MELSEC ST Series

Programmable Logic Controllers

User's Manual

ST1RD2
Platinum RTD Input Module

Art. no.: 194919
15 01 2006
SH(NA)-080591
Version A

● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

When using this product, thoroughly read this manual and the associated manuals introduced in this manual. Also pay careful attention to safety and handle the product properly.
The precautions given in this manual are concerned with this product only. Refer to the user's manual of the network system for safety precautions of the network system.
In this manual, safety precautions are classified into two categories: "DANGER" and "CAUTION".

⚠ DANGER	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.

Depending on circumstances, failure to observe ⚠ CAUTION level precautions may also lead to serious results.
Be sure to observe the instructions of both levels to ensure the safety.

Store this manual in a safe place for future reference and also pass it on to the end user.

[DESIGN PRECAUTIONS]

⚠ DANGER

● If a communication error occurs in the network, the error station (MELSEC-ST system) shows the following behavior:
All outputs turn OFF. (In the MELSEC-ST system, the output status at the time of error can be set to clear/hold/preset by user parameters of each slice module. As "clear" is set by default, the outputs turn OFF when an error occurs. In the case where the system operates safely with the output set to "hold" or "preset", change the parameter settings.)
Create an interlock circuit on the program so that the system operates safely based on the communication status information. Failure to do so may cause an accident due to faulty output or malfunction.

● Create an external fail safe circuit that will ensure the MELSEC-ST system operates safely, even when the external power supply or the system fails.
Accident may occur due to output error or malfunction.
(1) The status of output changes depending on the setting of various functions that control the output. Take sufficient caution when setting for those functions.
(2) Normal output may not be obtained due to malfunctions of output elements or the internal circuits. Configure a circuit to monitor signals whose operations may lead to a serious accident.

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[DESIGN PRECAUTIONS]

⚠ CAUTION

- Make sure to initialize the network system after changing parameters of the MELSEC-ST system or the network system. If unchanged data remain in the network system, this may cause malfunctions.

- Do not install the control wires or communication cables together with the main circuit or power wires. Keep a distance of 100 mm (3.94 inch) or more between them. Not doing so could result in malfunctions due to noise.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- Use the MELSEC-ST system in the general environment specified in the MELSEC-ST system users manual. Using this MELSEC-ST system in an environment outside the range of the general specifications could result in electric shock, fire, erroneous operation, and damage to or deterioration of the product.

- Mount the head module and base module(s) on the DIN rail securely (one by one) referring to the MELSEC-ST system users manual and then fix them with stoppers. Incorrect mounting may result in a fall of the module, short circuits or malfunctions.

- Secure the module with several stoppers when using it in an environment of frequent vibration. Tighten the screws of the stoppers within the specified torque range. Undertightening can cause a drop, short circuit or malfunction. Overtightening can cause a drop, short circuit or malfunction due to damage to the screw or module.

- Make sure to externally shut off all phases of the power supply for the whole system before mounting or removing a module. Failure to do so may damage the module.
  (1) Online replacement of the power distribution module and/or the base module is not available. When replacing either of the modules, shut off all phases of the external power supply.
  Failure to do so may result in damage to all devices of the MELSEC-ST system.
  (2) The I/O modules and the intelligent function modules can be replaced online.
  Since online replacement procedures differ depending on the module type, be sure to make replacement as instructed.
  For details, refer to the chapter of online module change in this manual.

- Do not directly touch the module's conductive parts or electronic components. Doing so may cause malfunctions or failure of the module.

- Make sure to securely connect each cable connector. Failure to do so may cause malfunctions due to poor contact.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- DIN rail must be conductive; make sure to ground it prior to use. Failure to do so may cause electric shocks or malfunctions. Undertightening can cause a short circuit or malfunction. Overtightening can cause a short circuit due to damage to the screw.

[WIRING PRECAUTIONS]

⚠ DANGER

- Completely turn off the external power supply when installing or placing wiring. Not completely turning off all power could result in electric shock or damage to the product.

- Always place the platinum RTD signal cable at least 100mm(3.94inch) away from the main circuit cables and AC control lines.
  Fully keep it away from high-voltage cables and circuits which include harmonics, such as an inverter's load circuit.
  Not doing so will make the module more susceptible to noises, surges and inductions.

⚠ CAUTION

- Make sure to ground the control panel where the MELSEC-ST system is installed in the manner specified for the MELSEC-ST system. Failure to do so may cause electric shocks or malfunctions.

- Check the rated voltage and the terminal layout and wire the system correctly. Connecting an inappropriate power supply or incorrect wiring could result in fire or damage.

- Tighten the terminal screws within the specified torque range. If the terminal screws are loose, it could result in short circuits or erroneous operation. Overtightening may cause damages to the screws and/or the module, resulting in short circuits or malfunction.

- Prevent foreign matter such as chips or wiring debris from entering the module. Failure to do so may cause fires, damage, or erroneous operation.

- When connecting the communication and power supply cables to the module, always run them in conduits or clamp them. Not doing so can damage the module and cables by pulling a dangling cable accidentally or can cause a malfunction due to a cable connection fault.

- When disconnecting the communication and power supply cables from the module, do not hold and pull the cable part. Disconnect the cables after loosening the screws in the portions connected to the module. Pulling the cables connected to the module can damage the module and cables or can cause a malfunction due to a cable connection fault.

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[STARTUP AND MAINTENANCE PRECAUTIONS]

⚠ DANGER

- Do not touch the terminals while power is on.
  Doing so could cause shock or erroneous operation.

- Make sure to shut off all phases of the external power supply for the system before cleaning the module or tightening screws.
  Not doing so can cause the module to fail or malfunction.

⚠ CAUTION

- Do not disassemble or modify the modules.
  Doing so could cause failure, erroneous operation, injury, or fire.

- Do not drop or give a strong impact to the module since its case is made of resin. Doing so can damage the module.

- Make sure to shut off all phases of the external power supply for the system before mounting/removing the module onto/from the control panel. Not doing so can cause the module to fail or malfunction.

- Before handling the module, make sure to touch a grounded metal object to discharge the static electricity from the human body.
  Failure to do so may cause a failure or malfunctions of the module.

- When using any radio communication device such as a cellular phone, keep a distance of at least 25cm (9.85 inch) away from the MELSEC-ST system.
  Not doing so can cause a malfunction.

[DISPOSAL PRECAUTIONS]

⚠ CAUTION

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

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REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Jan., 2006	SH(NA)-080591ENG-A	First edition

Japanese Manual Version SH-080590-A

INTRODUCTION

Thank you for choosing the ST1RD2 type MELSEC-ST thermocouple input module.
Before using the module, please read this manual carefully to fully understand the functions and performance of the ST1RD2 type MELSEC-ST thermocouple input module and use it correctly.

CONTENTS

About Manuals

The following manuals are related to this product.
Referring to this list, please request the necessary manuals.

Relevant Manuals

Manual Name	Manual Number (Model Code)
MELSEC-ST System User's Manual Explains the system configuration of the MELSEC-ST system and the performance specifications, functions, handling, wiring and troubleshooting of the power distribution modules, base modules and I/O modules. (Sold separately)	SH-080456ENG (13JR72)
MELSEC-ST PRFIBUS-DP Head Module User's Manual Explains the system configuration, specifications, functions, handling, wiring and troubleshooting of the ST1H-PB. (Sold separately)	SH-080436ENG (13JR68)
GX Configurator-ST Version 1 Operating Manual Explains how to operate GX Configurator-ST, how to set the intelligent function module parameters, and how to monitor the MELSEC-ST system. (Sold separately)	SH-080439ENG (13JU47)

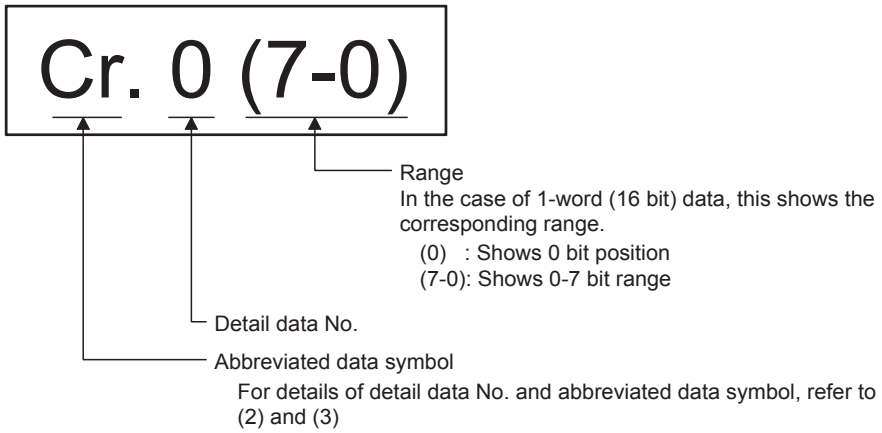
Compliance with the EMC Directive and the Low Voltage Directive

When incorporating the Mitsubishi MELSEC-ST system that is compliant with the EMC directive and the low voltage directive into other machine or equipment and making it comply with the EMC directive and the low voltage directive, refer to "EMC Directive and Low Voltage Directive" of the MELSEC-ST System User's Manual.
The CE logo is printed on the rating plate of the EMC Directive and the Low Voltage Directive.
By making this product conform to the EMC directive and low voltage instruction, it is not necessary to make those steps individually.

This manual explains each area for input data and output data using the following symbols.

(1) Data symbol

<Example: Cr Command result area>



(2) Input data

Data symbol		Area	Unit	Detail data No. notation
Br	Br.00 to Br.FF	Bit Input Area	1 bit/1 symbol	Hexadecimal
Er	Er.00 to Er.FF	Error Information Area	1 bit/1 symbol	Hexadecimal
Mr	Mr.0 to Mr.127	Module Status Area	1 bit/1 symbol	Decimal
Cr	＊1	Command Result Area	1 word/1 symbol	Decimal
Wr	Wr.00 to Wr.33	Word Input Area	1 word/1 symbol	Hexadecimal

＊1: The following shows the data symbols and the corresponding detail areas within the command result area.

Data symbol		Area
Cr.0	Cr.0 (15-8)	Command Execution Area
	Cr.0 (7-0)	Start Slice No. of Execution Target
Cr.1		Executed Command No.
Cr.2		Response Data 1
Cr.3		Response Data 2

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(3) Output data

Data symbol		Area	Unit	Detail data No. notation
Bw	Bw.00 to Bw.FF	Bit Output Area	1 bit/1 symbol	Hexadecimal
Ew	Ew.00 to Ew.FF	Error Clear Area	1 bit/1 symbol	Hexadecimal
Sw	Sw.0 to Sw.7	System Area	1 word/1 symbol	Decimal
Cw	＊1	Command Execution Area	1 word/1 symbol	Decimal
Ww	Ww.00 to Ww.33	Word Output Area	1 word/1 symbol	Hexadecimal

＊1: The following shows the data symbols and the corresponding detail areas within the command execution area.

Data symbol	Area
Cw.0	Start Slice No. of Execution Target
Cw.1	Command No. to be Executed
Cw.2	Argument 1
Cw.3	Argument 2

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About the Generic Terms and Abbreviations

This manual uses the following generic terms and abbreviations to describe the ST1RD2, unless otherwise specified.

Generic Term/Abbreviation	Description
ST1RD2	Abbreviation for ST1RD2 type MELSEC-ST platinum RTD input module.
Head module	ST1H-PB, MELSEC-ST PROFIBUS-DP compatible head module.
PROFIBUS-DP	PROFIBUS-DP network.
Bus refreshing module	Module that distributes the external SYS. power supply and external AUX. power supply among the head module and slice modules.
Power feeding module	Module that distributes external AUX. power supply among slice modules.
Power distribution module	Generic term for bus refreshing module and Power feeding module.
Base module	Module that transfers data/connects between the head module and slice modules, and between slice modules and external devices.
Input module	Module that handles input data in bit units.
Output module	Module that handles output data in bit units.
Intelligent function module	Module that handles input/output data in word units.
I/O module	Generic term for input module and output module.
Slice module	Module that can be mounted to the base module: power distribution module, I/O module and intelligent function module.
MELSEC-ST system	System that consists of head module, slice modules, end plates and end brackets.
GX Configurator-ST	SWnD5C-STPB-E type products. (n: 1 or later)
Configuration software	Software used to set slave parameters for head module and slice modules.(e.g., GX Configurator-DP)
User parameter	Generic term for setting items (Measurement range setting, Offset/gain value selection) set by the configuration software of the master station.
Command parameter	Generic term for setting items (Conversion enable/disable setting, Averaging processing specification, Time/count/moving average/time constant setting, Alarm output setting, Upper upper limit value/Upper lower limit value/Lower upper limit value/Lower lower limit value setting, Sensor compensation value setting , Conversion setting for disconnection detection, Conversion setting value for disconnection detection) set by commands. They can also be set by GX Configurator-ST.
Parameter	Generic term for user parameters and command parameters.

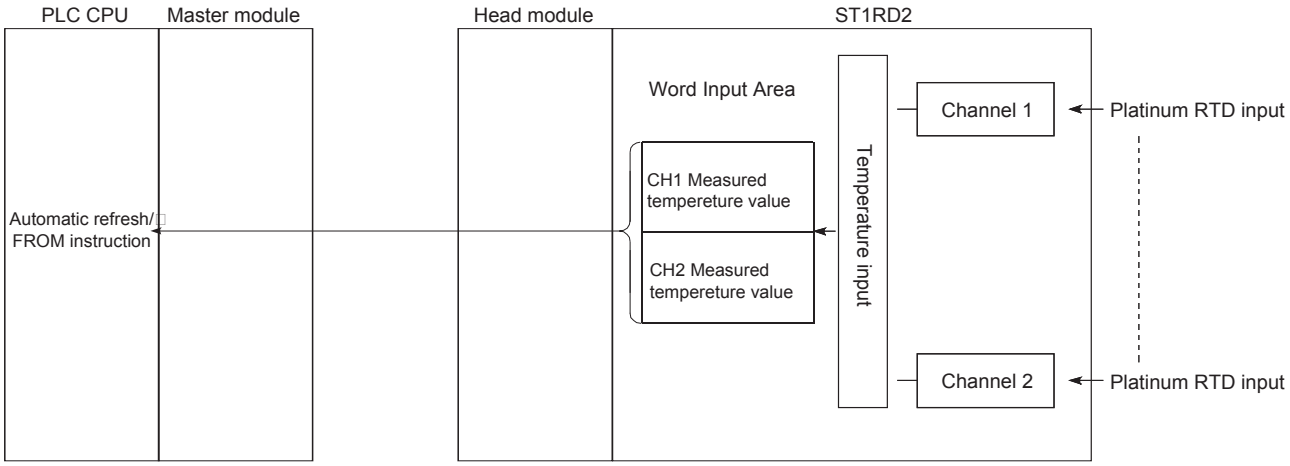
Term definition

The following explains the meanings and definitions of the terms used in this manual.

Term	Definition
Master station	Class 1 master station that communicates I/O data with slave stations.
Slave station	Device that communicates I/O data with the master station.
Repeater	Device that connects PROFIBUS-DP segments.
Bus terminator	Terminator that is connected to both ends of each PROFIBUS-DP segment
FDL address	Address assigned to the master station or slave station.
GSD file	The electronic file that includes description of the slave station parameters. The file is used to set parameters at the master station.
Input data	Data sent from the head module to the master station. The data consists of the following areas. ・[Br] Bit Input Area ・Information Area [Er] Error Information Area [Mr] Module Status Area [Cr] Command Result Area ・[Wr] Word Input Area
Output data	Data that the head module receives from the master station. The data consists of the following areas. ・[Bw] Bit Output Area ・Request Area [Ew] Error Clear Area [Sw] System Area [Cw] Command Execution Area ・[Ww] Word Output Area
I/O data	Data (input data, output data) transferred between the head module and the master station.
[Br.n] bit input	Bit input data of each module.
[Bw.n] bit output	Bit output data of each module.
[Wr.n] word input	Word (16-bit) input data of an intelligent function module. In the case of analog input module, a digital output data value is stored.
[Ww.n] word output	Word (16-bit) output data of an intelligent function module. In the case of analog output module, a digital setting data value is stored.
Information area	Bit/Word input data for checking each module status and command execution results.
Request area	Bit/Word output data for requesting each module to clear errors/to execute commands.
Number of occupied I/O points	The area, that is equivalent to the occupied I/O points, is occupied in [Br] bit input area/[Bw] bit output area.
Slice No.	No. assigned to every 2 occupied I/O points of each module. This numbering starts by assigning "0" to the head module and then proceeds in ascending order. (The maximum is 127). The No. is used for specifying the execution target.
Command	Generic term for requests made by the master station in order to read each module's operating status and to set and control intelligent function module operation.

1 OVERVIEW

This User's Manual provides the specifications, handling instructions, programming methods, etc. for the ST1RD2 type MELSEC-ST platinum RTD input module (hereinafter referred to as the ST1RD2).
This manual includes descriptions of only the ST1RD2.
For information on the MELSEC-ST system, refer to the MELSEC-ST System User's Manual.
ST1RD2 is a module converting the external platinum RTD input value into measured temperature value of signed 16-bit binary data.



1.1 Features

(1) One ST1RD2 enables 2-channel temperature measurement conversion

By using ST1RD2, the temperature measurement conversion can be performed for 2 channels.

(2) Up to 26 modules can be mounted

For one head module, up to 26 ST1RD2 modules (52 channels) can be mounted.

(3) Platinum RTDs, Pt100 and Pt1000 are applicable

Platinum RTDs, Pt100 and Pt1000 can be used.
Using configuration software in the master station and/or GX Configurator-ST, you can choose a desirable platinum RTD type for each channel.

(4) Three-wire type platinum RTDs are connectable

A 3-wire type platinum RTD can be connected to each channel.
By making the terminals short-circuited, a 2-wire platinum RTD can be also used.
(See Section 3.1.1)

(5) Disconnection detection

Disconnection of a platinum RTD or cable can be detected on each channel.
Also, disconnection is detectable for each wire (Wire A, B and b).

(6) Type of the values stored at disconnection detection is selectable

For values to be stored in the CH□ measured temperature value area in the case of disconnection detection, any of "Value immediately before disconnection", "Up scale (each measurement range's upper limit value + 5%)", "Down scale (each measurement range's lower limit value - 5%)" or "Given value" can be selected.

(7) Optimal conversion processing is selectable

From Sampling processing, Time or Count averaging processing, Moving average and Primary delay filter, a desired conversion method can be selected for each channel.

(8) Measurement ranges are selectable for each channel

Three different measurement ranges are available for each of the platinum RTDs, Pt100 and Pt1000, and are selectable for each channel.

(9) One-point compensation is available using the sensor compensation function

The sensor compensation function allows 1-point compensation for each channel.

When an error is identified between the "actual temperature" and the "measured temperature", it can be compensated easily by setting the sensor compensation value.

(10) Two-point compensation is available using the offset/gain setting

The offset/gain setting allows 2-point compensated for each channel.
You can choose the user range setting (setup corrected by users) or factory default (default setting) for the offset/gain setting.

(11) Alarm output

If the temperature detected is outside the preset measurement range, an alarm can be output on each channel.

(12) Online module change

The module can be changed without the system being stopped.

(13) Easy settings using GX Configurator-ST

The optional software package (GX Configurator-ST) is available.

GX Configurator-ST is not necessarily required for the system.

However, we recommend using GX Configurator-ST, as it enables on-screen parameter setting and offset/gain setting, which reduces programming steps and makes the setting/operating status check easier.

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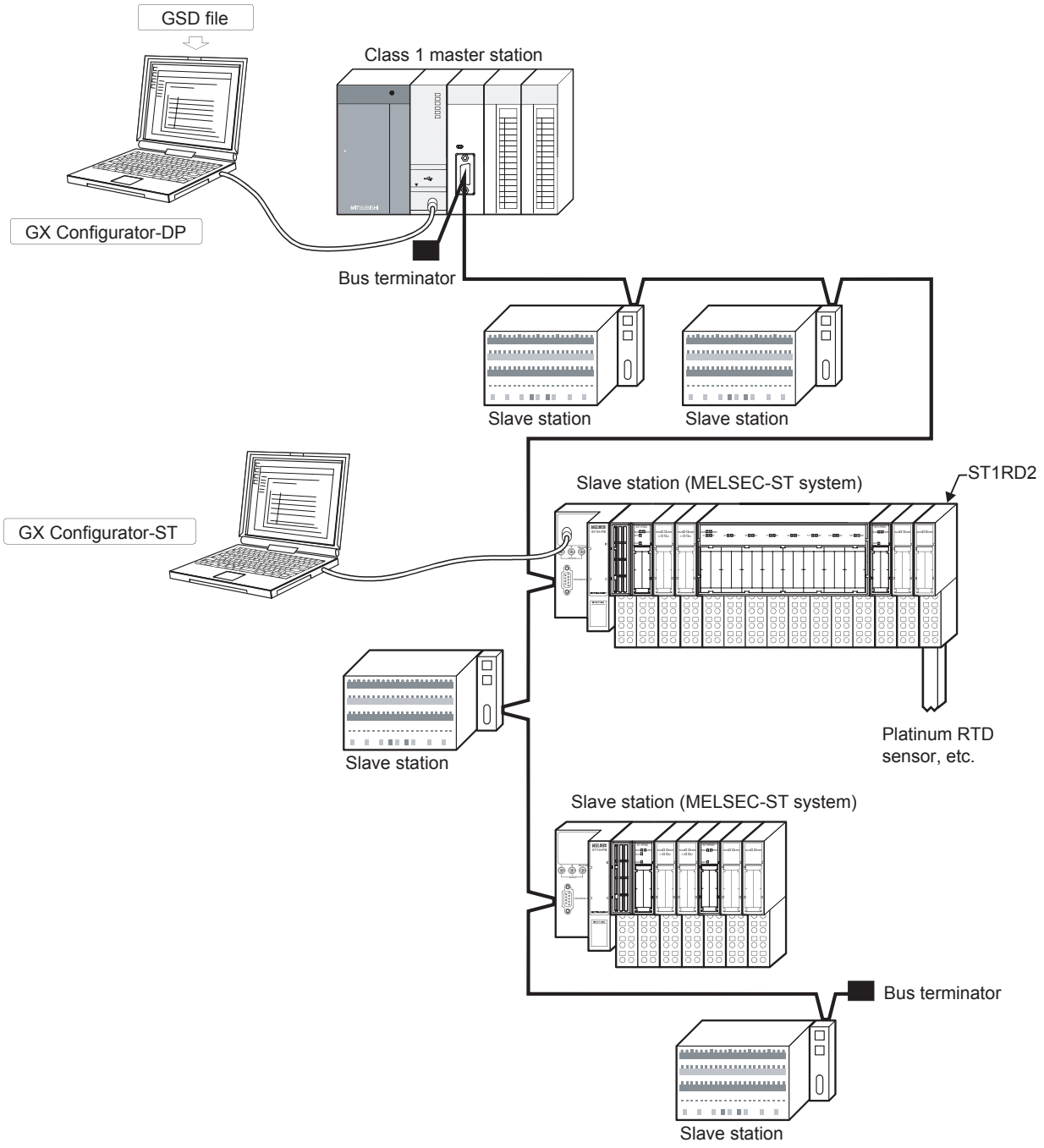
2 SYSTEM CONFIGURATION

This chapter describes the system configuration for use of the ST1RD2.

2.1 Overall Configuration

The overall configuration for use of the ST1RD2 is shown below.

<The system using MELSEC-Q series>



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2.2 Applicable System

This section explains the applicable system.

2.2.1 Applicable head module

The head module applicable to the ST1RD2 is indicated below.

Product name	Model name
MELSECT-ST PROFIBUS-DP Head Module	ST1H-PB

2.2.2 Applicable base module

The base modules applicable to the ST1RD2 are indicated below.

Type	Model name
Spring Clamp Type	ST1B-S4IR2
Screw Clamp Type	ST1B-E4IR2

2.2.3 Applicable coding element

The coding elements applicable to the ST1RD2 are indicated below.
The coding element is fitted before shipment.
It is also available separately in case it is lost.

Description	Model name
ST1RD2 coding element	ST1A-CKY-15

2.2.4 Applicable software package

The software package applicable to the ST1RD2 is indicated below.

Model name	Product name	Compatible software version
SW1D5C-STPB-E	GX Configurator-ST	Version 1.04E or later

2.2.5 Applicable GSD file

The GSD file applicable to the ST1RD2 is indicated below.

Description	Compatible version*
GSD file applicable to ST1RD2	rel. 1.03 or later

* The GSD file name and version are displayed in the GSD file registration list of the configuration software on the master station.
Check that the version is rel. 1.03 or later.

2.3 Precautions for System Configuration

For precautions for ST1RD2 system configuration, refer to Section 3.4 "Precautions for System Configuration" in MELSEC-ST system user's manual.

3 SPECIFICATIONS

This chapter provides the specifications of the ST1RD2.
For the general specifications of the ST1RD2, refer to the MELSEC-ST System User's Manual.

3.1 Performance Specifications

This section indicates the performance specifications of the ST1RD2.

(1) Performance specifications list

Item			Specifications
Number of analog input points			2 channels / 1 module
Output ＊1			16-bit signed binary (-2000 to 8500: Value to the first decimal place × 10 times)
Applicable platinum RTD			Pt100 (JIS C1604-1997, IEC751 1983), Pt1000 ＊2
Output current for temperature detection			0.25mA or less
Measured temperature range			-200 to 850℃
Resolution			0.1℃
Accuracy			Based on calculation expression marked ＊3
Conversion accuracy	-200 to 850℃	Pt100	±0.7℃ (25±5℃), ±2.4℃ (0 to 55℃)
		Pt1000	
	-20 to 120℃	Pt100	±0.3℃ (25±5℃), ±1.1℃ (0 to 55℃)
		Pt1000	
	0 to 200℃	Pt100	±0.4℃ (25±5℃), ±1.2℃ (0 to 55℃)
		Pt1000	
Conversion speed			80ms/1 channel
Conversion method			Δ Σ method
Disconnection detection			Detectable ＊4 (Each channel independent) ＊5
ROM write count			ROM write count by user range write or parameter setting: Up to 10,000 times
Number of occupied I/O points			4 points for each of input and output
Number of occupied slices			2
Information amount	Input data		Br.n : Number of occupancy 4, Er.n : Number of occupancy 4, Mr.n : Number of occupancy 2, Ww.n : Number of occupancy 2
	Output data		Bw.n : Number of occupancy 4, Ew.n : Number of occupancy 4, Ww.n : Number of occupancy 2
Isolation			Specific isolated area: Between platinum RTD input channels and internal bus — Isolation method: Photo coupler insulation — Dielectric withstand: 560V AC rms/3 cycles (elevation 2000m) — Insulation resistance: 500V DC 10MΩ or more Specific isolated area: Between platinum RTD input channels — Isolation method: No insulation — Dielectric withstand: — — Insulation resistance: —
Applicable base module			Spring clamp type: ST1B-S4IR2 Screw clamp type: ST1B-E4IR2
Applicable coding element			ST1A-CKY-15(dusty gray)
External AUX. power supply			24V DC (+20/-15%, ripple ratio within 5%)
			24V DC current: 0.030A
5V DC internal current consumption			0.080 A
External dimensions			77.6 (3.06in.) (H) × 12.6 (0.50in.) (w) × 55.4 (2.18in.) (D) [mm]
Weight			0.04 kg

*1: If a measured temperature value outside each range is input, it will be treated as a maximum or minimum value of the range.

*2: The reference resistance of Pt1000 can be obtained by multiplying that of Pt100 by 10.

*3: The accuracy can be calculated by the following.

(Accuracy) = (Conversion accuracy) + (Platinum RTD tolerance)

Class	Platinum RTD tolerance
A	±(0.15+0.002|t|)°C
B	±(0.3+0.005|t|)°C

(|t| denotes an absolute measured temperature value.)

Example) Under the condition: Platinum RTD: Class A, Operating ambient temperature: 40°C, Measured temperature: 800°C, the accuracy is (±2.4°C)+{±(0.15°C+0.002°C×800°C)}=±4.15°C.

*4: For output in the case of disconnection detection, select any of "Value immediately before disconnection", "Up scale (each measurement range's upper limit value + 5%)", "Down scale (each measurement range's lower limit value - 5%)" or "Given value". (Refer to section 3.2.5.)

*5: Disconnection is detectable for each wire (Wire A, B and b).

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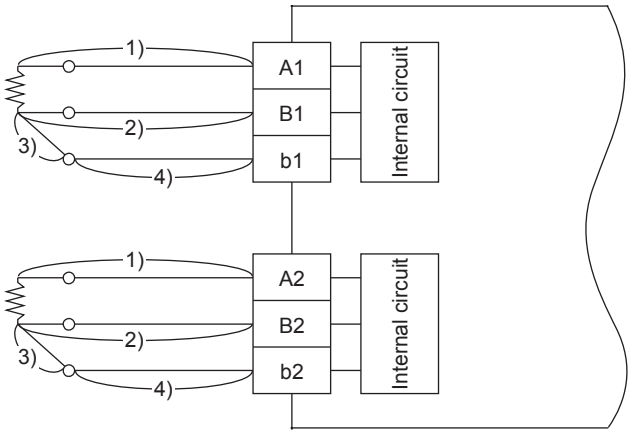
3.1.1 Specifications for platinum RTD connection

This section explains the specifications for connection of the ST1RD2 and platinum RTD.

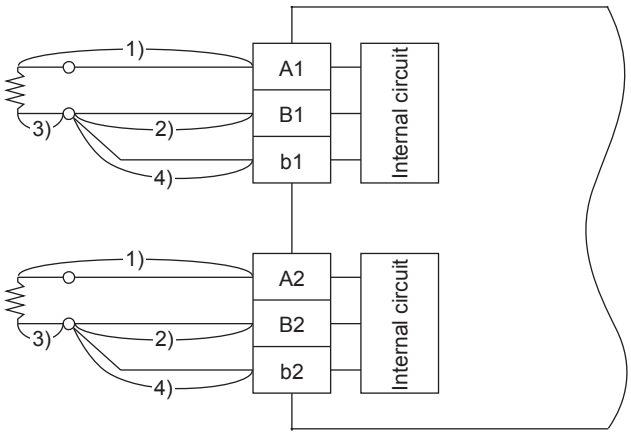
(1) For 3-wire type

The conductor resistance of 1)+3)+4) or 2)+3)+4) must be 2kΩ or less.
Also, the difference between the conductor resistance values 1) and 2) must be 10Ω or less.



(2) For 2-wire type

The conductor resistance of 1)+3)+4) or 2)+4) must be 2kΩ or less.
Also, the difference between the conductor resistance values 1)+3) and 2) must be 10Ω or less.



3.1.2 Conversion speed

The conversion speed of the ST1RD2 is 80ms/1 channel.

3.1.3 Intelligent function module processing time

The ST1RD2 intelligent function module processing time is (CH1 conversion speed) + (CH2 conversion speed).
For the input transmission delay time, refer to your head module user's manual.

3.2 Function

This section explains the functions of ST1RD2.

3.2.1 Function list

Table 3.1 lists the functions of ST1RD2.

Table 3.1 ST1RD2 Function List (1/3)

Item	Description	Reference section
Temperature conversion function	(1) This function allows conversion of a "temperature input value" input from a platinum RTD into a temperature data. (2) Temperature data are 16-bit signed binary (-2000 to 8500) and stored into Wr word input area.	Section 3.2.2
Conversion enable/disable function	(1) This function specifies whether temperature conversion is enabled or disabled on each channel. (2) Processing time can be reduced by setting the temperature conversion function to be enabled or disabled. (3) By default, the conversion for all channel is enabled. [Setting method] • Conversion enable/disable setting write (Command number: 2400H, see Section 8.4.1) • GX Configurator-ST (see Section 5.3)	——
Temperature conversion system	(1) Sampling processing Values input by each channel are successively converted into temperature values and output as digital values. (2) Averaging processing (a) Time averaging Temperature values converted by each channel are averaged in terms of time and the average is output as a digital value. (b) Count averaging Temperature values converted by each channel are averaged in terms of count and the average is output as a digital value. (c) Moving average Digital output values sampled at specified number of times are averaged. (3) Primary delay filter By a preset time constant, digital output values are smoothed. (4) Setting for averaging process specification, time/count/moving average/time constant setting can be done on each channel. (5) Averaging processing specification defaults to sampling process performed on all channels. (6) The time/count/moving average/time constant setting is defaulted to 0. [Aaveraging processing specification method] • Operation condition specification value write (Command number: 2402H, see Section 8.4.2) • GX Configurator-ST (see Section 5.3) [Time/count/moving average/time constant setting method] • CH□ time/count/moving average/time constant setting write (Command number: 2404H, see Section 8.4.3) • GX Configurator-ST (see Section 5.3)	Section 3.2.3
Disconnection detection function	(1) By this function, disconnection of a platinum RTD or a cable connected to each channel can be detected. Also, disconnection is detectable for each wire (Wire A, B and b). (2) Disconnection detection is made on only the channels set for conversion enabled.	Section 3.2.4

Table 3.1 ST1RD2 Function List (2/3)

<table>
<tr><th>Item</th><th>Description</th><th>Reference section</th></tr>
<tr><td>Conversion setting for disconnection detection</td><td>(1) For values to be stored in Wr.n, Wr.n+1 CH□ measured temperature value area in the case of disconnection detection, any of "Value immediately before disconnection", "Up scale (each measurement range's upper limit value + 5%)", "Down scale (each measurement range's lower limit value - 5%)" or "Given value" can be selected.
[Conversion setting for disconnection detection method]
• Operation condition set value write (Command No.: 2402H, see Section 8.4.2)
• GX Configurator-ST (see Section 5.3)
[Conversion setting value for disconnection detection method]
• Conversion setting value (for disconnection detection) write (Command No.: 241EH, see Section 8.4.7)
• GX Configurator-ST (see Section 5.3)</td><td>Section 3.2.5</td></tr>
<tr><td>Measurement range selection function</td><td>(1) This function sets the measurement range per channel.
(2) The measurement range is selectable from the following.
<table><tr><th colspan="2">Measurement range</th></tr><tr><td rowspan="3">Pt100</td><td>-200 to 850°C (default)</td></tr><tr><td>-20 to 120°C</td></tr><tr><td>0 to 200°C</td></tr><tr><td rowspan="3">Pt1000</td><td>-200 to 850°C</td></tr><tr><td>-20 to 120°C</td></tr><tr><td>0 to 200°C</td></tr></table>[Setting method]
• Master station configuration software
• GX Configurator-ST (see Section 5.3)</td><td>——</td></tr>
<tr><td>Alarm output function</td><td>(1) This function outputs an alarm when the temperature exceeds the range specified by the user.
Setting can be done on each channel.
(2) Alarm output setting default is set to No alarm output processing for all channels.
(3) Set the 4 alarm output values: upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value.
The upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value is set to 0 as defaults.
[Alarm output setting method]
• Operation condition specification value write (Command number: 2402H, see Section 8.4.2)
• GX Configurator-ST (see Section 5.3)
[Upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value setting method]
• CH□ upper upper limit value/upper lower limit value setting write (Command number: 2408H, 240AH, see Section 8.4.4)
• CH□ lower upper limit value/lower lower limit value setting write (Command number: 2409H, 240BH, see Section 8.4.5)
• GX Configurator- ST (see Section 5.3)</td><td>Section 3.2.6</td></tr>
<tr><td>Command</td><td>(1) By using commands, command parameters can be set, and the parameter settings can be written from RAM to ROM and read from ROM to RAM.</td><td>Chapter 8</td></tr>
</table>

Table 3.1 ST1RD2 Function List (3/3)

Item	Description	Reference section
Compensation of measured temperature value	(1) The ST1RD2 is capable of correcting the error between the "actual temperature" and the "measured temperature", which may occur due to variation in platinum RTD accuracy and/or a specific wiring or grounding condition. To compensate the error, the 1-point compensation using the sensor compensation function and the 2-point compensation using the offset/gain setting can be used. 1) Sensor compensation function When the measurement range width is less than 60℃, use the sensor compensation function. The compensation value can be easily obtained in 1-point temperature measurement only. 2) Offset/gain setting function When the measurement range width is 60℃ or more, use the offset/gain setting function. A wide-range compensation is available. (2) For the sensor compensation or the offset/gain setting, prepare a thermometer to measure the temperature of the object. Compensation is performed based on the difference between the temperature measured by the thermometer and the one measured by the ST1RD2.	――
Sensor compensation function	(1) The measured temperature value is compensated based on the set sensor compensation value. The compensation is available for each channel. [Sensor compensation method] • Sensor compensation value write (Command number : 241AH, see Section 8.4.6) • GX Configurator-ST	Section 3.2.7
Offset/gain setting function	(1) Linear compensation is available by individually compensating any given 2 points (offset/gain value) within the effective range. The offset/gain setting can be made for each channel. (2) To use the user range setting, it needs to be set in the offset/gain value selection (user parameter) in advance. The offset/gain value selection can be made for each channel. Default is set to "factory default". [Offset/gain setting method] • Master station program • GX Configurator-ST [Offset/gain value selection method] • Master station configuration software • GX Configurator-ST (see Section 5.3)	Section 4.5
Online module change	(1) A module change is made without the system being stopped. [Execution procedure] • Button operation on the head module • GX Configurator-ST	Chapter 7

3.2.2 Temperature conversion function

(1) By converting a "temperature value" input from a platinum RTD into temperature data, the temperature can be detected.

