mode

Set the manipulated value (MV) in the following buffer memory area.

- CH☐ MAN output setting (Un\G51, Un\G83, Un\G115, Un\G147) (Page 120, Section 3.4.2 (27))

Set the manipulated value (MV) after confirming MAN mode shift completion flag (Un\G30) has become MAN mode shift completed (1).

(11) E^2PROM's PID constants read/write completion flag (Un\G31) Common

This flag indicates whether an operation to the E^2PROM by the settings in the following buffer memory areas is completed or failed.

- CH□ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) (Page 129, Section 3.4.2 (36))
- CH□ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159) (Page 130, Section 3.4.2 (37))

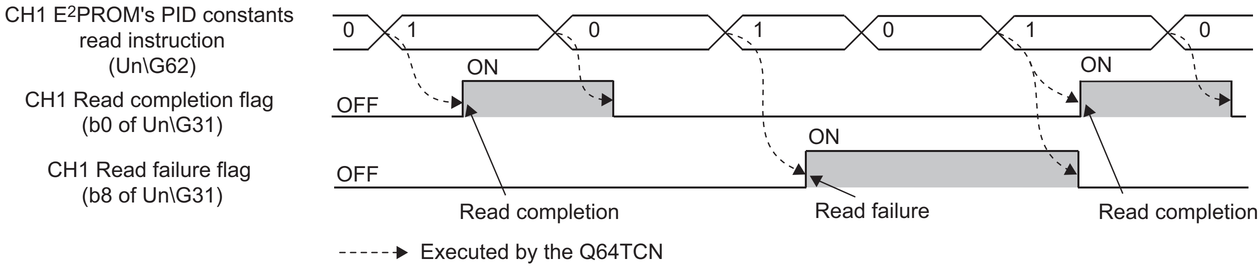
(a) Correspondence between each bit and flag

The following table lists flags that correspond to bits of this 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□ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) (Page 129, Section 3.4.2 (36))

The following figure shows the ON/OFF timing of this flag for CH□ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158). (For CH1)



When the data reading from E^2PROM is completed normally, CH□ Read completion flag (b0 to b3 of Un\G31) of the corresponding channel turns on.

CH□ Read completion flag (b0 to b3 of Un\G31) turns off when CH□ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) is turned off from on.

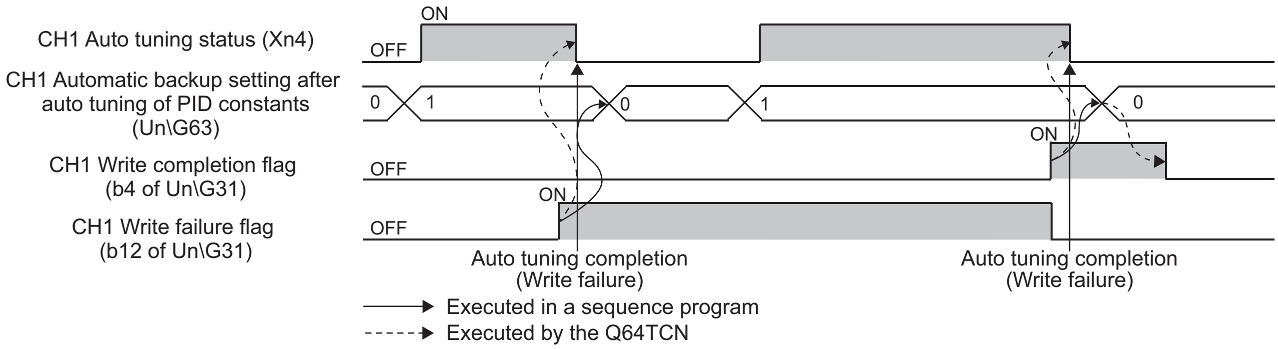
When the data reading from E^2PROM fails, CH□ Read failure flag (b8 to b11 of Un\G31) of the corresponding channel turns on and the Q64TCN operates with PID constants before the data reading. (The LED status remains.)

CH□ Read failure flag (b8 to b11 of Un\G31) turns off when the data reading of the corresponding channel is completed normally.

When the data reading fails, try it again by turning CH□ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) ON → OFF → ON.

(c) ON/OFF timing for CH☐ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159) (☞Page 130, Section 3.4.2 (37))

The following figure shows ON/OFF timing of this flag for CH☐ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159). (For CH1)



When the data writing to E^2PROM is completed normally, CH☐ Write completion flag (b4 to b7 of Un\G31) turns on.
CH☐ Write completion flag (b4 to b7 of Un\G31) turns off when CH☐ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159) is set to Disable (0) from Enable (1).

When the data writing to E^2PROM fails, CH☐ Write failure flag (b12 to b15 of Un\G31) of the corresponding channel turns on and the Q64TCN operates with PID constants calculated in the previous auto tuning. (The LED status remains.)
CH☐ Write failure flag (b12 to b15 of Un\G31) turns off when the data writing of the corresponding channel is completed normally.
When the data writing fails, perform auto tuning again by turning CH☐ Auto tuning instruction (Yn4 to Yn7) ON → OFF → ON. If the data writing fails even after executing auto tuning again, a hardware error can be the reason. Please consult your local Mitsubishi representative.

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 (Un\G63, Un\G95, Un\G127, Un\G159) to Disable (0).
  - CH☐ Write completion flag (b4 to b7 of Un\G31) (when automatic backup is completed normally)
  - CH☐ Write failure flag (b12 to b15 of Un\G31) (when automatic backup fails)

  If auto tuning is executed under Enable (1), although PID constants are stored after auto tuning is complete, CH☐ Auto tuning status (Xn4 to Xn7) does not turn off.

For details on the auto tuning function, refer to the following.

☞Page 182, Section 4.6

(12)CH□ Input range (Un\G32, Un\G64, Un\G96, Un\G128) Common

Select the set value according to temperature sensor, temperature measurement range[*1], output temperature unit (Celsius (°C)/Fahrenheit (°F)/digit) and resolution (1/0.1) which are used with the Q64TCN.

*1 In the case of input from other analog modules (such as an A/D converter module) also, set these values.

Ex. When the Q64TCTTN or Q64TCTTBWN is used and the following thermocouple is selected

- Thermocouple type: R
- Temperature measurement range: 0 to 1700°C
- Resolution: 1

Set 1 in CH□ Input range (Un\G32, Un\G64, Un\G96, Un\G128).

When using the Q64TCTTN or Q64TCTTBWN, refer to Page 99, Section 3.4.2 (12) (a).
When using the Q64TCRTN or Q64TCRTBWN, refer to Page 102, Section 3.4.2 (12) (b).

(a) Setting range of the Q64TCTTN, Q64TCTTBWN

The following table lists set values of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) and the corresponding thermocouple types. The relationship between temperature unit and setting values is as follows.

Setting of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)	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 (°C).
100 to 199		Output temperature unit is Fahrenheit (°F).
200 to 299	Other analog modules (such as an A/D converter module) are used. (200 to 299)	Unit is digit.

Thermocouple type	Temperature measurement range	Celsius (°C)/ Fahrenheit (°F)/digit	Resolution	CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)	Auto-setting at input range change*1	
					CH☐ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151)	CH☐ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152)
R	0 to 1700	°C	1	1	1700	0
	0 to 3000	°F	1	105	3000	0
K	-200.0 to 400.0	°C	0.1	38	4000	-2000
	0.0 to 400.0	°C	0.1	36	4000	0
	0 to 1300	°C	1	2 (Default value)	1300	0
	0 to 500	°C	1	11	500	0
	0.0 to 500.0	°C	0.1	40	5000	0
	0 to 800	°C	1	12	800	0
	0.0 to 800.0	°C	0.1	41	8000	0
	0 to 1000	°F	1	100	1000	0
	0.0 to 1000.0	°F	0.1	130	10000	0
	0 to 2400	°F	1	101	2400	0
J	0.0 to 400.0	°C	0.1	37	4000	0
	0 to 500	°C	1	13	500	0
	0.0 to 500.0	°C	0.1	42	5000	0
	0 to 800	°C	1	14	800	0
	0.0 to 800.0	°C	0.1	43	8000	0
	0 to 1200	°C	1	3	1200	0
	0 to 1000	°F	1	102	1000	0
	0.0 to 1000.0	°F	0.1	131	10000	0
	0 to 1600	°F	1	103	1600	0
	0 to 2100	°F	1	104	2100	0

Thermocouple type	Temperature measurement range	Celsius (°C)/ Fahrenheit (°F)/digit	Resolution	CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)	Auto-setting at input range change*1	
					CH☐ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151)	CH☐ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152)
T	-200 to 400	°C	1	4	400	-200
	-200 to 200	°C	1	21	200	-200
	-200.0 to 400.0	°C	0.1	39	4000	-2000
	0 to 200	°C	1	19	200	0
	0 to 400	°C	1	20	400	0
	0.0 to 400.0	°C	0.1	45	4000	0
	-300 to 400	°F	1	110	400	-300
	0 to 700	°F	1	109	700	0
	0.0 to 700.0	°F	0.1	132	7000	0
S	0 to 1700	°C	1	15	1700	0
	0 to 3000	°F	1	106	3000	0
B	0 to 1800	°C	1	16	1800	0
	0 to 3000	°F	1	107	3000	0
E	0 to 400	°C	1	17	400	0
	0.0 to 700.0	°C	0.1	44	7000	0
	0 to 1000	°C	1	18	1000	0
	0 to 1800	°F	1	108	1800	0
N	0 to 1300	°C	1	22	1300	0
	0 to 2300	°F	1	111	2300	0
U	-200 to 200	°C	1	26	200	-200
	0 to 400	°C	1	25	400	0
	0.0 to 600.0	°C	0.1	46	6000	0
	-300 to 400	°F	1	115	400	-300
	0 to 700	°F	1	114	700	0
L	0 to 400	°C	1	27	400	0
	0.0 to 400.0	°C	0.1	47	4000	0
	0 to 900	°C	1	28	900	0
	0.0 to 900.0	°C	0.1	48	9000	0
	0 to 800	°F	1	116	800	0
	0 to 1600	°F	1	117	1600	0
PLII	0 to 1200	°C	1	23	1200	0
	0 to 2300	°F	1	112	2300	0
W5Re/W26Re	0 to 2300	°C	1	24	2300	0
	0 to 3000	°F	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

Thermocouple type	Temperature measurement range	Celsius (°C)/ Fahrenheit (°F)/digit	Resolution	CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)	Auto-setting at input range change*1	
					CH☐ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151)	CH☐ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152)
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 buffer memory areas are initialized automatically and return to the default value (0).
(☞ Page 103, Section 3.4.2 (12) (d))
*2 Same as the Q64TCRTN, Q64TCRTBWN

Remark

For the following control mode and channel, CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) cannot be set to 201 to 205. If these values are set, a write data error (error code: ☐☐☐4_H) occurs.

- CH3 and CH4 in heating-cooling control (normal mode)
- CH2 in mix control (normal mode)

(b) Setting range of the Q64TCRTN, Q64TCRTBWN

The following table lists setting values of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) and the corresponding platinum resistance thermometer types.

Platinum resistance thermometer type	Temperature measurement range	Celsius (°C)/ Fahrenheit (°F)/digit	Resolution	CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)	Auto-setting at input range change*1	
					CH☐ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151)	CH☐ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152)
Pt100	-200.0 to 600.0	°C	0.1	7 (Default value)	6000	-2000
	-200.0 to 200.0	°C	0.1	8	2000	-2000
	-300 to 1100	°F	1	141	1100	-300
	-300.0 to 300.0	°F	0.1	143	3000	-3000
JPt100	-200.0 to 500.0	°C	0.1	5	5000	-2000
	-200.0 to 200.0	°C	0.1	6	2000	-2000
	-300 to 900	°F	1	140	900	-300
	-300.0 to 300.0	°F	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 buffer memory areas are initialized automatically and return to the default value (0).
(☞ Page 103, Section 3.4.2 (12) (d))

*2 Same as the Q64TCTTN, Q64TCTTBWN

Remark

For the following control mode and channel, CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) cannot be set to 201 to 205. If these values are set, a write data error (error code: ☐☐☐4_H) occurs.

- CH3 and CH4 in heating-cooling control (normal mode)
- CH2 in mix control (normal mode)

(c) Resolution

The resolution is applied to the stored values and the set values of particular buffer memory areas as described in the following table.

Resolution	Stored value	Set value
1	Value in 1°C (℉ or digit) unit is stored.	Set a value in 1°C (℉ or digit) unit.
0.1	Value in 0.1°C (℉) unit (tenfold value) is stored.	Set a value in 0.1°C (℉) unit (tenfold value).

For applicable buffer memory areas, refer to the following.

Page 88, Section 3.4.2 (2)

(d) When "Auto-setting at Input Range Change" is set to "1: Enable" on Switch Setting (Page 305, Section 6.2)

When the input range is changed, the following buffer memory areas are set automatically according to selected temperature sensor. Set the buffer memory areas again if necessary.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Upper limit setting limiter	Un\G55	Un\G87	Un\G119	Un\G151	Page 124, Section 3.4.2 (31)
CH□ Lower limit setting limiter	Un\G56	Un\G88	Un\G120	Un\G152	

At the same time, the following buffer memory areas related to the input range is initialized to the default value (0) automatically. Set the buffer memory areas again if necessary.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Set value (SV) setting	Un\G34	Un\G66	Un\G98	Un\G130	Page 106, Section 3.4.2 (14)
CH□ Alert set value 1	Un\G38	Un\G70	Un\G102	Un\G134	Page 110, Section 3.4.2 (18)
CH□ Alert set value 2	Un\G39	Un\G71	Un\G103	Un\G135	
CH□ Alert set value 3	Un\G40	Un\G72	Un\G104	Un\G136	
CH□ Alert set value 4	Un\G41	Un\G73	Un\G105	Un\G137	
CH□ AT bias setting	Un\G53	Un\G85	Un\G117	Un\G149	Page 122, Section 3.4.2 (29)
CH□ Loop disconnection detection dead band	Un\G60	Un\G92	Un\G124	Un\G156	Page 127, Section 3.4.2 (34)
CH□ Sensor two-point correction offset value (measured value)	Un\G544	Un\G576	Un\G608	Un\G640	Page 144, Section 3.4.2 (58)
CH□ Sensor two-point correction offset value (corrected value)	Un\G545	Un\G577	Un\G609	Un\G641	Page 144, Section 3.4.2 (59)
CH□ Sensor two-point correction gain value (measured value)	Un\G546	Un\G578	Un\G610	Un\G642	Page 145, Section 3.4.2 (60)
CH□ Sensor two-point correction gain value (corrected value)	Un\G547	Un\G579	Un\G611	Un\G643	Page 145, Section 3.4.2 (61)
CH□ Simultaneous temperature rise gradient data	Un\G731	Un\G747	Un\G763	Un\G779	Page 156, Section 3.4.2 (81)
CH□ Simultaneous temperature rise dead time	Un\G732	Un\G748	Un\G764	Un\G780	Page 157, Section 3.4.2 (82)

These 19 buffer memory areas are set automatically when the input range is changed and Setting change instruction (YnB) is turned OFF → ON → OFF during setting mode (Setting/operation mode status (Xn1): OFF).

(e) When "Auto-setting at Input Range Change" is set to "0: Disable" on Switch Setting (☞Page 305, Section 6.2)

Set values in the buffer memory (☞Page 103, Section 3.4.2 (12) (d)) can be out of the 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: □□□4_H) occurs in the buffer memory area where the value turns out of the setting range. Change the input range after setting each buffer memory area with values within the setting range after the input range change.

(f) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(g) Precautions

Soon after the input range is changed, input temperature may be unstable. Do not start the control until Temperature conversion completion flag (Un\G786) becomes First temperature conversion completed (1_H).

(13)CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) Common

Set the mode activated at PID control stop.

(a) Setting range and action of Q64TCN

The following table lists the relationship.

○: Executed ×: Not executed

Mode which can be set	Set value of CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129)	Action		
		PID control	Temperature judgment*1	Alert judgment
Stop	0	×	×	×
Monitor	1	×	○	×
Alert	2	×	○	○

*1 Means that the Q64TCN checks whether the input temperature is in the temperature measurement range set in the input range.

However, action of the Q64TCN differs depending on the following settings.

- CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) (☞Page 128, Section 3.4.2 (35))
- Setting/operation mode instruction (Yn1)(☞Page 58, Section 3.3.3 (1))
- PID continuation flag (Un\G169) (☞Page 133, Section 3.4.2 (43))
- CH☐ PID control forced stop instruction (YnC to YnF) (☞Page 60, Section 3.3.3 (7))
- "Output Setting at CPU Stop Error" (Switch Setting) (☞Page 305, Section 6.2)

For details, refer to the following.

- PID control:☞Page 176, Section 4.3 (6)
- Temperature judgment:☞Page 89, Section 3.4.2 (3)
- Alert judgment:☞Page 209, Section 4.12 (5)

(b) Default value

The default values are set to Monitor (1) in all channels.

Point

Default values are set to Monitor (1).
Therefore, channels which temperature sensors are not connected to detect sensor input disconnection and the ALM LED blinks.
When CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1), control of the corresponding channel is not performed. For channels which temperature sensors are not connected to, CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) must be set to Unused (1).

(14)CH□ Set value (SV) setting (Un\G34, Un\G66, Un\G98, Un\G130) Common

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 98, Section 3.4.2 (12))

When a value which is out of the setting range is set, a write data error (error code: □□□4_H) and the following situations occur.

- Write error flag (Xn2) turns on.
- The error code is stored in Write data error code (Un\G0).

(b) Setting unit

The value to be set differs depending on the stored value in CH□ Decimal point position (Un\G1 to Un\G4). (Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(c) Default value

The default values are set to 0 in all channels.

(15)CH☐ Proportional band (P) setting (Un\G35, Un\G67, Un\G99, Un\G131) Standard
CH☐ Heating proportional band (Ph) setting (Un\G35, Un\G67, Un\G99, Un\G131) Heating-cooling
CH☐ Cooling proportional band (Pc) setting (Un\G720, Un\G736, Un\G752, Un\G768) Heating-cooling

Set proportional band (P)/heating proportional band (Ph)/cooling proportional band (Pc) to perform PID control.
(In the heating-cooling control, set heating proportional band (Ph) to Un\G35, Un\G67, Un\G99, Un\G131.)

(a) Setting range

Set the value within the following ranges for the full scale of the set input range. (Page 98, Section 3.4.2 (12))

- 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 the value of the buffer memory is set as follows, the proportional band (P) is 60°C.

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (temperature measurement range: -200.0 to 400.0°C)
- CH☐ Proportional band (P) setting (Un\G35, Un\G67, Un\G99, Un\G131): 100 (10.0%)
  (Full scale) × (Proportional band (P) setting) = (400.0°C - (-200.0)) × 0.1 = 60°C

(b) Two-position control

Set the proportional band (P)/heating proportional band (Ph) to 0.
For details on control methods, refer to the following.
Page 172, Section 4.3

(c) 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 182, Section 4.6

Remark

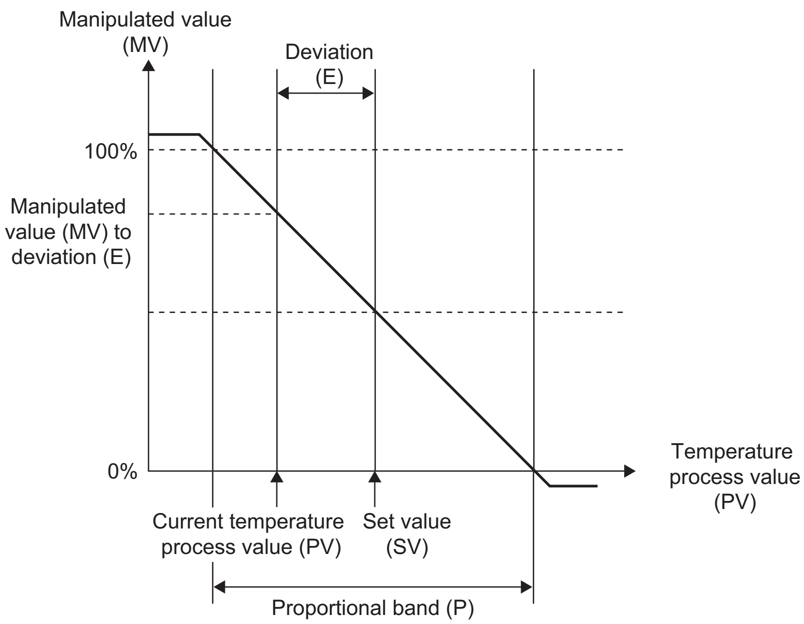
The proportional band (P) is the variation width of deviation (E) necessary for manipulated value (MV) to vary 0% to 100%.
The following formula shows the relationship between deviation (E) and manipulated value (MV) in proportional action.

$$MV = Kp \cdot E$$

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.



(16)CH□ Integral time (I) setting (Un\G36, Un\G68, Un\G100, Un\G132) 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 172, Section 4.3

(c) Default value

The default values are set to 240 (240s) in all channels.

(17)CH□ Derivative time (D) setting (Un\G37, Un\G69, Un\G101, Un\G133) 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 172, Section 4.3

(c) Default value

The default values are set to 60 (60s) in all channels.

(18)CH☐ Alert set value 1 (Un\G38, Un\G70, Un\G102, Un\G134) Common

CH☐ Alert set value 2 (Un\G39, Un\G71, Un\G103, Un\G135) Common

CH☐ Alert set value 3 (Un\G40, Un\G72, Un\G104, Un\G136) Common

CH☐ Alert set value 4 (Un\G41, Un\G73, Un\G105, Un\G137) Common

Set temperature values where CH☐ Alert 1 (Un\G5 to Un\G8 of b8) to CH☐ Alert 4 (Un\G5 to Un\G8 of b11) turn on according to selected alert mode of alert 1 to 4.

For CH☐ Alert definition (Un\G5 to Un\G8), refer to the following.

Page 89, Section 3.4.2 (3)

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

Page 200, Section 4.12

(a) Alert mode

Set the alert mode of alert 1 to 4 in the following buffer memory areas. Alert mode of alert 1 to 4 respectively correspond to alert set value 1 to 4.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Alert 1 mode setting	Un\G192	Un\G208	Un\G224	Un\G240	Page 139, Section 3.4.2 (52)
CH☐ Alert 2 mode setting	Un\G193	Un\G209	Un\G225	Un\G241	
CH☐ Alert 3 mode setting	Un\G194	Un\G210	Un\G226	Un\G242	
CH☐ Alert 4 mode setting	Un\G195	Un\G211	Un\G227	Un\G243	

(b) Setting range

The setting range differs depending on the setting of the following buffer memory area. (each full scale differs)

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) (Page 98, Section 3.4.2 (12))

Also, the setting range differs depending on alert mode to be set. (Page 110, Section 3.4.2 (18) (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: ☐☐☐4_H) and the following situations occur.

- Write error flag (Xn2) turns on.
- The error code is stored in Write data error code (Un\G0).

(c) Setting unit

The value to be set differs depending on the stored value in CH□ Decimal point position (Un\G1 to Un\G4).

(☞Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(d) Default value

The default values are set to 0 in all channels.

(19)CH□ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138) Standard

CH□ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139) Standard

CH□ Heating upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138) Heating-cooling

CH□ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769) 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. Additionally, Un\G42, Un\G74, Un\G106, Un\G138 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 buffer memory.

Buffer memory	Setting range	Remarks
CH□ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	-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, write data error (error code: □□□5$_H$) occurs. In addition, if the setting is out of the setting value, a write data error (error code: □□□4$_H$) occurs. When the error occurs, the following situations occur. • Write error flag (Xn2) turns on. • The error code is stored in Write data error code (Un\G0).
CH□ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139)		
CH□ Heating upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	0 to 1050 (0.0% to 105.0%)	If the setting is out of the setting value, a write data error (error code: □□□4$_H$) occurs. When the error occurs, the following situations occur. • Write error flag (Xn2) turns on. • The error code is stored in Write data error code (Un\G0).
CH□ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769)		

Point

- In the standard control, CH□ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769) is invalid even it is set.
- In the heating-cooling control, lower limit value is not used. When CH□ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139) is set to other than 0, a write data error (error code: □□□2$_H$) occurs.

(b) Two-position control (Page 172, Section 4.3 (1))

The following table lists Enable/Disable of the setting.

Buffer memory	Enable/Disable of the setting in the two-position control
CH☐ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	Disable
CH☐ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139)	
CH☐ Heating upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	Enable
CH☐ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769)	

(c) Manual control (Page 181, Section 4.5)

The following table lists Enable/Disable of the setting.

Buffer memory	Enable/Disable of the setting in the manual control	Remarks
CH☐ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	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 (Un\G43, Un\G75, Un\G107, Un\G139)		
CH☐ Heating upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	Disable	—
CH☐ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769)		

(d) Default value

The following table lists the default value of each buffer memory area.

Buffer memory	Default value
CH☐ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	1000(100.0%)
CH☐ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139)	0(0.0%)
CH☐ Heating upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)	1000(100.0%)
CH☐ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769)	

(20)CH□ Output variation limiter setting (Un\G44, Un\G76, Un\G108, Un\G140) Common

Set the limit of an output variation per 1s to regulate a rapid change of the manipulated value (MV).

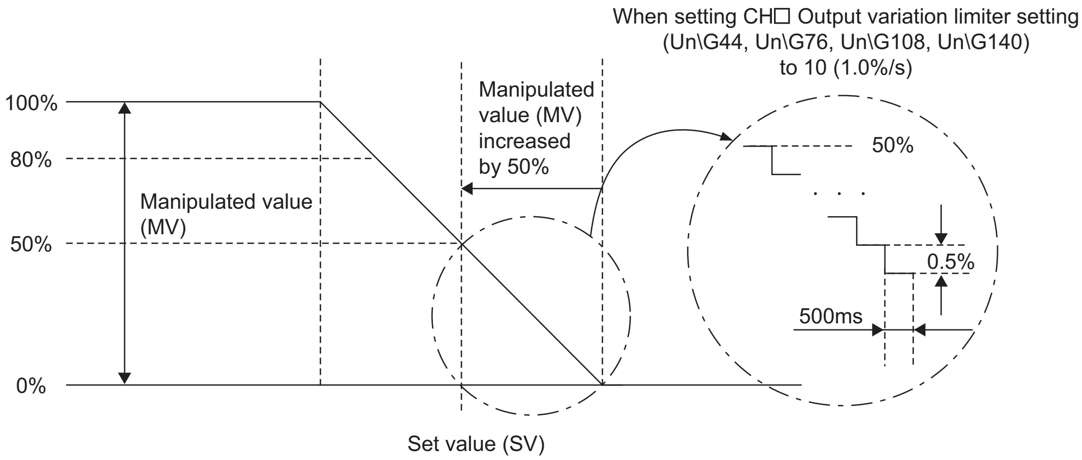
(a) Setting range

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 the value of the buffer memory is set as follows

- CH□ Output variation limiter setting (Un\G44, Un\G76, Un\G108, Un\G140): 10(1.0%/s)

  The output changes by 0.5% per 500ms because the sampling cycle is 500ms. 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 (☞Page 172, Section 4.3 (1))

The setting is invalid.

(c) Manual control (☞Page 181, Section 4.5)

The setting is enabled.

(d) Auto tuning function execution (☞Page 182, Section 4.6)

The setting is enabled, but some change in Output variation limiter setting during auto tuning does not lead to a calculation of the appropriate PID constants. During auto tuning, therefore, no adjustment for output variation is recommended.

(e) Default value

The default values are set to 0 in all channels.

(21)CH☐ Sensor correction value setting (Un\G45, Un\G77, Un\G109, Un\G141)

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 215, Section 4.14

(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. (Page 98, Section 3.4.2 (12))

(b) Enablement of setting contents

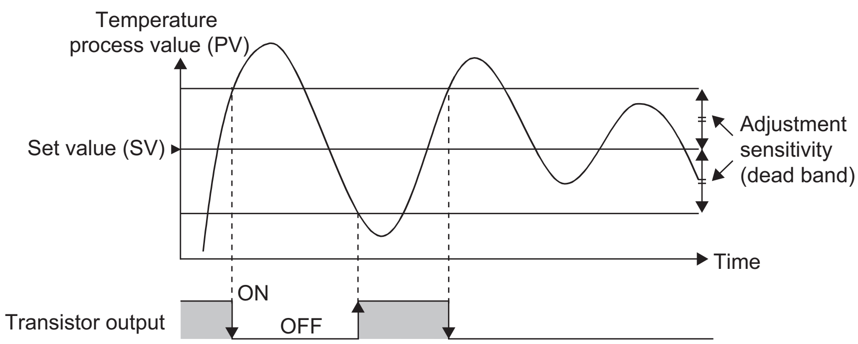
When Normal sensor correction (one-point correction) (0_H) is set in Sensor correction function selection (Un\G785), the setting content is enabled. (Page 161, Section 3.4.2 (87))

(c) Default value

The default values are set to 0 (0.00%) in all channels.

(22)CH☐ Adjustment sensitivity (dead band) setting (Un\G46, Un\G78, Un\G110, Un\G142) Common

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 172, Section 4.3 (1)

(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. (Page 98, Section 3.4.2 (12))

Ex. When the value of the buffer memory is set as follows

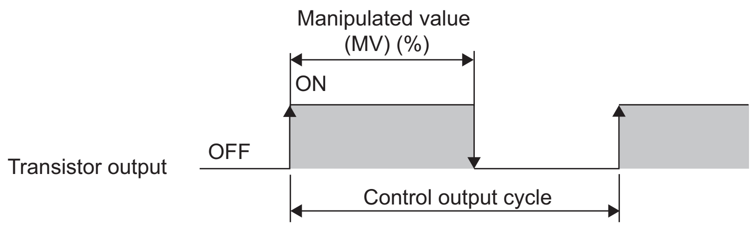
- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (temperature measurement range: -200.0 to 400.0°C)
- CH☐ Adjustment sensitivity (dead band) setting (Un\G46, Un\G78, Un\G110, Un\G142): 10 (1.0%)
  (Full scale) × (Adjustment sensitivity (dead band) setting) = (400.0°C - (-200.0°C)) × 0.01 = 6.0°C
  The dead band is the set value (SV) 6.0°C.

(b) Default value

The default values are set to 5 (0.5%) in all channels.

(23)CH□ Control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143) Standard
CH□ Heating control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143) Heating-cooling
CH□ Cooling control output cycle setting (Un\G722, Un\G738, Un\G754, Un\G770) 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. Additionally, Un\G47, Un\G79, Un\G111, Un\G143 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.

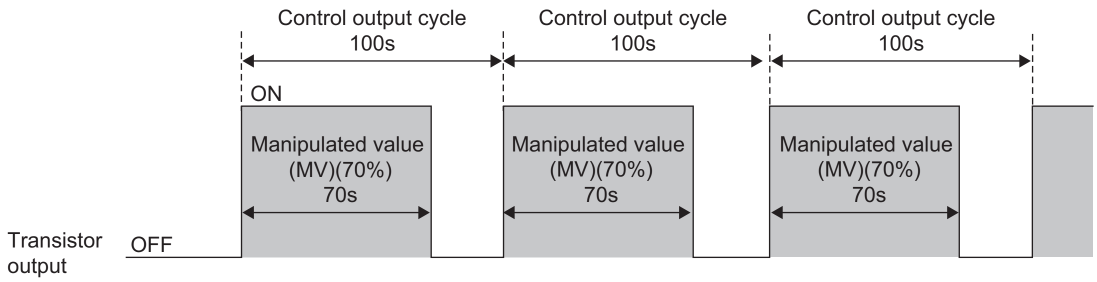
Ex. When 700 (70%) is stored in CH□ Manipulated value (MV) (Un\G13 to Un\G16) and the value of the buffer memory is set as follows

- CH□ Control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143): 100 (100s)

  100s × 0.7 (70%) = 70s

  The ON time is 70s.

  The transistor output turns on for 70s and off for 30s per 100s.



(a) Setting range

The setting range is 1 to 100 (1s to 100s).

(b) Two-position control (Page 172, Section 4.3 (1))

The setting is invalid.

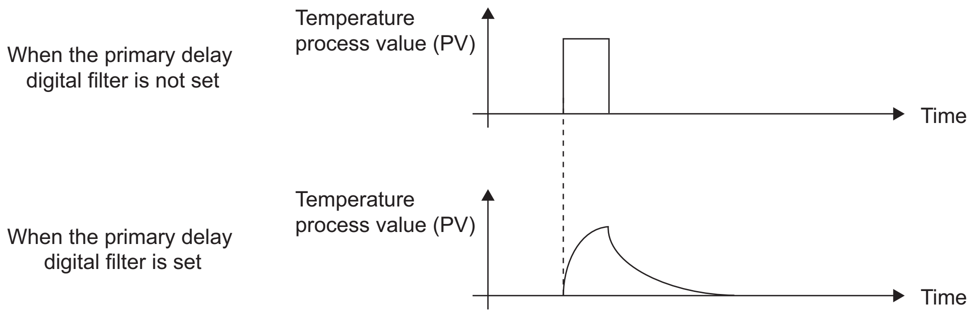
(c) Default value

The default values are set to 30 (30s) in all channels.

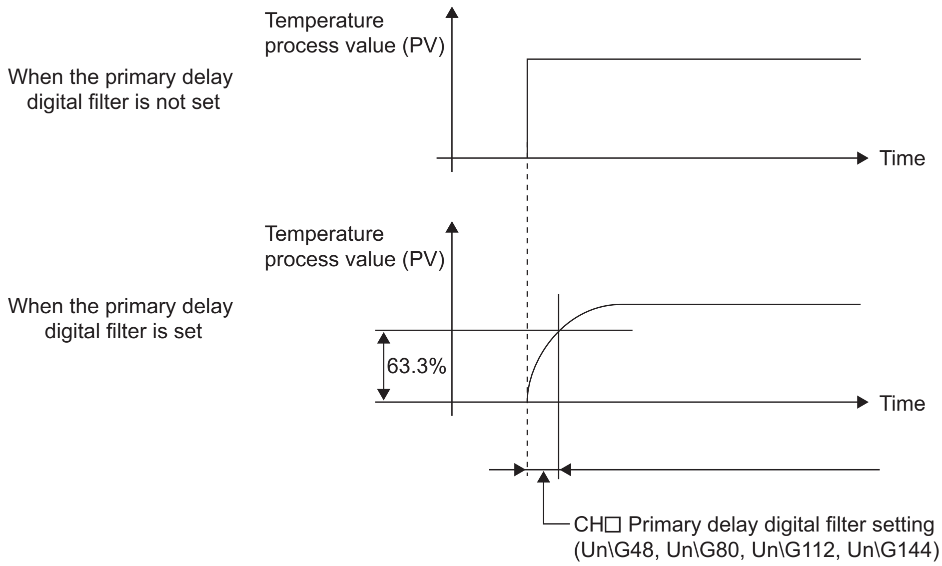
(24)CH□ Primary delay digital filter setting (Un\G48, Un\G80, Un\G112, Un\G144)

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) Default value

The default values are set to 0 (primary delay digital filter processing disabled) in all channels.

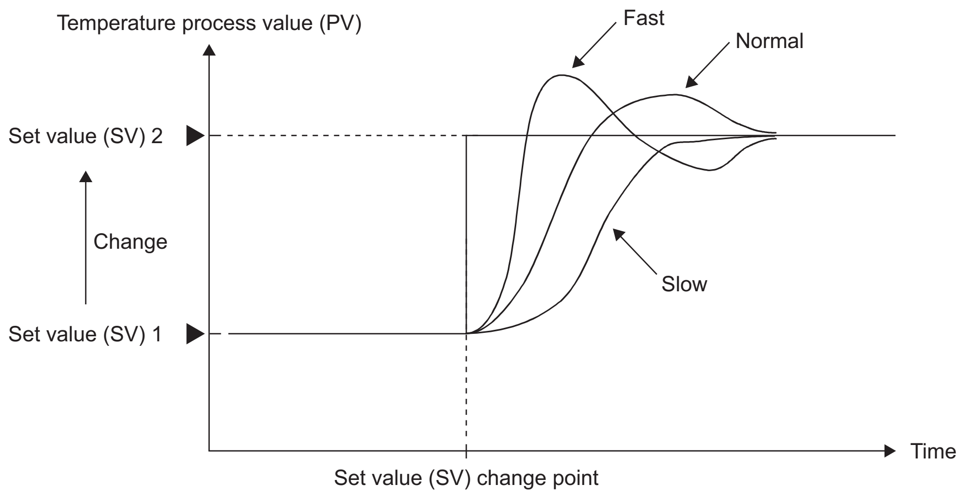
(25)CH□ Control response parameter (Un\G49, Un\G81, Un\G113, Un\G145) Common

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 194, Section 4.7

(a) Setting range

Set 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) Default value

The default values are set to Slow (0) in all channels.

(26)CH☐ AUTO/MAN mode shift (Un\G50, Un\G82, Un\G114, Un\G146) Common

Select whether to calculate the manipulated value (MV) by PID operation or to set it manually by the user.

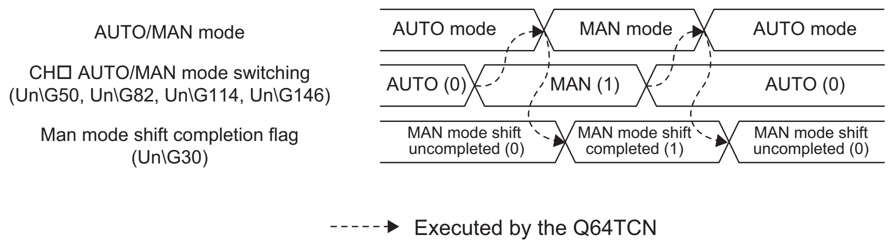
(a) Setting range

Set 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 (Un\G51, Un\G83, Un\G115, Un\G147) 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 (Un\G51, Un\G83, Un\G115, Un\G147). (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 shift completion flag (Un\G30) 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) Default value

The default values are set to AUTO (0) in all channels.

(27)CH☐ MAN output setting (Un\G51, Un\G83, Un\G115, Un\G147) Common

This 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 buffer memory area.

- CH☐ AUTO/MAN mode shift (Un\G50, Un\G82, Un\G114, Un\G146) (Page 119, Section 3.4.2 (26))

(b) Setting range

The setting range is different between the standard control and the heating-cooling control. (Page 168, Section 4.1)

- In standard control: -50 to 1050 (-5.0 to 105.0%)
- In heating-cooling control: -1050 to 1050 (-105.0 to 105.0%)

(c) Enablement of setting contents

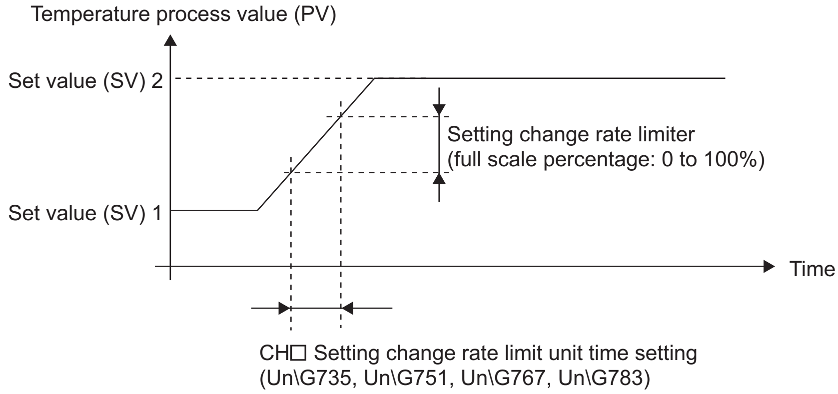
Make sure the corresponding bits of MAN mode shift completion flag (Un\G30) has been set to 1 (ON) and write a value in the MAN output setting.
A value that is written when MAN mode shift completion flag is OFF will be replaced with the manipulated value (MV) calculated by PID operation by the system.

(d) Default value

The default values are set to 0 (0.0%) in all channels.

(28)CH□ Setting change rate limiter (Un\G52, Un\G84, Un\G116, Un\G148) Common
CH□ Setting change rate limiter (temperature rise) (Un\G52, Un\G84, Un\G116, Un\G148) Common
CH□ Setting change rate limiter (temperature drop) (Un\G564, Un\G596, Un\G628, Un\G660) Common

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 time unit setting (Un\G735, Un\G751, Un\G767, Un\G783). (Page 159, Section 3.4.2 (85))



(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 it on Switch Setting.
For details on the setting method, refer to the following.
Page 305, Section 6.2
When setting change rate limiter is set individually, Un\G52, Un\G84, Un\G116, Un\G148 is for the temperature rise. The following table lists the buffer memory areas to be referred to.

Batch/Individual	Buffer memory area name	Buffer memory address			
		CH1	CH2	CH3	CH4
Batch	CH□ Setting change rate limiter	Un\52	Un\84	Un\116	Un\148
Individual	CH□ Setting change rate limiter (temperature rise)	Un\52	Un\84	Un\116	Un\148
	CH□ Setting change rate limiter (temperature drop)	Un\564	Un\596	Un\628	Un\660

For details on the function, refer to the following.
Page 196, Section 4.9

(b) Setting range

Set 0 or the value within the range 1 to 1000 (0.1% to 100.0%) toward the full scale of the set input range. When 0 is set, the setting is disabled.

(c) Default value

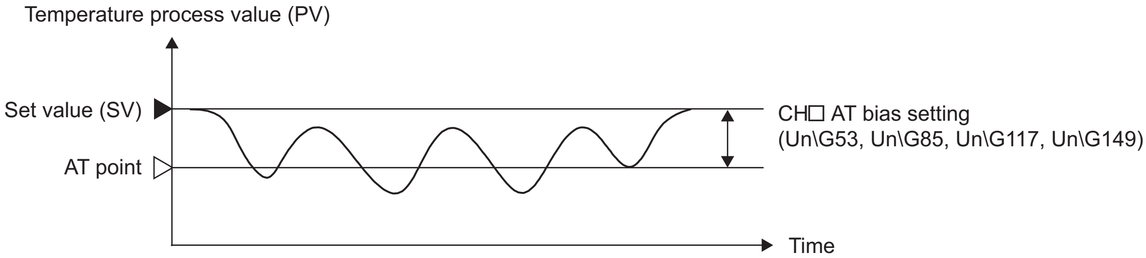
The default values are set to 0 in all channels.

(29)CH☐ AT bias setting (Un\G53, Un\G85, Un\G117, Un\G149) Common

The point set as the set value (SV) in the auto tuning can be rearranged by using this 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 (Un\G53, Un\G85, Un\G117, Un\G149) 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 182, Section 4.6

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 98, Section 3.4.2 (12))

Ex. When the value of the buffer memory is set as follows

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (temperature measurement range -200.0 to 400.0°C, resolution: 0.1)
  The setting range is -6000 to 6000.

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4). (Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(c) Default value

The default values are set to 0 in all channels.

(d) Precautions

For CH☐ AT bias setting (Un\G53, Un\G85, Un\G117, Un\G149), 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.

(30)CH□ Forward/reverse action setting (Un\G54, Un\G86, Un\G118, Un\G150)

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 258, Section 4.21

(a) Setting range

- 0: Forward action
- 1: Reverse action

(b) Default value

The default values are set to Reverse action (1) in all channels.

(31)CH□ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151) Common
CH□ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152) Common

Upper/lower limit value of the set value (SV) can be set.

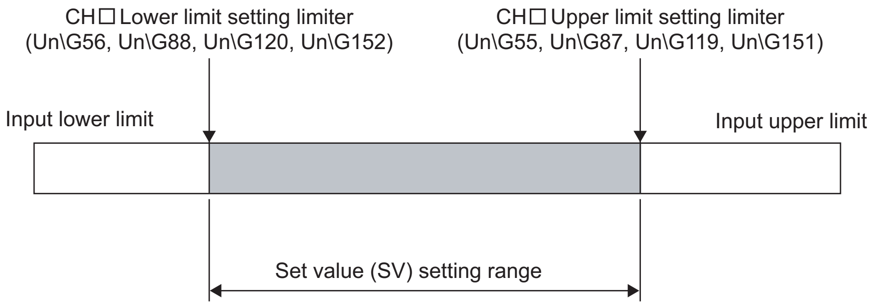
(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (Page 98, Section 3.4.2 (12))

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: □□□5_H) occurs.



(b) Setting unit

The value to be set differs depending on the stored value in CH□ Decimal point position (Un\G1 to Un\G4). (Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(c) Default value

A default value differs depending on modules to be used.

Buffer memory	Default value	
	Q64TCTTN/ Q64TCTTBWN	Q64TCRTN/ Q64TCRTBWN
CH□ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151)	1300	6000
CH□ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152)	0	-2000

(32)CH☐ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154)

Common

Set the set value in heater disconnection detection and off-time current error detection in percentage of the reference heater current value.

For details on the heater disconnection detection function, refer to the following.

☞Page 271, Section 4.28

For details on the output off-time current error detection function, refer to the following.

☞Page 275, Section 4.29

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

The setting range is 0 to 100 (%).

Ex. To generate Heater disconnection alert with the following conditions

- CT☐ Reference heater current value (Un\G280 to Un\G287): 100 (10.0A)
- When CT☐ Heater current process value (Un\G256 to Un\G263) is 80 (8.0A) or less, set CH☐ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154) to 80 (%).

$$\text{Heater disconnection alert setting} = 100 - \frac{\text{Reference heater current value} - \text{Heater current process value}}{\text{Reference heater current value}} \times 100 = 100 - \frac{100 - 80}{100} \times 100 = 80(\%)$$

When 0 is set, heater disconnection detection and off-time current error detection are not performed.

(c) Default value

The default values are set to 0 (%) in all channels.

(33)CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155) 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°C (°F) 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 259, Section 4.22

(a) Setting range

The setting range is 0 to 7200 (s).

Set a value that exceeds the time in which temperature changes by 2°C (°F).

(b) When performing auto tuning

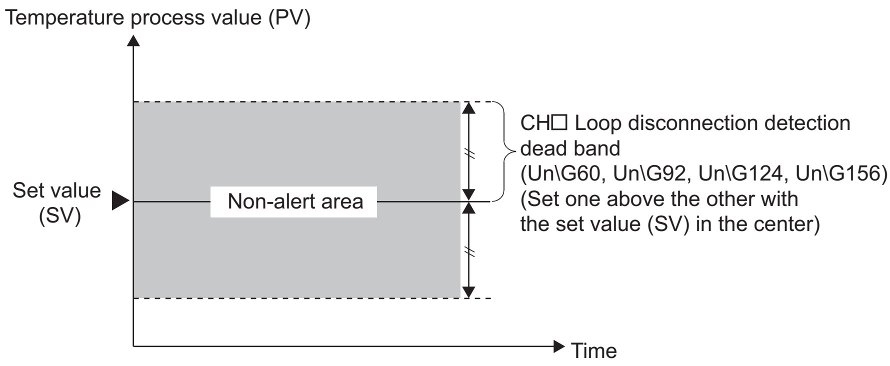
For this setting, the twice value of that of CH☐ Integral time (I) setting (Un\G36, Un\G68, Un\G100, Un\G132) is automatically set. (☞ Page 109, Section 3.4.2 (16)) However, when this setting is set to 0 (s) at the start of the auto tuning, Loop disconnection detection judgment time is not stored.

(c) Default value

The default values are set to 480 (s) in all channels.

(34)CH☐ Loop disconnection detection dead band (Un\G60, Un\G92, Un\G124, Un\G156) Standard

To prevent an error alarm 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 259, Section 4.22

(a) Setting range

The setting range is from 0 to full scale.

Ex. When the value of the buffer memory is set as follows

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (resolution: 0.1)
- CH☐ Loop disconnection detection dead band (Un\G60, Un\G92, Un\G124, Un\G156): 50
  (Loop disconnection detection dead band set value) × (resolution) = 50 × 0.1 = 5.0°C
  Within the range of the set value (SV) ±5.0°C, Loop disconnection is not detected.

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4).
(Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(c) Default value

The default values are set to 0 in all channels.

(35)CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) Common

Set this buffer memory area when treating channels that do not control temperature or are not connected with temperature sensors as "Unused". Setting them as unused channels stops detection of an alert.
For details on the unused channel setting, refer to the following.

☞Page 303, Section 5.5

(a) Setting range

- 0: Use
- 1: Unused

(b) Default value

The default values are set to Use (0) in all channels.

(c) ON of Default setting registration instruction (Yn9) (☞Page 60, Section 3.3.3 (5))

When Default setting registration instruction (Yn9) is turned on from off, CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is reset to Use (0).
Channels that do not control temperature or are not connected to temperature sensors needs to be set as unused channels again after settings of other buffer memory areas and non-volatile memories return to the default values. Set CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) to Unused (1) again.

(36)CH☐ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) Common

PID constants are read from an E^2PROM and stored in the buffer memory by using this instruction. Setting this buffer memory area to Requested (1) stores the value backed up in the E^2PROM in the buffer memory.

(a) Buffer memory areas to store set value of E^2PROM

The following table lists the buffer memory areas whose set value is read.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Proportional band (P) setting	Un\35	Un\67	Un\99	Un\131	Page 107, Section 3.4.2 (15)
CH☐ Heating proportional band (Ph) setting	Un\35	Un\67	Un\99	Un\131	
CH☐ Cooling proportional band (Pc) setting	Un\720	Un\736	Un\752	Un\768	
CH☐ Integral time (I) setting	Un\36	Un\68	Un\100	Un\132	Page 109, Section 3.4.2 (16)
CH☐ Derivative time (D) setting	Un\37	Un\69	Un\101	Un\133	Page 109, Section 3.4.2 (17)
CH☐ Loop disconnection detection judgment time	Un\59	Un\91	Un\123	Un\G155	Page 126, Section 3.4.2 (33)

(b) Setting range

- 0: Not requested
- 1: Requested

(c) Default value

The default values are set to Not requested (0) in all channels.

(d) Precautions

When Requested (1) is set, do not perform the following operations. An incorrect value may be stored in the E^2PROM.

- Change of the set value of the buffer memory read from the E^2PROM by this instruction (Page 129, Section 3.4.2 (36) (a))
- E^2PROM back up (Page 276, Section 4.30)
- Default setting registration (Page 60, Section 3.3.3 (5))
- Auto tuning (Page 182, Section 4.6)

Point

- When the initial setting by a programming tool is already configured, PID constants should be backed up to an E^2PROM after the auto tuning. Turning on this instruction at the next start-up can omits the auto tuning.
- This instruction is enabled in the setting mode or operation mode. (Page 58, Section 3.3.3 (1))
  However, it is disabled when CH☐ Auto tuning instruction (Yn4 to Yn7) is ON. (Page 182, Section 4.6)

(37)CH□ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159) Common

The set value to be stored in the buffer memory areas is automatically backed up to the E^2PROM by using this function. By reading the set value that is backed up, when the power is turned on from off or the CPU module is released from the reset status, another auto tuning can be omitted.
For details on the auto tuning function, refer to the following.

☞ Page 182, Section 4.6

(a) Buffer memory areas whose set value is backed up to the E^2PROM

The following table lists the buffer memory areas whose setting is backed up.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Proportional band (P) setting	Un\G35	Un\G67	Un\G99	Un\G131	Page 107, Section 3.4.2 (15)
CH□ Heating proportional band (Ph) setting	Un\G35	Un\G67	Un\G99	Un\G131	
CH□ Cooling proportional band (Pc) setting	Un\G720	Un\G736	Un\G752	Un\G768	
CH□ Integral time (I) setting	Un\G36	Un\G68	Un\G100	Un\G132	Page 109, Section 3.4.2 (16)
CH□ Derivative time (D) setting	Un\G37	Un\G69	Un\G101	Un\G133	Page 109, Section 3.4.2 (17)
CH□ Loop disconnection detection judgment time	Un\G59	Un\G91	Un\G123	Un\G155	Page 126, Section 3.4.2 (33)

(b) Setting range

- 0: Disable
- 1: Enable

(c) Default value

The default values are set to Disable (0) in all channels.

(d) Precautions

When Enable (1) is set, do not perform the following operations. An incorrect value may be stored in the E^2PROM.

- Changing the set value of the buffer memory
- E^2PROM back up (☞ Page 276, Section 4.30)
- Default setting registration (☞ Page 60, Section 3.3.3 (5))
- Change to Disable (0) during the auto tuning

(38)Alert dead band setting (Un\G164) Common

This setting is for using the alarm function.
For details on the alert function, refer to the following.

Page 200, Section 4.12

(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. (Page 98, Section 3.4.2 (12))

Ex. When the value of the buffer memory is set as follows

- CH□ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 2 (temperature measurement range 0 to 1300°C)
- Alert dead band setting (Un\G164): 5 (0.5%)
  (Full scale) × (Alert dead band) = (1300°C - 0°C) × 0.005 = 6.5°C
  The dead band is the alert set value (SV) ±6.5°C.

(b) Default value

The default value is set to 5 (0.5%).

(39)Number of alert delay (Un\G165) Common

Set the number of sampling for an alert judgment.
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 200, Section 4.12

(a) Setting range

The setting range is 0 to 255 (times).

(b) Default value

The default value is set to 0 (times).
Under 0 (times) condition, if the temperature process value (PV) enters the alert area, the alert status becomes active instantly.

(40)Heater disconnection/output off-time current error detection delay count (Un\G166) Common

Set the limit value for consecutive heater disconnection detections and output off-time current error detections so that the errors exceeding the limit value triggers an alert judgment.
For details on the heater disconnection detection function, refer to the following.

Page 271, Section 4.28

For details on the output off-time current error detection function, refer to the following.

Page 275, Section 4.29

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

The setting range is 3 to 255 (times).

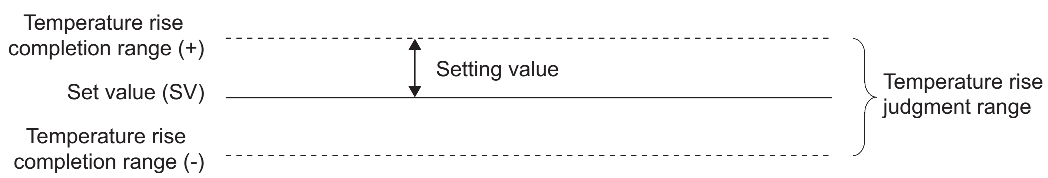
(c) Default value

The default value is set to 3 (times).

(41)Temperature rise completion range setting (Un\G167) Common

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) (Un\G9 to Un\G12) enters the temperature rise judgment range, CH☐ Temperature rise judgment flag (Un\G17 to Un\G20) is set to Within temperature rise completion range (1).
(Set the time from the temperature rise completion to Within temperature rise completion range (1) in Temperature rise completion soak time setting (Un\G168).)

(a) Setting range

- When the temperature unit of the input range is °C: 1 to 10 (°C)
- When the temperature unit of the input range is ℉: 1 to 10 (℉)
- Other than above: 1 to 10 (%) of the full scale

(b) Default value

The default value is set to 1.

(42)Temperature rise completion soak time setting (Un\G168) Common

Set the time for CH□ Temperature rise judgment flag (Un\G17 to Un\G20) (Page 93, Section 3.4.2 (6)) to be set to Within temperature rise completion range (1) after the completion of temperature rise.

(a) Setting range

The setting range is 0 to 3600 (min).

(b) Default value

The default value is set to 0 (min).

(43)PID continuation flag (Un\G169) Common

Set the operation status at the time when the mode has shifted from the operation mode to the setting mode (Setting/operation mode instruction (Yn1) ON → OFF).
For details on the relationship between this flag and the control status, refer to the following.

- PID control: Page 176, Section 4.3 (6)
- Temperature judgment: Page 89, Section 3.4.2 (3)
- Alert judgment: Page 209, Section 4.12 (5)

(a) Setting range

- 0: Stop
- 1: Continue

(b) Default value

The default value is set to Stop (0).

(44)Heater disconnection compensation function selection (Un\G170) Common

Set whether to use the heater disconnection compensation function or not.
For details on the heater disconnection compensation function, refer to the following.
Page 272, Section 4.28 (3)

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

- 0: Not use the heater disconnection compensation function
- 1: Use the heater disconnection compensation function

(c) Default value

The default value is set to Not use the heater disconnection compensation function (0).

(45)Transistor output monitor ON delay time setting (Un\G175) Common

Set the delay time of the ON delay output flag.

Set this buffer memory area to perform the heater disconnection detection with other input modules provided on the system.

For ON delay output flag, refer to the following.

☞ Page 94, Section 3.4.2 (7)

For details on the ON delay output function, refer to the following.

☞ Page 228, Section 4.17

(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) Default value

The default value is set to 0.

(46)CT monitor method switching (Un\G176) Common

Set the method for performing the heater current measurement.

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

- 0: ON/OFF current
- 1: ON current

When ON/OFF current (0) is set, the present current value of the current sensor (CT) is measured.

Selecting ON current (1) fixes the current value of the heater being OFF as the current value of the heater previously being ON.

(c) Default value

The default value is set to ON/OFF current (0).

(47)CH☐ Manipulated value (MV) for output with another analog module (Un\G177 to Un\G180) Standard
CH☐Manipulated value of heating (MVh) for output with another analog module (Un/G177 to Un\G180) Heating-cooling
CH☐ Manipulated value of cooling (MVc) for output with another analog module (Un\G708 to Un\G711) Heating-cooling

The values stored in the following buffer memory areas are converted for other analog modules such as a D/A converter module and stored in these buffer memory areas.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Manipulated value (MV)	Un\G13	Un\G14	Un\G15	Un\G16	Page 91, Section 3.4.2 (5)
CH☐ Manipulated value for heating (MVh)	Un\G13	Un\G14	Un\G15	Un\G16	
CH☐ Manipulated value for cooling (MVc)	Un\G704	Un\G705	Un\G706	Un\G707	

Un\G177 to Un\G180 are used for heating in the heating-cooling control.

The store range differs depending on the resolution set in the following 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 (Un\G181) (Page 136, Section 3.4.2 (48))

For details, refer to the following.

Page 227, Section 4.16 (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.

(48)Resolution of the manipulated value for output with another analog module (Un\G181) Common

Set the resolution of the following buffer memory areas. (Page 91, Section 3.4.2 (5))

- CH☐ Manipulated value (MV) (Un\G13 to Un\G16)
- CH☐ Manipulated value for heating (MVh) (Un\G13 to Un\G16)
- CH☐ Manipulated value for cooling (MVc) (Un\G704 to Un\G707)

For details, refer to the following.

Page 227, Section 4.16 (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 buffer memory areas.
(Page 135, Section 3.4.2 (47))

- CH☐ Manipulated value (MV) for output with another analog module (Un\G177 to Un\G180)
- CH☐ Manipulated value of heating (MVh) for output with another analog module (Un/G177 to Un\G180)
- CH☐ Manipulated value of cooling (MVc) for output with another analog module (Un\G708 to Un\G711)

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

The default value is set to 0 to 4000 (0).

(49)Cold junction temperature compensation selection (Un\G182) Common

Select whether to perform the cold junction temperature compensation using a standard terminal block or not to perform the cold junction temperature compensation.

(a) Supported modules

- Q64TCTTN
- Q64TCTTBWN

(b) Setting range

- 0: Use Standard Terminal Block
- 1: This setting cannot be used.
- 2: Not used the cold junction temperature compensation

(c) Default value

The default value is set to Use Standard Terminal Block (0).

(50)Control switching monitor (Un\G183) Common

The setting contents of the control mode selection set on Switch Setting are stored in this buffer memory area.
The control mode in operation can be confirmed.
The stored values and the contents are shown as below.

- 0: Standard control
- 1: Heating-cooling control (normal mode)
- 2: Heating-cooling control (expanded mode)
- 3: Mix control (normal mode)
- 4: Mix control (expanded mode)

Select the control mode on Switch Setting.
For details on the setting method, refer to the following.
Page 305, Section 6.2
For details on the control mode, refer to the following.
Page 168, Section 4.1

(51)CH□ Auto tuning mode selection (Un\G184 to Un\G187) Common

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 oscillates 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 182, Section 4.6

(a) Setting range

- 0: Standard mode
- 1: High response mode

(b) Default value

The default values are set to Standard mode (0) in all channels.

(52)CH□ Alert 1 mode setting (Un\G192, Un\G208, Un\G224, Un\G240) Common
CH□ Alert 2 mode setting (Un\G193, Un\G209, Un\G225, Un\G241) Common
CH□ Alert 3 mode setting (Un\G194, Un\G210, Un\G226, Un\G242) Common
CH□ Alert 4 mode setting (Un\G195, Un\G211, Un\G227, Un\G243) Common

Set the alert mode of alert 1 to 4.
For details on the alert function, refer to the following.
Page 200, Section 4.12

(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 buffer memory areas. Alert set values 1 to 4 respectively correspond to alert modes of alert 1 to 4.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Alert set value 1	Un\G38	Un\G70	Un\G102	Un\G134	Page 110, Section 3.4.2 (18)
CH□ Alert set value 2	Un\G39	Un\G71	Un\G103	Un\G135	
CH□ Alert set value 3	Un\G40	Un\G72	Un\G104	Un\G136	
CH□ Alert set value 4	Un\G41	Un\G73	Un\G105	Un\G137	

(b) Setting range

The following table lists set values and setting ranges which are available for alert set values set in each alert mode.

Set 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 98, Section 3.4.2 (12))
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 98, Section 3.4.2 (12))
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))	

Set value	Alert mode	Setting range of alert set value
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) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).
When the set value is out of the range, a write data error (error code: □□□4_H) occurs, and the Q64TCN operates with the previous set value. Turning Setting change instruction (YnB) OFF → ON → OFF after the error occurrence and setting a value within the range operate the Q64TCN with the new set value.

(d) Default value

The default values are set to 0 in all channels.

(53)CT□ Heater current process value (Un\G256 to Un\G263) Common

The heater current value which Q64TCTTBWN or Q64TCRTBWN detects is stored in this buffer memory area.
Values to be stored vary depending on the setting of CT□ CT selection (Un\G272 to Un\G279). (☞Page 142, Section 3.4.2 (55))

Setting of CT□ CT selection (Un\G272 to Un\G279)	Store range
When CTL-12-S36-8 is used (0.0 to 100.0A) (0)	0 to 1050 (0.0 to 105.0A)
When CTL-6-P(-H) is used (0.00 to 20.00A) (1)	0 to 2100 (0.00 to 21.00A)
When CT ratio setting is used (0.0 to 100.0A) (2)	0 to 1050 (0.0 to 105.0A)

- Q64TCTTBWN
- Q64TCRTBWN

Point

To perform the measurement of the heater current, the following buffer memory areas need to be set.

- CT□ CT input channel assignment setting (Un\G264 to Un\G271) (☞Page 141, Section 3.4.2 (54))
- CT□ Reference heater current value (Un\G280 to Un\G287) (☞Page 143, Section 3.4.2 (56))

If the both are set to 0, the heater current cannot be measured. If either of them is not set, the heater current cannot be measured precisely.

(54)CT☐ CT input channel assignment setting (Un\G264 to Un\G271) Common

Set the assignment of each current sensor (CT) input to the channels.

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Correspondence between CT input terminal and buffer memory address

CT input terminal	Buffer memory address
CT1	Un\G264
CT2	Un\G265
CT3	Un\G266
CT4	Un\G267
CT5	Un\G268
CT6	Un\G269
CT7	Un\G270
CT8	Un\G271

(c) Setting range

- 0: Unused
- 1: CH1
- 2: CH2
- 3: CH3
- 4: CH4

(d) Default value

The default values are set to Unused (0) for all terminals.

Point

- If a three-phase heater is used, the same channel should be assigned to two current sensor (CT) inputs.
  For setting examples, refer to the following.
  Page 302, Section 5.4.3
- In the heating-cooling control, CH3 and CH4 cannot be assigned to this setting.
  In the mix control, CH2 cannot be assigned to this setting.

(55)CT□ CT selection (Un\G272 to Un\G279) Common

Select the current sensor to be connected to each current sensor (CT) input.

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

- 0: When CTL-12-S36-8 is used (0.0 to 100.0A)
- 1: When CTL-6-P(-H) is used (0.00 to 20.00A)
- 2: When CT ratio setting is used (0.0A to 100.0A)

(c) Current sensor (CT) to be used and buffer memory setting

When using a current sensor (CT) other than CTL-12-S36-8 and CTL-6-P(-H), set the number of second-winding (turns) of the current sensor (CT) to be connected in CT□ CT ratio setting (Un\G288 to Un\G295). Set the buffer memory area as follows according to the specification of the current sensor (CT) to be used.

Current sensor (CT) to be used		CT□ CT Selection (Un\G272 to Un\G279)	CT□ CT ratio setting (Un\G288 to Un\G295) (Page 143, Section 3.4.2 (57))	Note
Products of U.R.D.Co., LTD.	CTL-12-S36-8	When CTL-12-S36-8 is used (0.0A to 100.0A) (0)	Setting not necessary	The product is discontinued, though it can be used.
	CTL-6-P	When CTL-6-P(-H) is used (0.00A to 20.00A) (1)	Setting not necessary	
	CTL-6-P-H	When CTL-6-P(-H) is used (0.00A to 20.00A) (1)	Setting not necessary	—
	CTL-12-S36-10	When CT ratio setting is used (0.0A to 100.0A) (2)	Set 1000, which is the number of second-winding (turns).	—
	CTL-12-S56-10	When CT ratio setting is used (0.0A to 100.0A) (2)	Set 1000, which is the number of second-winding (turns).	—
Other current sensors (CT)		When CT ratio setting is used (0.0A to 100.0A) (2)	Set the number of second-winding (turns) depending on the current sensor (CT) specification.	Current sensors (CT) whose number of second-winding (turns) is 600 to 9999 can be used.

For the URL of U.R.D.Co., LTD., refer to the following.

Page 33, Section 2.1 (6)

(d) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(e) Occurrence of write data error

In the following case, a write data error (error code: □□□4_H) occurs as when the setting is out of the setting value. Write error flag (Xn2) turns on and the error code is stored in Write data error code (Un\G0).

- When the set value of CT□ CT ratio setting (Un\G288 to Un\G295) is out of the setting when Setting change instruction (YnB) is turned OFF → ON → OFF

(f) Default value

The default values are set to When CTL-12-S36-8 is used (0.0 to 100.0A) (0) for all terminals.

Point

When CT ratio setting is used (0.0 to 100.0A) (2) is selected, the setting of CT☐ CT ratio setting (Un\G288 to Un\G295) is enabled. In advance, set CT☐ CT ratio setting (Un\G288 to Un\G295) corresponding to the sensor to be connected. After that, select When CT ratio setting is used (0.0 to 100.0A) (2).

(56)CT☐ Reference heater current value (Un\G280 to Un\G287) Common

Set the reference value of CT☐ Heater current process value (Un\G256 to Un\G263) of when the heater is turned on (Page 140, Section 3.4.2 (53)).

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

The setting range is within the heater current range of the current sensor selected in CT☐ CT selection (Un\G272 to Un\G279). (Page 142, Section 3.4.2 (55))

Setting of CT☐ CT selection (Un\G272 to Un\G279)	Setting range
• When CTL-12-S36-8 is used (0.0 to 100.0A) (0) • When CT ratio setting is used (0.0 to 100.0A) (2)	0 to 1000 (0.0 to 100.0A)
When CTL-6-P(-H) is used (0.00 to 20.00A) (1)	0 to 2000 (0.00 to 20.00A)

(c) Default value

The default values are set to 0 (0.0A) for all terminals.

(57)CT☐ CT ratio setting (Un\G288 to Un\G295) Common

Set the number of second-winding (turning number) of the current sensor (CT) to be connected.
This buffer memory area is available only when CT☐ CT selection (Un\G272 to Un\G279) is set to When CT ratio setting is used (0.0 to 100.0A) (2). (Page 142, Section 3.4.2 (55))

(a) Supported modules

- Q64TCTTBWN
- Q64TCRTBWN

(b) Setting range

The setting range is 600 to 9999.

(c) Default value

The default values are set to 800 for all terminals.

(58)CH☐ Sensor two-point correction offset value (measured value) (Un\G544, Un\G576, Un\G608, Un\G640) Common

The measured value of temperature corresponding to the offset value of the sensor two-point correction is stored in this buffer memory area.

The value to be stored differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4). (☞ Page 88, Section 3.4.2 (2))

- No decimal place (0): stored as it is.
- One decimal place (1): stored after a multiplication by 10.

For details on the sensor two-point correction function, refer to the following.

☞ Page 219, Section 4.14 (2)

(a) Enablement of the stored value

Turn Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF) to enable stored contents.

(59)CH☐ Sensor two-point correction offset value (corrected value) (Un\G545, Un\G577, Un\G609, Un\G641) 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 219, Section 4.14 (2)

(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (☞ Page 98, Section 3.4.2 (12))

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4). (☞ Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(c) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(d) Default value

The default values are set to 0 in all channels.

(60)CH☐ Sensor two-point correction gain value (measured value) (Un\G546, Un\G578, Un\G610, Un\G642) Common

The measured value of temperature corresponding to the gain value of the sensor two-point correction is stored in this buffer memory area.

The value to be stored differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4). (Page 88, Section 3.4.2 (2))

- No decimal place (0): stored as it is.
- One decimal place (1): stored after a multiplication by 10.

For details on the sensor two-point correction function, refer to the following.

Page 219, Section 4.14 (2)

(a) Enablement of the stored value

Turn Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF) to enable stored contents.

(61)CH☐ Sensor two-point correction gain value (corrected value) (Un\G547, Un\G579, Un\G611, Un\G643) 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 219, Section 4.14 (2))

(a) Setting range

The setting range is identical to the temperature measurement range of the set input range. (Page 98, Section 3.4.2 (12))

(b) Setting unit

The value to be set differs depending on the stored value in CH☐ Decimal point position (Un\G1 to Un\G4). (Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(c) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(d) Default value

The default values are set to 0 in all channels.

(62)CH☐ Sensor two-point correction offset latch request (Un\G548, Un\G580, Un\G612, Un\G644) Common

This request is for storing temperature process value (PV) as sensor two-point correction offset value to the following buffer memory area.

- CH☐ Sensor two-point correction offset value (measured value) (Un\G544, Un\G576, Un\G608, Un\G640) (☞Page 144, Section 3.4.2 (58))

For details on the sensor two-point correction function, refer to the following.

☞Page 219, Section 4.14 (2)

(a) Setting range

- 0: No request
- 1: Latch request

(b) Default value

The default values are set to No request (0) in all channels.

(63)CH☐ Sensor two-point correction offset latch completion (Un\G549, Un\G581, Un\G613, Un\G645) Common

When sensor two-point correction offset value is stored, 1 is stored in this buffer memory area, which is Latch completed (1).

When CH☐ Sensor two-point correction offset latch request (Un\G548, Un\G580, Un\G612, Un\G644) is set to No request (0), 0 is stored in this buffer memory area, which is No request (0). (☞Page 146, Section 3.4.2 (62))

For details on the sensor two-point correction function, refer to the following.

☞Page 219, Section 4.14 (2)

(64)CH☐ Sensor two-point correction gain latch request (Un\G550, Un\G582, Un\G614, Un\G646) Common

This is a request for storing temperature process value (PV) as sensor two-point correction gain value to the following buffer memory area.

- CH☐ Sensor two-point correction gain value (measured value) (Un\G546, Un\G578, Un\G610, Un\G642) (☞Page 145, Section 3.4.2 (60))

For details on the sensor two-point correction function, refer to the following.

☞Page 219, Section 4.14 (2)

(a) Setting range

- 0: No request
- 1: Latch request

(b) Default value

The default values are set to No request (0) in all channels.

(65)CH□ Sensor two-point correction gain latch completion (Un\G551, Un\G583, Un\G615, Un\G647) Common

When sensor two-point correction gain value is stored, 1 is stored in this buffer memory area, which is Latch completed (1).
When CH□ Sensor two-point correction gain latch request (Un\G550, Un\G582, Un\G614, Un\G646) is set to No request (0), 0 is stored in this buffer memory area, which is No request (0). (Page 146, Section 3.4.2 (64))
For details on the sensor two-point correction function, refer to the following.
Page 219, Section 4.14 (2)

(66)During AT loop disconnection detection function enable/disable setting (Un\G571) Standard

Set whether to enable or disable the loop disconnection detection function during auto tuning.
For details on the during AT loop disconnection detection function, refer to the following.
Page 261, Section 4.23

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 b15 to b4 are fixed to 0.

(a) Setting range

- 0: Disable
- 1: Enable

(b) Default value

The default values are set to Disable (0) in all channels.

(67)CH□ AT simultaneous temperature rise parameter calculation flag (Un\G573, Un\G605, Un\G637, Un\G669) Standard

The status when simultaneous temperature rise AT (auto tuning) calculates simultaneous temperature rise parameter is stored in this buffer memory area.

- 0: OFF
- 1: ON

b15						to						b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	0			

Bit data from b15 to b3 are fixed to 0.

Bit	Flag name	Description
b0	AT simultaneous temperature rise parameter calculation completion	This flag is set to 1 (ON) when the simultaneous temperature rise parameter*1 is calculated by simultaneous temperature rise AT.
b1	AT simultaneous temperature rise parameter calculation error status	This flag is set to 1 (ON) when the simultaneous temperature rise parameter*1 cannot be calculated by simultaneous temperature rise AT.
b2	Simultaneous temperature rise AT disable status	This flag is set to 1 (ON) when the simultaneous temperature rise AT cannot be performed.
b3 to b15	— (fixed to 0)	— (Unused)

*1 Indicates the values of CH☐ Simultaneous temperature rise gradient data (Un\G731, Un\G747, Un\G763, Un\G779) and CH☐ Simultaneous temperature rise dead time (Un\G732, Un\G748, Un\G764, Un\G780).

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 244, Section 4.20

(68)CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) Standard

Perform operation setting of self-tuning with this buffer memory area.

For details on the self-tuning function, refer to the following.

Page 229, Section 4.18

(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)

The simultaneous temperature rise parameter *1 can be calculated during the self-tuning setting depending on the setting.

*1 Indicates the values of CH☐ Simultaneous temperature rise gradient data (Un\G731, Un\G747, Un\G763, Un\G779) and CH☐ Simultaneous temperature rise dead time (Un\G732, Un\G748, Un\G764, Un\G780) to be used in the simultaneous temperature rise function.

For details on the simultaneous temperature rise function, refer to the following.

Page 244, Section 4.20

(b) 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

(69)CH☐ Self-tuning flag (Un\G575, Un\G607, Un\G639, Un\G671) Standard

The execution status of self-tuning can be monitored in this buffer memory area.
For details on the self-tuning function, refer to the following.

Page 229, Section 4.18

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 value turns to 1 (ON)	Condition on which value turns to 0 (OFF)
b0	PID auto-correction status	This flag is set to 1 (ON) when PID constants are corrected by the self-tuning.	This flag is set to 0 (OFF) when either of the following operation is performed. • When the operation mode shifts to the setting mode by turning off from on Setting/operation mode instruction (Yn1) • When CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1) • When CH☐ PID control forced stop instruction (YnC to YnF) is turned on from off • When CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) is set to Do not run the ST (0) This flag is also set to 0 (OFF) in the following cases. • When the self-tuning starts by changing the set value (SV) • When the vibration ST starts by vibration caused by disturbance of the process value (PV)
b1	Simultaneous temperature rise parameter correction status	This flag is set to 1 (ON) when simultaneous temperature rise parameter*1 is corrected by self-tuning.	
b2 to b7	— (fixed to 0)	— (Unused)	—
b8	Self-tuning disable status	This flag is set to 1 (ON) when the self-tuning cannot be performed.	This flag is set to 0 (OFF) when either of the following operation is performed. • When the operation mode shifts to the setting mode by turning off from on Setting/operation mode instruction (Yn1) • When CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1) • When CH☐ PID control forced stop instruction (YnC to YnF) is turned on from off • When CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) is set to Do not run the ST (0) This flag is also set to 0 (OFF) when all disable conditions are released. For disable conditions, refer to Page 235, Section 4.18 (6).

<table>
<tr><th>Bit</th><th>Flag name</th><th>Condition on which value turns to 1 (ON)</th><th>Condition on which value turns to 0 (OFF)</th></tr>
<tr><td>b9</td><td>Simultaneous temperature rise parameter error status</td><td>This flag is set to 1 (ON) when simultaneous temperature rise parameter[*1] cannot be calculated by self-tuning.</td><td rowspan="2">This flag is set to 0 (OFF) when either of the following operation is performed.
• When the operation mode shifts to the setting mode by turning off from on Setting/operation mode instruction (Yn1)
• When CH□ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1)
• When CH□ PID control forced stop instruction (YnC to YnF) is turned on from off
• When CH□ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) is set to Do not run the ST (0)
This flag is also set to 0 (OFF) in the following cases.
• When the self-tuning starts by changing the set value (SV)
• When the vibration ST starts by vibration caused by disturbance of the process value (PV)</td></tr>
<tr><td>b10</td><td>Self-tuning error</td><td>This flag is set to 1 (ON) when either of the following operation is performed during the self-tuning.[*2]
• Set value (SV) setting change (only during starting)
• PID constants change
• Setting change rate limiter change
• Output limiter change
• Output variation limiter change
• Control output cycle change
• Sensor correction change
• Primary delay digital filter change
• AUTO to MAN mode shift
• Forward/reverse action shift
This flag is also set to 1 (ON) in the following cases
• When 6000 seconds (1 hour 40 minutes) or more have elapsed from the start of self-tuning
• When the change rate of the process value (PV) during self-tuning is less than 1.125°C/minute
• When the temperature process value (PV) is out of the temperature measurement range
• When required measurement data is not obtained because the manipulated value (MV) does not reach the upper limit output limiter value or the lower limit output limiter value until the measurement is completed
• When the temperature process value (PV) decreases by 1°C (℉) or more though it should increase after the self-tuning is started as the starting ST
• When temperature process value (PV) increases by 1°C (℉) or more though it should decrease after the self-tuning is started as the starting ST</td></tr>
<tr><td>b11 to b15</td><td>— (fixed to 0)</td><td>— (Unused)</td><td>—</td></tr>
</table>

*1 Indicates the values of CH□ Simultaneous temperature rise gradient data (Un\G731, Un\G747, Un\G763, Un\G779) and CH□ Simultaneous temperature rise dead time (Un\G732, Un\G748, Un\G764, Un\G780).
For details on the simultaneous temperature rise function, refer to the following. Page 244, Section 4.20.

*2 If conditions other than above lead to 1 (ON), also check the following table depending on the set content in CH□ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670).

Set content in CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670)	Check description
1: Starting ST (PID constants only)	• Check the control loop for wiring problems. • Switch CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) to "4: Starting ST plus vibration ST (PID constants only)" to perform control.
3: Starting ST (PID constants and simultaneous temperature rise parameter)	• Check the control loop for wiring problems. • Save the calculated simultaneous temperature rise parameter, if any. Then, switch CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) to "4: Starting ST plus vibration ST (PID constants only)" to perform control. If no simultaneous temperature rise parameter is calculated, check the control loop for wiring problems.

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

(70)CH☐ Temperature process value (PV) for input with another analog module (Un\G689 to Un\G692) Common

Digital input value of the current/voltage converted in another analog module (such as A/D conversion module) connected to the system can be used as a temperature process value (PV).
Store digital input values of current/voltage converted by another analog module (such as A/D conversion module) in this area.
For details, refer to the following.

☞ Page 227, Section 4.16 (1)

Point

If a stored value is out of the set input range, the value to be used in control is fixed to the upper limit value or the lower limit value of the input range.

(71)CH☐ Temperature conversion setting (Un\G695 to Un\G697) 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 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	—	—	—	Un\G695	—
CH3	—	Un\G696	—	—	—
CH4	—	Un\G697	—	—	—

When the combination of the control mode and the buffer memory address is not the setting target in the above list, the combination is invalid even if it is set.
For details on the temperature conversion function (using unused channels), refer to the following.

☞ Page 268, Section 4.27

(a) Setting range

- 0: Not use
- 1: Use

(b) Default value

The default values are set to Not use (0) in all channels.

Point

- When this setting is set from Not use (0) to Use (1), after completion of the first temperature conversion, Temperature conversion completion flag (Un\G786) is set to First temperature conversion completed (1_H). Before referring to the temperature process value (PV) of each channel, check Temperature conversion completion flag (Un\G786) has been set to First temperature conversion completed (1_H).
- When the following control mode is selected, this setting is invalid.
  - Standard control
  - Heating-cooling control (expanded mode)
  - Mix control (expanded mode)

(72)CH□ Number of moving averaging (Un\G698 to Un\G701) 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 197, Section 4.10

This setting is enabled only when Enable (0) is set to Moving Averaging Process Setting in the intelligent function module switch setting. If Disable (1) is set to Moving Averaging Process Setting, this setting is ignored.
For details on the intelligent function module switch setting, refer to the following.

☞ Page 305, Section 6.2

(a) Setting range

2 to 10 (times)

(b) Default value

2 (times) are set in all channels as default values.

(73)Cooling method setting (Un\G719) 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 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 264, Section 4.25

(a) Setting range

- 0_H: Air cooled
- 1_H: Water cooled
- 2_H: Linear

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

The default value is set to Air cooled (0_H).

(74)CH☐ Overlap/dead band function (Un\G723, Un\G739, Un\G755, Un\G771) Heating-cooling

Configure the overlap/dead band setting.

For details on the overlap/dead band function, refer to the following.

☞ Page 265, Section 4.26

(a) Setting range

Set the value within the following ranges for the full scale of the set input range. (☞ Page 98, Section 3.4.2 (12))

- -100 to -1 (-10.0% to -0.1%): Overlap
- 0 (0.0%): None
- 1 to 100 (0.1% to 10.0%): Dead band

(b) Default value

The default values are set to 0 (0.0%) in all channels.

(75)CH☐ Manual reset amount setting (Un\G724, Un\G740, Un\G756, Un\G772) Common

Set the amount of the proportional band (P) to be moved.

For details on the manual reset function, refer to the following.

☞ Page 179, Section 4.4

(a) Setting range

Set the value within the range of -1000 to 1000 (-100.0% to 100.0%) for the full scale of the set input range. (☞ Page 98, Section 3.4.2 (12))

The setting range is the same between the standard control and heating-cooling control.

(b) 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.

(76)CH☐ Process value (PV) scaling function enable/disable setting (Un\G725, Un\G741, Un\G757, Un\G773) 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 198, Section 4.11

(a) Setting range

- 0: Disable
- 1: Enable

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

The default values are set to Disable (0) in all channels.

(77)CH☐ Process value (PV) scaling lower limit value (Un\G726, Un\G742, Un\G758, Un\G774) Common
CH☐ Process value (PV) scaling upper limit value (Un\G727, Un\G743, Un\G759, Un\G775) 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 198, Section 4.11

(a) Setting range

The setting range is -32000 to 32000.

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(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 198, Section 4.11 (2)

(78)CH☐ Process value (PV) scaling value (Un\G728, Un\G744, Un\G760, Un\G776) Common

When the temperature process value (PV) scaling function is enabled, the scaled temperature process value (PV) is stored.
For details on the temperature process value (PV) scaling function, refer to the following.

Page 198, Section 4.11

(79)CH☐ Derivative action selection (Un\G729, Un\G745, Un\G761, Un\G777) Common

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 195, Section 4.8

(a) Setting range

- 0: Measured value derivation
- 1: Deviation derivation

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

All channels are set to Measured value derivation (0).

(80)CH☐ Simultaneous temperature rise group setting (Un\G730, Un\G746, Un\G762, Un\G778) 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 244, Section 4.20

(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) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(d) Default value

The default values are set to No simultaneous temperature rise (0) in all channels.

(81)CH☐ Simultaneous temperature rise gradient data (Un\G731, Un\G747, Un\G763, Un\G779) Standard

Set Simultaneous temperature rise gradient data (temperature rising per minute).
For details on the simultaneous temperature rise function, refer to the following.

Page 244, Section 4.20

(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 (Un\G1 to Un\G4).
(Page 88, Section 3.4.2 (2))

- No decimal place (0): Set a value in 1°C (°F or digit) unit.
- One decimal place (1): Set a value in 0.1°C (°F) unit (tenfold value).

(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.

(82)CH□ Simultaneous temperature rise dead time (Un\G732, Un\G748, Un\G764, Un\G780) 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 244, Section 4.20

(a) Setting range

The setting range is 0 to 3600 (s).

(b) Default value

The default values are set to 0 (s) 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.

(83)CH□ Simultaneous temperature rise AT mode selection (Un\G733, Un\G749, Un\G765, Un\G781) Standard

Select mode of the auto tuning.

For details on the auto tuning function, refer to the following.

Page 182, Section 4.6

For details on the simultaneous temperature rise function, refer to the following.

Page 244, Section 4.20

(a) Setting range

- 0: Select normal auto tuning
- 1: Simultaneous temperature rise AT

(b) Default value

The default values are set to Select normal auto tuning (0) in all channels.

Point

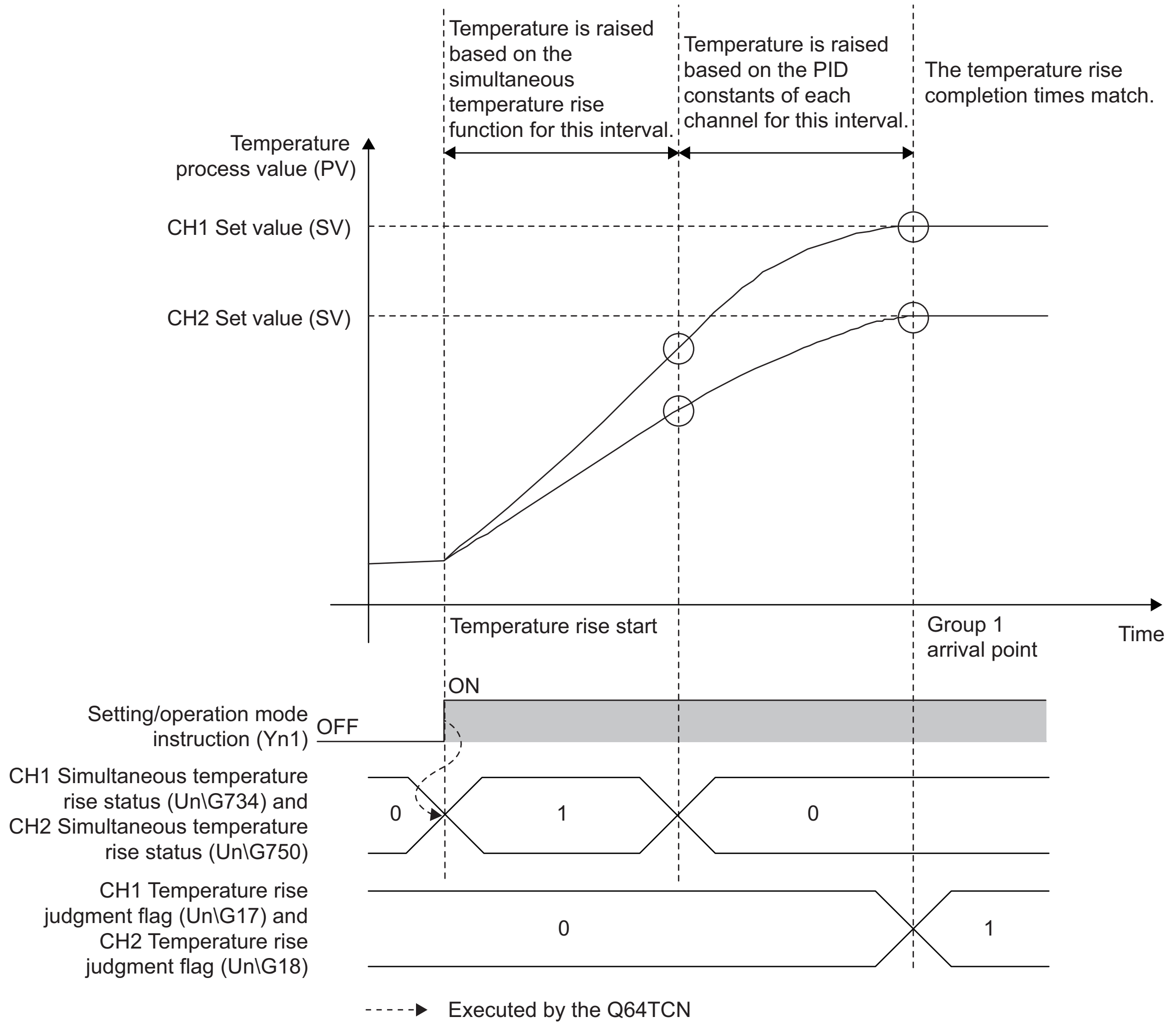
- This setting can be used with the setting of CH□ Auto tuning mode selection (Un\G184 to Un\G187). (Page 138, Section 3.4.2 (51))
- If this setting is changed during the auto tuning, it is enabled in the next auto tuning.