(2) The value of the measured temperature to the first decimal place is multiplied by 10 and the result is stored into Wr.n, Wr.n+1 CH□ measured temperature value in 16-bit signed binary. (The second decimal place and on are rounded down.)

[Example 1] At the measured temperature value of 123.45℃ ..... 1234 is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	1	0	0	1	1	0	1	0	0	1	0

(3) A negative measured temperature value is displayed as two's complement.

[Example 2] At the measured temperature value of -123.45℃ ..... -1234 is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	0

(4) All channels are set to 0 when the MELSEC-ST system is powered up, when the head module is reset or when the Bw.n+1 conversion setting request is OFF (0).

(5) Processing time can be reduced by setting unused channels to be conversion-disabled.
In addition, it prevents unnecessary disconnection of unused channels.

(6) Acceptable input temperature range varies with each measurement range. If any temperature outside of range is input, the measured temperature value will be fixed to the maximum or minimum of the selected measurement range.

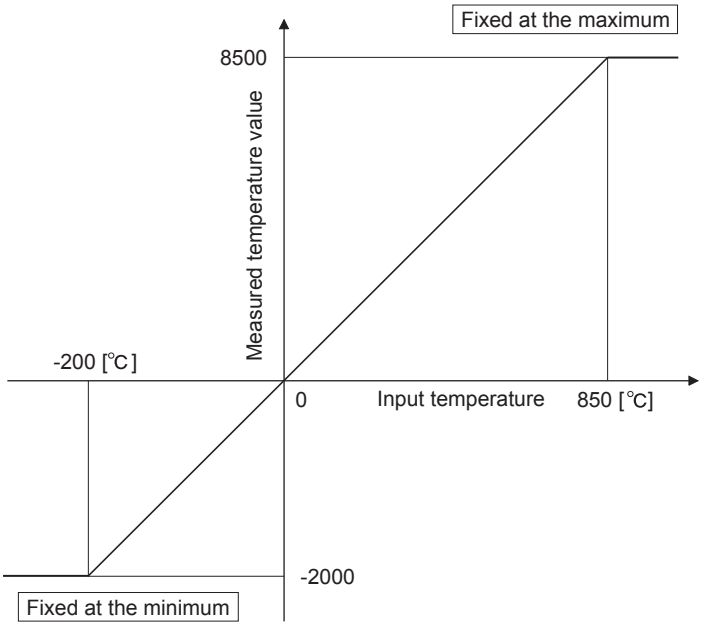


Figure 3.1 Conversion characteristic of -200 to 850℃ range

3.2.3 Temperature conversion system

There are the following temperature conversion methods: sampling, averaging (time averaging, count averaging and moving average) and primary delay filter.

(1) Sampling processing

Input temperature values are converted one by one, and each time a measured temperature value is stored into Wr.n , Wr. n+1 CH□ measured temperature value area.

(Processing time) = (Number of used channels) × (80ms)

[Example] If channels 1 and 2 are set conversion-enabled, the sampling time is 160ms.

$$20 \times 80\text{ms} = 160\text{ms}$$

(2) Averaging processing

The setting ranges for time, count, or moving average are shown below.

Setting any value outside the setting range will light up the ERR.LED.

- Time averaging: 640 to 5000ms
- Count averaging: 4 to 500 times
- Moving average: 4 to 60 times

(a) Time averaging

Conversion is performed for the specified channel for the preset period of time.

Then, the sum of the values excluding the maximum and minimum is averaged and the result is stored in Wr.n, Wr. n+1 CH□ measured temperature value area.

The number of processings conducted within the preset time varies depending on the number of used channels (number of channels set conversion-enabled).

$$\text{(Processing count)} = \frac{\text{(Preset time)}}{\text{(Number of used channels)} \times \text{(80ms)}}$$

[Example] If channels 1 and 2 are set conversion-enabled with the preset time of 840ms, the measurement will be taken 5 times and an average value will be output.

$$\frac{840}{2 \times 80} = 5.25 \text{ (times)} \ldots\ldots \text{Truncate the fractional part.}$$

(b) Count averaging

Conversion is performed for the specified channel for the preset number of times.

Then, the sum of the values excluding the maximum and minimum is averaged and the result is stored into Wr.n, Wr. n+1 CH□ measured temperature value area.

The time used for the case where a count-averaged value is stored into Wr.n, Wr. n+1 CH□ measured temperature value area varies depending on the number of used channels (number of channels set conversion-enabled).

(Processing time) = (Preset count) × (Number of used channels) × (80ms)

[Example] If channels 1 and 2 are set conversion-enabled with the preset count of 500, an average value will be output every 80000ms.

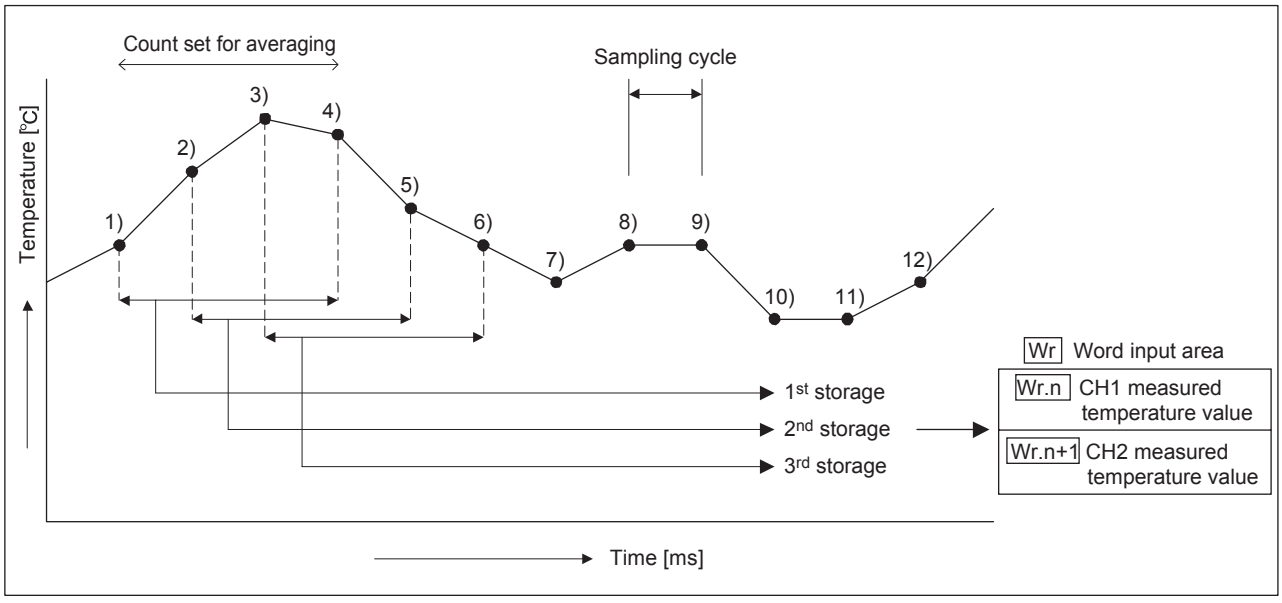
500 × 2 × 80 = 80000ms

(c) Moving average

From the conversion values obtained at sampling intervals for the specified number of times, the maximum and minimum values are eliminated and the others are averaged. The averaged value is stored in Wr.n, Wr. n+1 CH□ measured temperature value area.

Since the calculation is done for each sampling period, the latest digital output value can be obtained.

Moving average processing for setting of 4 times



Data transition in Wr.n, Wr. n+1 CH□ measured temperature value

1st storage	2nd storage	3rd storage
~~1)~~ + 2) + ~~3)~~ + 4) / 2	2) + ~~3)~~ + 4) + ~~5)~~ / 2	~~3)~~ + 4) + 5) + ~~6)~~ / 2

(3) Primary delay filter

By setting a time constant, excessive noise is eliminated and smoothed temperature value can be output. Depending the time constant, the degree of smoothness is changed.
The setting range is from 80 to 5000ms.
Setting any value outside the setting range will light up the ERR.LED.

The relational expression between the time constant and measured temperature value is shown below.
[In the case of n=1]
Yn=0

[In the case of n=2]

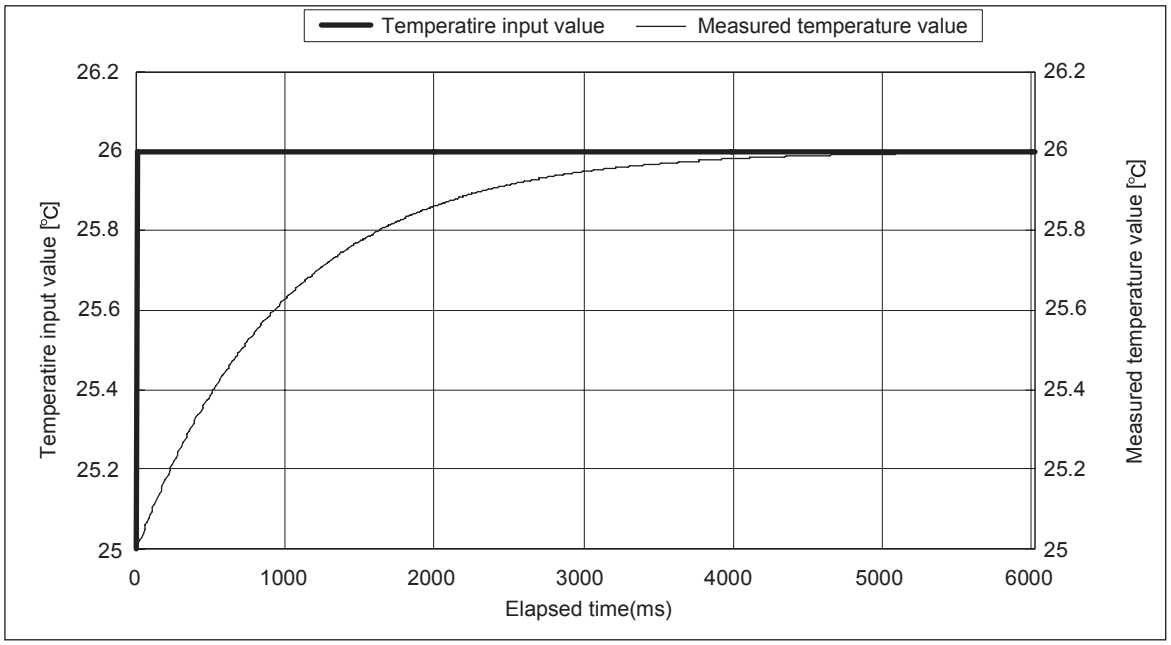
$$Yn = Xn-1 + \frac{\Delta t}{\Delta t + TA}(Xn - Xn-1)$$

[In the case of n ≧ 3]

$$Yn = Yn-1 + \frac{\Delta t}{\Delta t + TA}(Xn - Yn-1)$$

Yn: Current measured temperature value
Δt: Conversion time (0.08s)
N : Sampling count
TA: Time constant (s)
Yn-1: Preceding measured temperature value
Xn: Measured temperature value before smoothing
* Br. n+2 Conversion completion flag turns on at n ≧ 2.

[Example] When the temperature input value is changed from 25.0 to 26.0℃
In the time constant setting of 1000ms (1s), the measured temperature value is changed as shown below.
At 1000ms (1s) after the temperature input value is changed to 26.0℃, the measured temperature value reaches 63.2% of the value output in the case of selecting the sampling processing.



3.2.4 Disconnection detection function

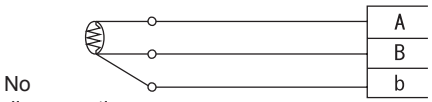
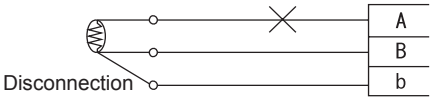
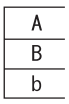
(1) If disconnection of a platinum RTD, or cable is detected, the ERR.LED will light up, and a system error will be stored in Er. n+3 to Er. n CH □ error information. (Refer to section 3.3.2)

(2) Disconnection is detected on only the channels set for conversion enabled.

(3) Disconnection is detected on each channel.
Also, disconnection is detectable for each wire (Wire A, B and b).
Whether the line is disconnected or not can be checked by an error code. (Refer to section 9.1)

(4) An option for the temperature conversion value at the time of disconnection can be selected from "Value immediately before disconnection", "Up scale (each measurement range's upper limit value + 5%)", "Down scale (each measurement range's lower limit value - 5%)" or "Given value". (Refer to section 3.2.5)

(5) The relationships between disconnection detection and conversion enable/disable setting are indicated below.

Connection Status	Conversion Enable/Disable Setting	Disconnection Detection Flag
 No disconnection	Enable	OFF
	Disable	
 Disconnection	Enable	ON
	Disable	OFF
 No connection	Enable	ON
	Disable	OFF

POINT

- Any channel where no platinum RTD is connected must be set to "conversion disable". If unconnected channel is set as conversion-enabled, disconnection is detected.
- Use the module within the allowable input range of each measurement range. If an analog value exceeding the input range is entered, wire disconnection will be detected.
- Refer to Section 4.4 for the wiring.
- Refer to Section 9.2.3 for the troubleshooting of disconnection detection.

3.2.5 Conversion setting for disconnection detection function

(1) For values to be stored in the Wr.n, Wr.n+1 CH□ measured temperature value in the case of disconnection detection, any of "Value immediately before disconnection", "Up scale (each measurement range's upper limit value + 5%)", "Down scale (each measurement range's lower limit value - 5%)" or "Given value" can be selected.
Setting is available for each channel.

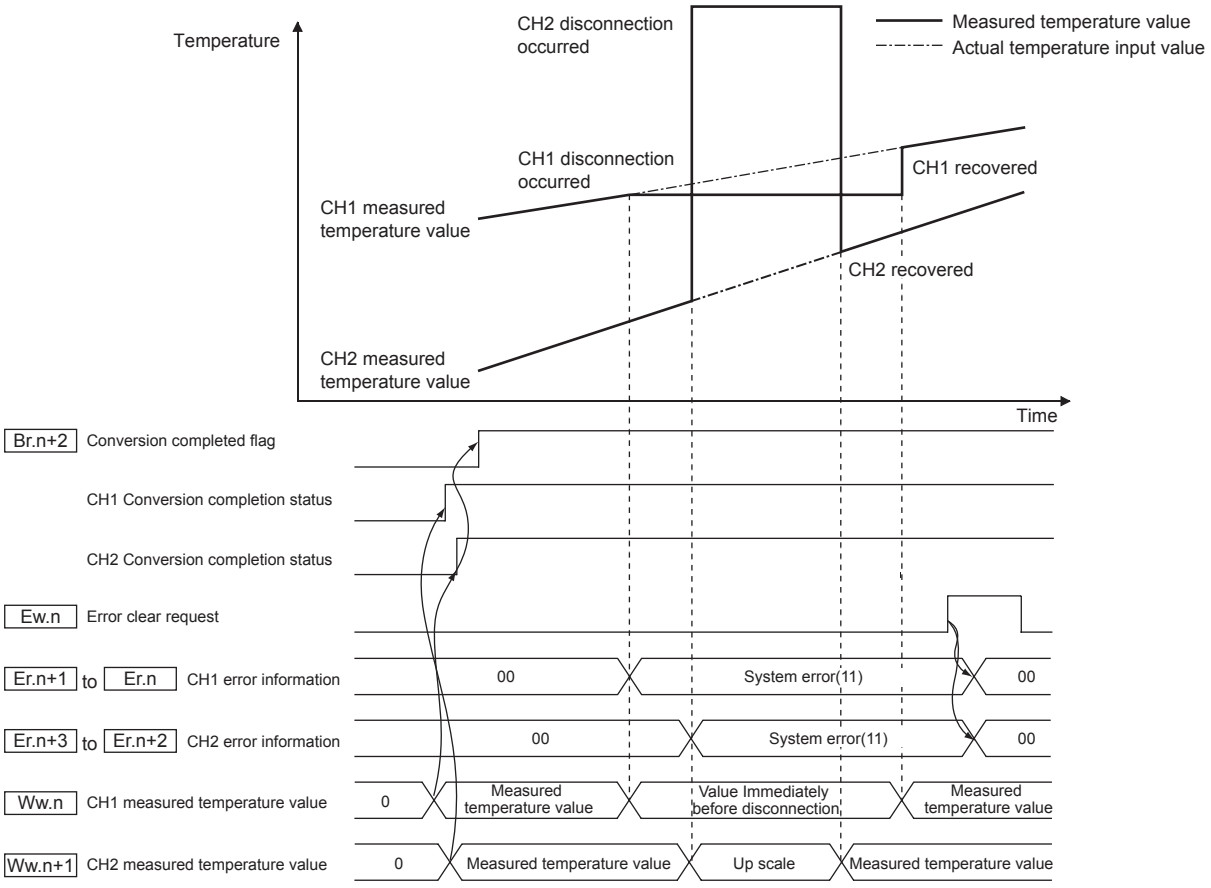
(2) This function can be utilized only for channels where temperature conversion is enabled.

(3) When Up scale or Down scale is set, an Up scale value (each measurement range's upper limit value + 5%) or a Down scale value (each measurement range's lower limit value - 5%) of the individual range is stored respectively.

Measurement range		Up scale	Down scale
Pt100 Pt1000	-200 to 850℃	902.5℃	-252.5℃
	-20 to 120℃	127℃	-27℃
	0 to 200℃	210℃	-10℃

(4) When Given value is selected, specify a value to Wr.n, Wr.n+1 CH□ conversion setting value for disconnection detection.
The value set in the area is stored in Wr.n, Wr.n+1 CH□ measured temperature value when disconnection is detected.

[Example] Operational behavior in the case of disconnection when the conversion setting for disconnection detection is set as follows: CH1: Value immediately before disconnection, CH2: Up scale



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3.2.6 Alarm output function

(1) If a detected measured temperature value rises to or above the upper upper limit value or falls to or below the lower lower limit value and enters the alarm output range, Br.n+1 alarm output signal turns on (1) and the alarm information is stored into Er.n+3 to Er.n CH□ error information. (Refer to Section 3.3.2)

(2) When the measured temperature value falls below the upper lower limit value or rises above the lower upper limit value and returns to within the setting range after the alarm output,
Er.n+3 to Er.n CH□ error information of the corresponding channel is automatically cleared.
Br.n+1 alarm output signal turns off (0) only when values detected on all channels return to within the setting range.

(3) Alarm output processing can be specified for each channel.
The default is set to No alarm output processing performed on all channels.

(4) Set the 4 alarm output values: upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value.
If a channel setting does not meet the condition shown in (a) and (b), it is considered as an error and the ERR.LED will light up.
(a) Setting range on each measurement range is shown below.
Setting is performed in 0.1℃ unit.
[Example] To set to 0.3℃ ..... Enter "3".

Measurement range		Setting range
Pt100 Pt1000	-200 to 850℃	-2000 to 8500
	-20 to 120℃	-200 to 1200
	0 to 200℃	0 to 2000

(b) The following is a conditional expression of the setting value.
Lower lower limit value ≤ lower upper limit value ≤ upper lower limit value ≤ upper upper limit value

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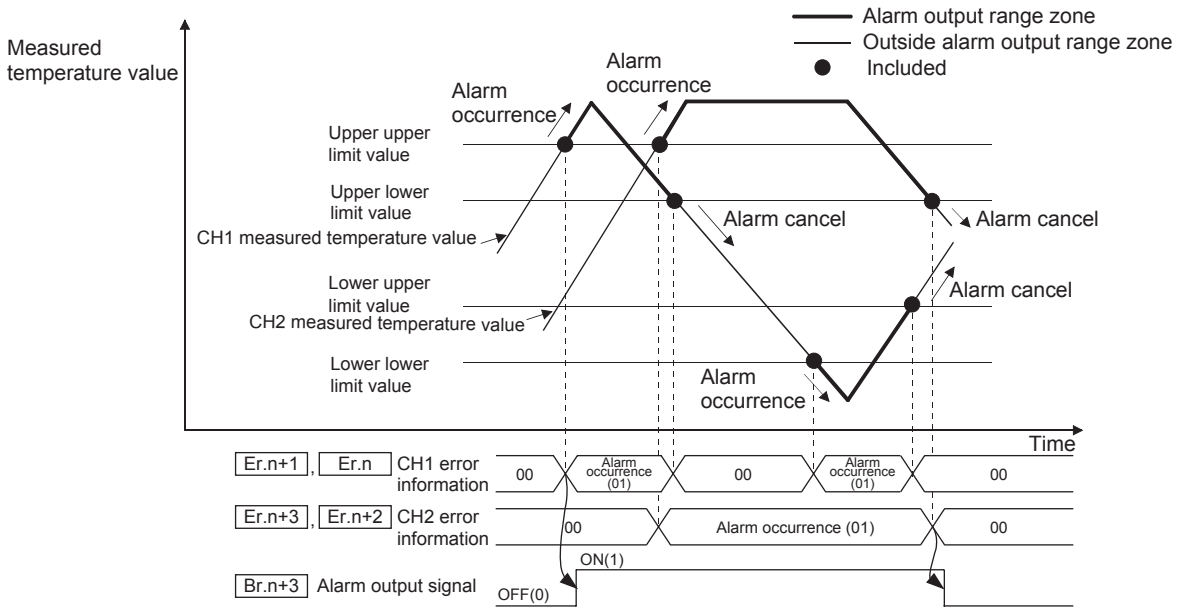
(5) An alarm is output for only the channel for which conversion is enabled.



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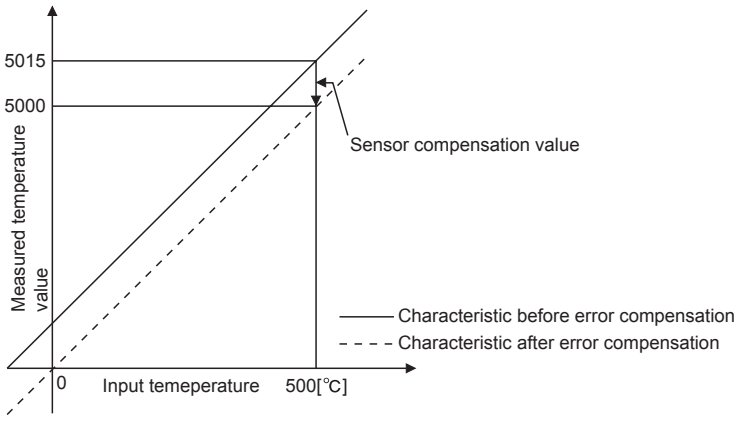
3.2.7 Sensor compensation function

(1) This function is used to correct the error between the "actual temperature" and the "measured temperature", which may occur due to variation in platinum RTD accuracy and/or a wiring or grounding condition.
The measured temperature value is compensated based on the set sensor compensation value.
The compensation is available for each channel.

(2) The setting range is -200 to 200.
Set the value in units of 0.1℃.

Example) When the measured temperature (501.5℃) is higher than the actual temperature (500.0℃) by 1.5℃, set -15 as the sensor compensation value.
500.0(℃) - 501.5(℃) = -1.5(℃)
-1.5(℃) x 10 =-15



3.3 I/O Data

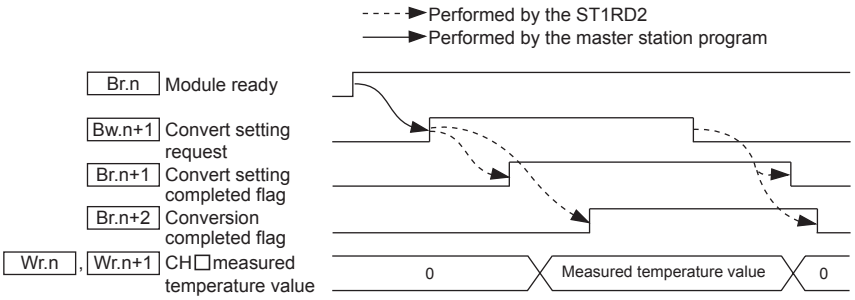
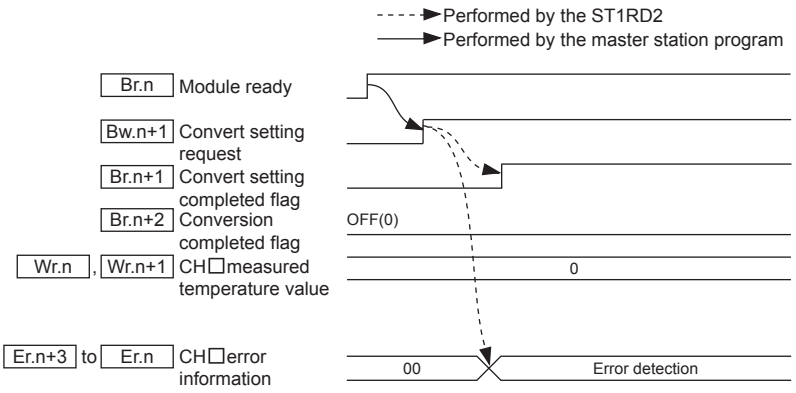
The ST1RD2 has the areas for data transfer with the head module as indicated in Table 3.3.
This section explains the composition of each area.

Table 3.3 I/O Data List

Transfer direction	Item		Number of Occupancy	Default value	Reference section
ST1RD2→ Head module (Input Data)	Br Bit Input Area		4	0	Section 3.3.1
	Information Area	Er Error Information Area	4	0	Section 3.3.2
		Mr Module Status Area	2	0	Section 3.3.3
	Wr Word Input Area		2	0	Section 3.3.4
Head module → ST1RD2 (Output Data)	Bw Bit Output Area		4	0	Section 3.3.5
	Request Area	Ew Error Clear Area	4	0	Section 3.3.6
	Ww Word Output Area		2	0	Section 3.3.7

3.3.1 Bit input area

This section explains the Br bit input area.

Bit input	Item	Description
Br.n	Module ready	(1) Turns on (1) when conversion is ready after the MELSEC-ST system (ST1RD2) is powered on or the head module is reset. (2) When the Br.n Module ready signal is off (0), conversion processing is not performed. Br.n Module ready turns off (0) in the following situations: • In offset/gain setting mode • When the ST1RD2 has a watchdog timer error • In module change enabled status during online module change (refer to Chapter 7)
Br.n+1	Convert setting completed flag	(1) After Bw.n+1 convert setting request has turned on (1), this turns on (1) when user parameter and command parameter setting check is completed. (Turns on (1) if a setting error is detected.) [When parameter setting check result is normal]  [When parameter setting check result is abnormal] 

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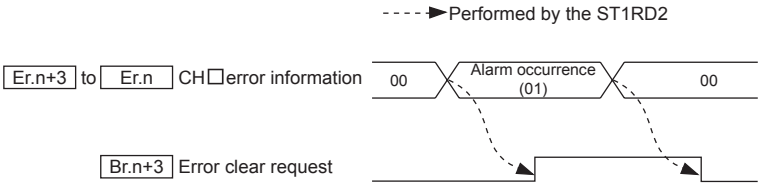
Bit input	Item	Description
Br.n+2	Conversion completed flag	(1) After Bw.n+1 convert setting request has turned on (1), Br.n+2 conversion completed flag turns on (1) when conversion is completed on all channels for which conversion is enabled. (2) The Br.n+2 conversion completed flag is processed only once when the Bw.n+1 convert setting request is changed. (a) When Bw.n+1 convert setting request is turned from off (0) to on (1) When the measured temperature value is stored into Wr.n, Wr.n+1 CH☐ measured temperature value, Br.n+2 conversion completed flag turns on (1). Specifying averaging process will cause a delay in turning Br.n+2 conversion completed flag on (1) by the processing time. (b) When Bw.n+1 convert setting request is turned from on (1) to off (0) Br.n+2 conversion completed flag turns off (0).
Br.n+3	Alarm output signal	(1) Turns on (1) when the measured temperature value falls outside the setting range for the CH☐ upper upper limit value/upper lower limit value (command parameter) and CH☐ lower upper limit value/lower lower limit value (command parameter) on either channel where the alarm output is validated and conversion is enabled. (2) Turns off (0) automatically when the measured temperature value returns to within the setting range on all channels for which enabled conversion is enabled. 

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3.3.2 Error information area

This section explains the Er error information area.

<table>
<tr><th colspan="2">Error information</th><th>Item</th><th>Description</th></tr>
<tr><td>Er.n+1</td><td>Er.n</td><td>CH1 error information</td><td rowspan="2">(1) Stores the error information or alarm information when an error or alarm occurs.
(2) The stored error information can be cleared by turning on (1) the Ew.n error clear request. (Refer to Section 3.3.6)
(3) If an alarm and a system error occur at the same time, a system error takes precedence and will be written over the area.
(4) The alarm information is automatically cleared when the measured temperature value returns to within the setting range. (Refer to Section 3.3.1.)
<table>
<tr><th>Er.n+1
Er.n+3</th><th>Er.n
Er.n+2</th><th>Information</th></tr>
<tr><td>0</td><td>0</td><td>Normal</td></tr>
<tr><td>0</td><td>1</td><td>Alarm has occurred</td></tr>
<tr><td>1</td><td>1</td><td>System error has occurred</td></tr>
</table>
</td></tr>
<tr><td>Er.n+3</td><td>Er.n+2</td><td>CH2 error information</td></tr>
</table>

3.3.3 Module status area

This section explains the Mr module status area.

<table>
<tr><th colspan="2">Module status</th><th>Item</th><th>Description</th></tr>
<tr><td>Mr.n+1</td><td>Mr.n</td><td>Module status</td><td>(1) The operating status of the ST1RD2 is stored.
<table>
<tr><th>Mr.n+1</th><th>Mr.n</th><th>Information</th></tr>
<tr><td>0</td><td>0</td><td>Online module change in progress or internal bus error occurred</td></tr>
<tr><td>1</td><td>1</td><td>Normal</td></tr>
</table>
</td></tr>
</table>

3.3.4 Word input area

This section explains the Wr word input area.

<table>
<tr><th>Word input</th><th>Item</th><th>Description</th></tr>
<tr><td>Wr.n</td><td>CH1 measured temperature value</td><td rowspan="2">(1) The measured temperature value converted from an analog value is stored into Wr.n, Wr.n+1 CH□ measured temperature value for each channel.
(2) The measured temperature value rounded off to 1 decimal place is multiplied by 10 and is stored as a signed 16-bit binary.
(The number is truncated at the second decimal place.)</td></tr>
<tr><td>Wr.n+1</td><td>CH2 measured temperature value</td></tr>
</table>

3.3.5 Bit output area

This section explains the Bw bit output area.

Bit output	Item	Description
Bw.n	System area	Use prohibited (fixed to 0)
Bw.n+1	Convert setting request	(1) Turn this item from off (0) to on (1) to validate the settings of the user parameter and command parameter. (a) When writing the command parameter, make sure to turn the Bw.n+1 convert setting request off (0) to stop the conversion. When it is on (1), the command parameter cannot be written. (b) Regardless of whether the Bw.n+1 convert setting request is on (1) or off (0), the user parameter are written but not validated. (Turn the Bw.n+1 convert setting request from off (0) to on (1).) (2) Turn this on (1) to start conversion for the channel for which conversion set to be enabled in the conversion enable/disable setting (command parameter). When it turns off (0), the conversion is stopped. (3) For the on (1)/off (0) timing, refer to the Br.n+1 column in Section 3.3.1. OFF (0): Conversion stop (Default) ON (1): Conversion start
Bw.n+2 Bw.n+3	System area	Use prohibited (fixed to 0)

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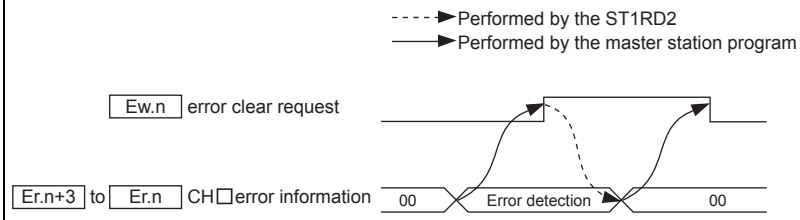
3.3.6 Error clear area

This section explains the Ew error clear area.

Error clear area	Item	Description
Ew.n	Error clear request	(1) Turn this request on (1) to clear the Er.n+3 to Er.n CH☐ error information. (2) After confirming that the Er.n+3 to Er.n CH☐ error information has been cleared, turn off (0) the Ew.n error clear request. OFF (0): No error clear requested (Default) ON (1): Error clear requested 
Ew.n+1 Ew.n+2 Ew.n+3	System area	Use prohibited (fixed to 0)

3.3.7 Word output area

The ST1RD2 does not use the Ww word output area since it is operational without reserving the area.
To make effective use of the Ww word output area, select "ST1RD2 (without Ww)" using the configuration software of the master station or GX Configurator-ST. The number of occupancy of the Ww word output area in the ST1RD2 is 0.

3.4 Memory and Parameters

This section explains the memory and parameters of the ST1RD2.

3.4.1 Memory

RAM and ROM are available as the parameter storage memory of the ST1RD2.

(1) RAM

(a) The ST1RD2 operates based on the parameter settings stored in the RAM.

(b) The parameter settings stored in the RAM become valid when the Bw.n+1 convert setting request turns from OFF to ON.

(2) ROM

(a) The ROM stores the parameters. The stored parameters are not erased at power-off.

(b) The parameters stored in the ROM are transferred to the RAM when:
- The MELSEC-ST system (ST1RD2) is powered off, then on.
- The head module is reset.
- Parameter setting ROM read (command number: 3400_H) is executed.

3.4.2 Parameters

The ST1RD2 has user parameters and command parameters.

(1) User parameters

(a) Setting item

- Measurement range setting
- Offset/gain value selection

(b) Setting method

Set the parameters using the configuration software of the master station. When the MELSEC-ST system is tested alone, set the parameters using GX Configurator-ST.

(2) Command parameters

(a) Setting item

- Conversion enable/disable setting
- Averaging processing specification
- Time/count/moving average/time constant setting
- Alarm output setting
- Upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value setting
- Sensor compensation value setting
- Conversion setting for disconnection detection
- Conversion setting value for disconnection detection

(b) Setting method

1) Command

Execute a command from the master station to write the settings to the RAM of the ST1RD2.
When the command parameters are written in advance using Parameter setting ROM write (command number: 3401H), master station program steps can be reduced.

2) GX Configurator-ST

Use of GX Configurator-ST allows the parameters to be easily set on-screen, reducing master station program steps.
Write and save the settings, which are used for a MELSEC-ST system startup, to the ROM. (Use write to RAM when conducting a test temporarily.)

4 SETUP AND PROCEDURES BEFORE OPERATION

4.1 Handling Precautions

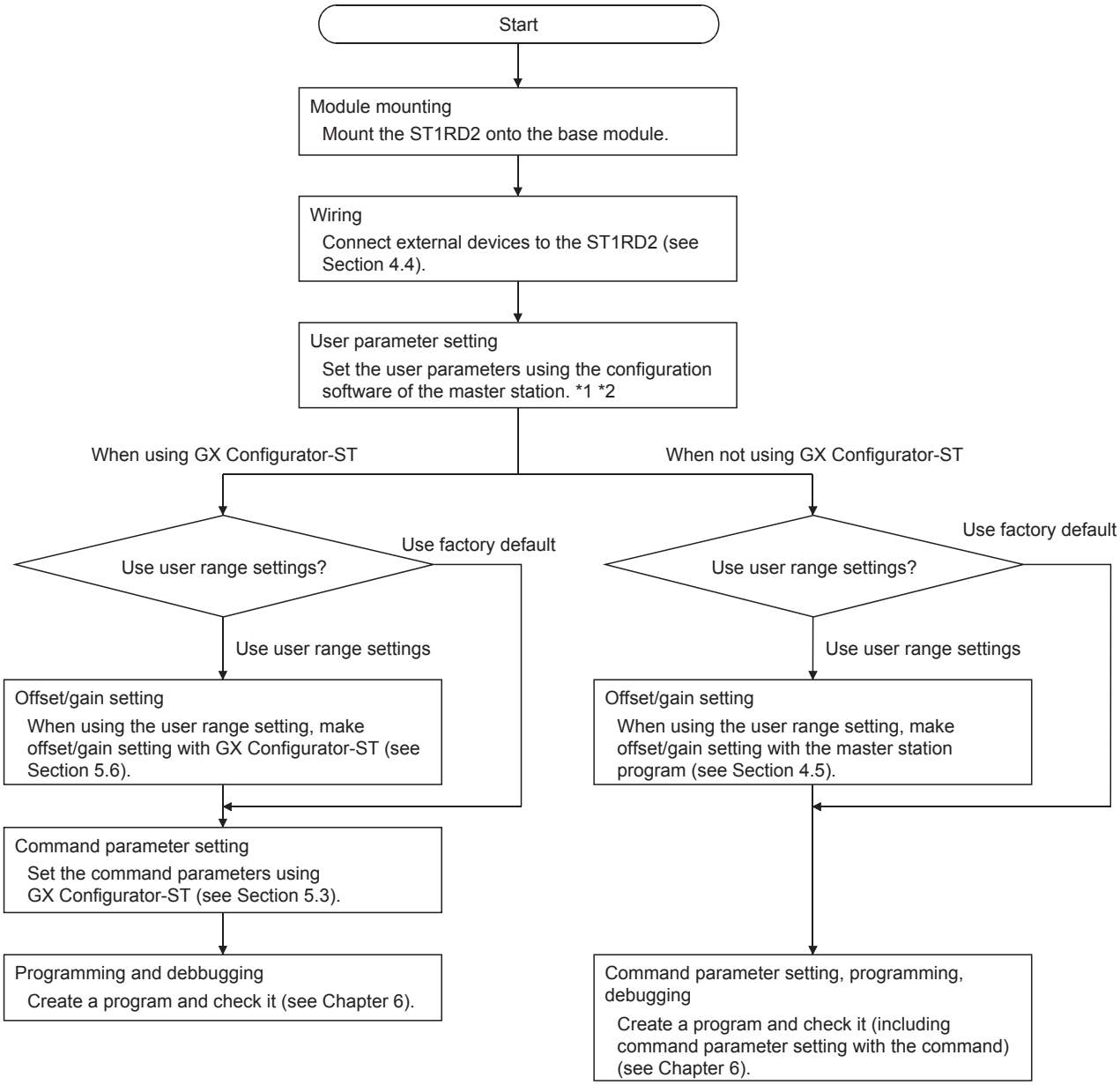
(1) Do not drop the module or give it hard impact since its case is made of resin.
Doing so can damage the module.

(2) Do not disassemble or modify the modules.
Doing so could cause failure, malfunction, injury or fire.

(3) Be careful not to let foreign particles such as swarf or wire chips enter the module.
They may cause a fire, mechanical failure or malfunction.

4 - 1

4.2 Setup and Procedure before Operation

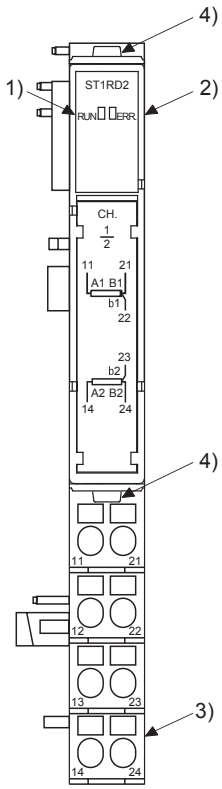


*1 When using the user range setting, set the offset/gain value selection (user parameter) as "user range setting".
*2 If executing offset / gain setting in the program, set the measurement range setting (user parameter) appropreate for the offset/gain setting.
(If making the offset / gain setting with GX Configurator-ST, set the measurement range using GX Configurator-ST.)

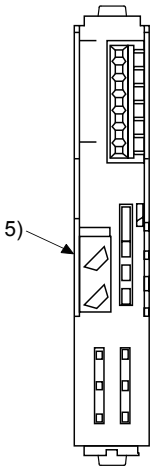
POINT
Refer to Section 3.4 for details of the user parameter and command parameter.

4.3 Part Names

The name of each part in the ST1RD2 is listed below.
The following shows the ST1RD2 mounted on the spring clamp type base module.



[Rear view of ST1RD2]



No.	Name and appearance	Description
1)	RUN LED	RUN LED and ERR. LED (on/flashing/off) indicate various statuses of the ST1RD2 (see section 4.3.1).
2)	ERR. LED	
3)	Terminal block	The input signal wires of the ST1RD2 are connected to the terminal block of the base module. [Applicable base modules] Spring Clamp Type : ST1B-S4IR2 Screw Clamp Type : ST1B-E4IR2
4)	Slice module fixing hooks (at both ends)	Used for mounting/dismounting the ST1RD2 to/from the base module. While pressing the hooks at both ends, mount/dismount the ST1RD2.
5)	Coding element	Prevents the module from being mounted incorrectly. The coding element consists of two pieces, and its shape varies depending on the model name. When the ST1RD2 is mounted on the base module and then dismounted, one piece of the coding element remains on the base module, and the other remains on the ST1RD2. The ST1RD2 can be mounted onto the base module only when the two pieces of the coding elements are matched. [Applicable coding element] ST1RD2 : ST1A-CKY-15

POINT
In order to ensure safety, make sure to attach the coding element to the base module and ST1RD2.

Terminal No.	Signal name		Terminal No.	Signal name	
11	CH1	A1	21	CH1	B1
12	Vacancy		22		b1
13	Vacancy		23	CH2	b2
14	CH2	A2	24		B2

4.3.1 Status confirmation by LED

Table 4.1 explains the LED indications.

Table 4.1 LED Indications

LED indication		Operating status
RUN LED	ERR.LED	
On	Off	Normal
	On	System error is occurring.
Flashing (1s interval)	Off	The data communication has stopped or the parameter communication is faulty between the master module and head module, other slice module is faulty or an internal bus error is occurring.
	On	System error is occurring when the data communication has stopped or the parameter communication is faulty between the master module and head module, other slice module is faulty or an internal bus error has occurred.
Flashing (0.5s interval)	Off	Module is in offset/gain setting mode.
	On	System error is occurring in offset/gain setting mode.
Flashing (0.25s interval)	Off	Module is selected as the target of online module change.
	On	System error is occurring when module is selected as the target of online module change.
Off	Off	Power is off or online module change is being made.
	On	System error is occurring during online module change.

4.4 Wiring

The wiring precautions and examples of module connection are provided in this section.

4.4.1 Wiring precautions

In order to optimize the functions of the ST1RD2 and ensure system reliability, external wiring, that is protected from noise, is required.
Please observe the following precautions for external wiring:

(1) Use separate cables for the AC control circuit and the external input signals of the ST1RD2 to avoid the influence of the AC side surges and inductions.

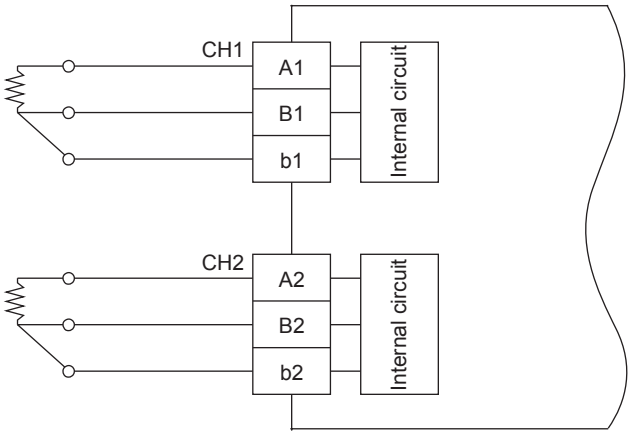
(2) Do not bring/install the cables closer to/together with the main circuit line, a high-voltage cable or a load cable from other than the MELSEC-ST system. Doing so may increase the effects of noise, surges and induction.

(3) Always place the platinum RTD signal cable at least 100mm (3.94inch) away from the main circuit cables and AC control lines.
Fully keep it away from high-voltage cables and circuits which include harmonics, such as an inverter's load circuit.
Not doing so will make the module more susceptible to noises, surges and inductions.

4.4.2 External wiring

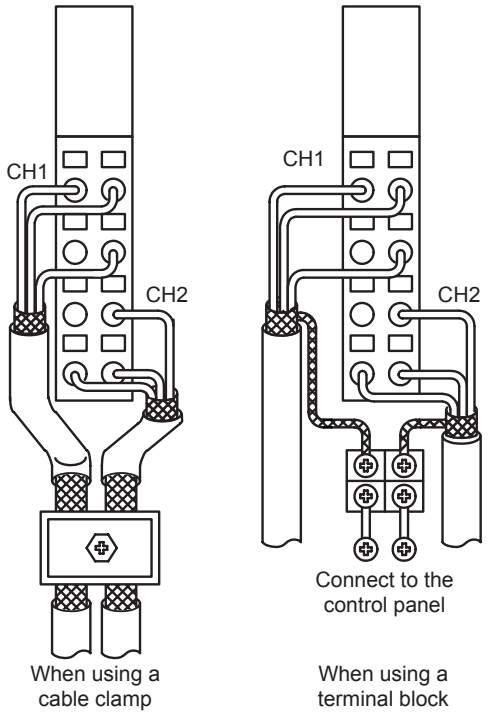
Connect the cables to the base module (sold separately).
For the specifications for platinum RTD connections, refer to Section 3.1.1.

(1) For 3-wire type



*1 As cables, always use shielded conductors.
Also, wire the shielded cables as short as possible.

*2 Ground the shield through the cable clamp or terminal block.
Depending on noise conditions, however, it is recommended to ground the shield on the external device side.



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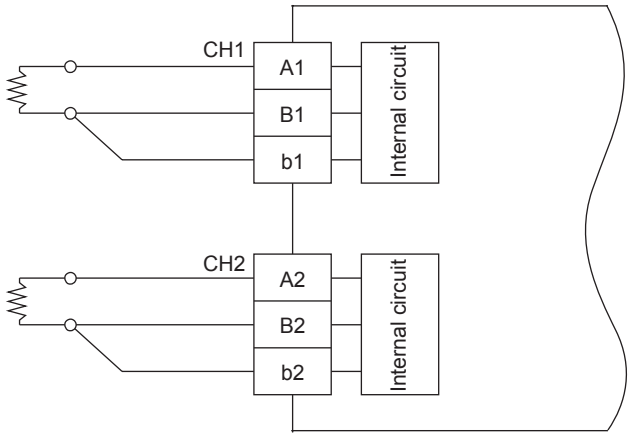
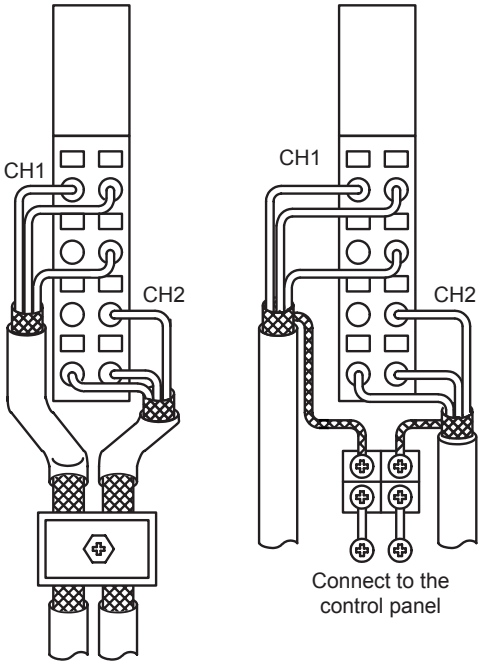
(2) For 2-wire type



*1 As cables, always use shielded conductors.
Also, wire the shielded cables as short as possible.

*2 Ground the shield through the cable clamp or terminal block.
Depending on noise conditions, however, it is recommended to ground the shield on the external device side.



POINT
Any channel where no platinum RTD is connected must be set to "conversion disable". If unconnected channel is set as conversion enable, disconnection is detected.

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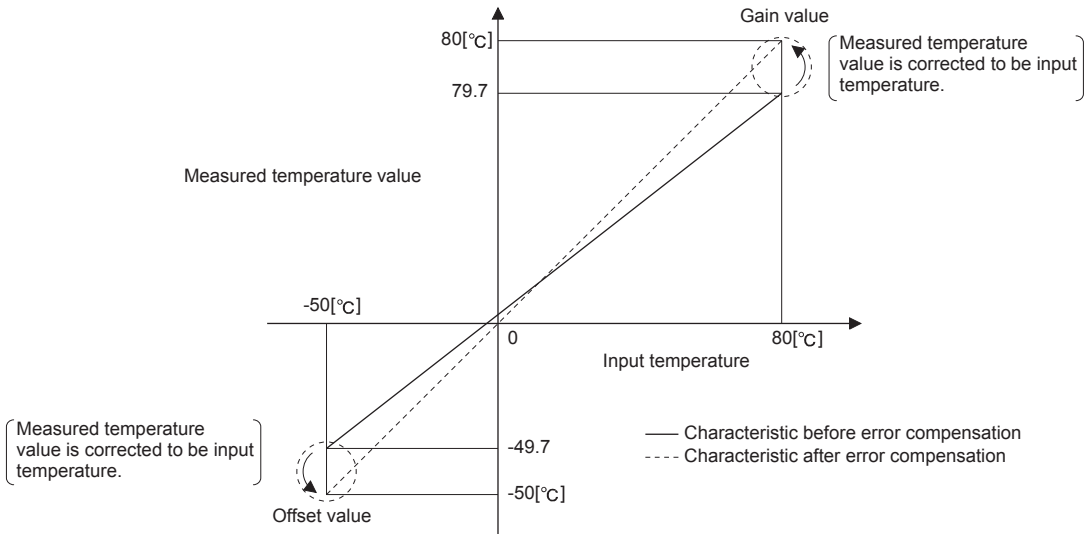
4.5 Offset/gain Setting

This section explains the offset/gain setting.

(1) The offset/gain setting is a function designed to compensate for the value at any two points (offset value/gain value) within the operating range when the proper measured temperature value is not available at system startup or when the measurement range is changed.

(2) The following are the relationships between the measured temperature value and respective input value corrected by the offset value/gain value.



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POINT

(1) Make the offset/gain setting within the temperature range of each measurement range (refer to Section 3.1). If the setting is made outside each range, the resolution and accuracy may not fall within the ranges of the performance specifications.

(2) Obtain the offset value and gain value in the status of actual use.
After the setting is completed, make sure that the offset value and gain value are set correctly in the status of actual use.

(3) The offset and gain values are stored into the ROM and are not erased at power-off.

(4) When making the offset/gain setting, write the values to the ROM using User range write (command number: 3405H). Data can be written to the ROM up to 10,000 times.
To prevent accidental write to the ROM, write to ROM is counted from the time of power-on.

(5) If an error occurs during offset/gain setting, the offset and gain values are not written to the ST1RD2.
Set the correct offset and gain values again.

(6) High accuracy is ensured when the offset and gain values are set as the minimum and maximum values of the operating range.

(7) High accuracy can be obtained if the offset/gain setting is done after 30-minute power-up.

(8) Always set the offset and gain values so that they will satisfy the following conditions. An error will occur if any of the conditions are not satisfied.
Condition 1: Within the input enabled range
Condition 2: Offset value < Gain value
Condition 3: (Gain value) - (offset value) $\geqq$ 0.2 [℃]

(9) For platinum RTD, error compensation may also be made using a standard DC voltage generator or like instead of inputting a temperature directly to the thermocouple.

Power value of standard DC voltage generator	=	Resistance value of platinum RTD

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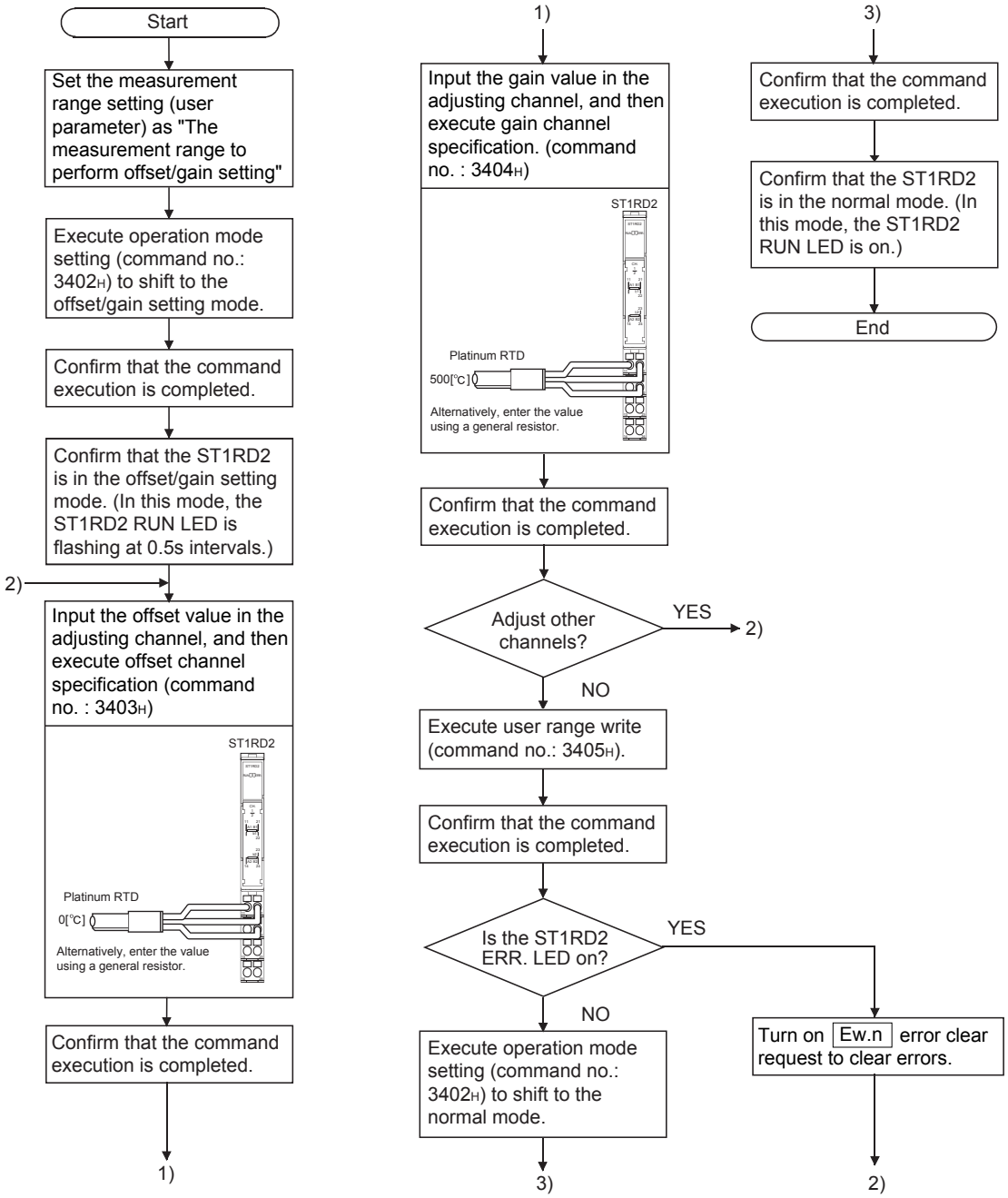
4.5.1 Offset/gain settings procedure

If using the user range setting, perform the offset/gain setting in the procedure shown below.
When the factory default is used, the offset/gain setting is not necessary.
If the GX Configurator-ST has been installed, perform the offset/gain settings according to the procedure described in Section 5.6.



(1) Programming

The program examples are given in this section, showing the mode switching (between the normal mode and the offset/gain setting mode), the channel specification for the offset/gain setting, the offset/gain value adjustment, and the offset/gain value writing to the ST1RD2.

(a) When QJ71PB92V/QJ71PB92D is used as master station

The program example is based on the system configuration given in Section 6.2.

1) Device assignment in program examples

Devices used by QJ71PB92V/QJ71PB92D

Device	Application	Device	Application
X0	Exchange start end signal	Y0	Exchange start request signal
X1B	Communication READY signal	—	
X1D	Module READY signal		
X1F	Watchdog timer error signal		

Devices used by user

Device	Application	Device	Application
X20	PROFIBUS-DP exchange start command	M0	Refresh start request
X25	Offset/gain setting mode select signal	—	
X26	Offset channel specification signal		
X27	Gain channel specification signal		
X28	User range write signal		
X29	Normal mode select signal		

Devices used in I/O data

Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	D1000.0	0	ST1H-PB
Br.01	Forced output test mode	D1000.1		
Br.02	Module being changed online	D1000.2	1	
Br.03	Command execution	D1000.3		
Br.04	External power supply status	D1000.4	2	ST1PSD
Br.05		D1000.5		
Br.06	Module ready	D1000.6	3	ST1RD2
Br.07	Convert setting completed flag	D1000.7		
Br.08	Conversion completed flag	D1000.8	4	
Br.09	Alarm output signal	D1000.9		
Br.0A	—	D1000.A	—	—
to				
Br.1F	—	D1001.F	—	—

Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	D1002.0	0	ST1H-PB
Er.01		D1002.1		
Er.02		D1002.2	1	
Er.03		D1002.3		
Er.04	Bus refreshing module error information	D1002.4	2	ST1PSD
Er.05		D1002.5		
Er.06	CH1 error information	D1002.6	3	ST1RD2
Er.07		D1002.7		
Er.08	CH2 error information	D1002.8	4	
Er.09		D1002.9		
Er.0A	_	D1002.A	_	_
to				
Er.1F	_	D1003.F	_	_

Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	D1004.0	0	ST1H-PB
Mr. 1		D1004.1	1	
Mr.2	Bus refreshing module existence information	D1004.2	2	ST1PSD
Mr.3	Module status	D1004.3	3	ST1RD2
Mr.4		D1004.4	4	
Mr.5	_	D1004.5	_	_
to				
Mr.15	_	D1004.F	_	_

Cr Command result area

Cr Command result area	Information	Master station side device	Slice No.	Module name
Cr.0	Cr.0(15-8) Command Execution Result, Cr.0(7-0) Start Slice No. of Execution Target	D1005	_	_
Cr.1	Executed Command No.	D1006		
Cr.2	Response Data 1	D1007		
Cr.3	Response Data 2	D1008		

Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	D2000.0	0	ST1H-PB
Bw.01	System area (0 fixed)	D2000.1		
Bw.02	System area (0 fixed)	D2000.2	1	
Bw.03	Command request	D2000.3		
Bw.04	System area (0 fixed)	D2000.4	2	ST1PSD
Bw.05	System area (0 fixed)	D2000.5		
Bw.06	System area (0 fixed)	D2000.6	3	ST1RD2
Bw.07	Convert setting request	D2000.7		
Bw.08	System area (0 fixed)	D2000.8	4	
Bw.09	System area (0 fixed)	D2000.9		
Bw.0A	_	D2000.A	_	_
to				
Bw.1F	_	D2001.F	_	_

Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	D2002.0	0	ST1H-PB
Ew.01	System area (0 fixed)	D2002.1		
Ew.02	System area (0 fixed)	D2002.2	1	
Ew.03	System area (0 fixed)	D2002.3		
Ew.04	Error clear request	D2002.4	2	ST1PSD
Ew.05	System area (0 fixed)	D2002.5		
Ew.06	Error clear request	D2002.6	3	ST1RD2
Ew.07	System area (0 fixed)	D2002.7		
Ew.08	System area (0 fixed)	D2002.8	4	
Ew.09	System area (0 fixed)	D2002.9		
Ew.0A	_	D2002.A	_	_
to				
Ew.1F	_	D2003.F	_	_

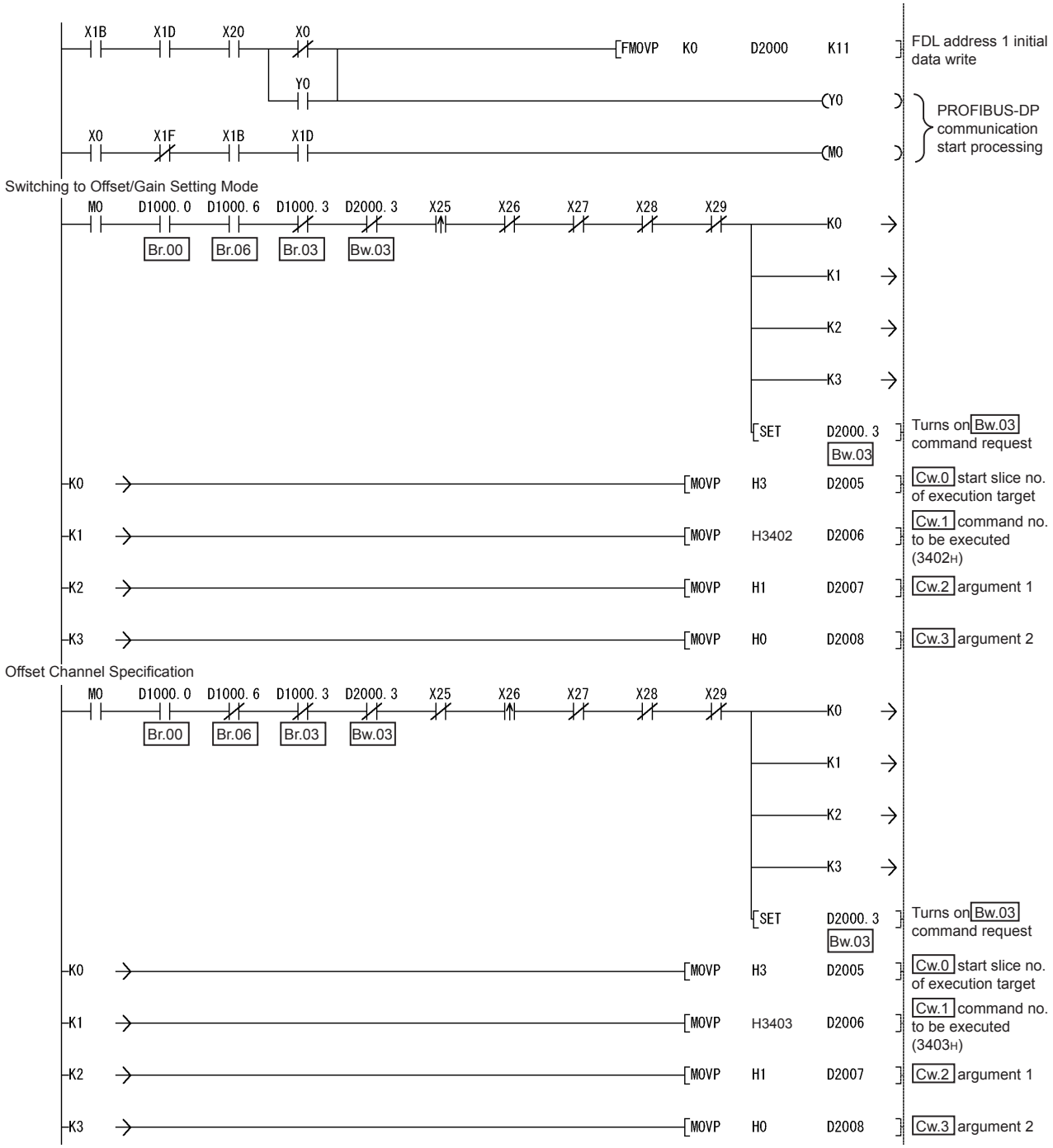
Sw System area

Sw System area	Information	Master station side device	Slice No.	Module name
Sw.0	System area (0 fixed)	D2004	—	—

Cw Command execution area

Cw Command execution area	Information	Master station side device	Slice No.	Module name
Cw.0	Start Slice No. of Execution Target	D2005	—	—
Cw.1	Command No. to be Executed	D2006		
Cw.2	Argument 1	D2007		
Cw.3	Argument 2	D2008		

2) Program example



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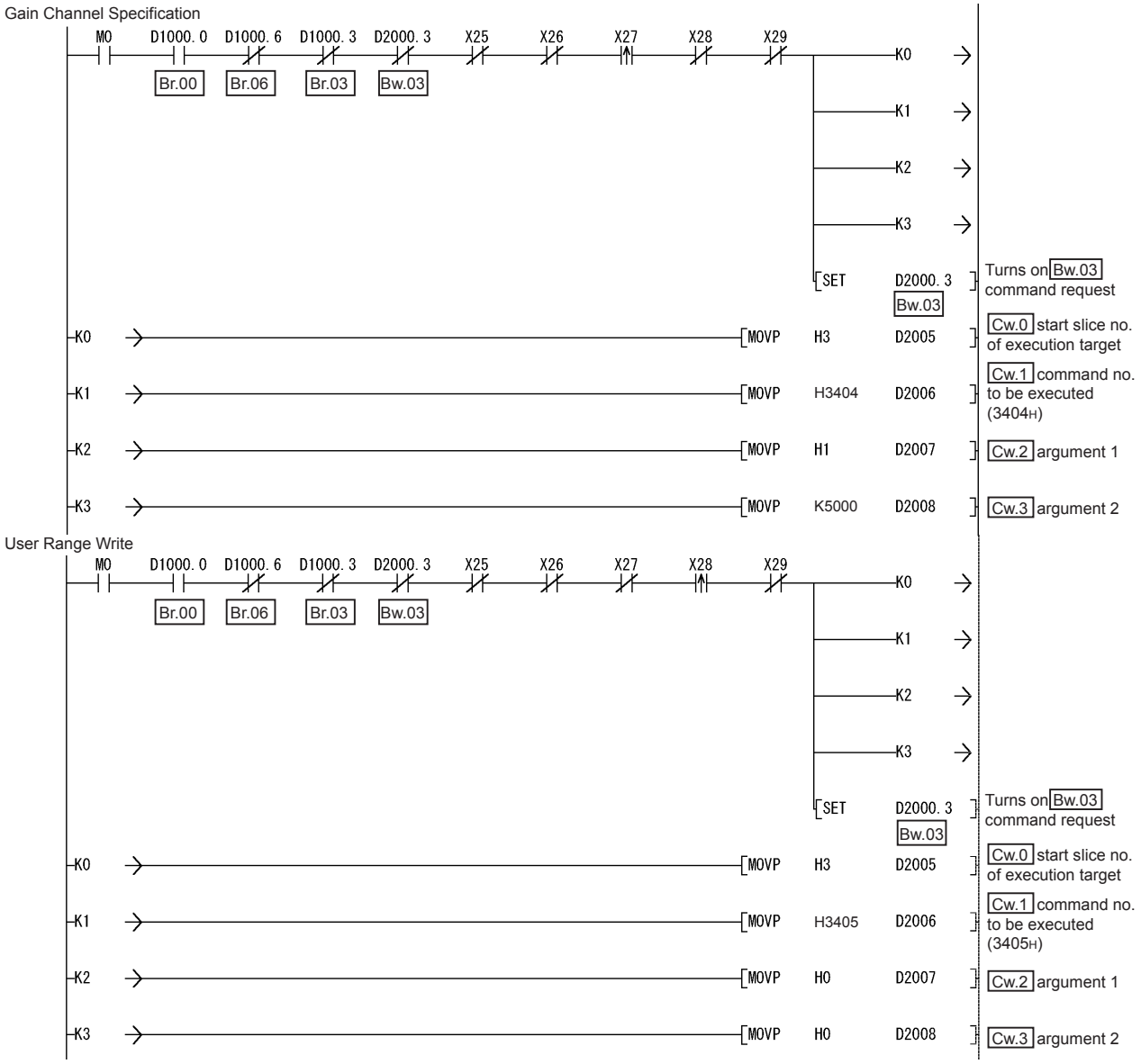
Gain Channel Specification
M0
D1000. 0
D1000. 6
D1000. 3
D2000. 3
X25
X26
X27
X28
X29
Br.00
Br.06
Br.03
Bw.03
K0
K1
K2
K3
SET
D2000. 3
Bw.03
Turns on Bw.03 command request
MOVP
H3
D2005
Cw.0 start slice no. of execution target
H3404
D2006
Cw.1 command no. to be executed (3404H)
H1
D2007
Cw.2 argument 1
K5000
D2008
Cw.3 argument 2
User Range Write
H3405
H0

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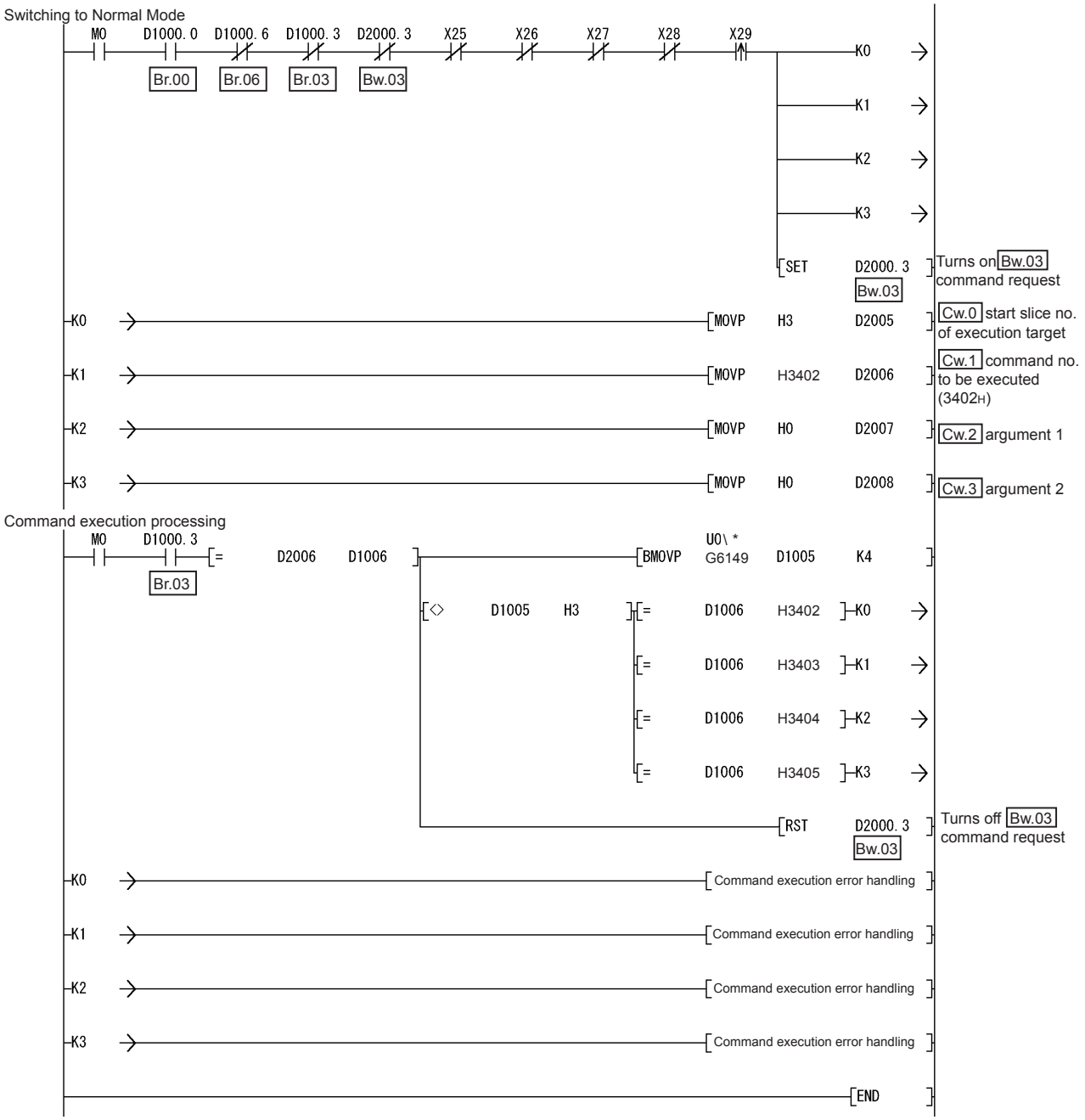

* When the master station is the QJ71PB92D, it is "U0\G5".