(84)CH□ Simultaneous temperature rise status (Un\G734, Un\G750, Un\G766, Un\G782) Standard

The execution state of the simultaneous temperature rise is monitored.

- 0: Simultaneous temperature rise not in process
- 1: Simultaneous temperature rise in process

During control by the simultaneous temperature rise function, Simultaneous temperature rise in process (1) is stored in this buffer memory area.
The following figure shows the timing when the value is set to Simultaneous temperature rise not in process (0).
(In the following, CH1 and CH2 are set to group 1. (Page 156, Section 3.4.2 (80)))



Completion of the temperature rise does not set CH□ Simultaneous temperature rise status (Un\G734, Un\G750, Un\G766, Un\G782) to Simultaneous temperature rise not in process (0). As in the figure above, the temperature rise is performed by the simultaneous temperature rise function to a certain point, and Simultaneous temperature rise in process (1) is set during the performance. After the point, the temperature rise is performed based on the PID constants of each channel, and Simultaneous temperature rise not in process (0) is set.

For details on the simultaneous temperature rise function, refer to the following.
Page 244, Section 4.20

(85)CH☐ Setting change rate limiter time unit setting (Un\G735, Un\G751, Un\G767, Un\G783) Common

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 196, Section 4.9

(a) Setting range

- 0 (Not use time unit setting)
- 1 to 3600 (1 to 3600s)

A setting of 0 results in the same operation with the setting of 60 corresponding to one minute.

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

The default values are set to 0 (Not use time unit setting) in all channels.

Remark

When 0 is set, the Q64TCN operation is the same as the case when 60, a variation per minute, is set.

(86)Peak current suppression control group setting (Un\G784) 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 239, Section 4.19

(a) Setting range

- 0_H: Not divide
- 1_H: Group 1
- 2_H: Group 2
- 3_H: Group 3
- 4_H: Group 4

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

The default value is set to Not divide (0_H).

Point

The division number depends on this setting. The upper limit output limiter value is automatically set to correspond to the specified division number.
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 (Un\G42, Un\G74, Un\G106, Un\G138) (Page 112, Section 3.4.2 (19))
2	500 (50.0%)
3	333 (33.3%)
4	250 (25.0%)

CH☐ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139) is set to 0.

(87)Sensor correction function selection (Un\G785) 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 215, Section 4.14

(a) Setting range

- 0_H: Normal sensor correction (one-point correction)
- 1_H: Sensor two-point correction

(b) Enablement of setting contents

Enable the setting contents by turning Setting change instruction (YnB) OFF → ON → OFF during the setting mode (Setting/operation mode status (Xn1): OFF).

(c) Default value

Default value is set to Normal sensor correction (one-point correction) (0_H).

(88)Temperature conversion completion flag (Un\G786) Common

This flag checks whether the temperature conversion has started properly for each channel. The following values are stored in this buffer memory area.

- 0_H: During conversion or unused CH
- 1_H: First temperature conversion completed

This flag becomes During conversion or unused CH (0_H) during temperature conversion or for unused channels.

When the first temperature conversion is completed and the temperature process value (PV) is stored in the buffer memory, First temperature conversion completed (1_H) is set.

The following figure shows the channel assignment of this area.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

(89)Function extension bit monitor (Un\G787) Common

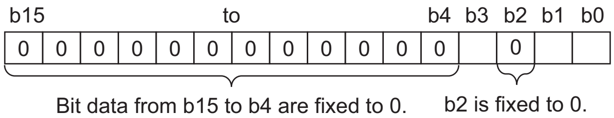
The following settings configured on Switch Setting are stored.

- "Auto-setting at Input Range Change"
- "Setting Change Rate Limiter"
- "Moving Averaging Process Setting"

For details on Switch Setting, refer to the following.

Page 305, Section 6.2

The following figure and table show how the setting is stored.



Bit	Flag name (Function extension bit monitor)	Description
b0	Auto-setting at input range change	When the input range is changed, the related buffer memory data is automatically changed to prevent the values in those buffer memory areas from being out of the setting range. (Page 103, Section 3.4.2 (12) (d)) 0: Disable 1: Enable
b1	Setting change rate limiter	Select whether the setting change rate limiter to be set in a batch or individually. (Page 196, Section 4.9) 0: Temperature Rise/Temperature Drop Batch Setting 1: Temperature Rise/Temperature Drop Individual Setting
b2	— (fixed to 0)	— (Unused)
b3	Moving averaging process setting	Select whether the moving averaging process setting is used. (Page 197, Section 4.10) 0: Enable 1: Disable
b4 to b15	— (fixed to 0)	— (Unused)

(90)CH□ AT error status monitor (Un\G789 to Un\G792) Common

The completion status of the auto tuning can be monitored with these areas. The bit corresponding to the error status turns 1 (ON).

For details on the auto tuning function, refer to the following.

Page 182, Section 4.6

b15	to		b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0												

Bit data from b12 to b15 are fixed to 0.

Bit	Error status	Action
b0	The temperature process value (PV) became out of the temperature measurement range.	Perform auto tuning again observing the points below. • Set the AT bias so that the temperature process value (PV) during auto tuning does not exceed or fall below the temperature measurement range. (Page 122, Section 3.4.2 (29)) • Check the value of upper limit output limiter and if the value is 1000 (100.0%) or greater, correct the value. (Page 112, Section 3.4.2 (19)) • For a controlled object with a high response, if Auto tuning mode selection is set to Standard mode, the temperature process value (PV) may become out of the temperature measurement range. In such case, change Auto tuning mode selection to High response mode. (Page 138, Section 3.4.2 (51))
b1	The set value (SV) or the AT point became out of the range of upper and lower limit setting limiters.	Correct the set value (SV) setting, the AT bias, or the upper/lower limit setting limiter so that the set value (SV) or the AT point becomes within the range of upper and lower limit setting limiters, and perform auto tuning again. (Page 106, Section 3.4.2 (14), Page 122, Section 3.4.2 (29), Page 124, Section 3.4.2 (31))
b2	The proportional band (P) or the heating proportional band (Ph) was changed to 0.	Set the proportional band (P) or the heating proportional band (Ph) to a value other than 0 and perform auto tuning again. (Page 107, Section 3.4.2 (15))
b3	During auto tuning, a buffer memory area for which the change during AT execution is prohibited was changed.	Perform auto tuning again. During auto tuning, do not change a buffer memory area for which the change during AT execution is prohibited.*1
b4	The time below exceeded two hours.*2 • Time from the start of auto tuning until the temperature process value (PV) reaches the set value (SV) for the first time • A half the hunting cycle of the temperature process value (PV)	Perform auto tuning again observing the points below. • Check that a heater is powered on. • Stop the control of an adjacent controlled object and perform auto tuning on a controlled object individually because the temperature of the controlled object may be affected by ambient environment and thus tend to not fall.

Bit	Error status	Action
b5	The calculated value of the proportional band (P) became out of the range. (Proportional band (P) < 1 (0.1%))	Perform the following operations and perform auto tuning again. Error cause: The amplitude of control response during auto tuning is small. • Check the value of upper limit output limiter and if the value is smaller than 1000 (100.0%), correct the value. (Page 112, Section 3.4.2 (19)) • Check the value of lower limit output limiter and if the value is greater than 0 (0.0%), correct the value. (Page 112, Section 3.4.2 (19)) • Change the input range to narrow the temperature measurement range. (Page 98, Section 3.4.2 (12))
b6	The calculated value of the proportional band (P) became out of the range. (Proportional band (P) ≥ 10001 (1000.1%))	Perform the following operation and perform auto tuning again. Error cause: The amplitude of control response during auto tuning is large. • Correct the values of upper limit output limiter and lower limit output limiter so that the amplitude of control response during auto tuning becomes small. (Page 112, Section 3.4.2 (19))
b7	The calculated value of the integral time (I) became out of the range. (Integral time (I) < 1 (1s))	Perform the following operations and perform auto tuning again. Error cause: The vibration cycle of control response during auto tuning is short. • Correct the values so that the upper limit output limiter becomes large and the lower limit output limiter becomes small. (Page 112, Section 3.4.2 (19)) • Check Auto tuning mode selection and if it is set to High response mode, change it to Standard mode. (Page 138, Section 3.4.2 (51))
b8	The calculated value of the integral time (I) became out of the range. (Integral time (I) ≥ 3601 (3601s))	Perform the following operations and perform auto tuning again. Error cause: The vibration cycle of control response during auto tuning is long. • Check and correct the value of primary delay digital filter. (Page 117, Section 3.4.2 (24)) • Check and correct the value of number of moving averaging. (Page 153, Section 3.4.2 (72)) [When the temperature process value (PV) does not fall after it has reached to the set value (SV)] • Check the value of lower limit output limiter and if the value is greater than 0 (0.0%), correct the value. (Page 112, Section 3.4.2 (19)) • The temperature of the controlled object may be affected by ambient environment and thus tend to not fall. Stop the control of an adjacent controlled object and perform auto tuning on a controlled object individually. [When the temperature process value (PV) does not rise after it has reached to the set value (SV)] • Check the value of upper limit output limiter and if the value is smaller than 1000 (100.0%), correct the value. (Page 112, Section 3.4.2 (19))

Bit	Error status	Action
b9	The calculated value of the derivative time (D) became out of the range. (Derivative time (D) ≥ 3601 (3601s))	Perform the following operation and perform auto tuning again. Error cause: The vibration cycle of control response during auto tuning is long. • Correct the relevant settings so that the derivative time (D) is 3600 (3600s) or smaller. (Page 109, Section 3.4.2 (17))
b10	In heating-cooling control, the calculated value of the cooling proportional band (Pc) became out of the range. (Cooling proportional band (Pc) < 1 (0.1%))	Perform the following operations and perform auto tuning again. Error cause: The undershoot amount of control response during auto tuning is small. • Check the value of cooling upper limit output limiter and if the value is smaller than 1000 (100.0%), correct the value. (Page 112, Section 3.4.2 (19)) • Change the input range to narrow the temperature measurement range. (Page 98, Section 3.4.2 (12))
b11	In heating-cooling control, the calculated value of the cooling proportional band (Pc) became out of the range. (Cooling proportional band (Pc) ≥ 10001 (1000.1%))	Perform the following operation and perform auto tuning again. Error cause: The undershoot amount of control response during auto tuning is large. • Correct the values of heating upper limit output limiter and cooling upper limit output limiter so that the amplitude of control response during auto tuning becomes small. (Page 112, Section 3.4.2 (19))
b12 to b15	Unused (fixed to 0)	

*1 For buffer memory areas for which the change is prohibited, refer to the following.
Page 191, Section 4.6 (7) (b)
Note that CH☐ Unused channel setting is excluded.

*2 If the setting change rate limiter is not equal to 0, the time monitoring starts when "Set value (SV) monitor" becomes equal to "AT point".

(a) Clearing the bit

The following are how to clear the bits described above.

- Perform auto tuning again.
- Turn on and off Error reset instruction (Yn2).

(91)Latest address of error history (Un\G1279) Common

The latest address of error history is stored.

The maximum of 16 errors and alarms occurred in the module are recorded.

Page 278, Section 4.31

(92)Error history 1 to 16 (Un\G1280 to Un\G1407) Common

The maximum of 16 errors and alarms occurred in the module are recorded.

Ex. For the error history 1

Buffer memory address	b15 to b8	b7 to b0
Un\G1280	Error code*1	
Un\G1281	First two digits of the year	Last two digits of the year
Un\G1282	Month	Day
Un\G1283	Hour	Minute
Un\G1284	Second	Day of the week *2
Un\G1285 to Un\G1287	System area	

*1 For error codes and alarm codes, refer to the following.

Page 373, Section 8.6, Page 376, Section 8.7

*2 The following table lists the stored value and corresponding each day of the week.

Stored value	Day of the week
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

For details on the error history function, refer to the following.

Page 278, Section 4.31

Memo

CHAPTER 4 FUNCTIONS

This chapter explains functions of the Q64TCN.

Point

For the functions indicated with the icon 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

4.1 Control Mode Selection Function

Common

A control mode can be selected using this function.This section explains selectable control modes of the Q64TCN.

(1) Standard control and heating-cooling control

There are two types of control modes in the Q64TCN: 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.
Select the control mode on Switch Setting.
For details on the setting method, refer to the following.

Page 305, Section 6.2

Control mode	Contents	Number of controllable 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 and others in the system.	Standard control 2 loops Heating-cooling control 2 loops

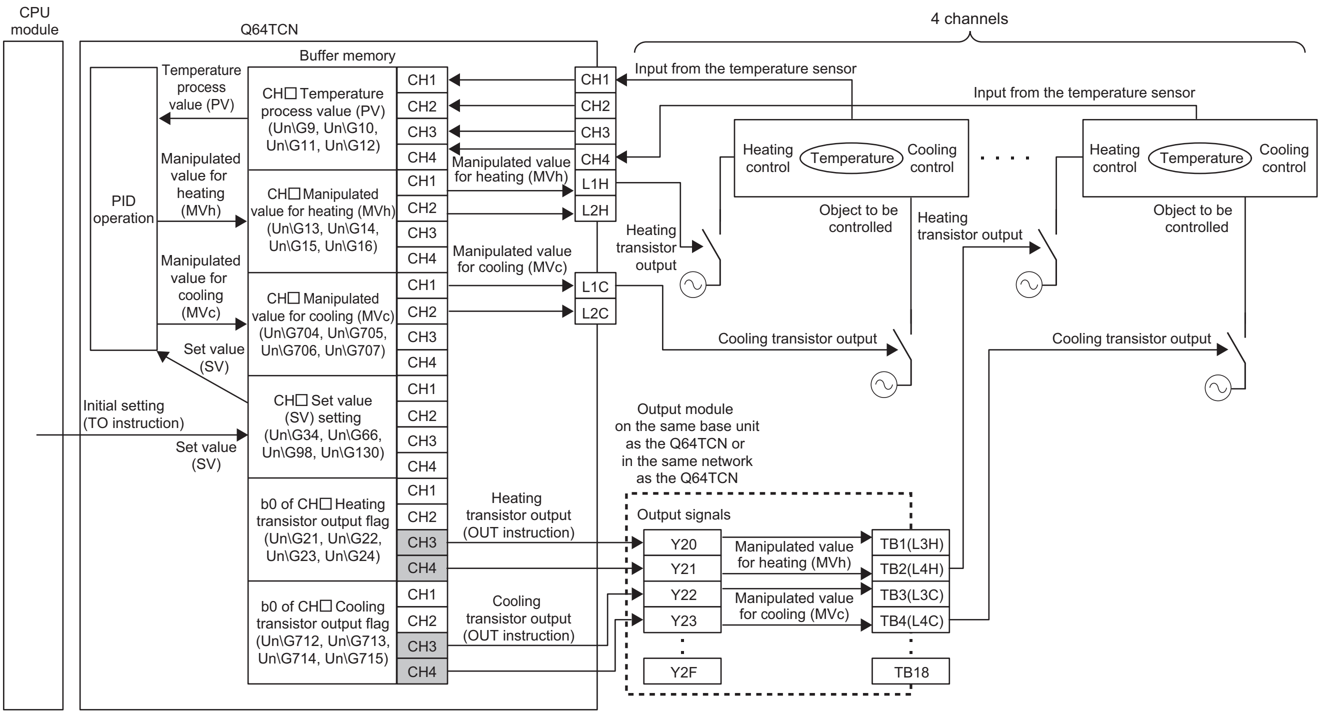
Control for each channel is as follows.

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 268, Section 4.27)
*2 Heating-cooling control is performed using an output module in the system. (Page 170, Section 4.1 (3))

(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 and others in the system. To use an expanded mode, construct a system such as the one shown below.

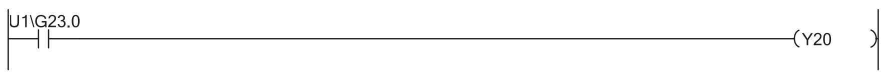


Point

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. If data is written into these areas when it is used by the system, a write data error occurs. (error code: □□□2_H)

The following is an example of using an expanded mode.

Ex. A program in which CH3 Heating transistor output flag (b0 of Un\G23) is assigned to Y20 of an output module (The start I/O number of the Q64TCN is set to 10 in the following program example.)



4.2 Control Output Setting at CPU Stop Error

Common

When a stop error occurs on the CPU module or when CPU's status is changed from RUN to STOP, whether to hold or clear the status of transistor output can be selected using this function.
Configure "Output Setting at CPU Stop Error" on Switch Setting.
For details on the setting method, refer to the following.
Page 305, Section 6.2
Processing for each status is describes in the following table.

<table>
<tr><th colspan="2">Status</th><th colspan="4">Processing</th><th>Reference</th></tr>
<tr><th colspan="2">Output Setting at CPU Stop Error</th><th colspan="2">CLEAR</th><th colspan="2">HOLD</th><th>Page 305, Section 6.2</th></tr>
<tr><th colspan="2">Setting of PID continuation flag (Un\G169)</th><th>Stop</th><th>Continue</th><th>Stop</th><th>Continue</th><th>Page 133, Section 3.4.2 (43)</th></tr>
<tr><td rowspan="3">Error</td><td>Q64TCN
Write data error</td><td colspan="4">Follow the operation of when an error occurs</td><td>Page 373, Section 8.6</td></tr>
<tr><td>Q64TCN
Hardware error</td><td colspan="4">Depends on the symptom of the hardware</td><td>—</td></tr>
<tr><td>CPU
Stop error</td><td colspan="2">Stops the operation and turns off external output</td><td>Follows the stop mode setting*1</td><td>Stops the operation and performs external output</td><td>—</td></tr>
<tr><td rowspan="2">CPU operation</td><td>RUN → STOP</td><td>Follows the stop mode setting*1</td><td>Stops the operation and performs external output</td><td>Follows the stop mode setting*1</td><td>Stops the operation and performs external output</td><td>—</td></tr>
<tr><td>Resetting</td><td colspan="4">The module is incapable to operate, and not performs external output</td><td>—</td></tr>
</table>

*1 CH□ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) (Page 105, Section 3.4.2 (13))

Important
• Fully pay attention to the setting of PID continuation flag (Un\G169) which controls external output. • 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.

4.3 Control Method

Common

The following control methods can be applied by setting the proportional band (P), integral time, and derivative time(D).

- Two-position control (Page 172, Section 4.3 (1))
- P control (Page 174, Section 4.3 (2))
- PI control (Page 175, Section 4.3 (3))
- PD control (Page 175, Section 4.3 (4))
- PID control (Page 175, Section 4.3 (5))

Remark

For P control and PD control, the manual reset function is activated. (Page 179, Section 4.4)

(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.

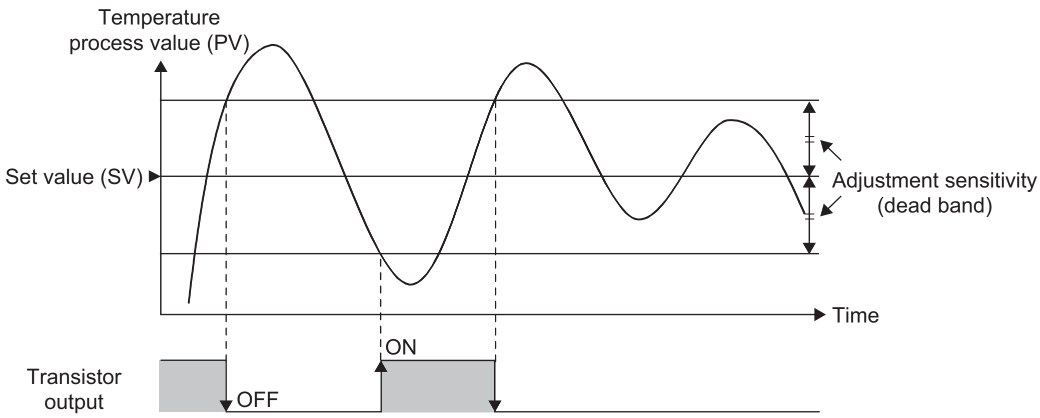
Point

By the setting in CH□ Adjustment sensitivity (dead band) setting (Un\G46, Un\G78, Un\G110, Un\G142) 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 (Un\G46, Un\G78, Un\G110, Un\G142). (Page 115, Section 3.4.2 (22))

(a) Standard control

The module operates as follows outside the range of CH□ Adjustment sensitivity (dead band) setting (Un\G46, Un\G78, Un\G110, Un\G142).

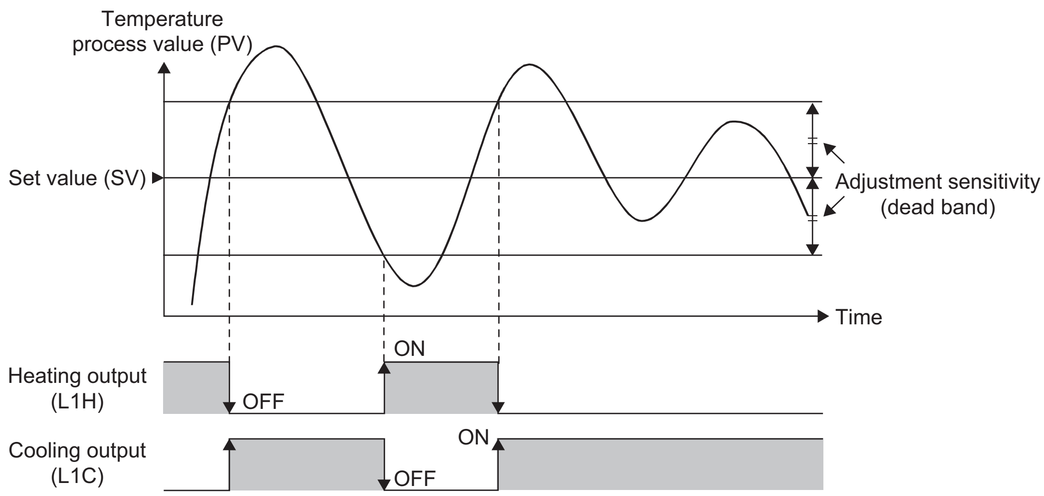
Condition	Transistor output status
The temperature process value (PV) is below the lower limit of the adjustment sensitivity (dead band).	ON
The temperature process value (PV) is above the upper limit of the adjustment sensitivity (dead band).	OFF



(b) Heating-cooling control

The module operates as follows outside the range of CH☐ Adjustment sensitivity (dead band) setting (Un\G46, Un\G78, Un\G110, Un\G142).

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 more details, refer to the following.

☞Page 267, Section 4.26 (3)

(d) Setting method

Set 0 in the following buffer memory areas.

- CH☐ Proportional band (P) setting (Un\G35, Un\G67, Un\G99, Un\G131) (☞Page 107, Section 3.4.2 (15))
- CH☐ Heating proportional band (Ph) setting (Un\G35, Un\G67, Un\G99, Un\G131) (☞Page 107, Section 3.4.2 (15))

(2) P Control

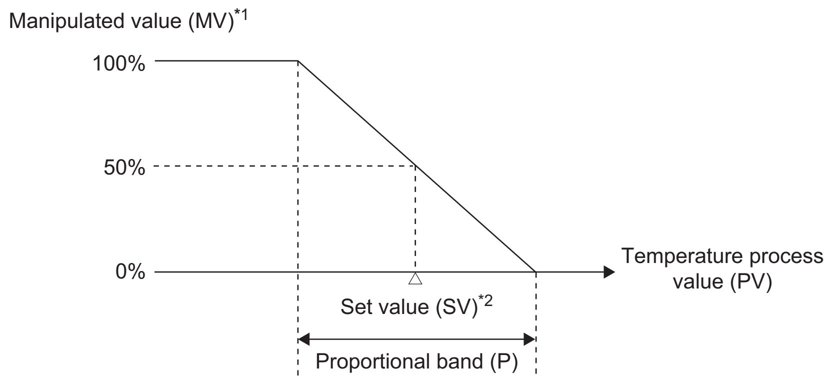
P control is a control method in which the manipulated value (MV) is determined proportional to the deviation (E) between the temperature process value (PV) and set value (SV).

(a) Standard control

The manipulated value is 50% in the following conditions.

- Temperature process value (PV) = Set value (SV)
- CH□ Manual reset amount setting (Un\G724, Un\G740, Un\G756, Un\G772) is set to 0 (0.0%).

(Page 154, Section 3.4.2 (75))



*1 The actual output value is restricted within the output limiter range set in CH□ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138) and CH□ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139). (Page 112, Section 3.4.2 (19))

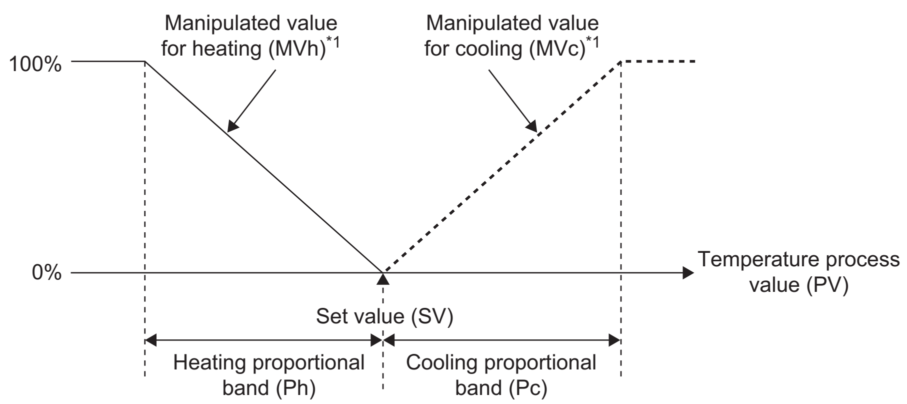
*2 The set value (SV) is in the center of the proportional band.

(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 (Un\G724, Un\G740, Un\G756, Un\G772) is set to 0 (0.0%).

(Page 154, Section 3.4.2 (75))



*1 The actual output value is restricted within the output limiter range set in CH□ Heating upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138) and CH□ Cooling upper limit output limiter (Un\G721, Un\G737, Un\G753, Un\G769). (Page 112, Section 3.4.2 (19))

(c) Setting method

Among proportional band (P), integral time (I), and derivative time (D), set any value to only proportional band (P). Set 0 to integral time (I) and derivative time (D).

(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

Among proportional band (P), integral time (I), and derivative time (D), set any value to only proportional band (P) and integral time (I). Set 0 to derivative time (D).

(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

Among proportional band (P), integral time (I), and derivative time (D), set any value to only proportional band (P) and derivative time (D). Set 0 to integral time (I).

(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

Set any value to proportional band (P), integral time (I), and derivative time (D).

(6) Condition to perform PID control

The condition to be able to perform PID control[*1] depends on the settings of the followings.

- Setting/operation mode instruction (Yn1) (Page 58, Section 3.3.3 (1))
- PID continuation flag (Un\G169)) (Page 133, Section 3.4.2 (43))
- CH☐ PID control forced stop instruction (YnC to YnF) (Page 60, Section 3.3.3 (7))
- CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) (Page 105, Section 3.4.2 (13))

The following table shows the relationship between the status of PID control[*1] and each of the settings above.

○: Performed ×: Not performed

Setting/operation mode instruction (Yn1)[*2]	PID continuation flag (Un\G169)	CH☐ PID control forced stop instruction (YnC to YnF)	CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129)	Control status of PID control[*1]
Setting mode at power-ON	Stop (0)/Continue (1)	OFF/ON	Stop (0)/Monitor (1)/Alert (2)	×
Operation mode (operating)	Stop (0)/Continue (1)	OFF	Stop (0)/Monitor (1)/Alert (2)	○
		ON	Stop (0)/Monitor (1)/Alert (2)	×
Setting mode (after operation)	Stop (0)	OFF/ON	Stop (0)/Monitor (1)/Alert (2)	×
	Continue (1)	OFF	Stop (0)/Monitor (1)/Alert (2)	○
		ON	Stop (0)/Monitor (1)/Alert (2)	×

*1 Here, this is the generic term for two-position control, P control, PI control, PD control, and PID control.

*2 For the timing of each, refer to Page 52, Section 3.3.2 (2).

Even though the conditions above are met, PID control is not performed when CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1). (Page 128, Section 3.4.2 (35))

Point

The manipulated value (MV) and manipulated value (MV) for output with another analog module of when CH☐ PID control forced stop instruction (YnC to YnF) is turned on from off are as follows.

Buffer memory area name	Buffer memory address				Stored value	Reference
	CH1	CH2	CH3	CH4		
CH☐ Manipulated value (MV)	Un\G13	Un\G14	Un\G15	Un\G16	-50 (-5.0%)	Page 91, Section 3.4.2 (5)
CH☐ Manipulated value (MV) for output with another analog module	Un\G177	Un\G178	Un\G179	Un\G180	0	Page 135, Section 3.4.2 (47)
CH☐ Manipulated value for heating (MVh) (Un\G13 to Un\G16)	Un\G13	Un\G14	Un\G15	Un\G16	-50 (-5.0%)	Page 91, Section 3.4.2 (5)
CH☐ Manipulated value of heating (MVh) for output with another analog module	Un\G177	Un\G178	Un\G179	Un\G180	0	Page 135, Section 3.4.2 (47)
CH☐ Manipulated value for cooling (MVc)	Un\G704	Un\G705	Un\G706	Un\G707	-50 (-5.0%)	Page 91, Section 3.4.2 (5)
CH☐ Manipulated value of cooling (MVc) for output with another analog module	Un\G708	Un\G709	Un\G710	Un\G711	0	Page 135, Section 3.4.2 (47)

When CH☐ PID control forced stop instruction (YnC to YnF) is turned off from on, the forced stop of PID control is released. After the release, PID operation starts from the beginning.

(7) Buffer memory areas related to control method

The following table shows the buffer memory areas related to control method.

<table>
<tr><th rowspan="2">Buffer memory area name</th><th colspan="4">Buffer memory address</th><th colspan="5">Setting range</th><th rowspan="2">Reference</th></tr>
<tr><th>CH1</th><th>CH2</th><th>CH3</th><th>CH4</th><th>Two-position control</th><th>P control</th><th>PD control</th><th>PI control</th><th>PID control</th></tr>
<tr><td>CH☐ Input range</td><td>Un\G32</td><td>Un\G64</td><td>Un\G96</td><td>Un\G128</td><td colspan="5">Thermocouple: 1 to 4, 11 to 28, 36 to 48, 100 to 117, 130 to 132, 201 to 205
Platinum resistance thermometer: 5 to 8, 53, 54, 140 to 143, 201 to 205</td><td>Page 98, Section 3.4.2 (12)</td></tr>
<tr><td>CH☐ Set value (SV) setting</td><td>Un\G34</td><td>Un\G66</td><td>Un\G98</td><td>Un\G130</td><td colspan="5">Set a value within the temperature measurement range of the set input range.</td><td>Page 106, Section 3.4.2 (14)</td></tr>
<tr><td>CH☐ Proportional band (P) setting</td><td>Un\G35</td><td>Un\G67</td><td>Un\G99</td><td>Un\G131</td><td rowspan="2">Fix the setting to 0.</td><td colspan="4" rowspan="2">Configure the setting in the range from 0 to 10000 (0.0% to 1000.0%) toward the full scale of the set input range.</td><td rowspan="3">Page 107, Section 3.4.2 (15)</td></tr>
<tr><td>CH☐ Heating proportional band (Ph) setting</td><td>Un\G35</td><td>Un\G67</td><td>Un\G99</td><td>Un\G131</td></tr>
<tr><td>CH☐ Cooling proportional band (Pc) setting</td><td>Un\G720</td><td>Un\G736</td><td>Un\G752</td><td>Un\G768</td><td>The setting is ignored.[*1]</td><td colspan="4">Configure the setting in the range from 1 to 10000 (0.1% to 1000.0%) toward the full scale of the set input range.</td></tr>
<tr><td>CH☐ Integral time (I) setting</td><td>Un\G36</td><td>Un\G68</td><td>Un\G100</td><td>Un\G132</td><td>The setting is ignored.[*1]</td><td>Fix the setting to 0.</td><td>Fix the setting to 0.</td><td>1 to 3600 (s)</td><td>1 to 3600 (s)</td><td>Page 109, Section 3.4.2 (16)</td></tr>
<tr><td>CH☐ Derivative time (D) setting</td><td>Un\G37</td><td>Un\G69</td><td>Un\G101</td><td>Un\G133</td><td>The setting is ignored.[*1]</td><td>Fix the setting to 0.</td><td>1 to 3600 (s)</td><td>Fix the setting to 0.</td><td>1 to 3600 (s)</td><td>Page 109, Section 3.4.2 (17)</td></tr>
<tr><td>CH☐ Upper limit output limiter</td><td>Un\G42</td><td>Un\G74,</td><td>Un\G106</td><td>Un\G138</td><td rowspan="4">The setting is ignored.[*1]</td><td colspan="4" rowspan="2">-50 to 1050 (-5.0% to 105.0%)</td><td rowspan="4">Page 112, Section 3.4.2 (19)</td></tr>
<tr><td>CH☐ Lower limit output limiter</td><td>Un\G43</td><td>Un\G75</td><td>Un\G107</td><td>Un\G139</td></tr>
<tr><td>CH☐ Heating upper limit output limiter</td><td>Un\G42</td><td>Un\G74</td><td>Un\G106</td><td>Un\G138</td><td colspan="4" rowspan="2">0 to 1050 (0.0% to 105.0%)</td></tr>
<tr><td>CH☐ Cooling upper limit output limiter</td><td>Un\G721</td><td>Un\G737</td><td>Un\G753</td><td>Un\G769</td></tr>
<tr><td>CH☐ Output variation limiter setting</td><td>Un\G44</td><td>Un\G76</td><td>Un\G108</td><td>Un\G140</td><td>The setting is ignored.[*1]</td><td colspan="4">1 to 1000 (0.1%/s to 100.0%/s)</td><td>Page 114, Section 3.4.2 (20)</td></tr>
<tr><td>CH☐ Adjustment sensitivity (dead band) setting</td><td>Un\G46</td><td>Un\G78</td><td>Un\G110</td><td>Un\G142</td><td>Configure the setting in the range from 1 to 100 (0.1% to 10.0%) toward the full scale of the set input range.</td><td colspan="4">The setting is ignored.[*1]</td><td>Page 115, Section 3.4.2 (22)</td></tr>
</table>

<table>
<tr><th rowspan="2">Buffer memory area name</th><th colspan="4">Buffer memory address</th><th colspan="5">Setting range</th><th rowspan="2">Reference</th></tr>
<tr><th>CH1</th><th>CH2</th><th>CH3</th><th>CH4</th><th>Two-position control</th><th>P control</th><th>PD control</th><th>PI control</th><th>PID control</th></tr>
<tr><td>CH□ Control output cycle setting</td><td>Un\G47</td><td>Un\G79</td><td>Un\G111</td><td>Un\G143</td><td rowspan="3">The setting is ignored.*1</td><td colspan="4" rowspan="3">1 to 100 (1s to 100s)</td><td rowspan="3">Page 116, Section 3.4.2 (23)</td></tr>
<tr><td>CH□ Heating control output cycle setting</td><td>Un\G47</td><td>Un\G79</td><td>Un\G111</td><td>Un\G143</td></tr>
<tr><td>CH□ Cooling control output cycle setting</td><td>Un\G722</td><td>Un\G738</td><td>Un\G754</td><td>Un\G770</td></tr>
<tr><td>CH□ Overlap/dead band setting</td><td>Un\G723</td><td>Un\G739</td><td>Un\G755</td><td>Un\G771</td><td colspan="5">Configure the setting in the range from -100 to 100 (-10.0% to 10.0%) toward the full scale of the set input range.</td><td>Page 154, Section 3.4.2 (74)</td></tr>
<tr><td>CH□ Manual reset amount setting</td><td>Un\G724</td><td>Un\G740</td><td>Un\G756</td><td>Un\G772</td><td>The setting is ignored.*1</td><td colspan="2">Configure the setting in the range from -1000 to 1000 (-100.0 to 100.0%) toward the full scale of the set input range.</td><td colspan="2">The setting is ignored.*1</td><td>Page 154, Section 3.4.2 (75)</td></tr>
</table>

*1 When outside the setting range, a write data error (error code: □□□4_H) occurs.

Point

The Q64TCN automatically sets optimum PID constants if the following functions are used.

- Auto tuning function (Page 182, Section 4.6)
- Self-tuning function (Page 229, Section 4.18)

4.4 Manual Reset Function

Common

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 (Un\G724, Un\G740, Un\G756, Un\G772) is ignored even if it is set. (Note that a write data error (error code: ☐☐☐4_H) occurs if it is outside the setting range.)

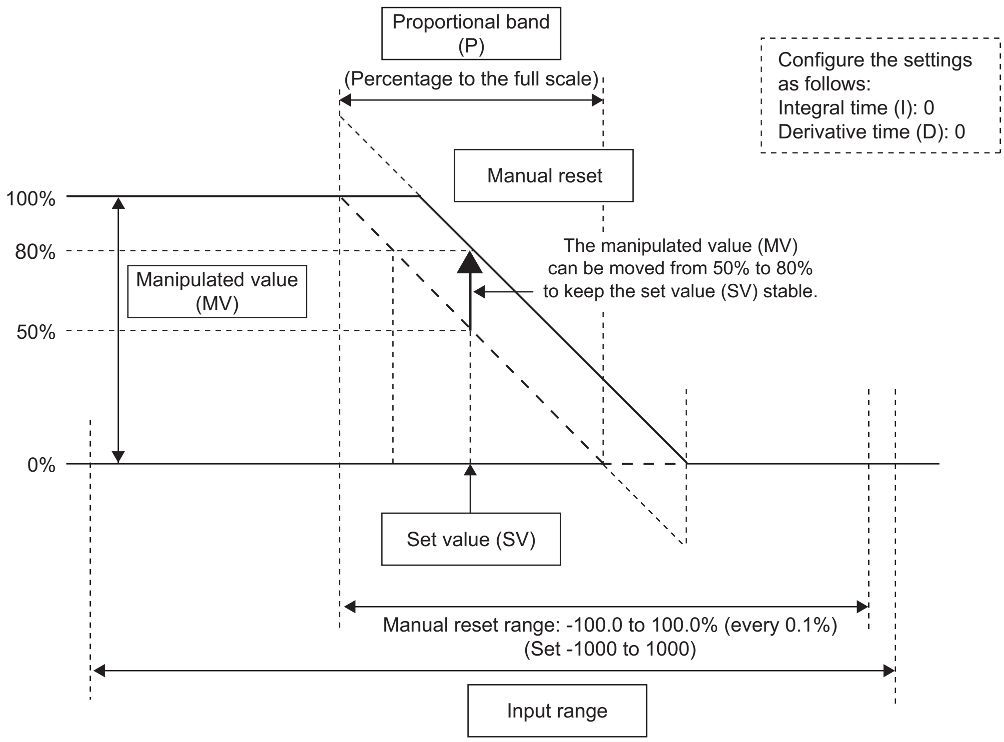
(1) Standard control

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, 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. When using the manual reset function in the following conditions

- Control method: P control
- CH☐ Manual reset amount setting (Un\G724, Un\G740, Un\G756, Un\G772): 300 (30%)

  The Q64TCN shifts the manipulated value (MV) by which the temperature is stabilized at the set value (SV) from 50% to 80%.

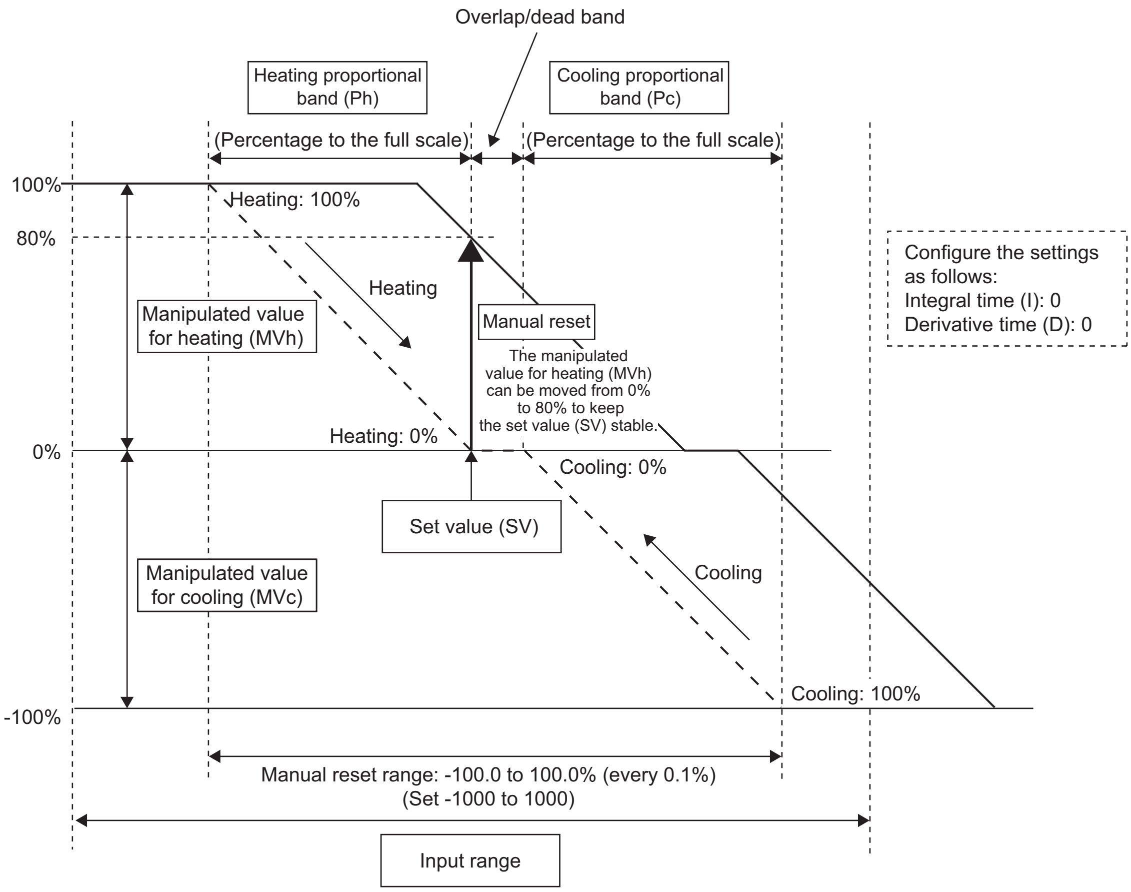


(2) Heating-cooling control

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. When using the manual reset function in the following conditions

- Control method: P control
- CH☐ Manual reset amount setting (Un\G724, Un\G740, Un\G756, Un\G772): 800 (80%)
  The Q64TCN shifts the manipulated value for heating (MVh) by which the temperature is stabilized at the set value (SV) from 0% to 80%.



(3) Setting method

Set a value in the following buffer memory area.

- CH☐ Manual reset amount setting (Un\G724, Un\G740, Un\G756, Un\G772) (Page 154, Section 3.4.2 (75))

4.5 Manual Control

Common

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 500ms, and is reflected to transistor output.

(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 (Un\G50, Un\G82, Un\G114, Un\G146).) (☞Page 119, Section 3.4.2 (26))**
2. **Check the storage of MAN mode shift completed (1) into MAN mode shift completion flag (Un\G30). (☞Page 95, Section 3.4.2 (10))**
3. **Set the manipulated value (MV) in CH☐ MAN output setting (Un\G51, Un\G83, Un\G115, Un\G147)*1 (☞Page 120, Section 3.4.2 (27))**

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

4.6 Auto Tuning Function

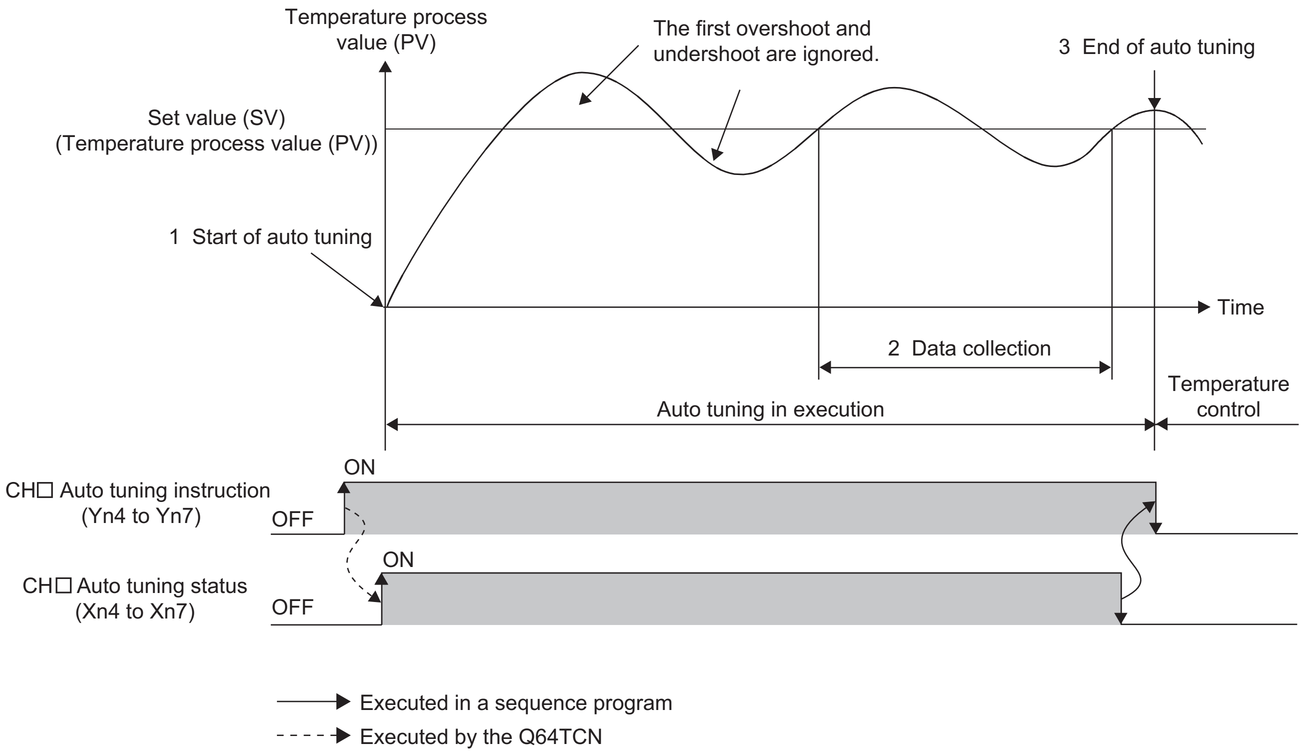
Common

This function is designed for the Q64TCN 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 process value (PV) against the set value (SV) due to the on-off action of control output.

(1) Auto tuning operation

The Q64TCN operates as follows.

	Operation of the Q64TCN
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) Buffer memory areas related to auto tuning

Auto tuning can be executed when the following data are set. 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 to the proportional band (P)/heating proportional band (Ph), auto tuning is not executed.

(Page 107, Section 3.4.2 (15))

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Input range	Un\G32	Un\G64	Un\G96	Un\G128	Page 98, Section 3.4.2 (12)
CH☐ Set value (SV) setting	Un\G34	Un\G66	Un\G98	Un\G130	Page 106, Section 3.4.2 (14)
CH☐ Upper limit output limiter	Un\G42	Un\G74	Un\G106	Un\G138	Page 112, Section 3.4.2 (19)
CH☐ Lower limit output limiter	Un\G43	Un\G75	Un\G107	Un\G139	
CH☐ Heating upper limit output limiter	Un\G42	Un\G74	Un\G106	Un\G138	
CH☐ Cooling upper limit output limiter	Un\G721	Un\G737	Un\G753	Un\G769	
CH☐ Output variation limiter setting	Un\G44	Un\G76	Un\G108	Un\G140	Page 114, Section 3.4.2 (20)
CH☐ Sensor correction value setting	Un\G45	Un\G77	Un\G109	Un\G141	Page 115, Section 3.4.2 (21)
CH☐ Control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	Page 116, Section 3.4.2 (23)
CH☐ Heating control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	
CH☐ Cooling control output cycle setting	Un\G722	Un\G738	Un\G754	Un\G770	
CH☐ Primary delay digital filter setting	Un\G48	Un\G80	Un\G112	Un\G144	Page 117, Section 3.4.2 (24)
CH☐ AUTO/MAN mode shift	Un\G50	Un\G82	Un\G114	Un\G146	Page 119, Section 3.4.2 (26)
CH☐ AT bias	Un\G53	Un\G85	Un\G117	Un\G149	Page 122, Section 3.4.2 (29)
CH☐ Forward/reverse action setting	Un\G54	Un\G86	Un\G118	Un\G150	Page 123, Section 3.4.2 (30)
CH☐ Auto tuning mode selection	Un\G184	Un\G185	Un\G186	Un\G187	Page 138, Section 3.4.2 (51)

Point

Set the upper limit output limiter for the system where the temperature rises fast. The standard setting value is twice the manipulated value (MV) at a stable state. After the completion of auto tuning, starting control with the output limiter returned to the initial value causes no problem.

(3) Storing the calculated value after auto tuning

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

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Proportional band (P) setting	Un\G35	Un\G67	Un\G99	Un\G131	Page 107, Section 3.4.2 (15)
CH☐ Heating proportional band (Ph) setting	Un\G35	Un\G67	Un\G99	Un\G131	
CH☐ Cooling proportional band (Pc) setting	Un\G720	Un\G736	Un\G752	Un\G768	
CH☐ Integral time (I) setting	Un\G36	Un\G68	Un\G100	Un\G132	Page 109, Section 3.4.2 (16)
CH☐ Derivative time (D) setting	Un\G37	Un\G69	Un\G101	Un\G133	Page 109, Section 3.4.2 (17)
CH☐ Loop disconnection detection judgment time*1	Un\G59	Un\G91	Un\G123	Un\G155	Page 126, Section 3.4.2 (33)

*1 A value twice greater than the one in CH☐ Integral time (I) setting (Un\G36, Un\G68, Un\G100, Un\G132) 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 buffer memory area to Enable (1) at the start of auto tuning, the calculated value (Page 183, Section 4.6 (3)) is automatically backed up into E^2PROM on completion of auto tuning.

- CH☐ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159) (Page 130, Section 3.4.2 (37))

To read the calculated value (Page 183, Section 4.6 (3)) from E^2PROM to the buffer memory, set the following buffer memory area to Requested (1).

- CH☐ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) (Page 129, Section 3.4.2 (36))

Point

To use the PID constants stored in the buffer memory also after the power is turned off, follow the methods below.

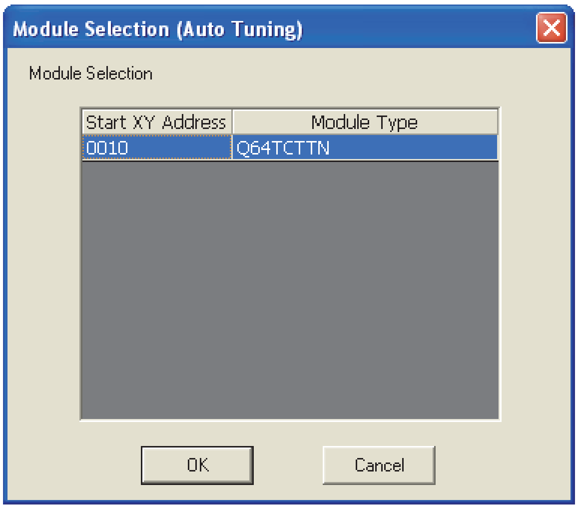
- Use the initial setting of GX Works2. (Page 306, Section 6.3)
- Keep the PID constants in E^2PROM, and transfer them when the power is turned on from off or when the CPU module is released from the reset status. (Page 276, Section 4.30)
- Write the value directly into the buffer memory through a sequence program.

(5) Procedure of auto tuning

(a) GX Works2

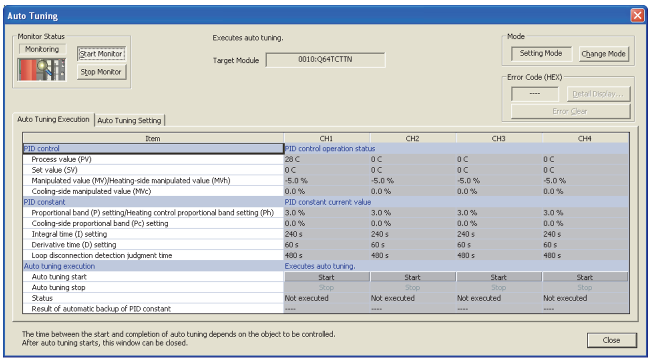
Set this function on the "Auto Tuning" window.

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Temperature Control Module] ⇨ [Auto Tuning...]



1. **Select the module by which auto tuning is executed, and click OK.**

↓



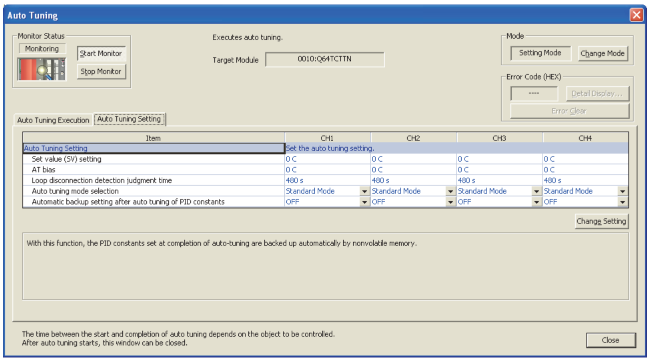
2. **Click the "Auto Tuning Setting" tab.**

↓

(To the next page)

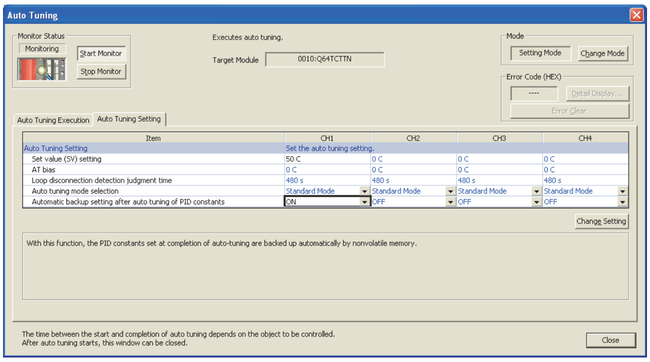
(From the previous page)

↓



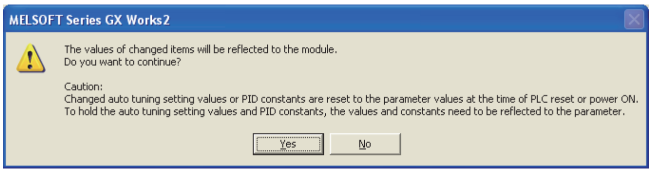
3. **Configure the auto tuning setting.**

↓



4. **Click** Change Setting **.**

↓



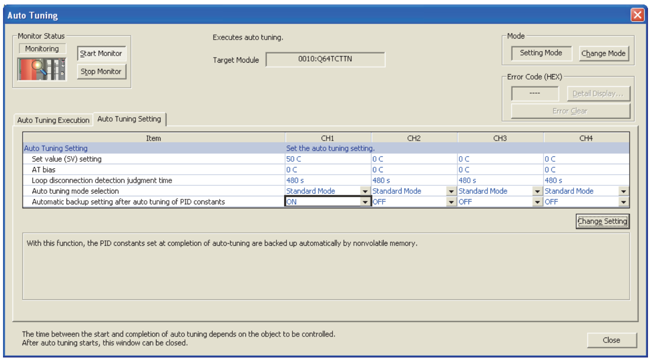
5. **Click** Yes **.**

↓

(To the next page)

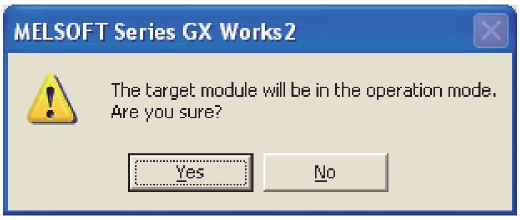
(From the previous page)

↓



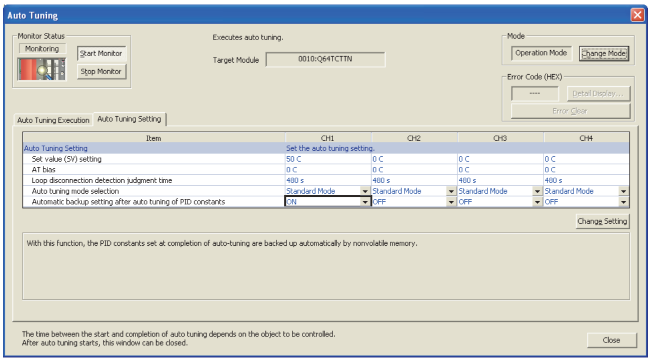
6. Click Change Mode .

↓



7. Click Yes .

↓



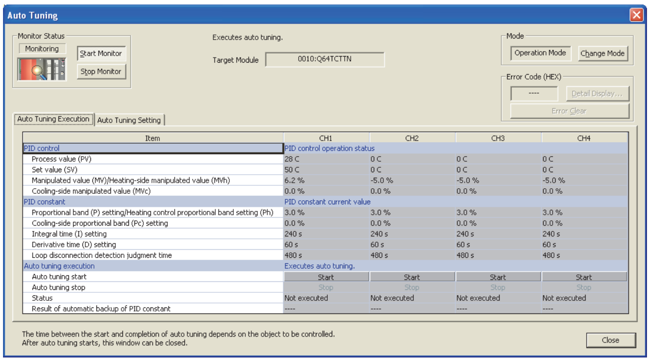
8. Click the "Auto Tuning Execution" tab.

↓

(To the next page)

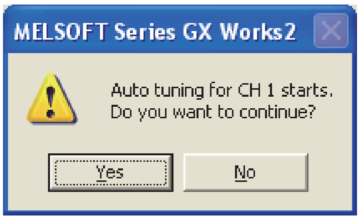
(From the previous page)

↓



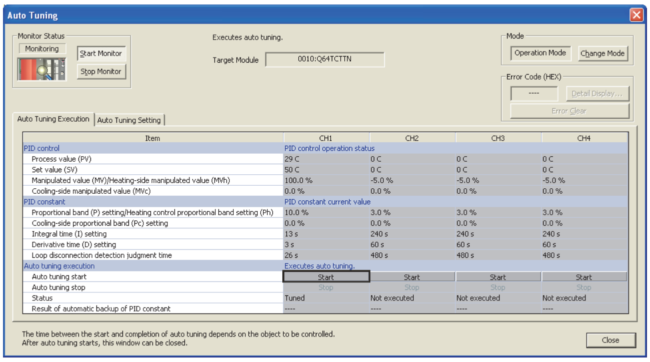
9. Click Start of the channel where auto tuning is to be executed.

↓



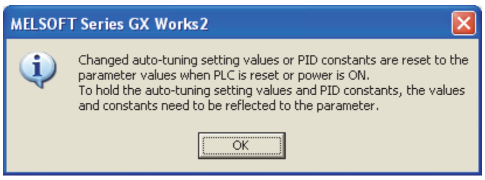
10. Click Yes.

↓



11. Check that "Status" has changed from "Executing" to "Tuned", and click Close.

↓



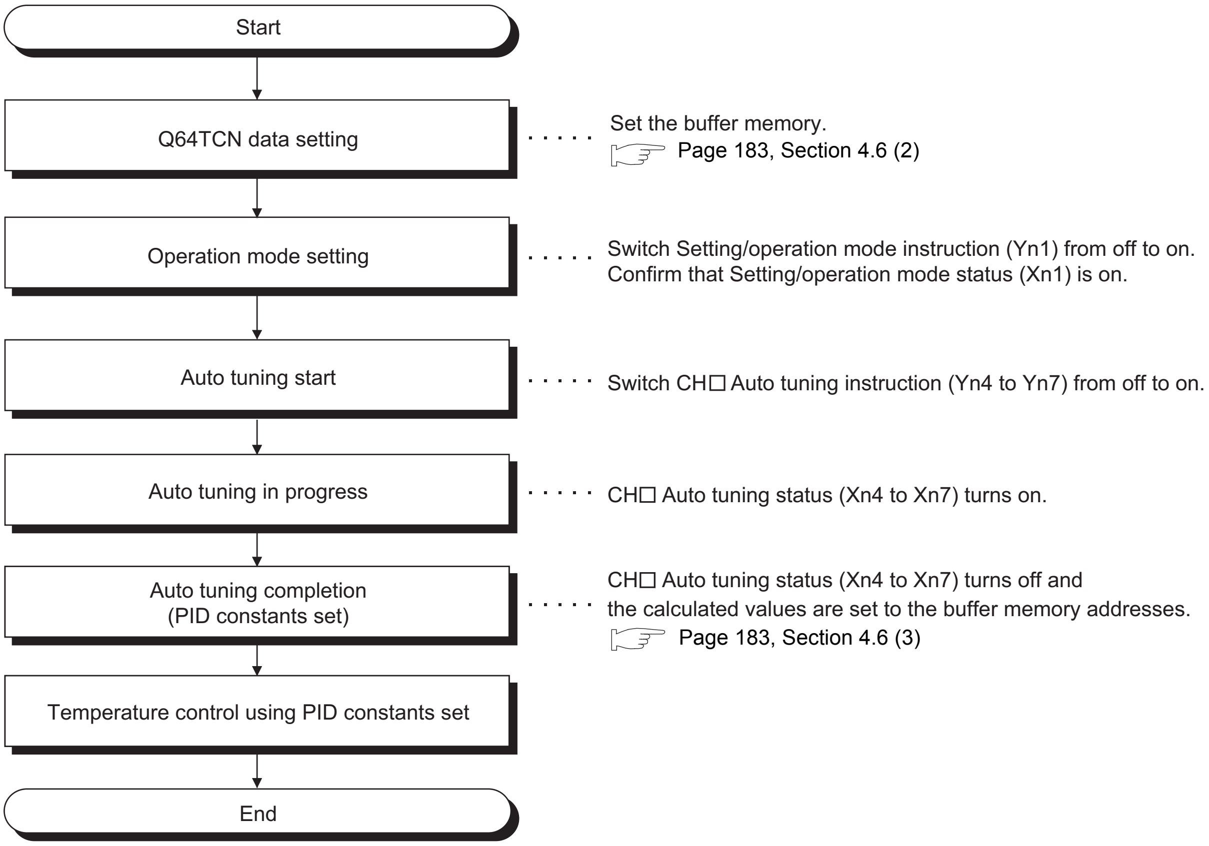
12. Click OK.

↓

End

(b) Sequence program

The execution procedure of auto tuning is as follows.



(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	The module is in the setting mode (Setting/operation mode status (Xn1): OFF).	Page 52, Section 3.3.2 (2)
2	In standard control, CH☐ Proportional band (P) setting (Un\G35, Un\G67, Un\G99, Un\G131) is set to 0. (operating in two-position control)	Page 107, Section 3.4.2 (15)
	In heating-cooling control, CH☐ Heating proportional band (Ph) setting (Un\G35, Un\G67, Un\G99, Un\G131) is set to 0. (operating in two-position control)	
3	CH☐ AUTO/MAN mode shift (Un\G50, Un\G82, Un\G114, Un\G146) is set to MAN (1).	Page 119, Section 3.4.2 (26)
4	Toward the corresponding channel, CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1).	Page 128, Section 3.4.2 (35)
5	CH☐ PID control forced stop instruction (YnC to YnF) is turned on.	Page 60, Section 3.3.3 (7)
6	Hardware failure has occurred. (The ERR. LED is on.)	Page 367, Section 8.3.2
7	CH☐ Temperature process value (PV) (Un\G9 to Un\G12) has exceeded the temperature measurement range (CH☐ Input range upper limit (b0 of Un\G5 to Un\G8) or CH☐ Input range lower limit (b1 of Un\G5 to Un\G8) is 1 (ON)).	Page 89, Section 3.4.2 (3)
8	CH☐ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) is set to Requested (1).	Page 129, Section 3.4.2 (36)
9	CH☐ Write completion flag (b4 to b7 of Un\G31) is on.	Page 96, Section 3.4.2 (11)
10	The set value (SV) or the AT point has exceeded CH☐ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151) or has fallen below CH☐ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152).	Page 163, Section 3.4.2 (90)

(a) When one of the conditions 1 to 5 applies

Auto tuning starts when the condition no longer applies.

(b) When the condition 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 (Yn4 to Yn7) is turned on from off once again.

(c) When the condition 8 or 9 applies

Even though the internal processing of auto tuning is completed and PID constants are stored, CH☐ Auto tuning status (Xn4 to Xn7) does not turn off, therefore the auto tuning is not completed.

(d) When the condition 10 applies

Even though the set value (SV) or the AT point goes back within the range of upper and lower limit setting limiters, auto tuning does not start until CH☐ Auto tuning instruction (Yn4 to Yn7) is turned on from off once again.

(7) Conditions where auto tuning ends in fail

The conditions are described below.

(a) Shift from the operation mode to the setting mode

Shifting from the operation mode to the setting mode (Setting/operation mode instruction (Yn1) is turned off from on) ends auto tuning in fail. Note that an exception is when PID continuation flag (Un\G169) is set to Continue (1). (Page 133, Section 3.4.2 (43))

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

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

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Set value (SV) setting	Un\G34	Un\G66	Un\G98	Un\G130	Page 106, Section 3.4.2 (14)
CH☐ Upper limit output limiter	Un\G42	Un\G74	Un\G106	Un\G138	Page 112, Section 3.4.2 (19)
CH☐ Lower limit output limiter	Un\G43	Un\G75	Un\G107	Un\G139	
CH☐ Cooling upper limit output limiter	Un\G721	Un\G737	Un\G753	Un\G769	
CH☐ Output variation limiter setting	Un\G44	Un\G76	Un\G108	Un\G140	Page 114, Section 3.4.2 (20)
CH☐ Sensor correction value setting	Un\G45	Un\G77	Un\G109	Un\G141	Page 115, Section 3.4.2 (21)
CH☐ Control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	Page 116, Section 3.4.2 (23)
CH☐ Cooling control output cycle setting	Un\G722	Un\G738	Un\G754	Un\G770	
CH☐ Primary delay digital filter setting	Un\G48	Un\G80	Un\G112	Un\G144	Page 117, Section 3.4.2 (24)
CH☐ AUTO/MAN mode shift	Un\G50	Un\G82	Un\G114	Un\G146	Page 119, Section 3.4.2 (26)
CH☐ AT bias	Un\G53	Un\G85	Un\G117	Un\G149	Page 122, Section 3.4.2 (29)
CH☐ Forward/reverse action setting	Un\G54	Un\G86	Un\G118	Un\G150	Page 123, Section 3.4.2 (30)
CH☐ Unused channel setting	Un\G61	Un\G93	Un\G125	Un\G157	Page 128, Section 3.4.2 (35)
Cold junction temperature compensation selection	Un\G182				Page 137, Section 3.4.2 (49)
CH☐ Auto tuning mode selection	Un\G184	Un\G185	Un\G186	Un\G187	Page 138, Section 3.4.2 (51)

(c) Out of the temperature measurement range

If CH☐ Temperature process value (PV) (Un\G9 to Un\G12) exceeds the temperature measurement range (CH☐ Input range upper limit (b0 of Un\G5 to Un\G8) or CH☐ Input range lower limit (b1 of Un\G5 to Un\G8) becomes 1 (ON)), auto tuning ends in fail. (Page 89, Section 3.4.2 (3))

(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 fail.

- Time from the start of auto tuning until CH☐ Temperature process value (PV) (Un\G9 to Un\G12) reaches the set value (SV) for the first time
- A half the hunting cycle of CH☐ Temperature process value (PV) (Un\G9 to Un\G12)

(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 fail.

- CH☐ Proportional band (P) setting (Un\G35, Un\G67, Un\G99, Un\G131): 1 to 10000 (0.1% to 1000.0%)
- CH☐ Integral time (I) setting (Un\G36, Un\G68, Un\G100, Un\G132): 1 to 3600 (1s to 3600s)
- CH☐ Derivative time (D) setting (Un\G37, Un\G69, Un\G101, Un\G133): 0 to 3600 (0s to 3600s)

Point

- If auto tuning ends in fail due to the calculated value of PID constants as described above, the system configuration needs to be reconsidered (such as selecting proper heater capacity).
- If the temperature control points of channels are close to one another and auto tuning is performed on all the channels at the same time, the auto tuning may not be completed due to the heat effect. In such case, perform auto tuning on each channel to avoid the heat effect.

(f) Change of the upper limit setting limiter or lower limit setting limiter and the AT point

If the AT point goes out of the setting range due to the change in one of the following buffer memory areas, auto tuning ends in fail.

- CH☐ Upper limit setting limiter (Un\G55, Un\G87, Un\G119, Un\G151)
- CH☐ Lower limit setting limiter (Un\G56, Un\G88, Un\G120, Un\G152)

(g) Other conditions

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

- CH☐ PID control forced stop instruction (YnC to YnF) has been turned on from off. (Page 60, Section 3.3.3 (7))
- Hardware failure has occurred.
- In standard control, CH☐ Proportional band (P) setting (Un\G35, Un\G67, Un\G99, Un\G131) has been set to 0. (has been set to two-position control) (Page 107, Section 3.4.2 (15))
- In heating-cooling control, CH☐ Heating proportional band (Ph) setting (Un\G35, Un\G67, Un\G99, Un\G131) has been set to 0. (has been set to two-position control) (Page 107, Section 3.4.2 (15))

(8) Operation on completion of auto tuning

(a) Normal completion

The Q64TCN operates as follows.

- Turns off CH☐ Auto tuning status (Xn4 to Xn7)
- Stores the PID constants in the buffer memory (Page 183, Section 4.6 (3))
- Stores a value in CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155) (If this was set to 0 (s) at the start of auto tuning, the setting remains unchanged.)

(b) Abnormal completion

The Q64TCN operates as follows.

- Turns off CH☐ Auto tuning status (Xn4 to Xn7).
- Does not store the PID constants in the buffer memory. (Page 183, Section 4.6 (3))
- Turns on the corresponding bit of CH☐ AT error status monitor (Un\G789 to Un\G792). (Page 163, Section 3.4 (90))

(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 (Xn4 to Xn7).

(10)Adjustment after auto tuning

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

- CH□ Control response parameter (Un\G49, Un\G81, Un\G113, Un\G145) (Page 118, Section 3.4.2 (25))

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 365, CHAPTER 8

(11)During auto tuning loop disconnection detection function

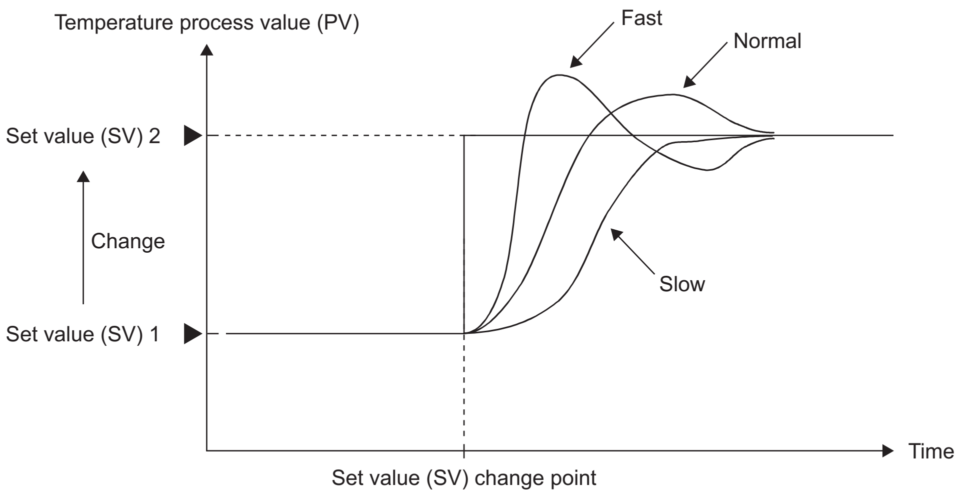
For details on the during AT loop disconnection detection function, refer to the following.
(Page 261, Section 4.23)

4.7 Simple Two-degree-of-freedom

Common

This is the simplified control form of the two-degree-of-freedom PID control. In this form of PID control, the Q64TCN 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 to improve "response to the change of the set value (SV)" are set, "response to the disturbance" degrades. Conversely, when PID constants to improve "response to the disturbance" are set, "response to the change of the set value (SV)" degrades.
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 Q64TCN 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

Set a value in CH□ Control response parameter (Un\G49, Un\G81, Un\G113, Un\G145). (☞Page 118, Section 3.4.2 (25))

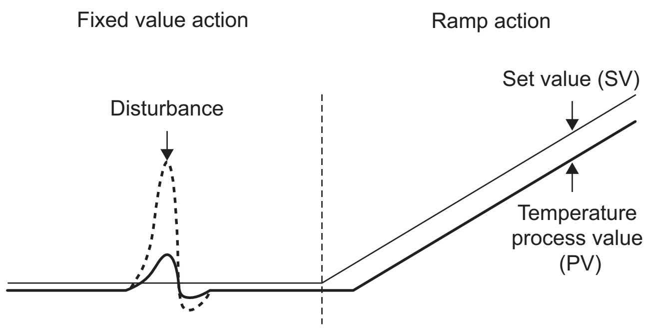
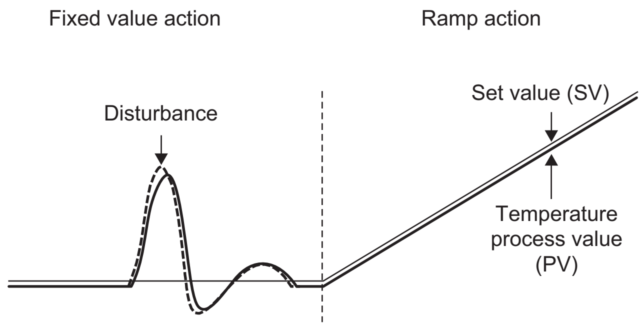
4.8 Derivative Action Selection Function

Common

An 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 (Un\G729, Un\G745, Un\G761, Un\G777)	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

Set a value in CH☐ Derivative action selection ((Un\G729, Un\G745, Un\G761, Un\G777).
For details on the setting, refer to the following.

☞Page 155, Section 3.4.2 (79)

4.9 Setting Change Rate Limiter Setting Function

Common

When the set value (SV) is changed, the change rate in the specified time unit can be set on "Setting Change Rate Limiter". 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 for temperature rise and temperature drop

Select the value on Switch Setting.

For details on the setting, refer to the following.

☞Page 305, Section 6.2

(b) Change rate setting

For batch-setting and individual setting, different buffer memory areas are assigned. The following is the buffer memory areas for each option.

Batch/individual	Buffer memory area name	Buffer memory address			
		CH1	CH2	CH3	CH4
Batch	CH□ Setting change rate limiter	Un\G52	Un\G84	Un\G116	Un\G148
Individual	CH□ Setting change rate limiter (temperature rise)	Un\G52	Un\G84	Un\G116	Un\G148
	CH□ Setting change rate limiter (temperature drop)	Un\G564	Un\G596	Un\G628	Un\G660

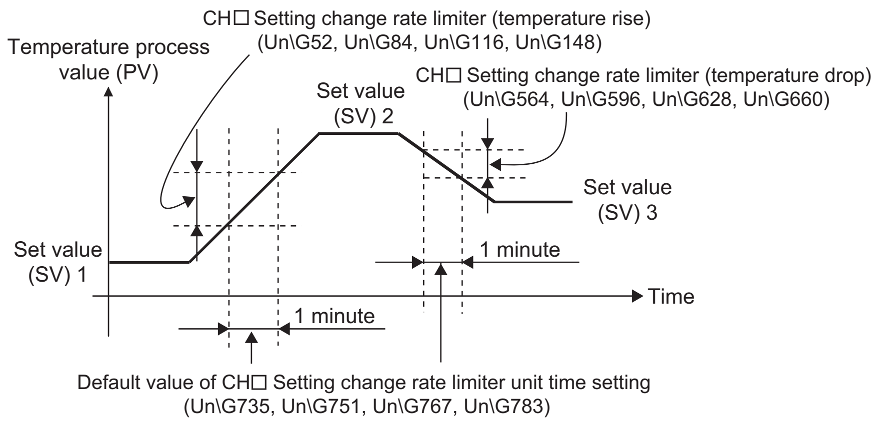
For details on the buffer memory areas above, refer to the following.

☞Page 121, Section 3.4.2 (28)

(c) Time unit setting

Set the time unit of the setting change rate limiter in CH□ Setting change rate limiter time unit setting (Un\G735, Un\G751, Un\G767, Un\G783). (☞Page 159, Section 3.4.2 (85))

Ex. Operation of when individual setting is selected on Switch Setting



4.10 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

Configure the settings as below.

1. Set Enable (0) to "Moving Averaging Process Setting" in the intelligent function module switch setting to use the moving averaging process.
Set Disable (1) to "Moving Averaging Process Setting" in the intelligent function module switch setting when not using the moving averaging process.
For details on the setting method, refer to the following.

Page 305, Section 6.2

2. Set the number of moving averaging to CH☐ Number of moving averaging (Un\G698 to Un\G701).

Buffer memory area name	Buffer memory address				Setting range	Reference
	CH1	CH2	CH3	CH4		
Number of moving averaging	Un\G698	Un\G699	Un\G700	Un\G701	2 to 10 (times) (Default value: 2)	Page 155, Section 3.4.2 (78)

Point

- When Disable (1) is set to "Moving Averaging Process Setting" in the intelligent function module switch setting, the set value in CH☐ Number of moving averaging (Un\G698 to Un\G701) is ignored. When Enable (0) is set to "Moving Averaging Process Setting" in the intelligent function module switch setting, if the value out of the setting range is set to CH☐ Number of moving averaging (Un\G698 to Un\G701), a write data error (error code: ☐☐☐4_H) 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.

4.11 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 buffer memory using this function. For example, the range of -100°C to 100°C can be scaled into the value range of 0 to 4000.

(1) Objects for scaling

CH☐ Temperature process value (PV) (Un\G9 to Un\G12) is scaled in general, but setting CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128) into the 200s allows scaling for the values of other analog modules (such as A/D converter modules) on the system. (☞Page 98, Section 3.4.2 (12))
For details, refer to the following.
☞Page 227, Section 4.16 (1)

Point

This section describes objects for scaling as CH☐ Temperature process value (PV) (Un\G9 to Un\G12). When scaling input values from other analog modules (such as A/D converter modules), substitute CH☐ Temperature process value (PV) (Un\G9 to Un\G12) for CH☐ Temperature process value (PV) for input with another analog module (Un\G689 to Un\G692) to set this.

(2) Monitoring the scaling value

The temperature process value (PV) after scaling processing is stored into the following buffer memory area.

- CH☐ Process value (PV) scaling value (Un\G728, Un\G744, Un\G760, Un\G776) (☞Page 155, Section 3.4.2 (78))

The calculation method of a scaling value is as follows:

$$\text{CH☐ Process value (PV) scaling value (Un\textbackslash G728, Un\textbackslash G744, Un\textbackslash G760, Un\textbackslash G776)} = \frac{(S_H - S_L) \times (P_X - P_{Min})}{P_{Max} - P_{Min}} + S_L$$

P_X : CH☐ Temperature process value (PV) (Un\G9, Un\G10, Un\G11, Un\G12)
P_{Max} : A maximum value of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)
P_{Min} : A minimum value of CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128)
S_H : CH☐ A maximum scaling value of process value (PV) (Un\G727, Un\G743, Un\G759, Un\G775)
S_L : CH☐ A minimum scaling value of process value (PV) (Un\G726, Un\G742, Un\G758, Un\G774)

(a) Calculation example

A calculation example to scale the temperature process value (PV) into percentage is shown below.

Set the following buffer memory areas as below.

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (Temperature measurement range: -200.0°C to 400.0°C)
- CH☐ Process value (PV) scaling lower limit value (Un\G726, Un\G742, Un\G758, Un\G774): 0
- CH☐ Process value (PV) scaling upper limit value (Un\G727, Un\G743, Un\G759, Un\G775): 100

Suppose that 3600 (360.0°C) is stored in CH☐ Temperature process value (PV) (Un\G9 to Un\G12).

The scaling value can be calculated as follows:

CH☐ Process value (PV) scaling value (Un\G728, Un\G744, Un\G760, Un\G776)

$$= \frac{(100 - 0) \times (3600 - (-2000))}{4000 - (-2000)} + 0$$

$$= 93.333 \cdots$$

$$= 93 \text{ (All decimal places are rounded off to an integer.)}$$

(3) Setting method

Set buffer memory areas in the following procedure.

1. Enable or disable the temperature process value (PV) scaling function in the following buffer memory area.

CH☐ Process value (PV) scaling function enable/disable setting (Un\G725, Un\G741, Un\G757, Un\G773) (Page 154, Section 3.4.2 (76))

2. Set a scaling upper limit value and lower limit value in the following buffer memory areas.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Process value (PV) scaling lower limit value	Un\G726	Un\G742	Un\G758	Un\G774	Page 155, Section 3.4.2 (77)
CH☐ Process value (PV) scaling upper limit value	Un\G727	Un\G743	Un\G759	Un\G775	

Point

- An error does not occur even though the areas above are set as follows: Lower limit value ≥ Upper limit value. The scaling is processed according to the calculation method described on Page 198, Section 4.11 (2).
- If a value outside the temperature measurement range is measured, the value set as a upper limit or lower limit is stored into the following buffer memory area.
  - CH☐ Process value (PV) scaling value (Un\G728, Un\G744, Un\G760, Un\G776) (Page 155, Section 3.4.2 (78))

4.12 Alert Function

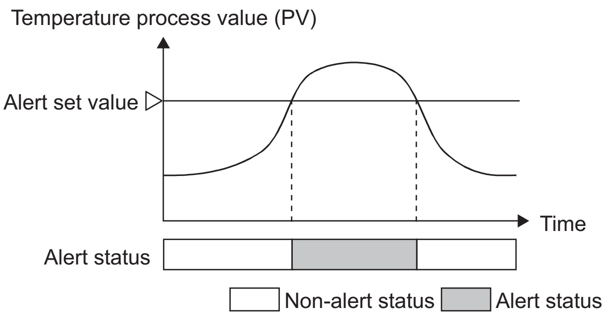
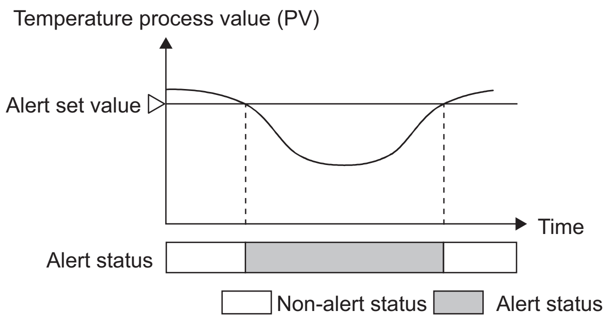
Common

When the 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 200, Section 4.12 (1))
- Deviation alert: upper limit deviation alert, lower limit deviation alert, upper lower limit deviation alert, within-range alert (Page 201, Section 4.12 (2))

(1) Input alert

With the upper limit input alert, when the 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 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 210, Section 4.12 (7) (a))

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

(2) Deviation alert

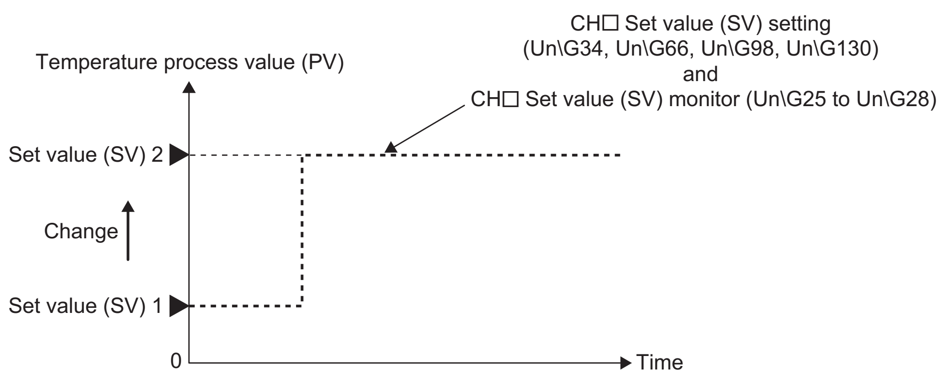
With the deviation alert, when the deviation (E) between the temperature process value (PV) and the set value (SV) meets a particular condition, the system is put in an alert status.
The set value (SV) to be referred is either "set value (SV) monitor" or "set value (SV) setting" depending on the alert 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 Page 121, Section 3.4.2 (28).)
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 (Un\G25 to Un\G28)	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 (Un\G34, Un\G66, Un\G98, Un\G130)	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 (Un\G25 to Un\G28) is changing, an alert can occur depending on the deviation (E) from the set value (SV).