(b) When AJ71PB92D/A1SJ71PB92D is used as master station

The program example is based on the system configuration given in Section 6.3.

1) Device assignment in program examples

Devices used by A1SJ71PB92D

Device	Application	Device	Application
X0	Exchange start end signal	Y0	Exchange start request signal
X0D	Watchdog timer error signal	—	
X1B	Communication READY signal		
X1D	Module READY signal		

Devices used by user

Device	Application	Device	Application
X20	PROFIBUS-DP exchange start command	M0	Refresh start request
X25	Offset/gain setting mode select signal	M225	Conversion of offset/gain setting mode select signal into pulse
X26	Offset channel specification signal	M226	Conversion of offset channel specification signal into pulse
X27	Gain channel specification signal	M227	Conversion of gain channel specification signal into pulse
X28	User range write signal	M228	Conversion of user range write signal into pulse
X29	Normal mode select signal	M229	Conversion of normal mode select signal into pulse

Devices used in I/O data

Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	B0	0	ST1H-PB
Br.01	Forced output test mode	B1		
Br.02	Module being changed online	B2	1	
Br.03	Command execution	B3		
Br.04	External power supply status	B4	2	ST1PSD
Br.05		B5		
Br.06	Module ready	B6	3	ST1RD2
Br.07	Convert setting completed flag	B7		
Br.08	Conversion completed flag	B8	4	
Br.09	Alarm output signal	B9		
Br.0A	—	BA	—	—
to				
Br.1F	—	B1F	—	—

Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	B20	0	ST1H-PB
Er.01		B21		
Er.02		B22	1	
Er.03		B23		
Er.04	Bus refreshing module error information	B24	2	ST1PSD
Er.05		B25		
Er.06	CH1 error information	B26	3	ST1RD2
Er.07		B27		
Er.08	CH2 error information	B28	4	
Er.09		B29		
Er.0A	_	B2A	_	_
to				
Er.1F	_	B3F	_	_

Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	B40	0	ST1H-PB
Mr. 1		B41	1	
Mr.2	Bus refreshing module existence information	B42	2	ST1PSD
Mr.3	Module status	B43	3	ST1RD2
Mr.4		B44	4	
Mr.5	_	B45	_	_
to				
Mr.15	_	B5F	_	_

Cr Command result area

Cr Command result area	Information	Master station side device	Slice No.	Module name
Cr.0	Cr.0(15-8) Command Execution Result, Cr.0(7-0) Start Slice No. of Execution Target	W0	_	_
Cr.1	Executed Command No.	W1		
Cr.2	Response Data 1	W2		
Cr.3	Response Data 2	W3		

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Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	B1000	0	ST1H-PB
Bw.01	System area (0 fixed)	B1001		
Bw.02	System area (0 fixed)	B1002	1	
Bw.03	Command request	B1003		
Bw.04	System area (0 fixed)	B1004	2	ST1PSD
Bw.05	System area (0 fixed)	B1005		
Bw.06	System area (0 fixed)	B1006	3	ST1RD2
Bw.07	Convert setting request	B1007		
Bw.08	System area (0 fixed)	B1008	4	
Bw.09	System area (0 fixed)	B1009		
Bw.0A	_	B100A	_	_
to				
Bw.1F	_	B101F	_	_

Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	B1020	0	ST1H-PB
Ew.01	System area (0 fixed)	B1021		
Ew.02	System area (0 fixed)	B1022	1	
Ew.03	System area (0 fixed)	B1023		
Ew.04	Error clear request	B1024	2	ST1PSD
Ew.05	System area (0 fixed)	B1025		
Ew.06	Error clear request	B1026	3	ST1RD2
Ew.07	System area (0 fixed)	B1027		
Ew.08	System area (0 fixed)	B1028	4	
Ew.09	System area (0 fixed)	B1029		
Ew.0A	_	B102A	_	_
to				
Ew.1F	_	B103F	_	_

Sw System area

Sw System area	Information	Master station side device	Slice No.	Module name
Sw.0	System area (0 fixed)	B1040 to B104F	—	—

Cw Command execution area

Cw Command execution area	Information	Master station side device	Slice No.	Module name
Cw.0	Start Slice No. of Execution Target	W1000	—	—
Cw.1	Command No. to be Executed	W1001		
Cw.2	Argument 1	W1002		
Cw.3	Argument 2	W1003		

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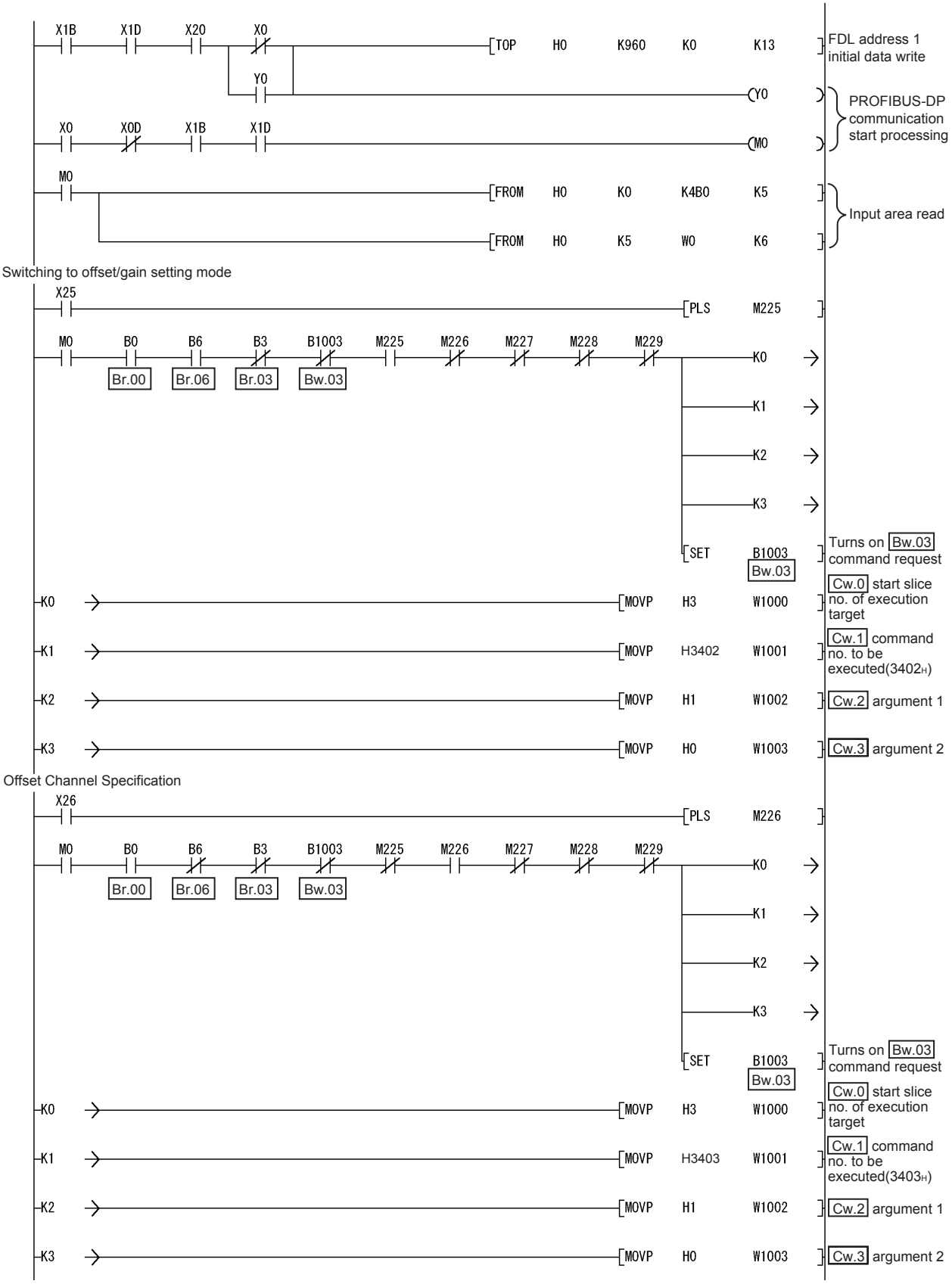
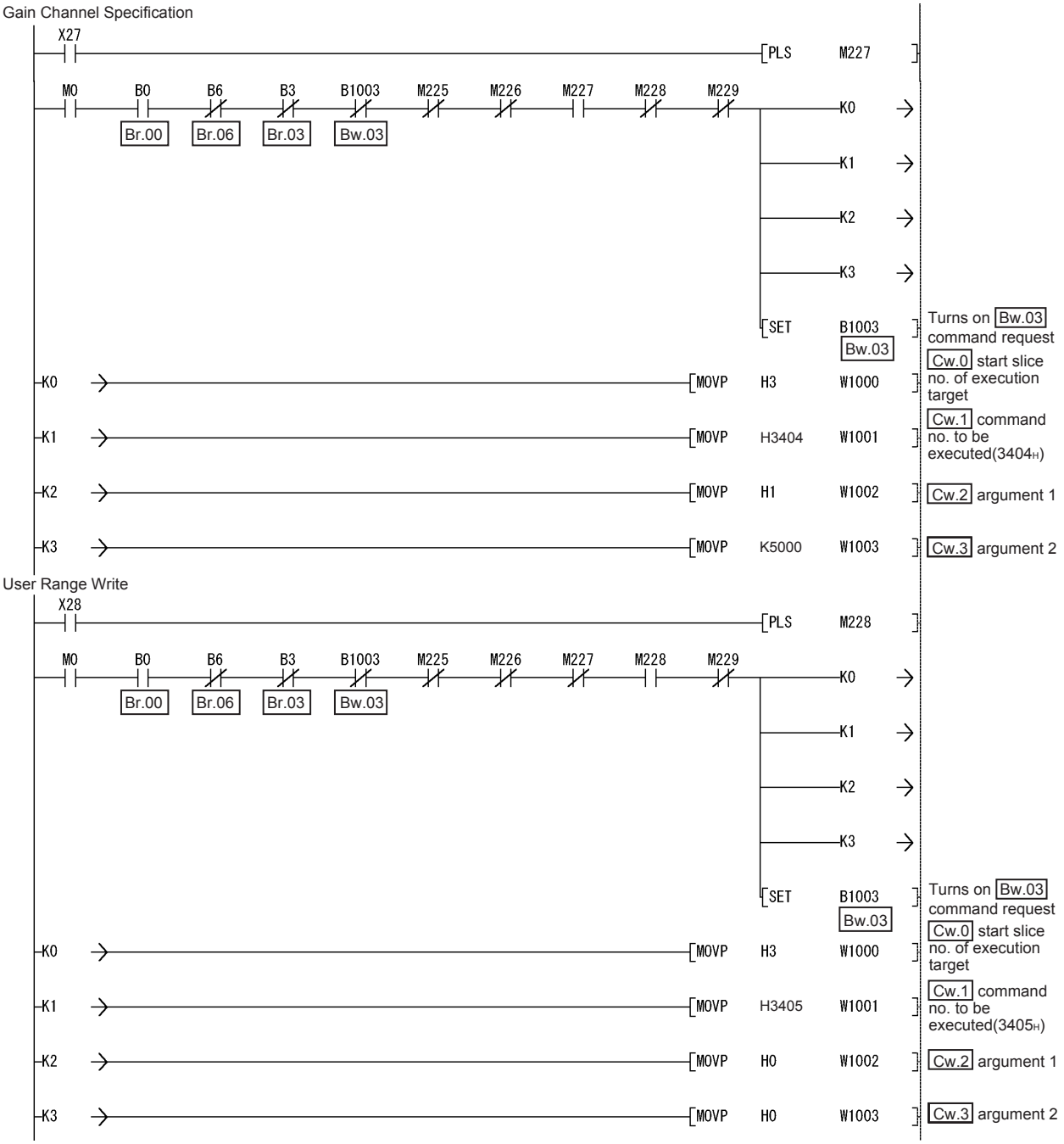
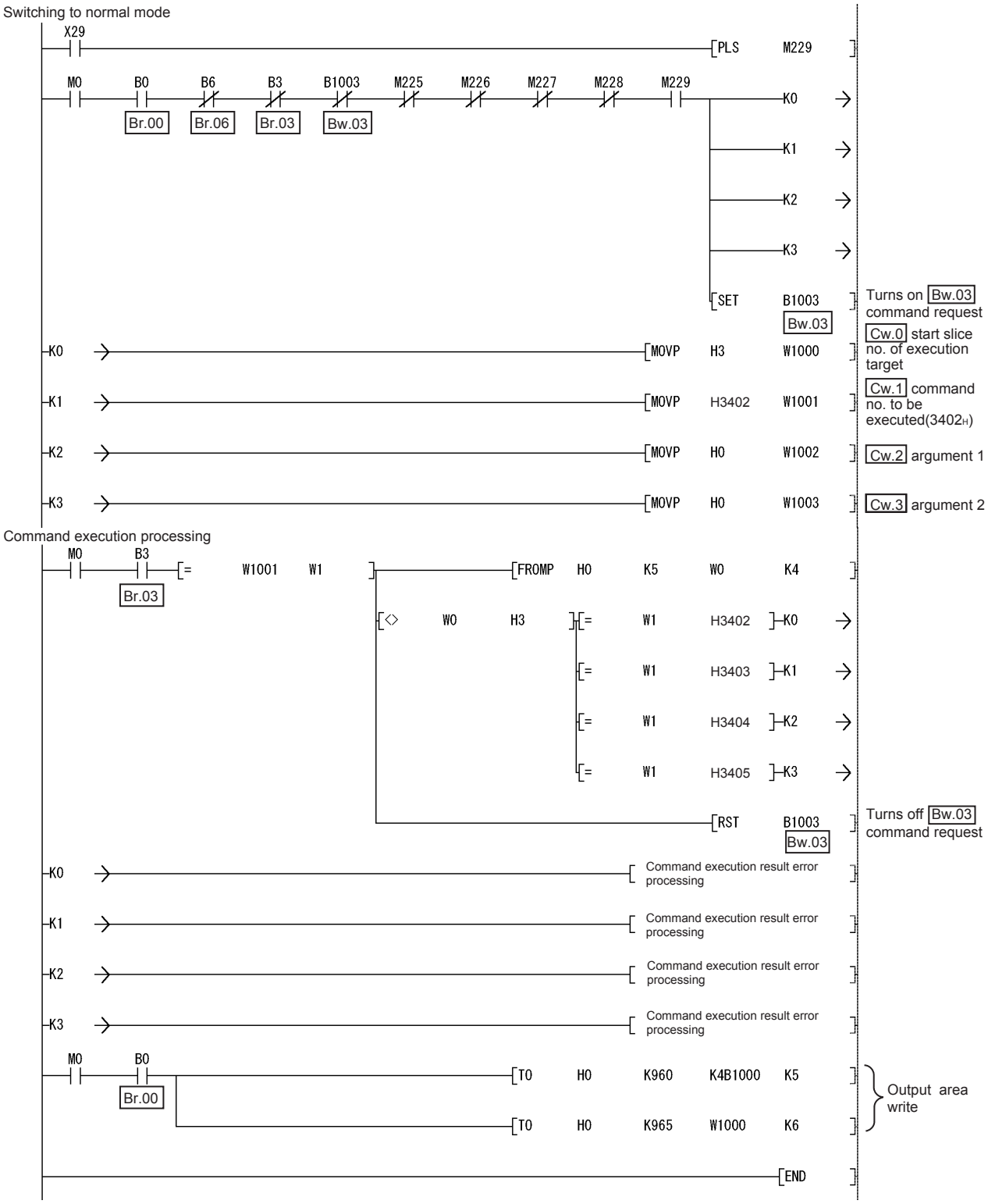
2) Program example



4 - 22


Gain Channel Specification
X27
PLS M227
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003 Bw.03
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3404 W1001
Cw.1 command no. to be executed(3404H)
K2 MOVP H1 W1002
Cw.2 argument 1
K3 MOVP K5000 W1003
Cw.3 argument 2
User Range Write
X28
PLS M228
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003 Bw.03
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3405 W1001
Cw.1 command no. to be executed(3405H)
K2 MOVP H0 W1002
Cw.2 argument 1
K3 MOVP H0 W1003
Cw.3 argument 2

4 - 23


Switching to normal mode
X29
PLS M229
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003 Bw.03
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3402 W1001
Cw.1 command no. to be executed(3402H)
K2 MOVP H0 W1002
Cw.2 argument 1
K3 MOVP H0 W1003
Cw.3 argument 2
Command execution processing
M0 B3
Br.03
= W1001 W1
FROMP H0 K5 W0 K4
<> W0 H3
= W1 H3402 K0
= W1 H3403 K1
= W1 H3404 K2
= W1 H3405 K3
RST B1003 Bw.03
Turns off Bw.03 command request
K0 Command execution result error processing
K1 Command execution result error processing
K2 Command execution result error processing
K3 Command execution result error processing
M0 B0
Br.00
TO H0 K960 K4B1000 K5
TO H0 K965 W1000 K6
Output area write
END

5 GX Configurator-ST

This chapter explains the functions of GX Configurator-ST used with the ST1RD2.
For details of GX Configurator-ST, refer to the GX Configurator-ST Operating Manual.

5.1 GX Configurator-ST Functions

Table 5.1 lists the GX Configurator-ST functions used with the ST1RD2.

Table 5.1 List of GX Configurator-ST Functions Used with ST1RD2

Item	Description	Reference section
Parameter Setting	(1) The following parameter items can be set on GX Configurator-ST. • CH☐ measurement range setting • CH☐ offset/gain value selection • CH☐ conversion enable/disable setting • CH☐ averaging processing specification • CH☐ alarm output setting • CH☐ conversion setting for disconnection detection • CH☐ time/count/moving average/time constant setting • CH☐ upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value • CH☐ sensor compensation value setting • CH☐ conversion setting value for disconnection detection (2) Specify the area (RAM or ROM) where parameter setting will be registered. (3) Using GX Configurator-ST, parameter setting can be made while online module change is performed.	Section 5.3
Input/output monitor	(1) The I/O data of the ST1RD2 can be monitored.	Section 5.4
Forced output test	(1) Test can be conducted with the values set in the Bw bit output area or Ew error clear area of the ST1RD2.	Section 5.5
Offset/gain setting	(1) The offset and gain values of the user range can be easily set on-screen. (2) Using GX Configurator-ST, gain/offset setting can be made while online module change is performed.	Section 5.6
Online module change	(1) A module can be replaced without the system being stopped.	Chapter 7

5 - 1

5.2 Project Creation

When the MELSEC-ST system can be connected to a personal computer with GX Configurator-ST preinstalled, select [get system] to create a project.
Even if there is no MELSEC-ST system, a project can be created.
For project creation and get system, refer to the GX Configurator-ST Operating Manual.

5 - 2

5.3 Parameter Setting

This section explains how to set the parameters.

(1) Mode changing

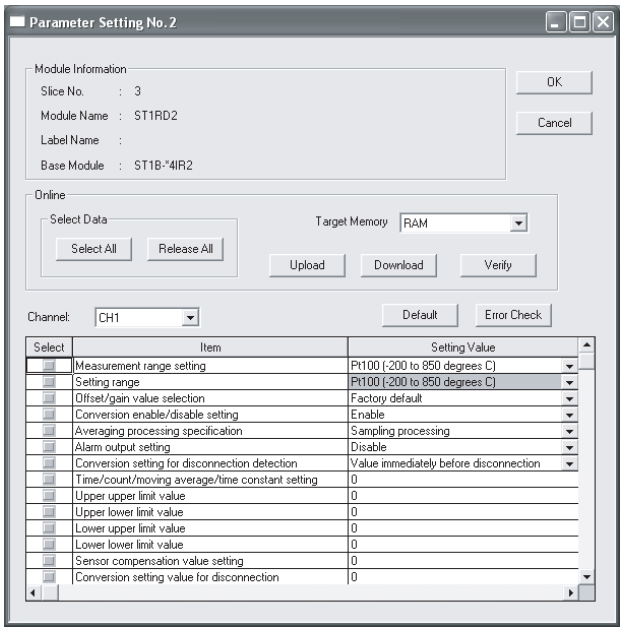
The mode need not be changed.

Either the edit mode or diagnosis mode can be used for the setting.

(2) Displaying "Parameter Setting" screen

1) Select ST1RD2 on the "Module Information List" screen or "System Monitor" screen.
2) Click [Edit] → [Parameter Setting].

(3) Display/Setting Screen



(4) Display/setting details

When setting the parameters of multiple channels, make the following setting for each channel.

(a) User parameters

Set the user parameters using the configuration software of the master station.

When the MELSEC-ST system is tested alone, set the parameters using GX Configurator-ST.

1) Measurement range setting

Set the measurement range.

Select the measurement range from among the following types.

Measurement range	
Pt100	-200 to 850℃
	-20 to 120℃
	0 to 200℃
Pt1000	-200 to 850℃
	-20 to 120℃
	0 to 200℃

2) Setting range

The measurement range setting currently valid is stored.

Setting is not allowed.

3) Offset/gain value selection

Set the factory default or user range setting.

(b) Command parameters

By setting the command parameters using GX Configurator-ST, master station program steps can be reduced.

Write and save the settings, which are used for a MELSEC-ST system startup, to the ROM. (Use RAM when conducting a test temporarily.)

1) Conversion enable/disable setting

Set whether conversion is enabled or disabled.

Disable : Conversion disabled

Enable : Conversion enabled

2) Averaging processing specification

Specify Sampling processing, Time or Count averaging, Moving average or Primary delay filter.

3) Alarm output setting

Set whether alarm output processing is performed or not.

Disable : Alarm output processing not performed

Enable : Alarm output processing performed

4) Conversion setting for disconnection detection

Specify the conversion setting that is applied when disconnection is detected.

Value immediately before disconnection
Up scale
Down scale
Given value

5) Time/count/moving average/time constant setting

Set a value for Time, Count, Moving average or Time constant.
The setting ranges are shown below.

Average time : 640 to 5000ms
Average number of times : 4 to 500 times
Moving average : 4 to 60 times
Time constant : 80 to 5000ms

6) Upper upper limit value/Upper lower limit value/Lower upper limit value/Lower lower limit value

Set the upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value of the alarm output.
Setting range on each measurement range is shown below.
Set the value in units of 0.1℃.
[Example] To set to 0.3℃ ..... Enter "3".

Measurement range		Setting range
Pt100 Pt1000	-200 to 850℃	-2000 to 8500
	-20 to 120℃	-200 to 1200
	0 to 200℃	0 to 2000

7) Sensor compensation value setting

Set the sensor compensation value.
The setting range of the sensor compensation value is –200 to 200.
Set the value in units of 0.1℃.
[Example] To set to 0.3℃ ..... Enter "3".

8) Conversion setting value for disconnection

Specify the conversion setting value applied when disconnection is detected.
The setting range of the conversion setting value for disconnection detection is -32768 to 32767.
Set the value in units of 0.1℃.
[Example] To set to 0.3℃ ..... Enter "3".

(5) Parameter writing

1) From the "Channel:" pull-down menu, select the channel where the parameters will be set.
2) Select the parameter items to be written to the ST1RD2 by checking the corresponding "select" check box.
3) Make setting in the "Setting Value" field.
4) Select the target memory (RAM or ROM) from the pull-down menu of "Target Memory".
5) Click the Download button.

When writing the parameters of multiple channels to the ST1RD2, perform the operations in steps 1) to 5) for each channel.

5.4 Input/Output Monitor

This section explains how to monitor the I/O data of the ST1RD2.

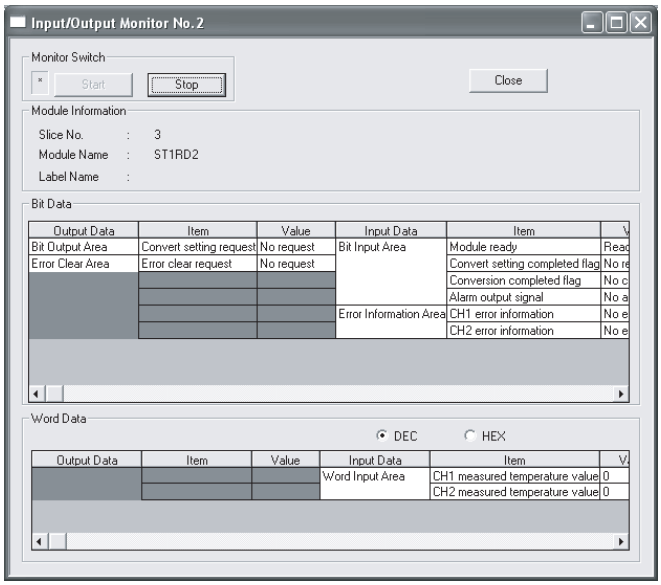
(1) Mode changing

Click [Mode] → [Diagnosis].

(2) Displaying "Input/Output Monitor" screen

1) Select ST1RD2 on the "System Monitor" screen.
2) Click the Input/Output Monitor button.
   Monitor starts as soon as the "Input/Output Monitor" screen is displayed.

(3) Display/Setting Screen



(4) Display/setting details

(a) Bit Data

Input/Output Data	Item	Description
Bit Output Area	Convert setting request	The status of Bw.n+1 Convert setting request is displayed.
Error Clear Area	Error clear request	The status of Ew.n Error clear request is displayed.
Bit Input Area	Module ready	The status of Br.n Module ready is displayed.
	Convert setting completed flag	The status of Br.n+1 Convert setting completed flag is displayed.
	Conversion completed flag	The status of Br.n+2 Conversion completed flag is displayed.
	Alarm output signal	The status of Br.n+3 Alarm output signal is displated.
Error Information Area	CH☐ error information	The status of Er.n+3 to Er.n CH☐ error information is displayed.

(b) Word Data

The display format (decimal/hexadecimal) can be changed.

Input/Output Data	Item	Description
Word Input Area	CH☐ measured temperature value	The value of Wr.n , Wr.n+1 CH☐ measured temperature value is displayed.

5.5 Forced Output Test

This section explains a forced output test.
Conduct the test after setting values to the bit output area or error clear area of the ST1RD2.

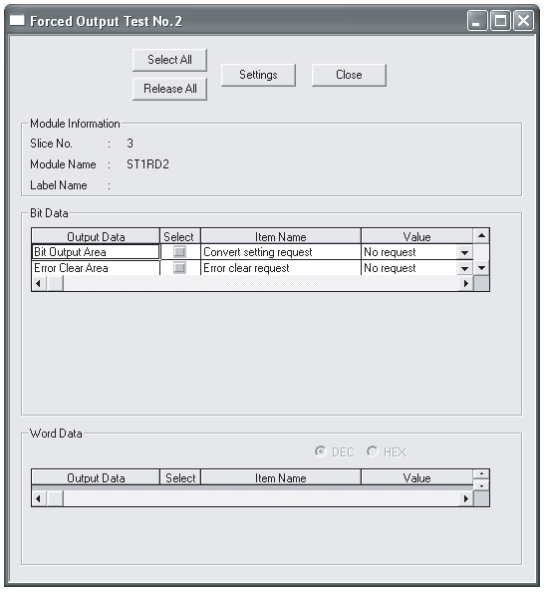
(1) Mode changing

Click [Mode] → [Diagnosis].

(2) Displaying "Forced Output Test" screen

1) Select ST1RD2 on the "System Monitor" screen.
2) Click the Forced Output Test button.

(3) Display/Setting Screen



(4) Display/setting details

(a) Bit Data

Output Data	Item	Description
Bit Output Area	Convert setting request	The setting of Bw.n+1 Convert setting request can be changed.
Error Clear Area	Error clear request	The setting of Ew.n Error clear request can be changed.

(b) Word Data

Unavailable for the ST1RD2.

(5) Test operation

1) Select the test item by checking the corresponding "Select" check box.
2) Make setting in the "Value" field.
3) Click the Settings button. *
   Clicking the Settings button executes the test.
   *: When the module is not in the forced output test mode, a screen asking whether to switch to the forced output test mode. Click the OK button to switch to the forced output test mode.
   When the module is switched to the forced output test mode, the RUN LED of the head module flashes.

POINT
When the forced output test mode has been cancelled, make sure that the RUN LED of the head module is on.

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5.6 Offset/gain Setting

This section explains how to make offset/gain setting.

(1) Measurement range setting

Set the measurement range for the offset/gain setting on the parameter setting screen.
For the parameter setting, refer to Section 5.3.

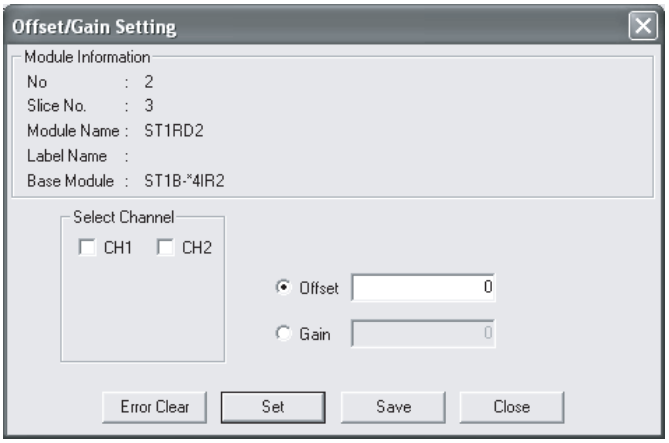
(2) Mode changing

Click [Mode] → [Diagnosis].

(3) Displaying "Offset/Gain Setting" screen

1) Select ST1RD2 on the "System Monitor" screen.
2) Click the Offset/Gain Setting button. *
   *: When the module is not in the forced output test mode, a screen appears asking whether to switch to the forced output test mode. Click the OK button to switch to the forced output test mode.
   When the module is switched to the forced output test mode, the RUN LED of the head module flashes.
3) As a screen appears asking whether to switch to the offset/gain setting mode, click the OK button to switch to the offset/gain setting mode.
   After switched to the offset/gain setting mode, the RUN LED of ST1RD2 flashes (0.5s interval) and the ST1RD2 stops.

(4) Display/Setting Screen



(5) Offset/gain setting

When setting different offset and gain values for different channels, perform the operations in (a), (b) for each channel.
Since the operation in (c) is to be done to write the offset/gain settings of all channels to the ST1RD2, perform it only once at the last.

(a) Offset value setting operation

1) Select the channel where the offset value will be set by checking the corresponding "Select channel" check box.
   By checking multiple check boxes, values can be set to multiple channels at the same time.
2) Specify "Offset".
3) Enter a value as an offset value to the channel to be adjusted, set a temperature setting value which suits to input, and then click the Set button.
   The setting is performed in units of 0.1℃.
   [Example] To set to 0.3℃ ..... Enter "3".
   Setting range on each measurement range is shown below.

Measurement range		Setting range
Pt100 Pt1000	-200 to 850℃	-2000 to 8500
	-20 to 120℃	-200 to 1200
	0 to 200℃	0 to 2000

(b) Gain value setting

1) Select the channel where the gain value will be set by checking the corresponding "Select channel" check box.
   By checking multiple check boxes, values can be set to multiple channels at the same time.
2) Specify "Gain".

3) Enter a value as a gain value to the channel to be adjusted, set a temperature setting value which suits to input, and then click the Set button.
The setting is performed in units of 0.1℃.
[Example] To set to 0.3℃ .....Enter "3".
Setting range on each measurement range is shown below.

Measurement range		Setting range
Pt100 Pt1000	-200 to 850℃	-2000 to 8500
	-20 to 120℃	-200 to 1200
	0 to 200℃	0 to 2000

(c) Offset/gain setting writing

Click the Save button.
The offset/gain settings for all channels are written to the ST1RD2.

POINT

(1) Clicking the Save button in the following condition generates errors.
For details of error codes, refer to Section 9.1.
• Offset value ≥ Gain value (Error code : 400 □H)
• (Gain value) - (Offset value) < 0.2[℃] (Error code : 410 □H)
In this case, click the Error Clear button to clear the error, and make setting again.

(2) When the offset/gain setting screen is closed, the screen displays a message that asks if you are sure to change to the normal mode. Click the OK button to change to the normal mode.
When the module is put in the normal mode, the RUN LED of the ST1RD2 turns on.

(3) When the forced output test mode has been released, make sure that the RUN LED of the head module is on.

6 PROGRAMMING

This chapter explains program examples available when the QJ71PB92V/QJ71PB92D and AJ71PB92D/A1SJ71PB92D are used as the master station.

REMARK

Refer to the following manuals for details of the QJ71PB92V/QJ71PB92D and AJ71PB92D/A1SJ71PB92D.