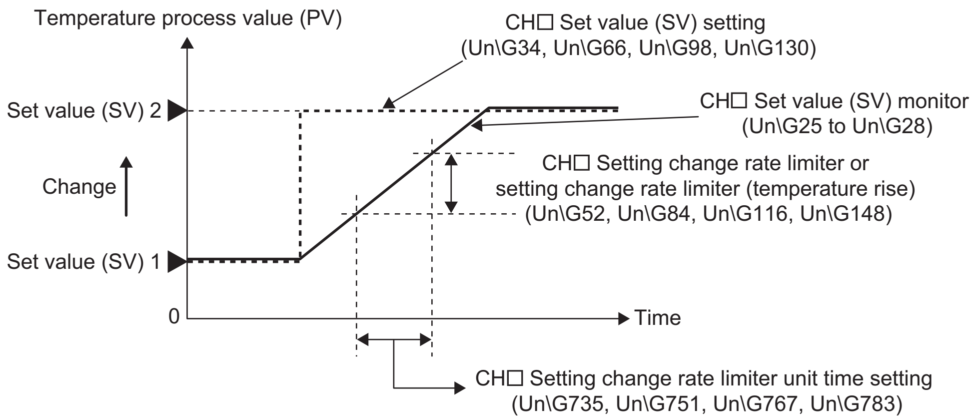
(a) Set value (SV) and the setting change rate limiter setting

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.

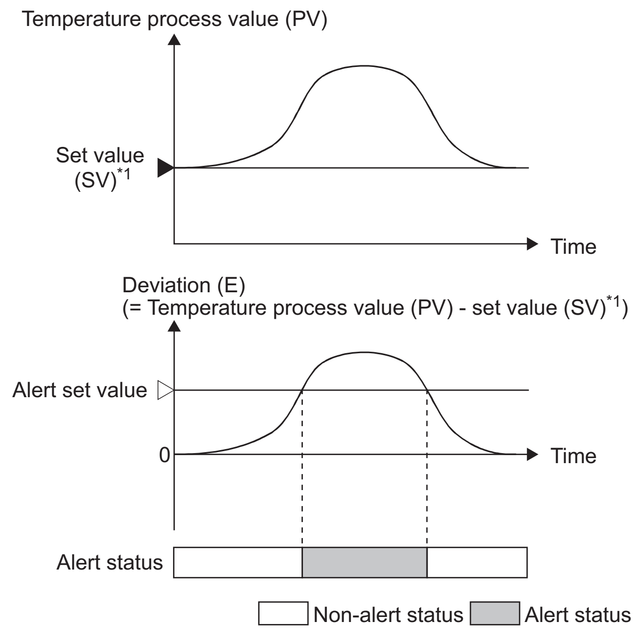
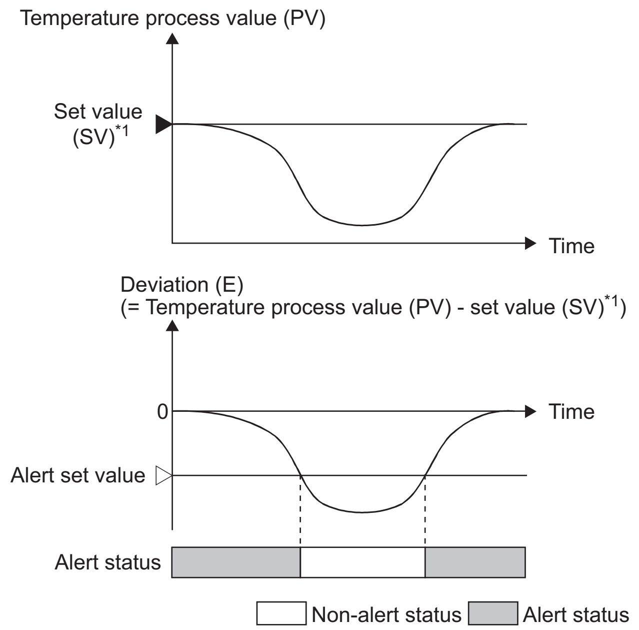


• When the setting change rate limiter is specified: The value in CH☐ Set value (SV) monitor (Un\G25 to Un\G28) follows the set value (SV) of after the setting is reflected.



(b) Upper limit deviation alert

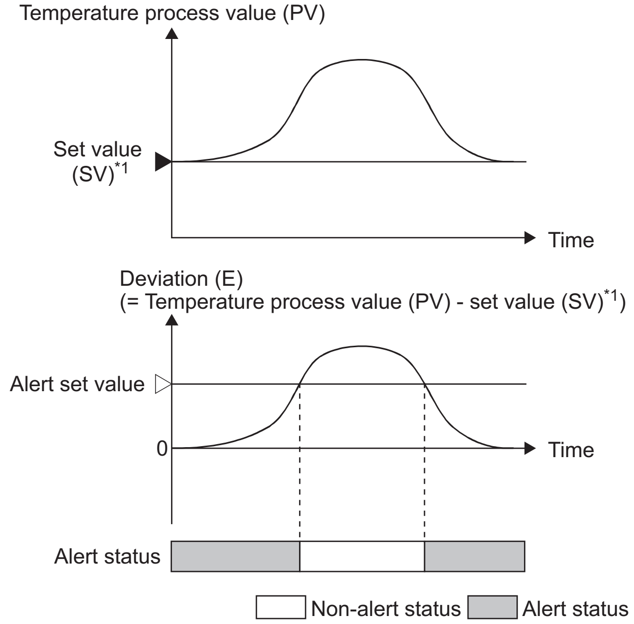
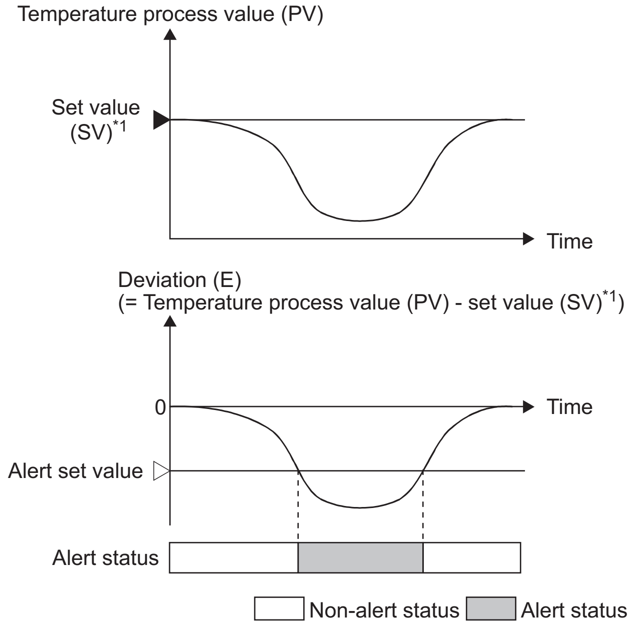
When the deviation (E) is equal to or greater than the alert set value, the system is put in an alert status.

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 201, Section 4.12 (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.

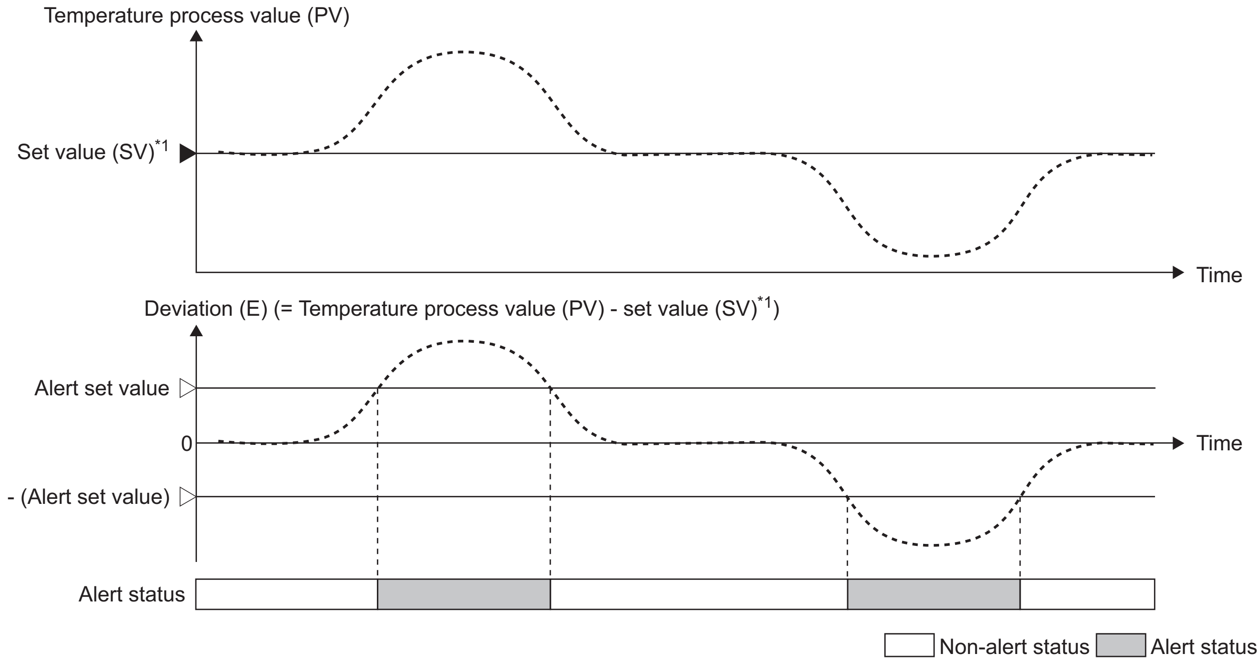
When the alert set value is positive	When the alert set value is negative
	

*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (Page 201, Section 4.12 (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)

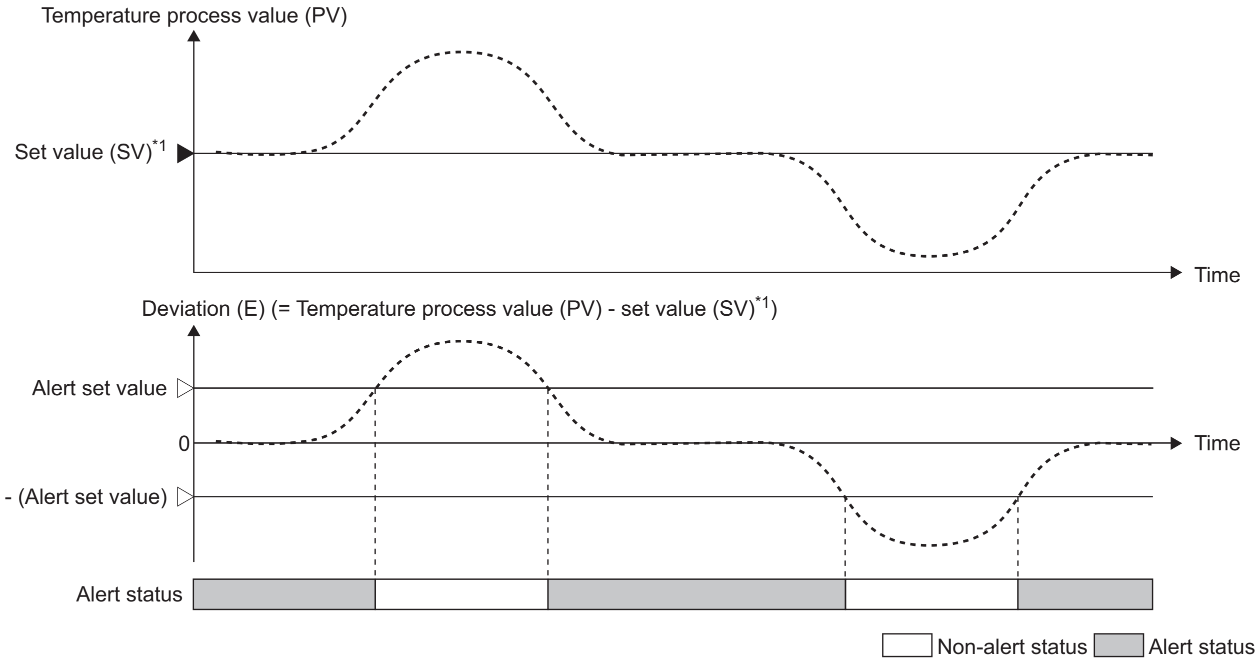


*1 Depending on the alert mode, this value becomes "set value (SV) monitor" or "set value (SV) setting". (Page 201, Section 4.12 (2) (a))

(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 201, Section 4.12 (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 201, Section 4.12 (2) (a) by specifying an alert mode.

- When the alert judgment requires the value in CH☐ Set value (SV) monitor (Un\G25 to Un\G28), set one of the following values.

Alert mode setting (Page 210, Section 4.12 (7) (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)

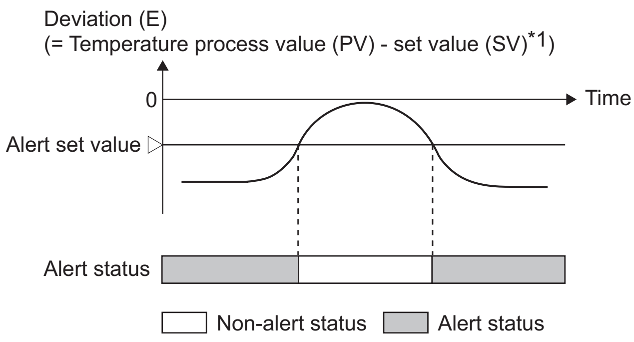
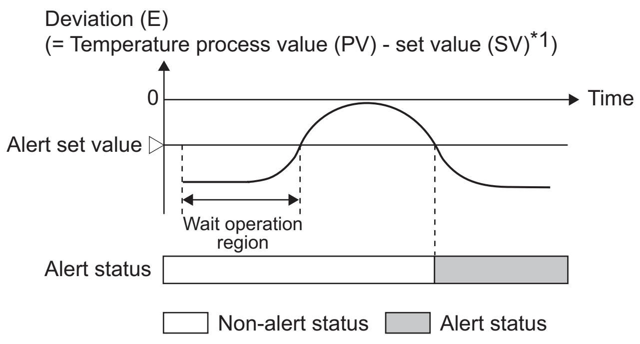
- When the alert judgment requires the value in CH☐ Set value (SV) setting (Un\G34, Un\G66, Un\G98, Un\G130), set one of the following values.

Alert mode setting (Page 210, Section 4.12 (7) (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 module's status is changed from the setting mode to the operation mode (Setting/operation mode instruction (Yn1): OFF→ON), 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 Lower limit deviation alert with standby (10)
The alert function is inactive until the deviation (E) exceeds the alert set value (right figure below).

Lower limit deviation alert (Page 203, Section 4.12 (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 201, Section 4.12 (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

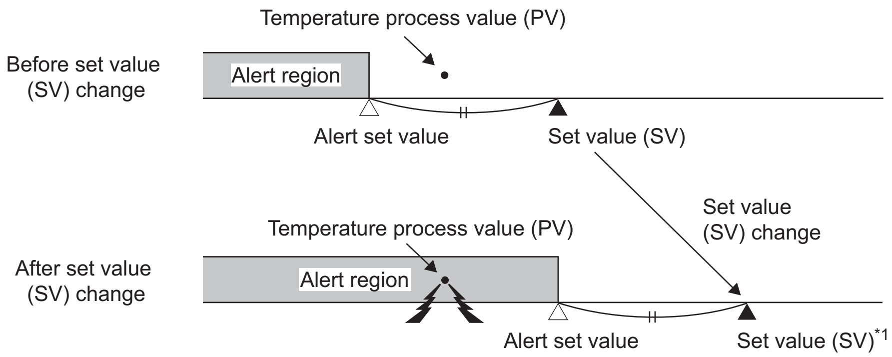
Select one of the following alert modes.

Alert mode setting (Page 210, Section 4.12 (7) (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 201, Section 4.12 (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 210, Section 4.12 (7) (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 210, Section 4.12 (7) (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)

The standby (second time) is used to prevent alert occurrence when the set value (SV) is changed.
If a setting change rate limiter is specified, the value in CH□ Set value (SV) monitor (Un\G25 to Un\G28) gradually changes following the set value (SV) when the set value (SV) is changed. Suppose that the standby (second time) function is activated under such occasion. The alert standby would be always active; therefore an alert would not be output even when the temperature process value (PV) is not following the value in CH□ Set value (SV) monitor (Un\G25 to Un\G28). To prevent such cases, the standby (second time) function is deactivated if a setting change rate limiter is used.

(5) Condition for alert judgment

Whether alert occurrence is judged or not depends on the settings of the followings:

- Setting/operation mode instruction (Yn1) (Page 58, Section 3.3.3 (1))
- PID continuation flag (Un\G169) (Page 133, Section 3.4.2 (43))
- CH☐ PID control forced stop instruction (YnC to YnF) (Page 60, Section 3.3.3 (7))
- CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) (Page 105, Section 3.4.2 (13))

The following table shows the relationship between each setting above and the execution of alert judgment.

○: Judged ×: Not judged

Setting/operation mode instruction (Yn1)*1	PID continuation flag (Un\G169)	CH☐ PID control forced stop instruction (YnC to YnF)	CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129)	Alert judgment
Power ON, Setting mode	Stop (0)/Continue (1)	OFF/ON	Stop (0)	×
			Monitor (1)	×
			Alert (2)	○
Operation mode (operating)	Stop (0)/Continue (1)	OFF	Stop (0)/Monitor (1)/Alert (2)	○
		ON	Stop (0)	×
			Monitor (1)	×
			Alert (2)	○
Setting mode (after operation)	Stop (0)	OFF/ON	Stop (0)	×
			Monitor (1)	×
			Alert (2)	○
	Continue (1)	OFF	Stop (0)/Monitor (1)/Alert (2)	○
		ON	Stop (0)	×
			Monitor (1)	×
			Alert (2)	○

*1 For details, refer to Page 52, Section 3.3.2 (2).

Even if the conditions above are satisfied, when CH☐ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157) is set to Unused (1), alert judgment is not executed. (Page 128, Section 3.4.2 (35))

(6) Condition where CH☐ Alert occurrence flag (XnC to XnF) turns off

The condition where CH☐ Alert occurrence flag turns off differs depending on the setting of the following buffer memory area.

- CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) (Page 105, Section 3.4.2 (13))

CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129)	Condition where CH☐ Alert occurrence flag (XnC to XnF) turns off
Stop (0)	When the cause of the alert is resolved, or when the system is shifted from the operation mode to the setting mode (when Setting/operation mode instruction (Yn1) is turned off from on).
Monitor (1)	
Alert (2)	When the cause of the alert is resolved,

(7) 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. Set them in the following buffer memory areas.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Alert 1 mode setting	Un\G192	Un\G208	Un\G224	Un\G240	Page 139, Section 3.4.2 (52)
CH☐ Alert 2 mode setting	Un\G193	Un\G209	Un\G225	Un\G241	
CH☐ Alert 3 mode setting	Un\G194	Un\G210	Un\G226	Un\G242	
CH☐ Alert 4 mode setting	Un\G195	Un\G211	Un\G227	Un\G243	

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 Un\G5 to Un\G8) to CH☐ Alert 4 (b11 of Un\G5 to Un\G8) turns on according to the set alert mode. Up to four values can be set for each channel. Set them in the following buffer memory areas.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Alert set value 1	Un\G38	Un\G70	Un\G102	Un\G134	Page 110, Section 3.4.2 (18)
CH☐ Alert set value 2	Un\G39	Un\G71	Un\G103	Un\G135	
CH☐ Alert set value 3	Un\G40	Un\G72	Un\G104	Un\G136	
CH☐ Alert set value 4	Un\G41	Un\G73	Un\G105	Un\G137	

Alert set value 1 to 4 corresponds to each alert mode for alert 1 to 4.

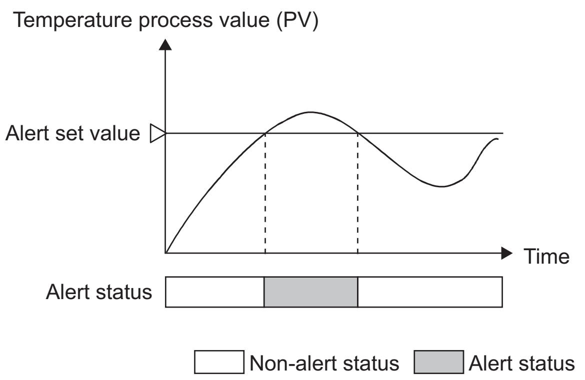
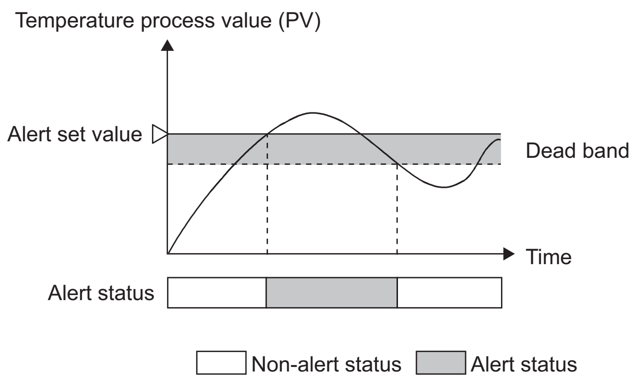
(8) Setting the alert dead band

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 case can be prevented by setting an alert dead band.

(a) Setting method

Set a value in Alert dead band setting (Un\G164). (Page 131, Section 3.4.2 (38))

Ex. When the alert mode is set to Upper limit input alert (1) (Page 200, Section 4.12 (1))
When a value other than 0 (0.0%) is set in Alert dead band setting (Un\G164), 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 (figure on the right).

When 0 (0.0%) is set in Alert dead band setting (Un\G164)	When a value other than 0 (0.0%) is set in Alert dead band setting (Un\G164)
	

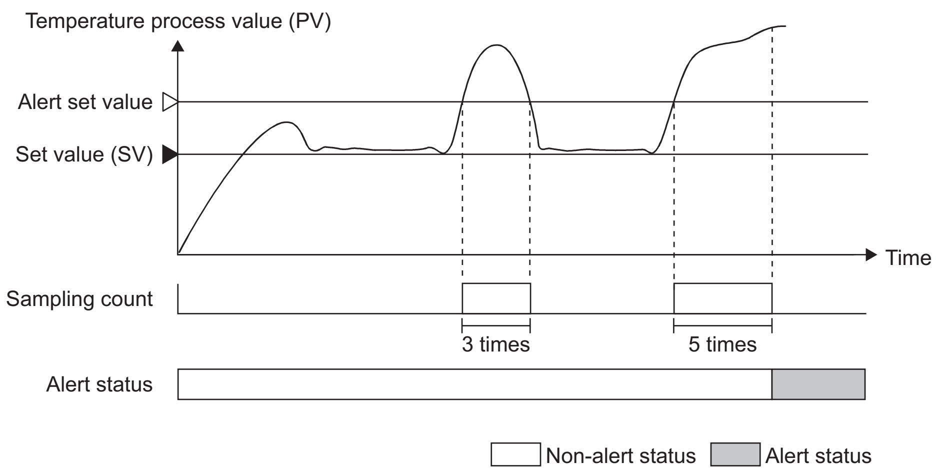
(9) Setting the number of alert delay

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

Set a value in Number of alert delay (Un\G165). (Page 131, Section 3.4.2 (39))

Ex. When the alert mode is set to Upper limit input alert (1) (Page 200, Section 4.12 (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.



(10)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 211, Section 4.12 (8))	Number of alert delay (Page 212, Section 4.12 (9))	Alert with standby (Page 206, Section 4.12 (3))	Alert with standby (second time) (Page 207, Section 4.12 (4))
Input alert	Upper limit input alert (Page 200, Section 4.12 (1))	○	○	○	—
	Lower limit input alert (Page 200, Section 4.12 (1))	○	○	○	—
Deviation alert	Upper limit deviation alert (Page 202, Section 4.12 (2) (b))	○	○	○	○
	Upper limit deviation alert (using the set value (SV)) (Page 202, Section 4.12 (2) (b))	○	○	○	○
	Lower limit deviation alert (Page 203, Section 4.12 (2) (c))	○	○	○	○
	Lower limit deviation alert (using the set value (SV)) (Page 203, Section 4.12 (2) (c))	○	○	○	○
	Upper lower limit deviation alert (Page 203, Section 4.12 (2) (d))	○	○	○	○
	Upper lower limit deviation alert (using the set value (SV)) (Page 203, Section 4.12 (2) (d))	○	○	○	○
	Within-range alert (Page 204, Section 4.12 (2) (e))	○	○	—	—
	Within-range alert (using the set value (SV)) (Page 204, Section 4.12 (2) (e))	○	○	—	—

4.13 RFB Limiter Function

The RFB (reset feed back) function operates when deviation (E) continues for a long period of time. In such 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 Q64TCN 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 Q64TCN 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.

4.14 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 215, Section 4.14 (1))
- Sensor two-point correction function (Page 219, Section 4.14 (2))

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

This function corrects a temperature correction value, the proportion of the temperature difference to the fullscale set input range.

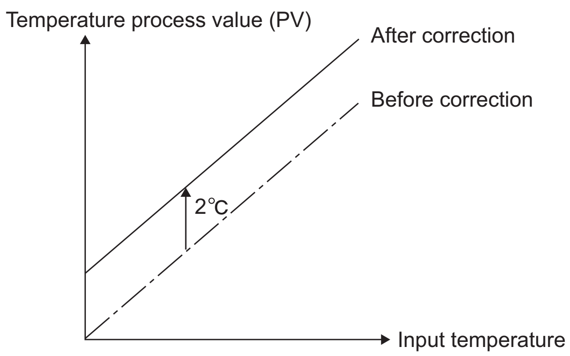
Set a correction value to CH□ Sensor correction value setting (Un\G45, Un\G77, Un\G109, Un\G141).

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

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

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

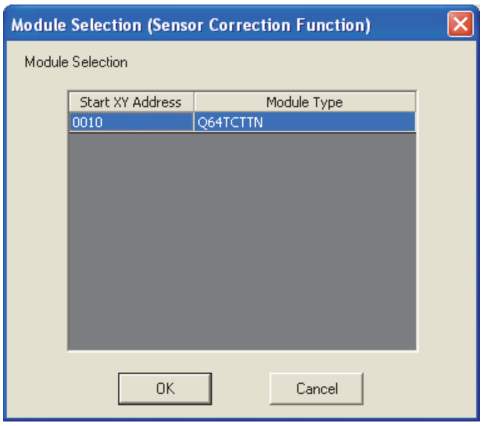
Based on the above formula, set 50 (0.50%) to CH□ Sensor correction value setting (Un\G45, Un\G77, Un\G109, Un\G141).



(a) How to execute normal sensor correction (one-point correction) (when using GX Works2)

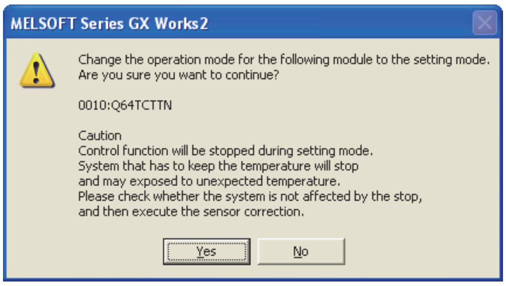
Set this function on the "Sensor Correction Function" window.

[Tool] ➪ [Intelligent Function Module Tool] ➪ [Temperature Control Module] ➪ [Sensor Correction Function...]



↓

1. Select the module where sensor correction is executed and click OK.

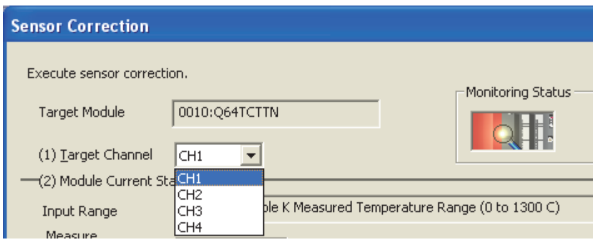


↓

2. Click Yes.

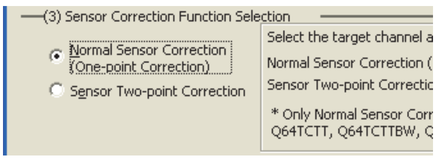
↓

3. Click OK.



↓

4. Select the channel where sensor correction is executed under "Target Channel".



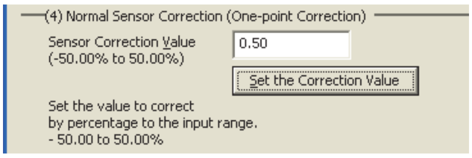
↓

5. Select "Normal Sensor Correction (One-point Correction)" under "Sensor Correction Function Selection".

(To the next page)

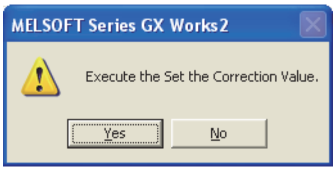
(From the previous page)

↓



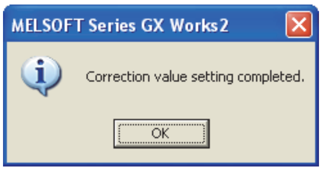
6. **Set "Sensor Correction Value" and click [Set the Correction Value].**

↓



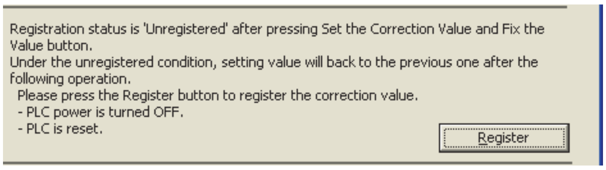
7. **Click [Yes].**

↓



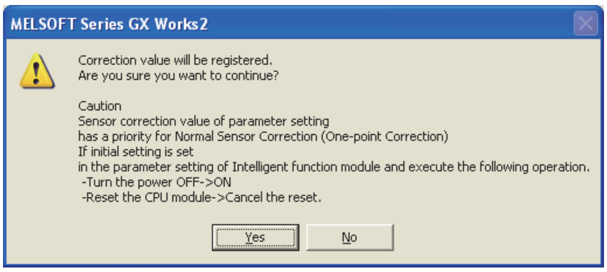
8. **Click [OK].**

↓



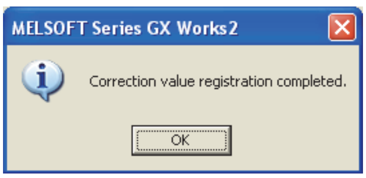
9. **To back up the correction value in E^2PROM, click [Register].**

↓



10. **Click [Yes].**

↓



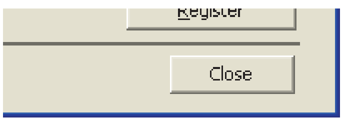
11. **Click [OK].**

↓

(To the next page)

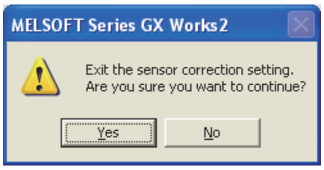
(From the previous page)

↓



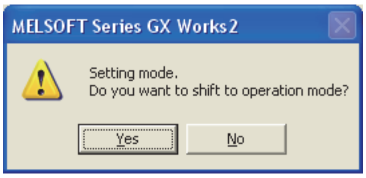
12. **Click Close.**

↓



13. **Click Yes.**

↓



14. **To shift from the setting mode to the operation mode, click Yes.**

↓

End

Remark

The value set in "Sensor correction value setting" on the "Parameter" window of GX Works2 has a priority over the correction value obtained by step 8, if the initial settings are set on the "Parameter" window and the following operation is executed.

- Turn off and on the power.
- Reset the CPU module and cancel the reset.

To use the correction value obtained by step 8 after executing the above operation, correct the value set in "Sensor correction value setting" on the "Parameter" window.
Before correcting the value, check the operation temporarily following the contents obtained by step 8.
For the setting in "Parameter", refer to the following.

☞ Page 306, Section 6.3

(b) How to execute normal sensor correction (one-point correction) (when using the program)

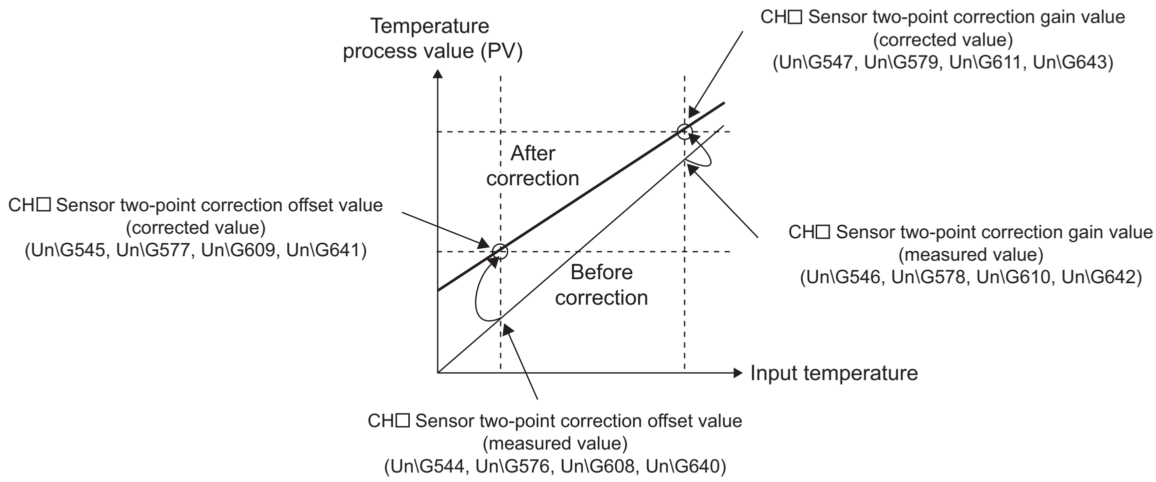
Follow the instructions below.

1. **Set Normal sensor correction (one-point correction) (0_H) in Sensor correction function selection (Un\G785). (☞ Page 161, Section 3.4.2 (87))**

2. **Set the correction value in CH□ Sensor correction value setting (Un\G45, Un\G77, Un\G109, Un\G141). (☞ Page 115, Section 3.4.2 (21))**

(2) Sensor two-point correction function

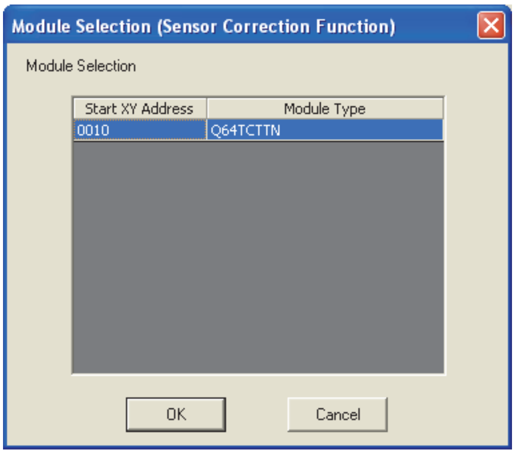
With this function, the difference between the temperature process value (PV) and the actual temperature between the two points selected in advance (a corrected offset value and a corrected gain value) is stored. Based on this gradient, the difference between a sensor and the actual temperature is corrected.
Sensor two-point correction is performed in the setting mode (Setting/operation mode status (Xn1): off). In addition, set CH☐ Stop mode setting (Un\G33, Un\G65, Un\G97, Un\G129) to Monitor (1).



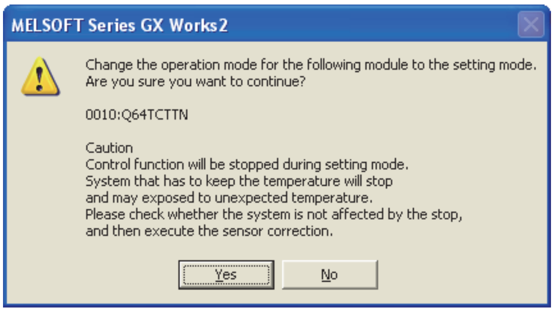
(a) How to execute sensor two-point correction (when using GX Works2)

Set this function on the "Sensor Correction Function" window.

[Tool] ➪ [Intelligent Function Module Tool] ➪ [Temperature Control Module] ➪ [Sensor Correction Function...]

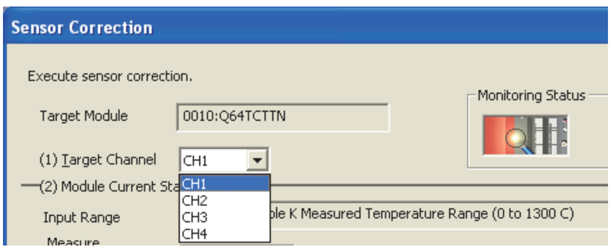


1. **Select the module where sensor correction is executed and click OK.**

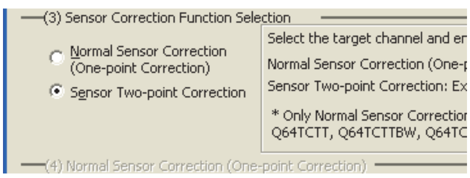


2. **Click Yes.**

3. **Click OK.**



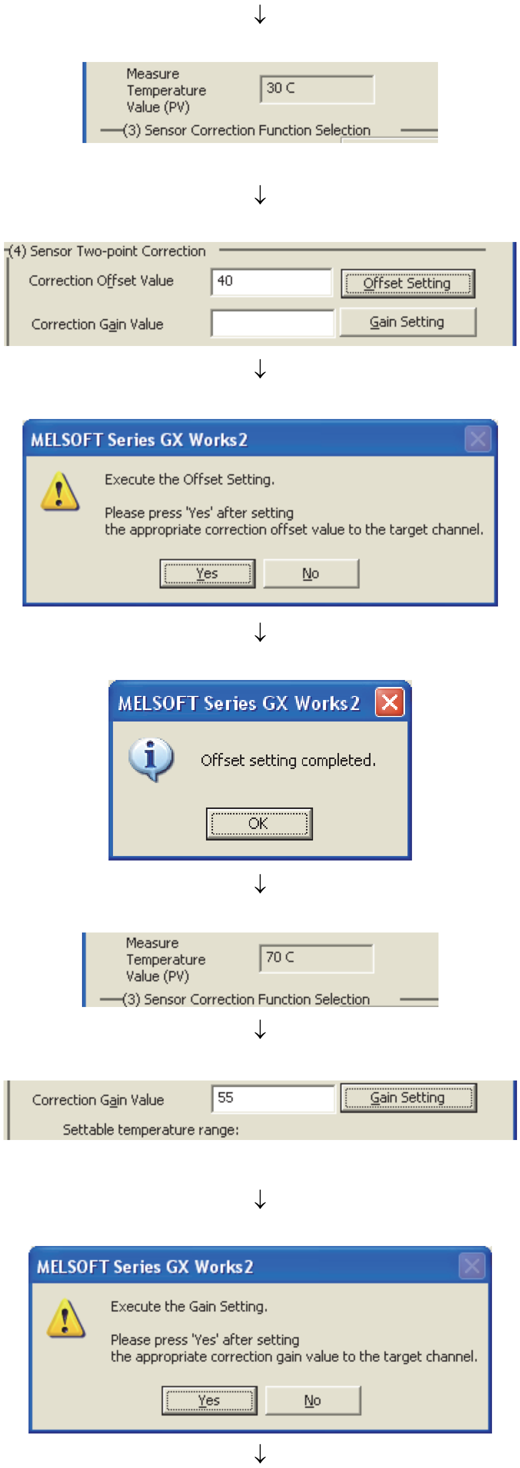
4. **Select the channel where sensor correction is executed under "Target Channel".**



5. **Select "Sensor Two-point Correction" under "Sensor Correction Function Selection".**

(To the next page)

(From the previous page)



(To the next page)

6. Monitor "Measure Temperature Value (PV)" and enter the corrected offset value.*1

7. Set the temperature process value (PV) to be input under "Correction Offset Value". Then click Offset Setting.

8. Click Yes.

9. Click OK.

10. Monitor "Measure Temperature Value (PV)" and enter the corrected gain value.*1

11. Set the temperature process value (PV) to be input under "Correction Gain Value". Then click Gain Setting.

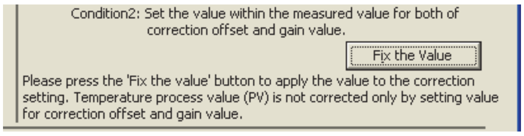
12. Click Yes.

(From the previous page)

↓

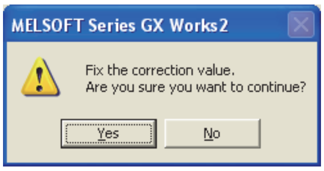
13. Click OK.

↓



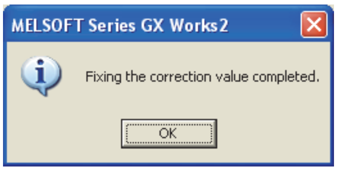
14. Click Fix the Value.

↓



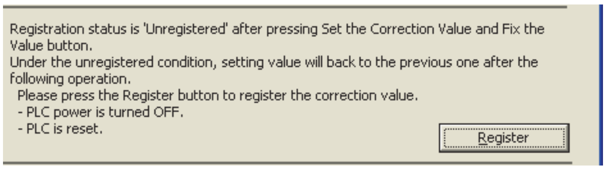
15. Click Yes.

↓



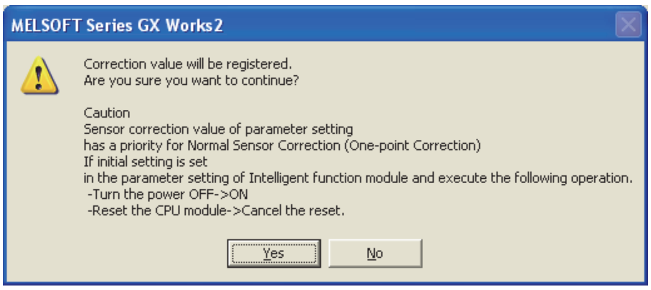
16. Click OK.

↓



17. To back up the correction value in E^2PROM, click Register.

↓

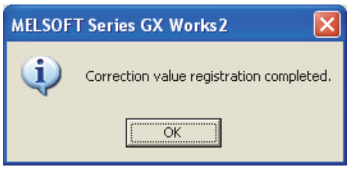


18. Click Yes.

↓

(To the next page)

(From the previous page)
↓

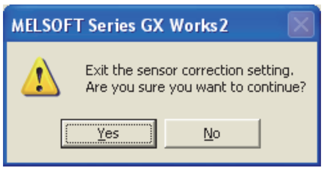


19. **Click OK .**

↓

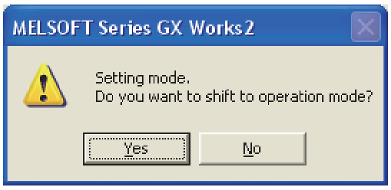
20. **Click Close .**

↓



21. **Click Yes .**

↓



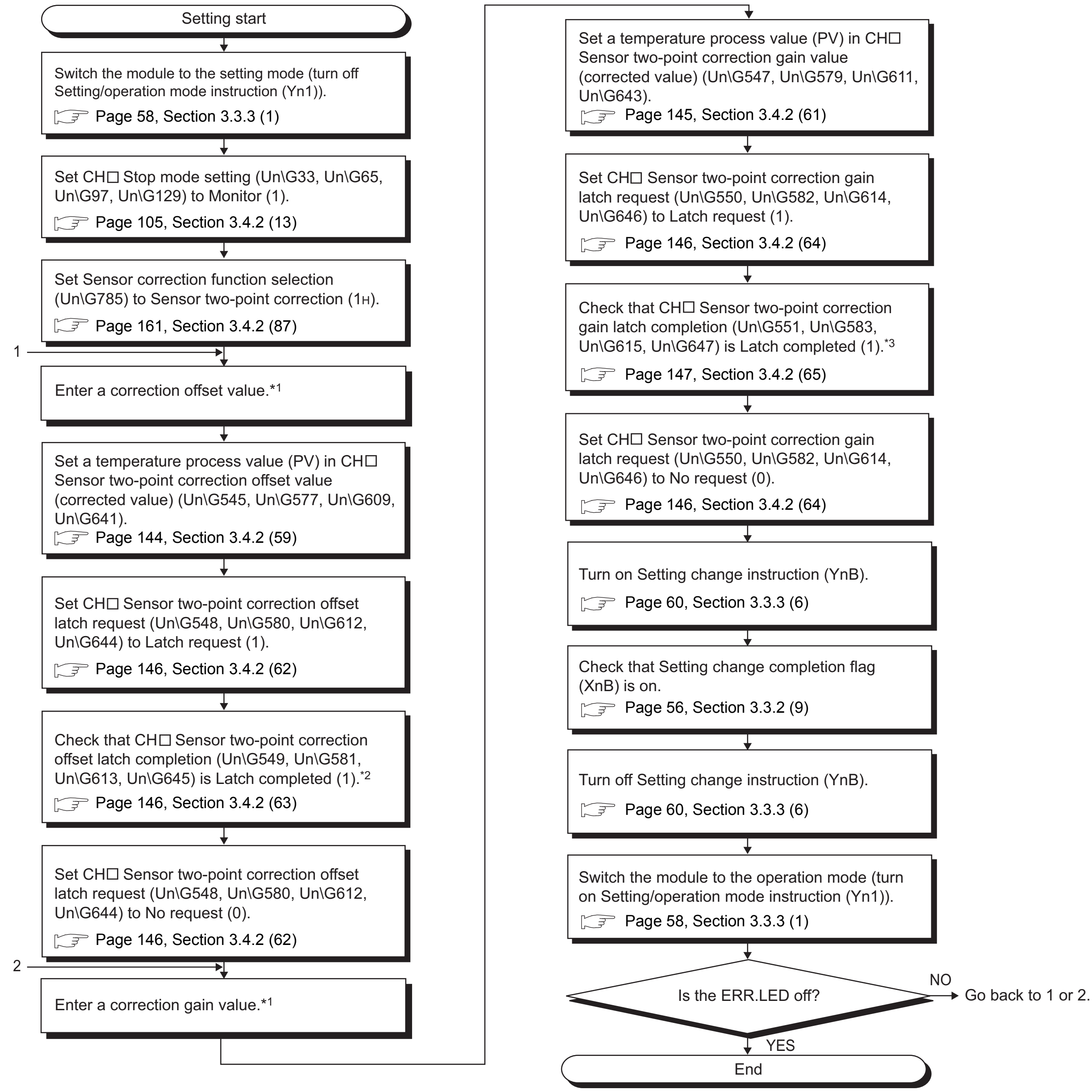
22. **To shift from the setting mode to the operation mode, click Yes .**

↓
End

*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.

(b) How to execute sensor two-point correction (when using the program)

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) (Un\G544, Un\G576, Un\G608, Un\G640). (Page 144, Section 3.4.2 (58))

*3 When the latch is completed, the temperature process value (PV) is stored in CH□ Sensor two-point correction gain value (measured value) (Un\G546, Un\G578, Un\G610, Un\G642). (Page 145, Section 3.4.2 (60))

Point

- If a write data error (error code: □□□7_H) 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 Q64TCN.)
- To use the value set for sensor two-point correction even after the power is turned off and on or the CPU module is reset and the reset is cancelled, back up the value with the following method.
    - Turn off and on E^2PROM backup instruction (Yn8). (Page 59, Section 3.3.3 (4))

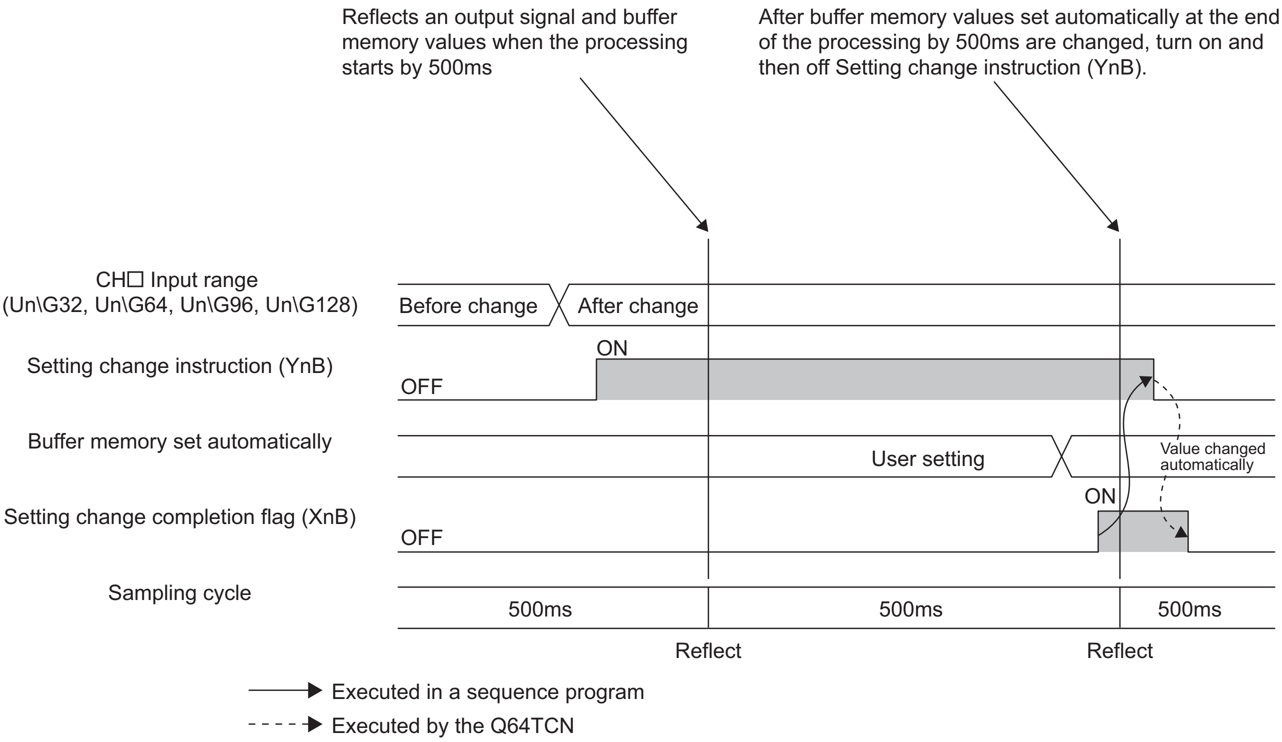
4.15 Auto-setting at Input Range Change

Common

When the input range is changed, using this function automatically changes related buffer memory data to prevent an error outside the setting range. Set the function on the "Switch Setting" window.
For details on the setting method, refer to the following.

Page 305, Section 6.2

The following is the setting timing.



(1) Buffer memory automatically set

Refer to Page 103, Section 3.4.2 (12) (d).

4.16 Input/output (with Another Analog Module) Function

Common

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 Q64TCN, 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

Follow the procedure below.

1. Set a value within the range of 200 to 299 in CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128). (**Page 98, Section 3.4.2 (12)**)

2. Store the value of another analog module (such as an A/D converter module) into CH☐ Temperature process value (PV) for input with another analog module (Un\G689 to Un\G692). (**Page 152, Section 3.4.2 (70)**)

Point

- If the second procedure above is executed ahead of the first procedure, a write data error (error code: ☐☐☐4_H) occurs.
- When this function is used, the value in the following buffer memory area is used for the temperature process value (PV) scaling function.
  - CH☐ Temperature process value (PV) for input with another analog module (Un\G689 to Un\G692)

  For details on the temperature process value (PV) scaling function, refer to the following.
  Page 200, Section 4.12

(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

Follow the procedure below (for the standard control).

1. Set a value in Resolution of the manipulated value for output with another analog module (Un\G181). (**Page 136, Section 3.4.2 (48)**)

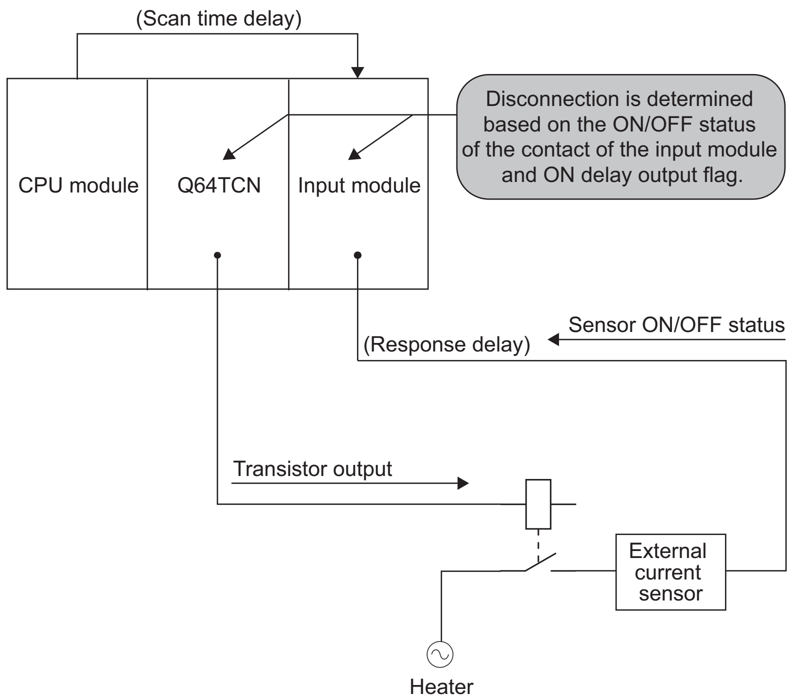
2. Store the value in CH☐ Manipulated value (MV) for output with another analog module (Un\G177 to Un\G180) into the buffer memory in other analog module (such as a D/A converter module). (**Page 135, Section 3.4.2 (47)**)

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.

4.17 ON Delay Output Function

This function allows the user to set the delay (response/scan time 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 flag.



(1) Setting method

Set a value in the following buffer memory area.

- Transistor output monitor ON delay time setting (Un\G175) (Page 134, Section 3.4.2 (45))

4.18 Self-tuning Function

Standard

The Q64TCN 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
- 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

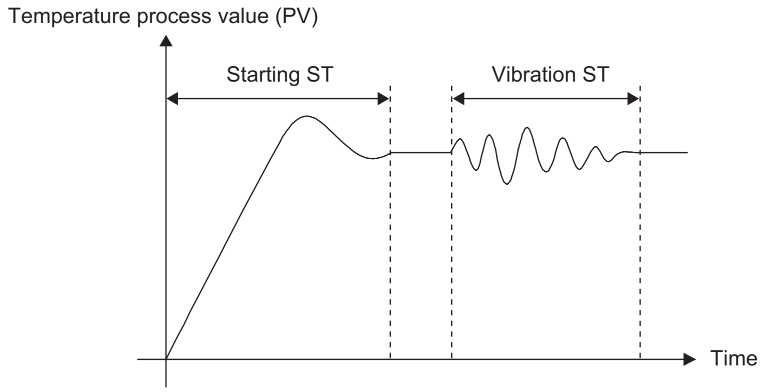
The following table lists the differences between auto tuning and self-tuning.

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 (Yn4 to Yn7) starts auto tuning and changes PID constants upon completion.	The Q64TCN 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 (Un\G59, Un\G91, Un\G123, Un\G155) is also calculated.	The optimum PID constants may not be obtained by one tuning. CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155) is not calculated.
PID constants setting when the characteristics of a controlled object fluctuate	Users perform auto tuning again to change PID constants.	The Q64TCN 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

Select one of the following four setting values in CH□ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670). (The default is Do not run the ST (0).) (Page 148, Section 3.4.2 (68))

- Starting ST (PID constants only) (1)
- Starting ST (Simultaneous temperature rise parameter only) (2)
- Starting ST (PID constants and simultaneous temperature rise parameter) (3)
- Starting ST plus vibration ST (PID constants only) (4)

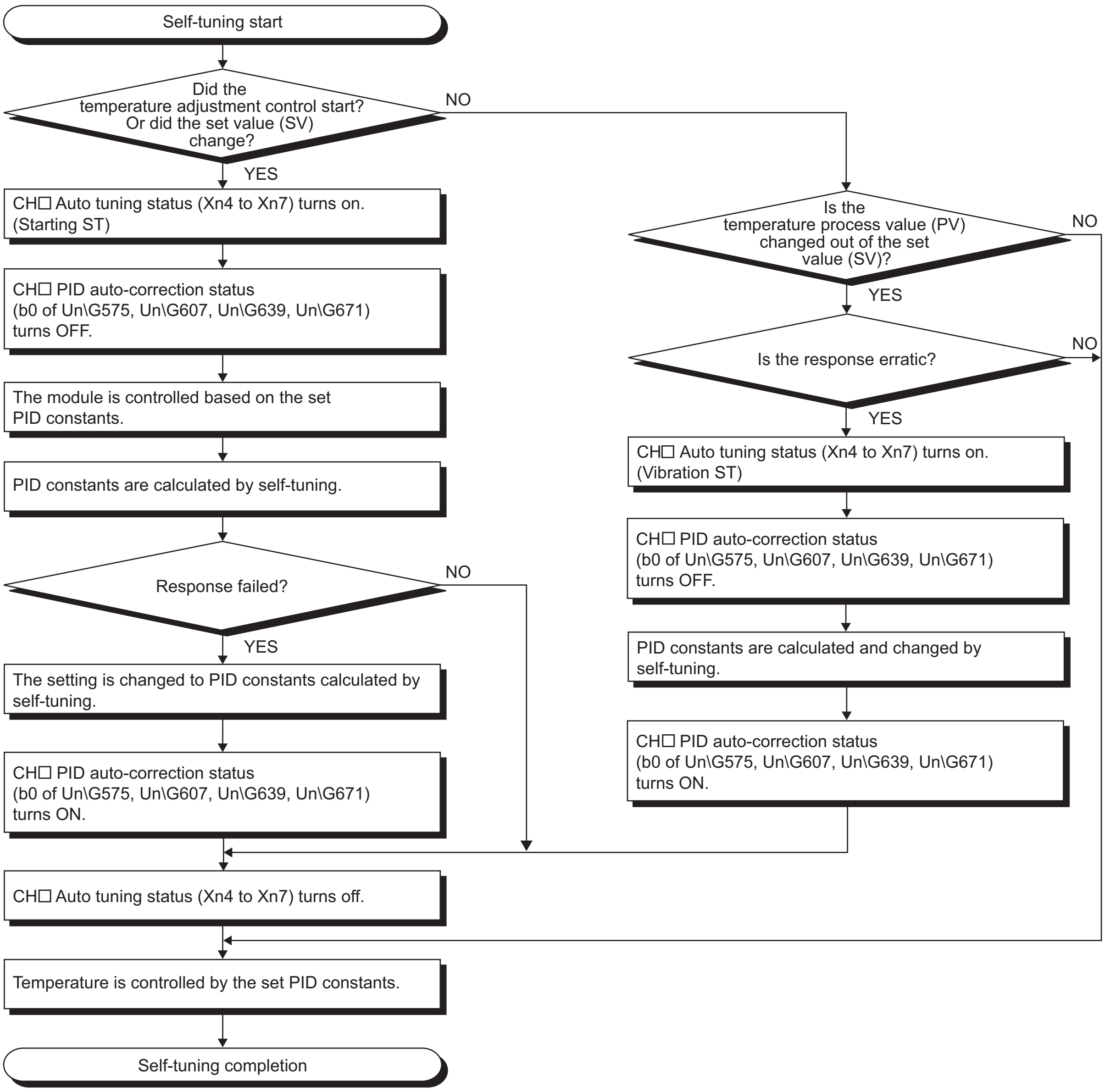
(b) How to set vibration ST

Set the following in CH□ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670). (Page 148, Section 3.4.2 (68))

- Starting ST plus vibration ST (PID constants only) (4)

(3) Procedure for the self-tuning control

The following is the flow chart for the control.

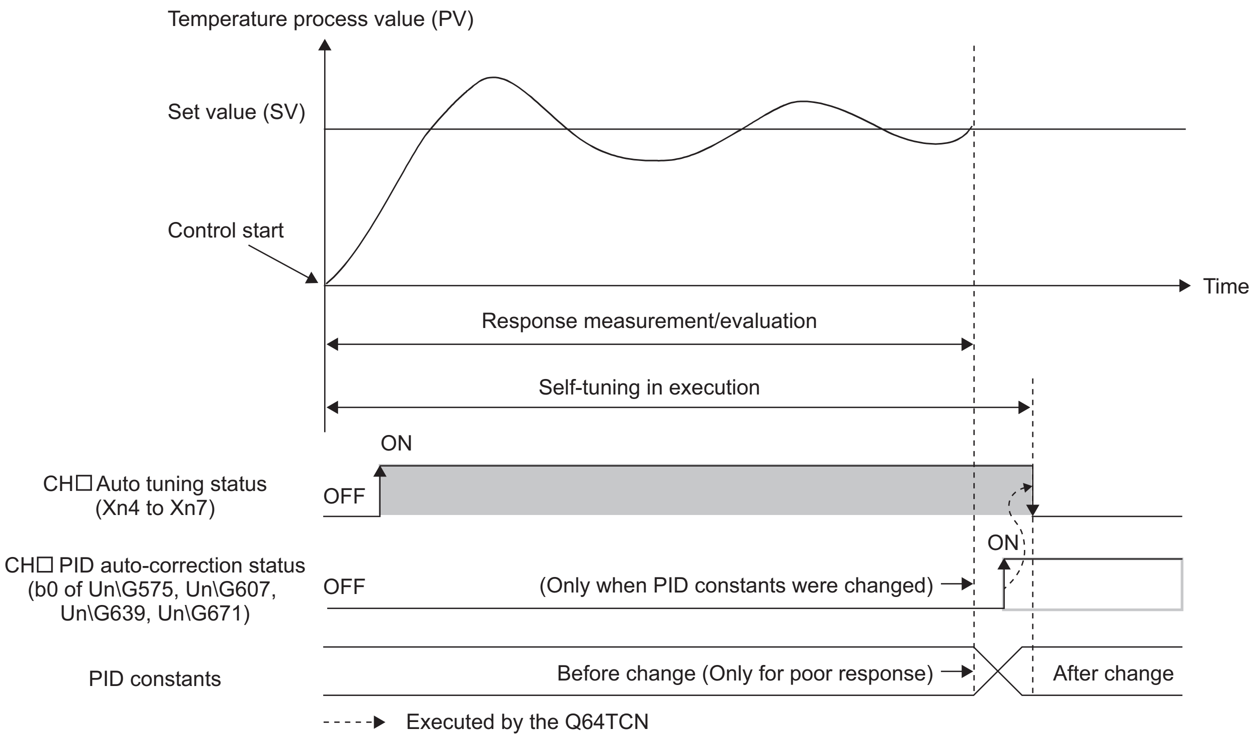


(4) Operation with starting ST

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 Un\G575, Un\G607, Un\G639, Un\G671) is turned 0 (OFF). In addition, CH☐ Auto tuning status (Xn4 to Xn7) 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 buffer memory. In addition, CH☐ PID auto-correction status (b0 of Un\G575, Un\G607, Un\G639, Un\G671) is turned 1 (ON). When a control response is good, CH☐ PID auto-correction status (b0 of Un\G575, Un\G607, Un\G639, Un\G671) remains 0 (OFF) and PID constants are not changed.
4	CH☐ Auto tuning status (Xn4 to Xn7) is turned off.



(a) Conditions for starting ST

Starting ST is executed under the following conditions:

- When the setting mode is shifted to the operation mode (Setting/operation mode instruction (Yn1) is turned off and on) the first time after the power is turned off and on or after the CPU module is reset and the reset is cancelled
- When the setting mode is shifted to the operation mode the second time or later after the power is turned off and on or after the CPU module is reset and the reset is cancelled (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 temperature process value (PV) before the set value (SV) change 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.

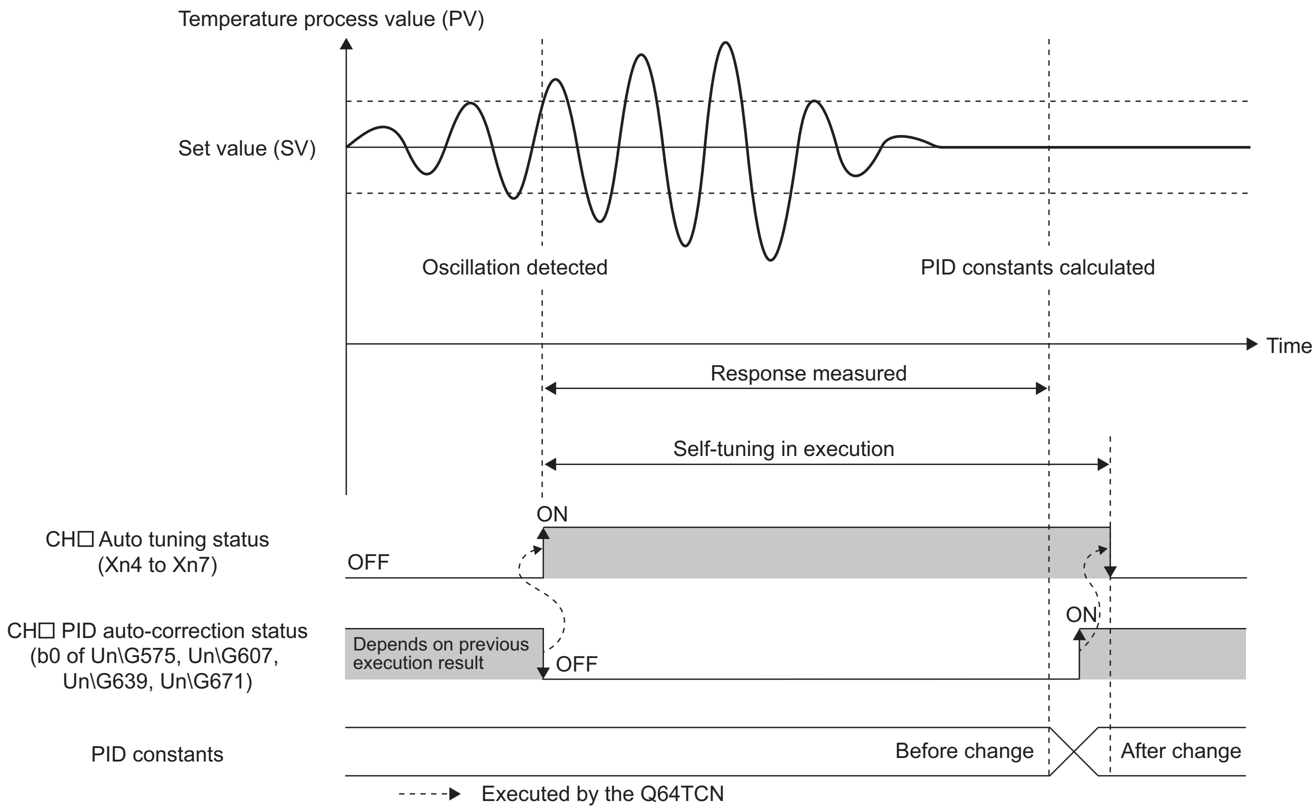
(5) Operation with vibration ST

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 Un\G575, Un\G607, Un\G639, Un\G671) is turned 0 (OFF). In addition, CH☐ Auto tuning status (Xn4 to Xn7) is turned on.
2	PID constants are calculated based on a response waveform.
3	PID constants are set in the buffer memory and CH☐ PID auto-correction status (b0 of Un\G575, Un\G607, Un\G639, Un\G671) is turned 1 (ON).
4	CH☐ Auto tuning status (Xn4 to Xn7) is turned off.



(a) Conditions for vibration ST

Vibration ST is executed when the temperature process value (PV) goes outside the range that is judged as stable.

(b) Precautions

If vibration ST is executed on the following objects, incorrect PID constants may be determined:

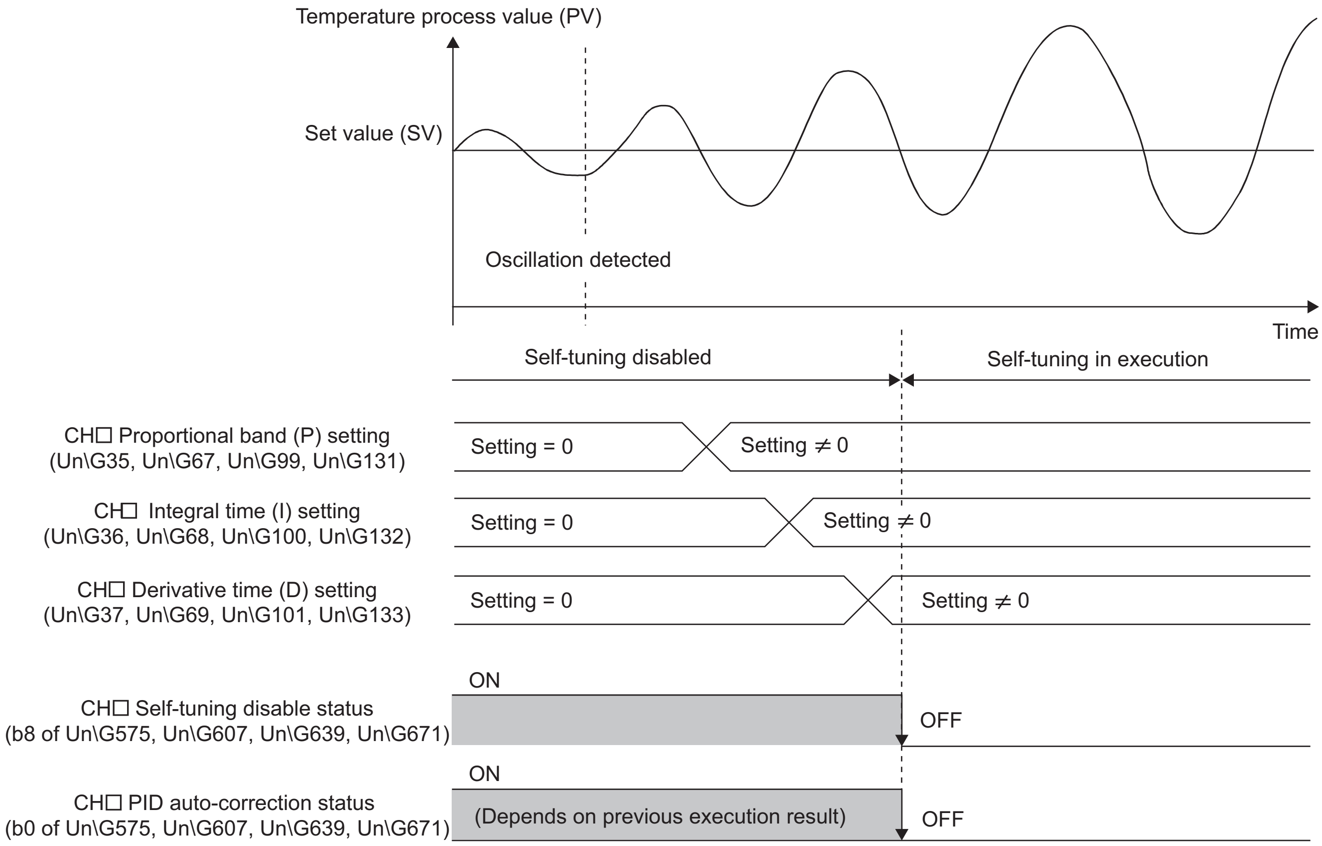
- Controlled objects where a disturbance periodically occurs
- Controlled objects with strong mutual interference

(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 one of the four methods other than the PID control (two-position control, P control, PI control, PD control), self-tuning is not executed. In addition, CH☐ Self-tuning disable status (b8 of Un\G575, Un\G607, Un\G639, Un\G671) 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

Self-tuning is not executed during the auto tuning (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 (Un\G574, Un\G606, Un\G638, Un\G670) is set to Starting ST plus vibration ST (4).

(d) The temperature process value (PV) is not within the temperature measurement range

Self-tuning is not executed. In addition, CH□ Self-tuning disable status (b8 of Un\G575, Un\G607, Un\G639, Un\G671) turns 1 (ON).

(e) The value set in CH□ Output variation limiter setting (Un\G44, Un\G76, Un\G108, Un\G140) is not 0 (Page 114, Section 3.4.2 (20))

Self-tuning is not executed. In addition, CH□ Self-tuning disable status (b8 of Un\G575, Un\G607, Un\G639, Un\G671) turns 1 (ON).

(f) CH□ AUTO/MAN mode shift (Un\G50, Un\G82, Un\G114, Un\G146) is set to MAN (1) (Page 119, Section 3.4.2 (26))

Self-tuning is not executed. In addition, CH□ Self-tuning disable status (b8 of Un\G575, Un\G607, Un\G639, Un\G671) turns 1 (ON).

(g) Values other than 0 (0.0%) have been set for the setting change rate limiter (Page 121, Section 3.4.2 (28))

If the values other than 0 (0.0%) have been set to the following buffer memory areas, CH□ Self-tuning disable status (b8 of Un\G575, Un\G607, Un\G639, Un\G671) turns 1 (ON).

Buffer memory area name	Buffer memory address			
	CH1	CH2	CH3	CH4
CH□ Setting change rate limiter/Setting change rate limiter (temperature rise)	Un\G52	Un\G84	Un\G116	Un\G148
CH□ Setting change rate limiter (temperature drop)	Un\G564	Un\G596	Un\G628	Un\G660

(h) The heating-cooling control has been selected for the control mode (Page 305, Section 6.2)

The self-tuning is not executed.

(7) Discontinuation of self-tuning

The following operation during self-tuning discontinues the self-tuning operation.

- The setting in CH□ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) 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 (Xn4 to Xn7). (Page 54, Section 3.3.2 (5))

(8) Conditions where self-tuning does not complete due to errors

Under the following conditions, self-tuning does not complete due to errors. In addition, at this abnormal termination, CH☐ Self-tuning error (b10 of Un\G575, Un\G607, Un\G639, Un\G671) turns 1 (ON).

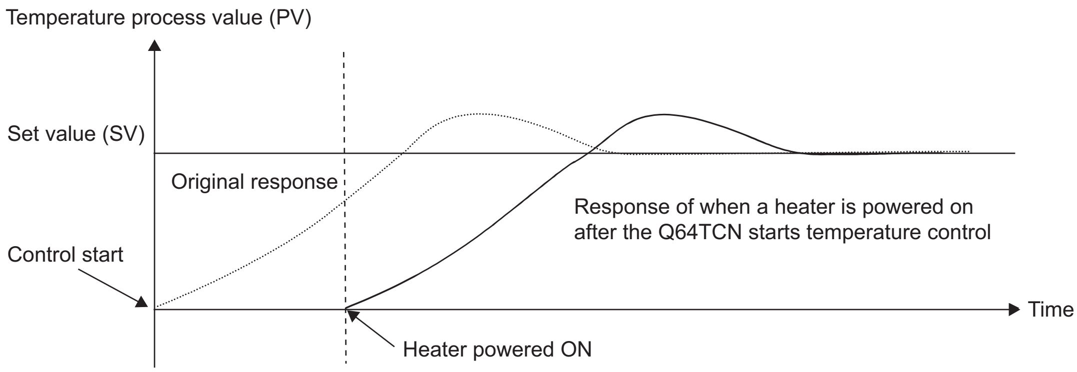
- When 6000 seconds (1 hour 40 minutes) or more have elapsed from the start of self-tuning
- When the change rate of the process value (PV) during self-tuning is less than 1.125°C/minute
- When CH☐ Temperature process value (PV) (Un\G9 to Un\G12) is outside the temperature measurement range (☞ Page 89, Section 3.4.2 (3))
- 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 the temperature process value (PV) that is supposed to rise drops by 1°C (°F) or more after self-tuning is started with the starting ST
- When the temperature process value (PV) that is supposed to drop rises by 1°C (°F) or more after self-tuning is started with the starting ST
- When the setting for the buffer memory areas in the following table is changed during self-tuning

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Set value (SV) setting[*1]	Un\G34	Un\G66	Un\G98	Un\G130	Page 106, Section 3.4.2 (14)
CH☐ Proportional band (P) setting	Un\G35	Un\G67	Un\G99	Un\G131	Page 107, Section 3.4.2 (15)
CH☐ Integral time (I) setting	Un\G36	Un\G68	Un\G100	Un\G132	Page 109, Section 3.4.2 (16)
CH☐ Derivative time (D) setting	Un\G37	Un\G69	Un\G101	Un\G133	Page 109, Section 3.4.2 (17)
CH☐ Upper limit output limiter	Un\G42	Un\G74	Un\G106	Un\G138	Page 112, Section 3.4.2 (19)
CH☐ Lower limit output limiter	Un\G43	Un\G75	Un\G107	Un\G139	
CH☐ Output variation limiter setting	Un\G44	Un\G76	Un\G108	Un\G140	Page 114, Section 3.4.2 (20)
CH☐ Sensor correction value setting	Un\G45	Un\G77	Un\G109	Un\G141	Page 115, Section 3.4.2 (21)
CH☐ Control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	Page 116, Section 3.4.2 (23)
CH☐ Primary delay digital filter setting	Un\G48	Un\G80	Un\G112	Un\G144	Page 117, Section 3.4.2 (24)
CH☐ AUTO/MAN mode shift	Un\G50	Un\G82	Un\G114	Un\G146	Page 119, Section 3.4.2 (26)
CH☐ Setting change rate limiter/Setting change rate limiter (temperature rise)	Un\G52	Un\G84	Un\G116	Un\G148	Page 121, Section 3.4.2 (28)
CH☐ Forward/reverse action setting	Un\G54	Un\G86	Un\G118	Un\G150	Page 123, Section 3.4.2 (30)
CH☐ Unused channel setting	Un\G61	Un\G93	Un\G125	Un\G157	Page 128, Section 3.4.2 (35)
CH☐ Setting change rate limiter (temperature drop)	Un\G564	Un\G596	Un\G628	Un\G660	Page 121, Section 3.4.2 (28)

*1 Only during starting

(9) Precautions

- Before starting the temperature control using the Q64TCN, 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.



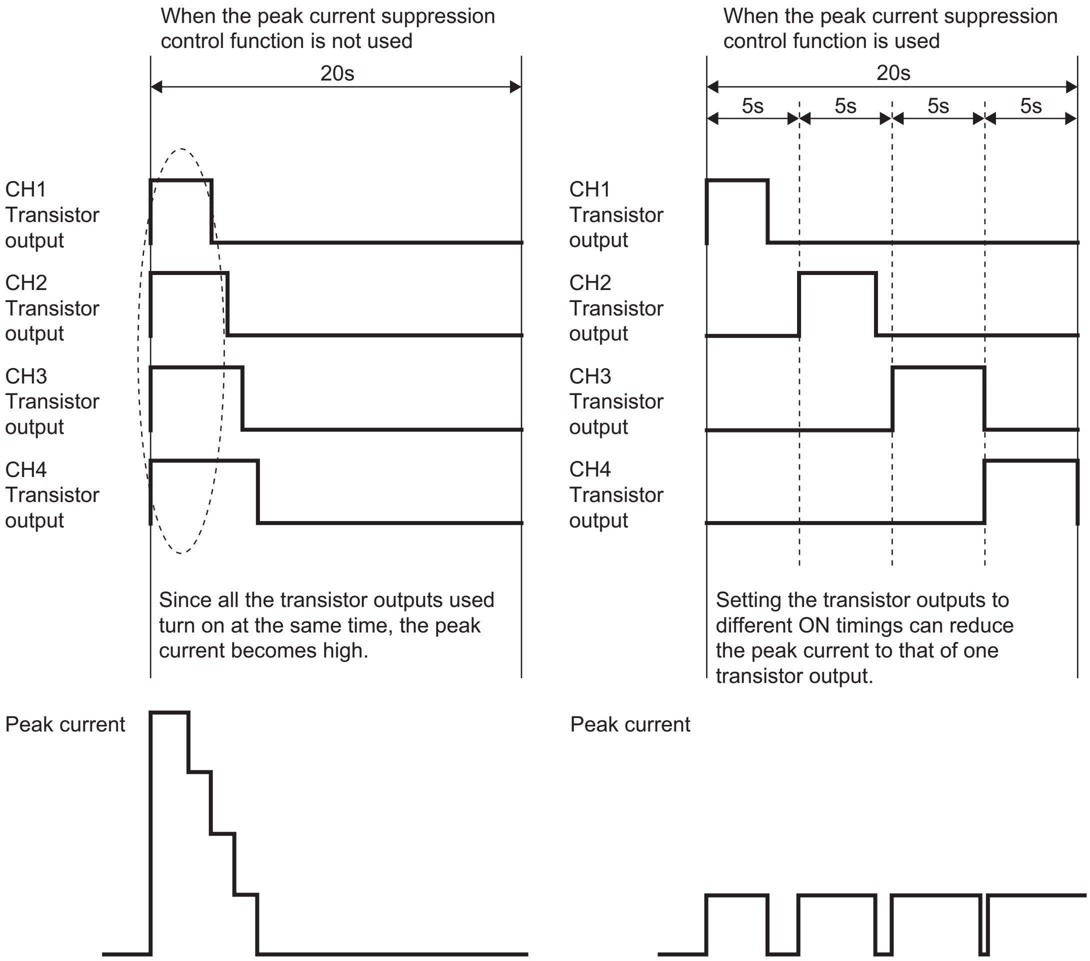
- Do not use the self-tuning function for controlled objects where a great disturbance (uncontrollable disturbance) occurs periodically. Doing so may cause improper PID constants to be determined by self-tuning. If the function is used for such objects, improper PID constants are set and the response 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

4.19 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. The timing can be divided into two to four intervals.



(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 (Un\G784) in the setting mode (Setting/operation mode status (Xn1): off). The setting is enabled by turning off, on, and off Setting change instruction (YnB). At the time when the setting is enabled, the following buffer memory area is automatically set according to the number of timing divided.

- CH☐ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)(Page 112, Section 3.4.2 (19))

The following table lists the setting details.

The no. of timing divided	CH☐ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138)
2	500(50.0%)
3	333(33.3%)
4	250(25.0%)

The following buffer memory area is set to 0.

- CH☐ Lower limit output limiter (Un\G43, Un\G75, Un\G107, Un\G139) (Page 112, Section 3.4.2 (19))

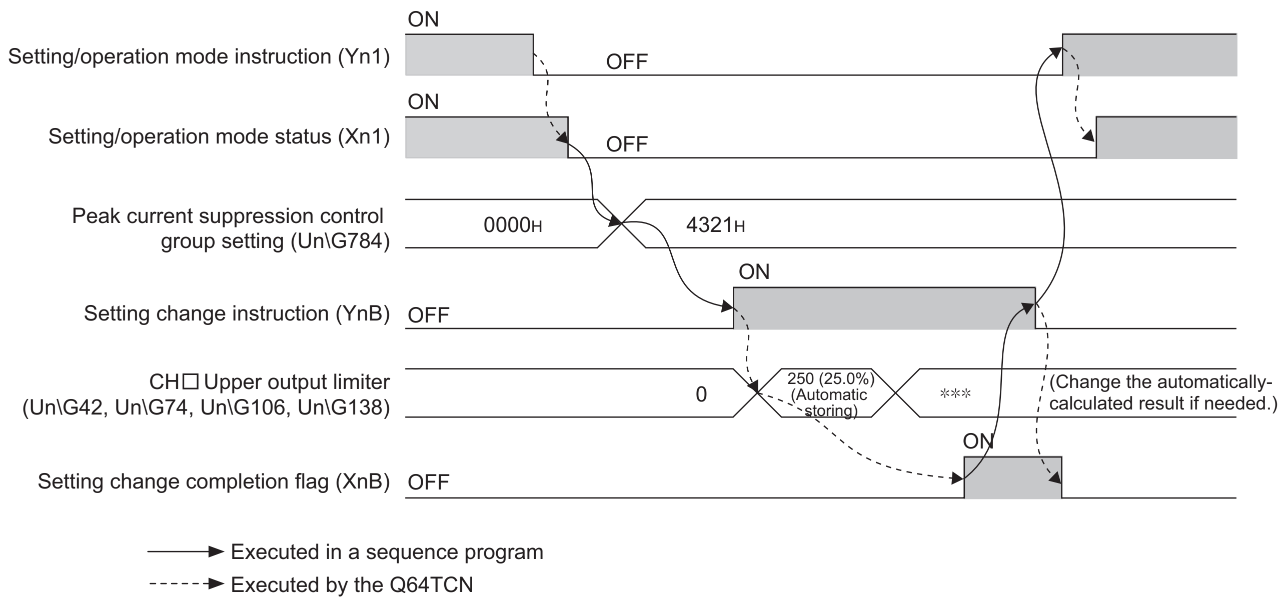
Point

When using this function, set the control output cycles for target channels to the same value. Even if the following buffer memory area setting is different by each channel, an error does not occur.

- CH☐ Control output cycle setting (Un\G47, Un\G79, Un\G111, Un\G143) (Page 116, Section 3.4.2 (23))

The module operates according to the value (%) of CH☐ Upper limit output limiter (Un\G42, Un\G74, Un\G106, Un\G138) automatically set when this function is used.

Ex. Timing chart of when timing is divided into four timing



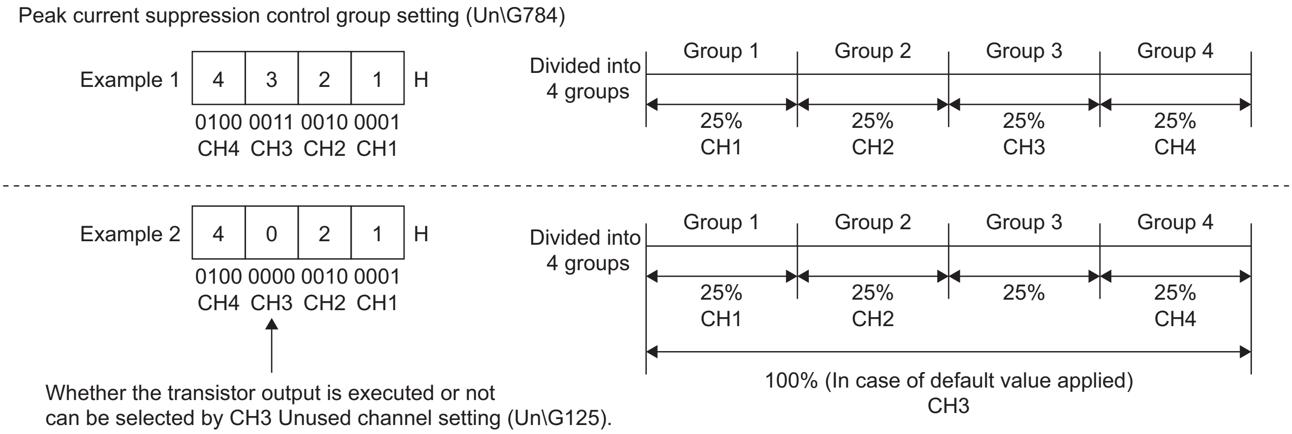
(2) Examples of dividing timing

(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 (Un\G42, Un\G74, Un\G106, Un\G138).



☞ Page 128, Section 3.4.2 (35)

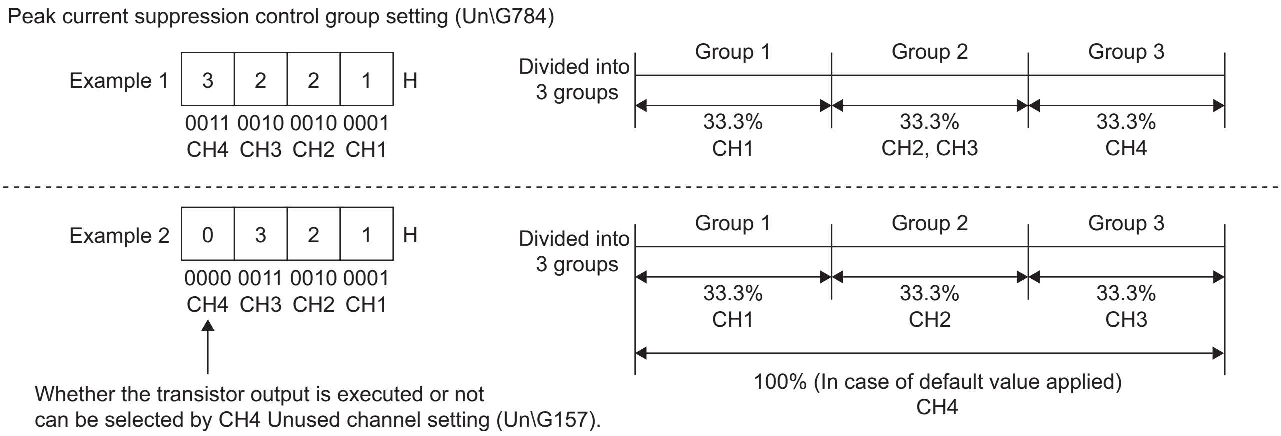
In Example 2, the maximum number of groups is four; therefore, timing is divided into four timing. Because no channel is set for Group 3, no channel starts transistor output at the timing for Group 3.

(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 (Un\G42, Un\G74, Un\G106, Un\G138).



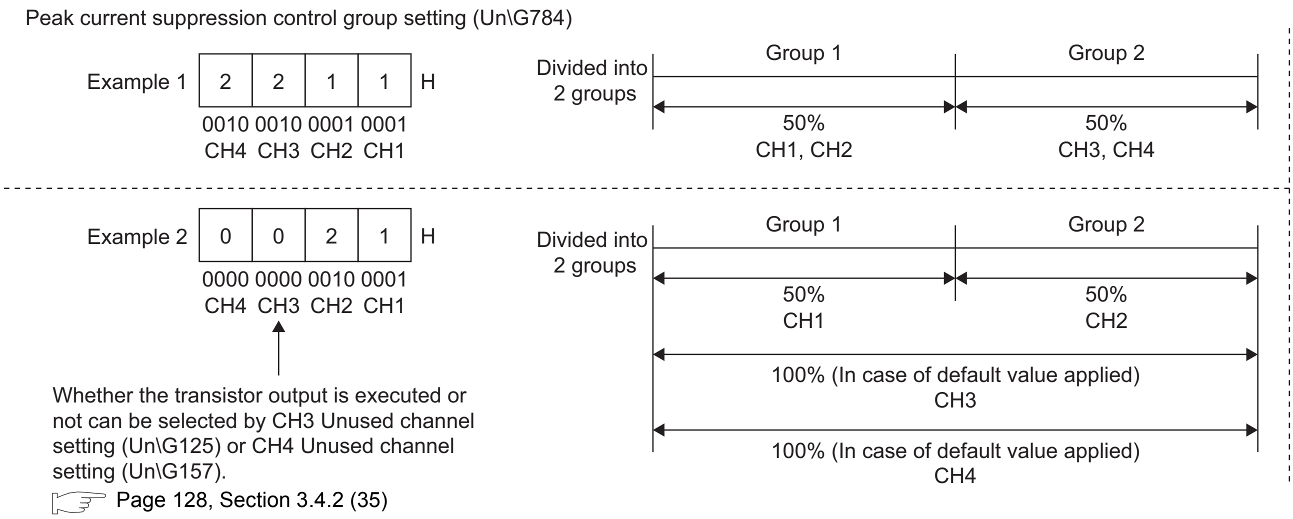
Page 128, Section 3.4.2 (35)

(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 (Un\G42, Un\G74, Un\G106, Un\G138).



(3) Setting method

Set the timing in Peak current suppression control group setting (Un\G784).

For the setting, refer to the following.

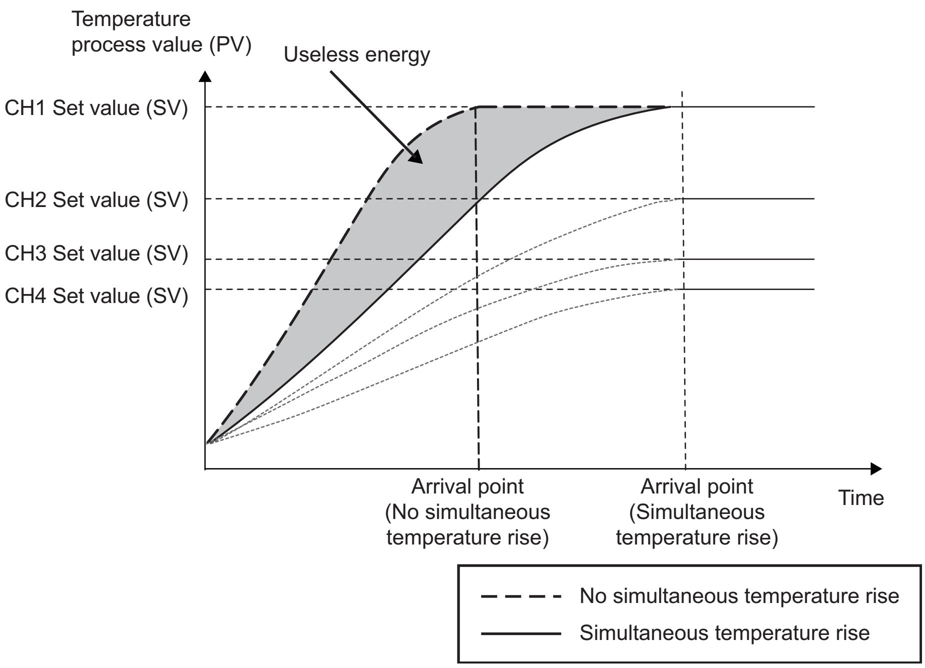
Page 160, Section 3.4.2 (86)

4.20 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.

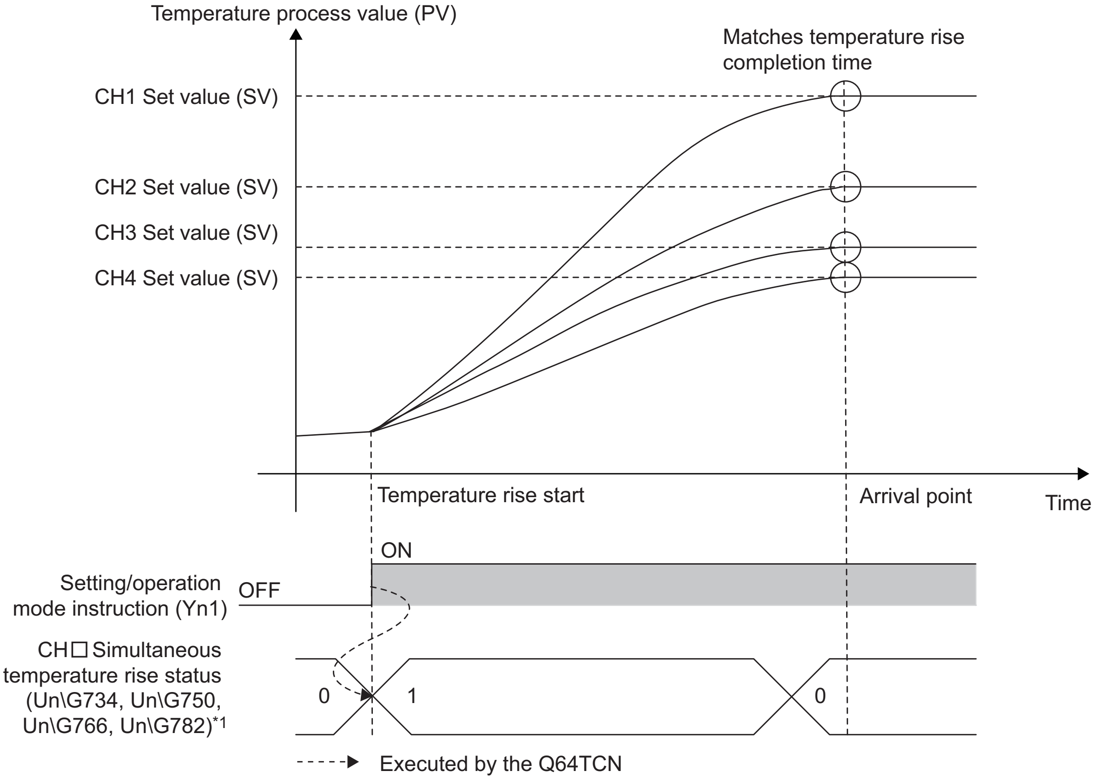
Ex. The simultaneous temperature rise function used and not used in CH1



(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).

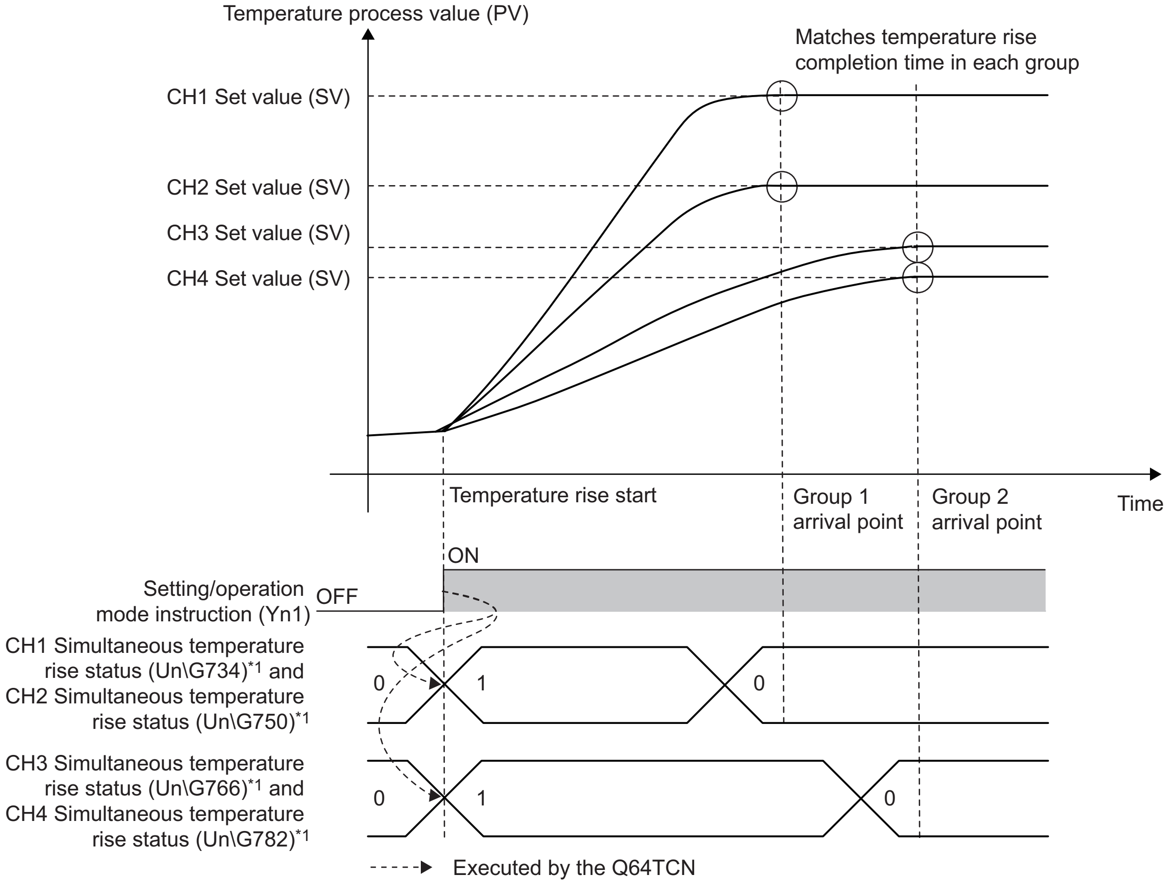
Ex. When all channels are selected for Group 1



*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



*1 They become Simultaneous temperature rise in process (1) when the temperature rise starts; however, they become Simultaneous temperature rise not in process (0) before the temperature rise starts.

Remark

- When the operation mode is changed to the setting mode (Setting/operation mode instruction (Yn1) is turned on and off) during simultaneous temperature rise, the control is stopped. In addition, CH□ Simultaneous temperature rise status (Un\G734, Un\G750, Un\G766, Un\G782) changes from Simultaneous temperature rise in process (1) to Simultaneous temperature rise not in process (0). (An error does not occur.)
- When the simultaneous temperature rise function is executed, the setting change rate limiter cannot be used. (Page 121, Section 3.4.2 (28))

(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 standard control is selected on Switch Setting (not executed in the heating-cooling control) (Page 305, Section 6.2)
- 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 (Un\G42, Un\G74, Un\G106, Un\G138) (Page 112, Section 3.4.2 (19))

(3) Setting method (dividing channels into groups)

Set the groups in the following buffer memory area.

- CH☐ Simultaneous temperature rise group setting (Un\G730, Un\G746, Un\G762, Un\G778) (Page 156, Section 3.4.2 (80))

(4) Simultaneous temperature rise parameter

The simultaneous temperature rise parameter is classified into the following two buffer memory values.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Simultaneous temperature rise gradient data	Un\G731	Un\G747	Un\G763	Un\G779	Page 156, Section 3.4.2 (81)
CH☐ Simultaneous temperature rise dead time	Un\G732	Un\G748	Un\G764	Un\G780	Page 157, Section 3.4.2 (82)

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 248, Section 4.20 (5))
- Simultaneous temperature rise parameter setting using self-tuning (Page 251, Section 4.20 (6))

Point

If the setting in Peak current suppression control group setting (Un\G784) 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 239, Section 4.19

(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 182, Section 4.6

(a) How to execute the simultaneous temperature rise AT function

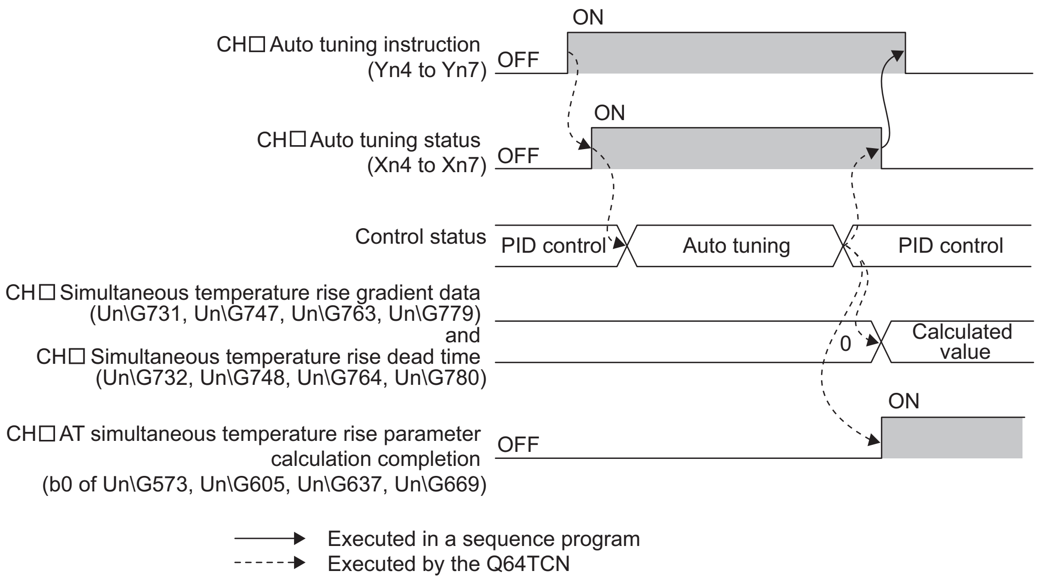
Follow the instructions below.

1. **During the setting mode (Setting/operation mode status (Xn1): off, set CH□ Simultaneous temperature rise AT mode selection (Un\G733, Un\G749, Un\G765, Un\G781) to Auto tuning for simultaneous temperature rise (1). (Page 157, Section 3.4.2 (83))**
2. **Turn off and on CH□ Auto tuning instruction (Yn4 to Yn7).**
3. **Set the module to the operation mode (turn off and on Setting/operation mode instruction (Yn1).**

(b) Operation with the simultaneous temperature rise AT function

After the procedure described on Page 248, Section 4.20 (5) (a) is executed, the Q64TCN operates as following.

	Operation of the Q64TCN
1	CH□ Auto tuning status (Xn4 to Xn7) 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 buffer memory when the simultaneous temperature rise parameter is normally calculated. In addition, CH□ AT simultaneous temperature rise parameter calculation completion (b0 of Un\G573, Un\G605, Un\G637, Un\G669) is turned 1 (ON). After auto-tuning is completed, CH□ Auto tuning status (Xn4 to Xn7) is turned off and the module is shifted to the PID control.



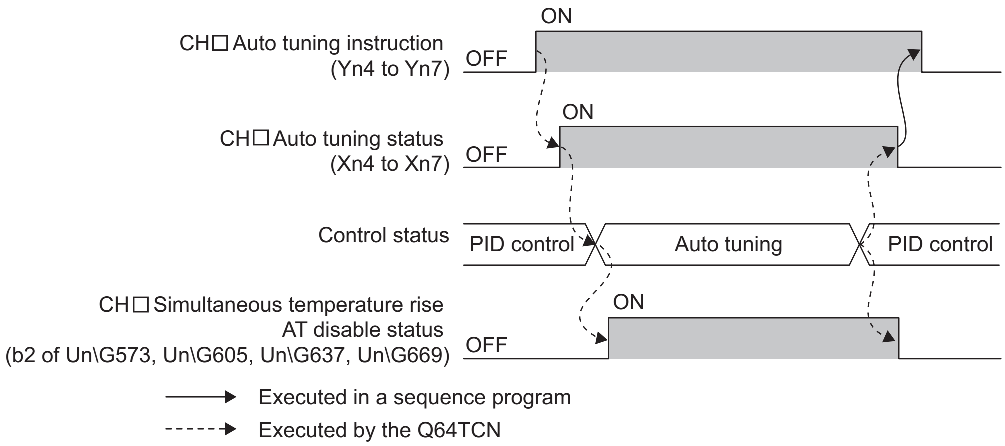
(c) Condition for the simultaneous temperature rise AT

The simultaneous temperature rise parameter is calculated when all the following conditions are satisfied after the procedure described on Page 248, Section 4.20 (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 fail. For the operation of the Q64TCN in that situation, refer to Page 192, Section 4.6 (8) (b).
- When CH□ Output variation limiter setting (Un\G44, Un\G76, Un\G108, Un\G140) is set to 0. (Page 114, Section 3.4.2 (20))

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 Q64TCN operates when the simultaneous temperature rise AT has not been executed.



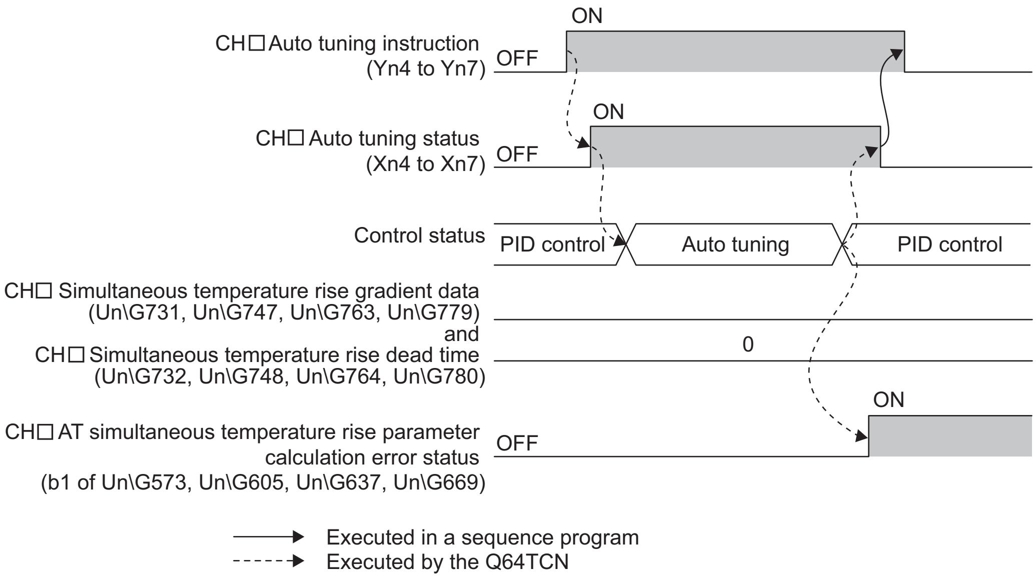
The Q64TCN turns CH□ Simultaneous temperature rise AT disable status (b2 of Un\G573, Un\G605, Un\G637, Un\G669) to 1 (ON). With CH□ Auto tuning status (Xn4 to Xn7) on, the module performs the same processing as normal auto tuning.

(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 Q64TCN turns CH☐ AT simultaneous temperature rise parameter calculation error status (b1 of Un\G573, Un\G605, Un\G637, Un\G669) to 1 (ON).



(6) The simultaneous temperature rise parameter setting using self-tuning

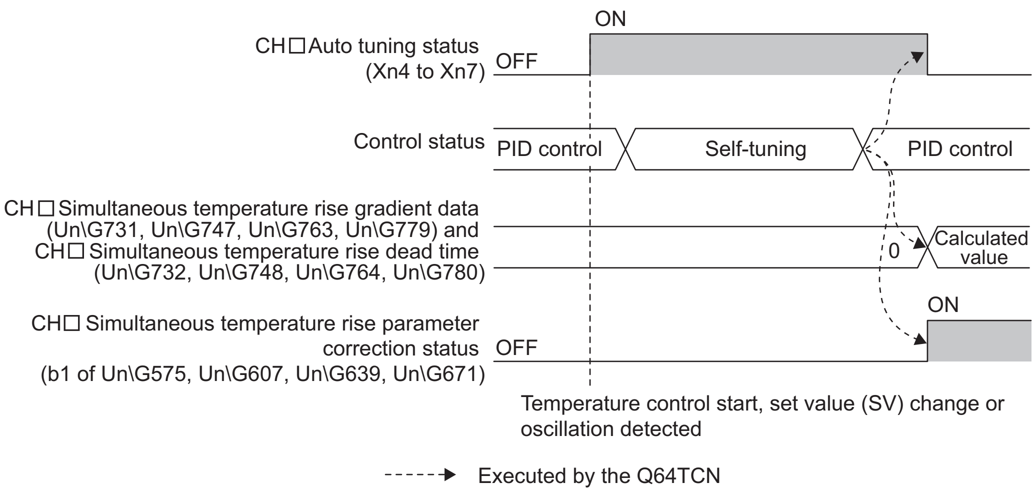
The control response at the time of temperature rise is constantly monitored during self-tuning and the simultaneous temperature rise parameter is calculated based on the characteristics of a controlled object. For details on the self-tuning function, refer to the following.

Page 229, Section 4.18

(a) Operation with the simultaneous temperature rise parameter setting using self-tuning

The Q64TCN operates as following.

	Operation of the Q64TCN
1	When self-tuning is normally started up, CH☐ Auto tuning status (Xn4 to Xn7) is turned on and the simultaneous temperature rise parameter is calculated.
2	The calculated value is stored in the buffer memory when the simultaneous temperature rise parameter is normally calculated. Then CH☐ Simultaneous temperature rise parameter correction status (b1 of Un\G575, Un\G607, Un\G639, Un\G671) is turned 1 (ON), CH☐ Auto tuning status (Xn4 to Xn7) is turned off, and the module is shifted to the PID control.



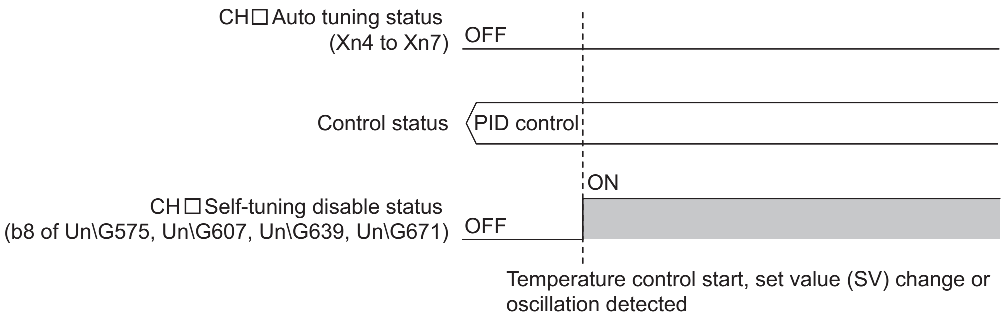
(b) Condition for the simultaneous temperature rise parameter setting using self-tuning

The condition is the same as that for the starting ST. (Page 233, Section 4.18 (4) (a))

When the self-tuning cannot be started up, the Q64TCN operates as following with the PID control continued:

- CH☐ Self-tuning disable status (b8 of Un\G575, Un\G607, Un\G639, Un\G671) is turned 1 (ON).

The following shows how the Q64TCN operates when self-tuning is not executed.

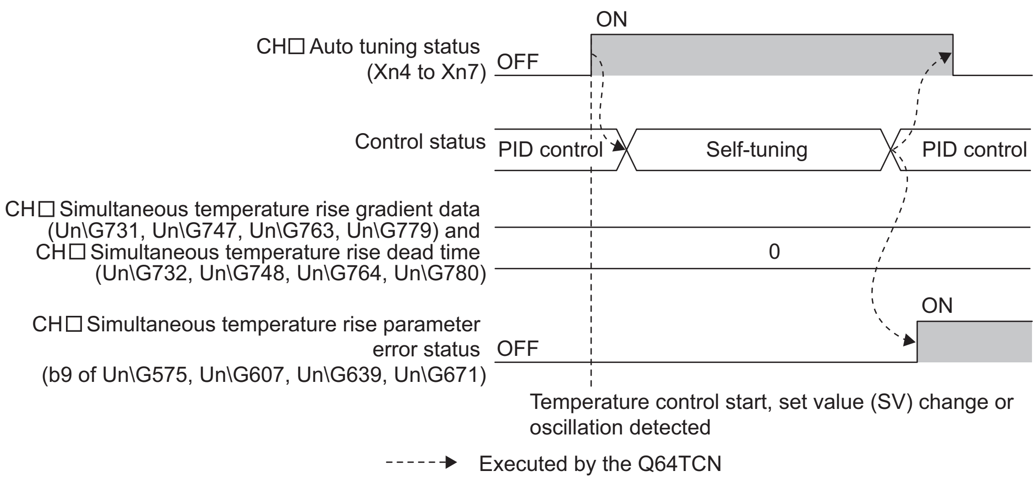


(c) When the simultaneous temperature rise parameter cannot be calculated

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 Q64TCN turns CH☐ Simultaneous temperature rise parameter error status (b9 of Un\G575, Un\G607, Un\G639, Un\G671) to 1 (ON).



Point

To restore CH☐ Simultaneous temperature rise parameter error status (b9 of Un\G575, Un\G607, Un\G639, Un\G671) to 0 (OFF), set the following:

- Set CH☐ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670) 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

Some characteristics of a controlled object do not lead to the optimum simultaneous temperature rise parameter. In addition, an abnormal termination of self-tuning causes the temperature control module to stop the calculation processing. For the conditions of an abnormal termination of self-tuning, refer to the following.

☞ Page 237, Section 4.18 (8)

(e) How to set the simultaneous temperature rise parameter using self-tuning

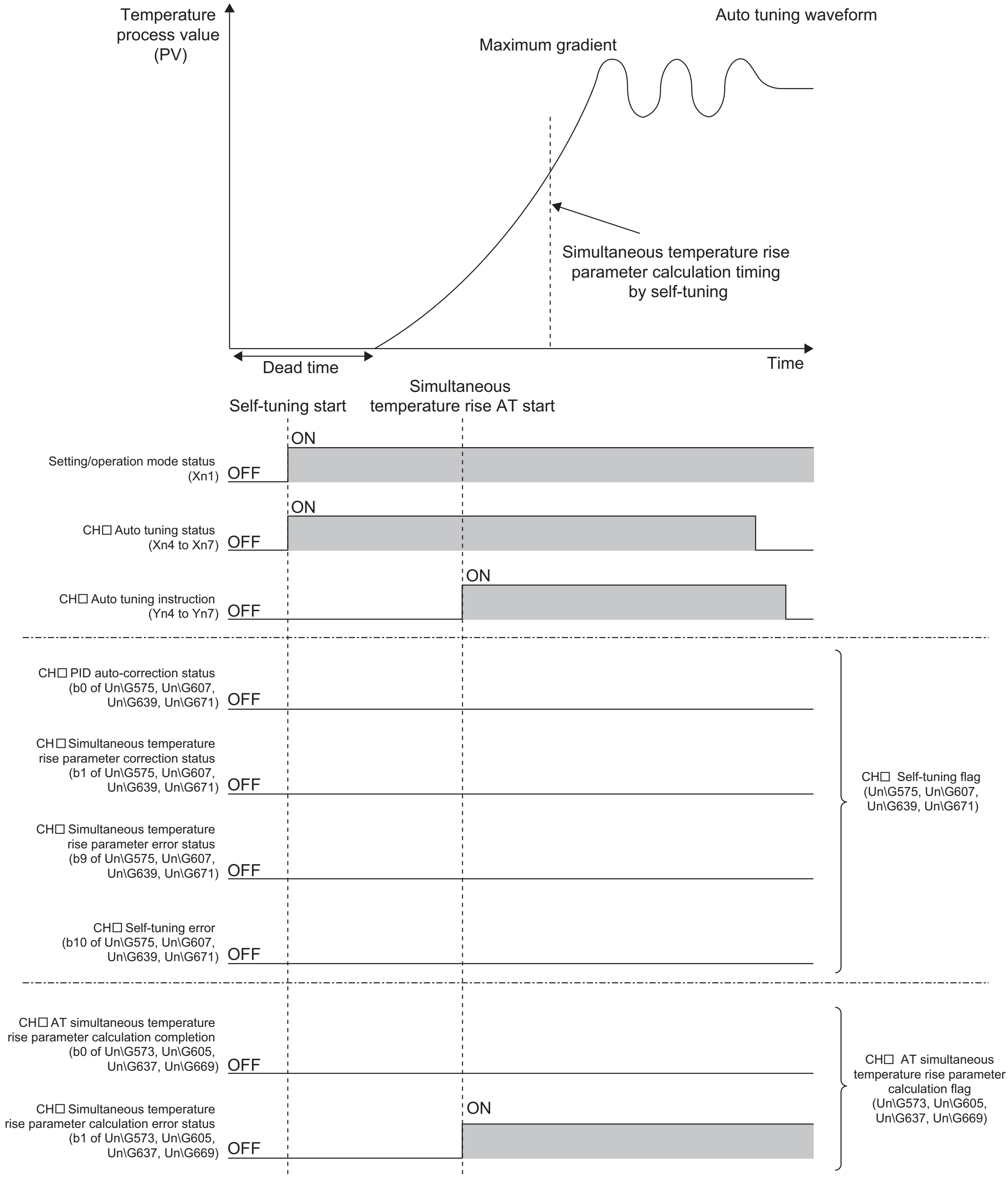
Select one of the following setting values in CH□ Self-tuning setting (Un\G574, Un\G606, Un\G638, Un\G670). (☞ Page 148, Section 3.4.2 (68))

- Starting ST (Simultaneous temperature rise parameter only*1) (2)
- Starting ST (PID constants and simultaneous temperature rise parameter*1) (3)

(7) Operation when the simultaneous temperature rise parameter is calculated with self-tuning and auto tuning

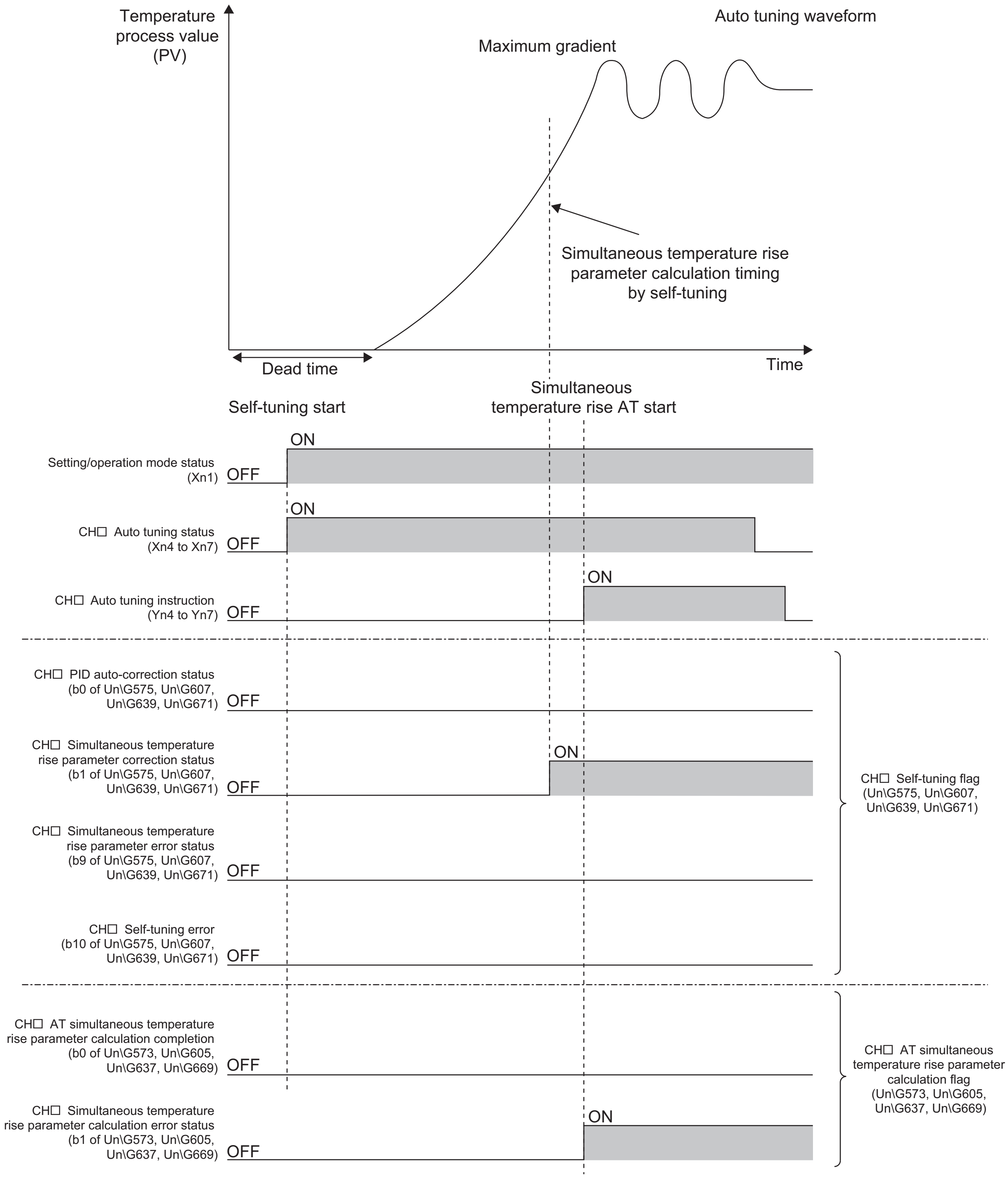
(a) When the simultaneous temperature rise AT is started before the simultaneous temperature rise parameter is calculated with self-tuning

The simultaneous temperature rise parameter is not calculated neither with self-tuning nor auto tuning. PID constants are changed.



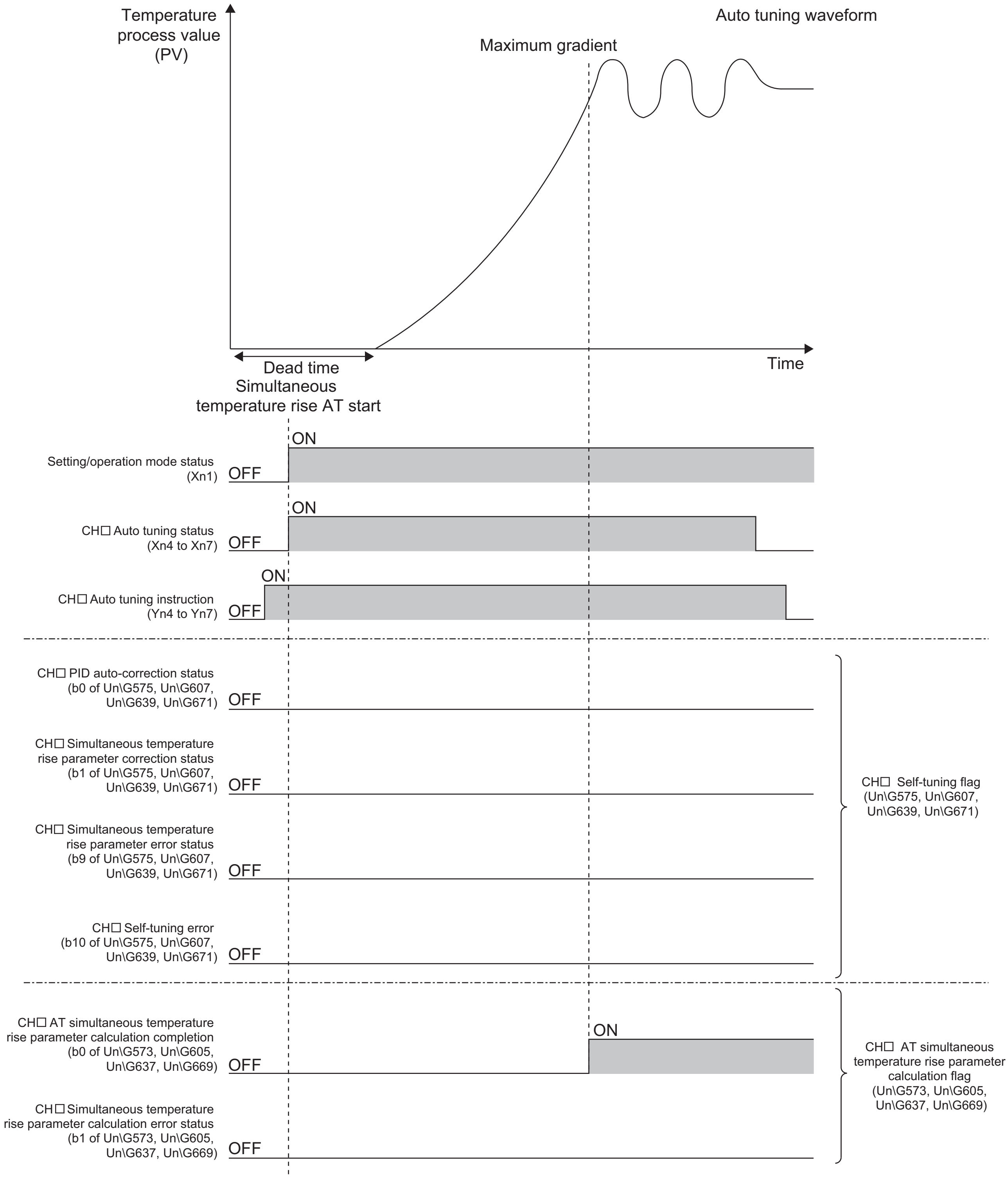
(b) When the simultaneous temperature rise AT is started after the simultaneous temperature rise parameter is calculated with self-tuning

The simultaneous temperature rise parameter calculated with self-tuning is effective. Then PID constants are changed with auto tuning.



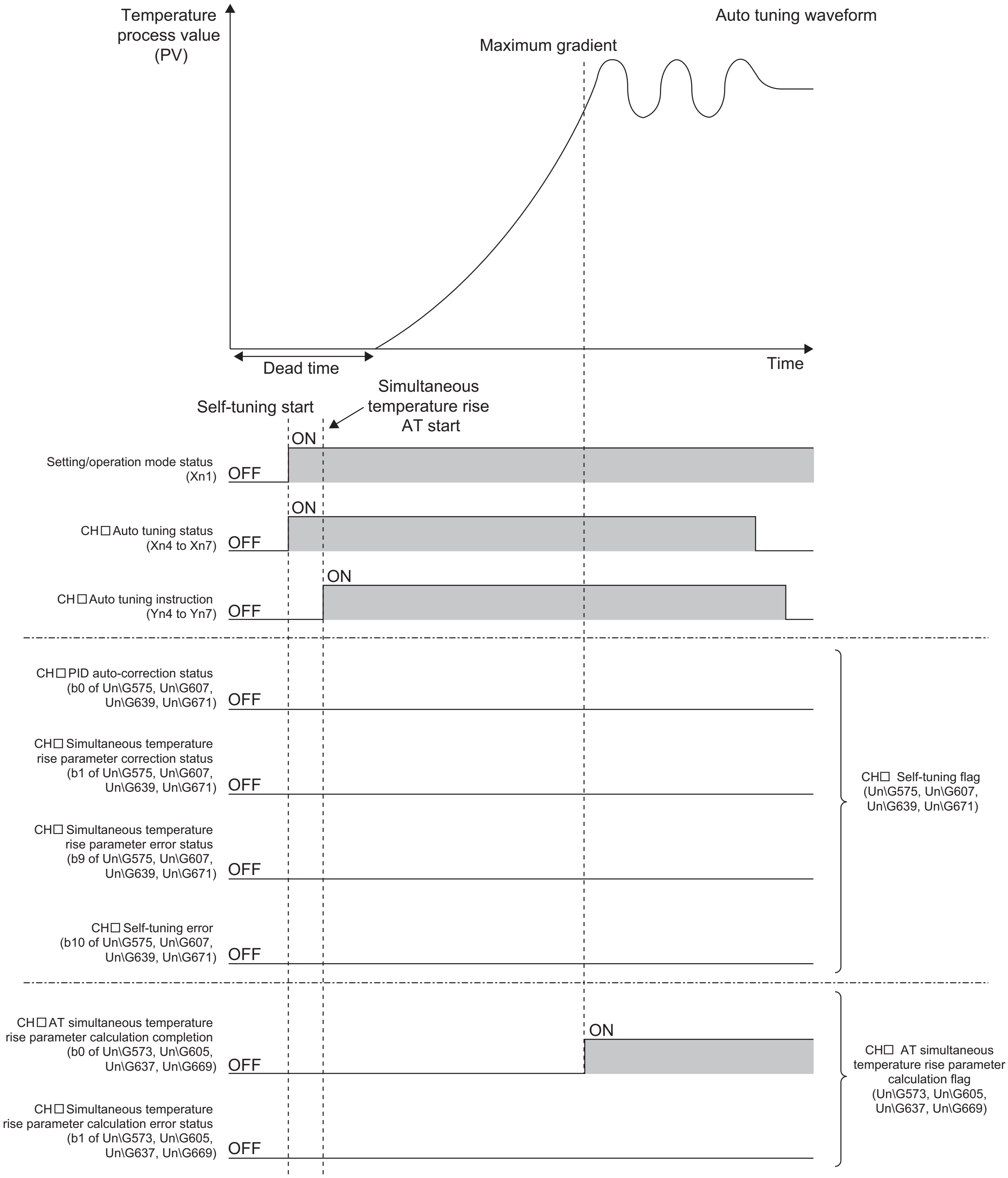
(c) When CH☐ Auto tuning instruction (Yn4 to Yn7) is turned off and on in the setting mode and the module is shifted to the operation mode

After the module is shifted to the operation mode (Setting/operation mode instruction (Yn1) is turned off and on), 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°C (°F)) after the setting mode is changed to the operation mode

Until the temperature process value (PV) goes outside the stable judgment width (1°C (°F)), the data measured after the module is shifted to the operation mode (Setting/operation mode instruction (Yn1) is turned off and on) can be used. Therefore, the simultaneous temperature rise parameter can be calculated with auto tuning.



4.21 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 172, Section 4.3)
For details on the operation, refer to the following.
Page 25, Section 1.3.2

(1) Setting method

Set the function in the following buffer memory area.

- CH☐ Forward/reverse action setting (Un\G54, Un\G86, Un\G118, Un\G150) (Page 123, Section 3.4.2 (30))

4.22 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 Q64TCN 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°C (°F) or more within the loop disconnection detection judgment time set, an alert is output. (The operation is reversed for forward action. (Page 258, Section 4.21))

(b) When control output is not being performed

The Q64TCN 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°C (°F) or more within the loop disconnection detection judgment time set, an alert is output. (The operation is reversed for forward action. (Page 258, Section 4.21))

(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)

Set the unit time in the following buffer memory area.

- CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155) (☞Page 126, Section 3.4.2 (33))

Point

When not using this function, set CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155) to 0.

(b) Setting for the dead band

To prevent an error alert for the loop disconnection detection, set a non-alert band (temperature band in which the loop disconnection is not detected) with the set value (SV) being its 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.
Set the dead band in the following buffer memory area.

- CH☐ Loop disconnection detection dead band (Un\G60, Un\G92, Un\G124, Un\G156) (☞Page 127, Section 3.4.2 (34))

Point

If this function is not necessary, set 0 to CH☐ Loop disconnection detection dead band (Un\G60, Un\G92, Un\G124, Un\G156).

4.23 During AT Loop Disconnection Detection Function

This function detects loop disconnections during auto tuning (AT). With this function, a channel that is not controlled can be detected during auto tuning, thus the error channel is detected more than two hours before the auto tuning error occurs. The auto tuning 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 259, Section 4.22

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 in 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 (Un\G571).
- A value other than 0 is set to CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155).
- 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

Set the function as shown below.

1. **Set CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155)[*1] (Page 126, Section 3.4.2 (33))**

*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.

2. **Set Enable (1) to the bit of During AT loop disconnection detection function enable/disable setting (Un\G571) for the channel where the loop disconnection detection is to be performed. (Page 147, Section 3.4.2 (66))**
3. **Turn on from off CH☐ Auto tuning instruction (Yn4 to Yn7).**

Remark

- Setting example for the control to rise the temperature by 200°C for 40 minutes
  It takes approx. 24 seconds to rise the temperature by 2°C. Also, the dead time of the controlled object must be added as the time required before the temperature starts rising. 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 (Un\G59, Un\G91, Un\G123, Un\G155).

(3) When an alert occurs, or does not occur

If an alert for the loop disconnection detection occurs, CH☐ Alert occurrence flag (XnC to XnF) and CH☐ Loop disconnection detection (b13 of Un\G5 to Un\G8) turn on and Alarm code (03☐A_H) is stored in Write data error code (Un\G0). (☞ Page 376, Section 8.7)

If an alert for the loop disconnection detection does not occur and auto tuning is normally completed, the value in CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155) is automatically updated to the value calculated by auto tuning.

Point

There is a possibility of an error in the control loop if the loop disconnection alert occurs. For this reason, even when auto tuning is normally completed, check the control loop and examine the appropriateness of the loop disconnection detection judgment time during auto tuning.

(4) To clear the alert status

If any of the following conditions is met, CH☐ Alert occurrence flag (XnC to XnF) and CH☐ Loop disconnection detection (b13 of Un\G5 to Un\G8) turn off.

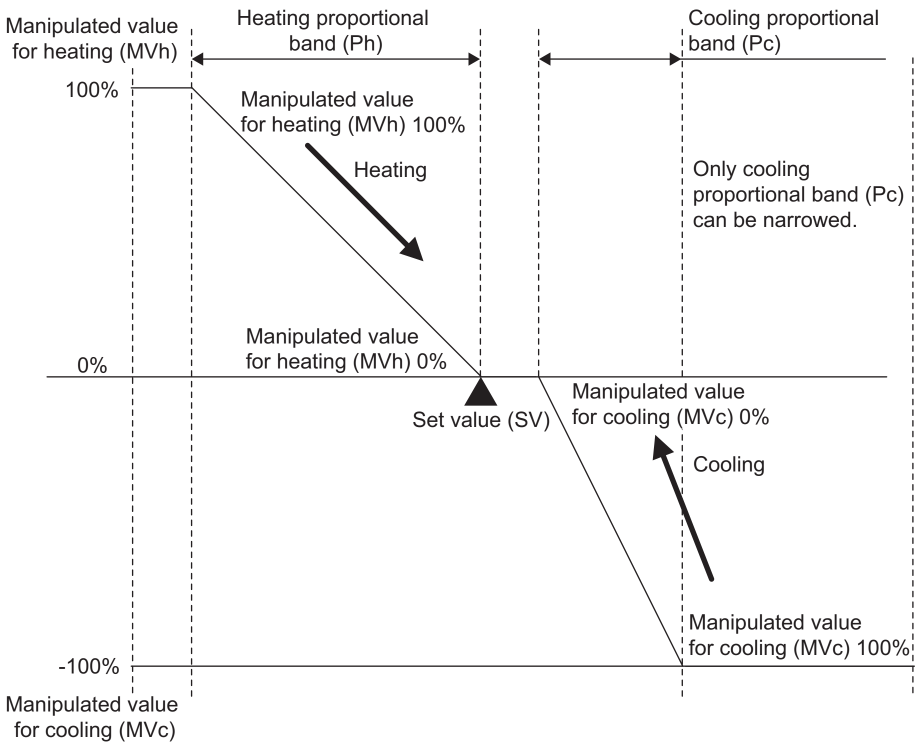
- CH☐ PID control forced stop instruction (YnC to YnF) is turned on from off.
- Setting/operation mode instruction (Yn1) is turned off from on and the mode has shifted to the setting mode.
- A manipulated value (MV) becomes greater than the lower limit output limiter value and smaller than the upper limit output limiter value.
- Disable (0) is set to During AT loop disconnection detection function enable/disable setting (Un\G571).
- 0 is set to CH☐ Loop disconnection detection judgment time (Un\G59, Un\G91, Un\G123, Un\G155).
- MAN (1) is set to CH☐ AUTO/MAN mode shift (Un\G50, Un\G82, Un\G114, Un\G146).

After performing the operations above, turn on and off Error reset instruction (Yn2) to clear the value in Write data error code (Un\G0).

4.24 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

Set the value in CH☐ Heating proportional band (Ph) setting (Un\G35, Un\G67, Un\G99, Un\G131).
(☞Page 107, Section 3.4.2 (15))

(b) For cooling

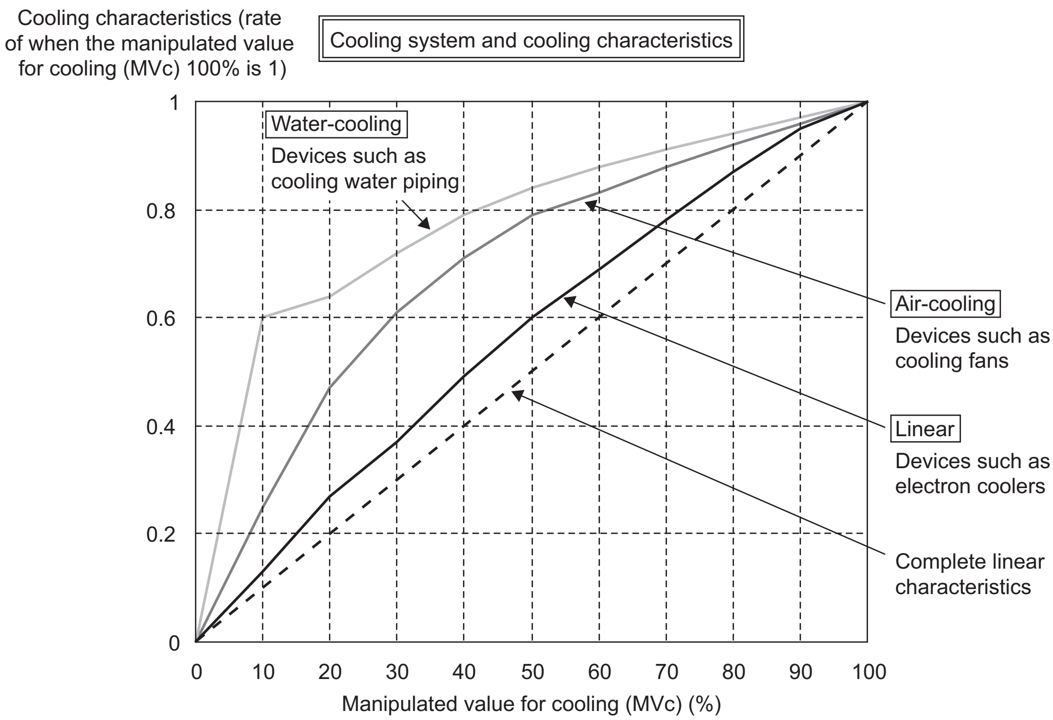
Set the value in CH☐ Cooling proportional band (Pc) setting (Un\G720, Un\G736, Un\G752, Un\G768).
(☞Page 107, Section 3.4.2 (15))

4.25 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 182, Section 4.6

(1) Setting method

Set the characteristic in Cooling method setting (Un\G719). (Page 153, Section 3.4.2 (73))

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 (1_H). When a device is not very cooled even if it is set to water cooled, set the module to Air cooled (0_H).
- 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 (1_H) become larger than those for when the module is set to Air cooled (0_H).

4.26 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 temperature 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.

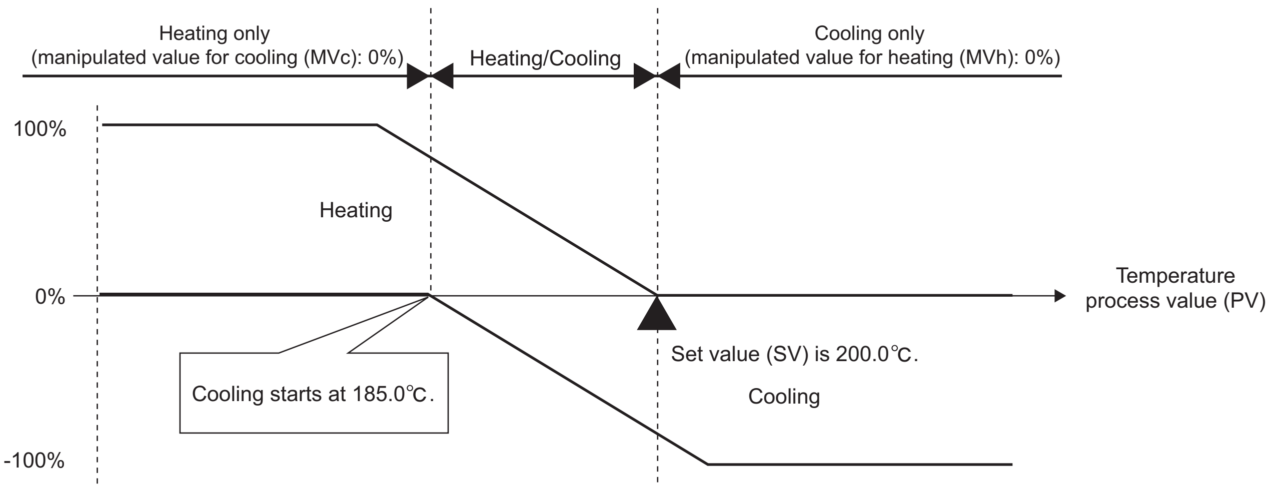
(1) Overlap

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 buffer memory values are set as following:

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (temperature measurement range: -200.0°C to 400.0°C)
- CH☐ Set value (SV) setting (Un\G34, Un\G66, Un\G98, Un\G130): 2000 (200.0°C)
- CH☐ Overlap/dead band setting (Un\G723, Un\G739, Un\G755, Un\G771): -25 (-2.5%)

185.0°C to 200.0°C is the overlapping area.
(Full scale) × (Overlap setting) = (400.0°C - (-200.0°C)) × -0.025 = -15.0°C
The temperature where cooling operation starts = (Set value (SV)) - 15.0°C = 185.0°C
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.)



4

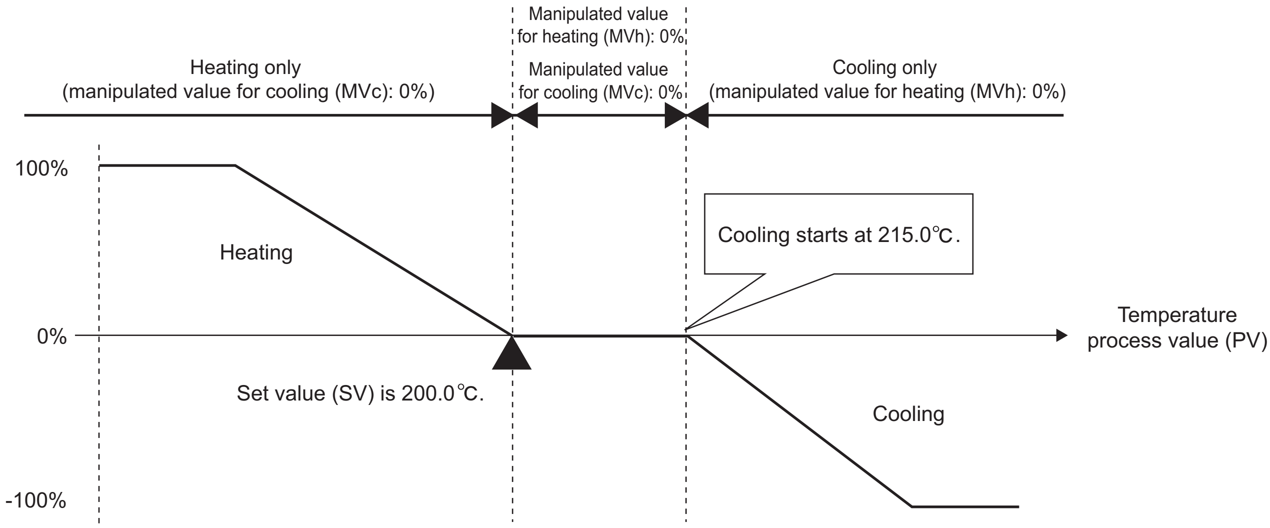
(2) Dead band

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 buffer memory values are set as following:

- CH☐ Input range (Un\G32, Un\G64, Un\G96, Un\G128): 38 (temperature measurement range: -200.0°C to 400.0°C)
- CH☐ Set value (SV) setting (Un\G34, Un\G66, Un\G98, Un\G130): 2000 (200.0°C)
- CH☐ Overlap/dead band setting (Un\G723, Un\G739, Un\G755, Un\G771): 25 (2.5%)

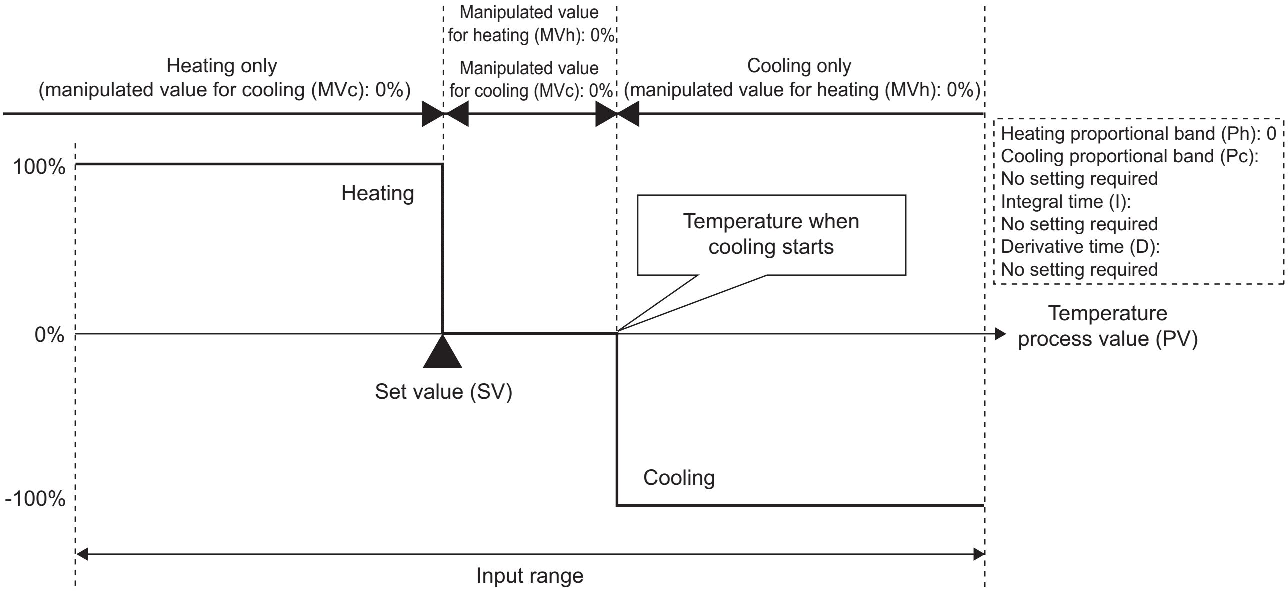
  200.0°C to 215.0°C is the area for dead band.
  (Full scale) × (Overlap setting) = (400.0°C - (-200.0°C)) × 0.025 = 15.0°C
  The temperature where cooling operation starts = (Set value (SV)) + 15.0°C = 215.0°C
  As shown below, shifting the temperature where cooling operation starts to the higher temperature 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

Set the function in the following buffer memory area.

- CH☐ Overlap/dead band setting (Un\G723, Un\G739, Un\G755, Un\G771) (Page 154, Section 3.4.2 (74))

4.27 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			
	Q64TCTTN/Q64TCTTBWN*1		Q64TCRTN/Q64TCRTBWN*1	
	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	MT2A
9	CH1-	CH1-	CH1 B	CH1 B
10	CH2-	MT2-	CH2 B	MT2B
11	Unused	Unused	CH1 b	CH1 b
12	CJ	CJ	CH2 b	MT2b
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

*1 For the Q64TCTTBWN and Q64TCRTBWN, the terminals in the table above are those on a terminal block for I/O.

(2) Buffer memory areas that can be used with this function

The following table lists the buffer memory areas that can be used with this function (the terminals used correspond to the buffer memory areas in the table).

Buffer memory area name	Buffer memory			Reference
	MT2 (Monitor CH2)	MT3 (Monitor CH3)	MT4 (Monitor CH4)	
Write data error code	Un\G0			Page 88, Section 3.4.2 (1)
CH☐ Decimal point position	Un\G2	Un\G3	Un\G4	Page 88, Section 3.4.2 (2)
CH☐ Alert definition	Un\G6	Un\G7	Un\G8	Page 89, Section 3.4.2 (3)
CH☐ Temperature process value (PV)	Un\G10	Un\G11	Un\G12	Page 91, Section 3.4.2 (4)
Cold junction temperature process value	Un\G29			Page 95, Section 3.4.2 (9)
CH☐ Input range	Un\G64	Un\G96	Un\G128	Page 98, Section 3.4.2 (12)
CH☐ Sensor correction value setting	Un\G77	Un\G109	Un\G141	Page 115, Section 3.4.2 (21)
CH☐ Primary delay digital filter setting	Un\G80	Un\G112	Un\G144	Page 117, Section 3.4.2 (24)
Cold junction temperature compensation selection	Un\G182			Page 137, Section 3.4.2 (49)
Control switching monitor	Un\G183			Page 137, Section 3.4.2 (50)
CH☐ Sensor two-point correction offset value (measured value)	Un\G576	Un\G608	Un\G640	Page 144, Section 3.4.2 (58)
CH☐ Sensor two-point correction offset value (corrected value)	Un\G577	Un\G609	Un\G641	Page 144, Section 3.4.2 (59)
CH☐ Sensor two-point correction gain value (measured value)	Un\G578	Un\G610	Un\G642	Page 145, Section 3.4.2 (60)
CH☐ Sensor two-point correction gain value (corrected value)	Un\G579	Un\G611	Un\G643	Page 145, Section 3.4.2 (61)
CH☐ Sensor two-point correction offset latch request	Un\G580	Un\G612	Un\G644	Page 146, Section 3.4.2 (62)
CH☐ Sensor two-point correction offset latch completion	Un\G581	Un\G613	Un\G645	Page 146, Section 3.4.2 (63)
CH☐ Sensor two-point correction gain latch request	Un\G582	Un\G614	Un\G646	Page 146, Section 3.4.2 (64)
CH☐ Sensor two-point correction gain latch completion	Un\G583	Un\G615	Un\G647	Page 147, Section 3.4.2 (65)
Sensor correction function selection	Un\G785			Page 161, Section 3.4.2 (87)
Temperature conversion completion flag	Un\G786			Page 161, Section 3.4.2 (88)
CH☐ Temperature conversion setting	Un\G695	Un\G696	Un\G697	Page 152, Section 3.4.2 (71)

(3) Setting method

Set whether using this function in the following buffer memory area.

- CH☐ Temperature conversion setting (Un\G695 to Un\G697) (Page 152, Section 3.4.2 (71))

Point

When heating-cooling control (expanded mode) or mix control (expanded mode) is selected, the setting in CH☐ Temperature conversion setting (Un\G695 to Un\G697) is ignored.

4.28 Heater Disconnection Detection Function

Common

When transistor output is on, whether a heater is disconnected or not can be checked based on a heater current process value (load current value detected by a current sensor (CT)) using this function. A heater current process value and heater disconnection alert current value are compared. When the heater current process value becomes equal to or lower than the heater disconnection alert current value, the heater is regarded as disconnected.
Heater disconnection is detected every 500ms. When transistor output is on for 500ms or less, heater disconnection is not detected. (CH☐ Heater disconnection detection (b12 of Un\G5 to Un\G8) remains 0 (OFF).) (Page 89, Section 3.4.2 (3))
The following is the timing output as an alert.

- 500ms × Setting value in Heater disconnection/output off-time current error detection delay count (Un\G166)

If a heater is disconnected longer than the time described above, Alarm code (04☐A_H) is stored in Write data error code (Un\G0). (Page 376, Section 8.7)

(1) Modules where this function can be used

- Q64TCTTBWN
- Q64TCRTBWN

(2) Setting method

Follow the instructions below.

1. **Set the current sensor (CT) to be used in CT☐ CT selection (Un\G272 to Un\G279). (Page 142, Section 3.4.2 (55))**
2. **When using a current sensor (CT) other than CTL-12-S36-8 and CTL-6-P(-H) manufactured by U.R.D.Co., LTD., set CT☐ CT ratio setting (Un\G288 to Un\G295). (Page 143, Section 3.4.2 (57))**
3. **Set the CT input assigned to each channel in CT☐ CT input channel assignment setting (Un\G264 to Un\G271). (Page 141, Section 3.4.2 (54))**
4. **Monitor CT☐ Heater current process value (Un\G256 to Un\G263) and check the current value of when the heater is on. (Page 140, Section 3.4.2 (53))**
5. **Set the value monitored in CT☐ Heater current process value (Un\G256 to Un\G263) in CT☐ Reference heater current value (Un\G280 to Un\G287). (Page 143, Section 3.4.2 (56))**
6. **Set the judgment value to perform the heater disconnection detection and output off-time current error detection*1 at the rate of the reference heater current value (%) in CH☐ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154). (Page 125, Section 3.4.2 (32))**
7. **Set how many times heater disconnection is detected successively to regard the heater as disconnected in Heater disconnection/output off-time current error detection delay count (Un\G166). (Page 132, Section 3.4.2 (40))**

*1 For details on the output off-time current error detection function, refer to Page 275, Section 4.29.

Point

- The standard setting value for CH□ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154) is 80%. However, the current value may significantly change depending on the characteristics of a heater or how the heater is used. Check that there is no problem in the actual system.
- A write data error (error code: □□□4_H) occurs if the current value to be used as a judgment value to detect heater disconnection (reference heater current value × CH□ Heater disconnection alert setting (%)) is within 0.1A under one of the following situations:
  - CT□ CT selection (Un\G272 to Un\G279) is set to When CTL-12-S36-8 (0.0A to 100.0A) is used (0).
  - CT□ CT selection (Un\G272 to Un\G279) is set to When CT ratio setting is used (0.0A to 100.0A) (2).

  In addition, when CTL-6-P(-H) used (0.00A to 20.00A) (1) has been set and the current value to be used as a judgment value to detect heater disconnection (reference heater current value × CH□ Heater disconnection alert setting (%)) is within 0.01A, Write data error (error code: □□□4_H) occurs.

(3) Heater disconnection compensation function

When heater voltage is dropped, heater current is reduced. The Q64TCTTBWN and Q64TCRTBWN detect heater disconnection by measuring heater current; therefore, an accidental alert may occur due to a voltage change caused by a reduced heater voltage.
The heater disconnection compensation function offsets the amount of heater current reduced (heater disconnection compensation), preventing disconnection from being detected.

(a) Calculation formula for heater disconnection compensation

Calculate (CH□ Heater current) - (reference heater current value). The largest positive value is the correction value. When there is no positive value, the value with the smallest gap is the correction value. The heater current for each channel is corrected using a correction value. When the corrected value is larger than the heater disconnection alert setting value, heater disconnection is found.

Ex. When CH□ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154) is 80% and the differences between CH□ Heater current and the reference heater current value are the following values:

- CH1: -2%
- CH2: 5%
- CH3: -1%
- CH4: -17%

The following table lists the result.

Channel	CH□ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154)	Difference between CH□ Heater current and reference heater current value	Correction value	Difference between CH□ Heater current and reference heater current value after correction	Disconnection detected
CH1	80 (%)	-2%	5%	-7% (= -2% - 5%)	Not detected
CH2		5%		0% (= 5% - 5%)	Not detected
CH3		-1%		-6% (= -1% - 5%)	Not detected
CH4		-17%		-22% (= -17% - 5%)	Detected

In the table above, the correction value is 5%. Heater disconnection is detected based on the differences of -7% for CH1, 0% for CH2, -6% for CH3, and -22% for CH4. When Heater disconnection alert setting is set to 80%, disconnection is detected only for CH4.

Ex. When CH□ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154) is 80% and the differences between CH□ Heater current and the reference heater current value are the following values:

- CH1: -16%
- CH2: -17%
- CH3: -22%
- CH4: -19%

The following table lists the result.

Channel	CH□ Heater disconnection alert setting (Un\G58, Un\G90, Un\G122, Un\G154)	Difference between CH□ Heater current and reference heater current value	Correction value	Difference between CH□ Heater current and reference heater current value after correction	Disconnection detected
CH1	80 (%)	-16%	-16%	0% (= -16% - (-16%))	Not detected
CH2		-17%		-1% (= -17% - (-16%))	Not detected
CH3		-22%		-6% (= -22% - (-16%))	Not detected
CH4		-19%		-3% (= -19% - (-16%))	Not detected

In the table above, the correction value is -16%. Heater disconnection is detected based on the differences of 0% for CH1, -1% for CH2, -6% for CH3, and -3% for CH4. When Heater disconnection alert setting is set to 80%, none of the channels are regarded as disconnected.

(b) Restrictions

- When only one channel is used, the heater disconnection compensation function does not work. To use this function, two channels or more need to be used.
- When several channels are used with a heater on for one channel and heaters off for other channels, the heater disconnection compensation function does not work. Therefore, disconnection may be detected even if there is no disconnection.
- The heater disconnection alert correction value is 20% at maximum. When Heater disconnection alert setting is set to 80% as shown in the two examples on Page 272, Section 4.28 (3) (a), the conditions for disconnection detection are satisfied even if correction is performed by 20% with a voltage drop by 40% or more. Consequently, disconnection is detected.

(c) Setting method

Set Heater disconnection compensation function selection (Un\G170) to Use the heater disconnection compensation function (1). (Page 133, Section 3.4.2 (44))

(4) To clear the disconnection detection status

Disconnection detection is disabled by restoring the disconnection status and turning CH☐ Heater disconnection detection (b12 of Un\G5 to Un\G8) from 1 (ON) to 0 (OFF). (Page 89, Section 3.4.2 (3))
The timing when a heater turns on differs depending on the setting for the following buffer memory areas.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	Page 116, Section 3.4.2 (23)
CH☐ Heating control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	
CH☐ Cooling control output cycle setting	Un\G722	Un\G738	Un\G754	Un\G770	

4.29 Output Off-time Current Error Detection Function

Common

Transistor output errors can be detected using this function. The current sensor (CT) for heater disconnection detection is used to check for errors of when transistor output is off.
A heater current process value and heater disconnection alert current value are compared. If the heater current process value is larger than the heater disconnection alert current value, an output off-time current error occurs.
Output off-time current errors are detected every 500ms. When transistor output is off for 500ms or less, output off-time current errors are not detected. (CH□ Output off-time current error (b14 of Un\G5 to Un\G8) stays 0 (OFF).) (☞Page 89, Section 3.4.2 (3))
The following is the timing output as an alert.

- 500ms × Setting value for Heater disconnection/output off-time current error detection delay count (Un\G166)

If an output off-time current error status lasts longer than the time described above, Alarm code (05□A_H) is stored in Write data error code (Un\G0). (☞Page 376, Section 8.7)

(1) Modules where this function can be used

- Q64TCTTBWN
- Q64TCRTBWN

(2) Setting method

The setting method is the same as that for the heater disconnection detection function. (☞Page 271, Section 4.28)

4.30 Buffer Memory Data Backup Function

Common

This function allows buffer memory data to be stored in E^2PROM and backed up.

The backed-up data is transferred from E^2PROM to the buffer memory when the power is turned off and on or the CPU module is reset and the reset is cancelled. Therefore, temperature can be controlled without writing data when the power is turned off and on or the CPU module is reset and the reset is cancelled.

(1) Applicable buffer memory areas

Refer to the buffer memory assignment list.

Page 61, Section 3.4.1

(2) Data write to E^2PROM

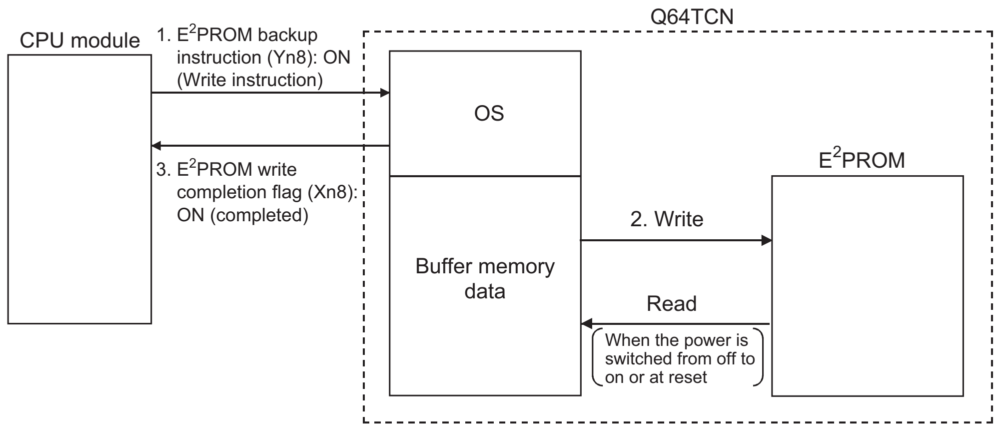
This function can be used to back up data directly written in the buffer memory using the PID constants set with the auto tuning function and the programming tool. When data is written to E^2PROM and the power is turned off and on or the CPU module is reset and the reset is cancelled, the buffer memory 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 Page 184, Section 4.6 (4).

To write data to E^2PROM, turn off and on E^2PROM backup instruction (Yn8).

When data write to E^2PROM is completed, E^2PROM write completion flag (Xn8) turns on.



If data write to E^2PROM does not complete, E^2PROM write failure flag (XnA) turns on.

(a) Setting change

Change the settings for buffer memory areas when E^2PROM write completion flag (Xn8) is off.

(3) Data read from E^2PROM

Follow the instructions below.

- Turn off and on the power or reset the CPU module and cancel the reset.
- Set CH☐ E^2PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) to Requested (1). (Page 129, Section 3.4.2 (36)) Data to be read are the PID constants and loop disconnection detection judgment time for the corresponding channel only. (Page 126, Section 3.4.2 (33))

(4) Precaution when executing the set value backup function

By executing this function, data are transferred to the buffer memory when the power is turned off and on or the CPU module is reset and the reset is cancelled. This transferred data can be overwritten by setting parameters on GX Works2.

To use the set values stored as backup data of the initial settings of the module, take either of following actions.

- Do not set parameters on GX Works2.
- When setting parameters on GX Works2, correct the set values of parameters to the ones stored as backup data, and write the parameters to the CPU module.

4.31 Error History Function

Common

The error or alert occurred with the Q64TCN is stored in the buffer memory areas (Un\G1280 to Un\G1404) as history. Up to 16 error history data can be stored.

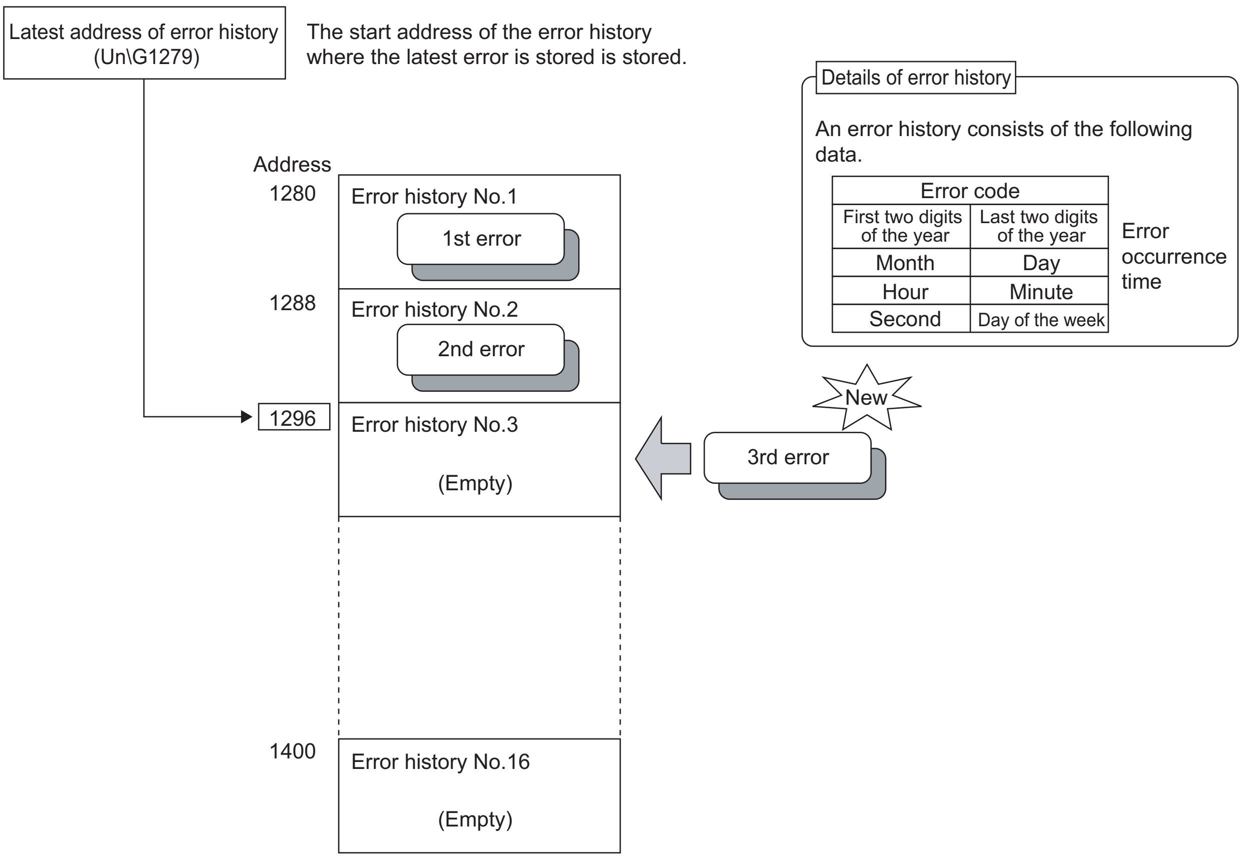
(1) Processing of the error history function

An error code and error occurrence time are stored starting from Error history No.1 (the start address is Un\G1280).

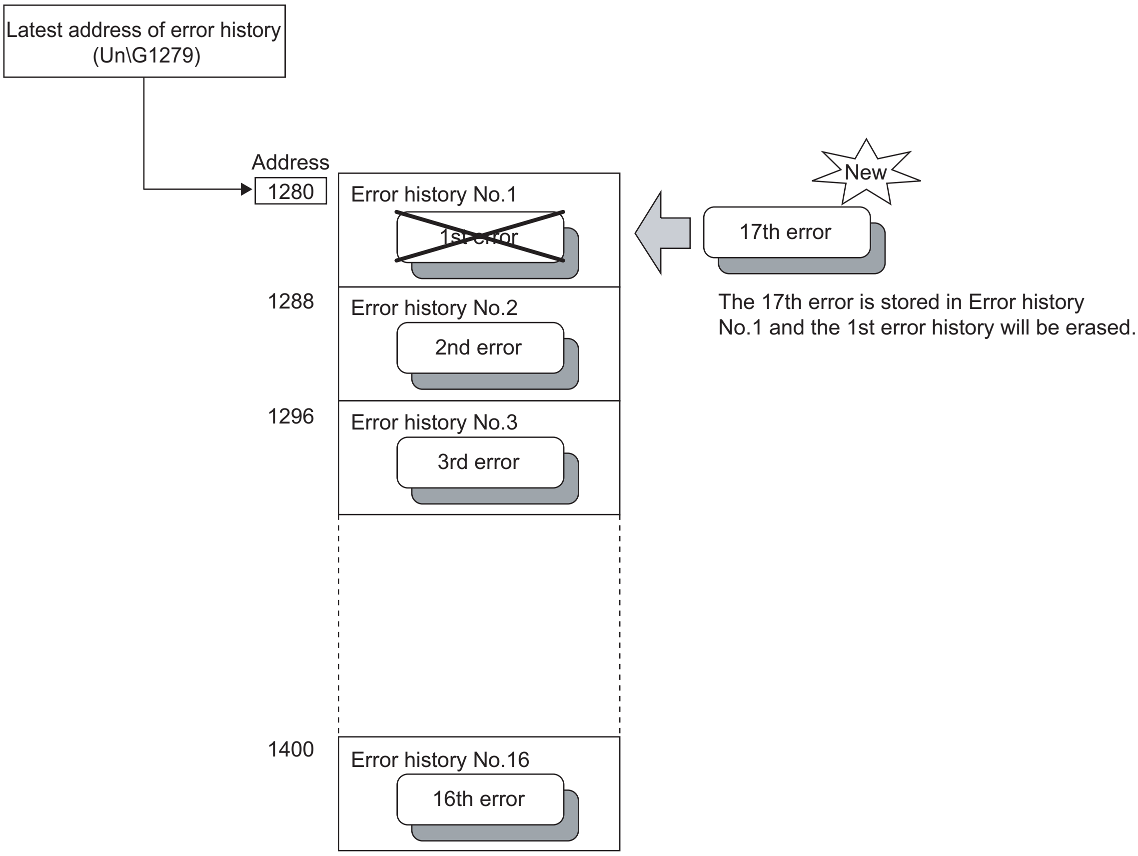
(2) How to check error history

The start address of the error history where the latest error is stored can be checked in Latest address of error history (Un\G1279).

Ex. If the third error occurred:
The third error is stored in Error history No.3 and 1296 (the start address of Error history No.3) is stored in Latest address of error history (Un\G1279).



Ex. If the 17th error occurred:
The 17th error is stored in Error history No.1 and 1280 (the start address of Error history No.1) is overwritten in Latest address of error history (Un\G1279).



Point

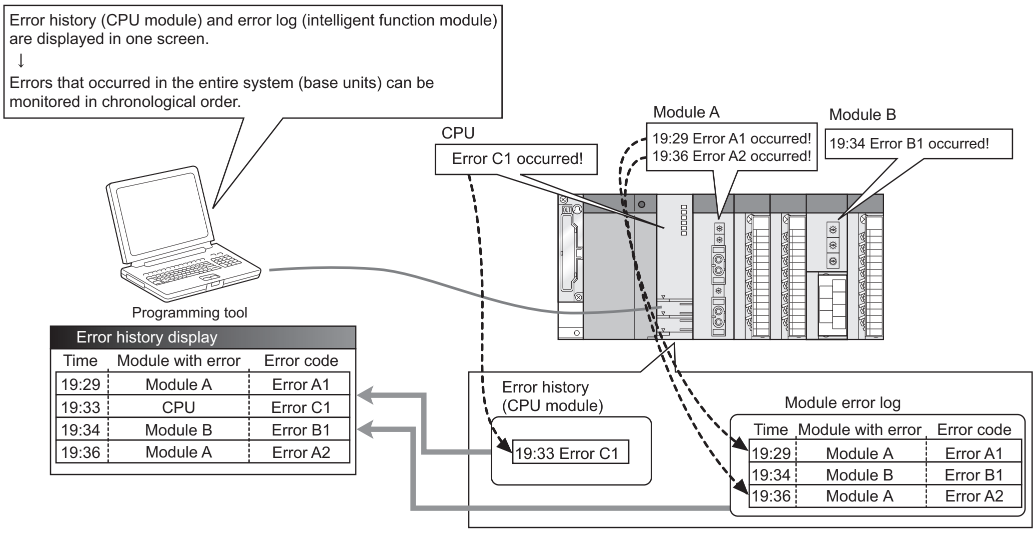
- The same processing is performed for an alarm.
- When the storage area for error histories is full, data is overwritten starting from Error history No.1 (Un\G1280 to Un\G1284) and error history recording is continued. (The history before data overwritten is deleted.)
- Recorded error histories are cleared to 0 by turning off and on the power supply or by resetting the CPU module and canceling the reset.

4.32 Module Error History Collection Function

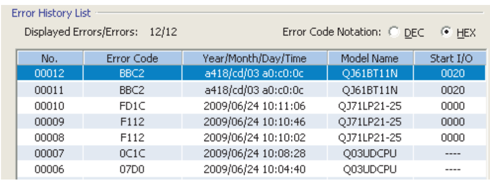
Common

The errors and alarms occurred with the Q64TCN are collected into the CPU module.
The CPU module keeps the error information collected from the Q64TCN as a module error history in the memory where data is maintained even at the time of the power failure. Therefore, the information of the errors occurred with the Q64TCN can be kept even if the power is turned off and on or the CPU module is reset and the reset is cancelled.

(1) Example of the operation of the module error history collection function



[Example of screen display]



Error History List

Displayed Errors/Errors: 12/12 Error Code Notation: DEC HEX

No.	Error Code	Year/Month/Day/Time	Model Name	Start I/O
00012	BBC2	a418/cd/03 a0:c0:0c	QJ61BT11N	0020
00011	BBC2	a418/cd/03 a0:c0:0c	QJ61BT11N	0020
00010	FD1C	2009/06/24 10:11:06	QJ71LP21-25	0000
00009	F112	2009/06/24 10:10:46	QJ71LP21-25	0000
00008	F112	2009/06/24 10:10:02	QJ71LP21-25	0000
00007	0C1C	2009/06/24 10:08:28	Q03UDCPU	----
00006	07D0	2009/06/24 10:04:40	Q03UDCPU	----

(2) Supported versions

The error history collection function can be used in the CPU module and GX Works2 with the following versions.