<QJ71PB92V>
- PROFIBUS-DP Master Module User's Manual
- SH-080572ENG (13JR84)

<QJ71PB92D>
- PROFIBUS-DP Interface Module User's Manual
- SH-080127 (13JR22)

<AJ71PB92D/A1SJ71PB92D>
- PROFIBUS-DP Interface Module type AJ71PB92D/A1SJ71PB92D User's Manual
- IB-66773 (13JL20)

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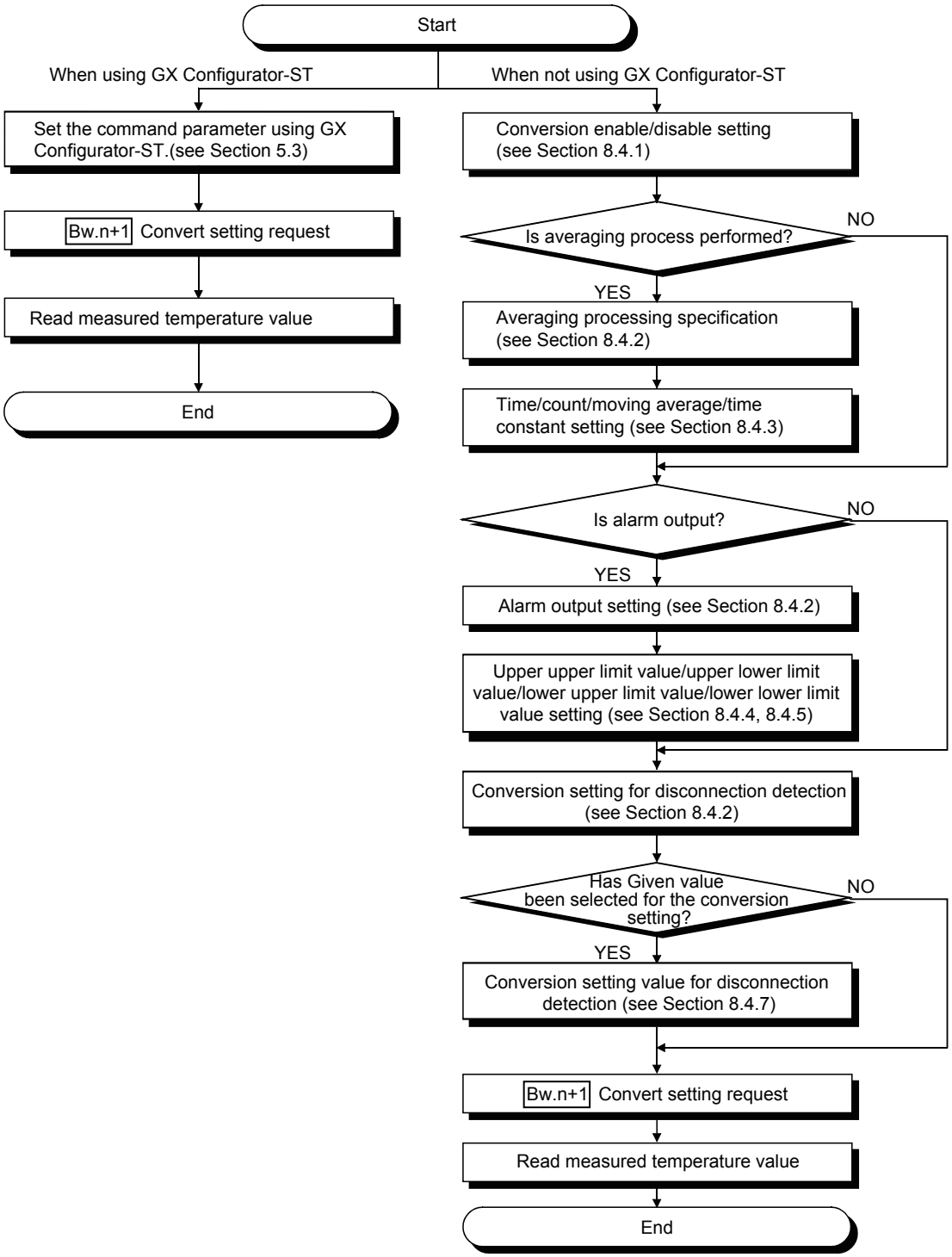
6.1 Programming Procedure

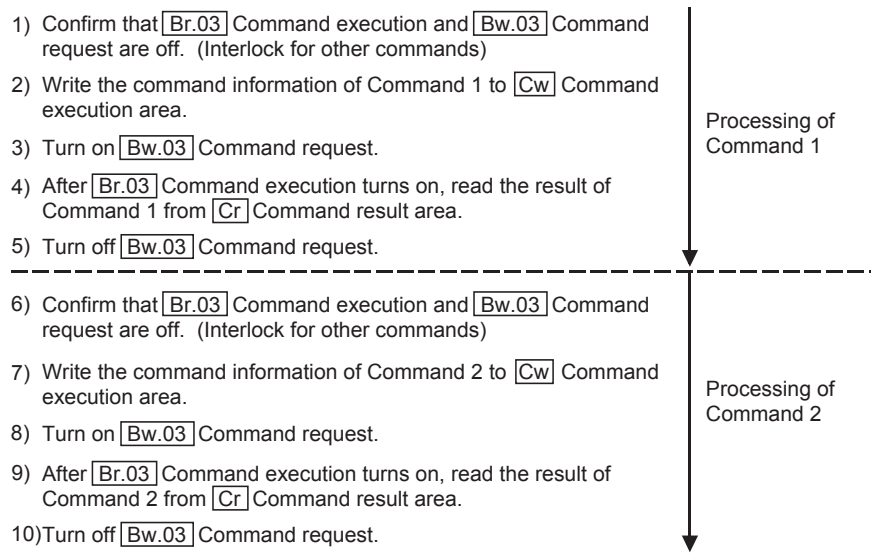
In the following procedure, create a program enabling execution of the temperature conversion or micro voltage conversion in the ST1RD2.
When utilizing the program example introduced in this chapter for an actual system, fully verify that there are no problems in controllability in the target system.



POINT

(1) While a command is being executed, other command is not executable.
Also, a command can be executed for only one module.
When executing the same command for multiple modules or executing several kinds of commands, provide an interlock in the program using [Br.03] Command execution and [Bw.03] Command request as shown below.

<Example>
Executing 2 commands (Commands 1 and 2) consecutively



If a command is executed without any interlock, the following status will be generated.

1) When turning off [Bw.03] Command request before completion of the command:
   • [Br.03] Command execution does not turn on.
   • The command result is not stored in [Cr] Command result area.
   • The command requested once may be executed.
2) When executing a command inadvertently during execution of other command:
   The command is executed based on the information written in [Cw] Command execution area at the time that [Bw.03] Command request turns on.

(2) Performing online module change may require a previous arrangement, depending on the use condition.
For details, refer to Section 7.2.

6.2 When QJ71PB92V/QJ71PB92D is Used as Master Station

This section explains program examples available when the QJ71PB92V/QJ71PB92D is used as the master station.
The following table shows the setting differences in the program examples between the QJ71PB92V and QJ71PB92D.
Except for the given differences, both models have identical settings.

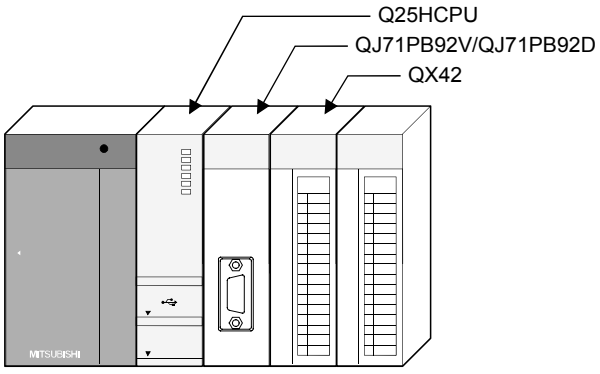
Item		Difference	Reference section
Master station settings		"Operation mode" and "I/O data area assignment" are different.	Section 6.2 (1)(b)
I/O data assignment	Input data	Buffer memory assignment is different between QJ71PB92V and QJ71PB92D.	Section 6.2 (3)
	Output data		
Program example		Because of the differences in buffer memory assignment, the intelligent function module device numbers in the programs are different.	Section 6.2.1 (2)

Section 6.2.1 uses the following system configuration example for explanation.

(1) System configuration of master station (QJ71PB92V/QJ71PB92D)

The system configuration of the master station (QJ71PB92V/QJ71PB92D) used in this section is shown below.

(a) System configuration of master station (QJ71PB92V/QJ71PB92D)



(b) Settings of master station (QJ71PB92V/QJ71PB92D)

1) QJ71PB92V

Item		Description
I/O signals		X/Y000 to X/Y01F
Operation mode		Communication mode (mode3)
I/O data area (buffer memory) for FDL address 1 (MELSEC-ST system)	Input data	6144(1800H) to 6154(180AH)
	Output data	14336(3800H) to 14346(380AH)

2) QJ71PB92D

Item		Description
I/O signals		X/Y000 to X/Y01F
Operation mode		Extended service mode (MODE E)
I/O data area (buffer memory) for FDL address 1 (MELSEC-ST system)	Input data	0(0H) to 10(0AH)
	Output data	960(3C0H) to 970(3CAH)

REMARK

In the MELSEC-ST system, the I/O data size varies depending on the maximum I/O point setting and the number of intelligent function modules mounted.
Therefore, the master station is set to the following modes where the data size is variable.

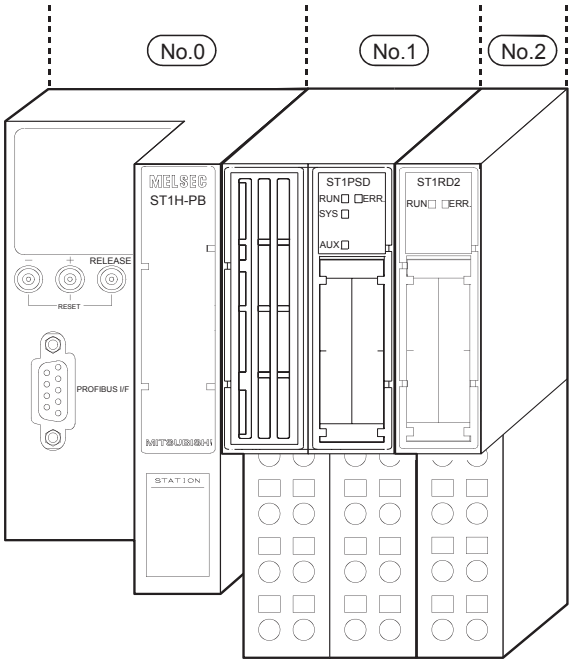
- For the QJ71PB92V: Communication mode (mode 3)
- For the QJ71PB92D: Extended service mode (MODE E)

(2) System configuration of MELSEC-ST system

The following system configuration is used as the MELSEC-ST system for explanation.

(a) System configuration of slave station (MELSEC-ST system)

1) FDL address: 1
2) Maximum I/O point setting: 32-point mode



The following table uses the maximum input/output points setting sheet given in the Head Module User's Manual.

No.	Module Name	Number of Occupied I/O Points	Start Slice No. (Number of occupied slices)	Wr.n	Ww.n	5V DC Internal Current Consumption (Total)	24V DC Current (Total)	System Length (Total)
0	ST1H-PB	4	0(2)	—	—	0.530A(0.530A)	0A(0A)	—
1	ST1PSD	2	2(1)	—	—	—	—	25.2mm(25.2mm)
2	ST1RD2	4	3(2)	2	2	0.080A(0.610A)	＊1	12.6mm(37.8mm)
Total		10	—	2	2	—	—	—

＊1: The 24V DC current changes depending on the external device connected to each slice module.
Confirm the current consumption of the external device connected to each slice module, and calculate the total value.
Refer to the MELSEC-ST System User's Manual for details of current consumption calculation.

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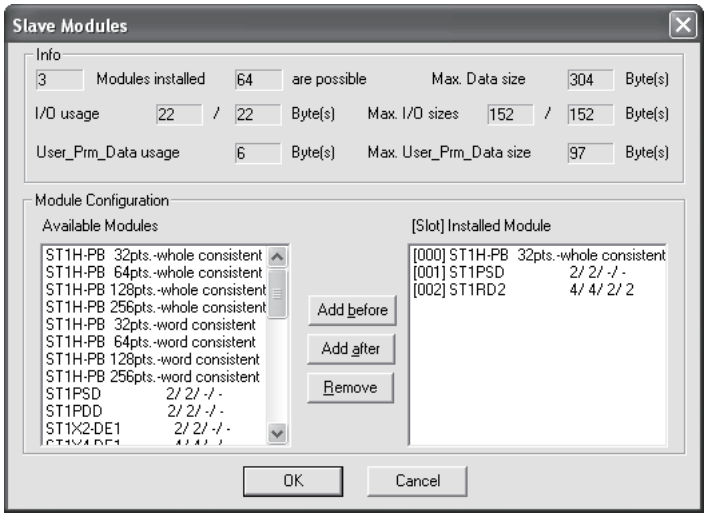
(b) GX Configurator-DP setting



(c) ST1RD2 setting

The measurement range setting is set by GX Configurator-DP.

- Conversion-enabled channel CH1, CH2
- CH1 measurement range setting ..... Pt100, -200 to 850℃
- CH2 measurement range setting ..... Pt1000, -20 to 120℃
- Sampling process channel CH2
- Count-based averaging process channel
  .....CH1 (average number of times: 50)
- Alarm output channel
  ..... CH1 (upper upper limit value, upper lower limit value: 2000)
  (lower upper limit value, lower lower limit value: 0)
- Sensor compensation channel.....CH2 (compensation value: 2)
- Conversion setting for disconnection detection
  .....CH1 (Value Immediately before disconnection), CH2 (Given value)
- CH2 Conversion setting value for disconnection detection
 5000

(3) I/O data assignment

The following shows the I/O data assignment result in the system configuration example given in (2) in this section.

(a) Input data

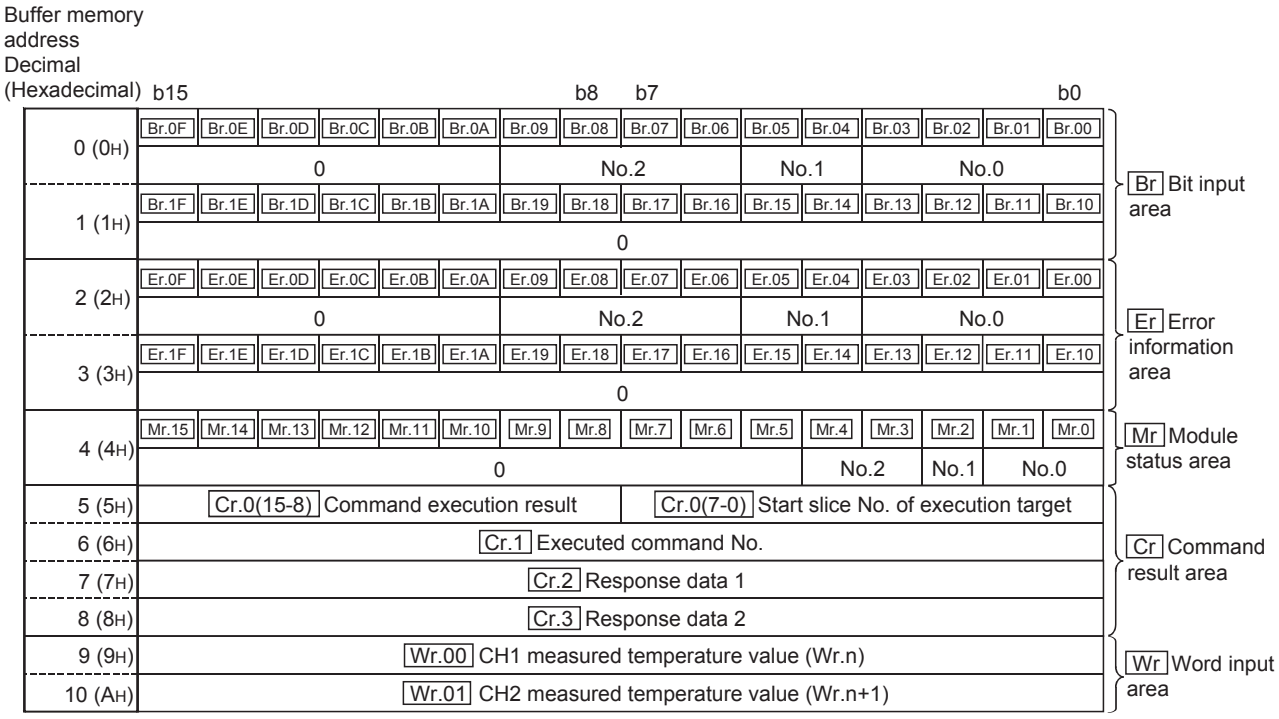
1) QJ71PB92V

Buffer memory address Decimal (Hexadecimal)

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
6144(1800H)	Br.0F	Br.0E	Br.0D	Br.0C	Br.0B	Br.0A	Br.09	Br.08	Br.07	Br.06	Br.05	Br.04	Br.03	Br.02	Br.01	Br.00	Br Bit input area
	0						No.2				No.1		No.0				
6145(1801H)	Br.1F	Br.1E	Br.1D	Br.1C	Br.1B	Br.1A	Br.19	Br.18	Br.17	Br.16	Br.15	Br.14	Br.13	Br.12	Br.11	Br.10	
	0																
6146(1802H)	Er.0F	Er.0E	Er.0D	Er.0C	Er.0B	Er.0A	Er.09	Er.08	Er.07	Er.06	Er.05	Er.04	Er.03	Er.02	Er.01	Er.00	Er Error information area
	0						No.2				No.1		No.0				
6147(1803H)	Er.1F	Er.1E	Er.1D	Er.1C	Er.1B	Er.1A	Er.19	Er.18	Er.17	Er.16	Er.15	Er.14	Er.13	Er.12	Er.11	Er.10	
	0																
6148(1804H)	Mr.15	Mr.14	Mr.13	Mr.12	Mr.11	Mr.10	Mr.9	Mr.8	Mr.7	Mr.6	Mr.5	Mr.4	Mr.3	Mr.2	Mr.1	Mr.0	Mr Module status area
	0											No.2		No.1		No.0	
6149(1805H)	Cr.0(15-8) Command execution result										Cr.0(7-0) Start slice No. of execution target						Cr Command result area
6150(1806H)	Cr.1 Executed command No.																
6151(1807H)	Cr.2 Response data 1																
6152(1808H)	Cr.3 Response data 2																
6153(1809H)	Wr.00 CH1 measured temperature value (Wr.n)																Wr Word input area
6154(180AH)	Wr.01 CH2 measured temperature value (Wr.n+1)																

No. 0: Head module (ST1H-PB)
No. 1: Bus refreshing module (ST1PSD)
No. 2: Intelligent Function Module (ST1RD2)

2) QJ71PB92D



No. 0: Head module (ST1H-PB)
No. 1: Bus refreshing module (ST1PSD)
No. 2: Intelligent Function Module (ST1RD2)

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(b) Output data

1) QJ71PB92V

Buffer memory address Decimal (Hexadecimal)	b15							b8	b7							b0	
14336(3800H)	Bw.0F	Bw.0E	Bw.0D	Bw.0C	Bw.0B	Bw.0A	Bw.09	Bw.08	Bw.07	Bw.06	Bw.05	Bw.04	Bw.03	Bw.02	Bw.01	Bw.00	Bw Bit output area
	0						No.2				No.1		No.0				
14337(3801H)	Bw.1F	Bw.1E	Bw.1D	Bw.1C	Bw.1B	Bw.1A	Bw.19	Bw.18	Bw.17	Bw.16	Bw.15	Bw.14	Bw.13	Bw.12	Bw.11	Bw.10	
	0																
14338(3802H)	Ew.0F	Ew.0E	Ew.0D	Ew.0C	Ew.0B	Ew.0A	Ew.09	Ew.08	Ew.07	Ew.06	Ew.05	Ew.04	Ew.03	Ew.02	Ew.01	Ew.00	Ew Error clear area
	0						No.2				No.1		No.0				
14339(3803H)	Ew.1F	Ew.1E	Ew.1D	Ew.1C	Ew.1B	Ew.1A	Ew.19	Ew.18	Ew.17	Ew.16	Ew.15	Ew.14	Ew.13	Ew.12	Ew.11	Ew.10	
	0																
14340(3804H)	Sw.0 System Area																Sw System Area
14341(3805H)	Cw.0 Start Slice No. of Execution Target																Cw Command execution area
14342(3806H)	Cw.1 Command No. to be Executed																
14343(3807H)	Cw.2 Argument 1																
14344(3808H)	Cw.3 Argument 2																
14345(3809H)	Ww.00 System Area (Ww.n)																Ww Word output area
14346(380AH)	Ww.01 System Area (Ww.n+1)																

No.0: Head module (ST1H-PB)
No.1: Bus refreshing module (ST1PSD)
No.2: Intelligent Function Module (ST1RD2)

2) QJ71PB92D

Buffer memory address Decimal (Hexadecimal)	b15							b8	b7							b0	
960(3C0H)	Bw.0F	Bw.0E	Bw.0D	Bw.0C	Bw.0B	Bw.0A	Bw.09	Bw.08	Bw.07	Bw.06	Bw.05	Bw.04	Bw.03	Bw.02	Bw.01	Bw.00	Bw Bit output area
	0						No.2				No.1		No.0				
961(3C1H)	Bw.1F	Bw.1E	Bw.1D	Bw.1C	Bw.1B	Bw.1A	Bw.19	Bw.18	Bw.17	Bw.16	Bw.15	Bw.14	Bw.13	Bw.12	Bw.11	Bw.10	
	0																
962(3C2H)	Ew.0F	Ew.0E	Ew.0D	Ew.0C	Ew.0B	Ew.0A	Ew.09	Ew.08	Ew.07	Ew.06	Ew.05	Ew.04	Ew.03	Ew.02	Ew.01	Ew.00	Ew Error clear area
	0						No.2				No.1		No.0				
963(3C3H)	Ew.1F	Ew.1E	Ew.1D	Ew.1C	Ew.1B	Ew.1A	Ew.19	Ew.18	Ew.17	Ew.16	Ew.15	Ew.14	Ew.13	Ew.12	Ew.11	Ew.10	
	0																
964(3C4H)	Sw.0 System Area																Sw System Area
965(3C5H)	Cw.0 Start Slice No. of Execution Target																Cw Command execution area
966(3C6H)	Cw.1 Command No. to be Executed																
967(3C7H)	Cw.2 Argument 1																
968(3C8H)	Cw.3 Argument 2																
969(3C9H)	Ww.00 System Area (Ww.n)																Ww Word output area
970(3CAH)	Ww.01 System Area (Ww.n+1)																

No.0: Head module (ST1H-PB)
No.1: Bus refreshing module (ST1PSD)
No.2: Intelligent Function Module (ST1RD2)

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(4) Device assignment in program examples

The program example in this section uses the following device assignment.

(a) Devices used by QJ71PB92V/QJ71PB92D

Device	Application	Device	Application
X0	Exchange start end signal	Y0	Exchange start request signal
X1B	Communication READY signal		
X1D	Module READY signal	—	
X1F	Watchdog timer error signal		

(b) Devices used by user

Device	Application	Device	Application
X20	PROFIBUS-DP exchange start command	M0	Refresh start request
X30	ST1RD2 error code read request	M100	Command execution signal
X31	ST1RD2 error clear request	M200	Conversion enable/disable setting write signal
D500	CH1 measured temperature value read destination	M201	Operation condition set value write signal
D501	CH2 measured temperature value read destination	M202	Time/count/moving average/time constant setting write signal
D600, D601	ST1RD2 error code read destination	M203	CH1 upper upper/upper lower limit set value write signal
—		M204	CH1 lower upper/lower lower limit set value write signal
		M205	Sensor compensation value write signal
		M206	Conversion setting value (for disconnection detection) write signal
		M210	Conversion start signal
		M230	ST1RD2 error clear request signal

(c) Devices used in I/O data

1) Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	D1000.0	0	ST1H-PB
Br.01	Forced output test mode	D1000.1		
Br.02	Module being changed online	D1000.2	1	
Br.03	Command execution	D1000.3		
Br.04	External power supply status	D1000.4	2	ST1PSD
Br.05		D1000.5		
Br.06	Module ready	D1000.6	3	ST1RD2
Br.07	Convert setting completed flag	D1000.7		
Br.08	Conversion completed flag	D1000.8	4	
Br.09	Alarm output signal	D1000.9		
Br.0A	—	D1000.A	—	—
to				
Br.1F	—	D1001.F	—	—

2) Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	D1002.0	0	ST1H-PB
Er.01		D1002.1		
Er.02		D1002.2	1	
Er.03		D1002.3		
Er.04	Bus refreshing module error information	D1002.4	2	ST1PSD
Er.05		D1002.5		
Er.06	CH1 error information	D1002.6	3	ST1RD2
Er.07		D1002.7		
Er.08	CH2 error information	D1002.8	4	
Er.09		D1002.9		
Er.0A	_	D1002.A	_	_
to				
Er.1F	_	D1003.F	_	_

3) Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	D1004.0	0	ST1H-PB
Mr. 1		D1004.1	1	
Mr.2	Bus refreshing module existence information	D1004.2	2	ST1PSD
Mr.3	Module status	D1004.3	3	ST1RD2
Mr.4		D1004.4	4	
Mr.5	_	D1004.5	_	_
to				
Mr.15	_	D1004.F	_	_

4) Cr Command result area

Cr Command result area	Information	Master station side device	Slice No.	Module name
Cr.0	Cr.0(15-8) Command Execution Result, Cr.0(7-0) Start Slice No. of Execution Target	D1005	_	_
Cr.1	Executed Command No.	D1006		
Cr.2	Response Data 1	D1007		
Cr.3	Response Data 2	D1008		

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5) Wr Word input area

Wr.n Word input	Information	Master station side device	Slice No.	Module name
Wr.00	CH1 measured temperature value (Wr.n)	D1009	3	ST1RD2
Wr.01	CH2 measured temperature value (Wr.n+1)	D1010		

6) Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	D2000.0	0	ST1H-PB
Bw.01	System area (0 fixed)	D2000.1		
Bw.02	System area (0 fixed)	D2000.2	1	
Bw.03	Command request	D2000.3		
Bw.04	System area (0 fixed)	D2000.4	2	ST1PSD
Bw.05	System area (0 fixed)	D2000.5		
Bw.06	System area (0 fixed)	D2000.6	3	ST1RD2
Bw.07	Convert setting request	D2000.7		
Bw.08	System area (0 fixed)	D2000.8	4	
Bw.09	System area (0 fixed)	D2000.9		
Bw.0A	_	D2000.A	_	_
to				
Bw.1F	_	D2001.F	_	_

7) Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	D2002.0	0	ST1H-PB
Ew.01	System area (0 fixed)	D2002.1		
Ew.02	System area (0 fixed)	D2002.2	1	
Ew.03	System area (0 fixed)	D2002.3		
Ew.04	Error clear request	D2002.4	2	ST1PSD
Ew.05	System area (0 fixed)	D2002.5		
Ew.06	Error clear request	D2002.6	3	ST1RD2
Ew.07	System area (0 fixed)	D2002.7		
Ew.08	System area (0 fixed)	D2002.8	4	
Ew.09	System area (0 fixed)	D2002.9		
Ew.0A	_	D2002.A	_	_
to				
Ew.1F	_	D2003.F	_	_

8) Sw System area

Sw System area	Information	Master station side device	Slice No.	Module name
Sw.0	System area (0 fixed)	D2004	—	—

9) Cw Command execution area

Cw Command execution area	Information	Master station side device	Slice No.	Module name
Cw.0	Start Slice No. of Execution Target	D2005	—	—
Cw.1	Command No. to be Executed	D2006		
Cw.2	Argument 1	D2007		
Cw.3	Argument 2	D2008		

10) Ww Word output area

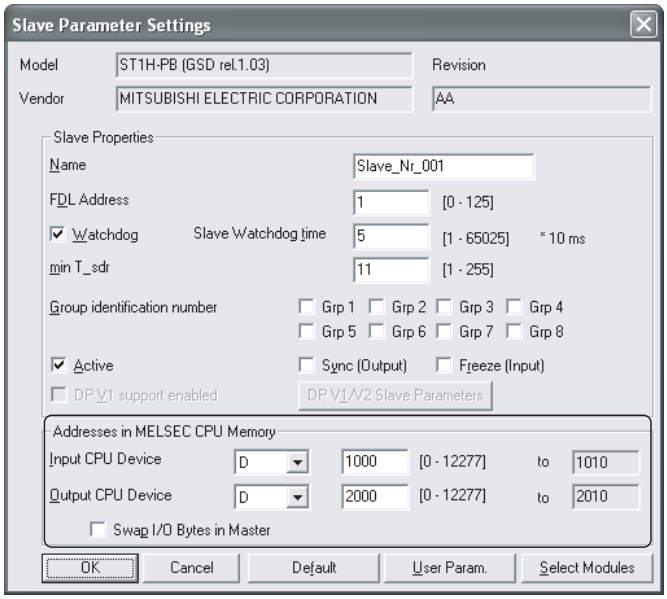
Ww Word output	Information	Master station side device	Slice No.	Module name
Ww.00	System area (0 fixed) (Ww.n)	D2009	3	ST1RD2
Ww.01	System area (0 fixed) (Ww.n+1)	D2010		

6.2.1 Program example available when using auto refresh in QJ71PB92V/QJ71PB92D

This section explains a program example available when auto refresh is used in the QJ71PB92V/QJ71PB92D to communicate with the MELSEC-ST system.
The program example in this section is based on the system configuration in Section 6.2.

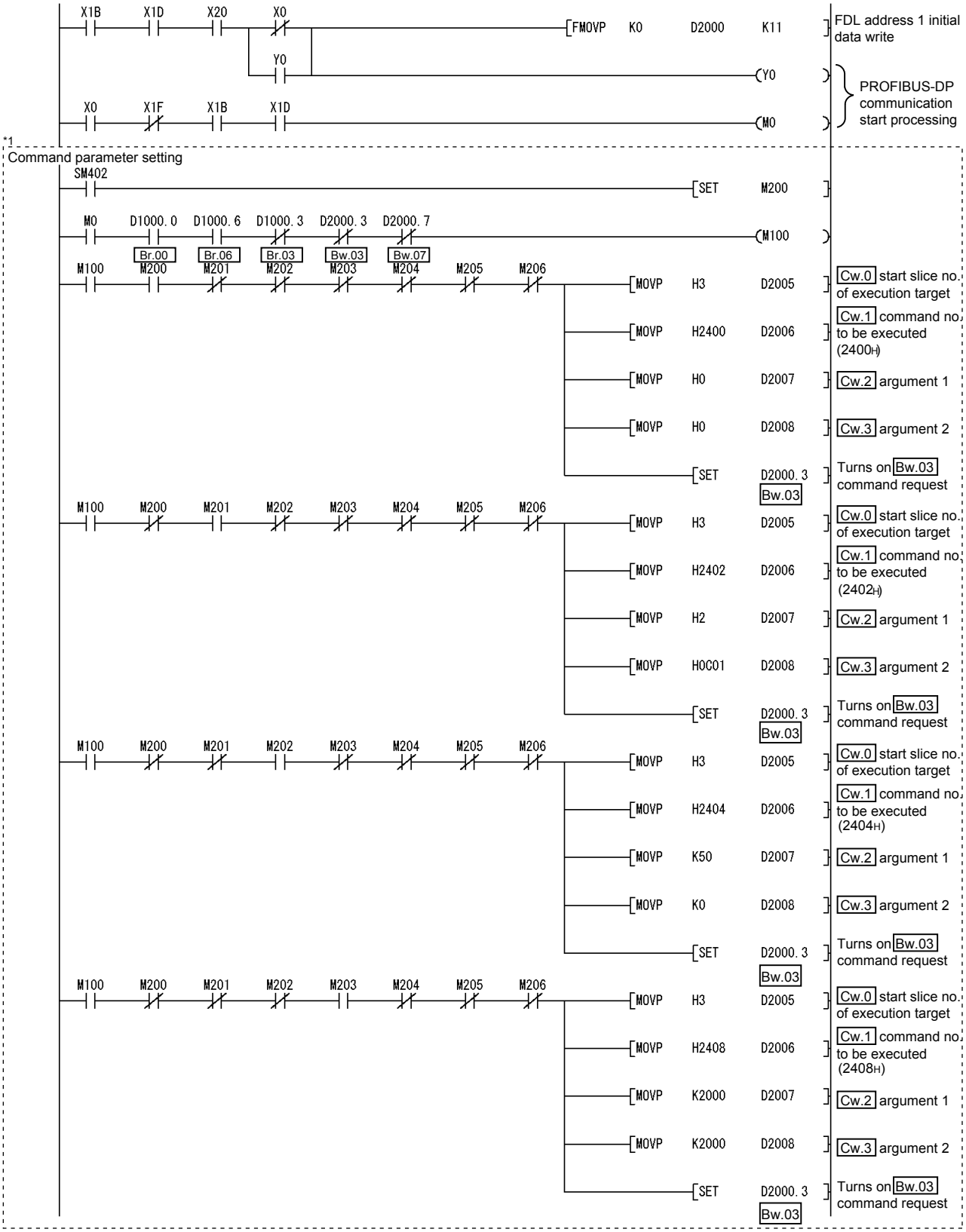
(1) Auto refresh setting

To use auto refresh, setting must be made on GX Configurator-DP.
Refer to the GX Configurator-DP Manual for details.