Item	Version
CPU module	Universal model QCPU whose first five digits of serial number is 11043 or later
GX Works2	Version 1.09K or later

Point

For details on the module error history collection function, refer to the following.
QnUCPU User's Manual (Function Explanation, Program Fundamentals)

4.33 Error Clear Function

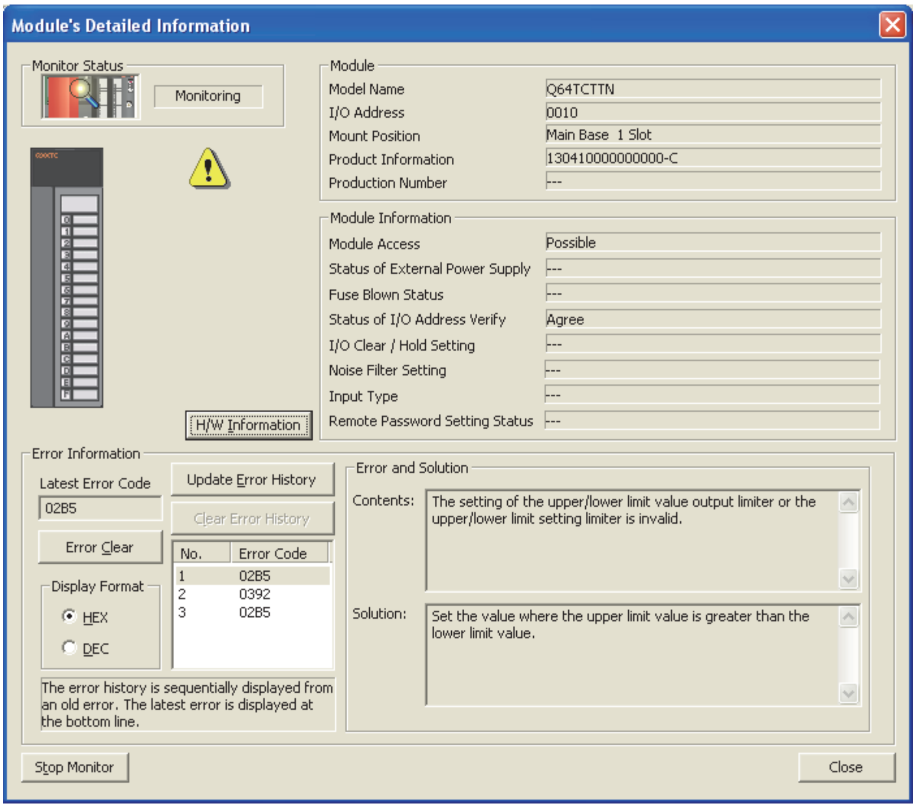
Common

When an error occurs, the error can be cleared on the system monitor.

Clicking the Error Clear button on the system monitor clears the error code stored in Write data error code (Un\G0) and turns off the ERR.LED. The operation is the same as when an error is cleared using Error reset instruction (Yn2). However, the error history is not cleared.
For how to clear an error using Error reset instruction (Yn2), refer to the following.

- Error reset instruction (Yn2) (Page 59, Section 3.3.3 (2))

[Diagnostics] ➪ [System Monitor...] ➪ The module where an error occurred



CHAPTER 5 SETTINGS AND THE PROCEDURE BEFORE OPERATION

This chapter describes the procedure prior to the Q64TCN operation, the name and setting of each part of the Q64TCN, and wiring method.

5.1 Handling Precautions

This section describes the precautions for handling the Q64TCN.

- Do not drop the module case, or do not subject it to strong impact.
- Do not remove the printed-circuit board from the case. Doing so can cause module failure.
- Tighten the screws such as a module fixing screw within the following torque ranges.
  Undertightening the screws can cause short circuit, failure, or malfunction.

Screw	Tightening torque range
Module fixing screw (M3 screw)*1	0.36 to 0.48N • m
Terminal screw (M3 screw)	0.42 to 0.58N • m
Terminal block mounting screw (M3.5 screw)	0.66 to 0.89N • m

*1 The module can be easily fixed onto the base unit using the hook at the top of the module.
However, it is recommended to secure the module with the module fixing screw if the module is subject to significant vibration.

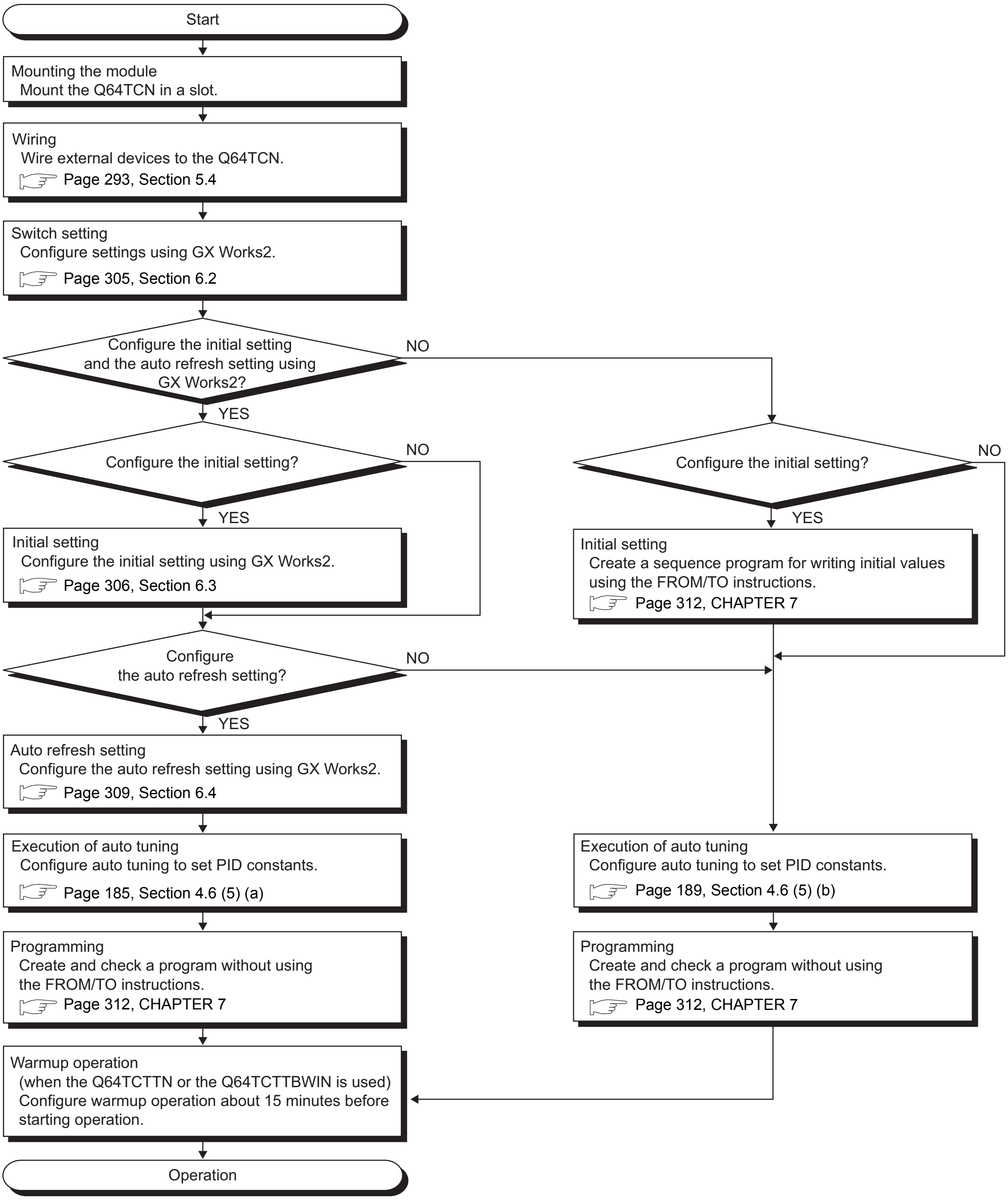
- The following table shows the applicable solderless terminal installed to the terminal block. For wiring, use the cable applicable to the following wire and mount with the applicable tightening torque. Use a UL-approved solderless terminal and tools recommended by the manufacturer of the solderless terminal. The sleeve solderless terminal cannot be used.

Solderless terminal		Wire			
Model name	Applicable tightening torque	Wire diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N • m	22 to 18 AWG	Stranded wire	Copper wire	75°C or more

- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection into the hole in the base unit and press the module until it snaps into place. Incorrect mounting may cause malfunction, failure or drop of the module.
  Securely fix the module with screws if it is subject to vibration during use.
- For the mounting direction of the module, the mounting surface, the combination with other devices, and the distance from other devices, refer to the following.
  QCPU User's Manual (Hardware Design, Maintenance and Inspection)

5.2 Settings and the Procedure before Operation

The following figure shows the procedure before operating the Q64TCN.

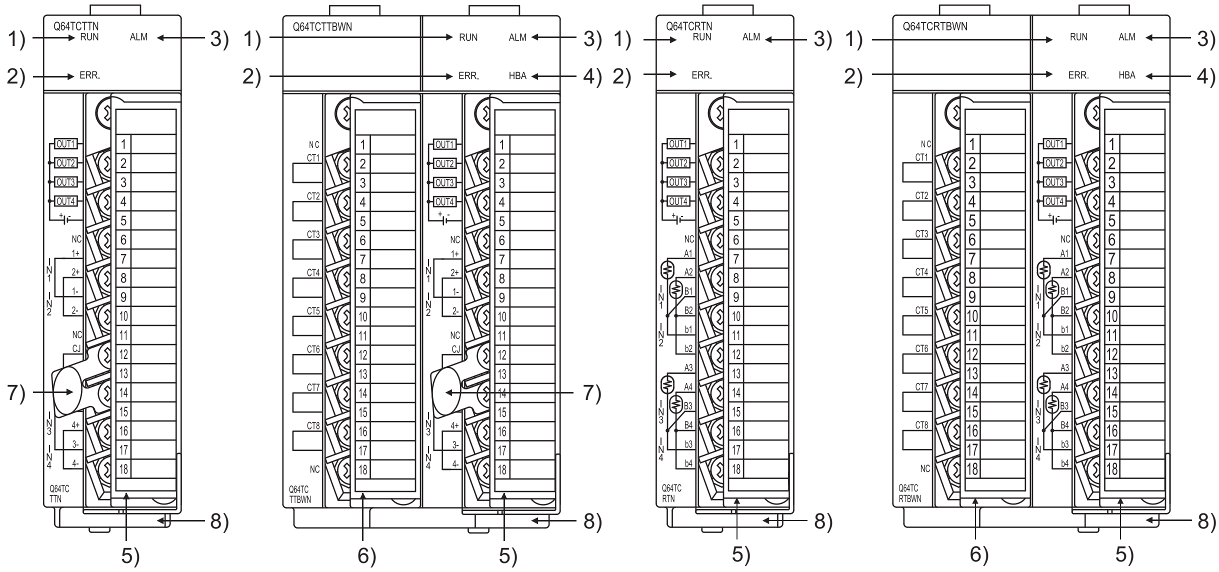


Point

When using the Q64TCTTN and the Q64TCTTBWN which use the thermocouples as the temperature sensors, temperature compensation must be executed properly. Perform warm-up operation about 15 minutes before starting operation.

5.3 Part Names

The following table shows part names of the Q64TCN.



Number	Name		Description
1)	RUN LED		Indicates the operating status of the Q64TCN.
		On	Operating normally
		Off	• The watchdog timer error has occurred. • Online module change enabled. • CPU stop error has occurred when all channels are set to "CLEAR" on Switch Setting.
2)	ERR. LED		Indicates the error status of the Q64TCN.
		On	Hardware fault (Including no connection of a cold junction temperature compensation resistor)
		Flashing	Write data error is occurring*2
		Off	Operating normally
3)	ALM LED		Indicates the alert status of the Q64TCN.
		On	Alert is occurring.
		Flashing	• Temperature process value (PV) came out of temperature measurement range. • Loop disconnection was detected. • Temperature sensor is not connected.
		Off	Alert is not occurring.
4)	HBA LED		Indicates the heater disconnection detection status or the output off-time current error status of the Q64TCTTBWN and Q64TCRTBWN.
		On	Either of the following is detected. • Heater disconnection • Output off-time current error
		Off	Neither of the following is detected. • Heater disconnection • Output off-time current error
5)	Terminal block for I/O*1		Used for temperature sensor input and transistor output.
6)	Terminal block for CT*1		Used for current sensor (CT) input.
7)	Cold junction temperature compensation resistor		Used when cold junction temperature compensation is executed for the Q64TCTTN and Q64TCTTBWN.

Number	Name	Description
8)	Serial number plate	Indicates the serial number of the Q64TCN.

*1 The terminal block layout differs depending on modules to be used. For respective terminal block layouts, refer to the following. Page 286, Section 5.3 (1) to Page 291, Section 5.3 (4)

*2 The error code and buffer memory address of the detected error can be checked in Write data error code (Un\G0). For details, refer to the following. Page 88, Section 3.4.2 (1)

(1) For the Q64TCTTN

Terminal number	Indication	Standard control		Heating-cooling control (normal mode)		Heating-cooling control (expanded mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	L1	CH1 Output	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L2	CH2 Output	L1C	CH1 Cooling output	L1C	CH1 Cooling output
3	OUT3	L3	CH3 Output	L2H	CH2 Heating output	L2H	CH2 Heating output
4	OUT4	L4	CH4 Output	L2C	CH2 Cooling output	L2C	CH2 Cooling output
5	+ −	COM-	Output common	COM-	Output common	COM-	Output common
6	NC	NC	Unused	NC	Unused	NC	Unused
7	IN1 1+	CH1+	CH1 Thermocouple +	CH1+	CH1 Thermocouple +	CH1+	CH1 Thermocouple +
8	IN2 2+	CH2+	CH2 Thermocouple +	CH2+	CH2 Thermocouple +	CH2+	CH2 Thermocouple +
9	IN1 1-	CH1-	CH1 Thermocouple -	CH1-	CH1 Thermocouple -	CH1-	CH1 Thermocouple -
10	IN2 2-	CH2-	CH2 Thermocouple -	CH2-	CH2 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	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
15	IN3 3+	CH3+	CH3 Thermocouple +	MT3+	Monitor 3 thermocouple +	CH3+	CH3 Thermocouple +
16	IN4 4+	CH4+	CH4 Thermocouple +	MT4+	Monitor 4 thermocouple +	CH4+	CH4 Thermocouple +
17	IN3 3-	CH3-	CH3 Thermocouple -	MT3-	Monitor 3 thermocouple -	CH3-	CH3 Thermocouple -
18	IN4 4-	CH4-	CH4 Thermocouple -	MT4-	Monitor 4 thermocouple -	CH4-	CH4 Thermocouple -

Terminal number	Indication	Mix control (normal mode)		Mix control (expanded mode)	
		Symbol	Name	Symbol	Name
1	OUT1	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L1C	CH1 Cooling output	L1C	CH1 Cooling output
3	OUT3	L3	CH3 Output	L3	CH3 Output
4	OUT4	L4	CH4 Output	L4	CH4 Output
5	+ −	COM-	Output common	COM-	Output common
6	NC	NC	Unused	NC	Unused
7	IN1 1+	CH1+	CH1 Thermocouple +	CH1+	CH1 Thermocouple +
8	IN2 2+	MT2+	Monitor 2 thermocouple +	CH2+	CH2 Thermocouple +
9	IN1 1-	CH1-	CH1 Thermocouple -	CH1-	CH1 Thermocouple -
10	IN2 2-	MT2-	Monitor 2 thermocouple -	CH2-	CH2 Thermocouple -
11	NC	NC	Unused	NC	Unused
12	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
13	NC	NC	Unused	NC	Unused
14	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
15	IN3 3+	CH3+	CH3 Thermocouple +	CH3+	CH3 Thermocouple +
16	IN4 4+	CH4+	CH4 Thermocouple +	CH4+	CH4 Thermocouple +
17	IN3 3-	CH3-	CH3 Thermocouple -	CH3-	CH3 Thermocouple -
18	IN4 4-	CH4-	CH4 Thermocouple -	CH4-	CH4 Thermocouple -

(2) For the Q64TCTTBWN

Terminal number	Terminal block for CT			Terminal block for I/O				
	Indication	Common to the all control modes		Indication	Standard control		Heating-cooling control (normal mode)	
		Symbol	Name		Symbol	Name	Symbol	Name
1	NC	NC	Unused	OUT1	L1	CH1 Output	L1H	CH1 Heating output
2	CT1	CT1	CT input 1	OUT2	L2	CH2 Output	L1C	CH1 Cooling output
3		CT1	CT input 1	OUT3	L3	CH3 Output	L2H	CH2 Heating output
4	CT2	CT2	CT input 2	OUT4	L4	CH4 Output	L2C	CH2 Cooling output
5		CT2	CT input 2	+ -	COM-	Output common	COM-	Output common
6	CT3	CT3	CT input 3	NC	NC	Unused	NC	Unused
7		CT3	CT input 3	IN1 1+	CH1+	CH1 Thermocouple +	CH1+	CH1 Thermocouple +
8	CT4	CT4	CT input 4	IN2 2+	CH2+	CH2 Thermocouple +	CH2+	CH2 Thermocouple +
9		CT4	CT input 4	IN1 1-	CH1-	CH1 Thermocouple -	CH1-	CH1 Thermocouple -
10	CT5	CT5	CT input 5	IN2 2-	CH2-	CH2 Thermocouple -	CH2-	CH2 Thermocouple -
11		CT5	CT input 5	NC	NC	Unused	NC	Unused
12	CT6	CT6	CT input 6	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
13		CT6	CT input 6	NC	NC	Unused	NC	Unused
14	CT7	CT7	CT input 7	CJ	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
15		CT7	CT input 7	IN3 3+	CH3+	CH3 Thermocouple +	MT3+	Monitor 3 thermocouple +
16	CT8	CT8	CT input 8	IN4 4+	CH4+	CH4 Thermocouple +	MT4+	Monitor 4 thermocouple +
17		CT8	CT input 8	IN3 3-	CH3-	CH3 Thermocouple -	MT3-	Monitor 3 thermocouple -
18	NC	NC	Unused	IN4 4-	CH4-	CH4 Thermocouple -	MT4-	Monitor 4 thermocouple -

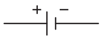
Terminal number	Indication	Terminal block for I/O					
		Heating-cooling control (expanded mode)		Mix control (normal mode)		Mix control (expanded mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	L1H	CH1 Heating output	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L1C	CH1 Cooling output	L1C	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-	Output common	COM-	Output common	COM-	Output common
6	NC	NC	Unused	NC	Unused	NC	Unused
7	IN1 1+	CH1+	CH1 Thermocouple +	CH1+	CH1 Thermocouple +	CH1+	CH1 Thermocouple +
8	IN2 2+	CH2+	CH2 Thermocouple +	MT2+	Monitor 2 thermocouple +	CH2+	CH2 Thermocouple +
9	IN1 1-	CH1-	CH1 Thermocouple -	CH1-	CH1 Thermocouple -	CH1-	CH1 Thermocouple -
10	IN2 2-	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	CJ	Cold junction temperature compensation resistor	CJ	Cold junction temperature compensation resistor
15	IN3 3+	CH3+	CH3 Thermocouple +	CH3+	CH3 Thermocouple +	CH3+	CH3 Thermocouple +
16	IN4 4+	CH4+	CH4 Thermocouple +	CH4+	CH4 Thermocouple +	CH4+	CH4 Thermocouple +
17	IN3 3-	CH3-	CH3 Thermocouple -	CH3-	CH3 Thermocouple -	CH3-	CH3 Thermocouple -
18	IN4 4-	CH4-	CH4 Thermocouple -	CH4-	CH4 Thermocouple -	CH4-	CH4 Thermocouple -

Point

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

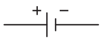
(3) For the Q64TCRTN

Terminal number	Indication	Standard control		Heating-cooling control (normal mode)		Heating-cooling control (expanded mode)	
		Symbol	Name	Symbol	Name	Symbol	Name
1	OUT1	L1	CH1 Output	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L2	CH2 Output	L1C	CH1 Cooling output	L1C	CH1 Cooling output
3	OUT3	L3	CH3 Output	L2H	CH2 Heating output	L2H	CH2 Heating output
4	OUT4	L4	CH4 Output	L2C	CH2 Cooling output	L2C	CH2 Cooling output
5	+ −	COM-	Output common	COM-	Output common	COM-	Output common
6	NC	NC	Unused	NC	Unused	NC	Unused
7	IN1 A1	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A
8	IN2 A2	CH2 A	CH2 Resistance thermometer A	CH2 A	CH2 Resistance thermometer A	CH2 A	CH2 Resistance thermometer A
9	IN1 B1	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B
10	IN2 B2	CH2 B	CH2 Resistance thermometer B	CH2 B	CH2 Resistance thermometer B	CH2 B	CH2 Resistance thermometer B
11	IN1 b1	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b
12	IN2 b2	CH2 b	CH2 Resistance thermometer b	CH2 b	CH2 Resistance thermometer b	CH2 b	CH2 Resistance thermometer b
13	IN3 A3	CH3 A	CH3 Resistance thermometer A	MT3 A	Monitor 3 resistance thermometer A	CH3 A	CH3 Resistance thermometer A
14	IN4 A4	CH4 A	CH4 Resistance thermometer A	MT4 A	Monitor 4 resistance thermometer A	CH4 A	CH4 Resistance thermometer A
15	IN3 B3	CH3 B	CH3 Resistance thermometer B	MT3 B	Monitor 3 resistance thermometer B	CH3 B	CH3 Resistance thermometer B
16	IN4 B4	CH4 B	CH4 Resistance thermometer B	MT4 B	Monitor 4 resistance thermometer B	CH4 B	CH4 Resistance thermometer B
17	IN3 b3	CH3 b	CH3 Resistance thermometer b	MT3 b	Monitor 3 resistance thermometer b	CH3 b	CH3 Resistance thermometer b
18	IN4 b4	CH4 b	CH4 Resistance thermometer b	MT4 b	Monitor 4 resistance thermometer b	CH4 b	CH4 Resistance thermometer b

Terminal number	Indication	Mix control (normal mode)		Mix control (expanded mode)	
		Symbol	Name	Symbol	Name
1	OUT1	L1H	CH1 Heating output	L1H	CH1 Heating output
2	OUT2	L1C	CH1 Cooling output	L1C	CH1 Cooling output
3	OUT3	L3	CH3 Output	L3	CH3 Output
4	OUT4	L4	CH4 Output	L4	CH4 Output
5		COM-	Output common	COM-	Output common
6	NC	NC	Unused	NC	Unused
7	IN1 A1	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A
8	IN2 A2	MT2 A	Monitor 2 resistance thermometer A	CH2 A	CH2 Resistance thermometer A
9	IN1 B1	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B
10	IN2 B2	MT2 B	Monitor 2 resistance thermometer B	CH2 B	CH2 Resistance thermometer B
11	IN1 b1	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b
12	IN2 b2	MT2 b	Monitor 2 resistance thermometer b	CH2 b	CH2 Resistance thermometer b
13	IN3 A3	CH3 A	CH3 Resistance thermometer A	CH3 A	CH3 Resistance thermometer A
14	IN4 A4	CH4 A	CH4 Resistance thermometer A	CH4 A	CH4 Resistance thermometer A
15	IN3 B3	CH3 B	CH3 Resistance thermometer B	CH3 B	CH3 Resistance thermometer B
16	IN4 B4	CH4 B	CH4 Resistance thermometer B	CH4 B	CH4 Resistance thermometer B
17	IN3 b3	CH3 b	CH3 Resistance thermometer b	CH3 b	CH3 Resistance thermometer b
18	IN4 b4	CH4 b	CH4 Resistance thermometer b	CH4 b	CH4 Resistance thermometer b

(4) For the Q64TCRTBWN

Terminal number	Terminal block for CT			Terminal block for I/O				
	Indication	Common to the all control modes		Indication	Standard control		Heating-cooling control (normal mode)	
		Symbol	Name		Symbol	Name	Symbol	Name
1	NC	NC	Unused	OUT1	L1	CH1 Output	L1H	CH1 Heating output
2	CT1	CT1	CT input 1	OUT2	L2	CH2 Output	L1C	CH1 Cooling output
3		CT1	CT input 1	OUT3	L3	CH3 Output	L2H	CH2 Heating output
4	CT2	CT2	CT input 2	OUT4	L4	CH4 Output	L2C	CH2 Cooling output
5		CT2	CT input 2	+ −	COM-	Output common	COM-	Output common
6	CT3	CT3	CT input 3	NC	NC	Unused	NC	Unused
7		CT3	CT input 3	IN1 A1	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A
8	CT4	CT4	CT input 4	IN2 A2	CH2 A	CH2 Resistance thermometer A	CH2 A	CH2 Resistance thermometer A
9		CT4	CT input 4	IN1 B1	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B
10	CT5	CT5	CT input 5	IN2 B2	CH2 B	CH2 Resistance thermometer B	CH2 B	CH2 Resistance thermometer B
11		CT5	CT input 5	IN1 b1	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b
12	CT6	CT6	CT input 6	IN2 b2	CH2 b	CH2 Resistance thermometer b	CH2 b	CH2 Resistance thermometer b
13		CT6	CT input 6	IN3 A3	CH3 A	CH3 Resistance thermometer A	MT3 A	Monitor 3 resistance thermometer A
14	CT7	CT7	CT input 7	IN4 A4	CH4 A	CH4 Resistance thermometer A	MT4 A	Monitor 4 resistance thermometer A
15		CT7	CT input 7	IN3 B3	CH3 B	CH3 Resistance thermometer B	MT3 B	Monitor 3 resistance thermometer B
16	CT8	CT8	CT input 8	IN4 B4	CH4 B	CH4 Resistance thermometer B	MT4 B	Monitor 4 resistance thermometer B
17		CT8	CT input 8	IN3 b3	CH3 b	CH3 Resistance thermometer b	MT3 b	Monitor 3 resistance thermometer b
18	NC	NC	Unused	IN4 b4	CH4 b	CH4 Resistance thermometer b	MT4 b	Monitor 4 resistance thermometer b

Terminal number	Indication	Terminal block for I/O					
		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-	Output common	COM-	Output common	COM-	Output common
6	NC	NC	Unused	NC	Unused	NC	Unused
7	IN1 A1	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A	CH1 A	CH1 Resistance thermometer A
8	IN2 A2	CH2 A	CH2 Resistance thermometer A	MT2 A	Monitor 2 resistance thermometer A	CH2 A	CH2 Resistance thermometer A
9	IN1 B1	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B	CH1 B	CH1 Resistance thermometer B
10	IN2 B2	CH2 B	CH2 Resistance thermometer B	MT2 B	Monitor 2 resistance thermometer B	CH2 B	CH2 Resistance thermometer B
11	IN1 b1	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b	CH1 b	CH1 Resistance thermometer b
12	IN2 b2	CH2 b	CH2 Resistance thermometer b	MT2 b	Monitor 2 resistance thermometer b	CH2 b	CH2 Resistance thermometer b
13	IN3 A3	CH3 A	CH3 Resistance thermometer A	CH3 A	CH3 Resistance thermometer A	CH3 A	CH3 Resistance thermometer A
14	IN4 A4	CH4 A	CH4 Resistance thermometer A	CH4 A	CH4 Resistance thermometer A	CH4 A	CH4 Resistance thermometer A
15	IN3 B3	CH3 B	CH3 Resistance thermometer B	CH3 B	CH3 Resistance thermometer B	CH3 B	CH3 Resistance thermometer B
16	IN4 B4	CH4 B	CH4 Resistance thermometer B	CH4 B	CH4 Resistance thermometer B	CH4 B	CH4 Resistance thermometer B
17	IN3 b3	CH3 b	CH3 Resistance thermometer b	CH3 b	CH3 Resistance thermometer b	CH3 b	CH3 Resistance thermometer b
18	IN4 b4	CH4 b	CH4 Resistance thermometer b	CH4 b	CH4 Resistance thermometer b	CH4 b	CH4 Resistance thermometer b

5.4 Wiring

This section describes the wiring precautions and module connection examples.

5.4.1 Wiring precautions

External wiring that is less likely to be affected by noise is one of the conditions for a highly reliable system that fully utilizes the Q64TCN.

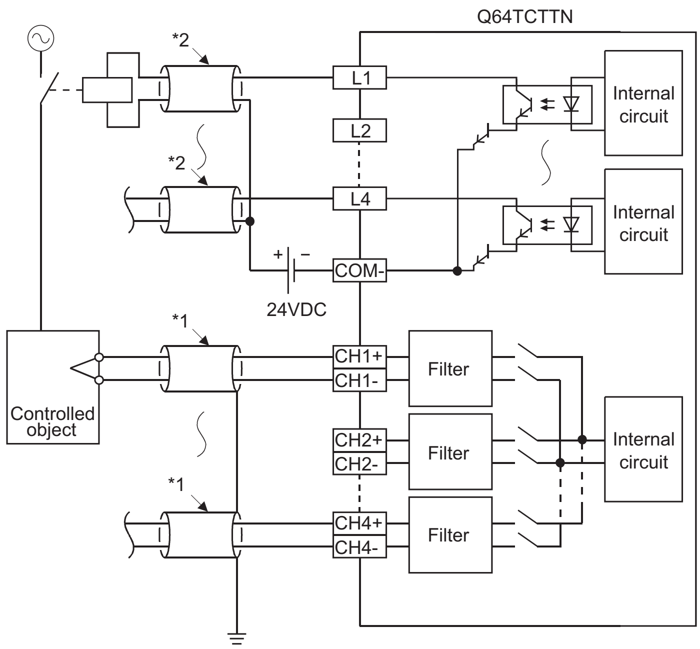
This section describes wiring precautions.

- Use separate cables for the AC control circuit and the Q64TCN's external I/O signals to avoid influence of AC side surges and induction.
- Do not locate external wires near the main circuit line, high-voltage circuit lines, and load circuit lines of devices other than programmable controllers such as an inverter. Also, do not bunch external wires with these lines. Otherwise, the external wires are more likely to be affected by noise, surges, and induction.
- Ground 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.
- To ensure that this product maintains EMC and Low Voltage Directives, please refer to the manual included with the CPU module or base unit.

5.4.2 External wiring

(1) Q64TCTTN

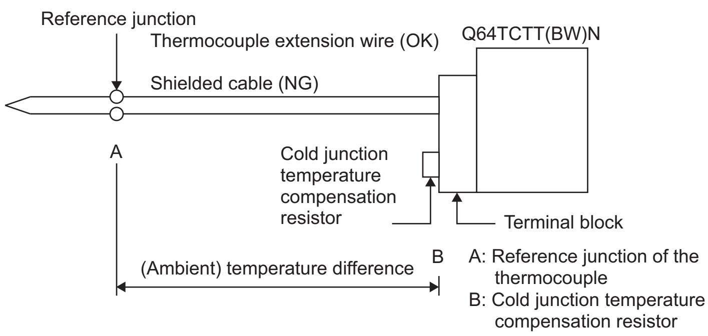
(a) In the standard control



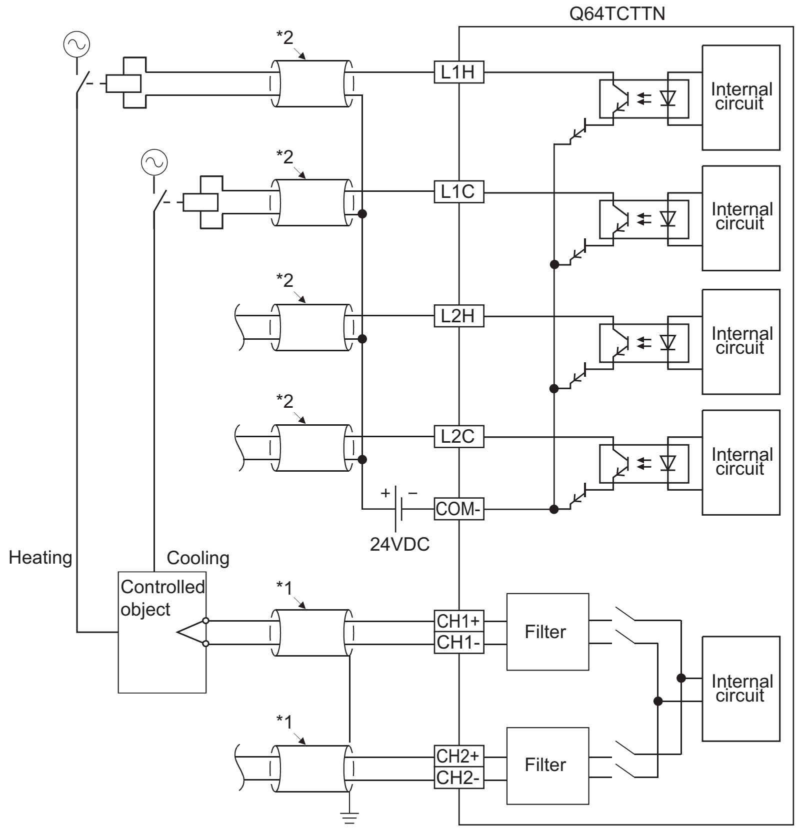
*1 Use the shielded compensation lead wire.
*2 Use the shielded cable.

Point

Use the compensation lead wire for the cable of 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).



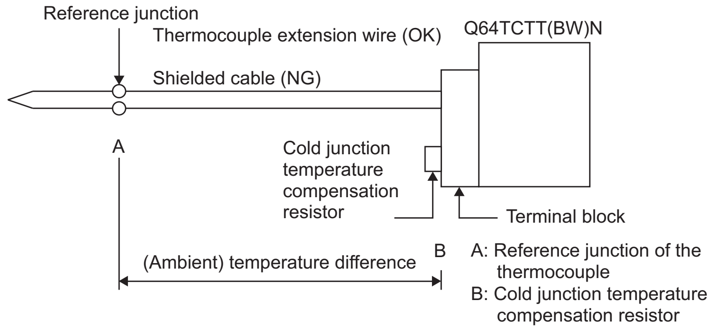
(b) In the heating-cooling control



*1 Use the shielded compensation lead wire.
*2 Use the shielded cable.

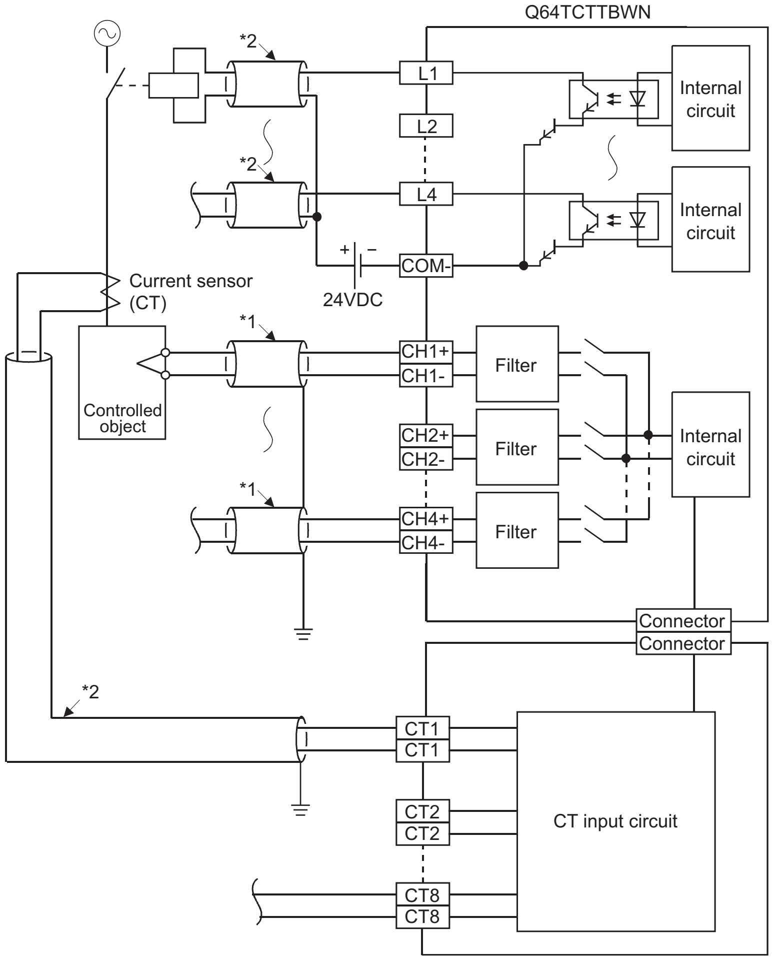
Point

Use the compensation lead wire for the cable of 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) Q64TCTTBWN

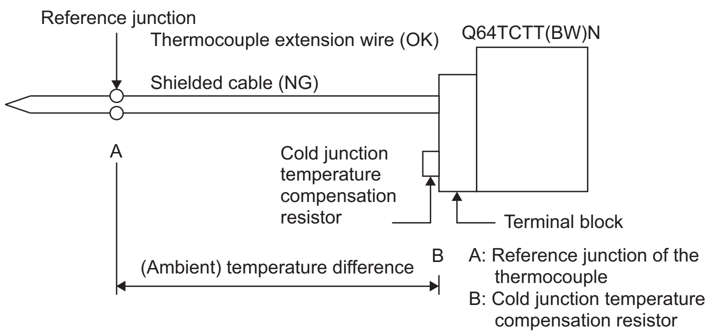
(a) In the standard control



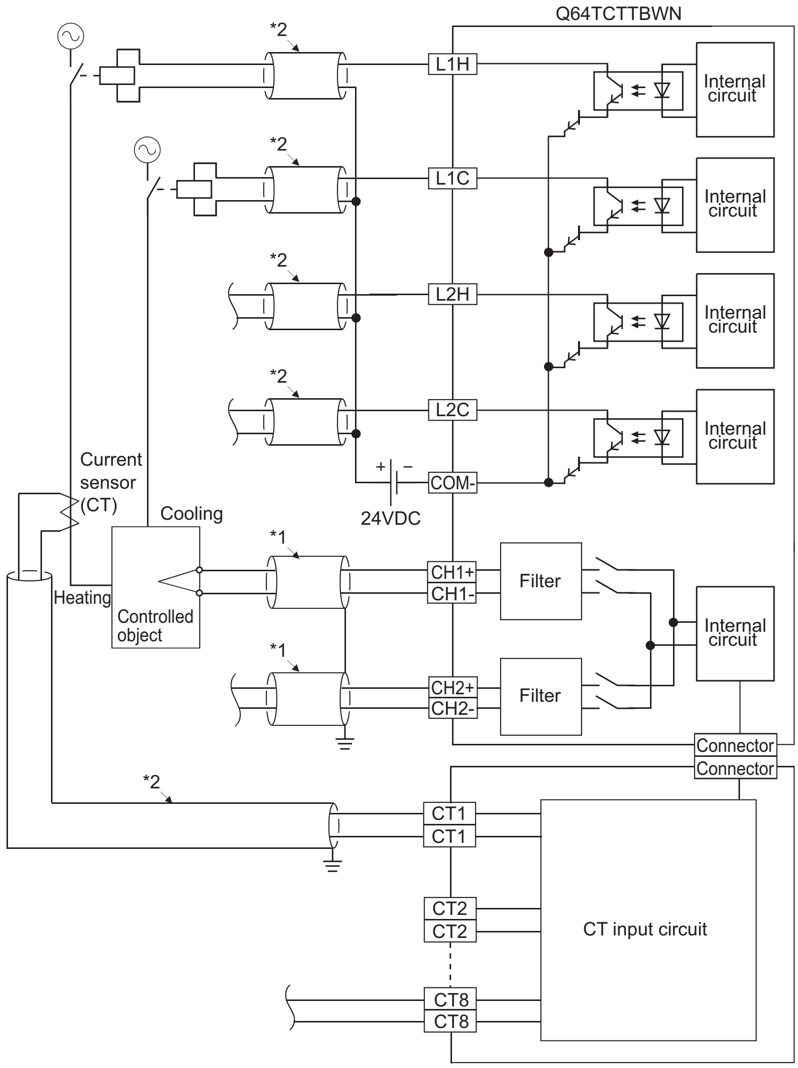
*1 Use the shielded compensation lead wire.
*2 Use the shielded cable.

Point

- To use the heater disconnection detection function, the CT input channel assignment must be set. Since the CT1 is used in the loop of CH1 in the above wiring example, set CH1(1) to CT1 CT input channel assignment setting (Un\G264).
- Use the compensation lead wire for the cable of 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).



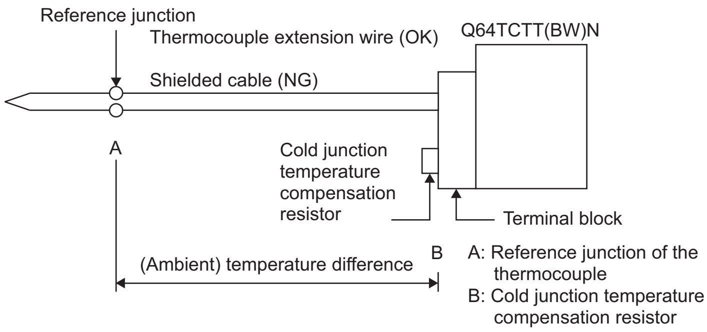
(b) In the heating-cooling control



*1 Use the shielded compensation lead wire.
*2 Use the shielded cable.

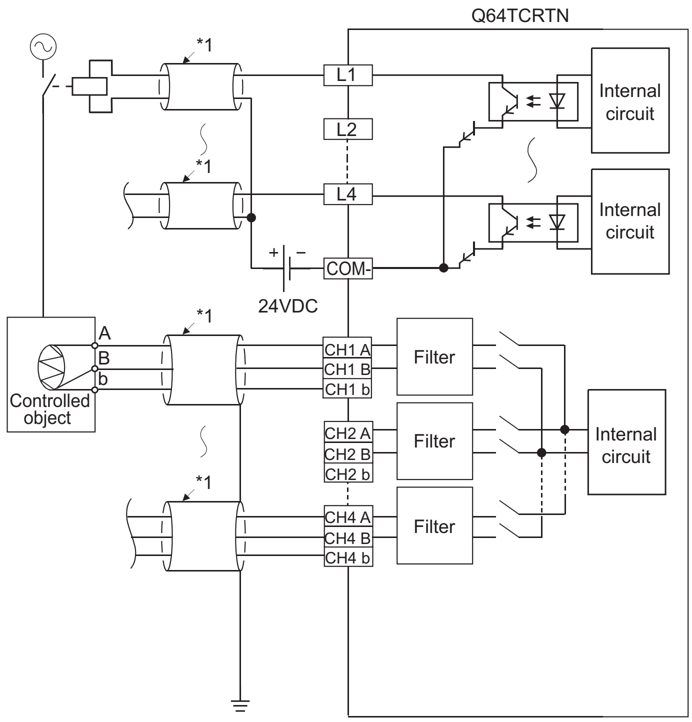
Point

- To use the heater disconnection detection function, the CT input channel assignment must be set. Since the CT1 is used in the loop of CH1 in the above wiring example, set CH1(1) to CT1 CT input channel assignment setting (Un\G264).
- Use the compensation lead wire for the cable of 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).



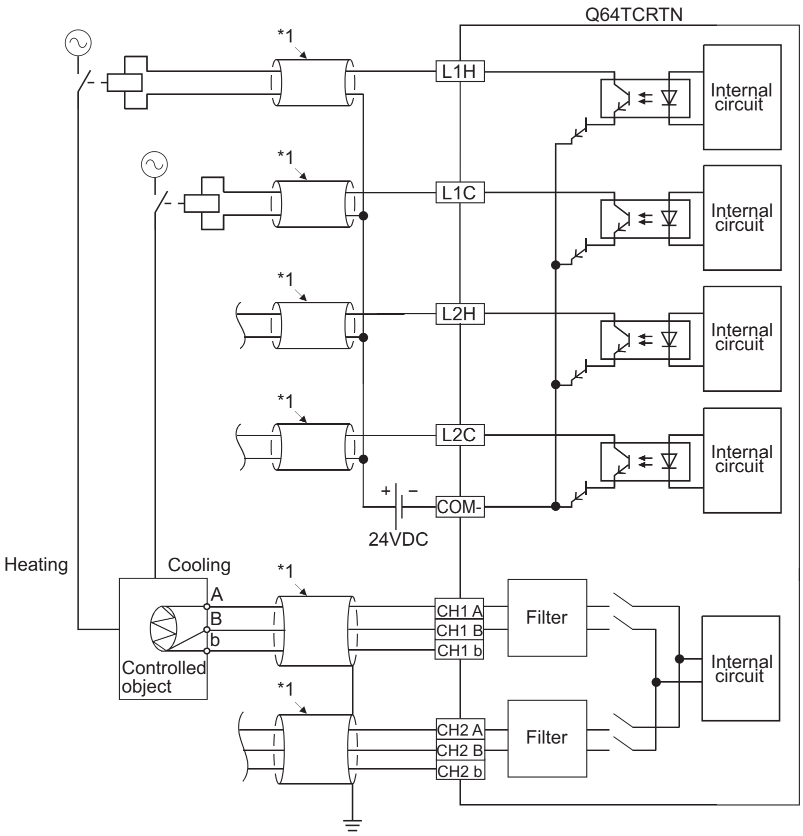
(3) Q64TCRTN

(a) In the standard control



*1 Use the shielded cable.

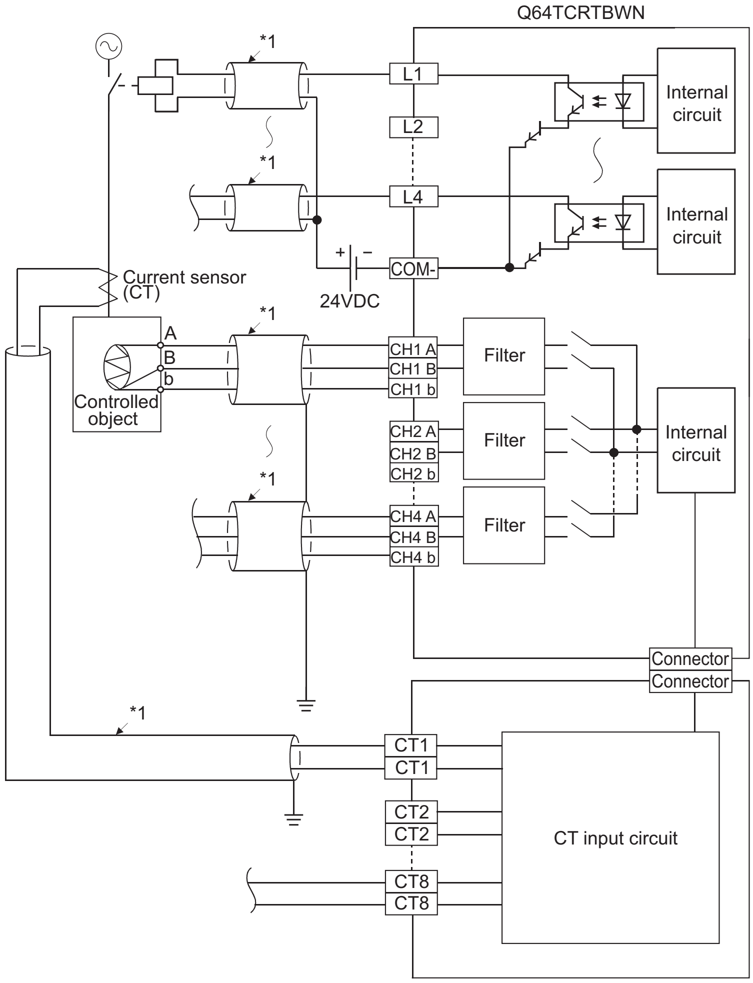
(b) In the heating-cooling control



*1 Use the shielded cable.

(4) Q64TCRTBWN

(a) In the standard control

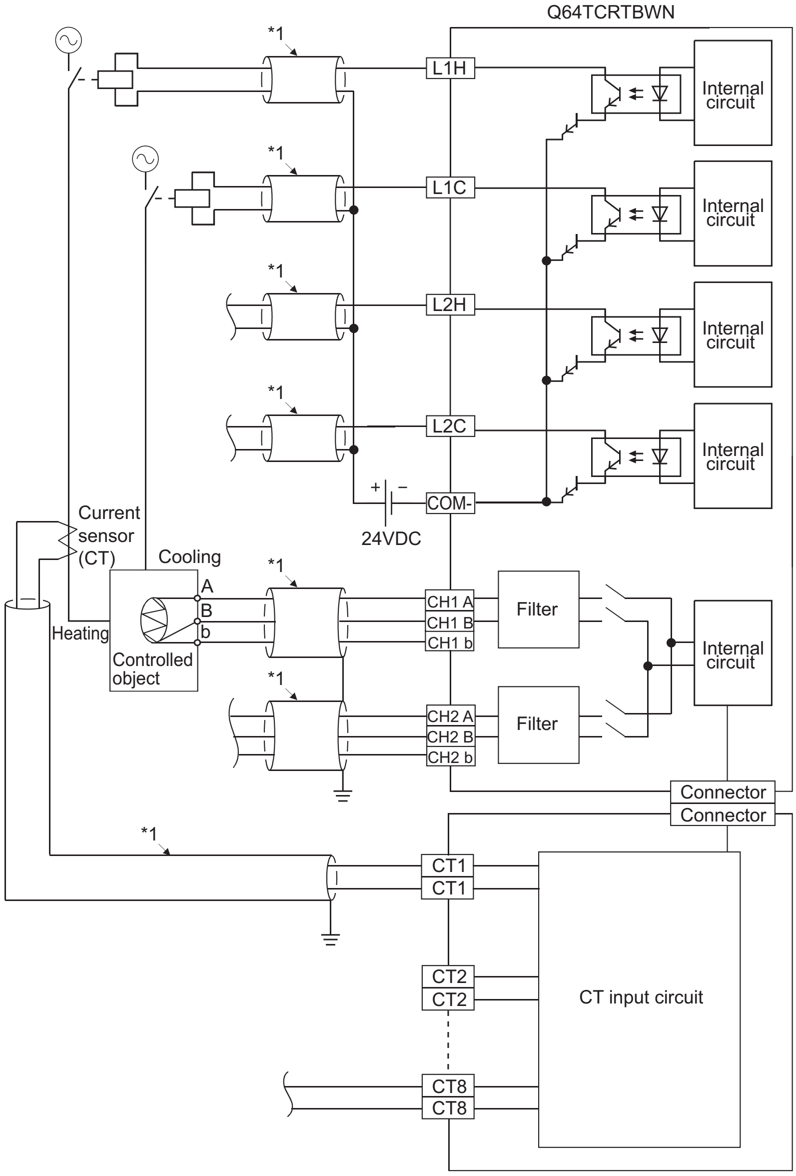


*1 Use the shielded cable.

Point

To use the heater disconnection detection function, the CT input channel assignment must be set.
Since the CT1 is used in the loop of CH1 in the above wiring example, set CH1(1) to CT1 CT input channel assignment setting (Un\G264).

(b) In the heating-cooling control



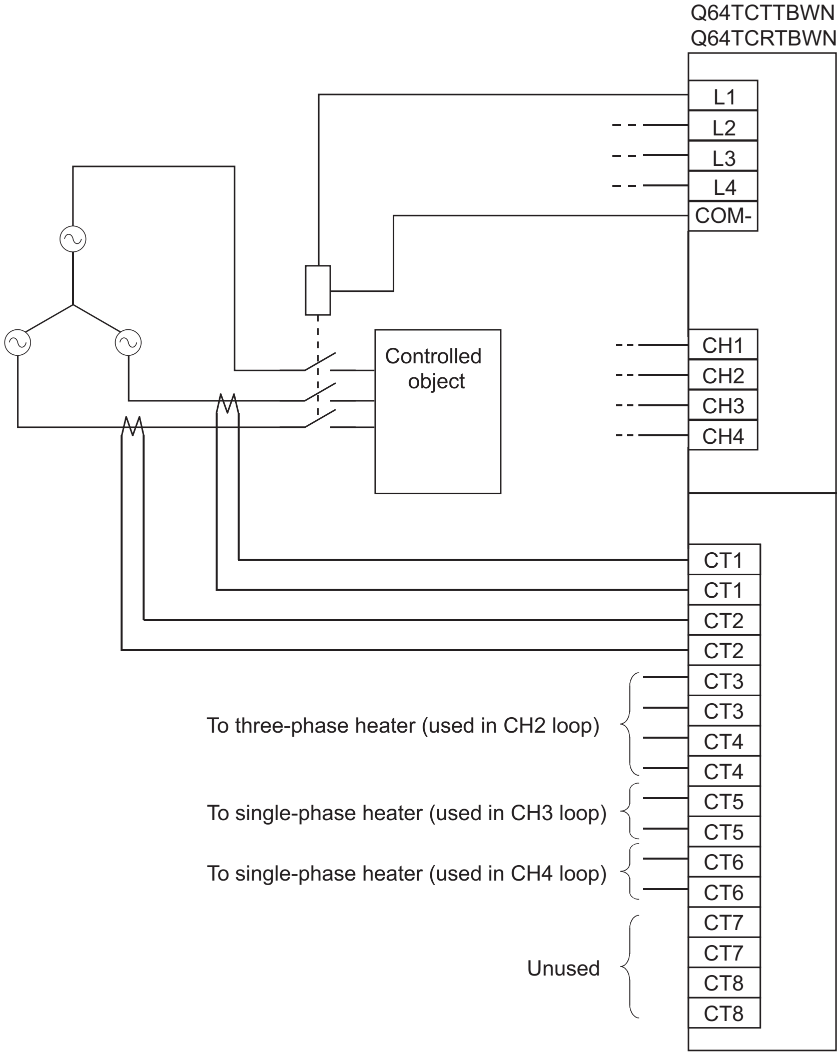
*1 Use the shielded cable.

Point

To use the heater disconnection detection function, the CT input channel assignment must be set.
Since the CT1 is used in the loop of CH1 in the above wiring example, set CH1(1) to CT1 CT input channel assignment setting (Un\G264).

5.4.3 Heater disconnection detection wiring and setting example for three-phase heater

The following figure shows a wiring and setting example to detect a three-phase heater disconnection by using the heater disconnection detection function.



Three-phase heater disconnection detection is executed by measuring the currents of two of the three cables.
In the above wiring example, set CT□ CT input channel assignment setting (Un\G264 to Un\G271) as indicated below.

CT input	Buffer memory address	Set value
CT1	Un\G264	1
CT2	Un\G265	1
CT3	Un\G266	2
CT4	Un\G267	2
CT5	Un\G268	3
CT6	Un\G269	4
CT7	Un\G270	0
CT8	Un\G271	0

5.5 Unused Channel Setting

When no temperature sensor is connected to a channel, the Q64TCN performs upscale processing for the channel. Therefore, when a temperature sensor is not connected to a channel where no temperature control is performed, the module determines that the temperature process value (PV) has exceeded the temperature measurement range for the input range, and the ALM LED blinks.

Once the unused channel setting is configured, no alarm will occur for a channel where a temperature sensor is not connected. To prevent faulty alert detection, configure the unused channel setting.

(1) Setting method

Set a value in CH□ unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157).

For details on the setting, refer to the following.

☞ Page 128, Section 3.4.2 (35)

The following table shows the relationship between the setting value and control status.

Set value	Control status		
	PID control	Temperature judgment	Alert judgment
0: Used	The controls are performed. (However, it depends on other setting status.)		
1: Unused	The controls are not performed.		

Remark

Even if the unused channel setting is configured, the sampling cycle does not change.

CHAPTER 6 VARIOUS SETTINGS

This chapter describes the setting procedures of the Q64TCN.

Point

- To enable the contents of the new module, parameter setting, and auto refresh setting, reset the CPU module, switch STOP → RUN → STOP → RUN, or turn off and on the power after writing the contents into the CPU module.
- To enable the contents of the switch setting, reset the CPU module, or turn off and on the power after writing the contents into the CPU module.

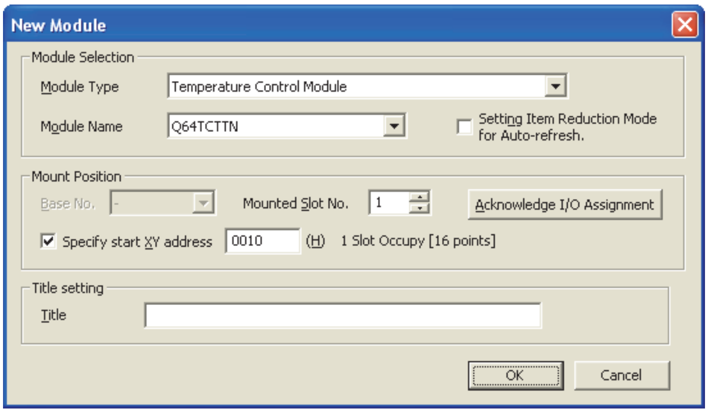
6.1 Addition of Modules

Add the model name of the Q64TCN to use on the project.

(1) Addition procedure

Open the "New Module..." window.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [New Module...]



Item		Description
Module Selection	Module Type	Set "Temperature Control Module".
	Module Name	Select the module model name to mount.
	Setting Item Reduction Mode for Auto-refresh	Select it to reduce the number of setting items for auto refresh. (Page 309, Section 6.4)
Mount Position	Base No.	Set the base unit where the module is mounted.
	Mounted Slot No.	Set the slot No. where the module is mounted.
	Specify start XY address	The start I/O number (hexadecimal) of the target module is set, according to the slot No. An arbitrary start I/O number can be also set.
Title setting	Title	Set an arbitrary title.

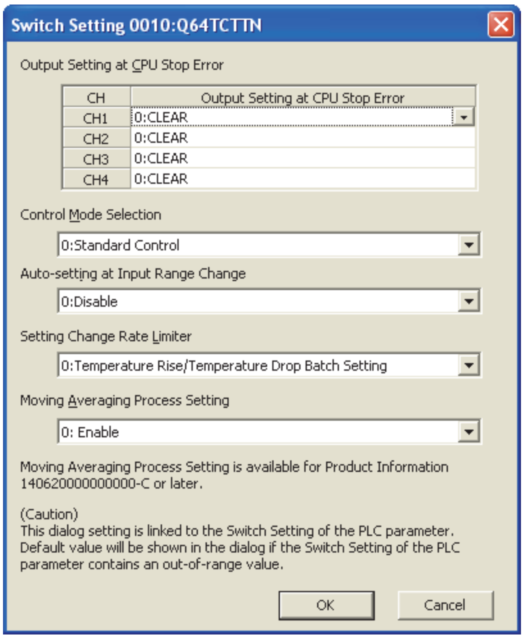
6.2 Switch Setting

Configure settings such as the output setting at CPU stop error and the control mode selection which are used in each channel.

(1) Setting method

Open the "Switch Setting" window.

Project window ⇨ [Intelligent Function Module] ⇨ Module name ⇨ [Switch Setting]



Item	Description	Set value	Reference
Output Setting at CPU Stop Error	Set whether to hold or clear the transistor output status when a CPU stop error occurs or when a CPU module is switched from RUN to STOP.	• 0: CLEAR (default value) • 1: HOLD	Page 171, Section 4.2
Control Mode Selection*1	Set the control mode.	• 0: Standard Control • 1: Heating/Cooling Control (Normal Mode) • 2: Heating/Cooling Control (Expanded Mode) • 3: Mix Control (Normal Mode) • 4: Mix Control (Expanded Mode)	Page 168, Section 4.1
Auto-setting at Input Range Change	Set this item to change data of the related buffer memory automatically when the input range is changed so that an error which is out of the setting does not occur.	• 0: Disable • 1: Enable	Page 226, Section 4.15
Setting Change Rate Limiter	Select "batch" setting or "individual" setting for the setting change rate limiter at temperature rise and drop .	• 0: Temperature Rise/Temperature Drop Batch Setting • 1: Temperature Rise/Temperature Drop Individual Setting	Page 196, Section 4.9
Moving Averaging Process Setting	Set whether to enable or disable the moving averaging process.	• 0: Enable • 1: Disable	Page 197, Section 4.10

*1 Immediately after the control mode selection is changed, a set value discrepancy error (error code: $001E_H$) occurs. To clear the set value discrepancy error, turn off, on, and off E^2PROM backup instruction (Yn8).

6.3 Parameter Setting

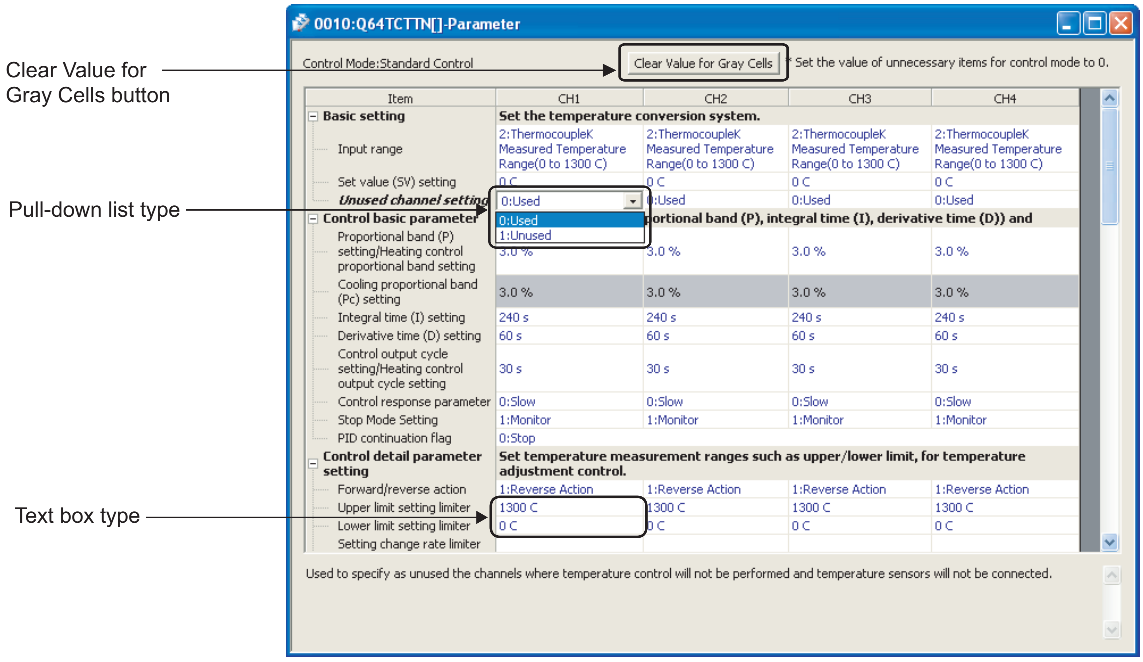
Set the parameter for each channel.
By setting parameters here, the parameter setting is not required on a program.

(1) Setting method

Open the "Parameter" window.

1. Start up "Parameter" on the Project window.

Project window ➪ [Intelligent Function Module] ➪ Module name ➪ [Parameter]



2. Click [Clear Value for Gray Cells] to set items unnecessary for the mode set on Switch Setting to 0.

3. Double-click the item to change the setting, and enter the set value.

- Items to select from a pull-down list
  Double-click the item to set to display the pull-down list. Select the item.
- Items to enter in a text box
  Double-click the item to set, and enter the value.

Remark

If writing is performed without setting unnecessary items for the mode set on Switch Setting to 0, a write data error (error code: □□□2_H) may occur.

For details on set values, refer to the following.

Setting item	Reference
Input range	Page 98, Section 3.4.2 (12)
Set value (SV) setting	Page 106, Section 3.4.2 (14)
Unused channel setting	Page 128, Section 3.4.2 (35)
Proportional band (P) setting/Heating control proportional band setting (Ph)	Page 107, Section 3.4.2 (15)
Cooling proportional band (Pc) setting	

Setting item	Reference
Integral time (I) setting	Page 109, Section 3.4.2 (16)
Derivative time (D) setting	Page 109, Section 3.4.2 (17)
Control output cycle setting/Heating control output cycle setting	Page 116, Section 3.4.2 (23)
Control response parameter	Page 118, Section 3.4.2 (25)
Stop Mode Setting	Page 105, Section 3.4.2 (13)
PID continuation flag	Page 133, Section 3.4.2 (43)
Forward/reverse action setting	Page 123, Section 3.4.2 (30)
Upper limit setting limiter	Page 124, Section 3.4.2 (31)
Lower limit setting limiter	
Setting change rate limiter or Setting change rate limiter (Temperature rise)	Page 121, Section 3.4.2 (28)
Setting change rate limiter (Temperature drop)	
Sensor correction value setting	Page 115, Section 3.4.2 (21)
Number of moving averaging	Page 153, Section 3.4.2 (72)
Primary delay digital filter setting	Page 117, Section 3.4.2 (24)
Upper limit output limiter/Heating upper limit output limiter	Page 112, Section 3.4.2 (19)
Lower limit output limiter	
Output variation limiter	Page 114, Section 3.4.2 (20)
Adjustment sensitivity (dead band) setting	Page 115, Section 3.4.2 (22)
Self-tuning setting	Page 148, Section 3.4.2 (68)
Temperature conversion setting	Page 152, Section 3.4.2 (71)
Cooling method setting	Page 153, Section 3.4.2 (73)
Cooling upper limit output limiter	Page 112, Section 3.4.2 (19)
Cooling control output cycle setting	Page 116, Section 3.4.2 (23)
Overlap/dead band setting	Page 154, Section 3.4.2 (74)
Process value (PV) scaling function enable/disable setting	Page 154, Section 3.4.2 (76)
Process value (PV) scaling lower limit value	Page 155, Section 3.4.2 (77)
Process value (PV) scaling upper limit value	
Derivative action selection	Page 155, Section 3.4.2 (79)
Simultaneous temperature rise group setting	Page 156, Section 3.4.2 (80)
Simultaneous temperature rise AT mode selection	Page 157, Section 3.4.2 (83)
Setting change rate limiter Unit time setting	Page 159, Section 3.4.2 (85)
Peak current suppression control group setting	Page 160, Section 3.4.2 (86)
Automatic backup setting after auto tuning of PID constants	Page 130, Section 3.4.2 (37)
Cold junction temperature compensation selection	Page 137, Section 3.4.2 (49)
Alert 1 to 4 mode setting	Page 139, Section 3.4.2 (52)
Alert set value 1 to 4	Page 110, Section 3.4.2 (18)
Alert dead band setting	Page 131, Section 3.4.2 (38)
Number of alert delay	Page 131, Section 3.4.2 (39)
Loop disconnection detection judgment time	Page 126, Section 3.4.2 (33)
Loop disconnection detection dead band	Page 127, Section 3.4.2 (34)
Heater disconnection alert setting	Page 125, Section 3.4.2 (32)
Heater disconnection/output off-time current error detection delay count	Page 132, Section 3.4.2 (40)
Heater disconnection compensation function selection	Page 133, Section 3.4.2 (44)
AT Bias	Page 122, Section 3.4.2 (29)
Auto tuning mode selection	Page 138, Section 3.4.2 (51)
During AT loop disconnection detection function enable/disable setting	Page 147, Section 3.4.2 (66)
Temperature rise completion range setting	Page 132, Section 3.4.2 (41)

Setting item	Reference
Temperature rise completion soak time setting	Page 133, Section 3.4.2 (42)
Transistor output monitor ON delay time setting	Page 134, Section 3.4.2 (45)
Resolution of the manipulated value for output with another analog module	Page 136, Section 3.4.2 (48)
CT monitor method switching	Page 134, Section 3.4.2 (46)
CT☐ CT input channel assignment setting	Page 141, Section 3.4.2 (54)
CT☐ CT selection	Page 142, Section 3.4.2 (55)
CT☐ Reference heater current value	Page 143, Section 3.4.2 (56)
CT☐ CT Ratio setting	Page 143, Section 3.4.2 (57)

4. **When using CH2 to CH4, follow the step 3 described earlier.**

6.4 Auto Refresh

Buffer memory data can be transferred to specified devices using this function.
By using this auto refresh setting, reading or writing is not required on a program.
For the Q64TCN, number of parameters of the auto refresh setting can be reduced by changing the normal mode to the setting item reduction mode.

(1) Setting item reduction mode

In the setting item reduction mode, setting items can be grouped so that the device setting is required only for the start item of the group and the number of parameters of the auto refresh setting can be saved compared with the normal mode.
For the number of parameters of the auto refresh setting, refer to the following:

☞ Page 46, Section 3.1.3 (2)

(a) GX Works2 version supporting this function

GX Works2 with version 1.73B or later supports this function.

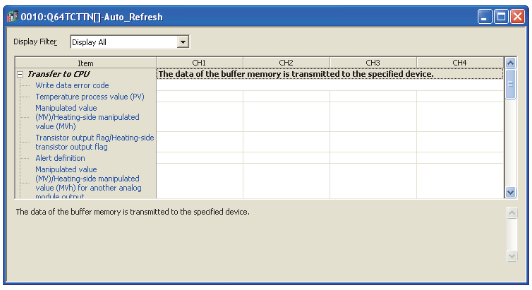
(2) Setting method

(a) In the setting item reduction mode

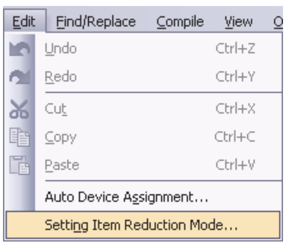
Configure settings from "Auto_Refresh" window.
The mode change to the setting item reduction mode can be performed from "New Module" window as well.
(☞ Page 304, Section 6.1)

1. Open "Auto_Refresh" window.

Project window ⇨ [Intelligent Function Module] ⇨ Module name ⇨ [Auto_Refresh]



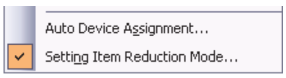
↓



2. Change from the normal mode to the setting item reduction mode.
If the setting item reduction mode is already set, the following operation is not required.

[Edit] ⇨ [Setting Item Reduction Mode]

If the mode is changed to the setting item reduction mode, the box to the left of [Setting Item Reduction Mode] is checked.

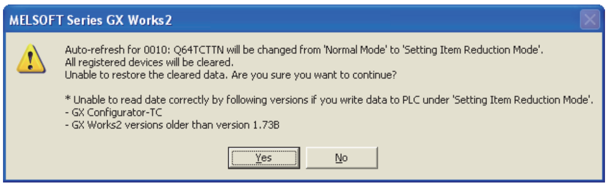


↓

(To the next page)

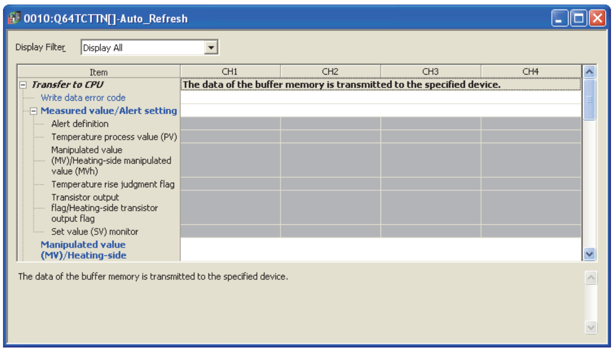
(From the previous page)

↓



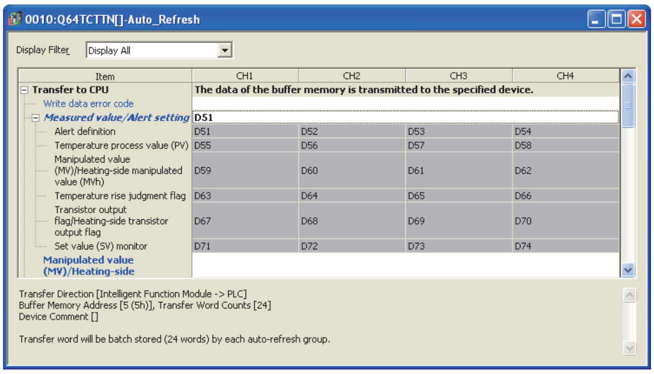
3. **Click the Yes button.**

↓



4. **Click the item to be set and enter the auto refresh target device.**

↓



5. **To set the device for a grouped setting items (gray part), set the device to the start item (white part).**
When the device is set to the start item, the consecutive devices are automatically set to the grouped setting items. (The left side window is the example when "D51" is set to "Measured value/Alert setting".)

↓

End

Point

- To change the mode back to the normal mode, perform [Edit] ⇨ [Setting Item Reduction Mode] again and uncheck the box to the left of [Setting Item Reduction Mode].
- By changing the mode (normal mode → setting item reduction mode, setting item reduction mode → normal mode), the settings before the change are all cleared.
- When the auto refresh settings configured in the setting item reduction mode are read with GX Configurator-TC
  - The setting contents are not displayed properly. Only the device set to the start item of the group is displayed.
  - Do not edit the read out auto refresh settings using GX Configurator-TC.

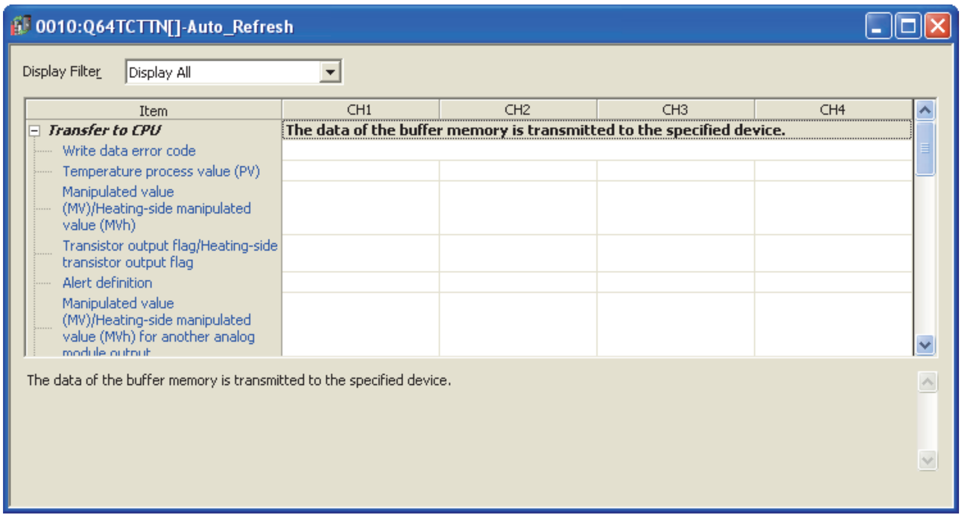
(b) In the normal mode

Open the "Auto_Refresh" window.

1. Start "Auto_Refresh" on the Project window.

Project window ➪ [Intelligent Function Module] ➪ Module name ➪ [Auto_Refresh]

2. Click the item to set, and enter the auto refresh target device.



6.5 Auto Tuning

For how to execute auto tuning, refer to the following.

Page 185, Section 4.6 (5)

6.6 Sensor Correction

For how to execute sensor correction, refer to the following.

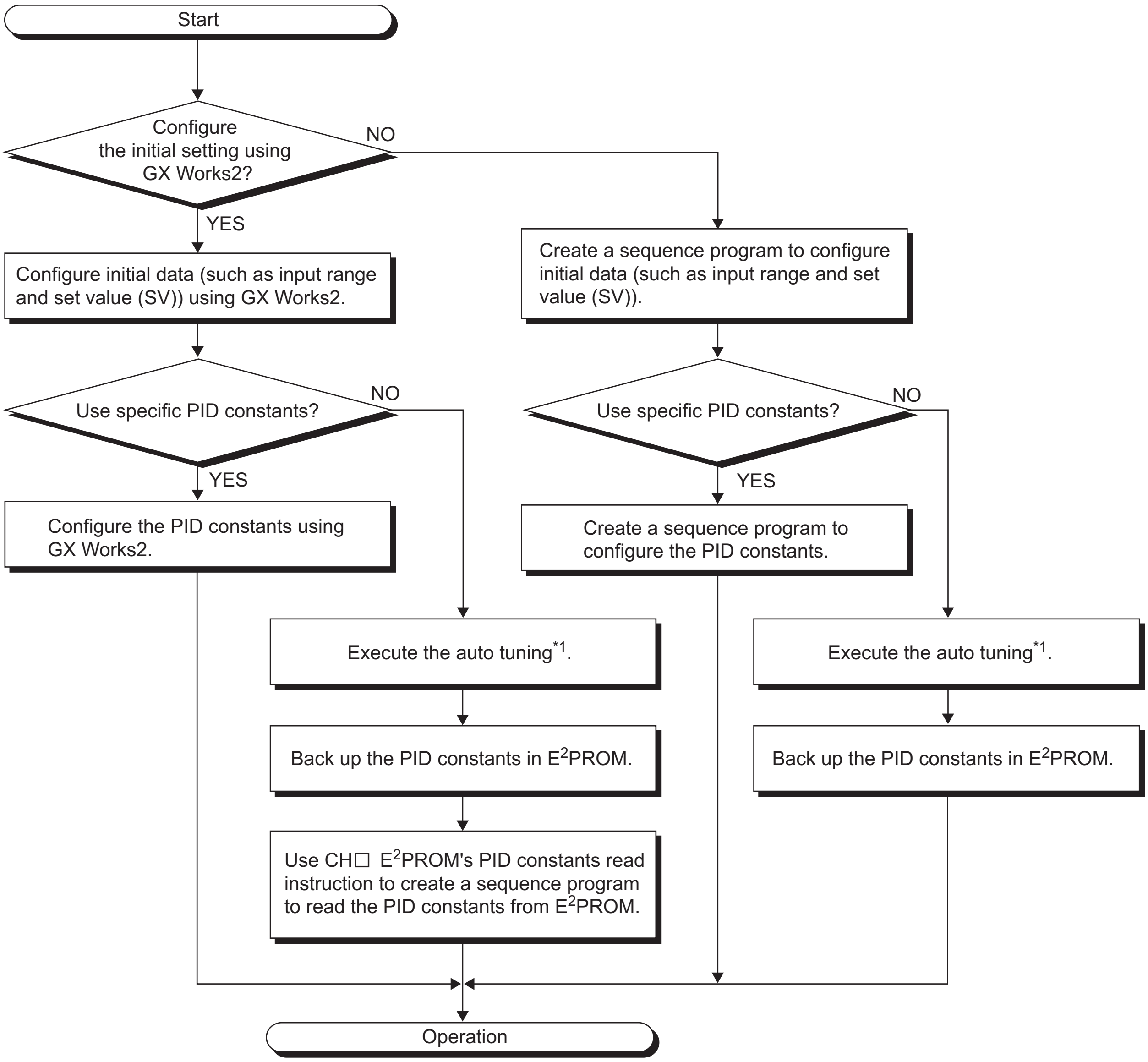
Page 215, Section 4.14

CHAPTER 7 PROGRAMMING

This chapter describes the programs of the Q64TCN.
When applying any of the program examples introduced in this chapter to the actual system, verify that the control of the target system has no problem thoroughly.

7.1 Programming Procedure

Create a program that performs temperature control in the Q64TCN using the following procedure.



*1 In the standard control, the self-tuning can be selected if necessary.

7.2 When Using the Module in a Standard System Configuration

This section describes the following program examples.

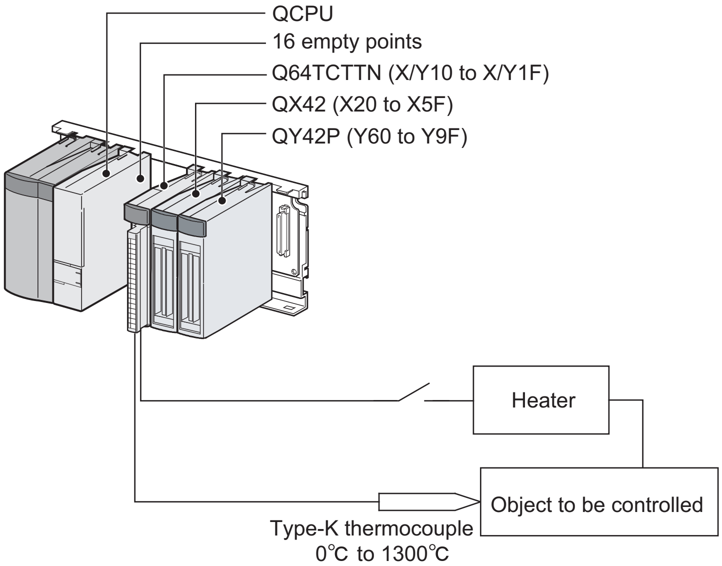
Control mode	Overview of the program example	Reference
Standard control	This is a program example for operations such as the auto tuning, self-tuning, and error code read.	Page 313, Section 7.2.1
	This is a program example where the peak current suppression function and the simultaneous temperature rise function are used for the control.	Page 325, Section 7.2.2
Heating-cooling control	This is a program example for the heating-cooling control.	Page 340, Section 7.2.3

7.2.1 Standard control (such as auto tuning, self-tuning, and error code read)

This section describes the program example for operations such as the auto tuning, self-tuning, and error code read.

(1) System configuration

The following figure shows the system configuration for operations such as the auto tuning, self-tuning, and error code read.



Point

When the Q64TCTTBWN or the Q64TCRTBWN is used, the I/O assignment is the same as that of the system configuration shown above.

- Slot 0: Empty 16 points
- Slot 1: Intelligent 16 points
- Slot 2: Input 64 points
- Slot 3: Output 64 points

(2) Programming condition

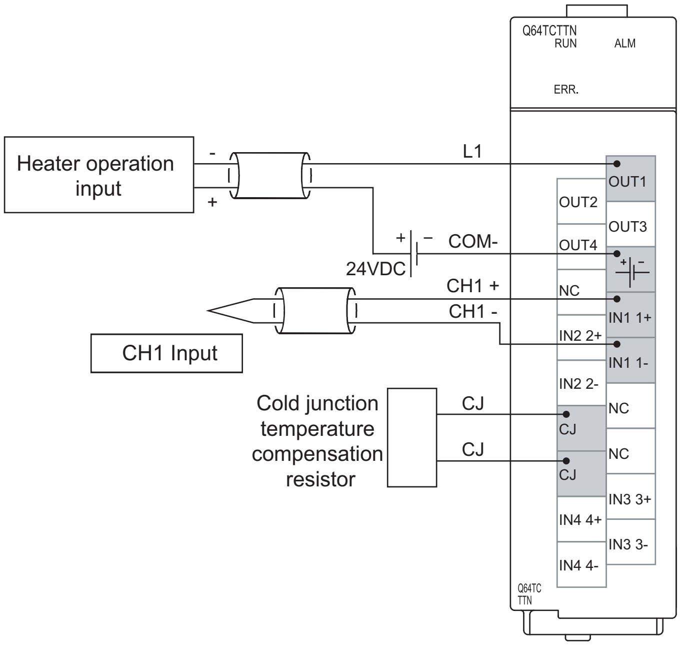
This program is designed to read the temperatures measured by the thermocouple (K type, 0 to 1300°C) connected to CH1.

An error code can be read and reset.

The self-tuning function automatically sets the PID constants optimal to CH1.

(3) Wiring example

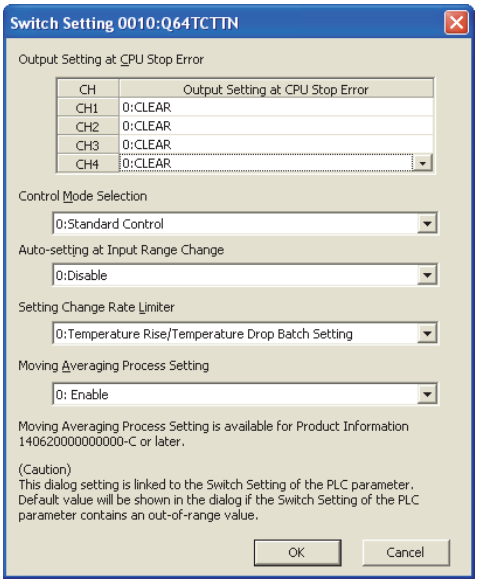
The following figure shows a wiring example.



(4) Switch Setting

Configure the output setting at CPU stop error and the control mode selection as follows.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Switch Setting]



Item	Set value			
	CH1	CH2	CH3	CH4
Output Setting at CPU Stop Error	0: CLEAR	0: CLEAR	0: CLEAR	0: CLEAR
Control Mode Selection	0: Standard Control			
Auto-setting at Input Range Change	0: Disable			
Setting Change Rate Limiter	0: Temperature Rise/Temperature Drop Batch Setting			
Moving Averaging Process Setting	0: Enable			

(5) Contents of the initial setting

Item	Description			
	CH1	CH2	CH3	CH4
Input range	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	200°C	0°C	0°C	0°C
Unused channel setting	0: Used	1: Unused	1: Unused	1: Unused
Control output cycle setting	30s	30s	30s	30s
Upper limit setting limiter	400°C	1300°C	1300°C	1300°C
Lower limit setting limiter	0°C	0°C	0°C	0°C
Self-tuning setting*1	1: Starting ST (PID Constant Only)	0: Do Not Run the ST	0: Do Not Run the ST	0: Do Not Run the ST
Alert 1 mode setting	1: Upper Limit Input Alert	0: Not Warning	0: Not Warning	0: Not Warning
Alert set value 1	250°C	0°C	0°C	0°C

*1 This setting is necessary only when the self-tuning function is used.

(6) When using the parameter of an intelligent function module

(a) Devices used by a user

Device	Description	
X10	Module READY flag	Q64TCTTN (X10 to X1F)
X12	Write error flag	
X22	Error code reset instruction	QX42 (X20 to X5F)
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
X30	CH1 Set value (SV) change instruction	
Y11	Setting/operation mode instruction	Q64TCTTN (Y10 to Y1F)
Y12	Error reset instruction	
Y18	E^2PROM backup instruction	
Y1B	Setting change instruction	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
D50	Write data error code	Devices where data is written by auto refresh
D51	CH1 Temperature process value (PV)	
D55	CH1 Alert definition	
M20 to M23	CH☐ Read completion flag	
M24 to M27	CH☐ Write completion flag	

(b) Parameter setting

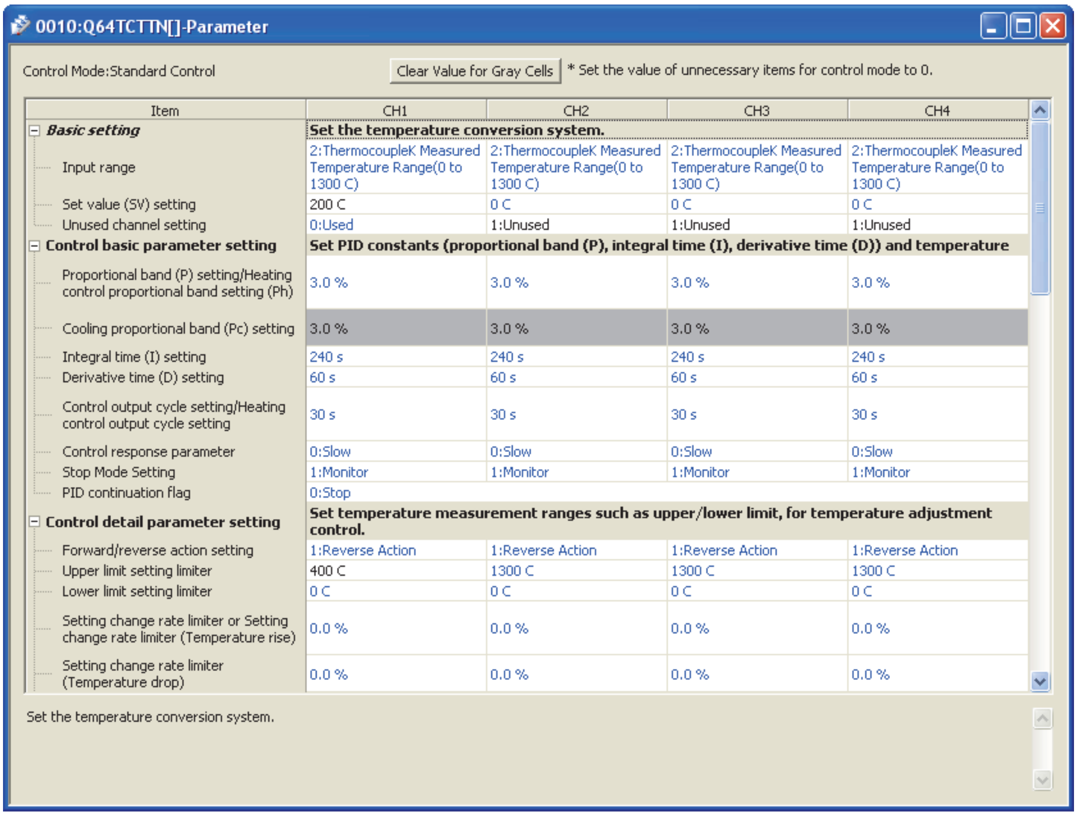
Set the contents of initial settings in the parameter.

1. Open the "Parameter" window.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Parameter]

2. Click Clear Value for Gray Cells to set items unnecessary for the mode set on Switch Setting to 0.

3. Set the parameter.



Item	Description	Set value			
		CH1	CH2	CH3	CH4
Input range	Set the temperature sensor used for the Q64TCN and the measurement range.	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	Set the target temperature value of PID control.	200°C	0°C	0°C	0°C
Unused channel setting	Configure this setting when the channels where the temperature control is not performed and the temperature sensor is not connected are set to be unused.	0: Used	1: Unused	1: Unused	1: Unused
Control output cycle setting/Heating control output cycle setting	Set the pulse cycle (ON/OFF cycle) of the transistor output.	30s	30s	30s	30s

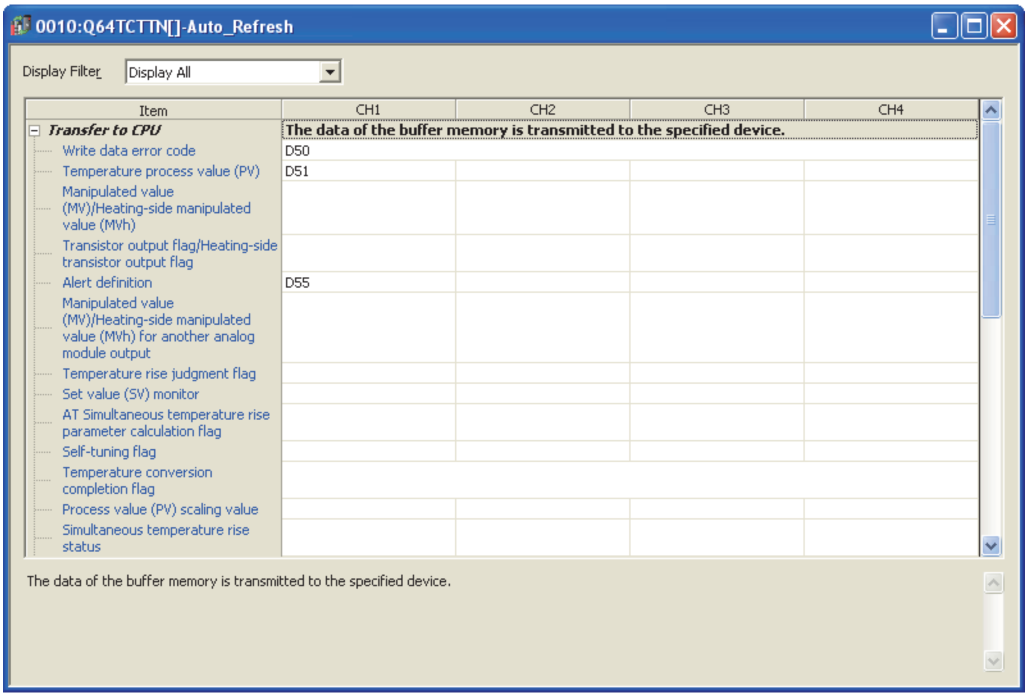
Item	Description	Set value			
		CH1	CH2	CH3	CH4
Upper limit setting limiter	Set the upper limit of the set value (SV).	400°C	1300°C	1300°C	1300°C
Lower limit setting limiter	Set the lower limit of the set value (SV).	0°C	0°C	0°C	0°C
Self-tuning setting*1	Set the operation of the self-tuning.	1: Starting ST (PID Constant Only)	0: Do Not Run the ST	0: Do Not Run the ST	0: Do Not Run the ST
Alert 1 mode setting	Set the alert mode.	1: Upper Limit Input Alert	0: Not Warning	0: Not Warning	0: Not Warning
Alert set value 1	Set the temperature where CH□ Alert 1 (b8 of Un\G5 to Un\G8) turns on.	250°C	—	—	—

*1 This setting is necessary only when the self-tuning function is used.

(c) Auto refresh setting

Set the device to be automatically refreshed.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Auto_Refresh]



Item	Description	Set value			
		CH1	CH2	CH3	CH4
Write data error code	An error code or alarm code is stored.	D50			
Temperature process value (PV)	The detected temperature value where sensor correction was performed is stored.	D51	—	—	—
Alert definition	The value is stored depending on the detected alert.	D55	—	—	—

Remark

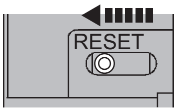
The number of parameters of the auto refresh setting can be reduced by using the setting item reduction mode of auto refresh.
When the setting item reduction mode is set, consecutive devices are automatically set to the grouped setting items.
For details on the setting item reduction mode of auto refresh, refer to the following.

☞ Page 309, Section 6.4

(d) Writing parameter of an intelligent function module

Write the set parameter to the CPU module. Then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online] ➪ [Write to PLC...]



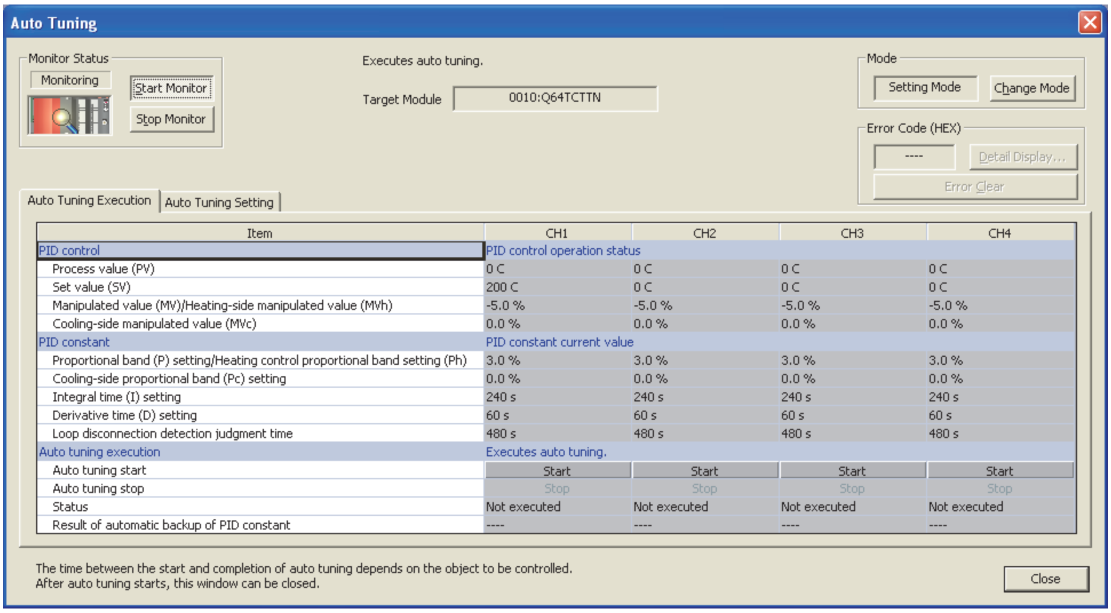
or Power OFF → ON

(e) Performing auto tuning

Set the "Automatic backup setting after auto tuning of PID constants" to "ON" and perform the auto tuning.

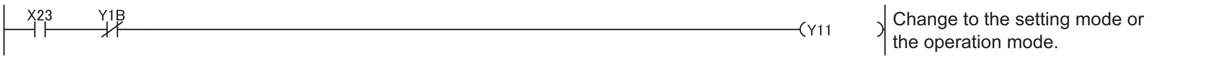
[Tool] ➪ [Intelligent Function Module Tool] ➪ [Temperature Control Module]

➪ [Auto Tuning...] ➪ "Q64TCTTN" ➪ OK



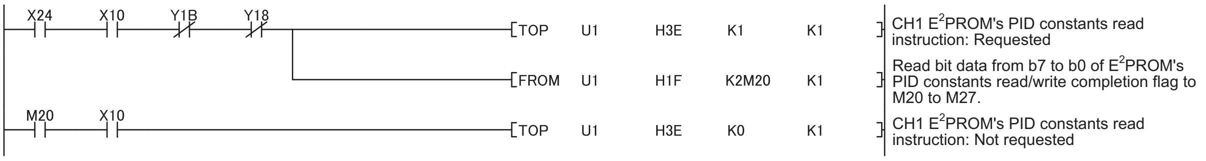
(f) Program example

- Program that changes the setting/operation mode

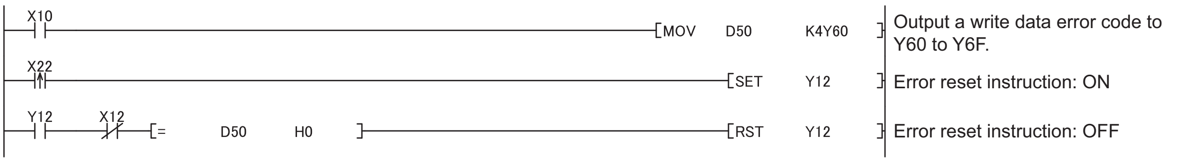


- Program that stops the auto tuning when an alert is detected

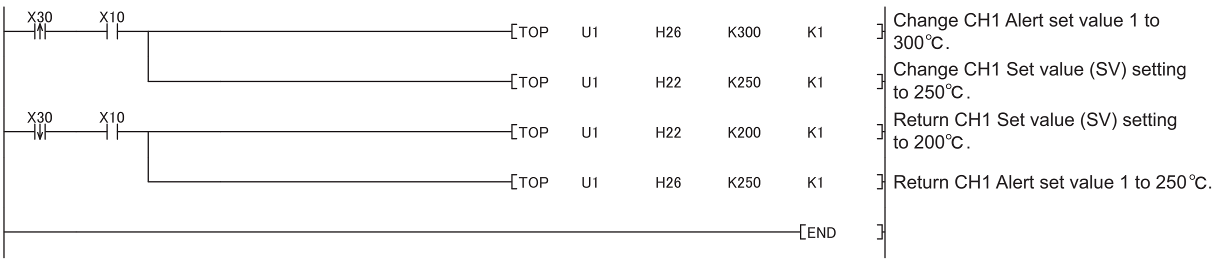
- Program that reads the PID constants from E^2PROM



- Program that reads an error code



- Program that changes the set values (SV) and the alert set value 1



(7) Program example of when not using the parameter of an intelligent function module

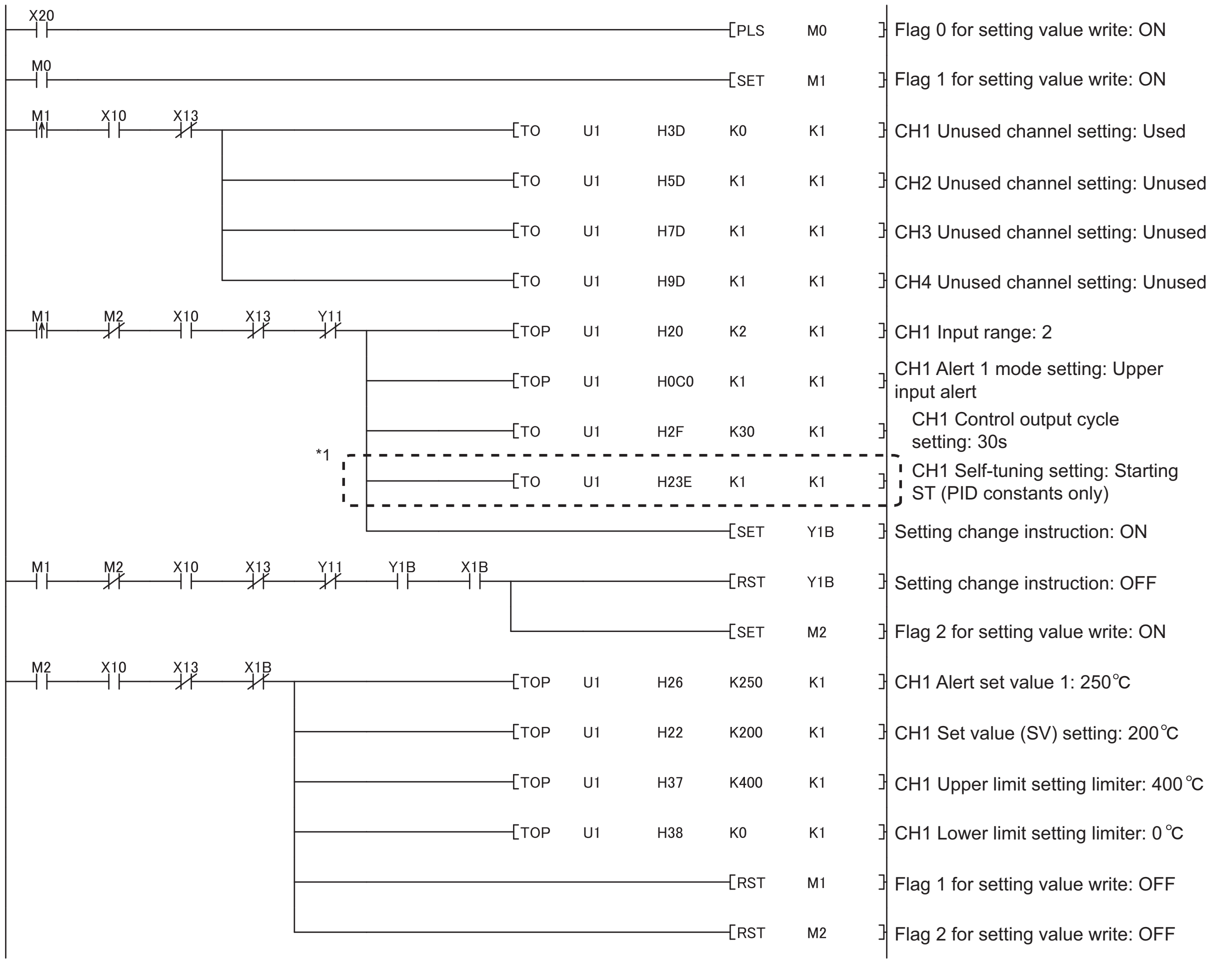
(a) Devices used by a user

Device	Description	
X10	Module READY flag	Q64TCTTN (X10 to X1F)
X11	Setting/operation mode status	
X12	Write error flag	
X13	Hardware error flag	
X14	CH1 Auto tuning status	
X18	E^2PROM write completion flag	
X1B	Setting change completion flag	
X20	Set value write instruction	QX42 (X20 to X5F)
X21	Auto tuning execute instruction	
X22	Error code reset instruction	
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
X30	CH1 Set value (SV) change instruction	
Y11	Setting/operation mode instruction	Q64TCTTN (Y10 to Y1F)
Y12	Error reset instruction	
Y14	CH1 Auto tuning instruction	
Y18	E^2PROM backup instruction	
Y1B	Setting change instruction	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
D50	Write data error code	
D51	CH1 Temperature process value (PV)	
D55	CH1 Alert definition	
M0	For writing set value 0	
M1	For writing set value 1	
M2	For writing set value 2	
M10	CH1 Auto tuning completion flag	
M20 to M23	CH☐ Read completion flag	
M24 to M27	CH☐ Write completion flag	

(b) Program example

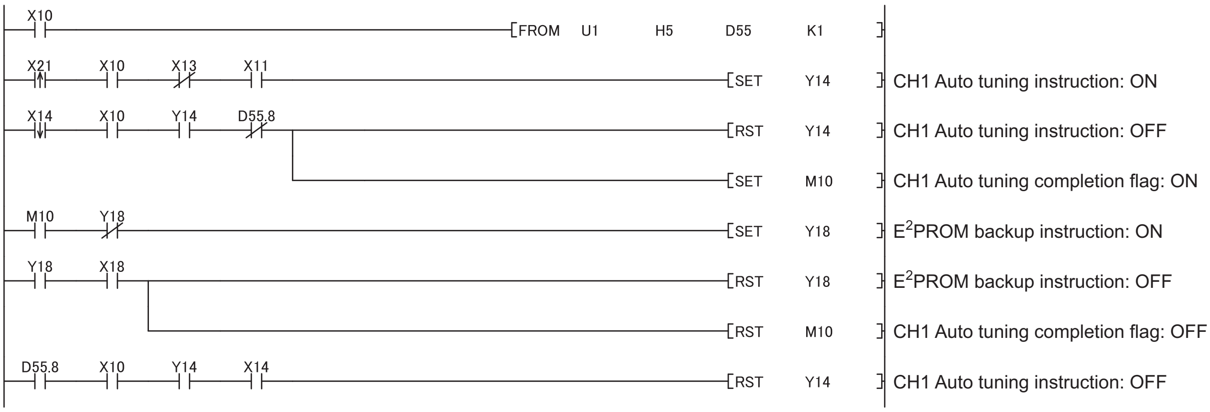
- Program that changes the setting/operation mode
  This program is the same as that of when the parameter of the intelligent function module is used.
  (Page 321, Section 7.2.1 (6) (f))

- Initial setting program



*1 Configure this setting only when the self-tuning function is used.

• Program that executes the auto tuning and backs up the PID constants in E^2PROM if the auto tuning is normally completed (The auto tuning is stopped when an alert is detected.)

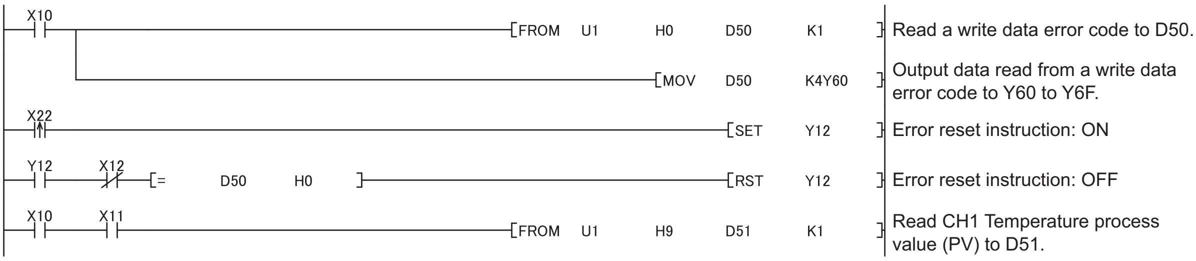


• Program that reads the PID constants from E^2PROM

This program is the same as that of when the parameter of the intelligent function module is used.

(Page 321, Section 7.2.1 (6) (f))

• Program that reads an error code and the temperature process value (PV)



• Program that changes the set values (SV) and the alert set value 1

This program is the same as that of when the parameter of the intelligent function module is used.

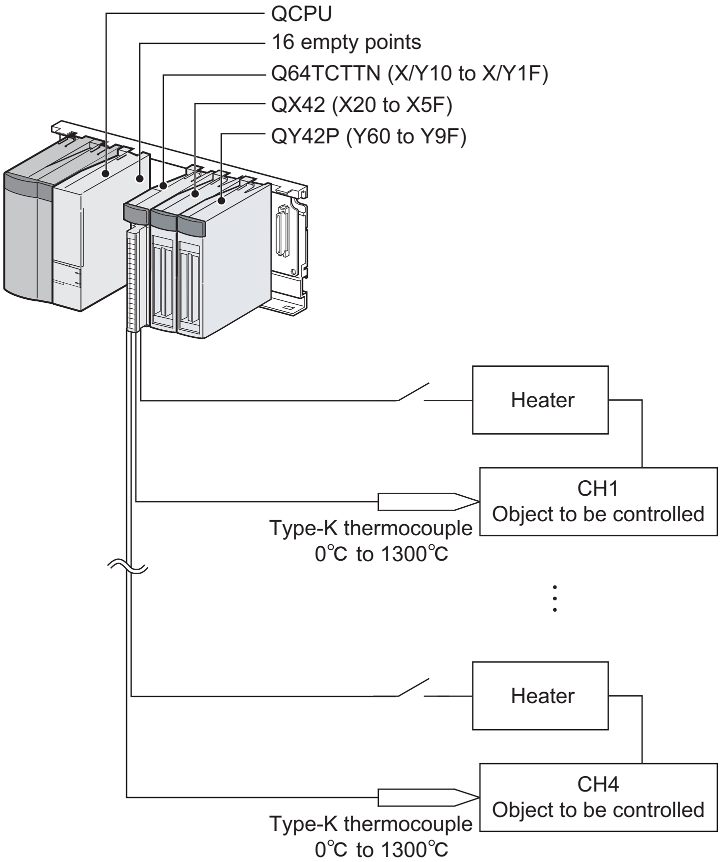
(Page 321, Section 7.2.1 (6) (f))

7.2.2 Standard control (peak current suppression function, simultaneous temperature rise function)

This section describes the program example where the peak current suppression function and the simultaneous temperature rise function are used for the control.

(1) System configuration

The following figure shows the system configuration example of when the peak current suppression function and the simultaneous temperature rise function are used for the control.



Point

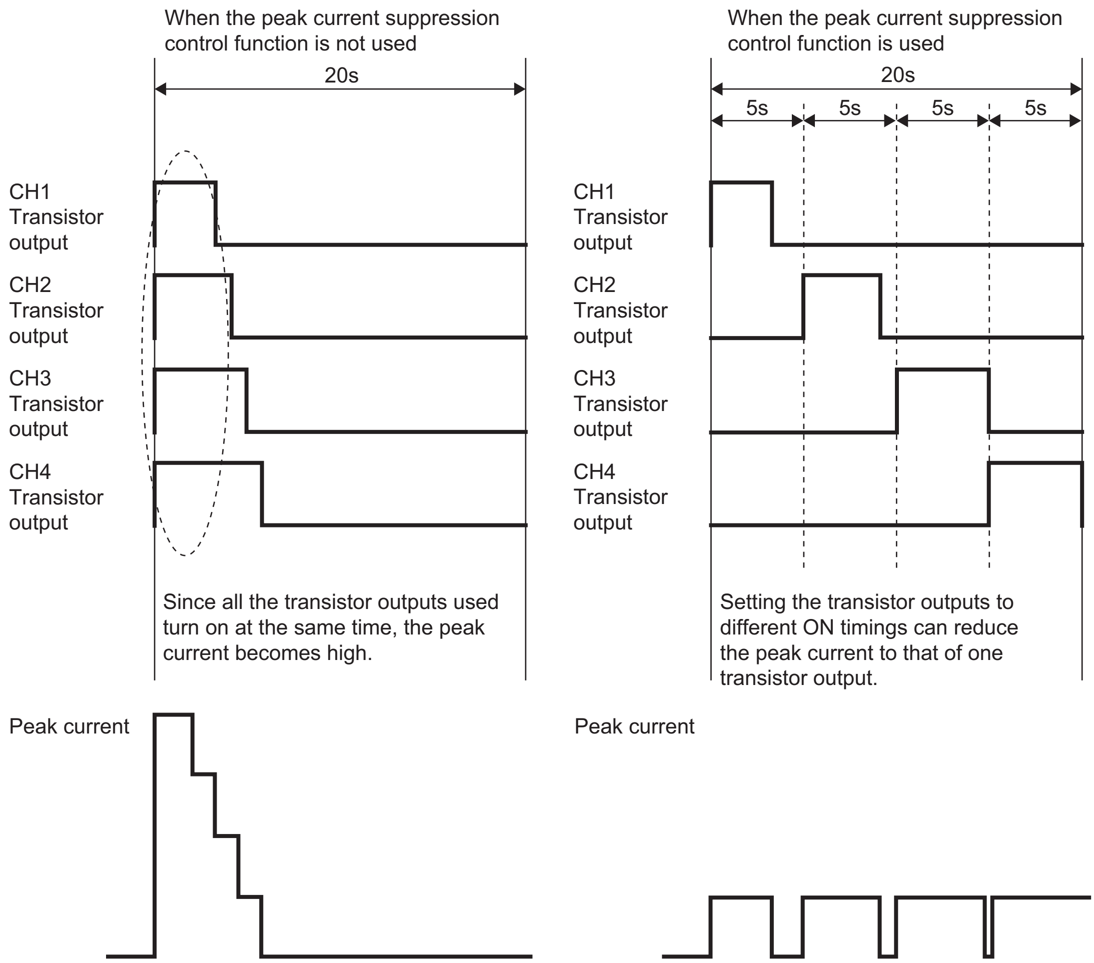
When the Q64TCTTBWN or the Q64TCRTBWN is used, the I/O assignment is the same as that of the system configuration shown above.

- Slot 0: Empty 16 points
- Slot 1: Intelligent 16 points
- Slot 2: Input 64 points
- Slot 3: Output 64 points

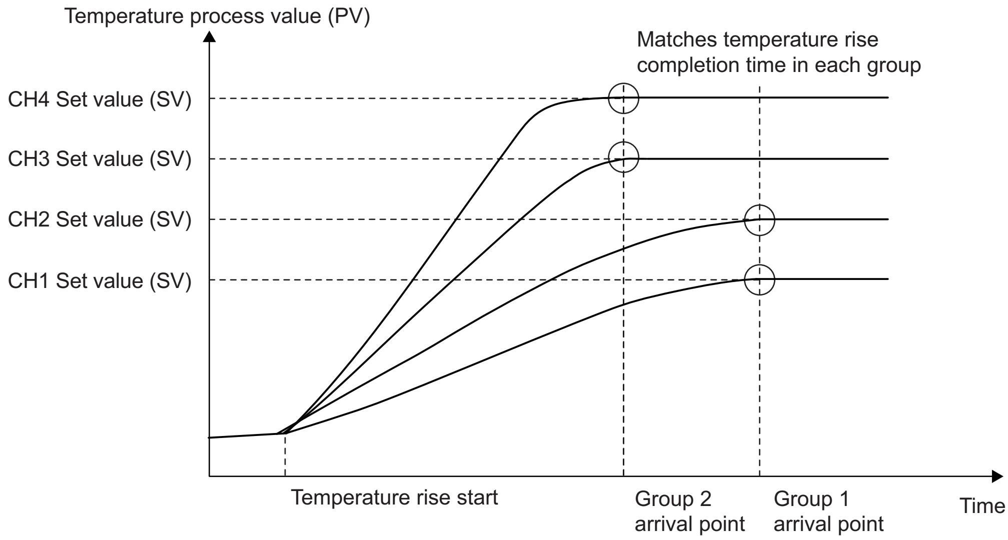
(2) Programming condition

- Program example where the peak current suppression function is used

  This program 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.

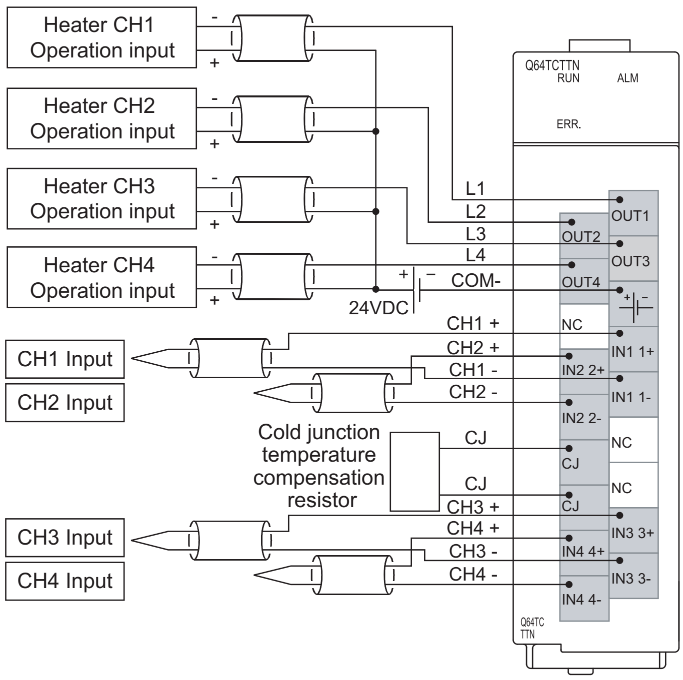


- Program example where the simultaneous temperature rise function is used
  This program is designed to classify the CH1 and CH2 into group 1 and CH3 and CH4 into group 2 so that the channels in each group reach the set values (SV) simultaneously.



(3) Wiring example

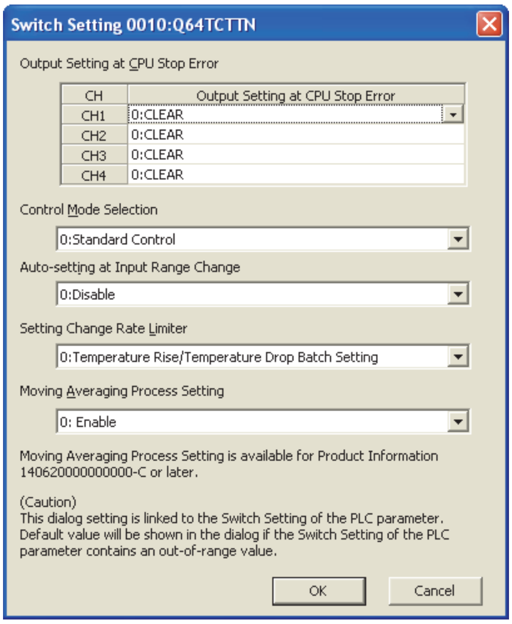
The following figure shows a wiring example.



(4) Switch Setting

Configure the output setting at CPU stop error and the control mode selection as follows.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Switch Setting]



Item	Set value			
	CH1	CH2	CH3	CH4
Output Setting at CPU Stop Error	0: CLEAR	0: CLEAR	0: CLEAR	0: CLEAR
Control Mode Selection	0: Standard Control			
Auto-setting at Input Range Change	0: Disable			
Setting Change Rate Limiter	0: Temperature Rise/Temperature Drop Batch Setting			
Moving Averaging Process Setting	0: Enable			

(5) Contents of the initial setting

Item	Description			
	CH1	CH2	CH3	CH4
Input range	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	200°C	250°C	300°C	350°C
Unused channel setting	0: Used	0: Used	0: Used	0: Used
Control output cycle setting	20s	20s	20s	20s
Simultaneous temperature rise group setting*1	1: Group 1	1: Group 1	2: Group 2	2: Group 2
Peak current suppression control group setting*2	1: Group 1	2: Group 2	3: Group 3	4: Group 4
Simultaneous temperature rise AT mode selection*1	1: AT for Simultaneous Temperature Rise	1: AT for Simultaneous Temperature Rise	1: AT for Simultaneous Temperature Rise	1: AT for Simultaneous Temperature Rise
Alert 1 mode setting	1: Upper Limit Input Alert	1: Upper Limit Input Alert	1: Upper Limit Input Alert	1: Upper Limit Input Alert
Alert set value 1	250°C	300°C	350°C	400°C

*1 Configure this setting only when the simultaneous temperature rise function is used.
*2 Configure this setting only when the peak current suppression function is used.

(6) When using the parameter of an intelligent function module

(a) Devices used by a user

Device	Description	
X10	Module READY flag	Q64TCTTN (X10 to X1F)
X12	Write error flag	
X22	Error code reset instruction	QX42 (X20 to X5F)
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
Y11	Setting/operation mode instruction	Q64TCTTN (Y10 to Y1F)
Y12	Error reset instruction	
Y18	E^2PROM backup instruction	
Y1B	Setting change instruction	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
D50	Error code	Devices where data is written by auto refresh
D51 to D54	CH☐ Temperature process value (PV)	
D55 to D58	CH☐ Alert definition	
M20 to M23	CH☐ Read completion flag	
M24 to M27	CH☐ Write completion flag	

7

(b) Parameter setting

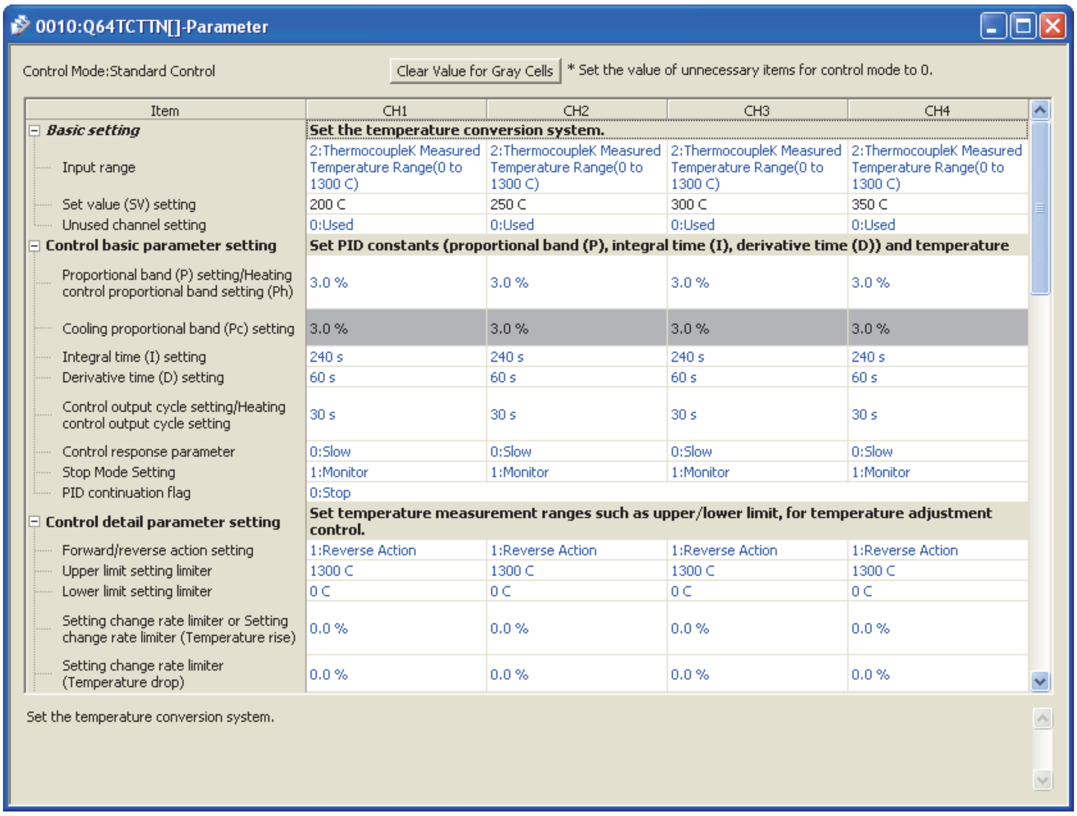
Set the contents of initial settings in the parameter.

1. **Open the "Parameter" window.**

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Parameter]

2. **Click** Clear Value for Gray Cells **to set items unnecessary for the mode set on Switch Setting to 0.**

3. **Set the parameter.**



Item	Description	Set value			
		CH1	CH2	CH3	CH4
Input range	Set the temperature sensor used for the Q64TCN and the measurement range.	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	Set the target temperature value of PID control.	200°C	250°C	300°C	350°C
Unused channel setting	Configure this setting when the channels where the temperature control is not performed and the temperature sensor is not connected are set to be unused.	0: Used	0: Used	0: Used	0: Used
Control output cycle setting/Heating control output cycle setting	Set the pulse cycle (ON/OFF cycle) of the transistor output.	20s	20s	20s	20s

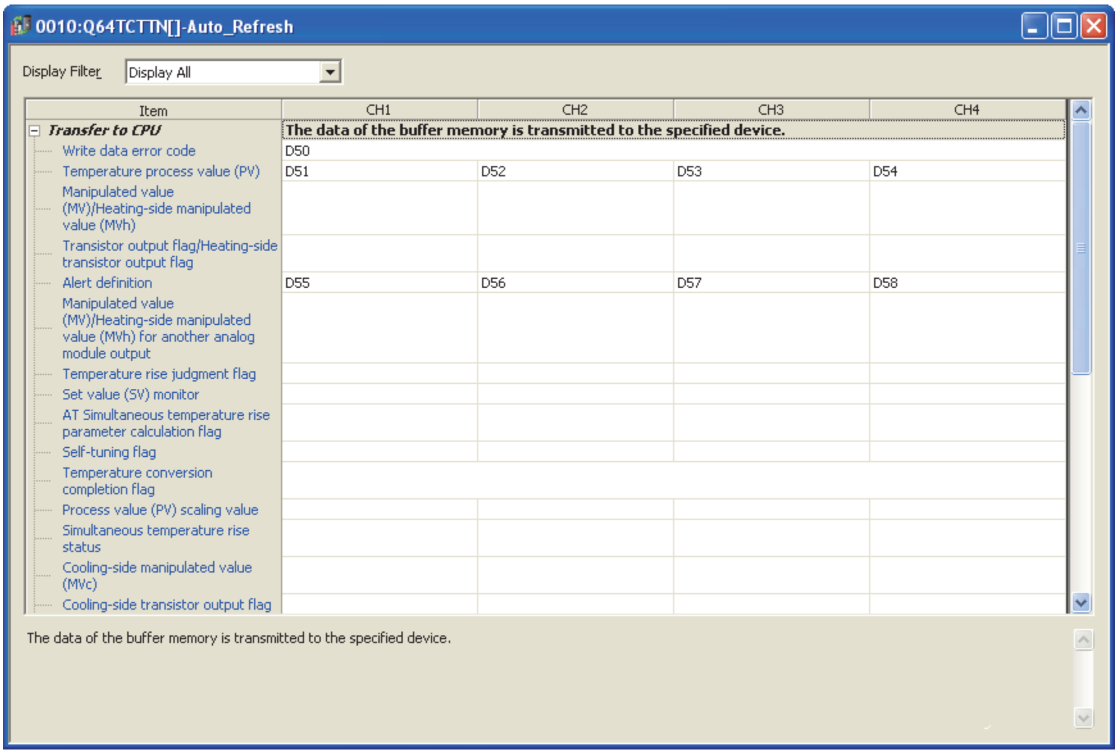
Item	Description	Set value			
		CH1	CH2	CH3	CH4
Simultaneous temperature rise group setting*1	Set a group to perform the simultaneous temperature rise function for each channel.	1: Group 1	1: Group 1	2: Group 2	2: Group 2
Peak current suppression control group setting*2	Set the target channels for the peak current suppression function and the gap of the control output cycle between channels.	1: Group 1	2: Group 2	3: Group 3	4: Group 4
Simultaneous temperature rise AT mode selection*1	Set the mode of the auto tuning.	1: AT for Simultaneous Temperature Rise	1: AT for Simultaneous Temperature Rise	1: AT for Simultaneous Temperature Rise	1: AT for Simultaneous Temperature Rise
Alert 1 mode setting	Set the alert mode.	1: Upper Limit Input Alert	1: Upper Limit Input Alert	1: Upper Limit Input Alert	1: Upper Limit Input Alert
Alert set value 1	Set the temperature where CH□ Alert 1 (b8 of Un\G5 to Un\G8) turns on.	250°C	300°C	350°C	400°C

*1 Configure this setting only when the simultaneous temperature rise function is used.
*2 Configure this setting only when the peak current suppression function is used.

(c) Auto refresh setting

Set the device to be automatically refreshed.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Auto_Refresh]



Item	Description	Set value			
		CH1	CH2	CH3	CH4
Write data error code	An error code or alarm code is stored.	D50			
Temperature process value (PV)	The detected temperature value where sensor correction was performed is stored.	D51	D52	D53	D54
Alert definition	The value is stored depending on the detected alert.	D55	D56	D57	D58

Remark

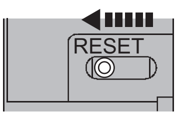
The number of parameters of the auto refresh setting can be reduced by using the setting item reduction mode of auto refresh.
When the setting item reduction mode is set, consecutive devices are automatically set to the grouped setting items.
For details on the setting item reduction mode of auto refresh, refer to the following.

Page 309, Section 6.4

(d) Writing parameter of an intelligent function module

Write the set parameter to the CPU module. Then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online] ➪ [Write to PLC...]

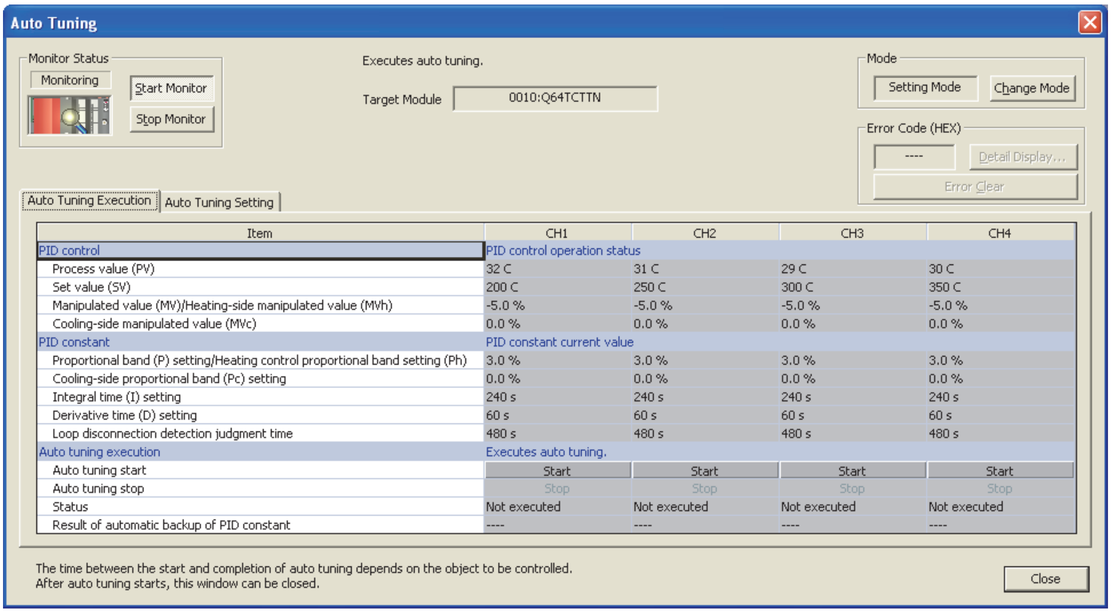


or Power OFF → ON

(e) Performing auto tuning

Set the "Automatic backup setting after auto tuning of PID constants" to "ON" and perform the auto tuning.

[Tool] ➪ [Intelligent Function Module Tool] ➪ [Temperature Control Module] ➪ [Auto Tuning...] ➪ "Q64TCTTN" ➪ OK

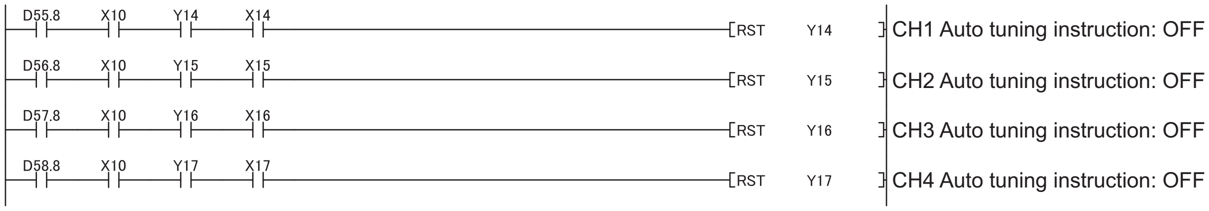


(f) Program example where the peak current suppression function or the simultaneous temperature rise function is used

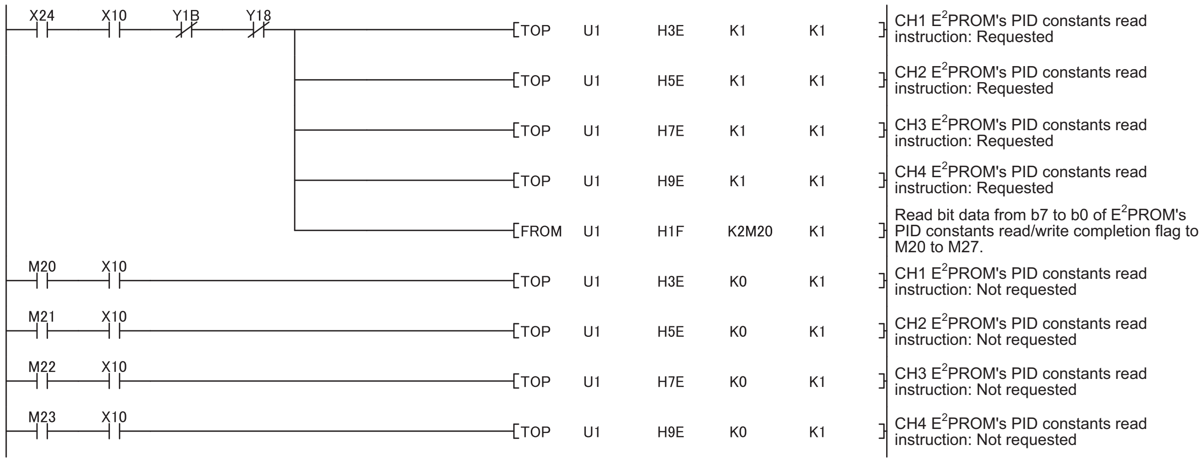
- Program that changes the setting/operation mode

  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (☞Page 321, Section 7.2.1 (6) (f))

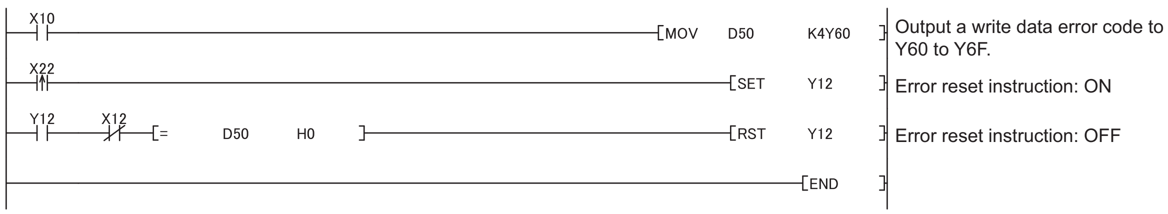
- Program that stops the auto tuning when an alert is detected



- Program that reads the PID constants from E^2PROM



- Program that reads an error code



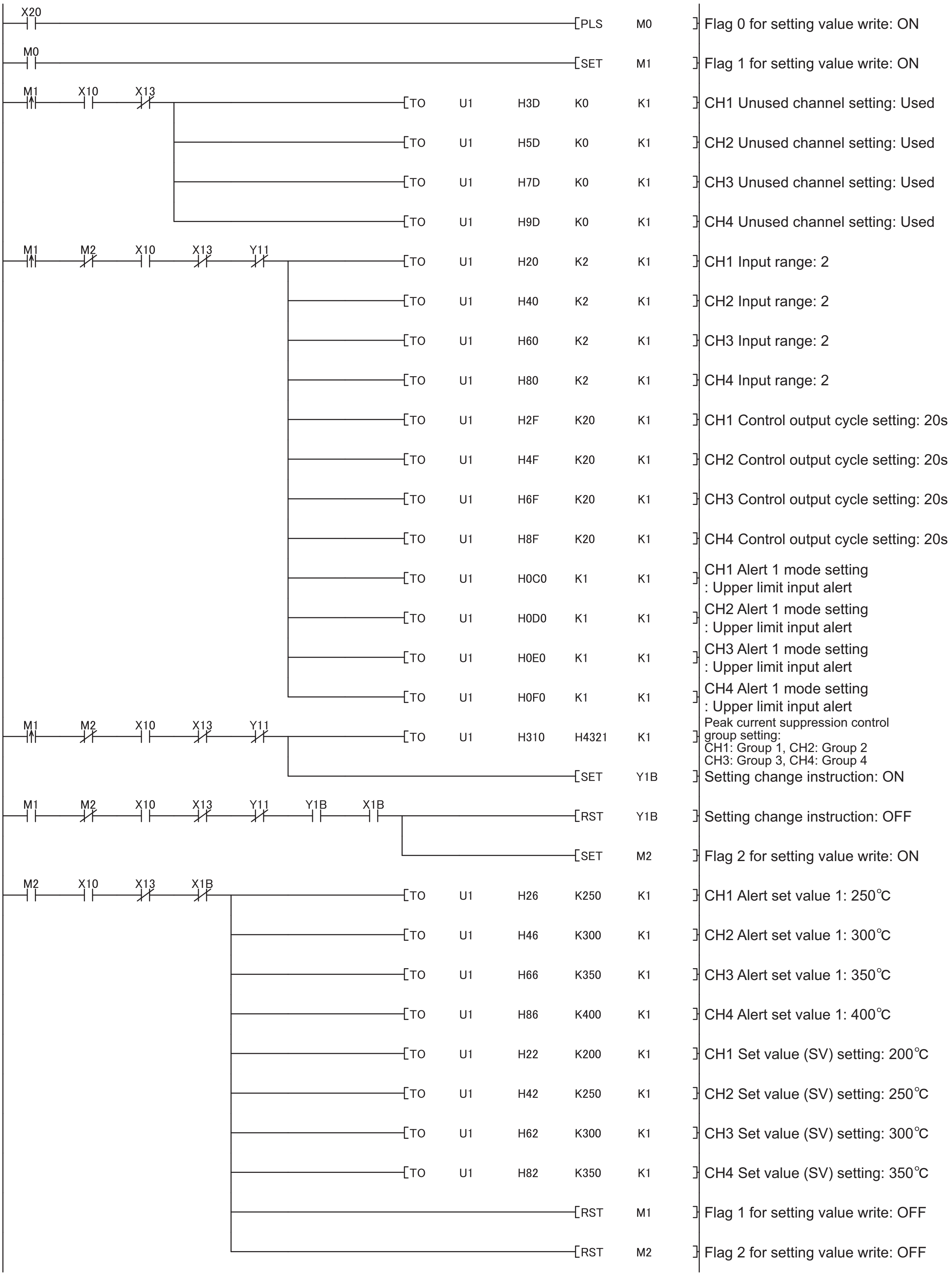
(7) Program example of when not using the parameter of an intelligent function module

(a) Devices used by a user

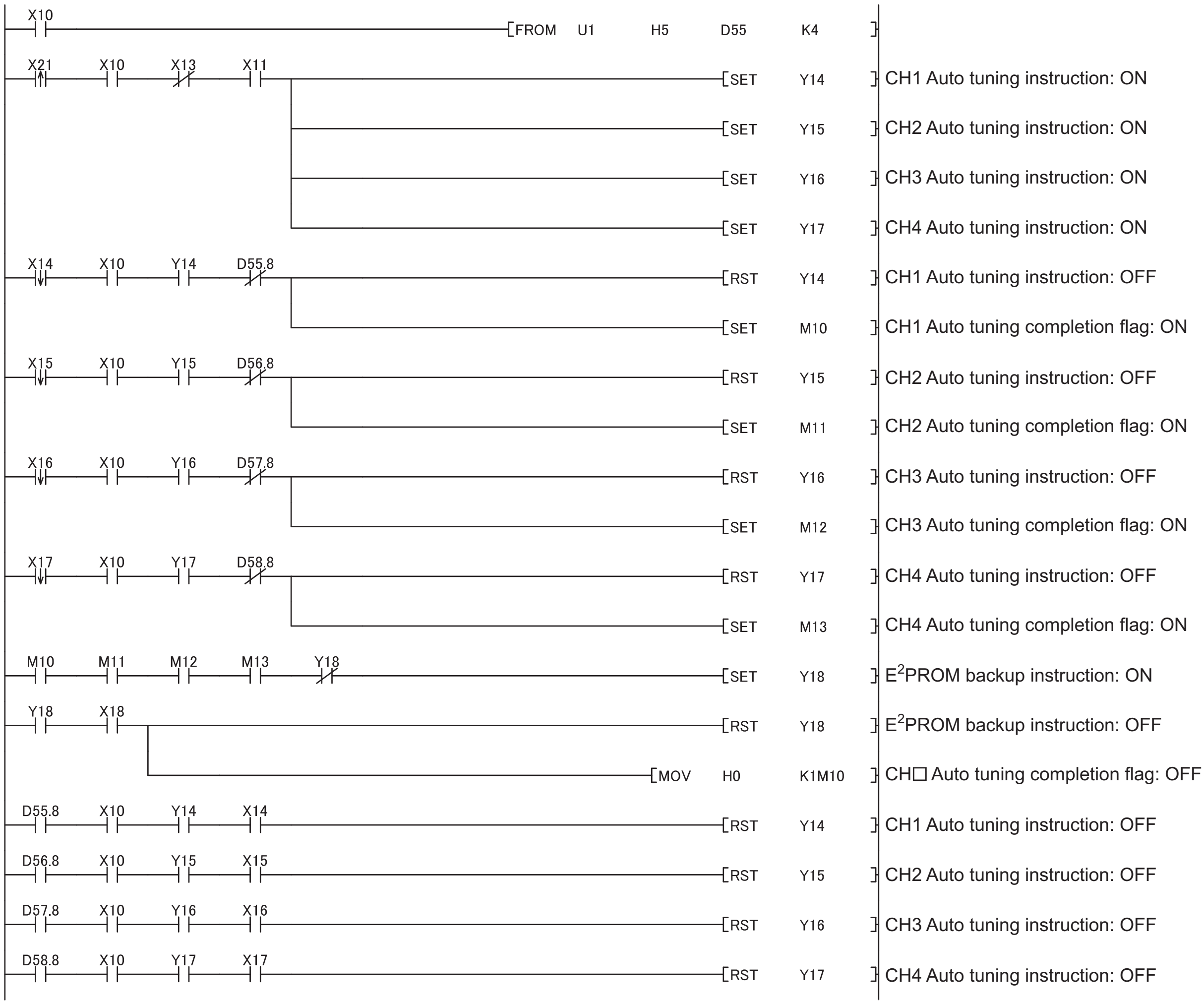
Device	Description	
X10	Module READY flag	Q64TCTTN (X10 to X1F)
X11	Setting/operation mode status	
X12	Write error flag	
X13	Hardware error flag	
X14 to X17	CH☐ Auto tuning status	
X18	E^2PROM write completion flag	
X1B	Setting change completion flag	
X20	Set value write instruction	QX42 (X20 to X5F)
X21	Auto tuning execute instruction	
X22	Error code reset instruction	
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
Y11	Setting/operation mode instruction	Q64TCTTN (Y10 to Y1F)
Y12	Error reset instruction	
Y14 to Y17	CH☐ Auto tuning instruction	
Y18	E^2PROM backup instruction	
Y1B	Setting change instruction	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
D50	Error code	
D51 to D54	CH☐ Temperature process value (PV)	
D55 to D58	CH☐ Alert definition	
M0	For writing set value 0	
M1	For writing set value 1	
M2	For writing set value 2	
M10 to M13	CH☐ Auto tuning completion flag	
M20 to M23	CH☐ Read completion flag	
M24 to M27	CH☐ Write completion flag	

(b) Program example where the peak current suppression function is used

- Program that changes the setting/operation mode
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))
- Initial setting program

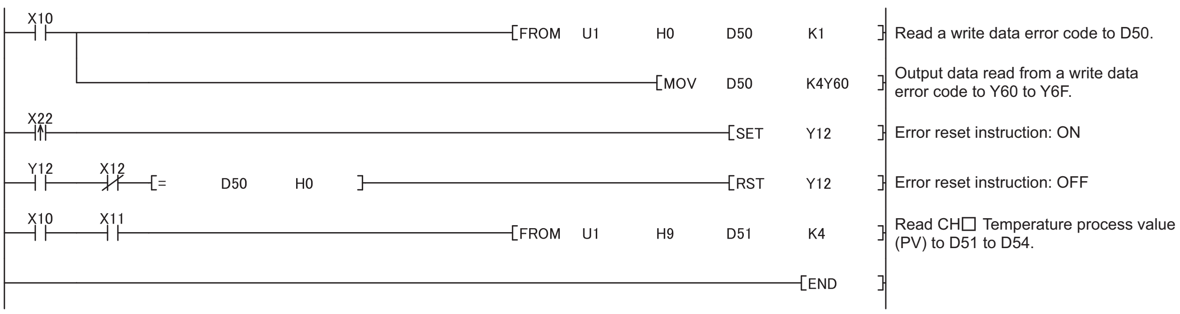


- Program that executes the auto tuning and backs up the PID constants in E^{2}PROM if the auto tuning is normally completed (The auto tuning is stopped when an alert is detected.)



- Program that reads the PID constants from E^{2}PROM
  This program is the same as that of when the parameter of the intelligent function module is used.
  (☞ Page 334, Section 7.2.2 (6) (f))

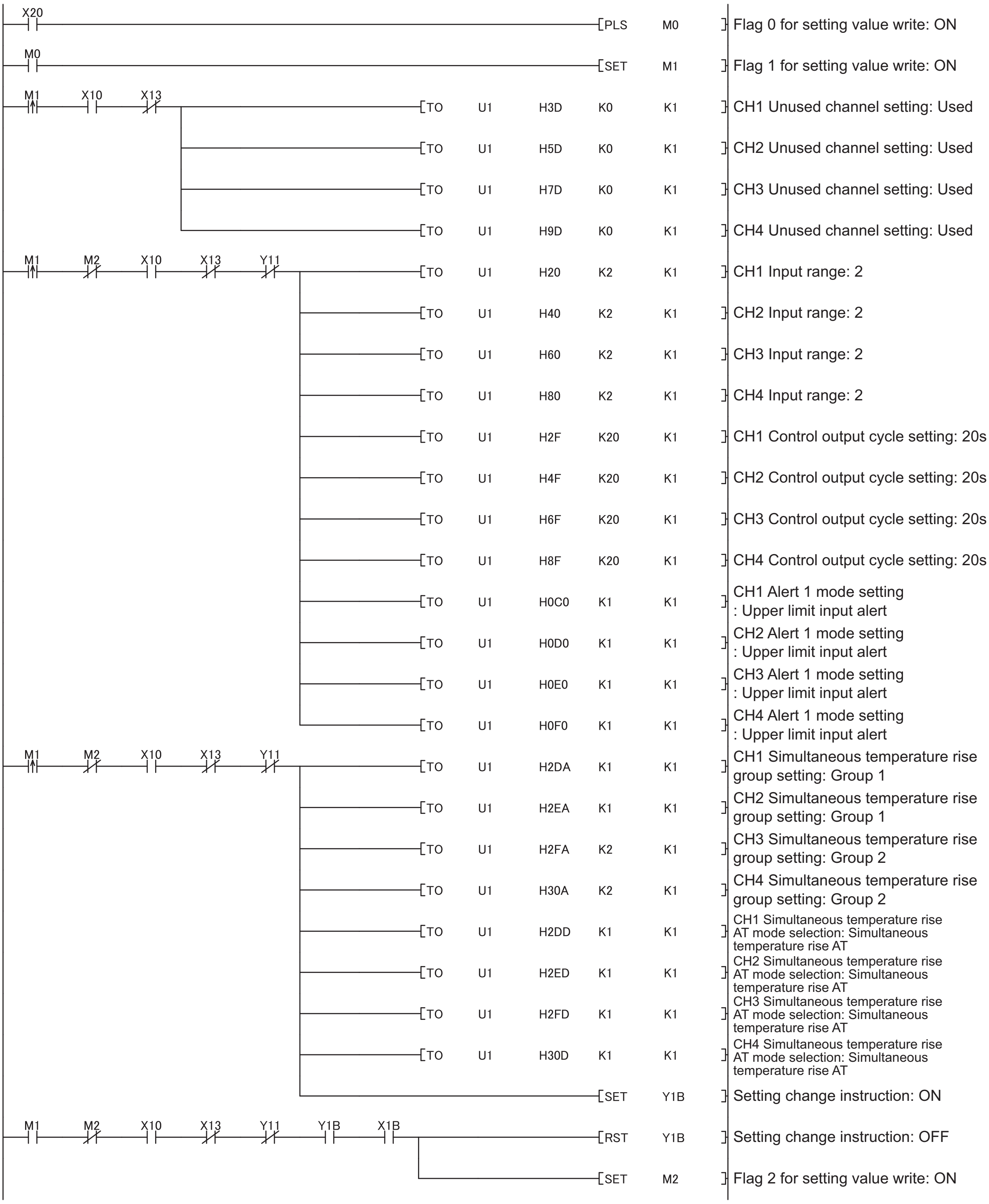
- Program that reads an error code and the temperature process value (PV)

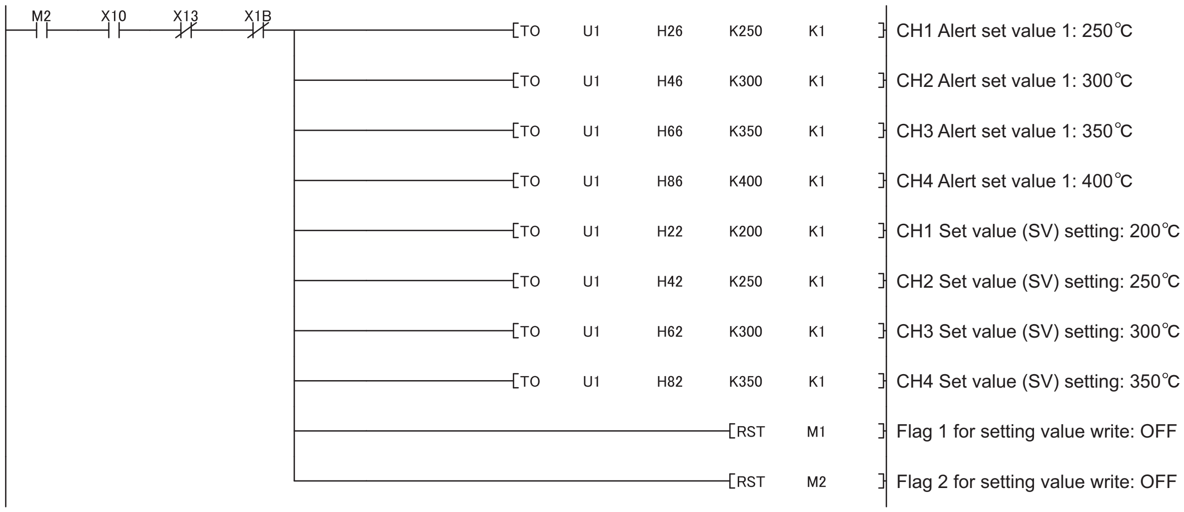


(c) Program example where the simultaneous temperature rise function is used

- Program that changes the setting/operation mode
  This program is the same as that of when the module is the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))

- Initial setting program





- Program that executes the auto tuning and backs up the PID constants in E^2PROM if the auto tuning is normally completed (The auto tuning is stopped when an alert is detected.)

  This program is the same as that of when the peak current suppression function is used. (Page 336, Section 7.2.2 (7) (b))

- Program that reads the PID constants from E^2PROM

  This program is the same as that of when the parameter of the intelligent function module is used. (Page 334, Section 7.2.2 (6) (f))

- Program that reads an error code

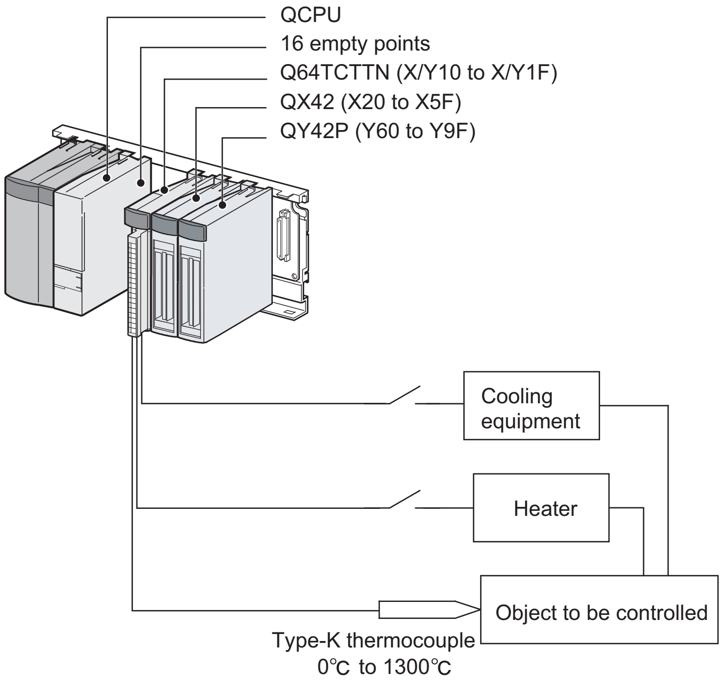
  This program is the same as that of when the peak current suppression function is used. (Page 336, Section 7.2.2 (7) (b))

7.2.3 When performing the heating-cooling control

This section describes the program example to perform the heating-cooling control.

(1) System configuration

The following figure shows the system configuration example to perform the heating-cooling control.



Point

When the Q64TCTTBWN or the Q64TCRTBWN is used, the I/O assignment is the same as that of the system configuration shown above.

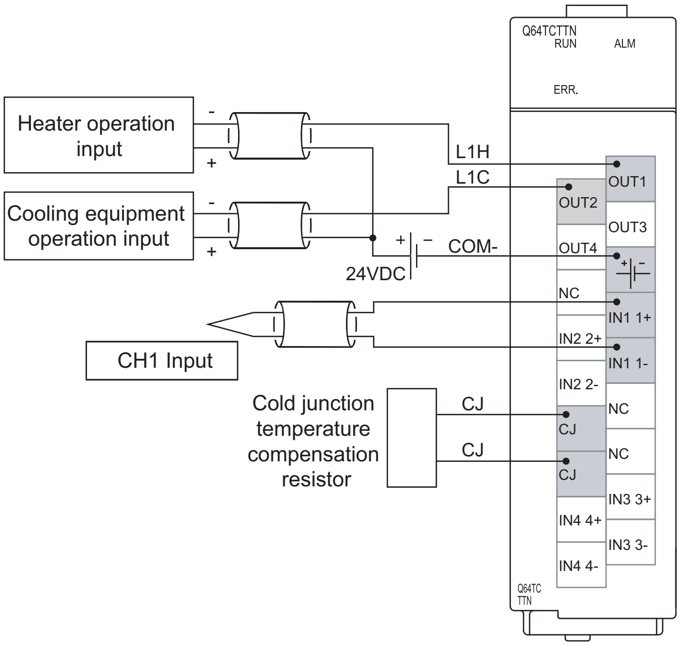
- Slot 0: Empty 16 points
- Slot 1: Intelligent 16 points
- Slot 2: Input 64 points
- Slot 3: Output 64 points

(2) Program conditions

This program is designed to perform the heating-cooling control by using the temperature input of CH1.

(3) Wiring example

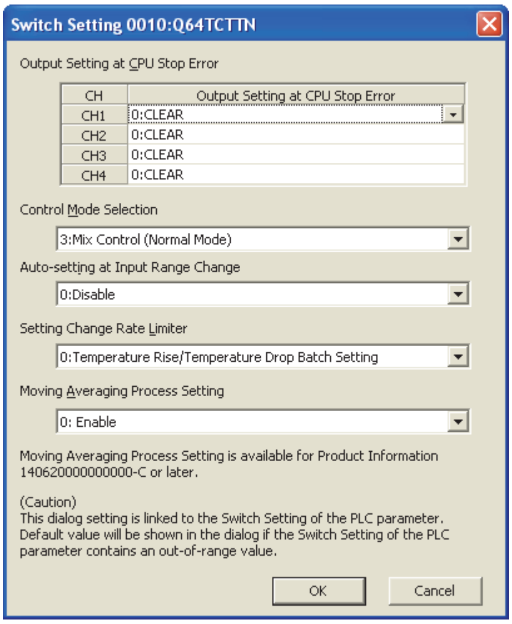
The following figure shows a wiring example.



(4) Switch Setting

Configure the output setting at CPU stop error and the control mode selection as follows.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Switch Setting]



Item	Set value			
	CH1	CH2	CH3	CH4
Output Setting at CPU Stop Error	0: CLEAR	0: CLEAR	0: CLEAR	0: CLEAR
Control Mode Selection	3: Mix Control (Normal Mode)			
Auto-setting at Input Range Change	0: Disable			
Setting Change Rate Limiter	0: Temperature Rise/Temperature Drop Batch Setting			
Moving Averaging Process Setting	0: Enable			

(5) Contents of the initial setting

Item	Description			
	CH1	CH2	CH3	CH4
Input range	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	200°C	0°C	0°C	0°C
Unused channel setting	0: Used	0: Used	1: Unused	1: Unused
Heating control output cycle setting	30s	0s	30s	30s
Cooling method setting	0: Air Cooled	0: Air Cooled	0: Air Cooled	0: Air Cooled
Cooling control output cycle setting	30s	0s	30s	30s
Overlap/dead band setting	-0.3%	0.0%	0.0%	0.0%
Alert 1 mode setting	1: Upper Limit Input Alert	0: Not Warning	0: Not Warning	0: Not Warning
Alert set value 1	250°C	0°C	0°C	0°C

(6) When using the parameter of an intelligent function module

(a) Devices used by a user

Device	Description	
X10	Module READY flag	Q64TCTTN (X10 to X1F)
X12	Write error flag	
X22	Error code reset instruction	QX42 (X20 to X5F)
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
Y11	Setting/operation mode instruction	Q64TCTTN (Y10 to Y1F)
Y12	Error reset instruction	
Y18	E^2PROM backup instruction	
Y1B	Setting change instruction	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
D50	Error code	Devices where data is written by auto refresh
D51	CH1 Temperature process value (PV)	
D55	CH□ Alert definition	
M20 to M23	CH□ Read completion flag	
M24 to M27	CH□ Write completion flag	

(b) Parameter setting

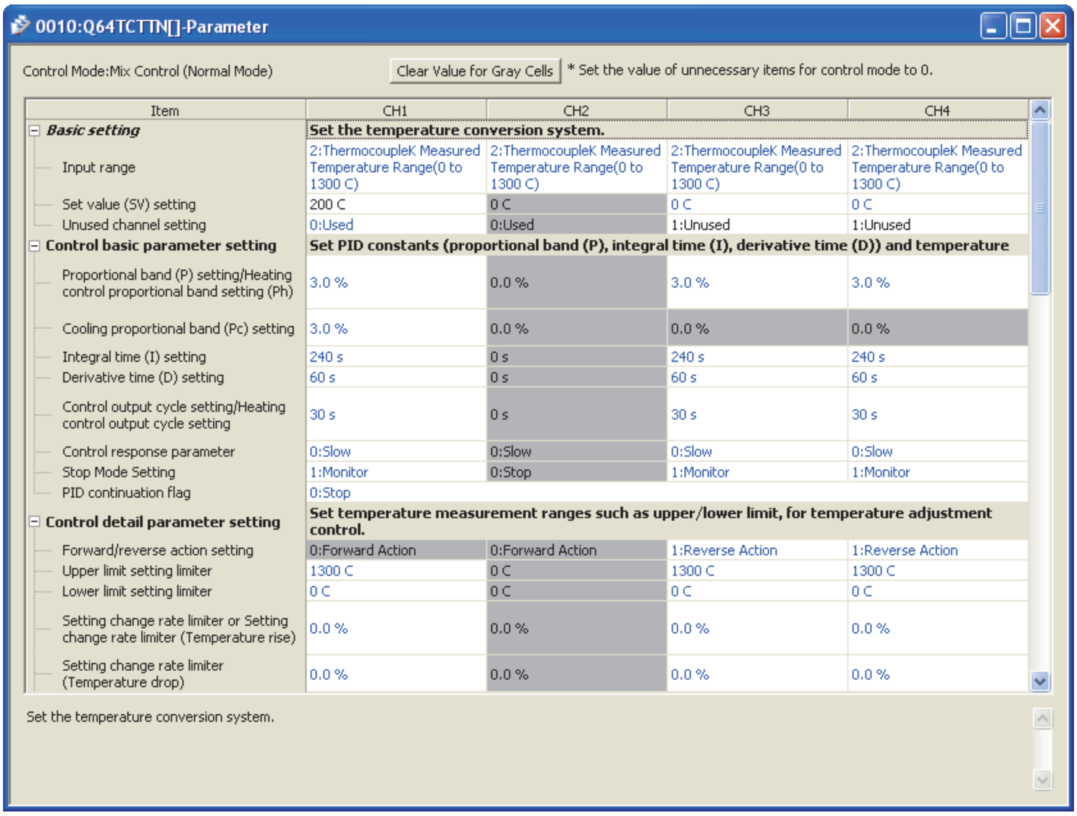
Set the contents of initial settings in the parameter.

1. Open the "Parameter" window.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Parameter]

2. Click Clear Value for Gray Cells **to set items unnecessary for the mode set on Switch Setting to 0.**

3. Set the parameter.



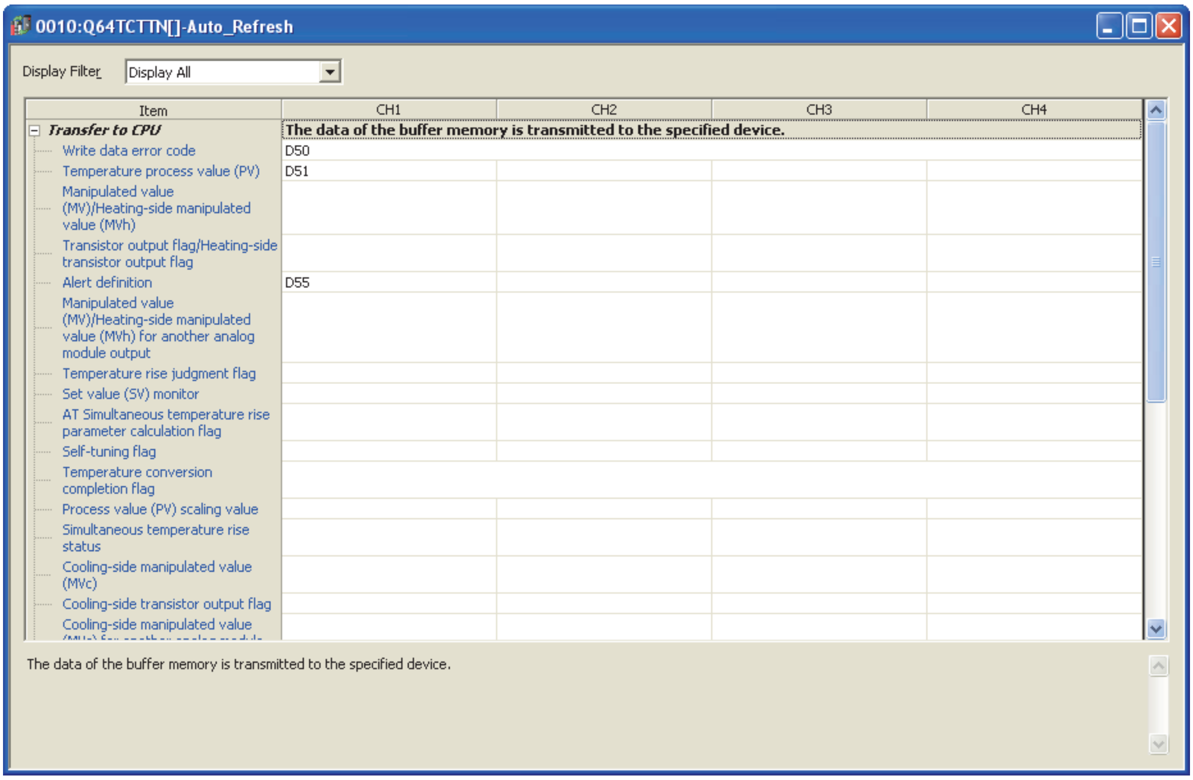
Item	Description	Set value			
		CH1	CH2	CH3	CH4
Input range	Set the temperature sensor used for the Q64TCN and the measurement range.	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)	2: Thermocouple K Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	Set the target temperature value of PID control.	200°C	0°C	0°C	0°C
Unused channel setting	Configure this setting when the channels where the temperature control is not performed and the temperature sensor is not connected are set to be unused.	0: Used	0: Used	1: Unused	1: Unused
Control output cycle setting/Heating control output cycle setting	Set the pulse cycle (ON/OFF cycle) of the transistor output.	30s	0s	30s	30s

Item	Description	Set value			
		CH1	CH2	CH3	CH4
Cooling method setting	Set the method for the cooling control in the heating-cooling control.	0: Air Cooled	0: Air Cooled	0: Air Cooled	0: Air Cooled
Cooling control output cycle setting	Set the pulse cycle (ON/OFF cycle) of the transistor output.	30s	0s	30s	30s
Overlap/dead band setting	Configure the overlap/dead band setting.	-0.3%	0.0%	0.0%	0.0%
Alert 1 mode setting	Set the alert mode.	1: Upper Limit Input Alert	0: Not Warning	0: Not Warning	0: Not Warning
Alert set value 1	Set the temperature where CH☐ Alert 1 (b8 of Un\G5 to Un\G8) turns on.	250°C	0°C	0°C	0°C

(c) Auto refresh setting

Set the device to be automatically refreshed.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Auto_Refresh]



Item	Description	Set value			
		CH1	CH2	CH3	CH4
Write data error code	An error code or alarm code is stored.	D50			
Temperature process value (PV)	The detected temperature value where sensor correction is performed is stored.	D51	—	—	—
Alert definition	The value is stored depending on the detected alert.	D55	—	—	—

Remark

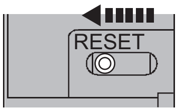
The number of parameters of the auto refresh setting can be reduced by using the setting item reduction mode of auto refresh.
When the setting item reduction mode is set, consecutive devices are automatically set to the grouped setting items.
For details on the setting item reduction mode of auto refresh, refer to the following.

Page 309, Section 6.4

(d) Writing parameter of an intelligent function module

Write the set parameter to the CPU module. Then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online] ⇨ [Write to PLC...]

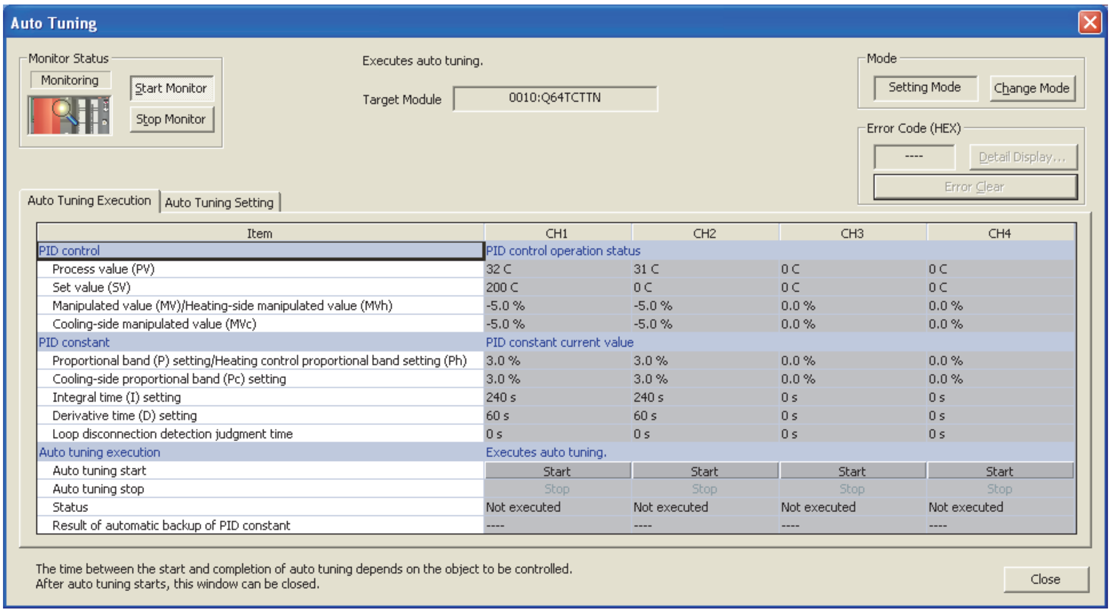


or Power OFF → ON

(e) Performing auto tuning

Set the "Automatic backup setting after auto tuning of PID constants" to "ON" and perform the auto tuning.

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Temperature Control Module]
⇨ [Auto Tuning...] ⇨ [Q64TCTTN] ⇨ OK



(f) Program example

- Program that changes the setting/operation mode
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))

- Program that stops the auto tuning when an alert is detected
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))

- Program that reads the PID constants from E^2PROM
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))

- Program that reads an error code
  This program is the same as that of when the peak current suppression function or the simultaneous temperature rise function is used. (Page 334, Section 7.2.2 (6) (f))

(7) Program example of when not using the parameter of an intelligent function module

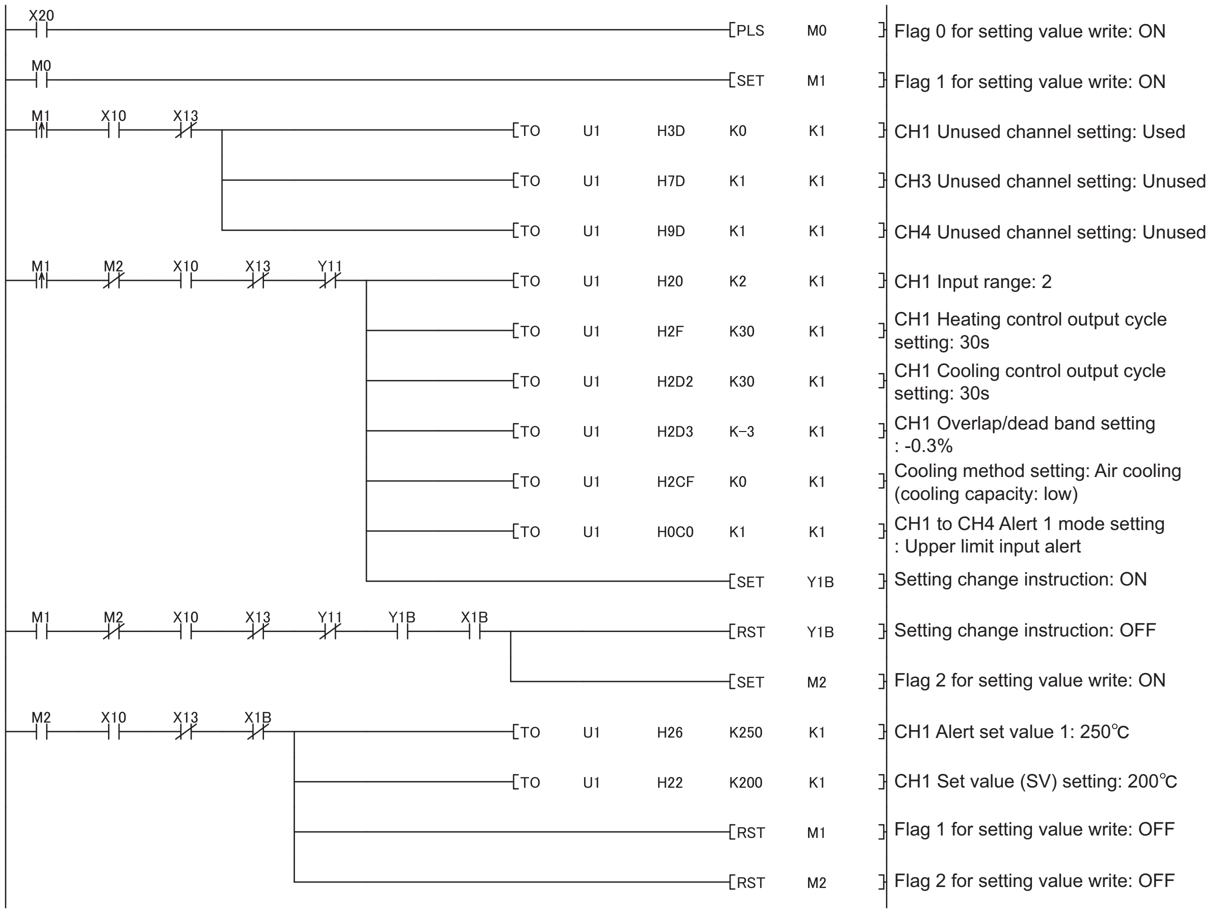
(a) Devices used by a user

Device	Description	
X10	Module READY flag	Q64TCTTN (X10 to X1F)
X11	Setting/operation mode status	
X12	Write error flag	
X13	Hardware error flag	
X14	CH1 Auto tuning status	
X18	E^2PROM write completion flag	
X1B	Setting change completion flag	
X20	Set value write instruction	QX42 (X20 to X5F)
X21	Auto tuning execute instruction	
X22	Error code reset instruction	
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
Y11	Setting/operation mode instruction	Q64TCTTN (Y10 to Y1F)
Y12	Error reset instruction	
Y14	CH1 Auto tuning instruction	
Y18	E^2PROM backup instruction	
Y1B	Setting change instruction	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
D50	Error code	
D51	CH1 Temperature process value (PV)	
D55	CH1 Alert definition	
M0	For writing set value 0	
M1	For writing set value 1	
M2	For writing set value 2	
M10	CH1 Auto tuning completion flag	
M20 to M23	CH□ Read completion flag	
M24 to M27	CH□ Write completion flag	

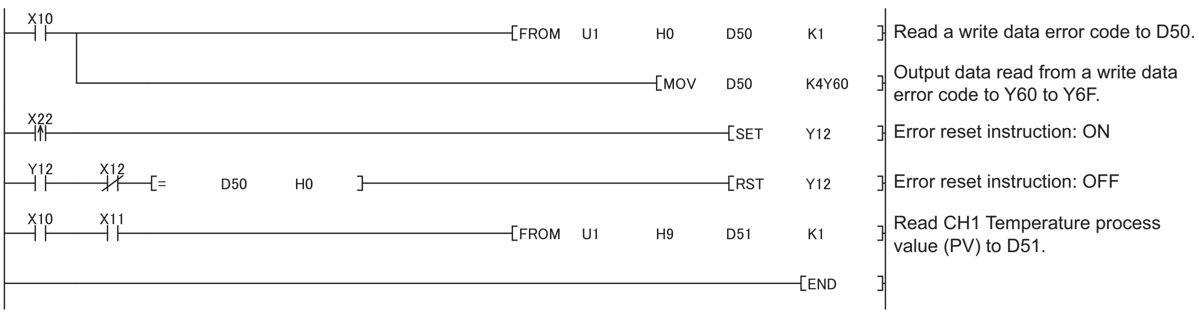
(b) Program example

- Program that changes the setting/operation mode
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))

- Initial setting program



- Program that executes the auto tuning and backs up the PID constants in E^2PROM if the auto tuning is normally completed (The auto tuning is stopped when an alert is detected.)
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 323, Section 7.2.1 (7) (b))
- Program that reads the PID constants from E^2PROM
  This program is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 321, Section 7.2.1 (6) (f))
- Program that reads an error code



7.3 When Using the Module on the Remote I/O Net

This section describes the program example of when the module is used on a remote I/O network.