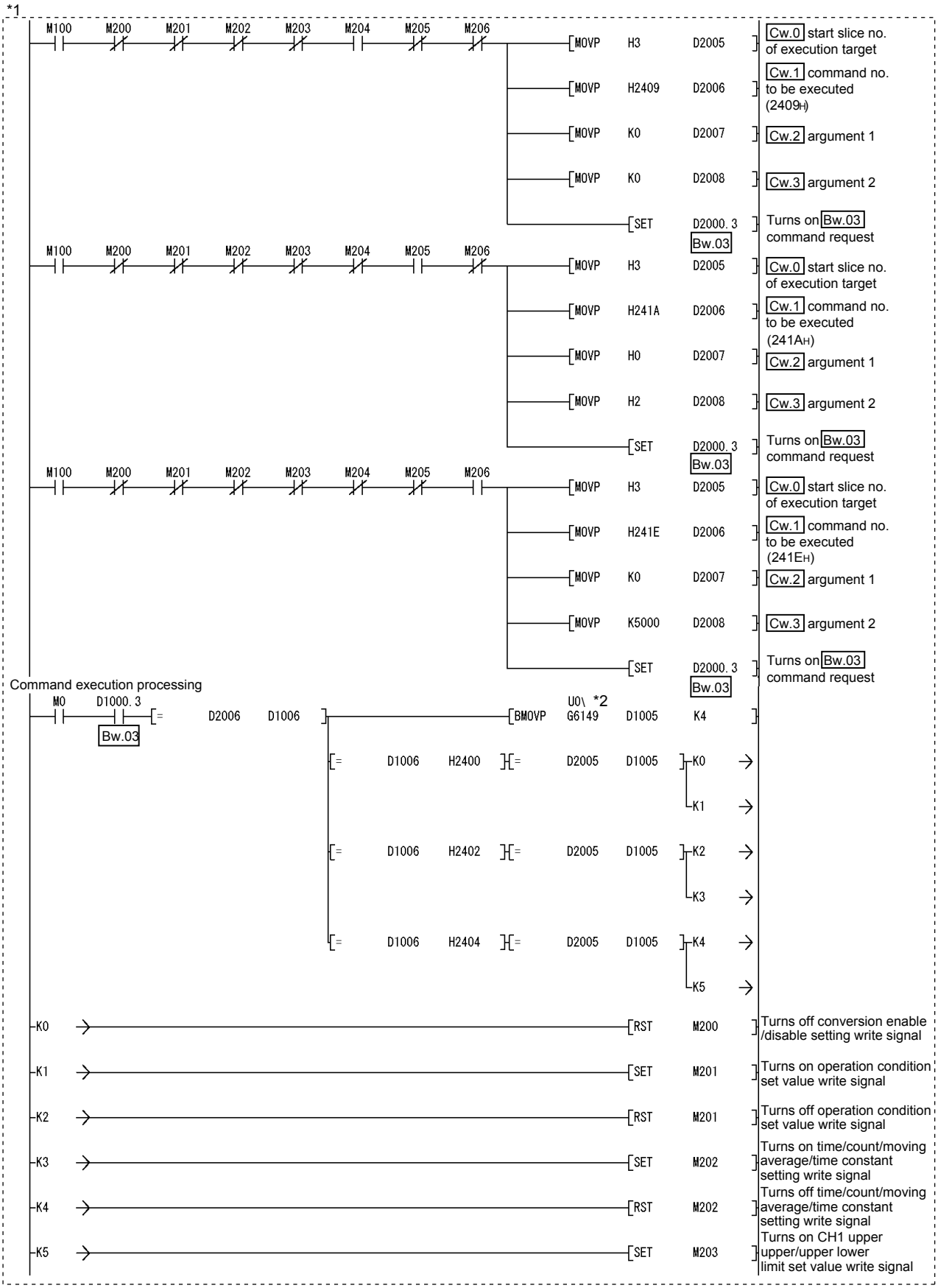


(2) Program example

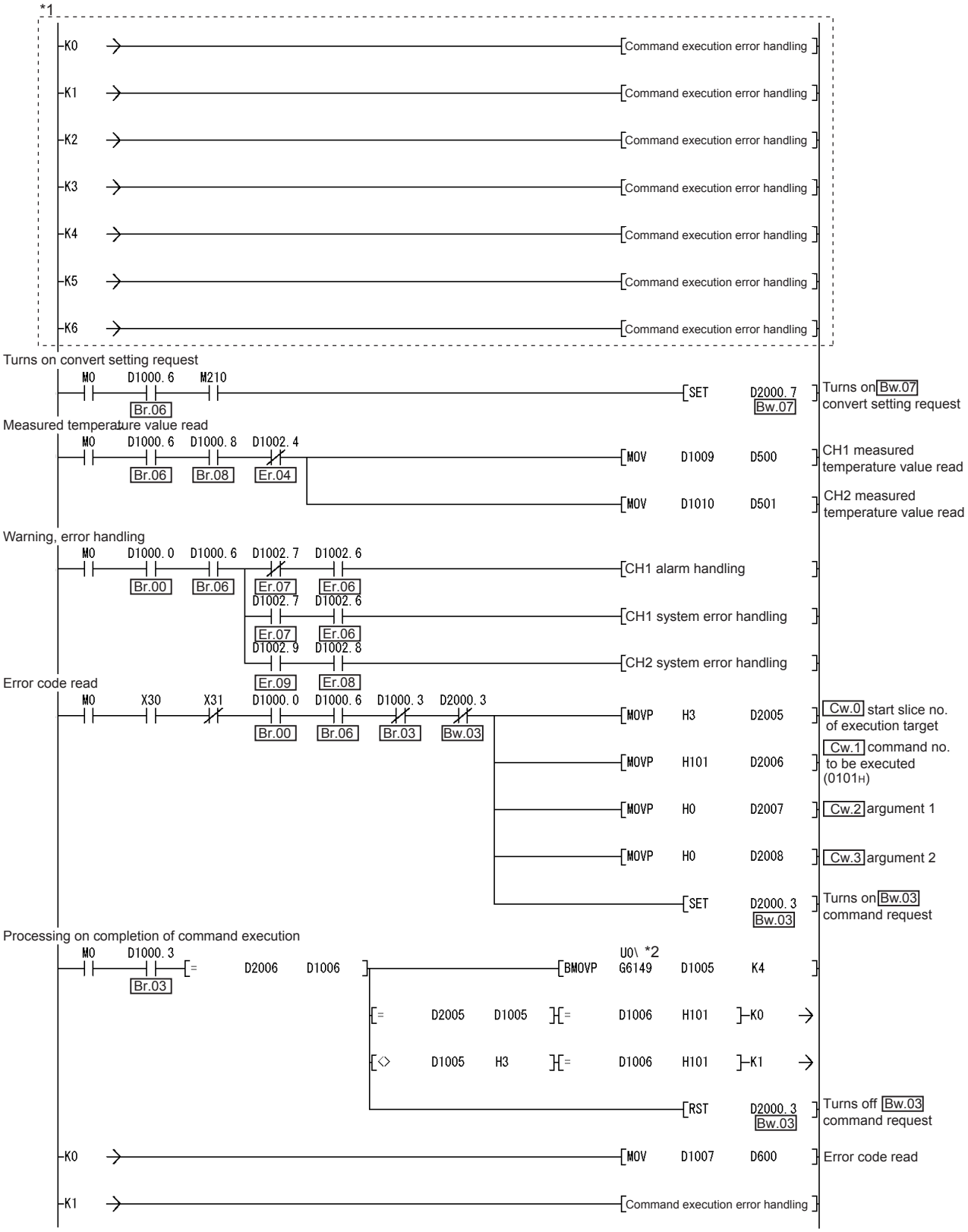
This is a program example for the QJ71PB92V.



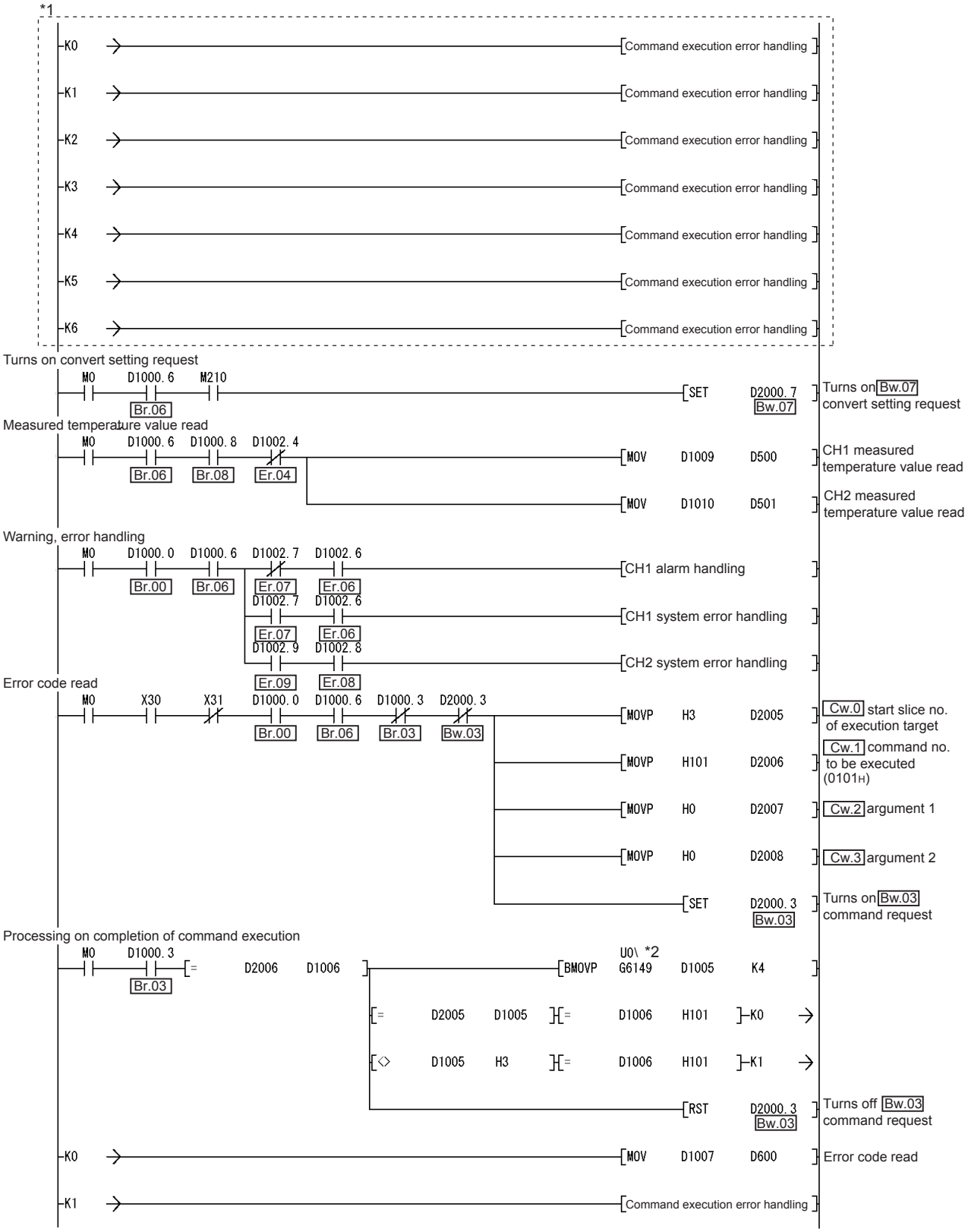
*1 The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.



*1 The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.
*2 When the master station is the QJ71PB92D, it is "U0\G5".

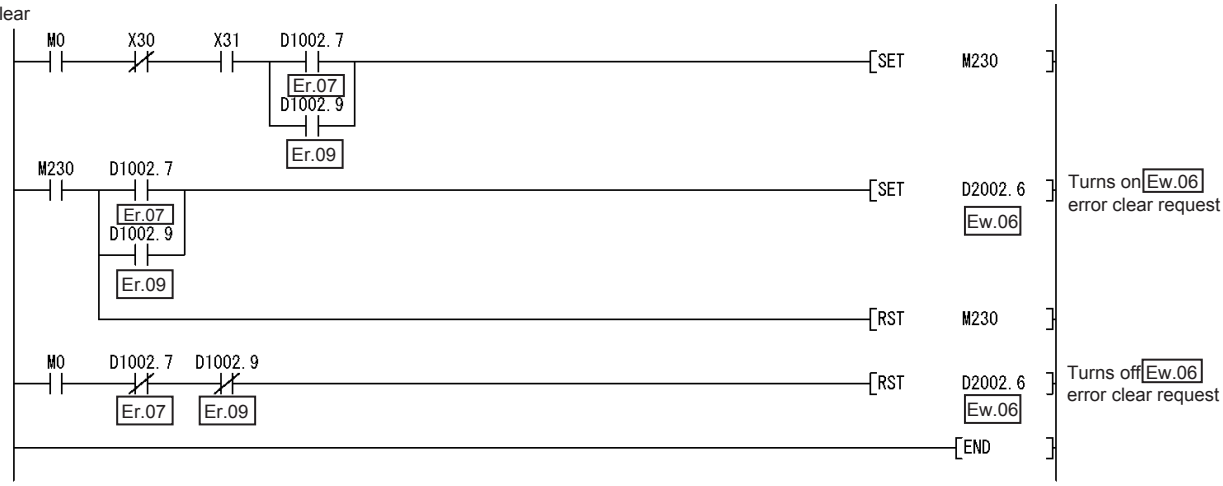


*1 The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.
*2 When the master station is the QJ71PB92D, it is "U0\G5".



*1 The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.
*2 When the master station is the QJ71PB92D, it is "U0\G5".

Error clear



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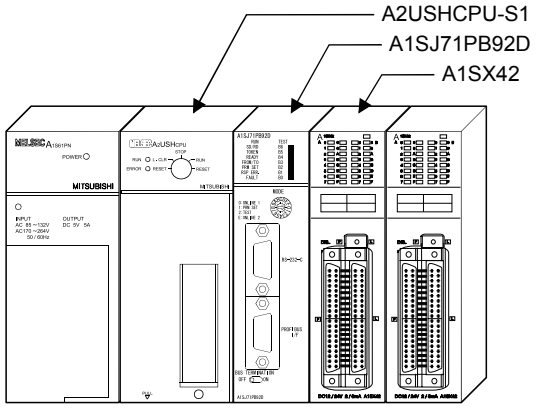
6.3 When Using AJ71PB92D/A1SJ71PB92D as Master Station

This section explains a program example available when the AJ71PB92D/A1SJ71PB92D is used as the master station.
The program example shown here is the case where the A1SJ71PB92D is used as the master station.

(1) System configuration of master station (A1SJ71PB92D)

The system configuration of the master station (A1SJ71PB92D) used in this section is shown below.

(a) System configuration of master station (A1SJ71PB92D)



(b) Settings of master station (A1SJ71PB92D)

Item		Setting
I/O signals		X/Y000 to X/Y01F
Operation mode		Extended service mode (MODE E)
I/O data area (buffer memory) for FDL address 1 (MELSEC-ST system)	Input data	0(0_H) to 10($0A_H$)
	Output data	960($3C0_H$) to 970($3CA_H$)

REMARK

The MELSEC-ST system changes in I/O data size depending on the maximum input/output point setting and the number of mounted intelligent function modules. Hence, the master station operation mode is set to the extended service mode (MODE E) where the data size is variable.

(2) System configuration of MELSEC-ST system

The MELSEC-ST system has the system configuration as described in Section 6.2 (2).

(3) I/O data assignment

The I/O data assignment results are the same as those shown in section 6.2 (3) (a) 2) and (b) 2).

(4) Device assignment in program examples

The program example in this section uses the following device assignment.

(a) Devices used by A1SJ71PB92D

Device	Application	Device	Application
X0	Exchange start end signal	Y0	Exchange start request signal
X0D	Watchdog timer error signal		
X1B	Communication READY signal	—	
X1D	Module READY signal		

(b) Devices used by user

Device	Application	Device	Application
X20	PROFIBUS-DP exchange start command	M0	Refresh start request
X30	ST1RD2 error code read request	M100	Command execution signal
X31	ST1RD2 error clear request	M200	Conversion enable/disable setting write signal
D500	CH1 measured temperature value read destination	M201	Operation condition set value write signal
D501	CH2 measured temperature value read destination	M202	Time/count/moving average/time constant setting write signal
D600, D601	ST1RD2 error code read destination	M203	CH1 upper upper/upper lower limit set value write signal
—		M204	CH1 lower upper/lower lower limit set value write signal
		M205	Sensor compensation value write singal
		M206	Conversion setting value (for disconnection detection) write signal
		M210	Conversion start signal
		M230	ST1RD2 error clear request signal

(c) Devices used in I/O data

1) Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	B0	0	ST1H-PB
Br.01	Forced output test mode	B1		
Br.02	Module being changed online	B2	1	
Br.03	Command execution	B3		
Br.04	External power supply status	B4	2	ST1PSD
Br.05		B5		
Br.06	Module ready	B6	3	ST1RD2
Br.07	Convert setting completed flag	B7		
Br.08	Conversion completed flag	B8	4	
Br.09	Alarm output signal	B9		
Br.0A	—	BA	—	—
to				
Br.1F	—	B1F	—	—

2) Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	B20	0	ST1H-PB
Er.01		B21		
Er.02		B22	1	
Er.03		B23		
Er.04	Bus refreshing module error information	B24	2	ST1PSD
Er.05		B25		
Er.06	CH1 error information	B26	3	ST1RD2
Er.07		B27		
Er.08	CH2 error information	B28	4	
Er.09		B29		
Er.0A	_	B2A	_	_
to				
Er.1F	_	B3F	_	_

3) Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	B40	0	ST1H-PB
Mr. 1		B41	1	
Mr.2	Bus refreshing module existence information	B42	2	ST1PSD
Mr.3	Module status	B43	3	ST1RD2
Mr.4		B44	4	
Mr.5	_	B45	_	_
to				
Mr.15	_	B4F	_	_

4) Cr Command result area

Cr Command result area	Information	Master station side device	Slice No.	Module name
Cr.0	Cr.0(15-8) Command Execution Result, Cr.0(7-0) Start Slice No. of Execution Target	W0	_	_
Cr.1	Executed Command No.	W1		
Cr.2	Response Data 1	W2		
Cr.3	Response Data 2	W3		

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5) Wr Word input area

Wr.n Word input	Information	Master station side device	Slice No.	Module name
Wr.00	CH1 measured temperature value (Wr.n)	W4	3	ST1RD2
Wr.01	CH2 measured temperature value (Wr.n+1)	W5		

6) Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	B1000	0	ST1H-PB
Bw.01	System area (0 fixed)	B1001		
Bw.02	System area (0 fixed)	B1002	1	
Bw.03	Command request	B1003		
Bw.04	System area (0 fixed)	B1004	2	ST1PSD
Bw.05	System area (0 fixed)	B1005		
Bw.06	System area (0 fixed)	B1006	3	ST1RD2
Bw.07	Convert setting request	B1007		
Bw.08	System area (0 fixed)	B1008	4	
Bw.09	System area (0 fixed)	B1009		
Bw.0A	_	B100A	_	_
to				
Bw.1F	_	B101F	_	_

7) Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	B1020	0	ST1H-PB
Ew.01	System area (0 fixed)	B1021		
Ew.02	System area (0 fixed)	B1022	1	
Ew.03	System area (0 fixed)	B1023		
Ew.04	Error clear request	B1024	2	ST1PSD
Ew.05	System area (0 fixed)	B1025		
Ew.06	Error clear request	B1026	3	ST1RD2
Ew.07	System area (0 fixed)	B1027		
Ew.08	System area (0 fixed)	B1028	4	
Ew.09	System area (0 fixed)	B1029		
Ew.0A	_	B102A	_	_
to				
Ew.1F	_	B103F	_	_

8) Sw System area

Sw System area	Information	Master station side device	Slice No.	Module name
Sw.0	System area (0 fixed)	B1040 to B104F	—	—

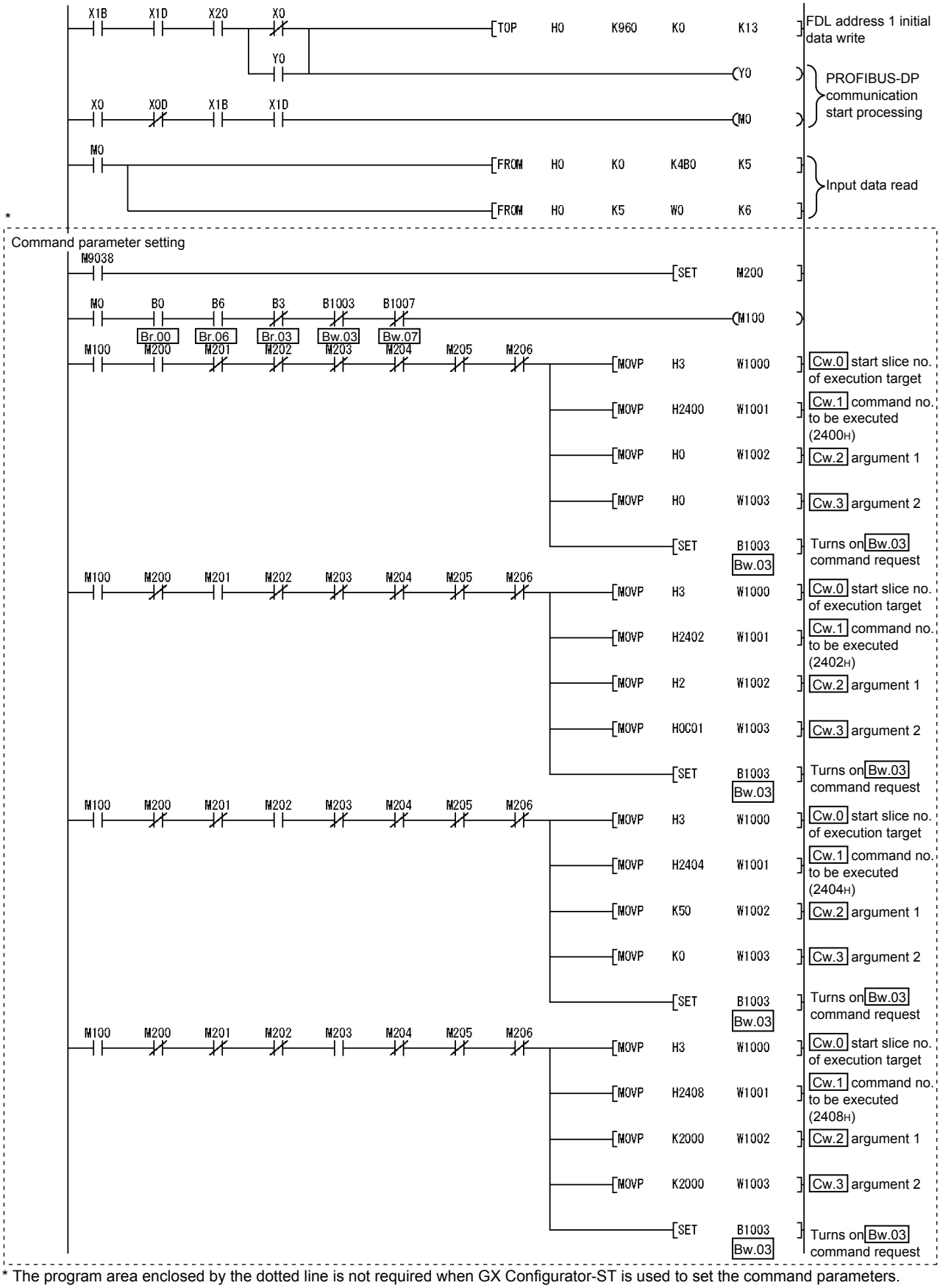
9) Cw Command execution area

Cw Command execution area	Information	Master station side device	Slice No.	Module name
Cw.0	Start Slice No. of Execution Target	W1000	—	—
Cw.1	Command No. to be Executed	W1001		
Cw.2	Argument 1	W1002		
Cw.3	Argument 2	W1003		

10) Ww Word output area

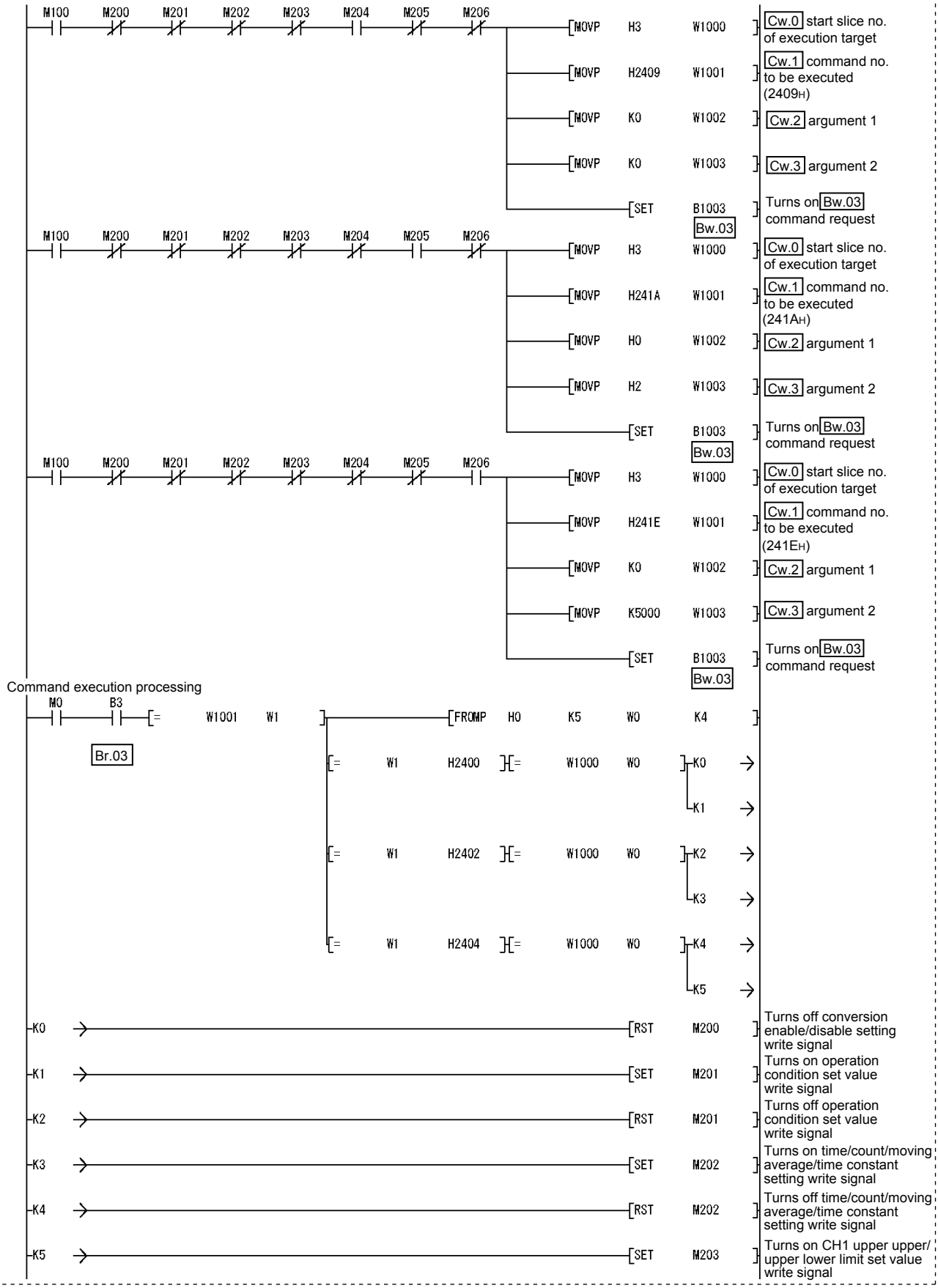
Ww Word output	Information	Master station side device	Slice No.	Module name
Ww.00	System area (0 fixed) (Ww.n)	W1004	3	ST1RD2
Ww.01	System area (0 fixed) (Ww.n+1)	W1005		

(5) Program example



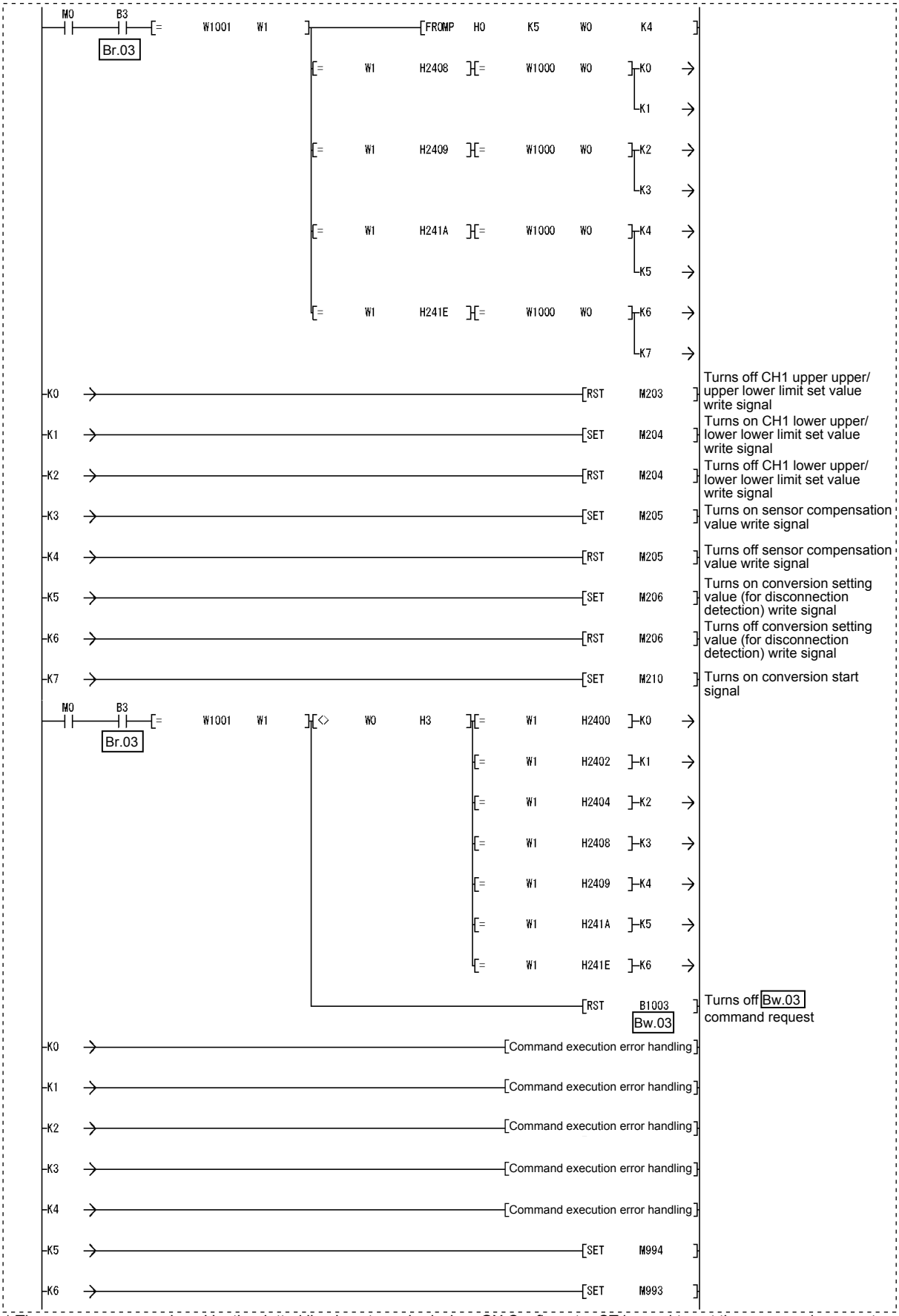
* The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.

*

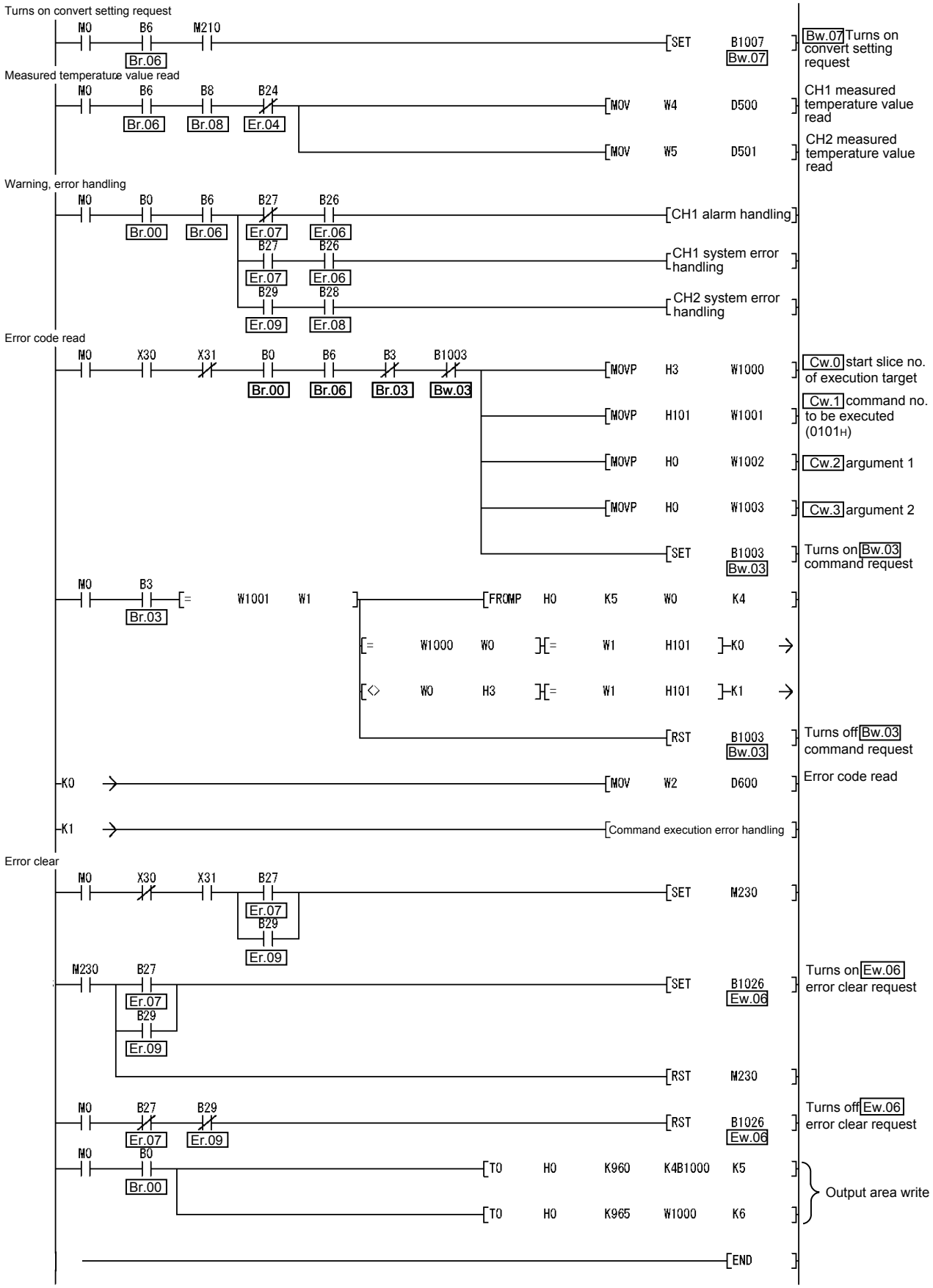


*The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.

*



* The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.


Turns on convert setting request
M0
B6
Br.06
M210
SET B1007 Bw.07
Bw.07 Turns on convert setting request
Measured temperature value read
M0
B6
Br.06
B8
Br.08
B24
Er.04
MOV W4 D500
CH1 measured temperature value read
MOV W5 D501
CH2 measured temperature value read
Warning, error handling
M0
B0
Br.00
B6
Br.06
B27
Er.07
B26
Er.06
CH1 alarm handling
B27
Er.07
B26
Er.06
CH1 system error handling
B29
Er.09
B28
Er.08
CH2 system error handling
Error code read
M0
X30
X31
B0
Br.00
B6
Br.06
B3
Br.03
B1003
Bw.03
MOVP H3 W1000
Cw.0 start slice no. of execution target
MOVP H101 W1001
Cw.1 command no. to be executed (0101H)
MOVP H0 W1002
Cw.2 argument 1
MOVP H0 W1003
Cw.3 argument 2
SET B1003 Bw.03
Turns on Bw.03 command request
M0
B3
Br.03
= W1001 W1
FROMP H0 K5 W0 K4
= W1000 W0
= W1 H101
K0
<> W0 H3
= W1 H101
K1
RST B1003 Bw.03
Turns off Bw.03 command request
K0
MOV W2 D600
Error code read
K1
Command execution error handling
Error clear
M0
X30
X31
B27
Er.07
B29
Er.09
SET M230
M230
B27
Er.07
B29
Er.09
SET B1026 Ew.06
Turns on Ew.06 error clear request
RST M230
M0
B27
Er.07
B29
Er.09
RST B1026 Ew.06
Turns off Ew.06 error clear request
M0
B0
Br.00
TO H0 K960 K4B1000 K5
TO H0 K965 W1000 K6
Output area write
END

7 ONLINE MODULE CHANGE

When performing online module change, make sure to read through Section 4.4 "Online module change" in the head module user's manual.
This chapter describes the specifications of an online module change.

(1) Perform an online module change by operating the head module buttons or using GX Configurator-ST.

(2) The user parameter, command parameter and user range setting's offset/gain setting values are automatically handed down to the new module.

(3) Using GX Configurator-ST, the offset/gain setting can be made during an online module change.
When higher accuracy is required, perform the offset/gain setting during an online module change using GX Configurator-ST.

7.1 Precautions for Online Module Change

The following are the precautions for online module change.

(1) To perform the online module change, the system configuration must be appropriate for execution of the online module change.
For details, refer to the MELSEC-ST System User's Manual, "3.4 Precautions for System Configuration".
Executing the online module change in an inappropriate system configuration may result in malfunction or failure.
In such a system configuration, shut off all phases of the external power supply for the MELSEC-ST system to replace a slice module.

(2) Be sure to perform an online module change in the "online module change procedure" in the user's manual of the used head module and in the procedure given in Section 7.4.1 of this manual.
Failure to do so can cause a malfunction or failure.

(3) Before starting an online module change, confirm that the external device connected with the slice module to be removed will not malfunction.

(4) Only the slice modules of the same model name can be replaced online. It is not possible to replace with/add the slice module of different model name.

(5) Only one slice module can be replaced in a single online module change process. To replace multiple slice modules, perform an online module change for each module.

(6) While an online module change is being executed (while the REL. LED of the head module is on), no command can be executed from the master station to the slice module being replaced online.
To do so will cause an error.

(7) When changing the user parameter of the slice module from the master station during online module change (while the head module's REL. LED is on), change it after the online module change is completed.
If the user parameter setting is changed from the master station during the online module change, the new setting is not validated since the new user parameter values are overwritten by the user parameter saved in the head module when the online module change is finished.