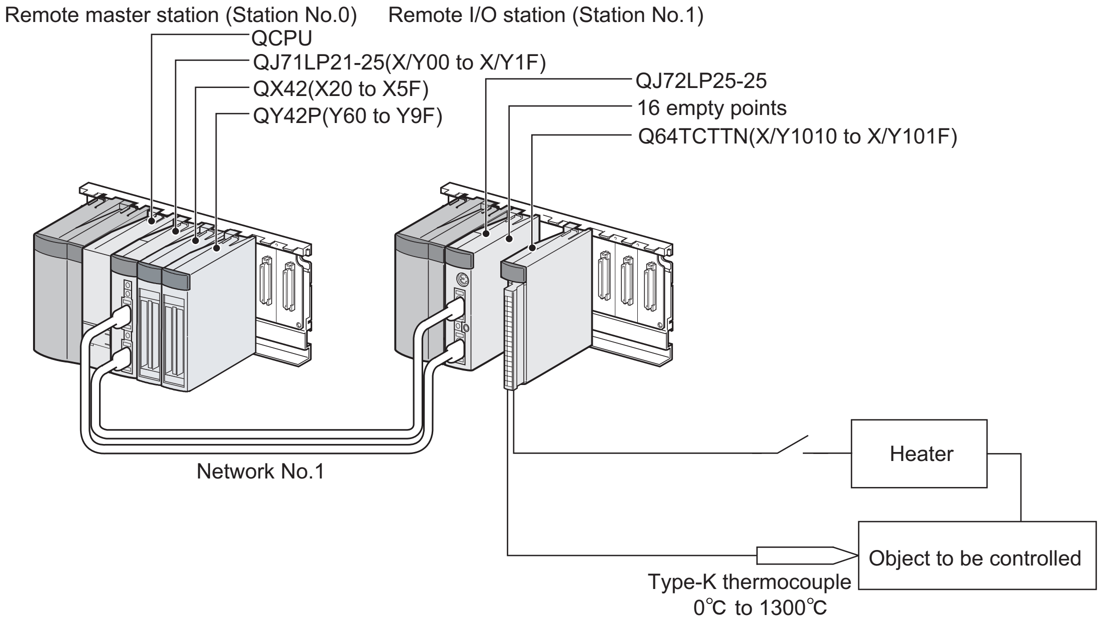
Point

For details on the MELSECNET/H remote I/O network, refer to the following.

Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

(1) System configuration

The following figure shows the system configuration example of when the module is used on the remote I/O network.



Point

When the Q64TCTTBWN or the Q64TCRTBWN is used, the I/O assignment is the same as that of the system configuration shown above.

- Slot 0: Empty 16 points
- Slot 1: Intelligent 16 points
- Slot 2: Input 64 points
- Slot 3: Output 64 points

(2) Programming condition

This program is designed to read the temperatures measured by the thermocouple (K type, 0 to 1300°C) connected to CH1.

An error code can be read and reset.

(3) Wiring example

The wiring is the same as that of when the module is in the standard control (such as auto tuning, self-tuning, and error code read). (Page 314, Section 7.2.1 (3))

(4) Switch Setting

Configure settings on the remote I/O station side.

- When using the parameter of an intelligent function module: Page 353, Section 7.3 (7) (a)
- When not using the parameter of an intelligent function module: Page 359, Section 7.3 (8) (a)

(5) Contents of the initial setting

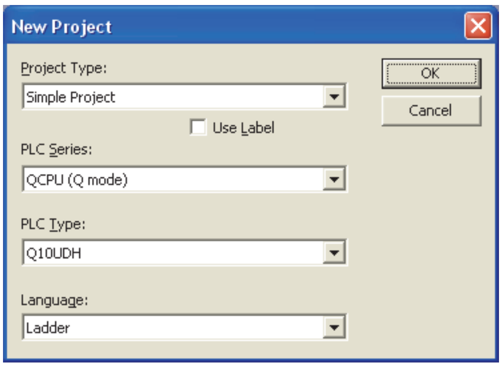
Item	Description			
	CH1	CH2	CH3	CH4
Input range	2: ThermocoupleK Measured Temperature Range (0 to 1300°C)	2: ThermocoupleK Measured Temperature Range (0 to 1300°C)	2: ThermocoupleK Measured Temperature Range (0 to 1300°C)	2: ThermocoupleK Measured Temperature Range (0 to 1300°C)
Set value (SV) setting	200°C	0°C	0°C	0°C
Unused channel setting	0: Used	1: Unused	1: Unused	1: Unused
Upper limit setting limiter	400°C	1300°C	1300°C	1300°C
Lower limit setting limiter	0°C	0°C	0°C	0°C
Alert 1 mode setting	1: Upper Limit Input Alert	0: Not Warning	0: Not Warning	0: Not Warning
Alert set value 1	250°C	0°C	0°C	0°C

(6) Setting on the master station

1. Create a project on GX Works2.

Select "QCPU (Q mode)" for "PLC Series:" and select the CPU module to be used for "PLC Type:".

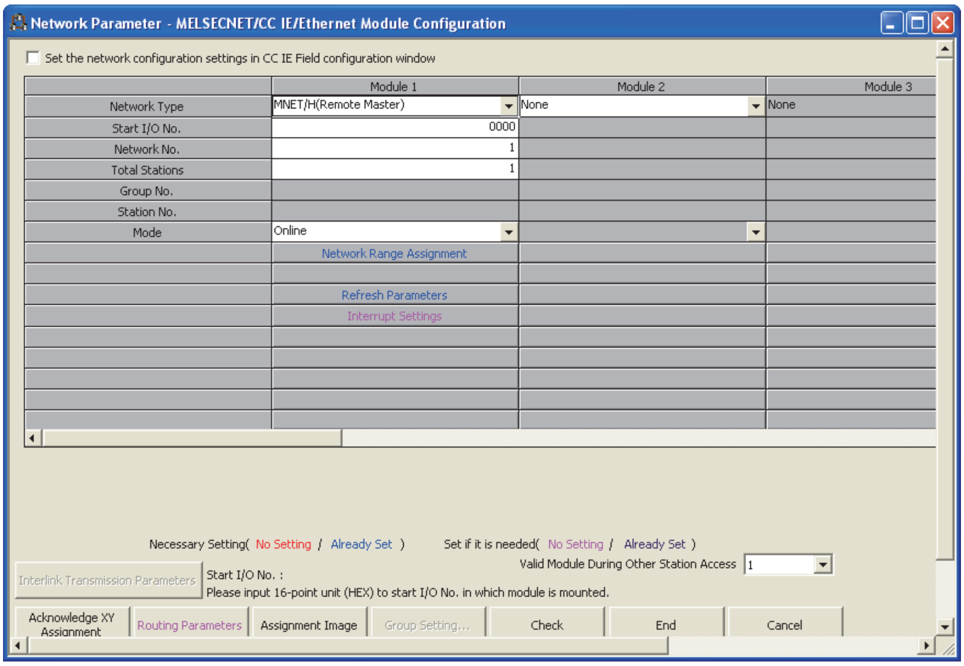
[Project] ⇨ [New...]



2. Display the network parameter setting window and configure the setting as follows.

Project window ➪ [Parameter] ➪ [Network Parameter]

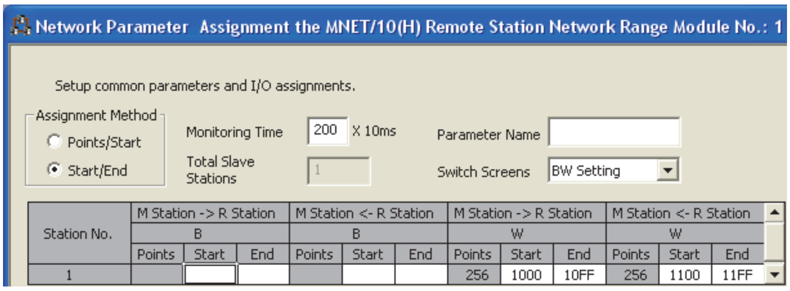
➪ [Ethernet/CC IE/MELSECNET]



3. Display the network range assignment setting window and configure the setting as follows.

Project window ➪ [Parameter] ➪ [Network Parameter]

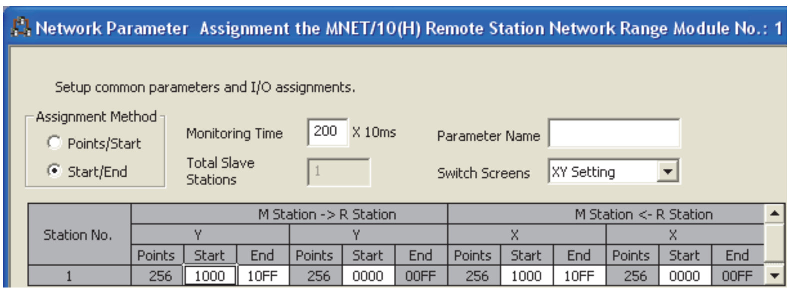
➪ [Ethernet/CC IE/MELSECNET] ➪ Network Range Assignment



Project window ➪ [Parameter] ➪ [Network Parameter]

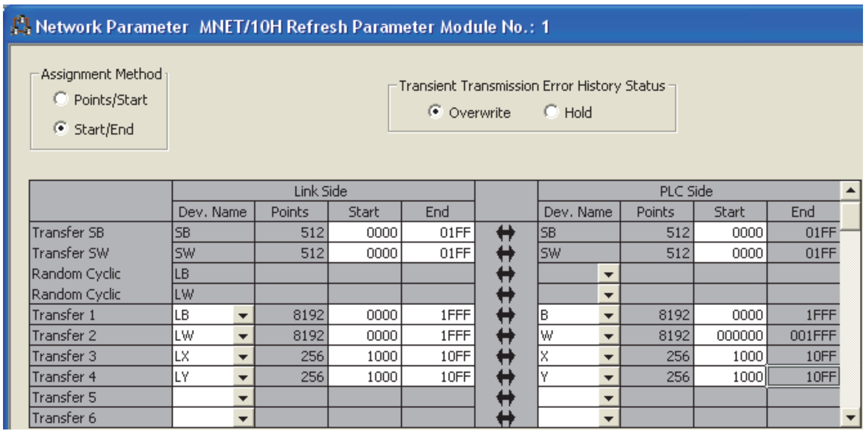
➪ [Ethernet/CC IE/MELSECNET] ➪ Network Range Assignment ➪ "Switch Screens"

➪ "XY Setting"



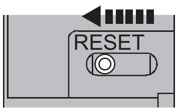
4. **Display the refresh parameter setting window and configure the setting as follows.**

Project window ⇨ [Parameter] ⇨ [Network Parameter]
⇨ [Ethernet/CC IE/MELSECNET] ⇨ Refresh Parameters



5. **Write the set parameter to the CPU module on the master station. Then reset the CPU module or turn off and on the power supply of the programmable controller.**

[Online] ⇨ [Write to PLC...]



or Power OFF → ON

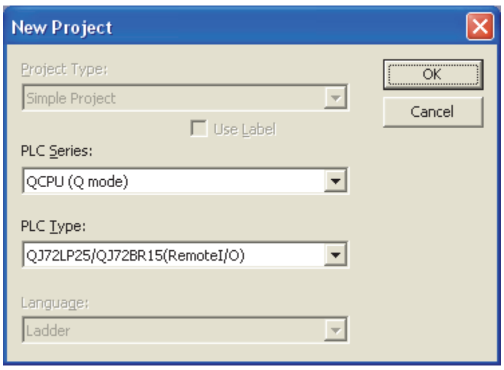
(7) Program example of when using the parameter of an intelligent function module

(a) Setting on remote I/O station side

1. **Create a project on GX Works2.**

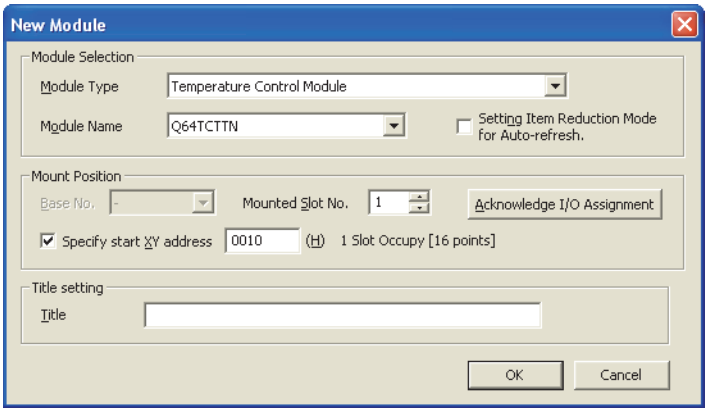
Select "QCPU (Q mode)" for "PLC Series:" and select "QJ72LP25/QJ72BR15(RemoteI/O)" for "PLC Type:".

[Project] ⇨ [New...]



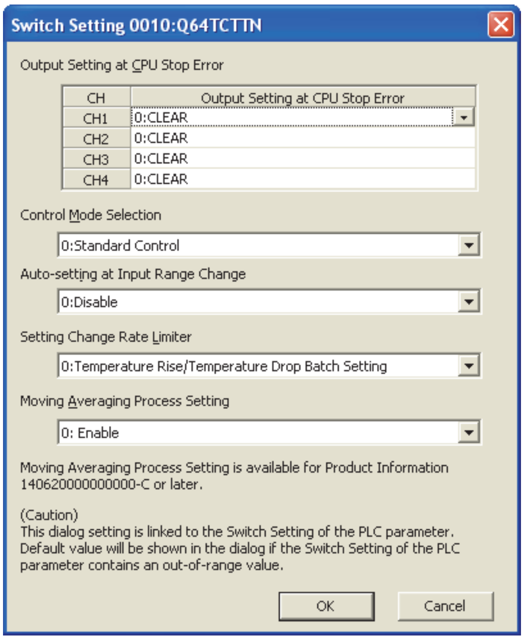
2. **Add the Q64TCTTN to the project on GX Works2.**

Project window ➪ [Intelligent Function Module] ➪ Right-click ➪ [New Module...]



3. **Display the Q64TCTTN "Switch Setting" window and configure the setting as follows.**

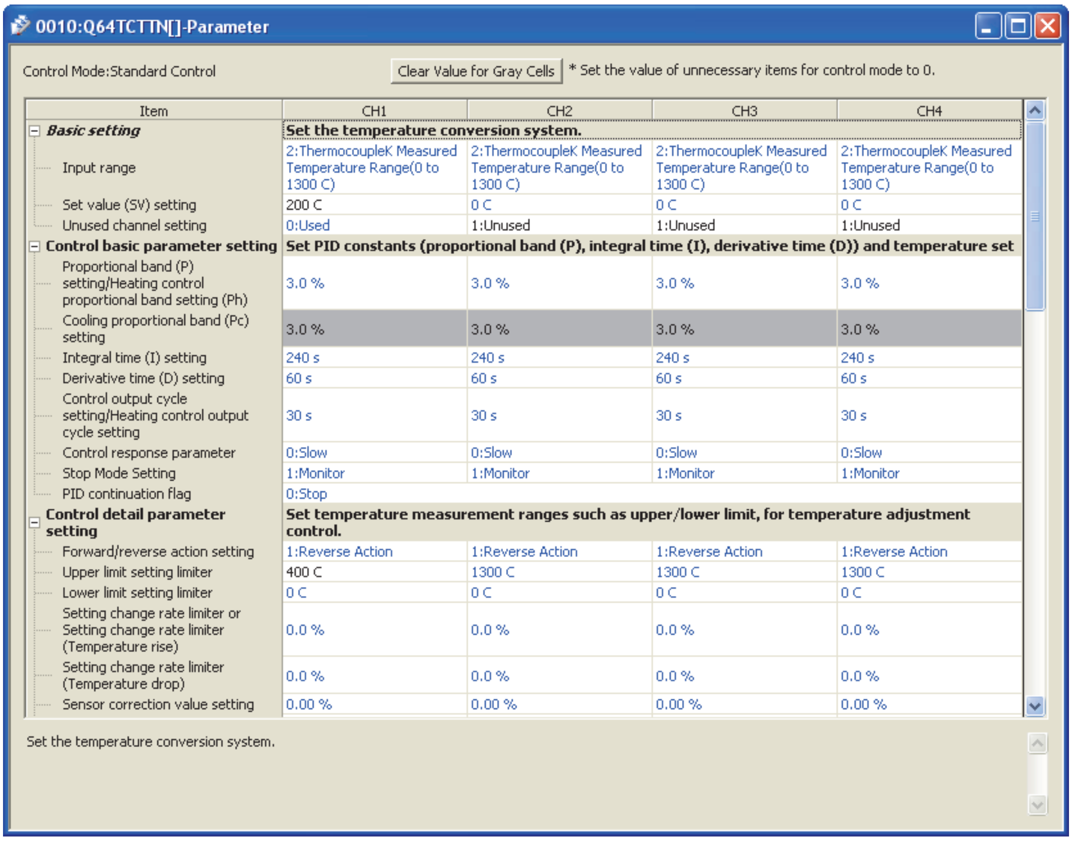
Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Switch Setting]



Item	Set value			
	CH1	CH2	CH3	CH4
Output Setting at CPU Stop Error	0: CLEAR	0: CLEAR	0: CLEAR	0: CLEAR
Control Mode Selection	0: Standard Control			
Auto-setting at Input Range Change	0: Disable			
Setting Change Rate Limiter	0: Temperature Rise/Temperature Drop Batch Setting			
Moving Averaging Process Setting	0: Enable			

4. **Display the Q64TCTTN initial setting window, click Clear Value for Gray Cells , and configure the setting as follows.**

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Parameter]



0010:Q64TCTTN[]-Parameter

Control Mode:Standard Control | Clear Value for Gray Cells | * Set the value of unnecessary items for control mode to 0.

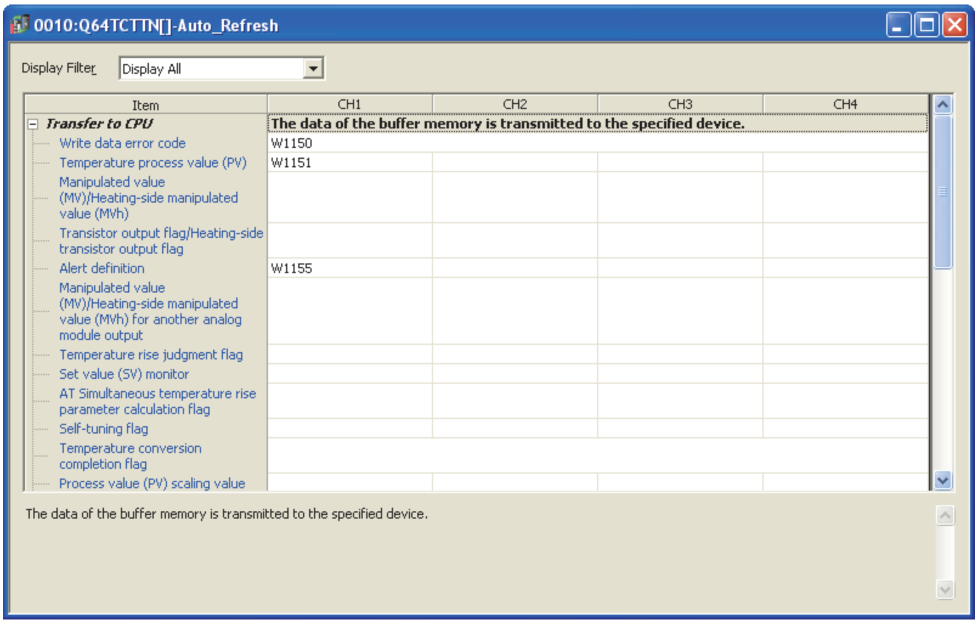
Item	CH1	CH2	CH3	CH4
Basic setting	Set the temperature conversion system.			
Input range	2:ThermocoupleK Measured Temperature Range(0 to 1300 C)	2:ThermocoupleK Measured Temperature Range(0 to 1300 C)	2:ThermocoupleK Measured Temperature Range(0 to 1300 C)	2:ThermocoupleK Measured Temperature Range(0 to 1300 C)
Set value (SV) setting	200 C	0 C	0 C	0 C
Unused channel setting	0:Used	1:Unused	1:Unused	1:Unused
Control basic parameter setting	Set PID constants (proportional band (P), integral time (I), derivative time (D)) and temperature set			
Proportional band (P) setting/Heating control proportional band setting (Ph)	3.0 %	3.0 %	3.0 %	3.0 %
Cooling proportional band (Pc) setting	3.0 %	3.0 %	3.0 %	3.0 %
Integral time (I) setting	240 s	240 s	240 s	240 s
Derivative time (D) setting	60 s	60 s	60 s	60 s
Control output cycle setting/Heating control output cycle setting	30 s	30 s	30 s	30 s
Control response parameter	0:Slow	0:Slow	0:Slow	0:Slow
Stop Mode Setting	1:Monitor	1:Monitor	1:Monitor	1:Monitor
PID continuation flag	0:Stop			
Control detail parameter setting	Set temperature measurement ranges such as upper/lower limit, for temperature adjustment control.			
Forward/reverse action setting	1:Reverse Action	1:Reverse Action	1:Reverse Action	1:Reverse Action
Upper limit setting limiter	400 C	1300 C	1300 C	1300 C
Lower limit setting limiter	0 C	0 C	0 C	0 C
Setting change rate limiter or Setting change rate limiter (Temperature rise)	0.0 %	0.0 %	0.0 %	0.0 %
Setting change rate limiter (Temperature drop)	0.0 %	0.0 %	0.0 %	0.0 %
Sensor correction value setting	0.00 %	0.00 %	0.00 %	0.00 %

Set the temperature conversion system.

Item	Description	Set value			
		CH1	CH2	CH3	CH4
Input range	Set the temperature sensor used for the Q64TCN and the measurement range.	2: Thermocouple K Measured Temperature Range (0 to 1300 °C)	2: Thermocouple K Measured Temperature Range (0 to 1300 °C)	2: Thermocouple K Measured Temperature Range (0 to 1300 °C)	2: Thermocouple K Measured Temperature Range (0 to 1300 °C)
Set value (SV) setting	Set the target temperature value of PID control.	200°C	0°C	0°C	0°C
Unused channel setting	Configure this setting when the channels where the temperature control is not performed and the temperature sensor is not connected are set to be unused.	0: Used	1: Unused	1: Unused	1: Unused
Upper limit setting limiter	Set the upper limit of the set value (SV).	400°C	1300°C	1300°C	1300°C
Lower limit setting limiter	Set the lower limit of the set value (SV).	0°C	0°C	0°C	0°C
Alert 1 mode setting	Set the alert mode.	1: Upper Limit Input Alert	0: Not Warning	0: Not Warning	0: Not Warning
Alert set value 1	Set the temperature where CH☐ Alert 1 (b8 of Un\G5 to Un\G8) turns on.	250°C	—	—	—

5. Display the Q64TCTTN auto refresh setting window and configure the setting as follows.

Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ Right-click ➪ [Auto_Refresh]



Item	Description	Set value			
		CH1	CH2	CH3	CH4
Write data error code	An error code or alarm code is stored.	W1150			
Temperature process value (PV)	Detected temperature value where Sensor Compensation is performed is stored.	W1151	—	—	—
Alert definition	The value is stored depending on the detected alert.	W1155	—	—	—

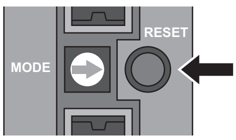
Remark

The number of parameters of the auto refresh setting can be reduced by using the setting item reduction mode of auto refresh.
When the setting item reduction mode is set, consecutive devices are automatically set to the grouped setting items.
For details on the setting item reduction mode of auto refresh, refer to the following.

Page 309, Section 6.4

6. Write the set parameter to the remote I/O module and reset the remote I/O module.

[Online] ➪ [Write to PLC...]



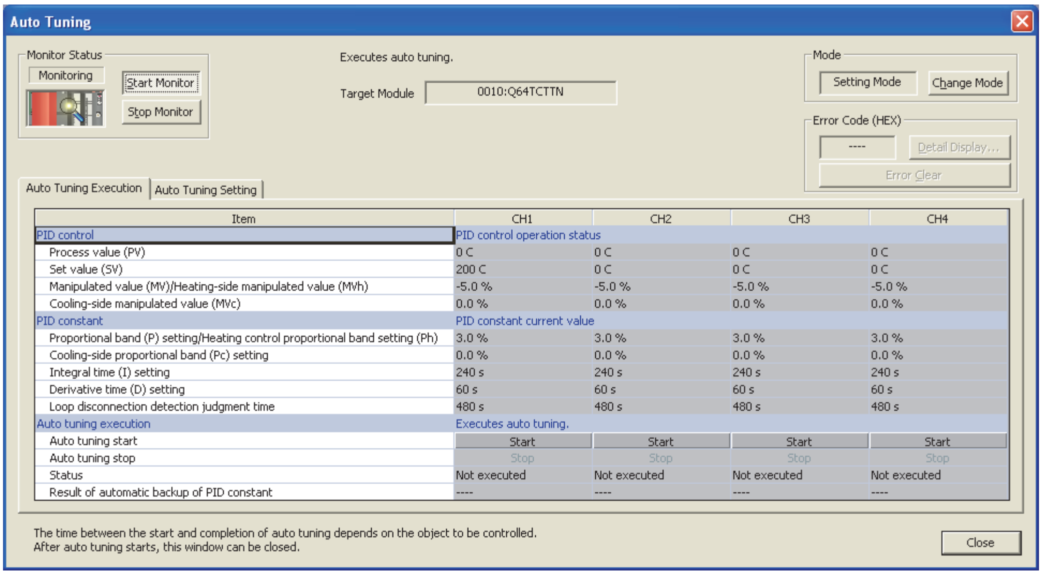
Press the switch for a while.

7. Perform auto tuning.

Set the "Automatic backup setting after auto tuning of PID constants" to "ON" and perform the auto tuning.

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Temperature Control Module]

⇨ [Auto Tuning...] ⇨ "Q64TCTTN" ⇨ OK



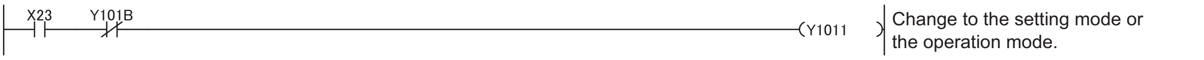
(b) Devices used by a user

Device	Description	
X22	Error code reset instruction	QX42 (X20 to X5F)
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
X1010	Module READY flag	Q64TCTTN (X1010 to X101F)
X1012	Write error flag	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
Y1011	Setting/operation mode instruction	Q64TCTTN (Y1010 to Y101F)
Y1012	Error reset instruction	
Y1018	E^2PROM backup instruction	
Y101B	Setting change instruction	
D9	Write data storage device using Z(P). REMTO instruction (for E^2PROM's PID constants read)	
D10	Read data storage device using Z(P). REMFR instruction (for E^2PROM's PID constants read)	
D11	Write data storage device using Z(P). REMTO instruction (for E^2PROM's PID constants read)	
M300 to M305	CH1 E^2PROM's PID constants read flag	
M310, M311	Z(P). REMTO instruction completion/result device	
M312, M313	Z(P). REMFR instruction completion/result device	
M314, M315	Z(P). REMTO instruction completion/result device	
W1150	Write data error code	Devices where data is written by auto refresh
W1151	CH1 Temperature process value (PV)	
W1155	CH1 Alert definition	

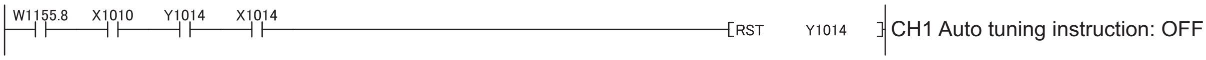
(c) Program example

Write the program to the CPU module on the master station.

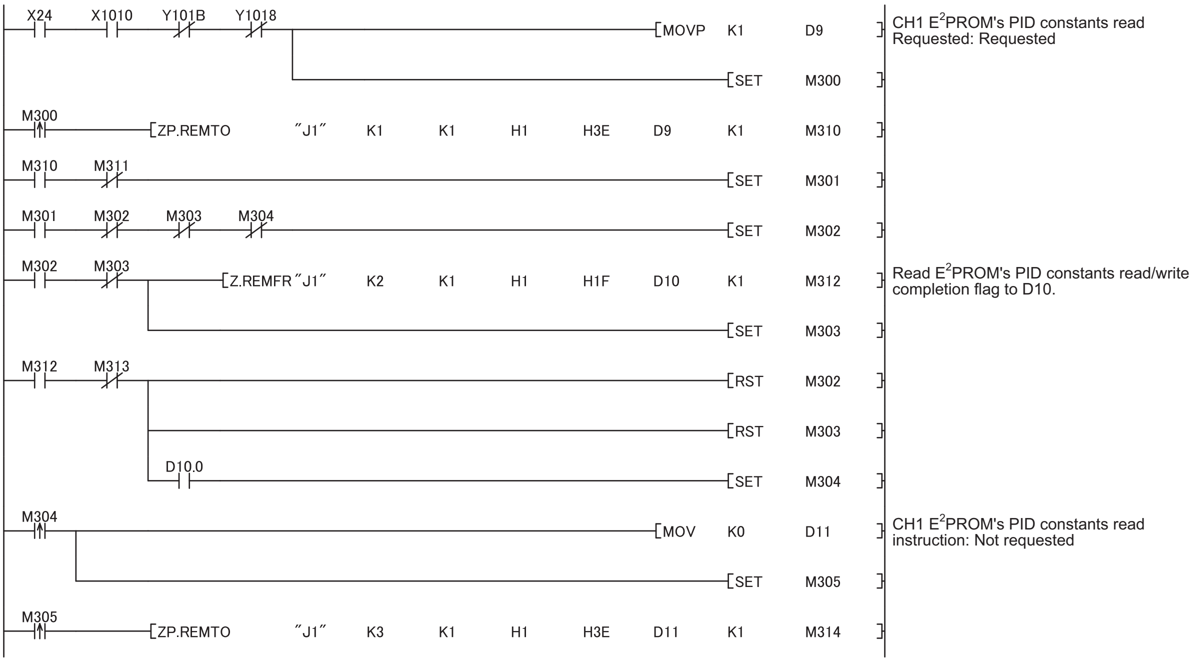
- Program that changes the setting/operation mode



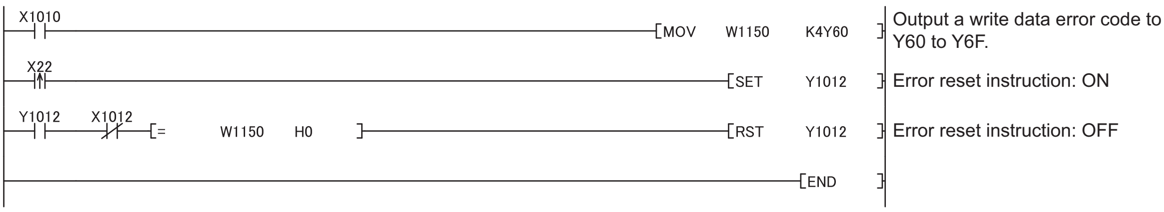
- Program that stops the auto tuning when an alert is detected



- Program that reads the PID constants from E²PROM



- Program that reads an error code



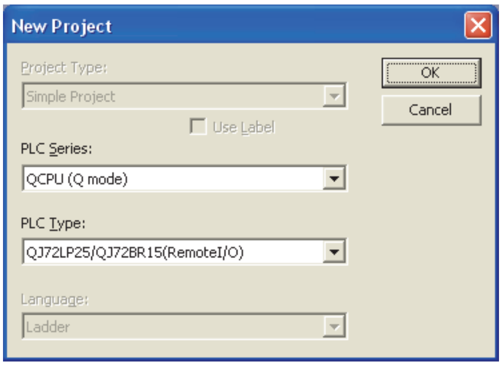
(8) Program example of when not using the parameter of an intelligent function module

(a) Setting on a remote I/O station

1. Create a project on GX Works2.

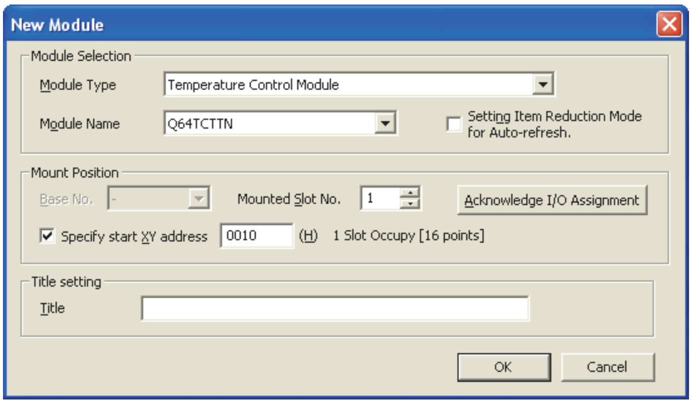
Select "QCPU (Q mode)" for "PLC series:" and select "QJ72LP25/QJ72BR15(RemoteI/O)" for "PLC Type:".

[Project] ⇨ [New...]



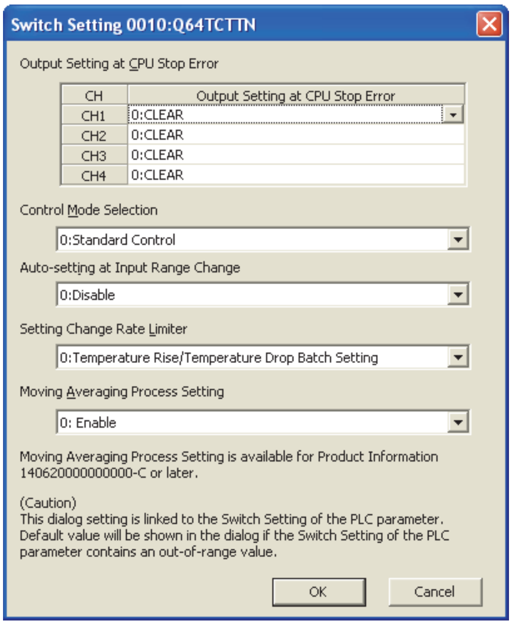
2. Add the Q64TCTTN to the project on GX Works2.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [New Module...]



3. Display the Q64TCTTN "Switch Setting" window and configure the setting as follows.

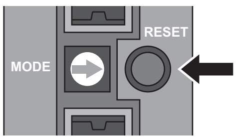
Project window ➪ [Intelligent Function Module] ➪ [Q64TCTTN] ➪ [Switch Setting]



Item	Set value			
	CH1	CH2	CH3	CH4
Output Setting at CPU Stop Error	0: CLEAR	0: CLEAR	0: CLEAR	0: CLEAR
Control Mode Selection	0: Standard Control			
Auto-setting at Input Range Change	0: Disable			
Setting Change Rate Limiter	0: Temperature Rise/Temperature Drop Batch Setting			
Moving Averaging Process Setting	0: Enable			

4. Write the set parameter to the remote I/O module and reset the remote I/O module.

[Online] ➪ [Write to PLC...]



Press the switch for a while.

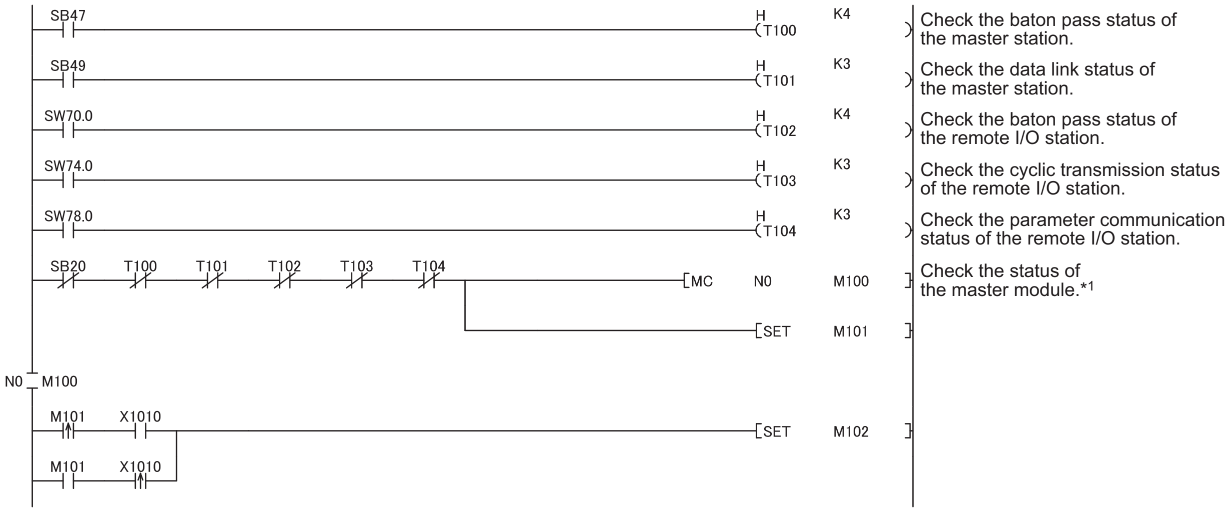
(b) Devices used by a user

Device	Description	
X20	Set value write instruction	QX42 (X20 to X5F)
X21	Auto tuning execute instruction	
X22	Error code reset instruction	
X23	Operation mode setting instruction	
X24	E^2PROM's PID constants read instruction	
X1010	Module READY flag	Q64TCTTN (X1010 to X101F)
X1011	Setting/operation mode status	
X1012	Write error flag	
X1013	Hardware error flag	
X1014	CH1 Auto tuning status	
X1018	E^2PROM write completion flag	
X101B	Setting change completion flag	
Y60 to Y6F	Error code output	QY42P (Y60 to Y9F)
Y1011	Setting/operation mode instruction	Q64TCTTN (Y1010 to Y101F)
Y1012	Error reset instruction	
Y1014	CH1 Auto tuning instruction	
Y1018	E^2PROM backup instruction	
Y101B	Setting change instruction	
D0 to D8	Write data storage device using Z(P). REMTO instruction (for the initial setting)	
D9	Read data storage device using Z(P). REMFR instruction (for E^2PROM's PID constants read)	
D10	Write data storage device for the Z(P). REMTO instruction (for E^2PROM's PID constants read)	
D11	Read data storage device for the Z(P). REMFR instruction (for E^2PROM's PID constants read)	
D50	Write data error code	
D51	CH1 Temperature process value (PV)	
D55	CH1 Alert definition	
M0	For writing set value 0	
M1	For writing set value 1	
M2	For writing set value 2	
M10	CH1 Auto tuning completion flag	
M100	Master module status check device (for the MC and MCR instructions)	
M101, M102	Initial setting auxiliary device	
M200 to M217	Z(P). REMTO instruction completion/result device	
M224 to M227	Z(P). REMFR instruction completion/result device	
M300 to M305	CH1 E^2PROM's PID constants read flag	
M310, M311	Z(P). REMTO instruction completion/result device	
M312, M313	Z(P). REMFR instruction completion/result device	
M314, M315	Z(P). REMTO instruction completion/result device	
M316, M317	Z(P). REMFR instruction completion/result device	
SB20	Module status	
SB47	Baton pass status of own station	
SB49	Data link status (own station)	
SW70.0	Baton pass status of each station (station number 1)	
SW74.0	Cyclic transmission status of each station (station number 1)	
SW78.0	Parameter communication status of each station (station number 1)	
T100 to T104	Interlock for own station and other stations	

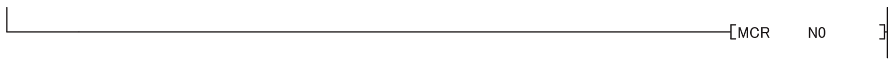
(c) Program example

Write the program to the CPU module on the master station.

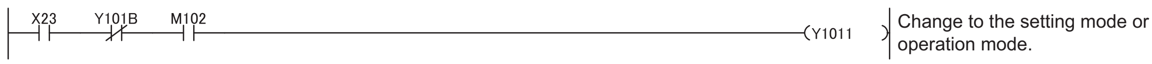
- Program that checks the operation status of the remote I/O station



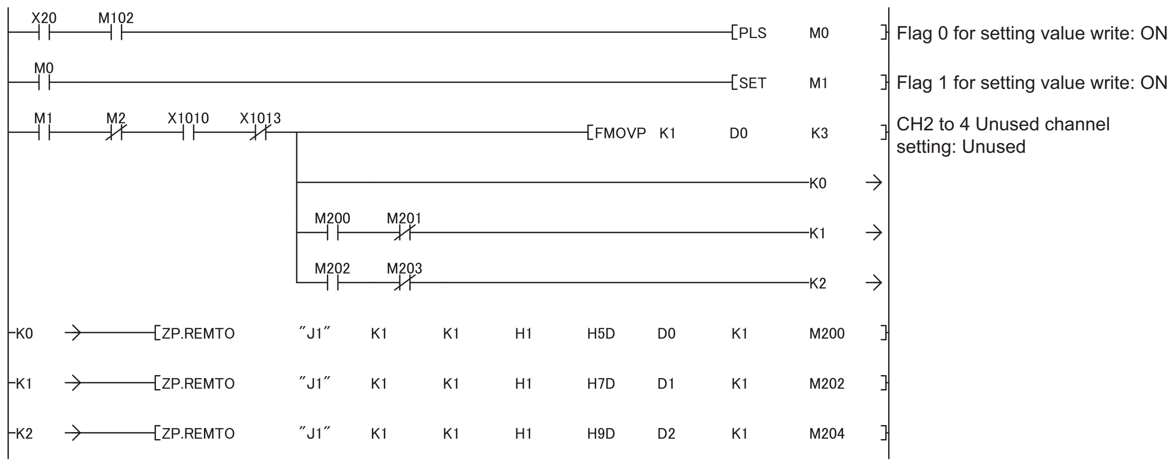
*1 Add the following MCR instruction to the end of the program.

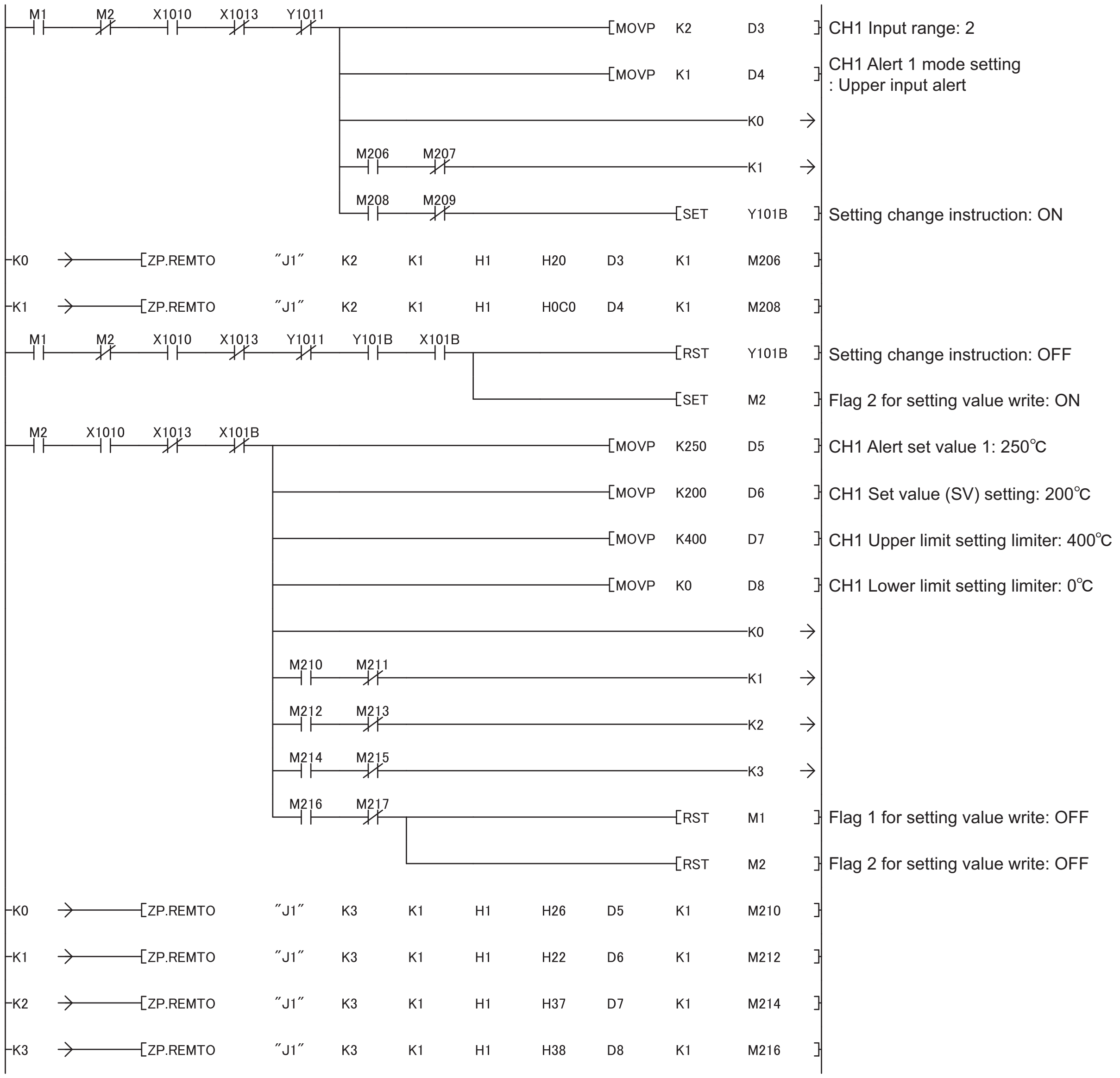


- Program that changes the setting/operation mode

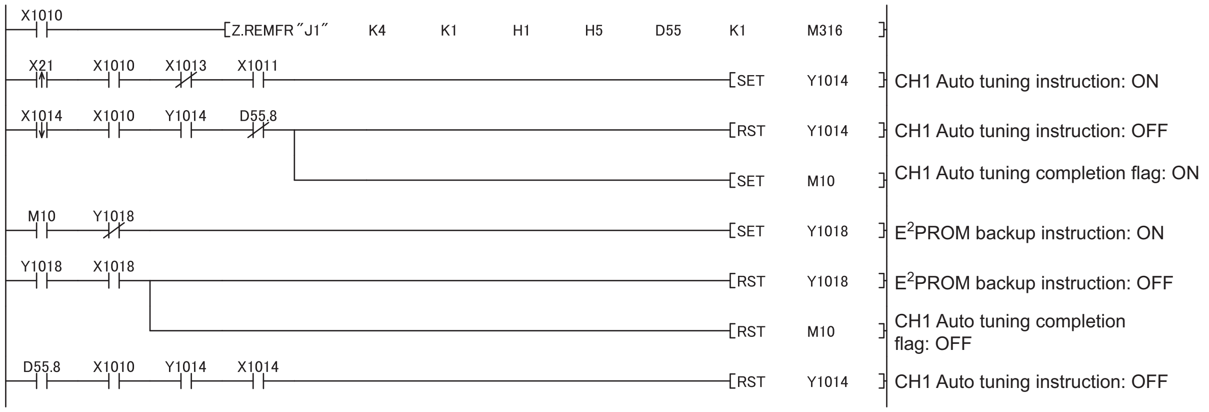


- Initial setting program

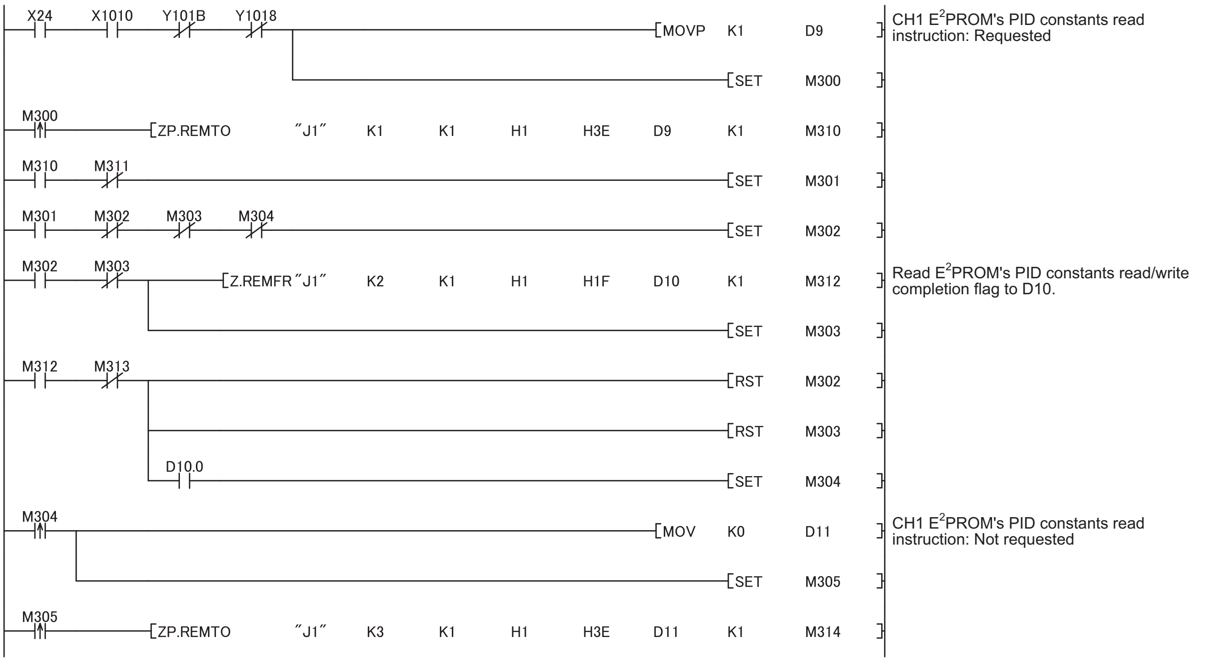




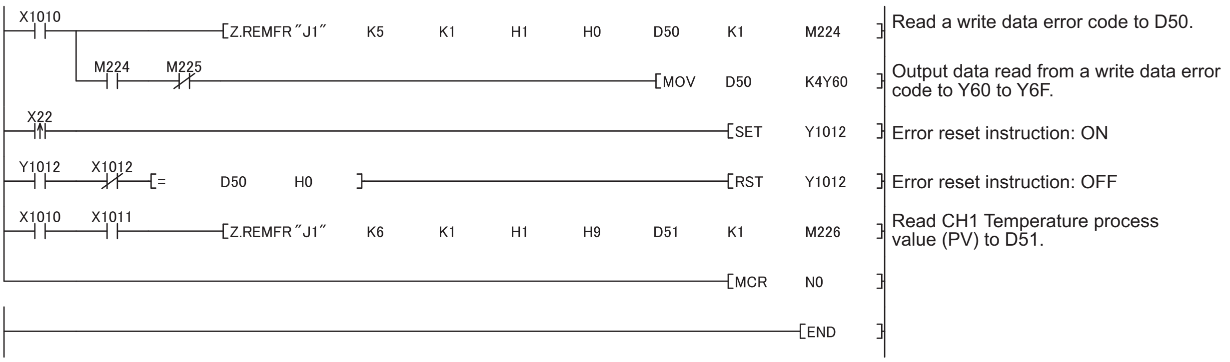
- Program that executes the auto tuning and backs up the PID constants in E^{2}PROM if the auto tuning is normally completed (The auto tuning is stopped when an alert is detected.)



• Program that reads the PID constants from E^2PROM



• Program that reads an error code and the temperature process value (PV)



CHAPTER 8 TROUBLESHOOTING

This chapter describes the causes and corrective actions to take when a problem occurs in the Q64TCN.

8.1 Before Troubleshooting

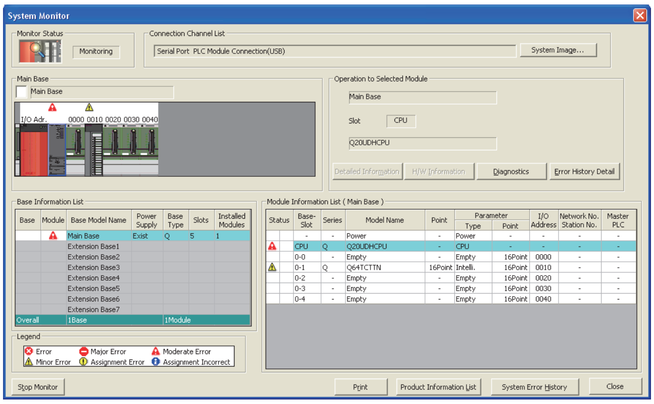
Check whether the POWER LED on the power supply module and the MODE LED on the CPU module are on. If both are off, proceed with CPU module troubleshooting.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

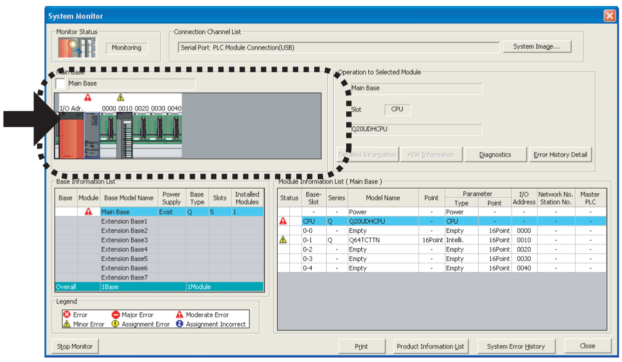
8.2 Troubleshooting Procedure

This section describes how to find problem causes and take corrective action.
Use GX Works2 to find problem causes and take corrective action.

(1) Procedure



↓



↓

(To the next page)

1. **Connect GX Works2 to the CPU module to display the "System Monitor" window.**

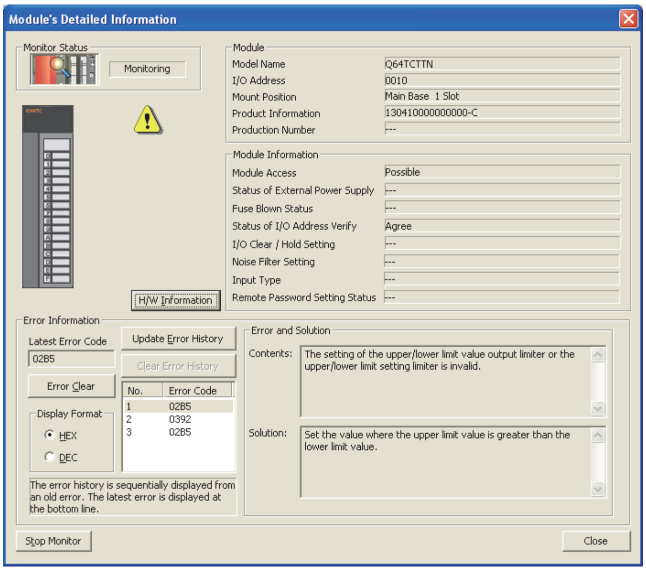
[Diagnostics] ⇨ [System Monitor...]

2. **After confirming that an error is displayed on the Q64TCN, select the Q64TCN and click** Detailed Information .

If an error LED is ON on a module other than the Q64CTN, refer to the user's manual for the module and take corrective action.

(From the previous page)

↓



3. **Click** Detailed Information **to open the "Module's Detailed Information" window.**
Check the error description and the corrective action to take under "Error and Solution".

4. **When the error description cannot be confirmed after doing the operation above, proceed with the following troubleshooting.**

- Checks using LEDs (☞ Page 367, Section 8.3)
- Checks using input signals (☞ Page 369, Section 8.4)

8.3 Checks Using LEDs

This section describes troubleshooting using LEDs.

8.3.1 When the RUN LED flashes or turns off

Check Item	Action
Is the power supply 5VDC supplied?	• Check the power supply module. • Properly mount the module.
Is the capacity of power supply module enough?	Add up the current consumption of the installed CPU module, I/O module, and intelligent function module to check whether power supply capacity is sufficient.
Has a watchdog timer error occurred?	• Reset the CPU module or turn on the power supply again. • Replace the Q64TCN.
Is module change enabled during an online module change?	Refer to the online module change (☞ Page 393, Appendix 4 or Page 408, Appendix 5) and take corrective action.
Is the intelligent function module switch setting outside the setting range?	Set the switch setting value of the intelligent function module to the value within the setting range.

8.3.2 When the ERR. LED turns on or flashes

(1) When turning on

Check Item	Action
Is the intelligent function module switch setting outside the setting range?	Set the switch setting value of the intelligent function module to the value within the setting range.
Is the cold junction temperature compensation resistor disconnected or loose? (The Q64TCTTN and Q64TCTTBWN only)	Properly connect the cold junction temperature compensation resistor.
Others	A hardware failure occurred in Q64TCN Please consult your local Mitsubishi representative.

(2) When flashing

Check Item	Action
Has a write data error occurred?	Check the error code list (☞ Page 373, Section 8.6) and take actions described.

8.3.3 When the ALM LED turns on or flashes

(1) When turning on

Check Item	Action
Is CH□ Alert occurrence flag (XnC to XnF) ON?	Check CH□ Alert definition (Un\G5 to Un\G8) and take the appropriate corrective action. (Page 89, Section 3.4.2 (3))

(2) When flashing

Check Item	Action
Has the temperature process value (PV) exceeded the temperature measurement range set as the input range?	Change the setting of CH□ Input range (Un\G32, Un\G64, Un\G96, Un\G128) to a setting in the temperature measurement range to be used. (Page 98, Section 3.4.2 (12))
Is there a channel where no temperature sensor is connected?	Set the channel where no temperature sensor is connected to unused in CH□ Unused channel setting (Un\G61, Un\G93, Un\G125, Un\G157). (Page 128, Section 3.4.2 (35))
Has a loop disconnection been detected?	Check for a load disconnection, externally-operable device failure, and sensor disconnection.

8.4 Checks Using Input Signals

This section describes troubleshooting using input signals.

8.4.1 When Module READY flag (Xn0) does not turn on

Check Item	Action
Has a watchdog timer error occurred?	• Reset the CPU module or turn on the power supply again. • Replace the Q64TCN.
Has an error occurred in the programmable controller?	Refer to the user's manual of the used CPU module and take corrective action.

8.4.2 When Write error flag (Xn2) is on

Check Item	Action
Has a write data error occurred?	Check the error code list (☞ Page 373, Section 8.6) and take actions described.

8.4.3 When Hardware error flag (Xn3) is on

Check Item	Action
Is the cold junction temperature compensation resistor disconnected or loose? (The Q64TCTTN and Q64TCTTBWN only)	Properly connect the cold junction temperature compensation resistor.
Others	A hardware failure occurred in the Q64TCN. Please consult your local Mitsubishi representative.

8.4.4 When the auto tuning does not start (CH□ Auto tuning status (Xn4 to Xn7) does not turn on)

Check Item	Action
Have the auto tuning start conditions been met?	Refer to the "Auto tuning function" section (☞ Page 182, Section 4.6) and confirm that all conditions have been met.
Has auto tuning ended abnormally?	Check the conditions that signify an abnormal end for auto tuning (☞ Page 191, Section 4.6 (7)) to see whether it has ended abnormally. If it has ended abnormally, remove the cause. Then execute auto tuning again.

8.4.5 When the auto tuning does not complete (CH☐ Auto tuning status (Xn4 to Xn7) stays on and does not turn off)

Check Item	Action
Are b4 to b7 of the E^{2}PROM's PID constants read/write completion flag (Un\G31) set to 1 (ON)?	Set CH☐ Automatic backup setting after auto tuning of PID constants (Un\G63, Un\G95, Un\G127, Un\G159) to Disable (0). (Page 130, Section 3.4.2 (37)) To back up the setting, turn off and on E^{2}PROM backup instruction (Yn8).
Is CH☐ E^{2}PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) set to Requested (1)?	Set CH☐ E^{2}PROM's PID constants read instruction (Un\G62, Un\G94, Un\G126, Un\G158) to Not requested (0). (Page 129, Section 3.4.2 (36))
Has the set value (SV) been set correctly? (Is the manipulated value (MV) still 0% because the set value (SV) is small?)	Set the set value (SV) to the desired value.

8.4.6 When the self-tuning does not start (CH☐ Auto tuning status (Xn4 to Xn7) does not turn on)

Check Item	Action
Have the self-tuning start conditions been met?	Refer to the "Self-tuning function" section (Page 229, Section 4.18) and confirm that all conditions have been met.
Has self-tuning ended abnormally?	Check the conditions that signify an abnormal end for self-tuning (Page 237, Section 4.18 (8)) to see whether it has ended abnormally. If it has ended abnormally, remove the cause. If the buffer memory setting was changed during self-tuning, restore the value to the one prior to change.

8.4.7 When E^{2}PROM write failure flag (XnA) is on

Check Item	Action
Has a backup to E^{2}PROM failed?	Turn off and on E^{2}PROM backup instruction (Yn8) and write the setting to the E^{2}PROM. If writing fails again, a hardware is in failure. Please consult your local Mitsubishi representative.
Has the reading of data from E^{2}PROM failed?	

8.4.8 When CH☐ Alert occurrence flag (XnC to XnF) is on

Check Item	Action
Has the temperature process value (PV) exceeded the alert set value range?	• Check CH☐ Alert definition (Un\G5 to Un\G8) and take the appropriate corrective action. (☞ Page 89, Section 3.4.2 (3)) • Correct the alert set value. (☞ Page 110, Section 3.4.2 (18))
Has a disconnection been detected?	• Check CH☐ Alert definition (Un\G5 to Un\G8) and take the appropriate corrective action. (☞ Page 89, Section 3.4.2 (3))

8.5 Troubleshooting by Symptom

This section describes troubleshooting using the wiring resistance values of thermocouples.

8.5.1 When the temperature process value (PV) is abnormal

Check Item	Action
Is the thermocouple wiring resistance value too high?	• Check the thermocouple wiring resistance value and check whether a difference in the temperatures was caused by the wiring resistance. (Page 42, Section 3.1.1) • Use the sensor correction function to correct the difference in the temperatures caused by the wiring resistance. (Page 215, Section 4.14)

8.6 Error Code List

When an error occurs in the Q64TCN during data write to the CPU module or data read from the CPU module, one of the following error codes is stored in Write data error code (Un\G0).
In addition, the error occurred is notified to the CPU module.

Error code (hexadecimal)	Cause	Operation at error occurrence	Action
0001_H	Hardware error	The operation varies depending on the symptom.	• Check that the terminal block or the cold junction temperature compensation resistor is not disconnected or loose. • Replace the Q64TCN. • Please consult your local Mitsubishi representative.
□□□2_H[*1]	Data (other than 0) is being written to the system area[*2].	• The data written is retained. • When data is written to multiple system areas, the address with the smallest number of the buffer memory area where an error was detected is stored.[*5]	• Return the value to 0 and turn off, on, and off Error reset instruction (Yn2). • Delete the program that is writing data to the system area.
□□□3_H[*1]	Data is being written in the operation mode[*4] to the area where data can be written only in the setting mode[*3].	• The data written is retained. • When data is written to multiple system areas, the address with the smallest number of the buffer memory area where an error was detected is stored.[*5]	• Follow the instructions below for error reset. 1. Change the mode to the setting mode. 2. Set the correct value and turn off, on, and off Setting change instruction (YnB). 3. Turn off, on, and off Error reset instruction (Yn2). • If switching from the operation mode to the setting mode, check that PID continuation flag (Un\G169) is set to Stop (0), and turn on and off Setting/operation mode instruction (Yn1).
□□□4_H[*1]	Data outside the settable range is being written.	• The data written is retained. • If temperature, time, or percentage settings exceed upper limit value/lower limit value, change the data within those values. • When data is written to multiple system areas, the address with the smallest number of the buffer memory area where an error was detected is stored.[*5]	Set data within the range.

Error code (hexadecimal)	Cause	Operation at error occurrence	Action
□□□5H*1	The setting of the upper/lower limit value output limiter or the upper/lower limit setting limiter is invalid.	• The data written is retained. • Change the setting to an allowable value for the upper/lower limit value. • When data is written to multiple system areas, the address with the smallest number of the buffer memory area where an error was detected is stored.*5	Set the value where the upper limit value is greater than the lower limit value.
□□□6H*1	The setting value is being changed while Default setting registration instruction (Yn9) was on.	• The data written is ignored. • The setting cannot be changed until an error reset is performed. • The content of Write data error code (Un\G0) does not change even if another write error occurs.	After turning off, on, and off Error reset instruction (Yn2), change the setting value.
□□□7H*1	2-point sensor compensation setting is invalid.	• The data written is retained. • When data is written to multiple system areas, the address with the smallest number of the buffer memory area where an error was detected is stored.*5 • When 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 as the address where the error occurred.	• Enter the temperature within the input range. • Set the values so that the 2-point sensor compensation offset value (measured value) is smaller than the 2-point sensor compensation gain value (measured value) and the 2-point sensor compensation offset value (compensation value) is smaller than the 2-point sensor compensation gain value (compensation value).
□□□AH	An alarm has occurred. Refer to the alarm code list (Page 376, Section 8.7).		
001EH	Set value discrepancy error The current control mode and the control mode backed up in the E²PROM are different due to the change of the control mode selection.	• The set value cannot be changed until the control mode is determined. • The buffer memory data reverts to the default value for the selected control mode.	Turn the E²PROM backup instruction (Yn8) OFF → ON → OFF.
000FH	Values set in the intelligent function module switch setting are those outside the setting range.	The RUN LED turns off, the ERR. LED turns on, and the module does not operate.	Set the correct values on the intelligent function module switch setting.

*1 The address where the error occurred is stored in □□□H.
Buffer memory addresses are written in decimal (Intelligent function module device (Un\G□)) in this manual. Read the stored value as a decimal value and refer to the buffer memory list (Page 61, Section 3.4.1).

*2 The buffer memory areas checked are Un\G0 to Un\G287. No error occurs for writes in the system area in or after Un\G288.

*3 For the writable area in setting mode, refer to the buffer memory list (Page 61, Section 3.4.1).

*4 "In the operation mode" refers to one of the following states.
• When Setting/operation mode instruction (Yn1) or Setting/operation mode status (Xn1) is on.
• When Setting/operation mode instruction (Yn1) turns on and off and PID continuation flag (Un\G169) is set to Continue (1).

*5 Ex. When an error occurs in CH1 Alert 1 mode setting (Un\G192) and CH1 Alert 2 mode setting (Un\G193), 0C0H (hex) in the buffer memory address with the smallest number "Un\G192" is stored in Error code (Un\G0).

Remark

- When a value outside the setting range is written in the following buffer memory areas while in setting mode, the error code □□□4_H is stored. Switching to operation mode without error reset changes the error code to □□□3_H. If this happens, take the corrective action for error code □□□3_H.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
Input range	Un\G32	Un\G64	Un\G96	Un\G128	Page 98, Section 3.4.2 (12)
Alert 1 mode setting	Un\G192	Un\G208	Un\G224	Un\G240	Page 139, Section 3.4.2 (52)
Alert 2 mode setting	Un\G193	Un\G209	Un\G225	Un\G241	
Alert 3 mode setting	Un\G194	Un\G210	Un\G226	Un\G242	
Alert 4 mode setting	Un\G195	Un\G211	Un\G227	Un\G243	

- Error code priorities are as described below.

  Priority

  1,F ← E ← 6 ← 3 ← 7 ← 5 ← 2,4
  Higher Lower

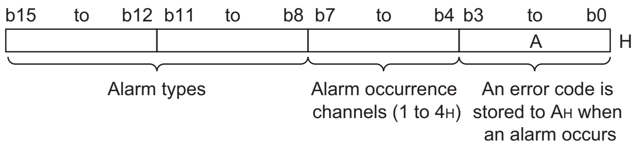
  When error codes are in the same priority level, the lower error addresses are prioritized.

  When a high-priority error occurs during a low-priority error, the error code of the high-priority error is written over the error occurrence address.

- Only one error code, as dictated by error priority, is stored in Write data error code (Un\G0). For that reason, when multiple errors occur, the next error code is stored, even when the error of the stored error code is corrected. Check for errors other than the stored error code in the parameters of other channels.

8.7 Alarm Code List

The following table lists alarm codes.
The alarm code is stored in all bits of Write data error code (Un\G0).



If the lower 4 bits are "0001" (1_H) to "1001" (9_H) or "1011" (B_H) to "1111" (F_H), an error occurs. When an error occurs, refer to the error code list (Page 373, Section 8.6).

<table>
<tr><th>Alarm code (hexadecimal) *1</th><th>Cause</th><th>Operation at alarm occurrence</th><th>Action</th></tr>
<tr><td>01□A_H</td><td>The temperature process value (PV) has exceeded the temperature measurement range that was set as the input range.</td><td>• The ALM LED flashes.
• CH□ Alert occurrence flag (XnC to XnF) turns on.
• CH□ Input range upper limit (b0 of Un\G5 to Un\G8) turns on.</td><td rowspan="2">When Error reset instruction (Yn2) is turned OFF → ON → OFF after the temperature process value (PV) has returned to the value within the temperature measurement range, Write data error code (Un\G0) is cleared to 0.
The following flags and buffer memory bits that turn on when an alarm occurs turn off automatically when the temperature process value (PV) has returned to the value within the temperature measurement range.
• CH□ Alert occurrence flag (XnC to XnF)
• The applicable bit (Page 89, Section 3.4.2 (3)) of CH□ Alert definition (Un\G5 to Un\G8)</td></tr>
<tr><td>02□A_H</td><td>The temperature process value (PV) is below the temperature measurement range that was set as the input range.</td><td>• The ALM LED flashes.
• CH□ Alert occurrence flag (XnC to XnF) turns on.
• CH□ Input range lower limit (b1 of Un\G5 to Un\G8) turns on.</td></tr>
<tr><td>03□A_H</td><td>A loop disconnection has been detected.</td><td>• The ALM LED flashes.
• CH□ Alert occurrence flag (XnC to XnF) turns on.
• CH□ Loop disconnection detection (b13 of Un\G5 to Un\G8) turns on.</td><td rowspan="3">When Error reset instruction (Yn2) is turned OFF → ON → OFF after a current error due to a disconnection or output-off is restored, Write data error code (Un\G0) is cleared to 0.
The following flags and buffer memory bits that turn on when an alarm occurs turn off automatically when the current error due to disconnection or output-off is restored.
• CH□ Alert occurrence flag (XnC to XnF)
• The applicable bit (Page 89, Section 3.4.2 (3)) of CH□ Alert definition (Un\G5 to Un\G8)</td></tr>
<tr><td>04□A_H</td><td>A heater disconnection has been detected.</td><td>• The HBA LED turns on.
• CH□ Alert occurrence flag (XnC to XnF) turns on.
• CH□ Heater disconnection detection (b12 of Un\G5 to Un\G8) turns on.</td></tr>
<tr><td>05□A_H</td><td>A current error at an output off-time has been detected.</td><td>• The HBA LED turns on.
• CH□ Alert occurrence flag (XnC to XnF) turns on.
• CH□ Output off-time current error (b14 of Un\G5 to Un\G8) turns on.</td></tr>
</table>

Alarm code (hexadecimal) *1	Cause	Operation at alarm occurrence	Action
06□A_H	Alert 1 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (XnC to XnF) turns on. • CH□ Alert 1 (b8 of Un\G5 to Un\G8) turns on.	When Error reset instruction (Yn2) is turned OFF → ON → OFF after the temperature process value (PV) is restored after going into alert status, Write data error code (Un\G0) is cleared to 0. The following flags and buffer memory bits that turn on when an alarm occurs turn off automatically when the temperature process value (PV) is restored from alert status. • CH□ Alert occurrence flag (XnC to XnF) • The applicable bit (Page 89, Section 3.4.2 (3)) of CH□ Alert definition (Un\G5 to Un\G8)
07□A_H	Alert 2 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (XnC to XnF) turns on. • CH□ Alert 2 (b9 of Un\G5 to Un\G8) turns on.	
08□A_H	Alert 3 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (XnC to XnF) turns on. • CH□ Alert 3 (b10 of Un\G5 to Un\G8) turns on.	
09□A_H	Alert 4 has occurred.	• The ALM LED turns on. • CH□ Alert occurrence flag (XnC to XnF) turns on. • CH□ Alert 4 (b11 of Un\G5 to Un\G8) turns on.	

*1 □ represents the number of the channel (1_H to 4_H) where the alarm occurred.

Remark

- The error code is always given priority over the alarm code for being stored in Write data error code (Un\G0). For that reason, when an alarm occurs during an error, the alarm code is not stored in Write data error code (Un\G0). Further, when an error occurs during an alarm, the error code is written over the alarm code in Write data error code (Un\G0).
- Alarm priorities are as follows.

  Priority

  High 01□A_H, 02□A_H, 03□A_H, 04□A_H, 05□A_H

  ↑

  Low 06□A_H, 07□A_H, 08□A_H, 09□A_H,

  When an alarm occurs, if its priority is the same as or higher than that of alarms already occurred, the new alarm code is written over Write data error code (Un\G0).

8.8 Check the Q64TCN Status

The error code and hardware status can be checked by selecting "Module's Detailed Information" of the Q64TCN in the system monitor of the programming tool.

(1) Operating the programming tool

From [Diagnostics] ⇨ [System Monitor...] ⇨ "Main Base", select Q64TCN ⇨ Detailed Information .

(2) Module's Detailed Information

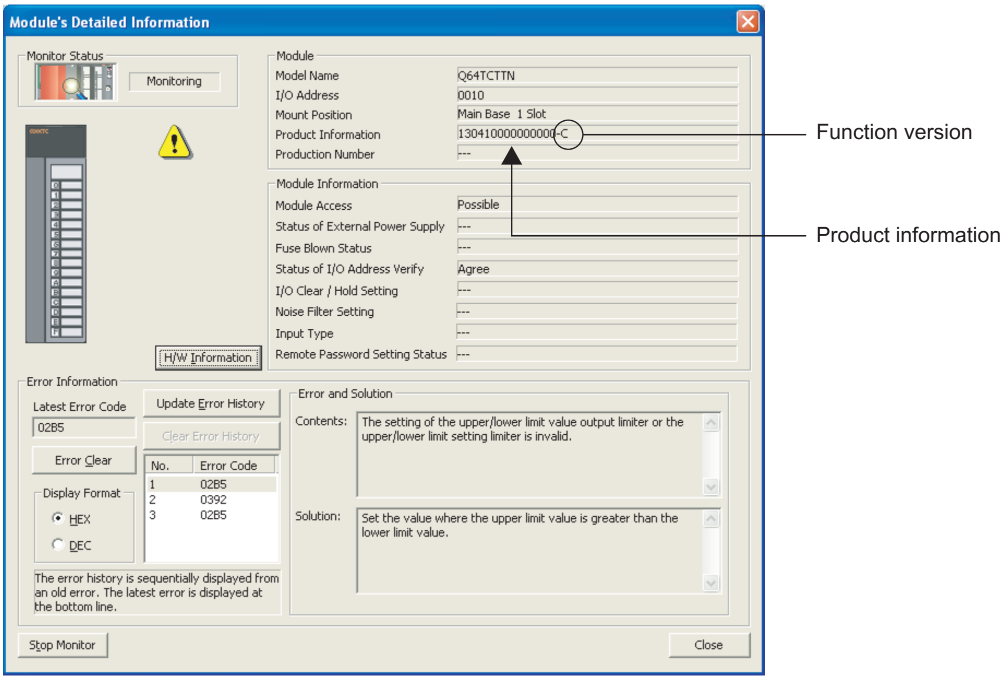
(a) Checking the function version and product information

The Product Information field shows the Q64TCN function version and product information.

(b) Checking the error code

The Latest Error Code field shows the error code stored in Write data error code (Un\G0) in the Q64TCN.

(Press Update Error History to display the content shown under Latest Error Code as No.1.)



(3) Hardware information

On the "Module's Detailed Information" window, click H/W Information .

(a) H/W LED information

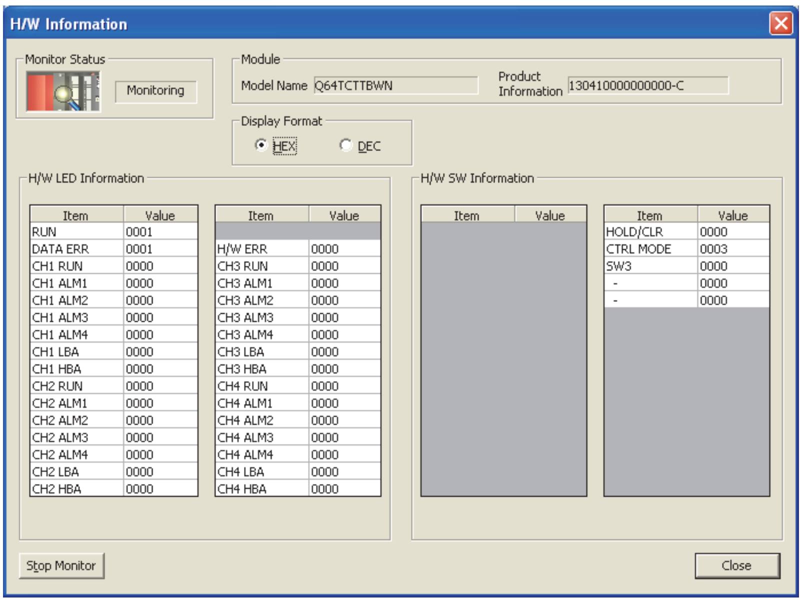
The following information is displayed.

Item	Value	Condition that results in 0001_H
RUN	• 0000_H: off • 0001_H: on	Operating normally (same as the RUN LED)
DATA ERR		A write data error has occurred
CH□ RUN		PID control is being run
CH□ ALM1		Alert 1 is on
CH□ ALM2		Alert 2 is on
CH□ ALM3		Alert 3 is on
CH□ ALM4		Alert 4 is on
CH□ LBA		A loop disconnection has been detected
CH□ HBA		Either of the following has been detected. (the Q64TCTTBWN and Q64TCRTBWN only) • Heater disconnection • Output off-time current error
H/W ERR		A hardware error has occurred

(b) H/W switch information

The setting status of the intelligent function module switch setting is displayed.

Item	Intelligent function module switch setting	Value
HOLD/CLR	Switch 1: Output setting at CPU stop error	Refer to Page 305, Section 6.2
CTRL MODE	Switch 2: Control mode selection	
SW3	Switch 3: • Auto-setting at input range change • Setting change rate limiter • Moving averaging process setting	



APPENDICES

Appendix 1 Addition and Change of Functions

Appendix 1.1 Additional function

The following table shows the function added to the Q64TCN and the product information of the Q64TCN that supports the additional function.

Additional function	Product information	Applicable GX Works2 version	Reference
Moving averaging process to a temperature process value (PV)	The first five digits are 14062 or later.	1.91V or later	Page 197, Section 4.10
During AT loop disconnection detection function	The first five digits are 15042 or later.	1.501X or later	Page 261, Section 4.23
CH☐ AT error status monitor (Un\G789 to Un\G792)	The first five digits are 18022 or later.	—	Page 163, Section 3.4 (90)

Appendix 1.2 Change of functions

The following table shows the changed functions of the Q64TCN and the product information of the Q64TCN that supports the changed functions.

Changed function	Product information	Applicable GX Works2 version	Reference
Function extension bit monitor (Un\G787)	The first five digits are 14062 or later.	1.91V or later	Page 381, Appendix 1 (1)
Intelligent function module switch setting			Page 381, Appendix 1 (2)

(1) Function extension bit monitor (Un\G787)

The following contents set in the intelligent function module switch setting are stored.

- "Auto-setting at Input Range Change"
- "Setting Change Rate Limiter"
- "Moving Averaging Process Setting"

(a) When using the Q64TCN that does not support this function

Because the module does not support "Moving Averaging Process Setting", setting contents of "Moving Averaging Process Setting" cannot be checked.

(2) Intelligent function module switch setting

Whether to perform the moving averaging process can be selected in the intelligent function module switch setting.

(a) When using the Q64TCN that does not support this function

The moving averaging process setting cannot be configured in the intelligent function module switch setting.

Appendix 2 Comparison of the Q64TCN with the Q64TCTT, Q64TCTTBW, Q64TCRT, and Q64TCRTBW

The Q64TCN has several new functions in addition to the functions of the Q64TCTT, Q64TCTTBW, Q64TCRT, and Q64TCRTBW (hereafter abbreviated as the Q64TC).
This section describes the comparison of functions, I/O signals, and buffer memory between the Q64TCN and Q64TC in accordance with the addition of the new functions. Precautions on replacing modules are also explained.

(1) Comparison of the functions between the Q64TCN and the Q64TC

The following table lists the functions supported by the Q64TCN and the Q64TC.

○: Usable, △: Partially usable, ×: Unusable

Function	Q64TC	Q64TCN	Remarks
Control mode selection function	×	○	—
Control output setting at CPU stop error	○	○	—
Control method selection function	×	○	—
Manual reset function	×	○	—
Manual control	○	○	—
Auto tuning function	○	○	—
Simple two-degree-of-freedom	○	○	—
Derivative action selection function	×	○	—
Setting change rate limiter setting function	△	○	The temperature rise/temperature drop batch setting or individual setting can be selected on Switch Setting with the Q64TCN. (☞ Page 196, Section 4.9)
Temperature process value (PV) scaling function	×	○	—
Moving averaging process to a temperature process value (PV)	×	○	—
Alert function	△	○	The reference set value (SV) for the deviation alert can be selected from among the following buffer memory areas with the Q64TCN. (☞ Page 200, Section 4.12) • CH☐ Set value (SV) monitor (Un\G25 to Un\G28) • CH☐ Set value (SV) setting (Un\G34, Un\G66, Un\G98, Un\G130)
RFB limiter function	○	○	—
Sensor correction function	△	○	Errors can be corrected by setting any two points (corrected offset value and corrected gain value) with the Q64TCN. (☞ Page 219, Section 4.14 (2))
Auto-setting at input range change	×	○	—
Input/output (with another analog module) function	×	○	—
ON delay output function	○	○	—
Self-tuning function	×	○	—
Peak current suppression function	×	○	—
Simultaneous temperature rise function	×	○	—

Function	Q64TC	Q64TCN	Remarks
Forward/reverse action selection function	○	○	—
Loop disconnection detection function	○	○	—
During AT loop disconnection detection function	×	○	—
Proportional band setting function	×	○	—
Cooling method setting function	×	○	—
Overlap/dead band function	×	○	—
Temperature conversion function (using unused channels)	×	○	—
Heater disconnection detection function	○	○	—
Output off-time current error detection function	○	○	—
Buffer memory data backup function	○	○	—
Error history function	×	○	—
Module error history collection function	×	○	—
Error clear function	×	○	—

(2) Comparison of I/O signals

The same I/O signals can be used for the Q64TCN in the standard control and the Q64TC.

(3) Comparison of buffer memory

○: Usable, △: Partially usable, ×: Unusable

Buffer memory	Q64TC	Q64TCN	Remarks
CH□ AT error status monitor	×	△	The Q64TCN with the serial number (first five digits) of 18022 or later can use this buffer memory area.

Point

Buffer memory addresses are written in hexadecimal in the Q64TC manual*1, while they are written in decimal (Intelligent function module device (Un\G□)) in this manual.
Although the addresses are differently written, buffer memory areas with the same function have the same address.

*1 Temperature Control Module User's Manual

Appendix 2.1 Compatibility between the Q64TC and Q64TCN

(1) Restrictions when setting parameters on GX Works2

When the module added to a project on GX Works2 and the mounted module are different, the following restrictions apply.

Mounted module	Module added to a project	Restriction
Q64TC	Q64TCN	The sequence program cannot be executed.
Q64TCN	Q64TC	The sequence program can be executed. However, only functions supported by the Q64TC can be used.

(2) Restrictions when online module change is performed

When the online module change is performed between the Q64TC and Q64TCN, the following restrictions apply.

Details of online module change	Restriction
Q64TC → Q64TCN	Online module change can be performed. However, only functions supported by the Q64TC can be used.
Q64TCN → Q64TC	Online module change cannot be performed.

(3) Restrictions when changing modules or applying a sequence program

When modules are changed between the Q64TC and Q64TCN and a sequence program is applied, the following restrictions apply.

○: Possible, ×: Not possible

How to change modules and how to apply a sequence program	Restriction	
	Module change	Applying a sequence program
Q64TC → Q64TCN	○ *1	○ *1
Q64TCN → Q64TC	×	×

*1 Only functions supported by the Q64TC can be used.

Appendix 3 When Using GX Developer and GX Configurator-TC

This section describes how to configure the setting using GX Developer and GX Configurator-TC.

(1) Applicable software version

For the applicable software versions, refer to the following.

Page 32, Section 2.1 (4)

Appendix 3.1 GX Developer operation

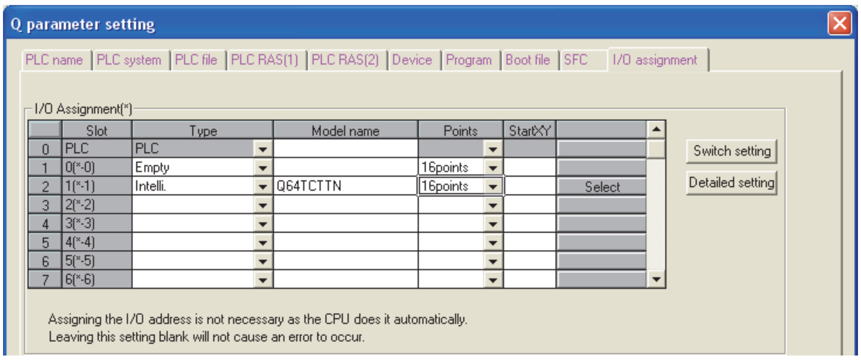
Configure the setting on the following windows when using GX Developer.