(8) During an online module change, the ERR. LED of the head module turns on only when an error related to the online module change occurs.
It will not turn on or flicker when any other error occurs.

(9) While an online module change is being executed (while the REL. LED of the head module is on), the following data of the slice module being replaced online all turn to 0 (OFF).
- Br.n Bit input
- Er.n Error information
- Mr.n Module status
- Wr.n Word input

(10) After an online module change, the accuracy of the user range setting is decreased about three times or more compared with the one before the online module change.
When the user range setting is used, set the offset and gain values again as necessary.

(11) Make sure to perform online module change in the normal mode.

(12) Except the error clear request, the forced output test of GX Configurator-ST cannot be used for the module being changed online.
If it is used, the module will not operate. It will not display an error, either.

7.2 Preparations for Online Module Change

Prepare GX Configurator-ST when changing the ST1RD2 online.
Depending on the module failure status, the user parameter, command parameter and user range setting's offset/gain setting values may not be saved into the head module.
Refer to Section 7.4.1 for the procedure used in the parameter setting or offset/gain setting during an online module change.
When GX Configurator-ST is unavailable, make the following preparations.
Failure to do so may not import the offset/gain setting values of user range setting and others to the new module, if these settings cannot be saved into the head module.

(1) Command parameter

When GX Configurator-ST is unavailable, the command parameter must be set by commands after an online module change is finished. Include a command parameter setting program in the master station program.
Refer to Section 6.2.1 and Section 6.3 for the command parameter setting program.

(2) Offset/gain setting values

When the user range setting is used and GX Configurator-ST is unavailable, the offset/gain setting must be made by commands after completion of online module change. Include an offset/gain setting program in the master station program.
Refer to Section 4.5 for the offset/gain setting program.

POINT

When GX Configurator-ST is unavailable, set the command parameter and offset/gain setting values after the module has operated once by default.

REMARK

The preparations for the user parameter are not specially required since the values set by the configuration software of the master station are written from the head module.

7.3 Disconnecting/Connecting the External Device for Online Module Change

Disconnect and connect the ST1RD2 external device according to the following.

(1) Disconnection

Power off the external device.

(2) Connection

Power on the external device.

7.4 Online Module Change Procedure

This section explains how to make the parameter setting or offset/gain setting during an online module change when the user parameter, command parameter and user range setting's offset/gain setting values could not be saved in the head module or when the user range setting is used and high accuracy is required.
For the other online module change procedure, refer to the user's manual of the head module.

7.4.1 When parameter setting or offset/gain setting is performed using GX Configurator-ST during online module change

POINT

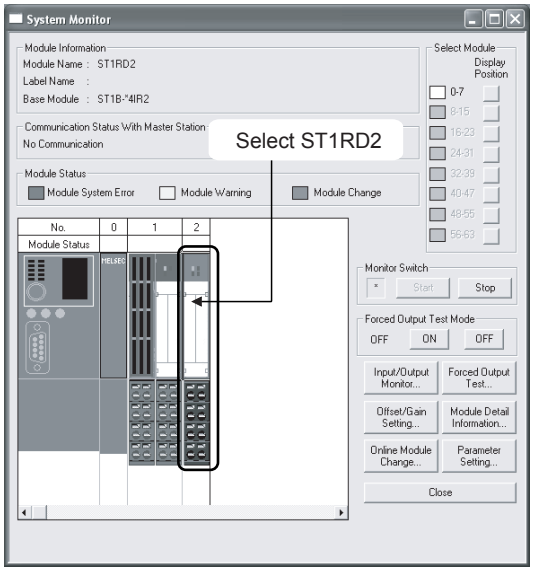
If a slice module different from the target one is selected by mistake, restart the operation as instructed below.

(1) To restart the operation at step 3)
Click the Cancel button on the screen to terminate online module change.

(2) When you noticed on the screen in step 4)
Do not change the slice module, click the Next button, and perform the operations in steps 7), 12), 13) to complete the online module change once.

(3) To restart the operation at step 7)
Mount the removed slice module again, click the Next button, and perform the operations in steps 12), 13) to complete the online module change once.

Preparation for replacing ST1RD2



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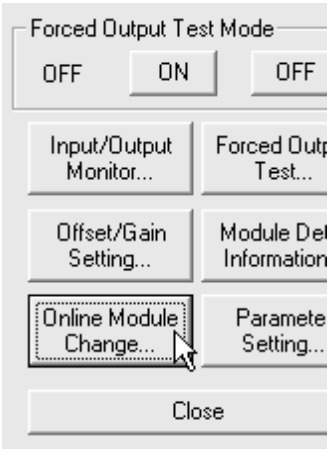

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1) Select the ST1RD2 to be replaced online on the "System Monitor" screen.

2) Click the Online Module Change button on the "System Monitor" screen.
Then, confirm that the RUN LED of the selected ST1RD2 is flashing at 0.25s intervals.

REMARK

Instead of the above, the following operations are also available.

- Select [Diagnostics] → [Online Module Change].
- Right-click the ST1RD2 selected at step 1), and click [Online Module Change] on the menu.

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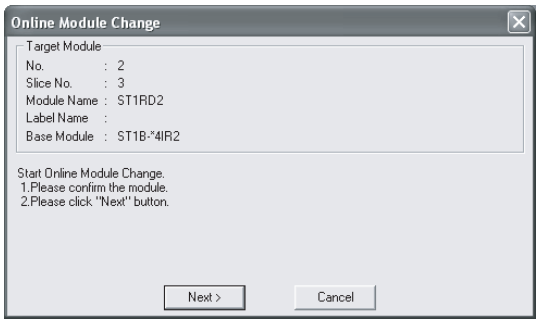

3) Confirm that the ST1RD2 displayed as "Target Module" is the ST1RD2 to be replaced and click the Next button.
   (a) Clicking the Next button validates the settings and the following will be performed.
   - Puts the head module into the online module change mode.
   - Save the user parameter, command parameter and user range setting's offset/gain setting values of the ST1RD2 to be changed into the head module.

   (b) After clicking the Next button, confirm the following module statuses.
   - The REL. LED of the head module is on.
   - The RUN LED of the target ST1RD2 is off.
   - The "Module Status" indicator of the target module has turned purple. This applies only when monitoring from the "System Monitor" screen.

   (c) If the user parameter, command parameter and user range setting's offset/gain setting values could not be read from the ST1RD2, the REL. LED and ERR. LED of the head module turn on and the corresponding error message is displayed on the screen by the operation in step 7).
   Confirm the error definition.
   For details of the error code reading operation and error code of the head module, refer to the user's manual of the used head module.
   When making parameter setting and offset/gain setting to the new ST1RD2, perform the operations in step 4, and later.

   When not executing online module change, click the Cancel button.
   (a) Clicking the Cancel button causes the screen to show that online module change is cancelled.

   Clicking the Exit button returns to the step 1).

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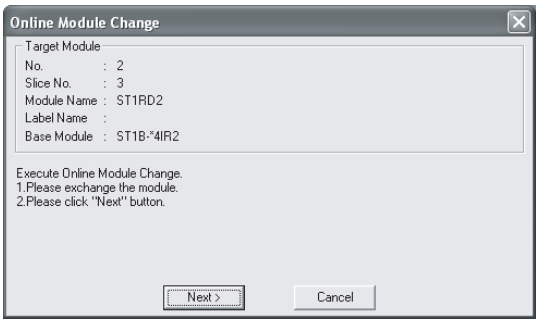
Disconnection from external device



4) As the left screen appears, power off the external device connected with the ST1RD2 to be removed.

POINT
If the external device cannot be powered off, shut off all phases of the external power for the MELSEC-ST system and replace the ST1RD2.

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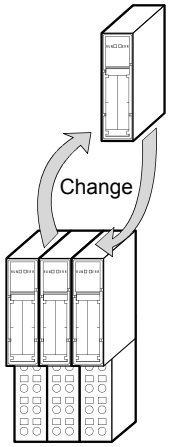
Replacing ST1RD2



5) Remove the ST1RD2 and replace with new one.

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Connection to external device after replacement

6) Mount a new ST1RD2. And then, power on the external device.

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Operations after external device connection

7) After connecting to the external device, click the Next button on the screen at step 4).

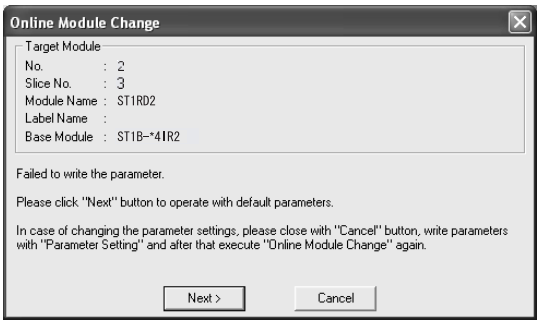
(a) Clicking the Next button performs the following.

- Checks whether the module name of the newly mounted slice module is the same as that of the removed one.
- Write the user parameter, command parameter and user range setting's offset/gain setting values, which were saved in the head module in step 3), to the mounted ST1RD2.

(b) After clicking the Next button, confirm the following module statuses.

- The REL. LED of the head module is flashing.
- The RUN LED of the newly mounted ST1RD2 is flashing (at 0.25s intervals).

Clicking the Cancel button, i.e., interrupting online module change returns to step 1) In this case, select the same slice module as selected before, and complete online module change. Note that selecting different one causes an error.



If the parameter setting or user range setting's offset/gain setting values could not be written to the ST1RD2, the REL. LED and ERR. LED of the head module turn on and the screen shown on the left appears.
Confirm the error definition.
For details of the error code reading operation and error code of the head module, refer to the user's manual of the used head module.

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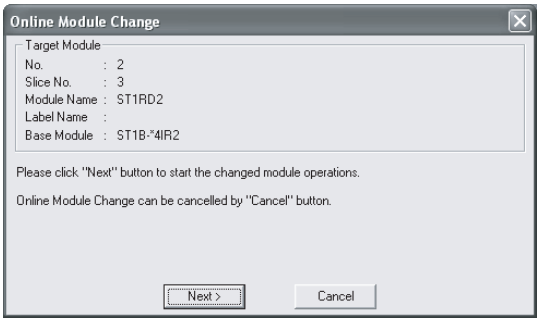
Parameter setting/offset/gain setting



8) Click the Cancel button to stop the online module change.

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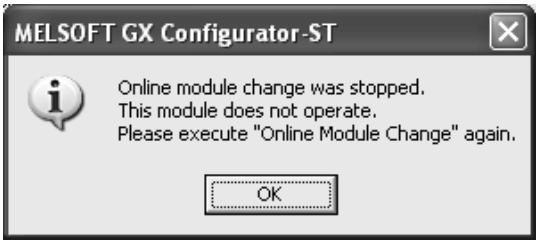

9) Click the OK button.

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10) Make parameter setting or offset/gain setting.
Follow the procedure in Section 5.3 for the parameter setting, or the procedure in Section 5.6 for the offset/gain setting.
The following describes the POINT of parameter setting and offset/gain setting to be noted during the online module change.

POINT

(1) As the system is already in the diagnostic mode, the mode need not be changed.

(2) When setting the parameters during an online module change, write them to both the RAM and ROM.
After the control resumes, the module will operates with the setting written on the RAM.

(3) If the parameter setting or user range setting's offset/gain setting values could not be read from the old ST1RD2, the user parameter have been written when the operation in step 7, was performed.
Using GX Configurator-ST, check whether the user parameter have been written.

(4) When offset/gain setting was made during an online module change, the RUN LED of the ST1RD2 flickers at 0.25s intervals even in the offset/gain setting mode.

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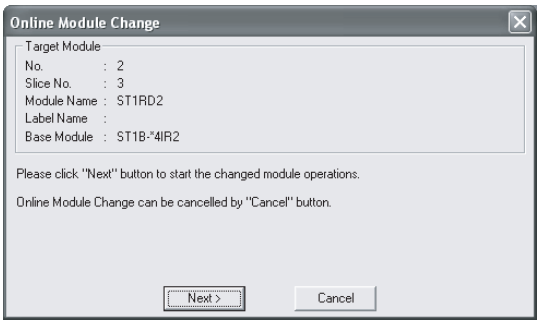
Processing after parameter setting or offset/gain setting

11) After parameter setting or offset/gain setting, execute the operations in steps 1), 2) to resume the online module change.
* Select the same ST1RD2 as before the online module change was stopped.
If the selected ST1RD2 is different, an error will occur.



12) Clicking the Next button releases the head module from the online module change mode.
(a) Clicking the Next button performs the following.
- Releases the head module from the online module change mode.
- Restarts refreshing the I/O data, etc.

(b) After clicking the Next button, confirm the following module statuses.
- The REL. LED of the head module is off.
- The RUN LED of the newly mounted ST1RD2 is on.
- The "Module Status" indicator of the target ST1RD2 has turned white. This applies only when monitoring from the "System Monitor" screen.

(c) If the head module cannot be released from the online module change mode, both REL. LED and ERR. LED of the head module turn on.
Confirm the error definition.
For details of the error code reading operation and error code of the head module, refer to the user's manual of the used head module.

When interrupting online module exchange, click the Cancel button.
(a) Clicking the Cancel button, i.e., interrupting online module change returns to step 1). In this case, select the same slice module as selected before, and complete online module change.
Note that selecting different one causes an error.

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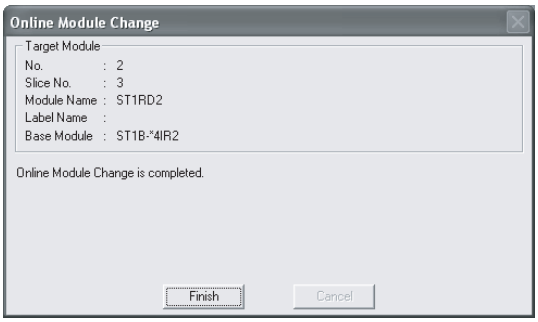

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(Completed)

13) The left screen appears showing that online module change has been completed.
Click the Finish button.

7 - 11

8 COMMAND

This chapter explains the commands.

8.1 Command List

The ST1RD2 supports command execution that uses the Cw Command execution area/Cr Command result area of the head module.
For the command execution procedure, refer to the user's manual of the used head module.
A list of commands that can be executed by the ST1RD2 is given in Table 8.1.

Table 8.1 Command List (1/2)

Command			Description	Executability			Reference section
Command type	Command No.	Command name		1)	2)	3)	
Common command	0100H	Operating status read request	Reads the operating status of the ST1RD2.	○	○	○	Section 8.2.1
	0101H	Error code read request	Reads the error code and alarm information of the ST1RD2.	○	○	○	Section 8.2.2
ST1RD2 parameter setting read command	1400H	Conversion enable/ disable setting read	Reads the conversion enable/disable setting from the RAM of the ST1RD2.	○	○	○	Section 8.3.1
	1401H	Conversion completion channel read	Reads the currently valid conversion enable/ disable setting and conversion completed status.	○	○	○	Section 8.3.2
	1402H	Operation condition set value read	Reads the averaging processing specification, alarm output setting and conversion setting for disconnection detection from the RAM of the ST1RD2.	○	○	○	Section 8.3.3
	1404H	CH□ time/count/moving average/time constant setting value read	Reads the time, count, count for moving average, or time constant from the RAM of the ST1RD2.	○	○	○	Section 8.3.4
	1408H	CH1 upper upper/upper lower limit set value read	Reads the upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value of the alarm output from the RAM of the ST1RD2.	○	○	○	Section 8.3.5
	1409H	CH1 lower upper/lower lower limit set value read					Section 8.3.6
	140AH	CH2 upper upper/upper lower limit set value read					Section 8.3.5
	140BH	CH2 lower upper/lower lower limit set value read					Section 8.3.6
	1418H	User parameter set value read	Reads the measurement range setting and offset/gain value selection RAM of the ST1RD2.	○	○	○	Section 8.3.7
	141AH	Sensor compensation value read	From the ST1RD2's RAM, reads out a compensation value when an error is identified between "the actual temperature" and "the measured temperature".	○	○	○	Section 8.3.8
	141EH	Conversion setting value (for disconnection detection) read	Reads the conversion setting value for disconnection detection from the RAM of the ST1RD2.	○	○	○	Section 8.3.9

○: Can be executed ×: Cannot be executed

1) When Bw.n+1 convert setting request is OFF (0) in the normal mode
2) When Bw.n+1 convert setting request is ON (1) in the normal mode
3) When the module is in the offset/gain setting mode

Table 8.1 Command List (2/2)

Command			Description	Executability *			Reference section
Command type	Command No.	Command name		1)	2)	3)	
ST1RD2 parameter setting write command	2400H	Conversion enable/ disable setting write	Writes the conversion enable/disable setting to the RAM of the ST1RD2.	○	×	×	Section 8.4.1
	2402H	Operation condition set value write	Writes the averaging processing specification, alarm output setting and conversion setting for disconnection detection to the RAM of the ST1RD2.	○	×	×	Section 8.4.2
	2404H	CH□ time/count/moving average/time constant setting value write	Writes the time, count, count for moving average, or time constant to the RAM of the ST1RD2.	○	×	×	Section 8.4.3
	2408H	CH1 upper upper/upper lower limit set value write	Writes the upper upper limit value/upper lower limit value or lower upper limit value/lower lower limit value of the alarm output to the RAM of the ST1RD2.	○	×	×	Section 8.4.4
	2409H	CH1 lower upper/lower lower limit set value write					Section 8.4.5
	240AH	CH2 upper upper/upper lower limit set value write					Section 8.4.4
	240BH	CH2 lower upper/lower lower limit set value write					Section 8.4.5
	241AH	Sensor compensation value write	Writes a compensation value to the ST1RD2's RAM when an error is identified between "the actual temperature" and "the measured temperature".	○	×	×	Section 8.4.6
	241EH	Conversion setting value (for disconnection detection) write	Writes the conversion setting value for disconnection detection to the RAM of the ST1RD2.	○	×	×	Section 8.4.7
ST1RD2 control command	3400H	Parameter setting ROM read	Reads the parameters from the ROM of the ST1RD2 to the RAM.	○	×	×	Section 8.5.1
	3401H	Parameter setting ROM write	Writes the parameters from the RAM of the ST1RD2 to the ROM.	○	×	×	Section 8.5.2
	3402H	Operation mode setting	Changes the mode of the ST1RD2.	○	×	○	Section 8.5.3
	3403H	Offset channel specification	Specifies the offset channel of offset/gain setting and adjusts the offset value.	×	×	○	Section 8.5.4
	3404H	Gain channel specification	Specifies the gain channel of offset/gain setting and adjusts the gain value.	×	×	○	Section 8.5.5
	3405H	User range write	Writes the adjusted offset/gain settings to the ROM of the ST1RD2.	×	×	○	Section 8.5.6

○: Can be executed ×: Cannot be executed

1) When Bw.n+1 convert setting request is OFF (0) in the normal mode
2) When Bw.n+1 convert setting request is ON (1) in the normal mode
3) When the module is in the offset/gain setting mode
* If a command is executed when it cannot be executed, it fails and "06H" or "13H" is stored into the Cr.0(15-8) Command execution result.

8 - 2

8.2 Common Command

8.2.1 Operating status read request (Command No.: 0100H)

Reads the operating status of the ST1RD2.

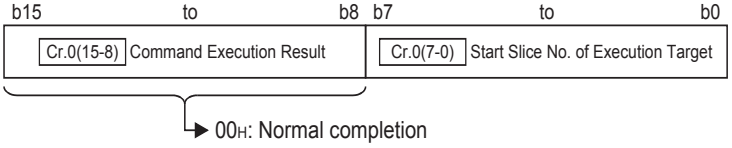
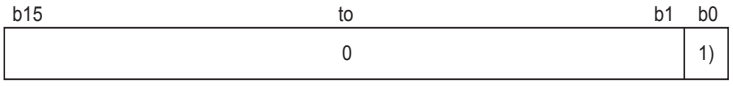
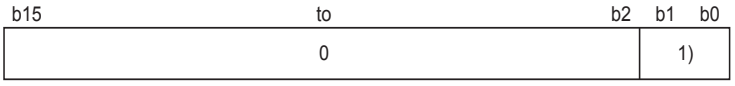
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	0100H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

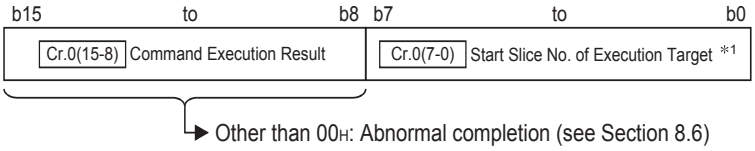
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The operating status of the ST1RD2 is stored.  1) 0: Normal 1: System error
Cr.3	The current operation mode of the ST1RD2 is stored.  1) 01: Normal mode 10: Offset/gain setting mode

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.2.2 Error code read request (Command No.: 0101H)

Reads the error code of the ST1RD2.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	0101H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

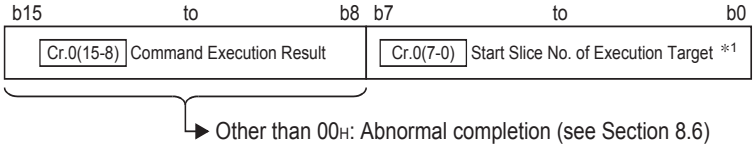
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result | Cr.0(7-0) Start Slice No. of Execution Target 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The error code currently occurring in the ST1RD2 is stored. (Hexadecimal) Refer to Section 9.1 for details of the error code.
Cr.3	The alarm information is stored for each channel. b15 to b4 b3 to b0 0 | 1) 1) CH☐ alarm status (b0: CH1 upper limit value, b1: CH1 lower limit value, b2: CH2 upper limit value, b3: CH2 lower limit value) 0: Normal 1: Alarm occurrence

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3 ST1RD2 Parameter Setting Read Command

8.3.1 Conversion enable/disable setting read (Command No.: 1400H)

Reads the conversion enable/disable setting from the RAM of the ST1RD2.

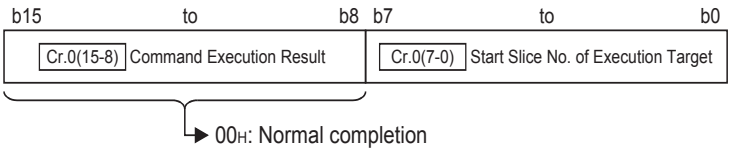
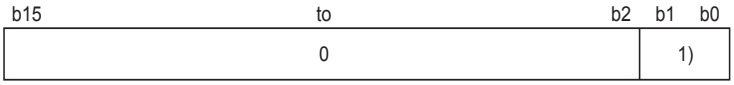
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	1400H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

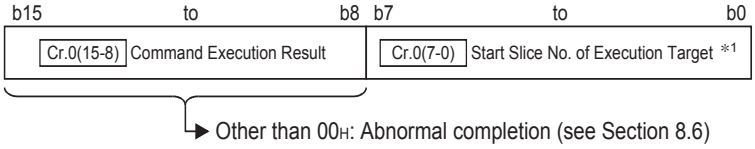
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The conversion enable/disable setting written to the RAM is stored for each channel.  1) CH□ Conversion enable/disable setting (b0: CH1, b1: CH2) 0: Conversion enable 1: Conversion disable
Cr.3	0000H

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.2 Conversion completion channel read (Command No.: 1401H)

Reads the currently valid conversion enable/disable setting and conversion completed status.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	1401H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

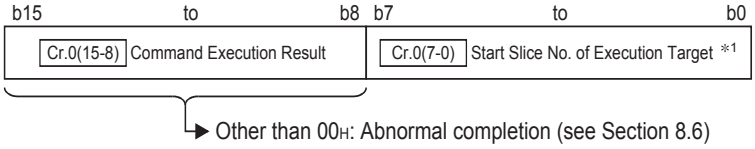
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result | Cr.0(7-0) Start Slice No. of Execution Target → 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The currently valid conversion enable/disable setting is stored for each channel. b15 to b2 b1 b0 0 | 1) 1) CH□ conversion enable/disable setting (b0: CH1, b1: CH2) 0: Conversion enable 1: Conversion disable
Cr.3	The conversion completed status is stored for each channel. b15 to b2 b1 b0 0 | 1) 1) CH□ conversion completed setting (b0: CH1, b1: CH2) 0: Conversion being executed or not used 1: Conversion completed

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.3 Operation condition set value read (Command No.: 1402H)

Reads the averaging processing specification, alarm output setting and conversion setting for disconnection detection from the RAM of the ST1RD2.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	1402H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

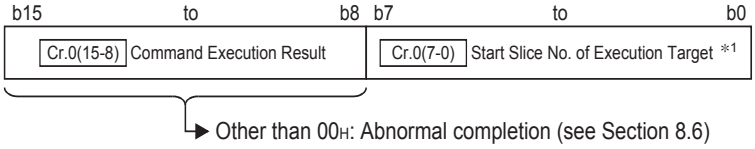
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result | Cr.0(7-0) Start Slice No. of Execution Target 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The averaging processing specification is stored for each channel. b15 to b8 b7 to b0 0 | 1) 1) Averaging processing specification (b0 to b3: CH1, b4 to b7: CH2) 0000: Sampling processing 0001: Time averaging 0010: Count averaging 0011: Moving average 0100: Primary delay filter
Cr.3	The alarm output setting and the conversion setting for disconnection detection are stored for each channel. b15 to b12 b11 to b8 b7 to b2 b1 b0 0 | 2) | 0 | 1) 1) Alarm output setting (b0: CH1, b1: CH2) 0: Alarm output processing not performed 1: Alarm output processing performed 2) Conversion setting for disconnection detection (b8 to b9: CH1, b10 to b11: CH2) 00: Value Immediately before disconnection 01: Up scale 10: Down scale 11: Given value

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.4 CH□ time/count/moving average/time constant setting value read (Command No.: 1404H)

Reads the time, count, count for moving average, or time constant from the RAM of the ST1RD2.

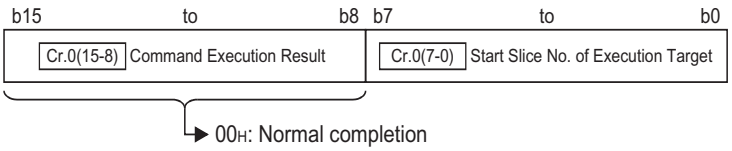
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	1404H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

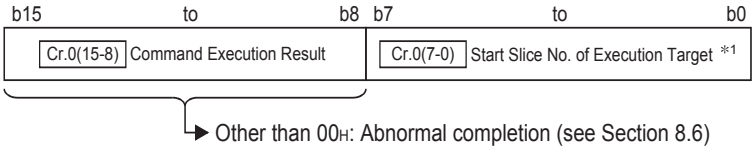
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The time, count, count for moving average, or time constant for Channel 1 is stored. The value in the following range is stored. Time averaging : 640 to 5000 (ms) Count averaging: 4 to 500 (times) Moving average : 4 to 60 (times) Time constant : 80 to 5000 (ms)
Cr.3	The time, count, count for moving average, or time constant for Channel 2 is stored. The range of the stored value is the same as in Cr.2 Response data 1.

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.5 CH□ upper upper/upper lower limit set value read (Command No.: 1408H, 140AH)

Reads the upper upper limit value/upper lower limit value of the alarm output from the RAM of the ST1RD2.

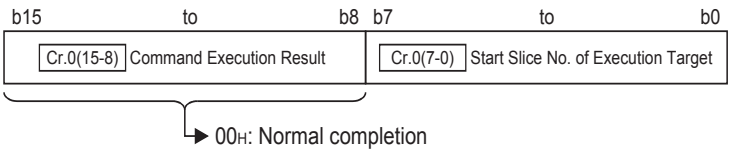
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	CH1 upper upper/upper lower limit set value read: 1408H CH2 upper upper/upper lower limit set value read: 140AH
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

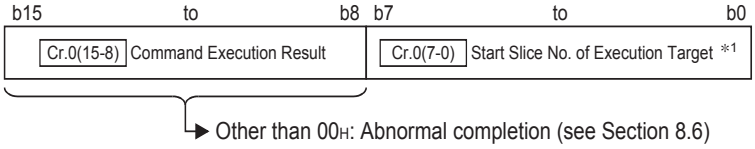
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The CH□ upper upper limit value is stored. (16-bit signed binary) The range to store the data is from -32768 to 32767.
Cr.3	The CH□ upper lower limit value is stored. (16-bit signed binary) The range of the stored value is the same as in Cr.2 Response data 1.

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.6 CH□ lower upper/lower lower limit set value read (Command No.: 1409H, 140BH)

Reads the lower upper limit value/ lower lower limit value of the alarm output from the RAM of the ST1RD2.

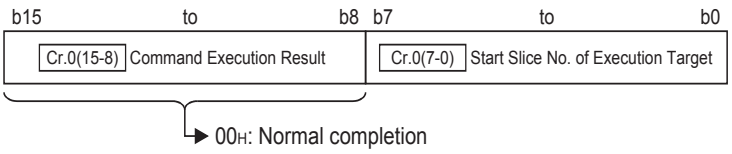
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	CH1 lower upper/ lower lower limit set value read: 1409H CH2 lower upper/ lower lower limit set value read: 140BH
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

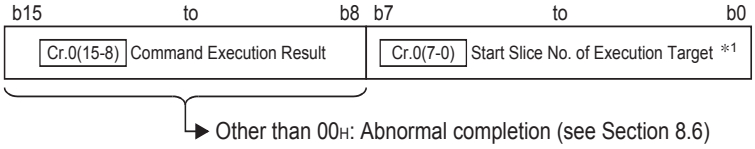
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The CH□ lower upper limit value is stored. (16-bit signed binary) The range to store the data is from -32768 to 32767.
Cr.3	The CH□ lower lower limit value is stored. (16-bit signed binary) The range of the stored value is the same as in Cr.2 Response data 1.

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.7 User parameter set value read (Command No.: 1418H)

Reads the measurement range setting and offset/gain value section from the RAM of the ST1RD2.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	1418H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

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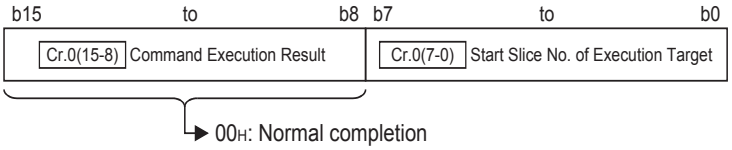
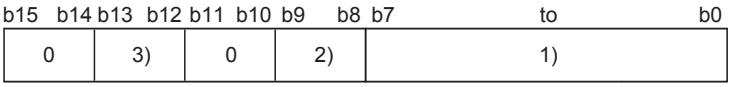
(2) Execution result in Cr Command result area

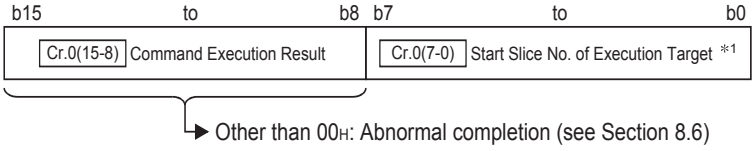
The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2 *	The measurement range setting and offset/gain value selection written to the RAM are stored for each channel.  1) CH□measurement range setting（b0 to b3:CH1,b4 to b7:CH2） 0000 : Pt100（-200 to 850℃） 0001 : Pt100（-20 to 120℃） 0010 : Pt100（0 to 200℃） 0100 : Pt1000（-200 to 850℃） 0101 : Pt1000（-20 to 120℃） 0110 : Pt1000（0 to 200℃） 2) CH□ offset/gain setting (b8:CH1,b9:CH2) 0 : Factory default 1 : User range setting
Cr.3 *	The currently valid measurement range setting and offset/gain value selection are stored for each channel. The stored values are the same as those of Cr.2 Response data 1.

* If the stored values differ between Cr.2 Response data 1 and Cr.3 Response data 2, refer to Section 3.4 and take corrective action.

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.8 Sensor compensation value read (Command No.: 141AH)

From the ST1RD2's RAM, reads out a compensation value when an error is identified between "the actual temperature" and "the measured temperature".

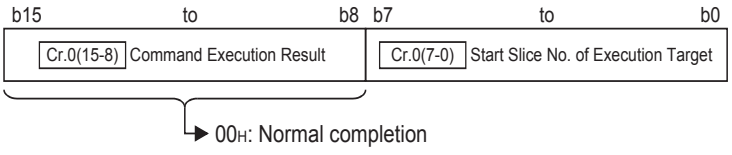
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	141AH
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

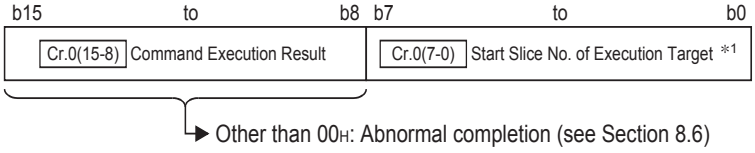
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The CH1 sensor compensation value is stored. The range to store the data is from -200 to 200.
Cr.3	The CH2 sensor compensation value is stored. The range of the stored value is the same as in Cr.2 Response data 1.

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.3.9 Conversion setting value (for disconnection detection) read (Command No.: 141EH)

Reads the conversion setting value for disconnection detection from the RAM of the ST1RD2.

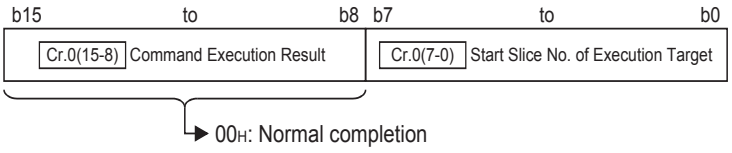
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	141EH
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

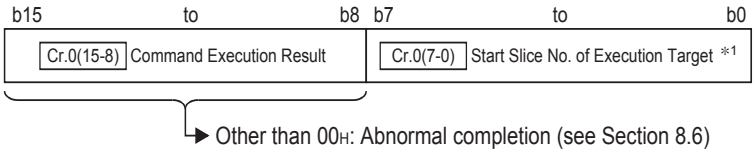
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The CH1 conversion setting value for disconnection detection is stored. The range to store the data is from -32768 to 32767.
Cr.3	The CH2 conversion setting value for disconnection detection is stored. The range of the stored value is the same as in Cr.2 Response data 1.

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.4 ST1RD2 Parameter Setting Write Command

8.4.1 Conversion enable/disable setting write (Command No.: 2400H)

Writes the conversion enable/disable setting to the RAM of the ST1RD2.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	2400H
Cw.2	Set the conversion enable/disable setting for each channel. b15 to b2 b1 b0 0 | 1) CH☐ Conversion enable/disable setting (b0: CH1, b1: CH2) 0: Conversion enable 1: Conversion disable
Cw.3	Fixed to 0000H (Any value other than 0000H is ignored.)

(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result | Cr.0(7-0) Start Slice No. of Execution Target 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	0000H

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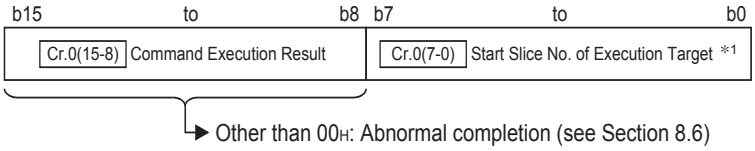
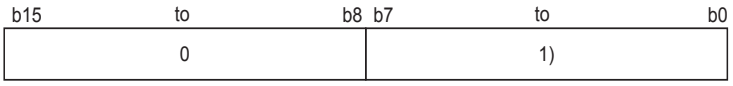
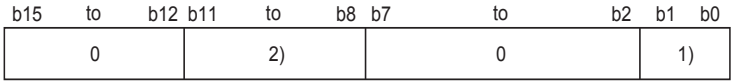
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.4.2 Operation condition set value write (Command No.: 2402H)

Writes the averaging processing specification, alarm output setting and conversion setting for disconnection detection to the RAM of the ST1RD2.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	2402H
Cw.2	Specify the channel where sampling process or averaging process will be performed. When averaging process is specified, specify time or number of times.  1) Averaging processing specification (b0 to b3: CH1, b4 to b7: CH2) 0000: Sampling processing 0001: Time averaging 0010: Count averaging 0011: Moving average 0100: Primary delay filter
Cw.3	Specify the alarm output setting and the conversion setting for disconnection detection for each channel.  1) Alarm output setting (b0: CH1, b1: CH2) 0: Alarm output processing not performed 1: Alarm output processing performed 2) Conversion setting for disconnection detection (b8 to b9: CH1, b10 to b11: CH2) 00: Value Immediately before disconnection 01: Up scale 10: Down scale 11: Given value

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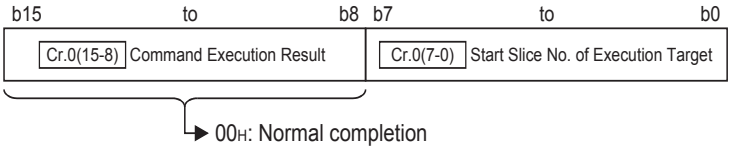
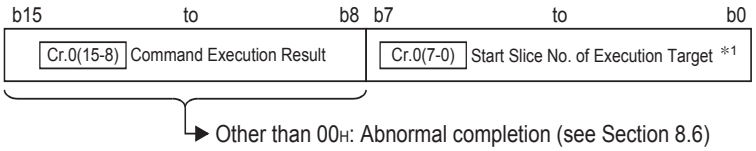
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.4.3 CH□ time/count/moving average/time constant setting value write (Command No.: 2404H)

Writes the time, count, count for moving average, or time constant to the RAM of the ST1RD2.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

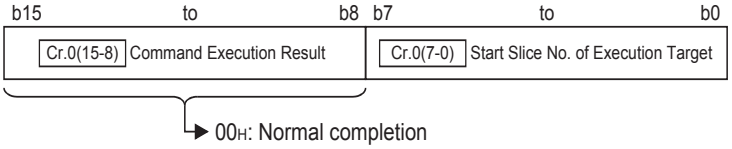
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	2404H
Cw.2	Set the time, count, count for moving average, or time constant of Channel 1. The allowable setting ranges are as follows: Time averaging : 640 to 5000 (ms) Count averaging : 4 to 500 (times) Moving average : 4 to 60 (times) Time constant : 80 to 5000 (ms) If an invalid value has been set, an error will occur when Bw.n+1 convert setting request turns ON, not at the time of command execution.
Cw.3	Set the time, count, count for moving average, or time constant of Channel 2. The setting range is the same as in Cw.2 Argument 1.

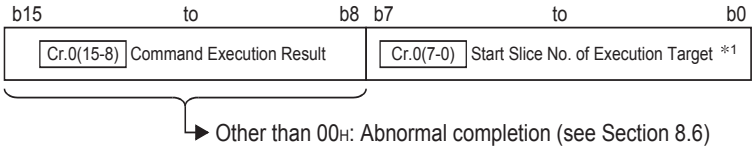
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.4.4 CH□ upper upper/upper lower limit set value write (Command No.: 2408H, 240AH)

Writes the upper upper limit value/upper lower limit value to the RAM of the ST1RD2. This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

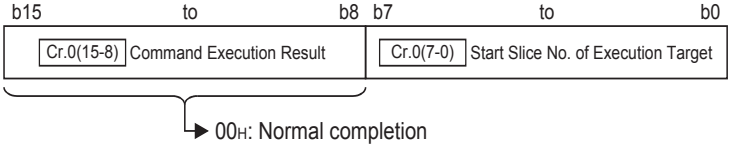
(1) Values set to Cw Command execution area

<table>
<tr><th>Cw Command execution area</th><th>Setting value</th></tr>
<tr><td>Cw.0</td><td>Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)</td></tr>
<tr><td>Cw.1</td><td>CH1 upper upper/upper lower limit set value write: 2408H
CH2 upper upper/upper lower limit set value write: 240AH</td></tr>
<tr><td>Cw.2</td><td>Set the upper upper limit value of the alarm output.
Setting range on each measurement range is shown below.
Setting is in 0.1℃ unit.
[Example] To set to 0.3℃ ...Store 3.
<table>
<tr><th colspan="2">Measurement range</th><th>Setting range</th></tr>
<tr><td rowspan="3">Pt100
Pt1000</td><td>-200 to 850℃</td><td>-2000 to 8500</td></tr>
<tr><td>-20 to 120℃</td><td>-200 to 1200</td></tr>
<tr><td>0 to 200℃</td><td>0 to 2000</td></tr>
</table>
Make setting to satisfy the condition of upper upper value ≧ upper lower value ≧ lower upper value ≧ lower lower value.
If an invalid value has been set, an error will occur when Bw.n+1 convert setting request turns ON, not at the time of command execution.</td></tr>
<tr><td>Cw.3</td><td>Set the upper lower limit value of the alarm output.
The setting range is the same as in Cw.2 Argument 1.</td></tr>
</table>

(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

<table>
<tr><th>Cr Command result area</th><th>Result details</th></tr>
<tr><td>Cr.0</td><td>The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.
 
</td></tr>
<tr><td>Cr.1</td><td>The executed command no. is stored. (Hexadecimal)</td></tr>
<tr><td>Cr.2</td><td rowspan="2">0000H</td></tr>
<tr><td>Cr.3</td></tr>
</table>

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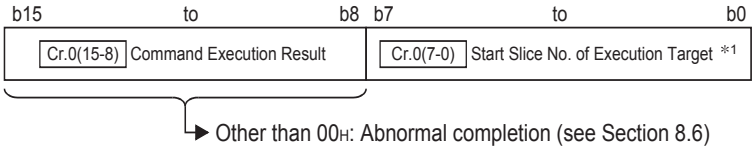
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.4.5 CH□ lower upper/ lower lower limit set value write (Command No.: 2409H, 240BH)

Writes the lower upper limit value/lower lower limit value to the RAM of the ST1RD2. This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	CH1 lower upper/ lower lower limit set value write: 2409H CH2 lower upper/ lower lower limit set value write: 240BH
Cw.2	Set the lower upper limit value of the alarm output. Setting range on each measurement range is shown below. Setting is in 0.1℃ unit. [Example] To set to 0.3℃ ...Store 3. Measurement range / Setting range: Pt100 Pt1000: -200 to 850℃ → -2000 to 8500 Pt100 Pt1000: -20 to 120℃ → -200 to 1200 Pt100 Pt1000: 0 to 200℃ → 0 to 2000 Make setting to satisfy the condition of upper upper value ≧ upper lower value ≧ lower upper value ≧ lower lower value. If an invalid value has been set, an error will occur when Bw.n+1 convert setting request turns ON, not at the time of command execution.
Cw.3	Set the lower lower limit value of the alarm output. The setting range is the same as in Cw.2 Argument 1.

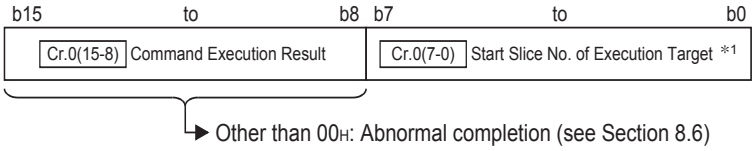
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result | Cr.0(7-0) Start Slice No. of Execution Target 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

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8.4.6 Sensor compensation value write (Command No.: 241A$_H$)

Writes a compensation value to the ST1RD2's RAM when an error is identified between "the actual temperature" and "the measured temperature".

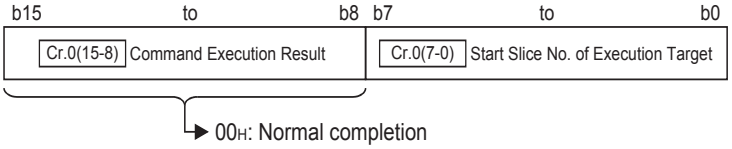
(1) Values set to [Cw] Command execution area

[Cw] Command execution area	Setting value
[Cw.0]	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
[Cw.1]	241A$_H$
[Cw.2]	Set the sensor compensation value for channel 1. The setting range is -200 to 200. Setting is in 0.1℃ unit. [Example] To set to 0.3℃ ...Enter "3".
[Cw.3]	Set the sensor compensation value for channel 2. The setting range is the same as in [Cw.2] Argument 1.

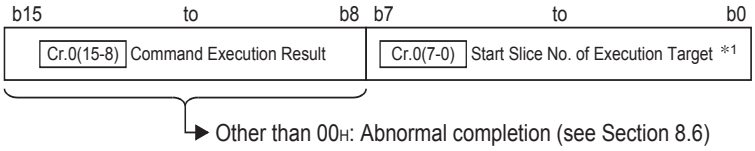
(2) Execution result in [Cr] Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in [Cr.0(15-8)] Command execution result.

(a) Normal completion (When [Cr.0(15-8)] Command execution result is 00$_H$)

[Cr] Command result area	Result details
[Cr.0]	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
[Cr.1]	The executed command no. is stored. (Hexadecimal)
[Cr.2]	0000$_H$
[Cr.3]	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.4.7 Conversion setting value (for disconnection detection) write (Command No.: 241EH)

Writes the conversion setting value for disconnection detection to the RAM of the ST1RD2.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

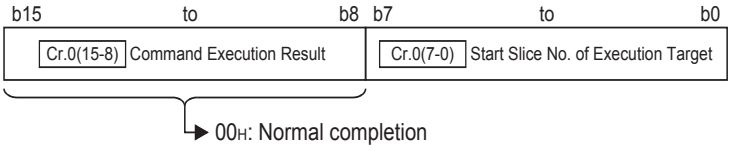
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	241EH
Cw.2	Set the conversion setting value for disconnection detection for channel 1. The setting range is -32768 to 32767.
Cw.3	Set the conversion setting value for disconnection detection for channel 2. The setting range is the same as in Cw.2 Argument 1.

(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

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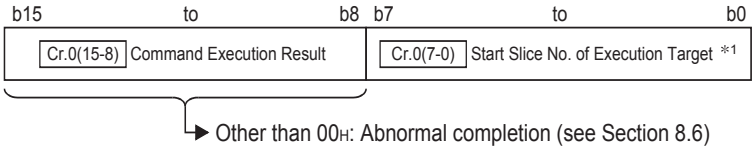
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.5 ST1RD2 Control Command

8.5.1 Parameter setting ROM read (Command No.: 3400H)

Reads the parameters from the ROM of the ST1RD2 to the RAM.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	3400H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result / Cr.0(7-0) Start Slice No. of Execution Target 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result / Cr.0(7-0) Start Slice No. of Execution Target *1 Other than 00H: Abnormal completion (see Section 8.6) *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.5.2 Parameter setting ROM write (Command No.: 3401H)

Writes the parameters from the RAM of the ST1RD2 to the ROM.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

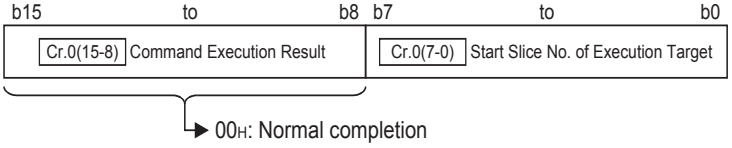
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	3401H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

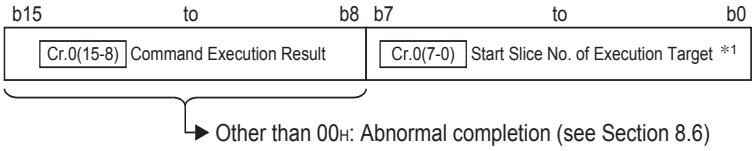
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

POINT

Execute Parameter setting ROM write (command number: 3401H) after confirming that normal operation is performed with the settings written to the RAM.

8.5.3 Operation mode setting (Command No.: 3402H)

Changes the mode of the ST1RD2. (Normal mode to offset/gain setting mode, offset/gain setting mode to normal mode)
This command can be executed when Bw.n+1 convert setting request is off (0) in the normal mode or when the module is in the offset/gain setting mode.

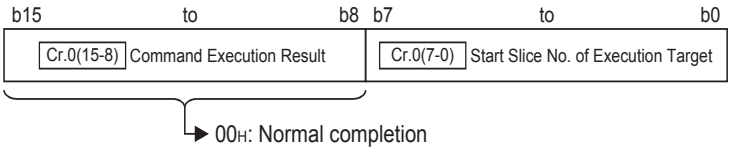
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	3402H
Cw.2	Set the operation mode. 0000H : Normal mode 0001H : Offset/gain setting mode
Cw.3	Fixed to 0000H (Any value other than 0000H is ignored.)

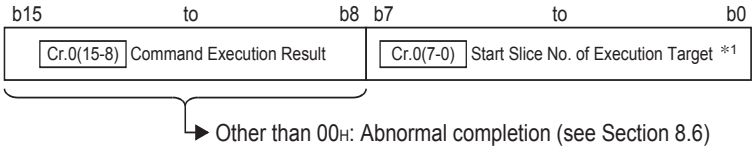
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	0000H

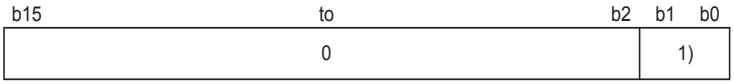
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.5.4 Offset channel specification (Command No.: 3403H)

Specify the channel where the offset value will be adjusted.
When this command is executed, the value given to ST1RD2 is written in RAM as the offset value.
This command can be executed only in the offset/gain setting mode.

(1) Values set to [Cw] Command execution area

[Cw] Command execution area	Setting value
[Cw.0]	Set the start slice no. of the ST1RD2 where the command will be executed. (Hexadecimal)
[Cw.1]	3403H
[Cw.2]	Specify the channel where the offset value of offset/gain setting will be adjusted. Values can be set to multiple channels at a time.  1) Offset channel specification (b0: CH, b1: CH2) 0: Invalid 1: Channel to set
[Cw.3]	Set the acceptable temperature setting value for input. The setting is set in the unit of 0.1℃. [Example] To set to 0.3℃ ...Store 3. Setting range on each measurement range is shown below. Measurement range / Setting range: Pt100, Pt1000: -200 to 850℃ → -2000 to 8500 Pt100, Pt1000: -20 to 120℃ → -200 to 1200 Pt100, Pt1000: 0 to 200℃ → 0 to 2000

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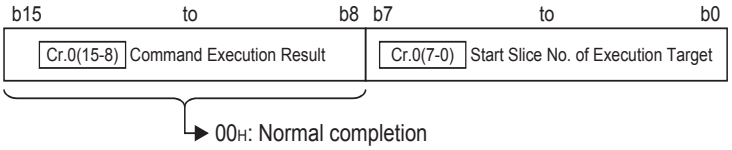
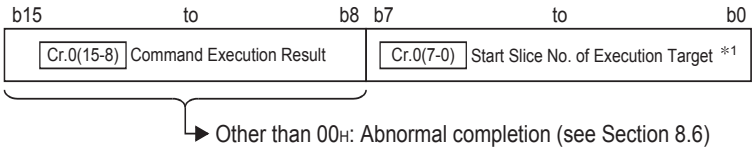
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

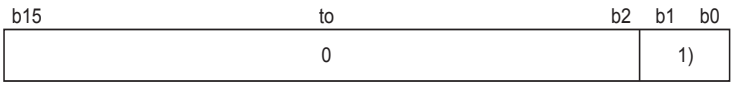
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.5.5 Gain channel specification (Command No.: 3404H)

Specify the channel where the gain value will be adjusted.
When this command is executed, the value given to ST1RD2 is written in RAM as the gain value.
This command can be executed only in the offset/gain setting mode.

(1) Values set to [Cw] Command execution area

<table>
<tr><th>[Cw] Command execution area</th><th>Setting value</th></tr>
<tr><td>[Cw.0]</td><td>Set the start slice no. of the ST1RD2 where the command will be executed.
(Hexadecimal)</td></tr>
<tr><td>[Cw.1]</td><td>3404H</td></tr>
<tr><td>[Cw.2]</td><td>Specify the channel where the gain value of offset/gain setting will be adjusted.
Values can be set to multiple channels at a time.
 

1) Gain channel specification (b0: CH1, b1: CH2)
0: Invalid
1: Channel to set</td></tr>
<tr><td>[Cw.3]</td><td>Set the acceptable temperature setting value for input.
The setting is set in the unit of 0.1℃.
[Example] To set to 0.3℃ ...Store 3.
Setting range on each measurement range is shown below.
<table>
<tr><th colspan="2">Measurement range</th><th>Setting range</th></tr>
<tr><td rowspan="3">Pt100
Pt1000</td><td>-200 to 850℃</td><td>-2000 to 8500</td></tr>
<tr><td>-20 to 120℃</td><td>-200 to 1200</td></tr>
<tr><td>0 to 200℃</td><td>0 to 2000</td></tr>
</table>
</td></tr>
</table>

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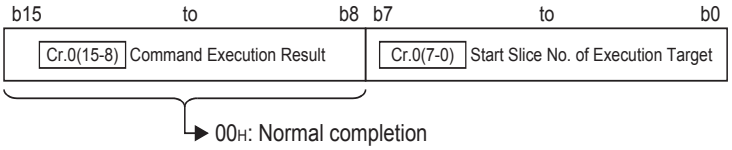
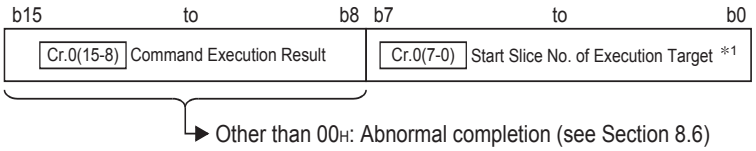
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.5.6 User range write (Command No.: 3405H)

Writes the adjusted offset/gain settings to the ROM of the ST1RD2.
This command can be executed only in the offset/gain setting mode.

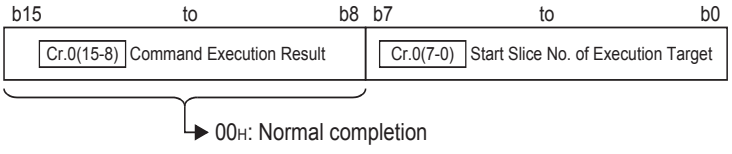
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice number of the ST1RD2 where the command will be executed. (Hexadecimal)
Cw.1	3405H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

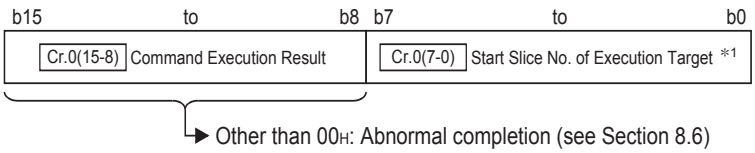
(2) Execution result in Cr Command result area

The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

(a) Normal completion (When Cr.0(15-8) Command execution result is 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	0000H
Cr.3	

(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below.  *1: When 0FH is stored into the Cr.0(15-8) Command Execution Result, 00H (start slice No. of head module) is stored into the Cr.0(7-0) Start Slice No. of Execution Target.
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	Cw.3 Argument 2 at command execution is stored.

8.6 Values Stored into Command Execution Result

The following table indicates the values stored into Cr.0(15-8) Command execution result in Cr Command result area.

Cr.0 (15-8) Command execution result	Description	Corrective action
00H	Normal completion	—
01H	The requested command is not available for the specified module.	Check Table 8.1 in section 8.1 to see if the requested command no. can be used for the ST1RD2.
		Check whether the specified start slice No. of execution target is the start slice No. of the ST1RD2.
02H	The value set in Cw.2 Argument 1 or Cw.3 Argument 2 is outside the allowable range.	Check whether the value set to Cw.2 Argument 1 or Cw.3 Argument 2 in the command execution area is within the range usable for the requested command no.
03H	The start slice No. of the execution target is wrong.	Check whether the ST1RD2 is mounted to the specified start slice No. of execution target.
		Check whether the specified start slice No. of execution target is the start slice No. of the ST1RD2.
04H	There is no response from the specified module.	Check Table 8.1 in section 8.1 to see if the requested command no. can be used for the ST1RD2. When the requested command no. can be used, the possible cause is a ST1RD2 failure. Please consult your local distributor or branch office, explaining a description of the problem.
05H	No communication is available with the specified module.	The possible cause is a ST1RD2 failure. Please consult your local distributor or branch office, explaining a description of the problem.
06H	The requested command is not executable in the current operating status (operation mode) of the module.	Check the error code and take corrective actions. (Refer to section 9.1.) If no error code is stored, refer to Table 8.1 in section 8.1 and check whether the requested command no. is executable in the operation mode or not.
07H	The module has already been in the specified mode.	Continue the processing since the operation mode of the ST1RD2 specified by the start slice No. of execution target is the mode already requested.
08H	The module cannot be changed into the specified mode.	Execute the command after turning Bw.n+1 convert setting request to OFF (0).
09H	The specified module is in the online module change status.	Execute the command after online module change is completed.
10H	Data cannot be read from the specified module.	Execute the command again. If the problem on the left persists, the possible cause is a ST1RD2 failure. Please consult your local distributor or branch office, explaining a description of the problem.
11H	Data cannot be written to the specified module.	

Cr.0 (15-8) Command execution result	Description	Corrective action
13_H	The specified module is not in the status available for parameter writing.	Execute the command after turning Bw.n+1 convert setting request to OFF (0).
$0F_H$	The value of Cw.0 Start Slice No. of Execution Target is outside the applicable range.	Check whether the value set at Cw.0 Start Slice No. of Execution Target is not more than $7F_H$.

9 TROUBLESHOOTING

This chapter explains the errors that may occur when the ST1RD2 is used, and how to troubleshoot them.

9.1 Error Code List

In the ST1RD2, when an error occurs due to write of data to the master module, executing error code read request (command no.: 0101H) stores the error code into Cr Command result area of the head module.

Table 9.1 Error code list (1/2)

Error code (Hexadecimal)	Error level	Error name	Description	Corrective action
1100H	System error	ROM error	ROM fault.	Power the ST1RD2 off and then on, or reset the head module. If the error code given on the left is still stored, the possible cause is a ST1RD2 failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
1200H	System error	Number of writes for ROM error	Parameter setting ROM write (command no.: 3401H) or User range write (command no.: 3405H) was executed more than 25 times after power-on.	After power-on, execute the command for a single module, or write offset/gain settings to the ROM using GX Configurator-ST, within 25 times.
			Offset/gain settings were written to the ROM using GX Configurator-ST more than 25 times after power-on.	
1300H	System error	Converter error	A converter is faulty.	Turn the convert setting request off to clear the error. Then, turn the convert setting request on again.
200☐H	System error	Measurement range setting error	The value set to measurement range setting is outside the valid range. ☐ indicates the number of the channel where the error has occurred.	Set a value that is within the valid range.
210☐H	System error	Average setting error	The average time setting is outside the range 640 to 5000ms. ☐ indicates the number of the channel where the error has occurred.	Set a value that is within the valid range.
220☐H	System error	Average setting error	The average number of times setting is outside the range 4 to 500 times. ☐ indicates the number of the channel where the error has occurred.	Set a value that is within the valid range.
230☐H	System error	Average setting error	Moving average number of setting value is out of 4 to 60 times. ☐ indicates the number of the channel where the error has occurred.	Set a value that is within the valid range.
240☐H	System error	Average setting error	Time constant setting value is out of 80 to 5000ms. ☐ indicates the number of the channel where the error has occurred.	Set a value that is within the valid range.

Table 9.1 Error code list (2/2)

<table>
<tr><th>Error code (Hexadecimal)</th><th>Error level</th><th>Error name</th><th>Description</th><th>Corrective action</th></tr>
<tr><td>300☐H</td><td>System error</td><td>Alarm setting error</td><td>The value set to the upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value of the alarm output is outside the valid range.
Setting range on each measurement range is shown below.
<table><tr><th colspan="2">Measurement range</th><th>Setting range</th></tr><tr><td rowspan="3">Pt100
Pt1000</td><td>-200 to 850℃</td><td>-2000 to 8500</td></tr><tr><td>-20 to 120℃</td><td>-200 to 1200</td></tr><tr><td>0 to 200℃</td><td>0 to 2000</td></tr></table>☐ indicates the number of the channel where the error has occurred.</td><td>Set a value that is within the valid range.</td></tr>
<tr><td>312☐H</td><td>System error</td><td>Alarm setting error</td><td>In the lower upper limit value/lower lower limit value of the alarm output, the lower upper limit value is less than the lower lower limit value.
☐ indicates the number of the channel where the error has occurred.</td><td rowspan="3">Re-set the limit values so that the condition of upper upper limit value≧ upper lower limit value ≧ lower upper limit value ≧ lower lower limit value is satisfied.</td></tr>
<tr><td>313☐H</td><td>System error</td><td>Alarm setting error</td><td>In the upper lower limit value/lower upper limit value of the alarm output, the upper lower limit value is less than the lower upper limit value.
☐ indicates the number of the channel where the error has occurred.</td></tr>
<tr><td>314☐H</td><td>System error</td><td>Alarm setting error</td><td>In the upper upper limit value/upper lower limit value of the alarm output, the upper upper limit value is less than the upper lower limit value.
☐ indicates the number of the channel where the error has occurred.</td></tr>
<tr><td>400☐H</td><td>System error</td><td>User range setting error</td><td>In User range setting, offset value is equal to or greater than gain value.
☐ indicates the number of the channel where the error has occurred.</td><td>Reset the range so that offset value is smaller than gain value.</td></tr>
<tr><td>410☐H</td><td>System error</td><td>User range setting error</td><td>In user range setting, gain value - offset value < 0.2 [℃].
☐ indicates the number of the channel where the error has occurred.</td><td>Reset the user range to gain value - offset value ≧ 0.2[℃].</td></tr>
<tr><td>500☐H</td><td>System error</td><td>Disconnection detection error</td><td>Disconnection of wire A has been detected.
☐ indicates the number of the channel where the error has occurred.</td><td rowspan="3">Check for any abnormality on the signal lines by doing a visual check and performing a continuity check.</td></tr>
<tr><td>510☐H</td><td>System error</td><td>Disconnection detection error</td><td>Disconnection of wire B has been detected.
☐ indicates the number of the channel where the error has occurred.</td></tr>
<tr><td>520☐H</td><td>System error</td><td>Disconnection detection error</td><td>Disconnection of wire b has been detected.
☐ indicates the number of the channel where the error has occurred.</td></tr>
</table>

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POINT

(1) When multiple errors of the same level occur, the code of the error first found by the ST1RD2 is stored.
(2) The error can be cleared by turning on Ew.n error clear request.

9.2 Troubleshooting

9.2.1 When the RUN LED is flashing or turned off

(1) When flashing at 0.5s intervals

Check item	Corrective action
Is the offset/gain setting mode active ?	Execute operation mode setting (command number: 3402H) to active the normal mode. (see Section 8.5.3).

(2) When flashing at 0.25s intervals

Check item	Corrective action
Is the module selected as the target of online module change?	Refer to Chapter 7 and take corrective action.

(3) When flashing at 1s intervals

Check item	Corrective action
Has data communication been stopped between the master station and head module?	Refer to the MELSEC-ST System User's Manual and take corrective action.
Has a parameter communication error occurred between the master station and head module?	
Has an error occurred in another slice module?	
Has an internal bus error occurred?	

(4) When off

Check item	Corrective action
Is a module change enabled during an online module change?	Refer to Chapter 7 and take corrective action.
Is External SYS. power supply being supplied?	Check whether the supply voltage of the bus refreshing module is within the rated range.
Is the capacity of the bus refreshing module adequate?	Calculate the current consumption of the mounted modules, and check that the power supply capacity is sufficient.
Is the ST1RD2 correctly mounted on the base module?	Check the mounting condition of the ST1RD2.
Has a watchdog timer error occurred?	Power the ST1RD2 off and then on, or reset the head module, and check whether the LED turns on. If the LED still does not turn on, the possible cause is a ST1RD2 failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

9.2.2 When the RUN LED and the ERR. LED turned on

Check item	Corrective action
Is an error being generated?	Confirm the error code and take corrective action described in Section 9.1.

9.2.3 When line break down has been detected

Check item	Corrective action
Check whether the platinum RTD is connected incompletely or not.	Connect the platinum RTD securely.
Is the terminal screw tightened enough when the base module is screw clamp type?	Retighten the terminal screws within the specified torque range. For the specified torque range of terminal screw, refer to the MELSEC-ST System User's Manual.
Check the connected platinum RTD for wire break.	Make continuity check on the platinum RTD, and replace it if it is broken.
Check whether the channel where no platinum RTD is connected is set to conversion-enabled.	Check the channels which are set to conversion-enabled and the channels where platinum RTD are connected, and make the correct conversion enable setting.

9.2.4 Measured temperature value cannot be read

Check item	Corrective action
Is external AUX. power being supplied?	Check whether the power distribution modules is supplied with a 24V DC voltage.
Is there any fault with the analog signal lines such as broken or disconnected line?	Check for any abnormality on the signal lines by doing a visual check or continuity check.
Are the offset/gain settings correct?	Verify that the offset/gain settings are correct. (see section 4.5 and 5.6) When the user range setting is used, switch it to the factory default setting and check whether conversion is performed correctly or not. If it is correctly performed, redo the offset/gain setting.
Is the measurement range setting correct?	Execute user range set value read (command number: 1418_H) and confirm the measurement range setting. (see section 8.3.7) If the measurement range setting is wrong, make the setting again using the configuration software of the master station.
Is the conversion enable/disable setting for the channel, where data was input, set to Disable?	Execute conversion enable/disable setting read (command number: 1400_H) and confirm the conversion enable/disable setting. (see section 8.3.1) If conversion is disabled, enable conversion by executing conversion enable/disable setting write (command number: 2400_H) or using GX Configurator-ST (see section 5.3 and 8.4.1).
Are Bw.n+1 convert setting request and Br.n+1 convert setting completed flag on?	Check whether Bw.n+1 convert setting request and Br.n+1 convert setting completed flag are on or off using the program of the master station or the I/O monitor of GX Configurator-ST (see section 5.4). If Bw.n+1 convert setting request and Br.n+1 convert setting completed flag are off, reexamine the program of the master station (see section 3.3.1 and 3.3.5).

9.2.5 Measured temperature value is abnormal

Check Item	Corrective action
Check whether the connected platinum RTD differs from the setting.	Set the measurement range setting (User Parameter) to the connected platinum RTD.
Check whether the connected platinum RTD is connected reversely.	Connect the platinum RTD correctly.
Check for noise in the platinum RTD input.	Check influence from the ground and adjacent devices, and take action to prevent noise.
Is the cold junction temperature compensation setting correct?	Set the cold junction temperature compensation setting (User Parameter) correctly.
Check whether conversion is made with the other platinum RTD set after setting of the offset/gain value.	Make offset/gain setting again for the platinum RTD changed.

POINT

If the normal measured temperature value cannot be read after taking corrective actions corresponding to the above check items, the possible cause is a module failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

APPENDIX

Appendix 1 Accessories

This section explains the accessories related to the ST1RD2.

(1) Wiring maker

For how to use the wiring marker, refer to the MELSEC-ST System User's Manual.

Model name	Description	Color
ST1A-WMK-BK	Terminal marker (Signal wire)	Black

(2) Coding element

The coding element is fitted before shipment.
It is also available as an option in case it is lost.

Model name	Description	Shape*		Color
		Base module side	Slice module side	
ST1A-CKY-15	Coding element for ST1RD2			Dusty gray

*Indicates the position of the projection or hole when the coding element is viewed from above.
: Projection : Hole

App

App - 1

Appendix 2 Reference Resistance of Platinum RTD

This section explains the reference resistance of Pt100.

JIS C1604-1997, IEC 751 1983 Unit: Ω

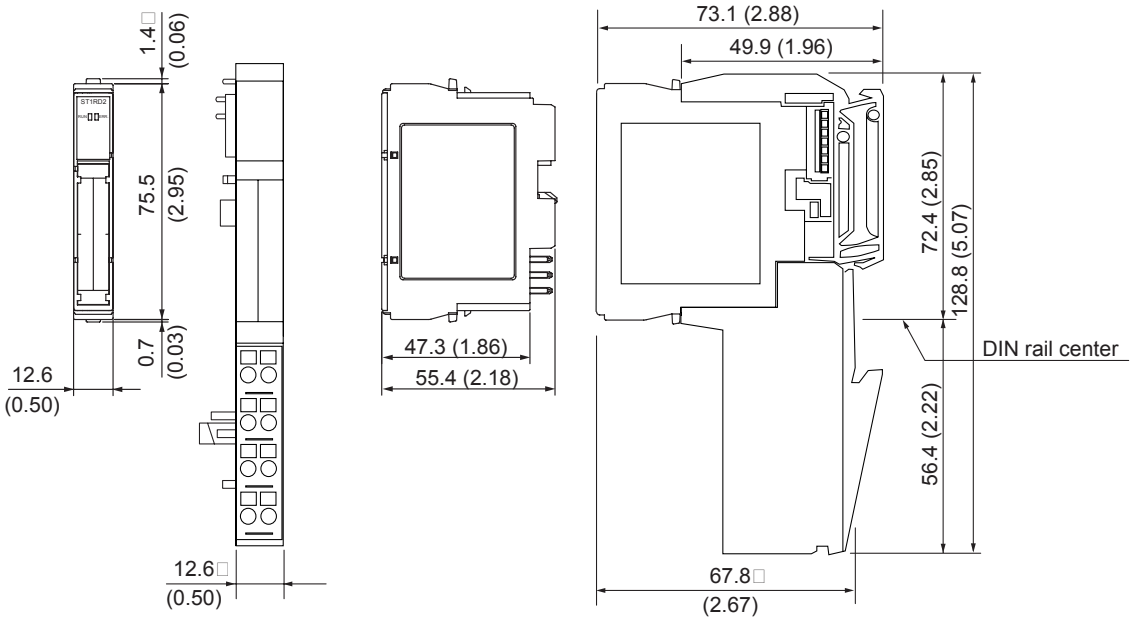
-200	-100	-0	Temperature[℃]		Temperature[℃]	0	100	200	300	400	500	600	700	800
18.52	60.26	100.00	-0		0	100.00	138.51	175.86	212.05	247.09	280.98	313.71	345.28	375.70
	56.19	96.09	-10		10	103.90	142.29	179.53	215.61	250.53	284.30	316.92	348.38	378.68
	52.11	92.16	-20		20	107.79	146.07	183.19	219.15	253.96	287.62	320.12	351.46	381.65
	48.00	88.22	-30		30	111.67	149.83	186.84	222.68	257.38	290.92	323.30	354.53	384.60
	43.88	84.27	-40		40	115.54	153.58	190.47	226.21	260.78	294.21	326.48	357.59	387.55
	39.72	80.31	-50		50	119.40	157.33	194.10	229.72	264.18	297.49	329.64	360.64	390.48
	35.54	76.33	-60		60	123.24	161.05	197.71	233.21	267.56	300.75	332.79	363.67	
	31.34	72.33	-70		70	127.08	164.77	201.31	236.70	270.93	304.01	335.93	366.70	
	27.10	68.33	-80		80	130.90	168.48	204.90	240.18	274.29	307.25	339.06	369.71	
	22.83	64.30	-90		90	134.71	172.17	208.48	243.64	277.64	310.49	342.18	372.71	

POINT

The reference resistance of Pt1000 can be obtained by multiplying that of Pt100 by 10.

App

Appendix 3 External Dimensions



Unit:mm(inch)

App - 3

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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 of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not , compensation for accidents, and compensation for damages to products other than Mitsubishi products, 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.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
(2) The Mitsubishi programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable logic controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

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