Window name	Application	Reference
I/O assignment	Set the type of a module to be connected and the range of I/O signal.	Page 385, Appendix 3.1 (1)
Intelligent function module switch setting	Configure the switch setting of the intelligent function module.	Page 386, Appendix 3.1 (2)

(1) I/O assignment

Configure the setting on "I/O assignment" in "PLC Parameter".

Parameter ⇨ [PLC Parameter] ⇨ [I/O assignment]

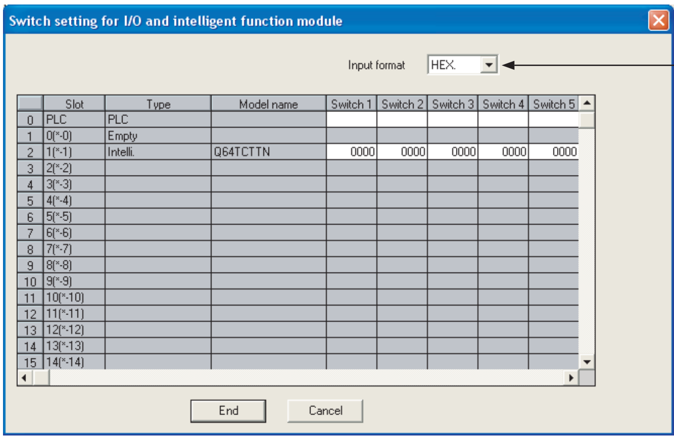


Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the module.
Points	• For the Q64TCTTN or Q64TCRTN: Select "16 points". • For the Q64TCTTBWN or Q64TCRTBWN: Use two slots. Select "Empty" and "16 points" for the first slot. Select "Intelli." and "16 points" for the second slot.
Start XY	Enter an arbitrary start I/O number of the Q64TCN.

(2) Intelligent function module switch setting

Configure the setting on "Switch setting" in "PLC parameter".

Parameter ➪ [PLC Parameter] ➪ [I/O assignment] ➪ Click Switch setting.



Select "HEX.".

Item	Setting item		
Switch 1	Control output HOLD/CLEAR setting		
	□□□□ H CH4 CH3 CH2 CH1	Set value	Output setting
		0	CLEAR
		Other than 0	HOLD
Switch 2	Control mode selection		
	Set value*1	Control mode	Number of control loops
	0000_H	Standard control	Standard control 4 loops
	0001_H	Heating-cooling control (normal mode)	Heating-cooling control 2 loops
	0002_H	Heating-cooling control (expanded mode)*2	Heating-cooling control 4 loops
	0003_H	Mix control (normal mode)	Heating-cooling control 1 loop Standard control 2 loops
	0004_H	Mix control (expanded mode)*2	Heating-cooling control 2 loops Standard control 2 loops
Switch 3	Function extension bit specification		
Switch 4	0: Fixed (empty)		
Switch 5	0: Fixed (empty)		

Switch 3 (Function extension bit specification):

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		

b15 to b4: Fixed to 0
b2: Fixed to 0

b0: Auto-setting at input range change
0: Disable
1: Enable

b1: Setting change rate limiter setting
0: Temperature rise/Temperature drop batch setting
1: Temperature rise/Temperature drop individual setting

b3: Moving averaging process setting
0: Enable
1: Disable

*1 When a value other than 0 to 4 is set, a switch setting error (error code: $000F_H$) occurs. In this case, the Q64TCN does not operate properly. Set the correct value. Immediately after the control mode selection is changed, a set value discrepancy error (error code: $001E_H$) occurs. To clear the set value discrepancy error, turn off, on, and off E^2PROM backup instruction (Yn8).

*2 Control in the expanded mode requires an external output module. For the system configuration in expanded mode, refer to Page 170, Section 4.1 (3).

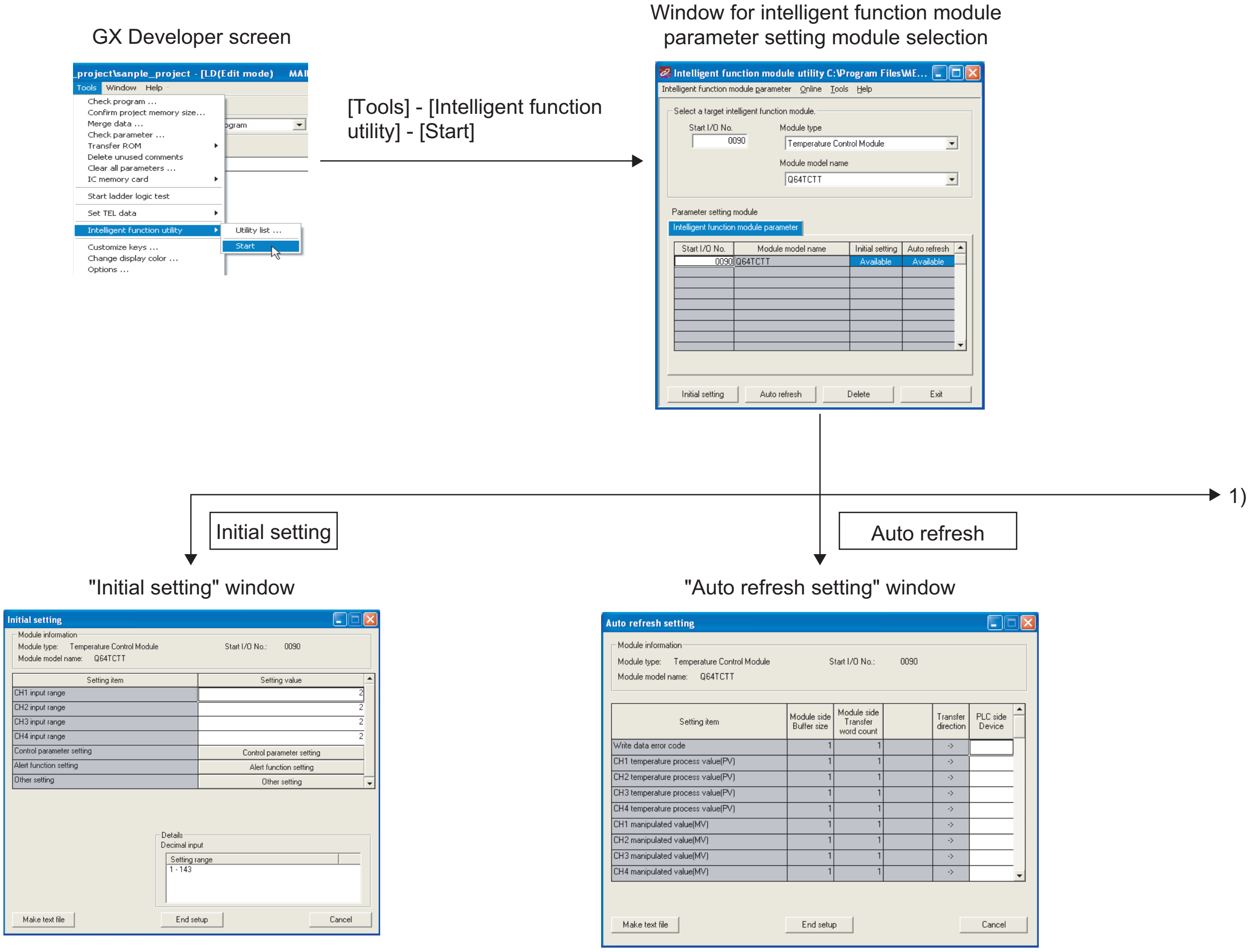
Appendix 3.2 GX Configurator-TC operation

When the Q64TCN parameters are configured using GX Configurator-TC, the display method and contents on windows such as the setting window are different from those on GX Works2.

(1) Window display method

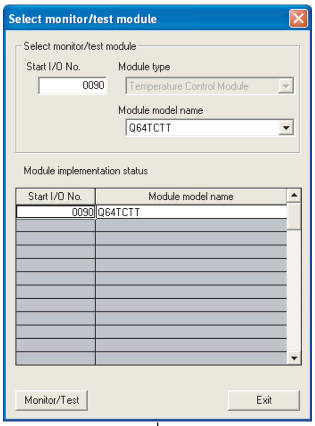
The following table lists the window display method on GX Configurator-TC.

Window name	Application
Initial setting	Parameters such as the input range and set value (SV) can be set.
Auto refresh setting	Buffer memory data can be transferred to specified devices.
Monitor/test	Monitor/test can be performed on buffer memory and I/O signals.



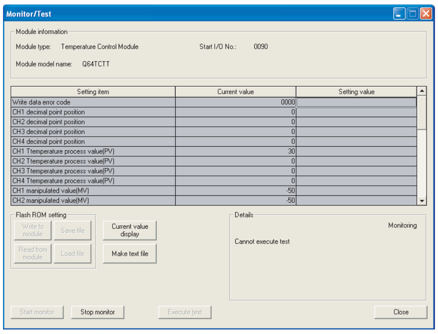
1) [Online] - [Monitor/Test]

"Select monitor/test module" window



Select a module to be monitored/tested.

"Monitor/Test" window



The "Module model name" is displayed as shown below.

- For the Q64TCTTp: Q64TCTT
- For the Q64TCRTN: Q64TCRT
- For the Q64TCTTBWN: Q64TCTTBW
- For the Q64TCRTBWN: Q64TCRTBW

(2) GX Configurator-TC functions

The following table shows the functions of GX Configurator-TC.

Function	Description
Initial setting	Configure the initial settings for each channel to operate the Q64TCN. Set the data for items that require an initial setting. • CH□ input range • CH□ set value (SV) setting • CH□ proportional band (P) setting (× 0.1%) • CH□ integral time (I) setting (Unit: s) • CH□ derivative time (D) setting (Unit: s) • CH□ control output period setting (Unit: s) • CH□ control response parameter • CH□ stop mode setting • PID continuation flag • CH□ alert 1 mode setting • CH□ alert set value 1 • CH□ alert 2 mode setting • CH□ alert set value 2 • CH□ alert 3 mode setting • CH□ alert set value 3 • CH□ alert 4 mode setting • CH□ alert set value 4 • Alert dead band setting (× 0.1%) • Alert delay count • CH□ loop disconnection detection judgment time (Unit: s) • CH□ loop disconnection detection dead band • CH□ heater disconnection alert setting (%) • Heater disconnection/output off-time current error detection delay count • Heater disconnection compensation function selection • CT monitor method switching • CT□ channel assignment setting • CT□ CT selection • CT□ reference heater current value • CH□ upper setting limiter • CH□ lower setting limiter • CH□ forward/reverse action setting • CH□ setting change rate limiter (× 0.1%/min) • CH□ sensor compensation value setting (× 0.01%) • CH□ primary delay digital filter setting (Unit: s) • CH□ upper output limiter (× 0.1%) • CH□ lower output limiter (× 0.1%) • CH□ output variation limiter (× 0.1%) • CH□ adjustment sensitivity (dead band) setting (× 0.1%) • CH□ AT bias • CH□ auto tuning mode selection • CH□ unused channel setting • Transistor output monitor ON delay time setting (× 10ms) • Manipulated value resolution switching • Temperature rise completion range setting (Unit: deg.) • Temperature rise completion soak time setting (Unit: min) The initial settings are written in the CPU module. Turning the CPU module to RUN automatically writes the setting data into the Q64TCN and the settings become enabled.

Function	Description	
Auto refresh setting	Set the buffer memory for each channel in the Q64TCN where auto refresh is performed.	
	• Write data error code	• CH☐ alert definition
	• CH☐ temperature process value (PV)	• CH☐ alert set value 1
	• CH☐ manipulated value (MV)	• CH☐ alert set value 2
	• CH☐ set value (SV) setting	• CH☐ alert set value 3
	• CH☐ proportional band (P) setting	• CH☐ alert set value 4
	• CH☐ integral time (I) setting	• CT☐ heater disconnection alert setting
	• CH☐ derivative time (D) setting	• CT☐ heater current process value
	• CH☐ loop disconnection detection judgment time	• CH☐ manipulated value (0-4000/0-12000/0-16000)
	• CH☐ transistor output flag	• CH☐ temperature rise judgment flag
	Values stored in the buffer memory in the Q64TCN where the auto refresh setting is configured are automatically read when the CPU module executes END instruction.	
Monitor/test	Monitor/test the buffer memory and I/O signals of the Q64TCN. Also the auto tuning function can be executed.	
	• Write data error code	• CH☐ Alert 2
	• CH☐ decimal point position	• CH☐ Alert 3
	• CH☐ temperature process value (PV)	• CH☐ Alert 4
	• CH☐ manipulated value (MV)	• CH☐ Heater disconnection alert
	• CH☐ set value (SV) setting	• CH☐ Loop disconnection alert
	• CH☐ transistor output flag	• CH☐ Output off-time current error alert
	• CH☐ ON delay output	• CH☐ alert 1 mode setting
	• Cold junction temperature process value	• CH☐ alert set value 1
	• X00: Module ready flag	• CH☐ alert 2 mode setting
	• X01: Operation mode status	• CH☐ alert set value 2
	• X02: Write error flag	• CH☐ alert 3 mode setting
	• X03: Hardware error flag	• CH☐ alert set value 3
	• X04: CH1 auto tuning status	• CH☐ alert 4 mode setting
	• X05: CH2 auto tuning status	• CH☐ alert set value 4
	• X06: CH3 auto tuning status	• Alert dead band setting (× 0.1%)
	• X07: CH4 auto tuning status	• Alert delay count
	• X08: E^2PROM write completion flag	• CH☐ loop disconnection detection judgment time (Unit: s)
	• X09: Default value write completion flag	• CH☐ loop disconnection detection dead band
	• X0A: E^2PROM write failure flag	• CH☐ heater disconnection alert setting (%)
	• X0B: Setting change completion flag	• Heater disconnection/output off-time current error detection delay count
	• X0C: CH1 alert flag	• Heater disconnection compensation function selection
	• X0D: CH2 alert flag	• CT monitor method switching
	• X0E: CH3 alert flag	• CT☐ heater current process value
	• X0F: CH4 alert flag	• CT☐ channel assignment setting
	• Y01: Operation mode command	• CT☐ CT selection
	• Y02: Error reset command	• CT☐ reference heater current value

Function	Description	
Monitor/test	• Y04: CH1 auto tuning start command	• CH□ manipulated value (0-4000/0-12000/0-16000)
	• Y05: CH2 auto tuning start command	• manipulated value resolution Change switching
	• Y06: CH3 auto tuning start command	• CH□ temperature rise judgment flag
	• Y07: CH4 auto tuning start command	• Temperature rise completion range setting (Unit: deg.)
	• Y08: E^2PROM backup start command	• Temperature rise completion soak time setting (Unit: min)
	• Y09: Default setting registration start command	• CH□ input range
	• Y0B: Setting change command	• CH□ upper setting limiter
	• Y0C: CH1 forced PID control stop command	• CH□ lower setting limiter
	• Y0D: CH2 forced PID control stop command	• CH□ forward/reverse action setting
	• Y0E: CH3 forced PID control stop command	• CH□ setting change rate limiter (× 0.1%/min)
	• Y0F: CH4 forced PID control stop command	• CH□ sensor compensation value setting (× 0.01%)
	• CH□ proportional band (P) setting (× 0.1%)	• CH□ primary delay digital filter setting (Unit: s)
	• CH□ integral time (I) setting (Unit: s)	• CH□ upper output limiter (× 0.1%)
	• CH□ derivative time (D) setting (Unit: s)	• CH□ lower output limiter (× 0.1%)
	• CH□ PID constants read command from EEPROM	• CH□ output variation limiter (× 0.1%)
	• CH□ EEPROM PID constant read completion flag	• CH□ adjustment sensitivity (dead band) setting (× 0.1%)
	• CH□ EEPROM PID constant read abnormal completion flag	• CH□ AT bias
	• CH□ control output period setting (Unit: s)	• CH□ unused channel setting
	• CH□ control response parameter	• Transistor output monitor ON delay time setting (× 10ms)
	• CH□ stop mode setting	• CH□ MAN mode shift completion flag
	• PID continuation flag	• CH□ AUTO/MAN mode switching
	• CH□ alert definition Temperature process value (PV) upper limit cross alert	• CH□ MAN output setting (× 0.1%)
	• CH□ Temperature process value (PV) lower limit cross alert	• Auto tuning
	• CH□ Alert 1	

A

Appendix 4 Online Module Change Procedure (When Using GX Developer)

This appendix describes the online module change procedure using GX Developer.

Before performing an online module change, carefully read the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

Appendix 4.1 Precautions on online module change

Precautions on an online module change are listed below.

- When an online module change is performed, not all set values are inherited by the module after the change. After the online module change, write the set values in the changed module again.
- When an online module change is performed, properly follow the procedure. (Page 398, Appendix 4.4) Not doing so may cause malfunction and failure.
- Before performing an online module change, check that the system outside of the programmable controller does not malfunction.
- Prepare methods, such as a switch, that disconnect individually the external power supply for the module to be changed online and the power supply for external devices to prevent electric shock and malfunction of the module during transportation.
- Record the content to save (data of the writable buffer memory (Page 394, Appendix 4.2 (5))) beforehand, because the buffer memory data may not be saved normally in the event that the module malfunctions.
- Even if pre-recorded data are set to the buffer memory in the module that was changed online and control is restarted, the following areas are cleared when control is stopped. Therefore, control cannot be restarted in the same control status.

• CH□ Manipulated value (MV) (Un\G13 to Un\G16)
• CH□ Manipulated value for heating (MVh) (Un\G13 to Un\G16)
• CH□ Manipulated value for cooling (MVc) (Un\G704 to Un\G707)

- Even if an alert occurs before performing an online module change, the same alert does not necessarily occur when the control is restarted. For example, if an upper limit alert with standby is set and the alert occurs before performing an online module change, the module goes into the standby status and the alert does not occur when the control is restarted after performing the online module change.
- To check the following items, it is recommended to perform the online module change on the actual system and verify that the operation of modules not to be changed is not affected.

• The method and configuration to disconnect the connection with external devices are correct.
• Turning off, on, and off the switch has no influence.

- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit may cause malfunction.

Appendix 4.2 Conditions for online module change

To perform an online module change, a CPU module, a MELSECNET/H remote I/O module, the Q64TCN, GX Developer, and a base unit as listed below are required.

Remark

The Q64TCN with the function version C supports the online module change since it was first released.

(1) CPU module

A Process CPU or Redundant CPU is required.

For the precautions on the multiple CPU system configuration, refer to the following.

QCPU User's Manual (Multiple CPU System)

For the precautions on the redundant system configuration, refer to the following.

QnPRHCPU User's Manual (Redundant System)

(2) MELSECNET/H remote I/O module

A module with function version D or later is required.

(3) GX Developer

GX Developer version 7.10L or later is required.

To perform an online change on a remote I/O station, GX Developer version 8.17T or later is required.

(4) Base unit

- When a slim type main base unit (Q3□SB) is used, an online module change cannot be performed.
- When an extension base unit (Q5□B) that does not require the power supply module is used, an online module change cannot be performed for modules on all the base units connected.

(5) Buffer memory areas that can be saved and restored

The following table lists the buffer memory areas that can be saved and restored.

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH□ Input range	Un\G32	Un\G64	Un\G96	Un\G128	Page 98, Section 3.4.2 (12)
CH□ Stop mode setting	Un\G33	Un\G65	Un\G97	Un\G129	Page 105, Section 3.4.2 (13)
CH□ Set value (SV) setting	Un\G34	Un\G66	Un\G98	Un\G130	Page 106, Section 3.4.2 (14)
CH□ Proportional band (P) setting	Un\G35	Un\G67	Un\G99	Un\G131	Page 107, Section 3.4.2 (15)
CH□ Integral time (I) setting	Un\G36	Un\G68	Un\G100	Un\G132	Page 109, Section 3.4.2 (16)
CH□ Derivative time (D) setting	Un\G37	Un\G69	Un\G101	Un\G133	Page 109, Section 3.4.2 (17)
CH□ Alert set value 1	Un\G38	Un\G70	Un\G102	Un\G134	Page 110, Section 3.4.2 (18)
CH□ Alert set value 2	Un\G39	Un\G71	Un\G103	Un\G135	
CH□ Alert set value 3	Un\G40	Un\G72	Un\G104	Un\G136	
CH□ Alert set value 4	Un\G41	Un\G73	Un\G105	Un\G137	
CH□ Upper limit output limiter	Un\G42	Un\G74	Un\G106	Un\G138	Page 112, Section 3.4.2 (19)
CH□ Lower limit output limiter	Un\G43	Un\G75	Un\G107	Un\G139	
CH□ Output variation limiter setting	Un\G44	Un\G76	Un\G108	Un\G140	Page 114, Section 3.4.2 (20)

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CH☐ Sensor correction value setting	Un\G45	Un\G77	Un\G109	Un\G141	Page 115, Section 3.4.2 (21)
CH☐ Adjustment sensitivity (dead band) setting	Un\G46	Un\G78	Un\G110	Un\G142	Page 115, Section 3.4.2 (22)
CH☐ Control output cycle setting	Un\G47	Un\G79	Un\G111	Un\G143	Page 116, Section 3.4.2 (23)
CH☐ Primary delay digital filter setting	Un\G48	Un\G80	Un\G112	Un\G144	Page 117, Section 3.4.2 (24)
CH☐ Control response parameters	Un\G49	Un\G81	Un\G113	Un\G145	Page 118, Section 3.4.2 (25)
CH☐ AUTO/MAN mode shift	Un\G50	Un\G82	Un\G114	Un\G146	Page 119, Section 3.4.2 (26)
CH☐ MAN output setting	Un\G51	Un\G83	Un\G115	Un\G147	Page 120, Section 3.4.2 (27)
CH☐ Setting change rate limiter/Setting change rate limiter (temperature rise)	Un\G52	Un\G84	Un\G116	Un\G148	Page 121, Section 3.4.2 (28)
CH☐ AT bias	Un\G53	Un\G85	Un\G117	Un\G149	Page 122, Section 3.4.2 (29)
CH☐ Forward/reverse action setting	Un\G54	Un\G86	Un\G118	Un\G150	Page 123, Section 3.4.2 (30)
CH☐ Upper limit setting limiter	Un\G55	Un\G87	Un\G119	Un\G151	Page 124, Section 3.4.2 (31)
CH☐ Lower limit setting limiter	Un\G56	Un\G88	Un\G120	Un\G152	
CH☐ Heater disconnection alert setting	Un\G58	Un\G90	Un\G122	Un\G154	Page 125, Section 3.4.2 (32)
CH☐ Loop disconnection detection judgment time	Un\G59	Un\G91	Un\G123	Un\G155	Page 126, Section 3.4.2 (33)
CH☐ Loop disconnection detection dead band	Un\G60	Un\G92	Un\G124	Un\G156	Page 127, Section 3.4.2 (34)
CH☐ Unused channel setting	Un\G61	Un\G93	Un\G125	Un\G157	Page 128, Section 3.4.2 (35)
CH☐ E^2PROM's PID constants read instruction	Un\G62	Un\G94	Un\G126	Un\G158	Page 129, Section 3.4.2 (36)
CH☐ Automatic backup setting after auto tuning of PID constants	Un\G63	Un\G95	Un\G127	Un\G159	Page 130, Section 3.4.2 (37)
CH☐ Alert dead band setting	Un\G164				Page 131, Section 3.4.2 (38)
CH☐ Number of alert delay	Un\G165				Page 131, Section 3.4.2 (39)
CH☐ Heater disconnection/output off-time current error detection delay count	Un\G166				Page 132, Section 3.4.2 (40)
CH☐ Temperature rise completion range setting	Un\G167				Page 132, Section 3.4.2 (41)
CH☐ Temperature rise completion soak time setting	Un\G168				Page 133, Section 3.4.2 (42)
CH☐ PID continuation flag	Un\G169				Page 133, Section 3.4.2 (43)
CH☐ Heater disconnection compensation function selection	Un\G170				Page 133, Section 3.4.2 (44)
CH☐ Transistor output monitor ON delay time setting	Un\G175				Page 134, Section 3.4.2 (45)
CH☐ CT monitor method switching	Un\G176				Page 134, Section 3.4.2 (46)
CH☐ Resolution of the manipulated value for output with another analog module	Un\G181				Page 136, Section 3.4.2 (48)
CH☐ Cold junction temperature compensation selection	Un\G182				Page 137, Section 3.4.2 (49)
CH☐ Auto tuning mode selection	Un\G184	Un\G185	Un\G186	Un\G187	Page 138, Section 3.4.2 (51)
CH☐ Alert 1 mode setting	Un\G192	Un\G208	Un\G224	Un\G240	Page 139, Section 3.4.2 (52)
CH☐ Alert 2 mode setting	Un\G193	Un\G209	Un\G225	Un\G241	
CH☐ Alert 3 mode setting	Un\G194	Un\G210	Un\G226	Un\G242	
CH☐ Alert 4 mode setting	Un\G195	Un\G211	Un\G227	Un\G243	
CT☐ CT input channel assignment setting	Un\G264 to Un\G271 (set for each current sensor (CT))				Page 141, Section 3.4.2 (54)

Buffer memory area name	Buffer memory address				Reference
	CH1	CH2	CH3	CH4	
CT☐ CT selection	Un\G272 to Un\G279 (set for each current sensor (CT))				Page 142, Section 3.4.2 (55)
CT☐ Reference heater current value	Un\G280 to Un\G287 (set for each current sensor (CT))				Page 143, Section 3.4.2 (56)

Appendix 4.3 Operations when performing an online module change

The following table shows the operations of the Q64TCN when an online module change is performed.

○: Executed ×: Not executed

User operation	Operation of the Q64TCN	Operation of the CPU module: X/Y refresh	Operation of the CPU module: FROM/TO instructions*1	Operation of the CPU module: Device test	GX Configurator-TC: Initial setting parameters	GX Configurator-TC: Monitor/Test···
(1) Stop the operation. Turn off all the Y signals turned on by the sequence program.	The module is normally operating.	○	○	○	×	○
(2) Remove the module. Start the online module change using GX Developer. ↓ Click the Execution button on GX Developer to enable t he module to be removed. ↓ Remove the selected module.	The operation of the module has stopped. ・The RUN LED turns off.	×	×	×	×	×
(3) Mount a new module. Mount a new module. ↓ After mounting the module, click Execution on GX Developer. Check the operation before the control starts.	The X/Y refresh restarts and the module starts up. ・The RUN LED turns on. ・Default operation (Module READY flag (Xn0) stays off.) (When there are initial setting parameters, the module starts to operate based on the initial setting parameters at this point.)	○	×	×	○	×
(4) Check the operation. Click the Cancel button on GX Developer to turn off the online mode. ↓ On "Device test" on GX Developer or on "Monitor/Test···" on GX Configurator, test the operation of the module. Operation check is completed.	The module operates based on the test operation*2.	○	×	○	×	○
(5) Restart the control. Restart the online module change using GX Developer. Click the Execution button to restart the control.	Module ready flag (Xn0) turns on. ↓ The module operates based on the initial setting sequence program started*2 when Module READY flag (Xn0) is started.	○	○	○	×	○

*1 An access to Intelligent function module device (U□\G□) is included.

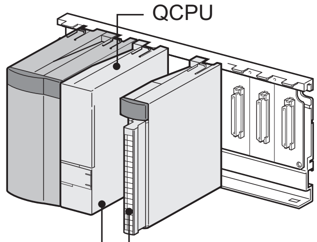
*2 The intelligent function module operates according to the previous setting when the user does not perform any operation.

Appendix 4.4 Online module change procedures

This section describes two online module change procedures: configuring the initial settings using GX Configurator-TC and configuring the initial settings using a sequence program.

(1) System configuration

The following system configuration is used to explain the online module change procedure.



(2) Procedure

The following flow shows the online module change procedure.

Start

↓

Stop the operation. ······ When initial settings are set on GX Configurator-TC
Page 399, Appendix 4.5 (1)
When initial settings are set on a sequence program
Page 403, Appendix 4.6 (1)

↓

Remove the module. ······ When initial settings are set on GX Configurator-TC
Page 400, Appendix 4.5 (2)
When initial settings are set on a sequence program
Page 404, Appendix 4.6 (2)

↓

Mount a new module. ······ When initial settings are set on GX Configurator-TC
Page 401, Appendix 4.5 (3)
When initial settings are set on a sequence program
Page 405, Appendix 4.6 (3)

↓

Check the operation. ······ When initial settings are set on GX Configurator-TC
Page 401, Appendix 4.5 (4)
When initial settings are set on a sequence program
Page 405, Appendix 4.6 (4)

↓

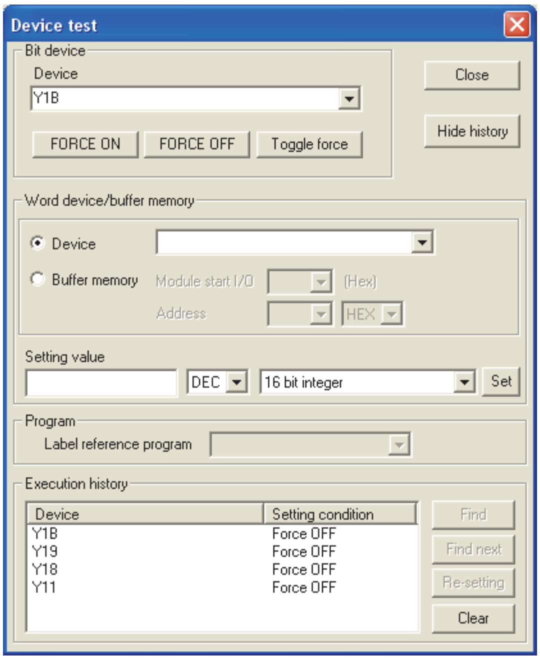
Restart the control. ······ When initial settings are set on GX Configurator-TC
Page 402, Appendix 4.5 (5)
When initial settings are set on a sequence program
Page 407, Appendix 4.6 (5)

↓

End

Appendix 4.5 When GX Configurator-TC was used for the initial setting

(1) Stopping operation



1. Open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

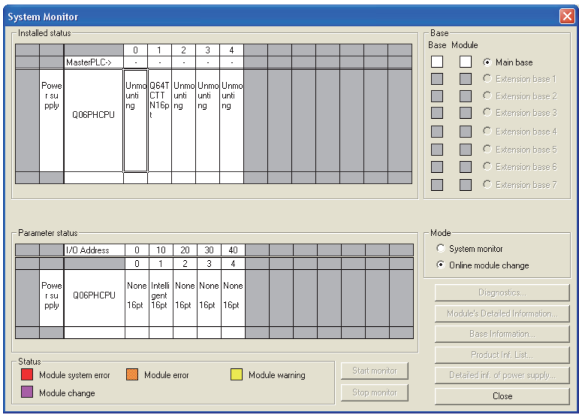
2. Turn off the following output signals to stop the operation of the module.

- Setting/operation mode instruction (Yn1)
- E^2PROM backup instruction (Yn8)
- Default setting registration instruction (Yn9)
- Setting change instruction (YnB)

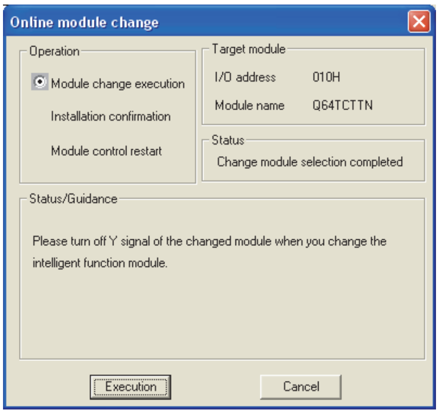
Point

When PID continuation flag (Un\G169) is set to Continue (1), control does not stop even if Setting/operation mode instruction (Yn1) is turned off. Change PID continuation flag (Un\G169) to Stop (0) and turn off Setting/operation mode instruction (Yn1).
Whether the control has been stopped can be checked by Setting/operation mode status (Xn1) being off.

(2) Removing a module



↓



1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online module change...]

2. **Select "Online module change" under the "Mode" field and double-click the module to be changed online.**

3. **Click** Execution **to enable a module change.**

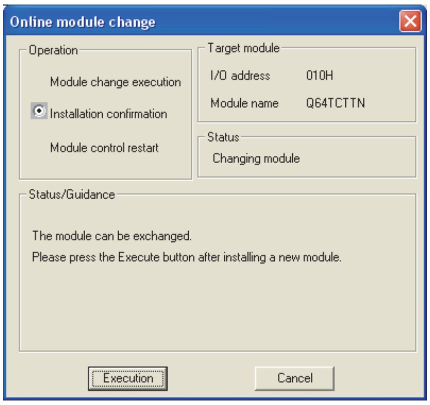
4. **When the following error window appears, click** OK **and perform the operation described on and after Page 401, Appendix 4.5 (3).**

5. **Check that the RUN LED on the module is off, disconnect the external cable, and remove the module.**

Point

- If the terminal block is removed, the temperature process value (PV) may vary within the accuracy range due to the individual differences in the cold junction temperature compensation resistors (the Q64TCTTN and Q64TCTTBWN only).
- Remove the module before installation confirmation. If the installation confirmation is executed without removing the module, the module does not start up normally and the RUN LED does not turn on.

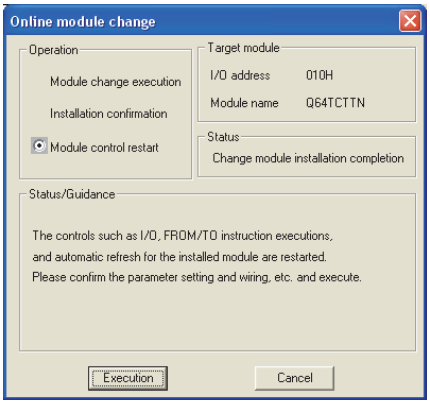
(3) Mounting a new module



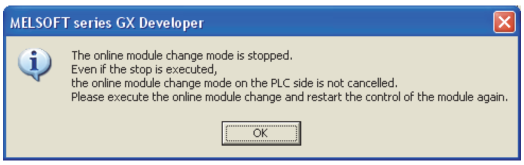
1. Mount a new module in the same slot and connect the external cable.

2. When the module is mounted, click Execution, and check that the RUN LED is on. Module READY flag (Xn0) remains off.

(4) Checking operation



↓



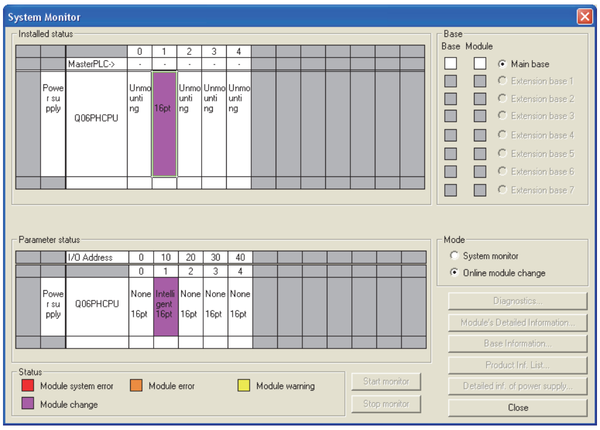
↓

(To the next page)

1. To check the operation, click Cancel to cancel the control start.

2. Click OK to stop the "Online module change" mode.

(From the previous page)
↓

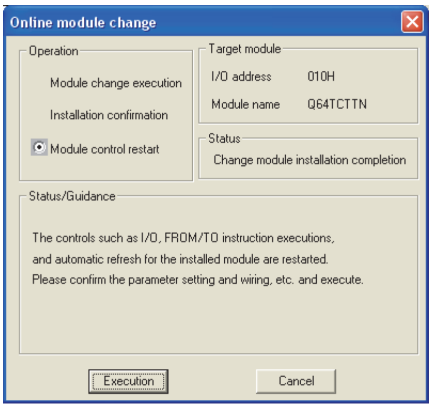


3. **Click Close to close the "System Monitor" window.**

4. **Before restarting the control, check the following items for the Q64TCN. If an error occurs, refer to TROUBLESHOOTING (Page 365, CHAPTER 8) and take corrective action.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Write error flag (Xn2) is off.
- If Hardware error flag (Xn3) is off.

(5) Restarting control



↓

1. **Open the "Online module change" window again.**

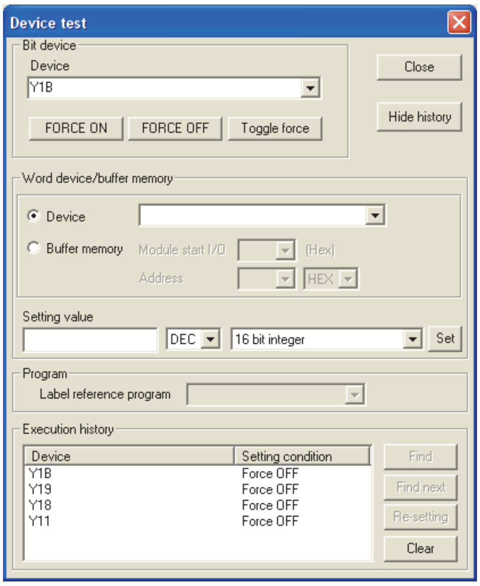
[Diagnostics] ➪ [Online module change...]

2. **When the window appears, click Execution to restart the control. Module READY flag (Xn0) turns on.**

3. **The online module change is complete.**

Appendix 4.6 When a sequence program was used for the initial setting

(1) Stopping operation



1. Open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

2. Turn off the following output signals to stop the operation of the module.

- Setting/operation mode instruction (Yn1)
- E^2PROM backup instruction (Yn8)
- Default setting registration instruction (Yn9)
- Setting change instruction (YnB)

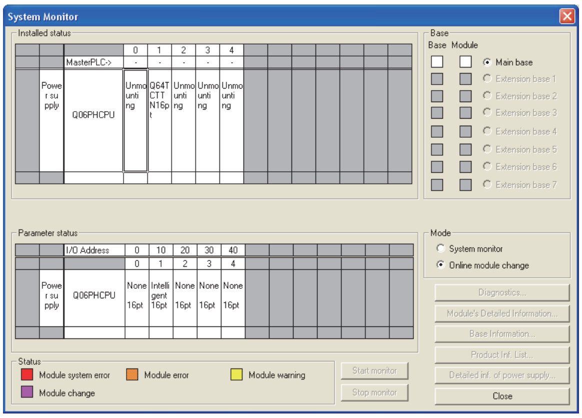
3. If the buffer memory data to be saved beforehand is not recorded, monitor the data in "Buffer memory batch monitor" and record it.

[Online] ⇨ [Monitor] ⇨ [Buffer memory batch...]

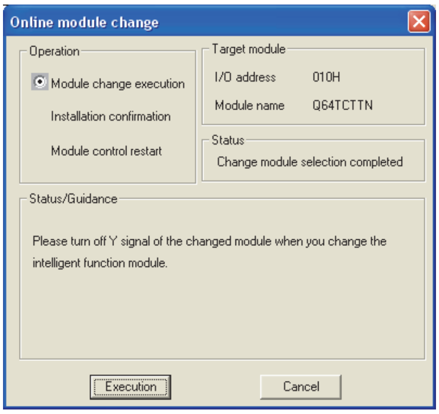
Point

- If PID continuation flag (Un\G169) is set to Continue (1), control does not stop even when Setting/operation mode instruction (Yn1) is turned off. Change PID continuation flag (Un\G169) to Stop (0) and turn off Setting/operation mode instruction (Yn1).
  Whether the control has been stopped can be checked by Setting/operation mode status (Xn1) being off.
- If a CPU continuation error (such as SP.UNIT DOWN and UNIT VERIFY ERR.) is occurring due to an error in the module to be changed, the buffer memory data cannot be saved.

(2) Removing a module



↓



1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online module change...]

2. **Select "Online module change" under the "Mode" field and double-click the module to be changed online.**

3. **Click** 

to enable a module change.

4. **If the following error window appears, click** 

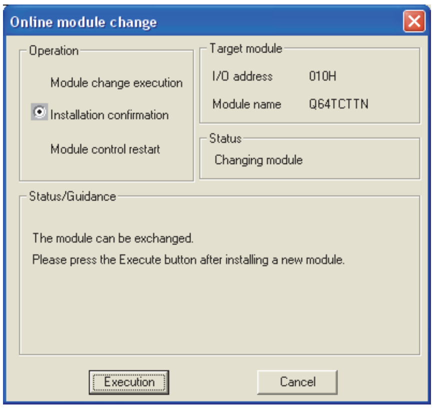
and perform the operation described on and after Page 405, Appendix 4.6 (3).

5. **Check that the RUN LED on the module is off, disconnect the external cable, and remove the module.**

Point

- If the terminal block is removed, the temperature process value (PV) may vary within the accuracy range due to the individual differences in the cold junction temperature compensation resistors (the Q64TCTTN and Q64TCTTBWN only).
- Remove the module before installation confirmation. If the installation confirmation is executed without removing the module, the module does not start up normally and the RUN LED does not turn on.

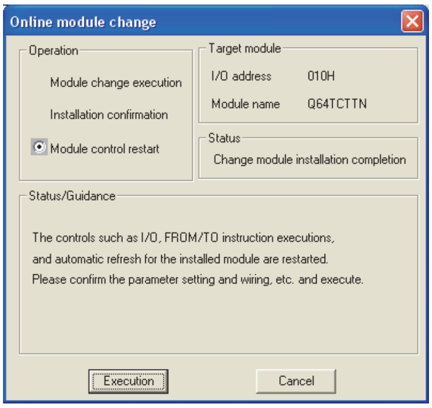
(3) Mounting a new module



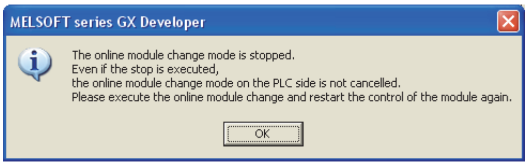
1. Mount a new module in the same slot and connect the external cable.

2. When the module is mounted, click [Execution], and check that the RUN LED is on. Module READY flag (Xn0) remains off.

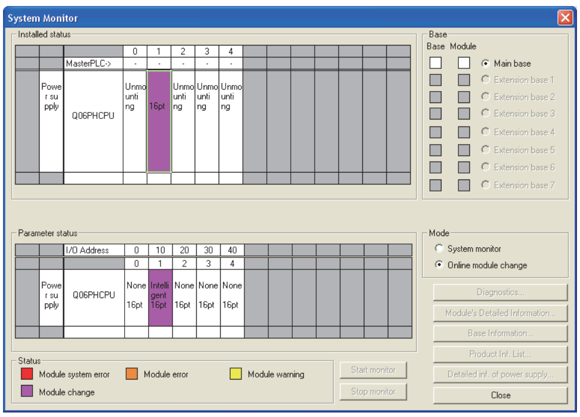
(4) Checking operation



↓



↓



↓

(To the next page)

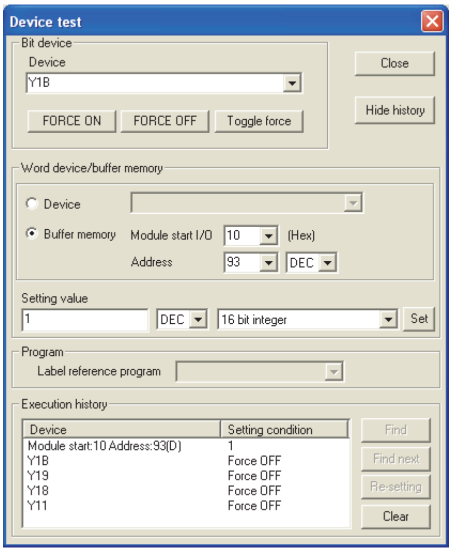
1. To check the operation, click [Cancel] to cancel the control start.

2. Click [OK] to stop the "Online module change" mode.

3. Click [Close] to close the "System Monitor" window.

(From the previous page)

↓



4. **Set the data pre-recorded in the device test to the buffer memory.**

[Online] ⇨ [Debug] ⇨ [Device test...]

5. **To back up the data in E²PROM, turn off and on E²PROM backup instruction (Yn8) and write the buffer memory data to E²PROM.**

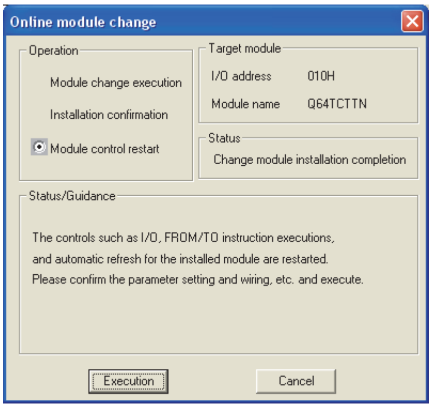
6. **Before restarting the control, check the following items of the Q64TCN. If an error occurs, refer to TROUBLESHOOTING (Page 365, CHAPTER 8) and take corrective action.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Write error flag (Xn2) is off.
- If Hardware error flag (Xn3) is off.

7. **Because the new module is in the default status, configure the initial settings using a sequence program after restarting the control. Before configuring the initial settings, check that the details on the initial setting program are correct.**

- In a standard system configuration
  When Module READY flag (Xn0) in the Q64TCN turns on, use a sequence program where the initial settings are configured. When the control is restarted, Module READY flag (Xn0) turns on and the initial settings are configured. (In a sequence program where the initial settings are configured only for a single scan after RUN, the initial settings are not configured.)
- When using the remote I/O network
  Install a user device (initial setting request signal) where the initial settings are configured at any timing in the sequence program. After the control is restarted, turn on the initial setting request signal and configure the initial settings. (In a sequence program where the initial settings are configured only for a single scan after restarting the remote I/O network data link, the initial settings are not configured.)

(5) Restarting control



↓

1. **Open the "Online module change" window again.**

2. **When the window appears, click [Execution] to restart the control. Module READY flag (Xn0) turns on.**

3. **The online module change is complete.**

Appendix 5 Online Module Change Procedure (When Using GX Works2)

This section describes the online module change procedure of using GX Works2.

When performing an online module change, carefully read the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

Appendix 5.1 Precautions on online module change

This section lists precautions on an online module change.

- When an online module change is performed, not all set values are inherited by the module after the change. After the online module change, write the set values in the changed module again.
- When an online module change is performed, properly follow the instructions. Not doing so may cause malfunction and failure.
- Before performing an online module change, check that the system outside of the programmable controller does not malfunction.
- Prepare methods, such as a switch, that disconnect individually the external power supply for the module to be changed online and the power supply for external devices to prevent electric shock and malfunction of the module during transportation.
- Record the content to save (data of the writable buffer memory (Page 61, Section 3.4)) beforehand, because the buffer memory data may not be saved normally in the event that the module malfunctions.
- Even if pre-recorded data are set to the buffer memory in the module that was changed online and control is restarted, the following areas are cleared when control is stopped. Therefore, control cannot be restarted in the same control status.

• CH□ Manipulated value (MV) (Un\G13 to Un\G16) • CH□ Manipulated value for heating (MVh) (Un\G13 to Un\G16) • CH□ Manipulated value for cooling (MVc) (Un\G704 to Un\G707)

- Even if an alert occurs before performing an online module change, the same alert does not necessarily occur when the control is restarted. For example, if an upper limit alert with standby is set and an alert occurs before performing an online module change, the module goes into the standby status and an alert does not occur when the control is restarted after performing the online module change.
- To check the following items, it is recommended to perform the online module change on the actual system and verify that the operation of modules not to be changed is not affected

• The method and configuration to disconnect the connection with external devices are correct. • Turning off, on, and off the switch has no influence.

- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively.
  Exceeding the limit may cause malfunction.

Appendix 5.2 Online module change conditions

To perform an online module change, a CPU module, a MELSECNET/H remote I/O module, the Q64TCN, GX Works2, and a base unit as listed below are required.

Remark

The Q64TCN with the function version C supports the online module change since it was first released.

(1) CPU module

A Process CPU or Redundant CPU is required.

For the precautions on the multiple CPU system configuration, refer to the following.

QCPU User's Manual (Multiple CPU System)

For the precautions on the redundant system configuration, refer to the following.

QnPRHCPU User's Manual (Redundant System)

(2) MELSECNET/H remote I/O module

A module with function version D or later is required.

(3) GX Works2

GX Works2 with the following version is required according to system configuration.

System configuration	GX Works2 version
Standard system	Version 1.87R or later
Remote I/O station	Version 1.34L or later

(4) Base unit

- When a slim type main base unit (Q3□SB) is used, an online module change cannot be performed.
- When an extension base unit (Q5□B) that does not require the power supply module is used, an online module change cannot be performed for any modules on the base unit.

Appendix 5.3 Operations of when performing an online module change

The following table shows the operations of when performing an online module change.

○: Executed ×: Not executed

User operation	Operation of the Q64TCN	Operation of the CPU module			
		X/Y refresh	FROM/TO instructions*1	Device test	Initial setting parameters
(1) Stop the operation. Turn off all the Y signals turned on by the sequence program.	The module is normally operating.	○	○	○	×
(2) Remove the module. Start the online module change using GX Works2. ↓ Click the Execute button on GX Works2 to enable the module to be removed. ↓ Remove the selected module.	The operation of the module has stopped. ・The RUN LED turns off.	×	×	×	×
(3) Mount a new module. Mount a new module. ↓ After mounting the module, click Execute on GX Works2. Check the operation before the control starts.	The X/Y refresh restarts and the module starts up. ・The RUN LED turns on. ・Default operation (Module READY flag (Xn0) stays off.) (When there are initial setting parameters, the module starts to operate based on the initial setting parameters at this point.)	○	×	×	○
(4) Check the operation. Click the Cancel button on GX Works2 to turn off the online mode. ↓ On "Modify Value ⋯ " on GX Works2, test the operation of the module after replacement. Operation check is completed.	The module operates based on the test operation*1.	○	×	○	×
(5) Restart the control. Restart the online module change using GX Works2. Click the Execute button to restart the control.	Module READY flag (Xn0) turns on. ↓ The module operates based on the initial setting sequence program started*2 when Module READY flag (Xn0) is started.	○	○	○	×

*1 The access to the intelligent function module device (U□\G□) is included.

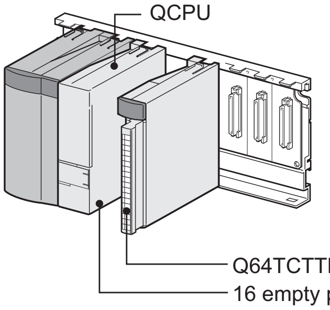
*2 The intelligent function module operates according to the previous setting when the user does not perform any operation.

Appendix 5.4 Online module change procedures

This section describes two online module change procedures: setting parameters using GX Works2 and the setting parameters using a sequence program.

(1) System configuration

The following system configuration is used to explain the online module change procedure.



(2) Procedure

The following flow shows the online module change procedure.

Start

↓

Stop the operation. · · · · ·
When parameters are set on GX Works2
Page 412, Appendix 5.5 (1)
When parameters are set on the sequence program
Page 417, Appendix 5.6 (1)

↓

Remove the module. · · · · ·
When parameters are set on GX Works2
Page 413, Appendix 5.5 (2)
When parameters are set on the sequence program
Page 418, Appendix 5.6 (2)

↓

Mount a new module. · · · · ·
When parameters are set on GX Works2
Page 414, Appendix 5.5 (3)
When parameters are set on the sequence program
Page 419, Appendix 5.6 (3)

↓

Check the operation. · · · · ·
When parameters are set on GX Works2
Page 414, Appendix 5.5 (4)
When parameters are set on the sequence program
Page 419, Appendix 5.6 (4)

↓

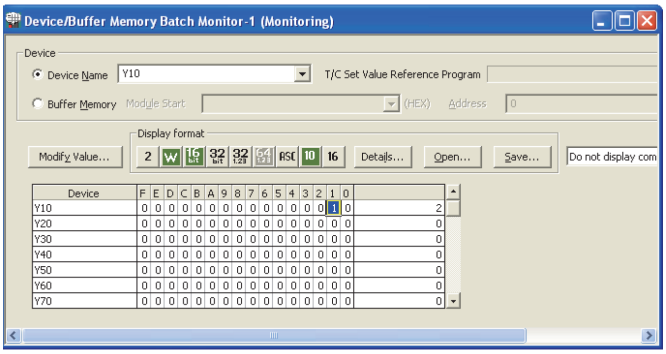
Restart the control. · · · · ·
When parameters are set on GX Works2
Page 416, Appendix 5.5 (5)
When parameters are set on the sequence program
Page 422, Appendix 5.6 (5)

↓

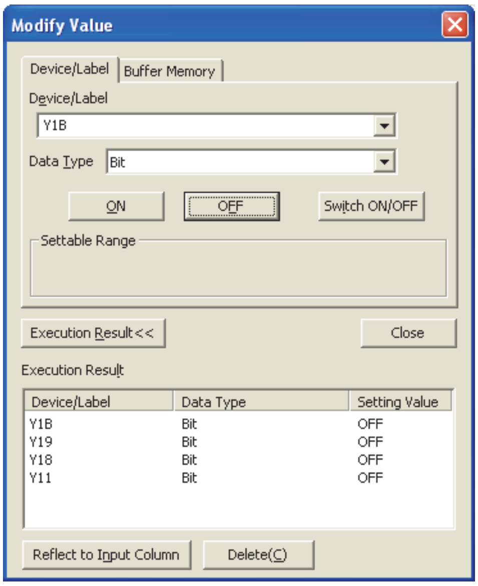
End

Appendix 5.5 When parameters were configured using GX Works2

(1) Stopping operation



↓



1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

2. **In "Device Name", enter and display the name of the CPU module device to be refreshed in the Q64TCN.**

3. **Select the following output signals and click** Modify Value... **.**

Turn off the output signals in the CPU module to turn off the following output signals in the Q64TCN.

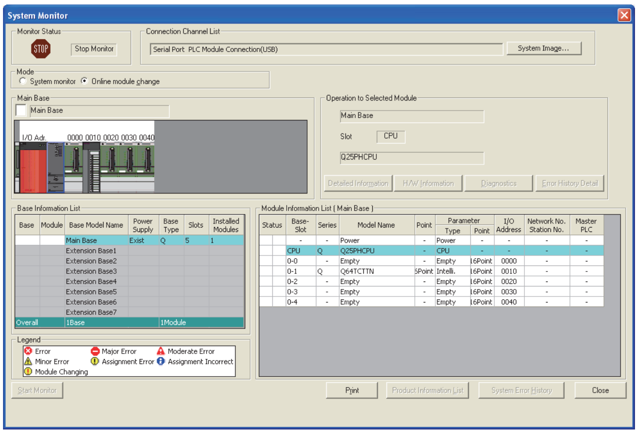
- Setting/operation mode instruction (Yn1)
- E^2PROM backup instruction (Yn8)
- Default setting registration instruction (Yn9)
- Setting change instruction (YnB)

This operation stops the operation of the Q64TCN.

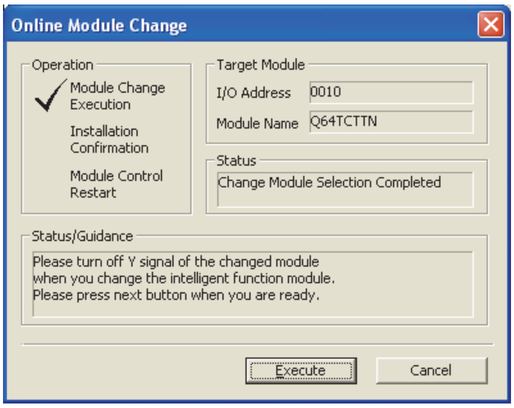
Point

If PID continuation flag (Un\G169) is set to Continue (1), control does not stop even when Setting/operation mode instruction (Yn1) is turned off. Change PID continuation flag (Un\G169) to Stop (0) and turn off Setting/operation mode instruction (Yn1).
Whether the control has been stopped can be checked by Setting/operation mode status (Xn1) being off.

(2) Removing a module



↓



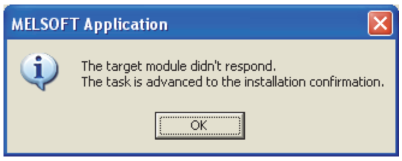
1. **Open the "System Monitor" Window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module to be changed online.**

3. **Click Execution to enable a module change.**

4. **When the following error window appears, click OK and perform the operation described on and after Page 414, Appendix 5.5 (3).**

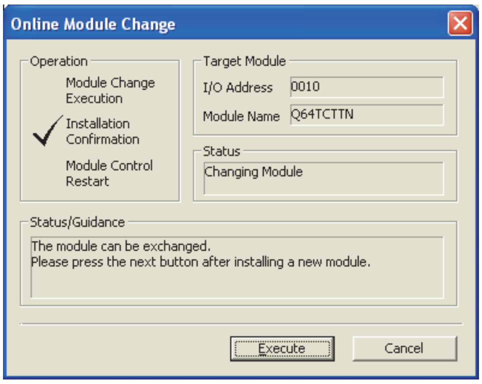


5. **Check that the RUN LED on the module is off, disconnect the external cable, and remove the module.**

Point

- If the terminal block is removed, the temperature process value (PV) may vary within the accuracy range due to the individual differences in the cold junction temperature compensation resistors (the Q64TCTTN and Q64TCTTBWN only).
- Remove the module before installation confirmation. If the installation confirmation is executed without removing the module, the module does not start up normally and the RUN LED does not turn on.

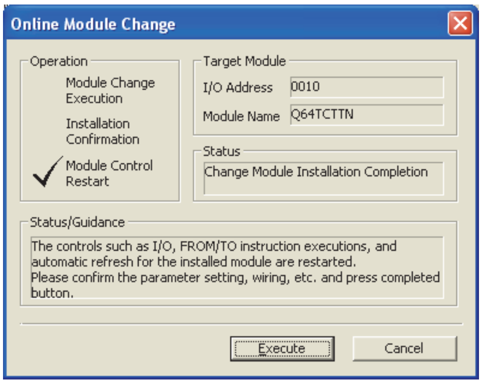
(3) Mounting a new module



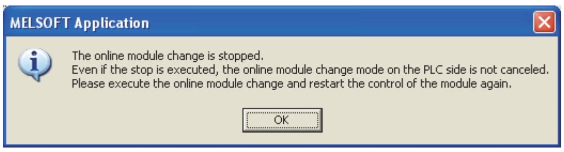
1. **Mount a new module in the same slot and connect the external cable.**

2. **After the module is mounted, click [Execution], and check that the RUN LED is on. Module READY flag (Xn0) remains off.**

(4) Checking operation



↓



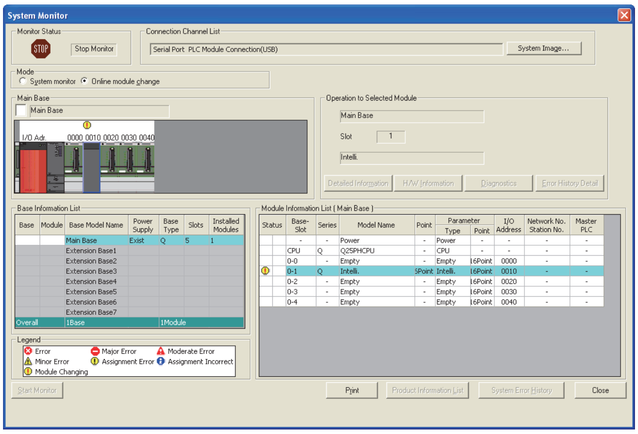
↓

(To the next page)

1. **To check the operation, click [Cancel] to cancel the control start.**

2. **Click [OK] to stop the "Online module change" mode.**

(From the previous page)
↓

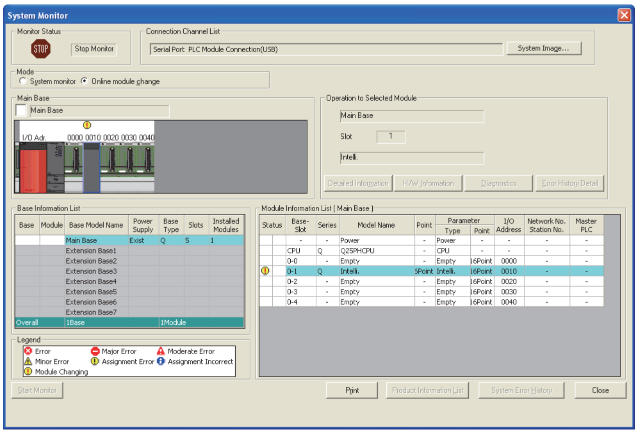


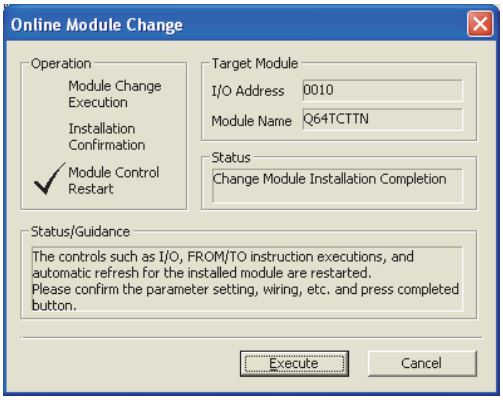
3. **Click Close to close the "System Monitor" window.**

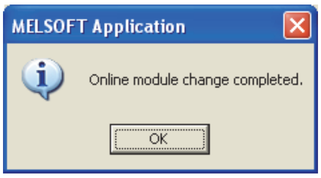
4. **Before restarting the control, check the following items for the Q64TCN. If an error occurs, refer to TROUBLESHOOTING (Page 365, CHAPTER 8) and take corrective action.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Write error flag (Xn2) is off.
- If Hardware error flag (Xn3) is off.

(5) Restarting control







1. **Open the "System Monitor" window again.**

[Diagnostics] ➪ [Online Module Change...]

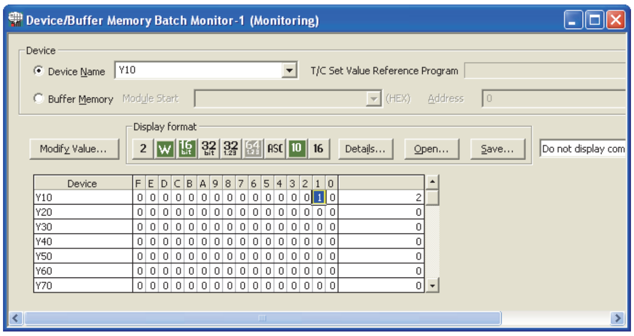
2. **Double-click the changed module name.**

3. **When the window appears, click Execution to restart the control. Module READY flag (Xn0) turns on.**

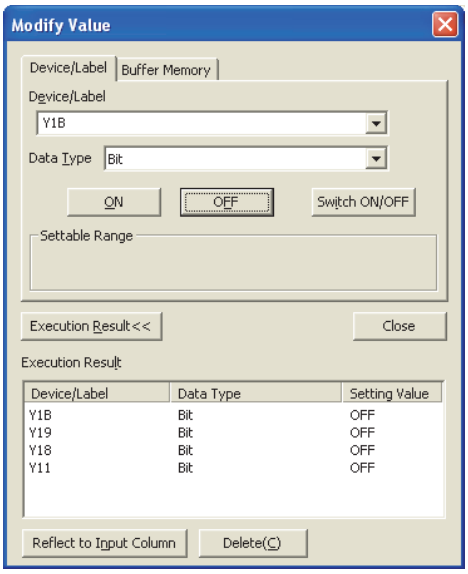
4. **The online module change is complete.**

Appendix 5.6 When the initial settings were configured using a sequence program

(1) Stopping operation



↓



1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

2. **In "Device Name", enter and display the name of the CPU module device to be refreshed in the Q64TCN.**

3. **Select the following output signals and click** Modify Value... **.**

Turn off the output signals in the CPU module to turn off the following output signals in the Q64TCN.

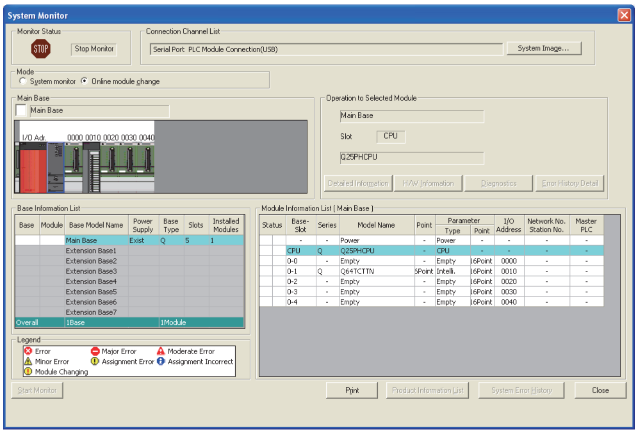
- Setting/operation mode instruction (Yn1)
- E^2PROM backup instruction (Yn8)
- Default setting registration instruction (Yn9)
- Setting change instruction (YnB)

This operation stops the operation of the Q64TCN.

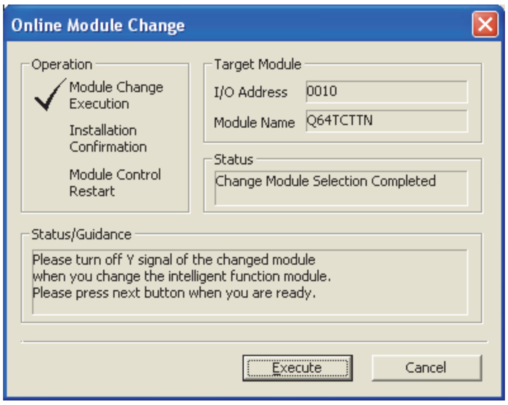
Point

- If PID continuation flag (Un\G169) is set to Continue (1), control does not stop even when Setting/operation mode instruction (Yn1) is turned off. Change PID continuation flag (Un\G169) to Stop (0) and turn off Setting/operation mode instruction (Yn1).
  Whether the control has been stopped can be checked by Setting/operation mode status (Xn1) being off.
- If a CPU continuation error (such as SP.UNIT DOWN and UNIT VERIFY ERR.) is occurring due to an error in the module to be changed, the buffer memory data cannot be saved.

(2) Removing a module



↓



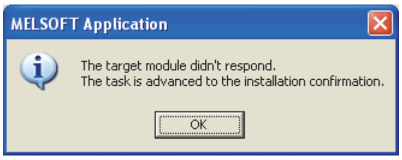
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module to be changed online.**

3. **Click [Execution] to enable a module change.**

4. **If the following error window appears, click [OK] and perform the operation described on and after ☞ Page 419, Appendix 5.6 (3).**

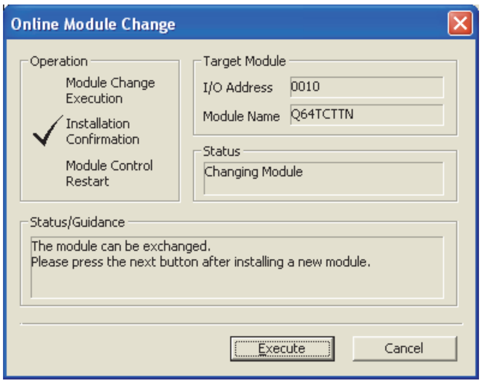


5. **Check that the RUN LED on the module is off, disconnect the external cable, and remove the module.**

Point

- If the terminal block is removed, the temperature process value (PV) may vary within the accuracy range due to the individual differences in the cold junction temperature compensation resistors (the Q64TCTTN and Q64TCTTBWN only).
- Remove the module before installation confirmation. If the installation confirmation is executed without removing the module, the module does not start up normally and the RUN LED does not turn on.

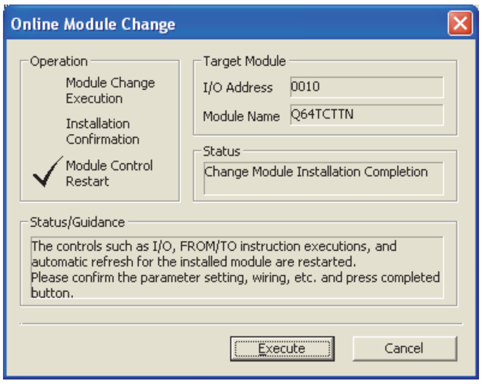
(3) Mounting a new module



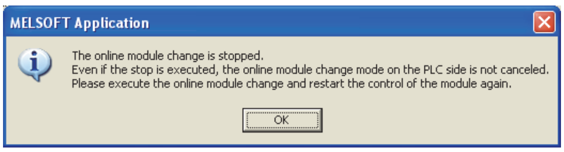
1. Mount a new module in the same slot and connect the external cable.

2. After the module is mounted, click Execution, and check that the RUN LED is on. Module READY flag (Xn0) remains off.

(4) Checking operation



↓



↓

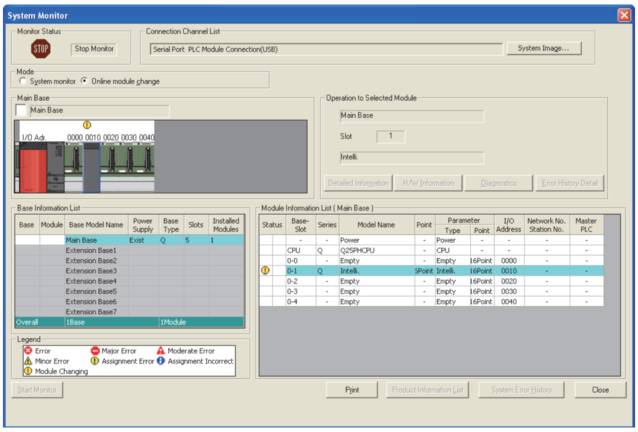
(To the next page)

1. To check the operation, click Cancel to cancel the control start.

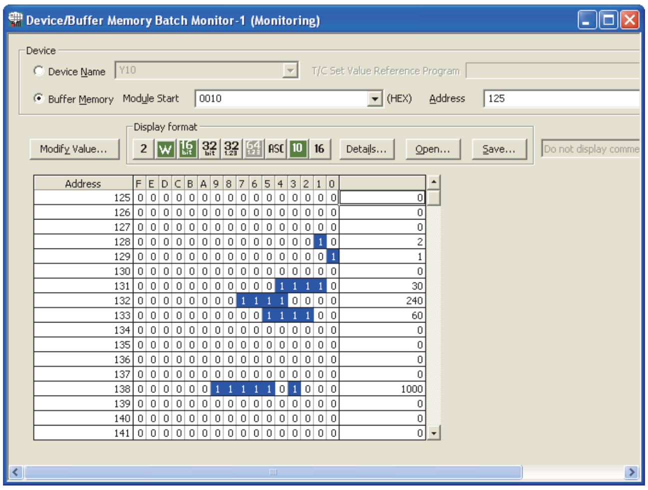
2. Click OK to stop the "Online module change" mode.

(From the previous page)

↓



↓



↓

(To the next page)

3. **Click** Close **to close the "System Monitor" window.**

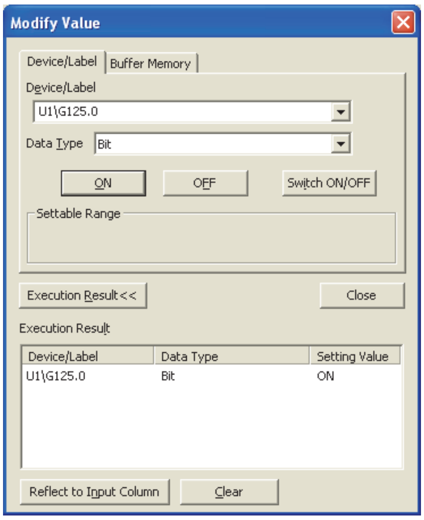
4. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ➪ [Monitor] ➪ [Device/Buffer Memory Batch]

5. **Display and select the pre-recorded device and click** Modify Value... **.**

(From the previous page)

↓



6. **Set the pre-recorded data to the buffer memory.**

7. **To back up the data in E^2PROM, turn off and on E^2PROM backup instruction (Yn8) and write the buffer memory data to E^2PROM.**

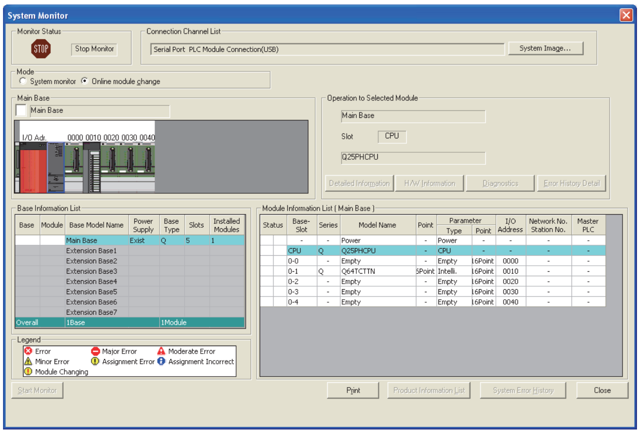
8. **Before restarting the control, check the following items for the Q64TCN. If an error occurs, refer to TROUBLESHOOTING (☞ Page 365, CHAPTER 8) and fix the error.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Write error flag (Xn2) is off.
- If Hardware error flag (Xn3) is off.

9. **Because the new module is in the default status, configure the initial settings using a sequence program after restarting the control. Before configuring the initial settings, check that the details on the initial setting program are correct.**

- In a standard system configuration
  Use a sequence program to configure the initial settings when Module READY flag (Xn0) in the Q64TCN turns on. When the control is restarted, Module READY flag (Xn0) turns on and the initial settings are configured. (In a sequence program to configure the initial settings only for a single scan after RUN, the initial settings are not configured.)
- When using the remote I/O network
  In the sequence program, install a user device (initial setting request signal) to configure the initial settings at any timing. After the control is restarted, turn on the initial setting request signal and configure the initial settings. (In a sequence program to configure the initial settings only for a single scan after the restart of the remote I/O network data link, the initial settings are not configured.)

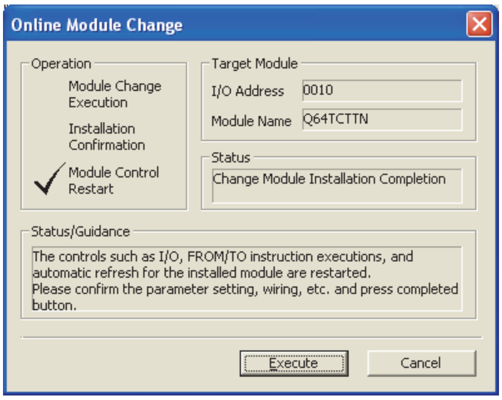
(5) Restarting control



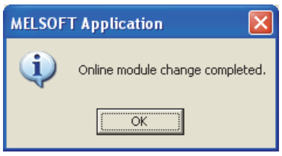
1. **Open the "System Monitor" window again.**

[Diagnostics] ➪ [Online Module Change...]

2. **Double-click the changed module name.**



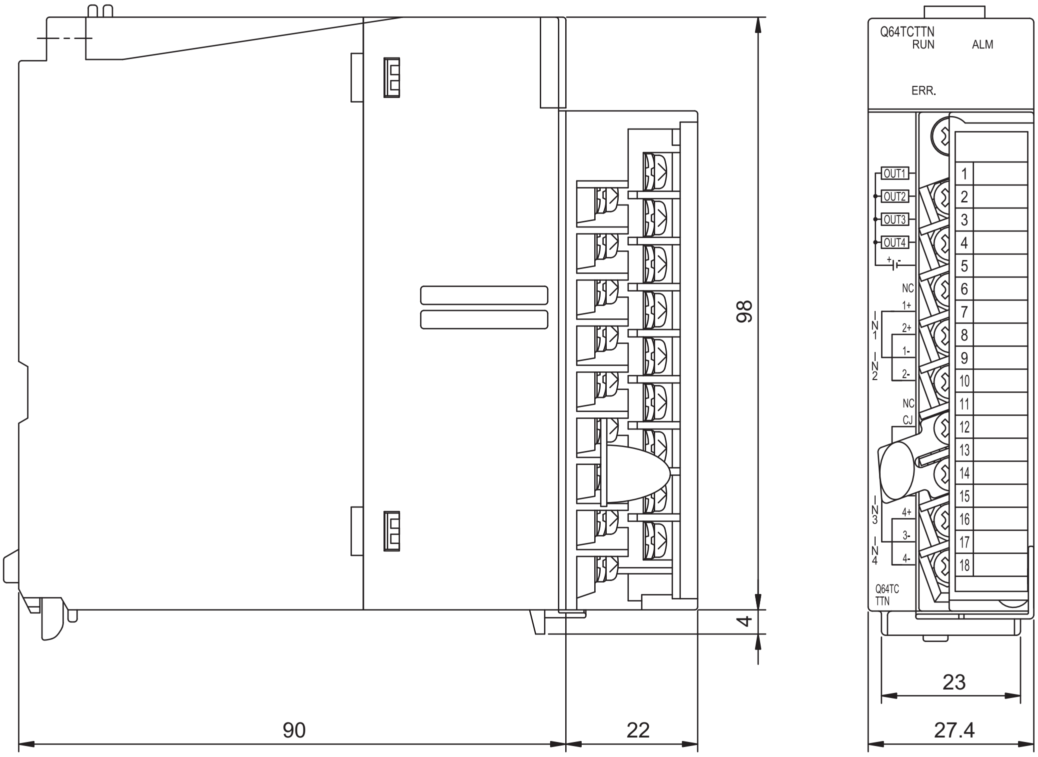
3. **When the window appears, click [Execution] to restart the control. Module READY flag (Xn0) turns on.**



4. **The online module change is complete.**

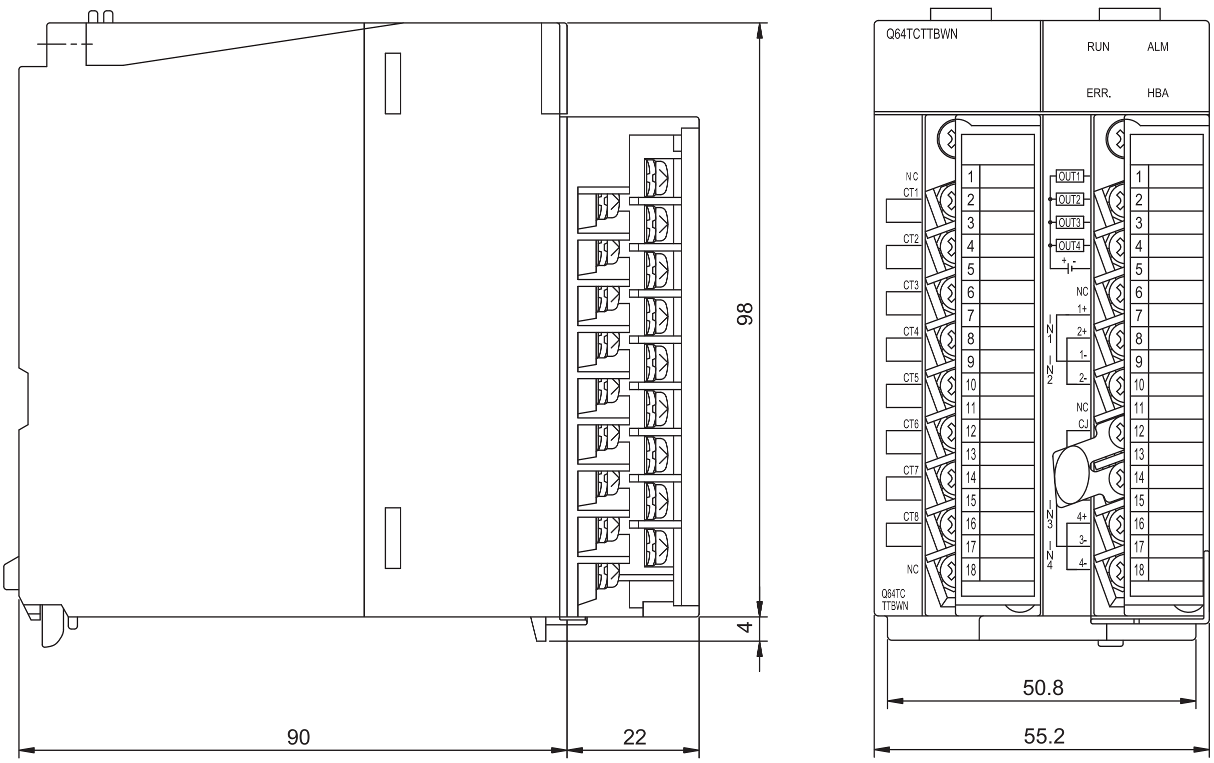
Appendix 6 External Dimensions

(1) Q64TCTTN



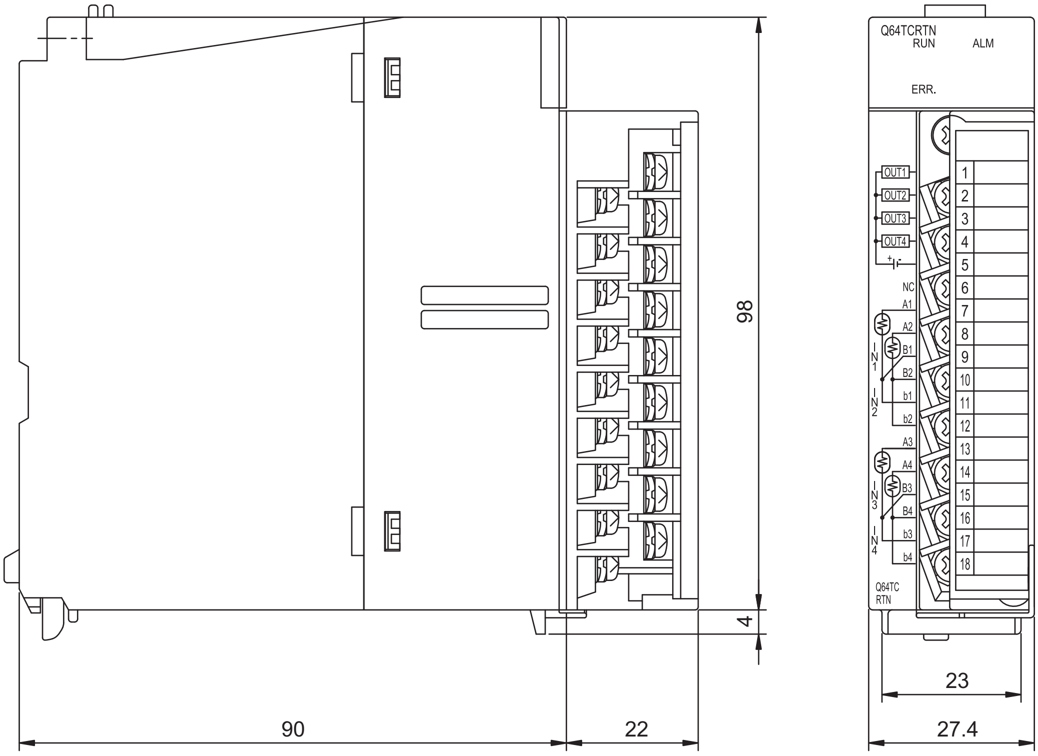
(Unit: mm)

(2) Q64TCTTBWN



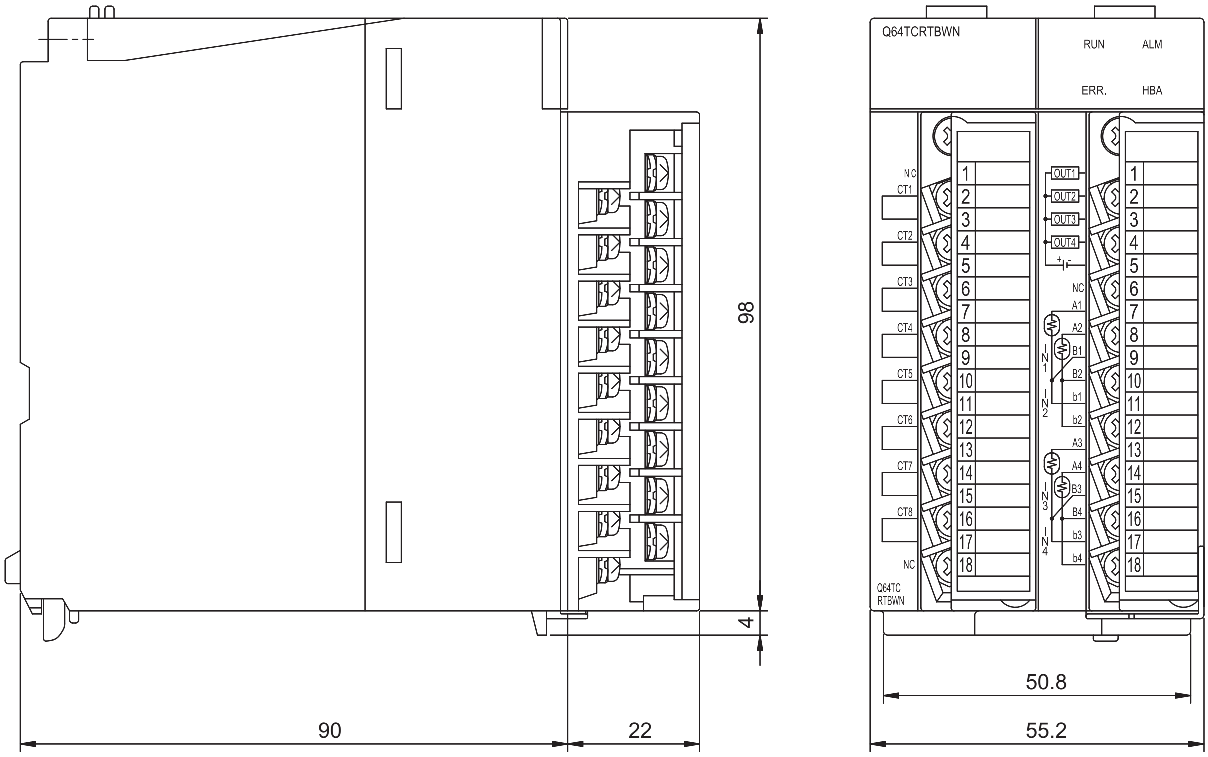
(Unit: mm)

(3) Q64TCRTN



(Unit: mm)

(4) Q64TCRTBWN



(Unit: mm)

Memo

INDEX

A

B

C

I

D

E

F

G

H

R

S

T

U

V

W

I

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print date	*Manual number	Revision
July 2011	SH(NA)-080989ENG-A	First edition
August 2014	SH(NA)-080989ENG-B	Revision due to the following: • changes of the setting method when using CTL-12-S36-10 or CTL-12-S56-10 as a current sensor (CT) • addition of the setting item reduction mode of auto refresh • additional function of moving averaging process to a temperature process value (PV) • GX Works2 function to support Process CPU and Redundant CPU • addition of the during AT loop disconnection detection function • changes of the parameter setting window of GX Works2
February 2016	SH(NA)-080989ENG-C	Revision due to the addition of buffer memory address of AT error status monitor
February 2016	SH(NA)-080989ENG-D	Error correction

Japanese manual version SH-080988-H

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.

SH(NA)-080989ENG-D

SH(NA)-080989ENG-D(1602)MEE
MODEL: Q64TCTTN/RTN-U-E
MODEL CODE: 13JZ60

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN