

MELSEC ST Series

Programmable Logic Controllers

User's Manual (CC-Link)

Thermocouple Input Module ST1TD2

● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

When using Mitsubishi equipment, thoroughly read this manual and the associated manuals introduced in this manual. Also pay careful attention to safety and handle the module properly.

The precautions given in this manual are concerned with this product only. Refer to the user's manual of the network system to use for a description of the network system safety precautions.

These SAFETY PRECAUTIONS classify the safety precautions 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, procedures indicated by  CAUTION may also be linked to serious results. In any case, it is important to follow the directions for usage.

Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

[DESIGN PRECAUTIONS]

DANGER

- Create an interlock circuit on the program so that the system will operate safely based on the communication status information. Failure to do so may cause an accident due to an erroneous output or malfunction.

When an error occurs, all outputs are turned off in the MELSEC-ST system. (At default)

However, I/O operations of the head module and respective slice modules can be selected for the following errors:

- (1) Communication error (☞ MELSEC-ST CC-Link Head Module User's Manual "4.3.1 Output status setting for module error")

- (2) Slice module error

The output status for the case of an error can be set to Clear, Hold, or Preset with a command parameter of each slice module. (For the setting availability, refer to each slice module manual.)

Since the parameter is set to Clear by default, outputs will be turned off when an error occurs.

This parameter setting can be changed to Hold or Preset when the system safety is more ensured by holding or presetting the output.

[DESIGN PRECAUTIONS]

DANGER

- Create an external failsafe circuit so that the MELSEC-ST system will operate safely, even when the external power supply or the system fails.
Failure to do so may cause an accident due to an erroneous output or malfunction.
 - (1) The status of output changes depending on the setting of various functions that control the output. Take sufficient caution when setting those functions.
 - (2) Outputs may be kept ON or OFF due to malfunctions of output elements or the internal circuits.
For signals that may cause a serious accident, configure an external monitoring circuit.

[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 on the DIN rail securely (one rail for one module) referring to the MELSEC-ST System User's 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) I/O modules and 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.

[INSTALLATION PRECAUTIONS]

CAUTION

- 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.
- 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 drop, short circuit or malfunction. Overtightening can cause a drop, short circuit or malfunction due to damage to the screw or module.

[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.
- Place the thermocouple/micro voltage signal cables at least 100mm away from the main circuit lines or AC control lines. Especially, ensure a sufficient distance from high-voltage cables or any harmonic circuit such as an inverter load circuit. Failure to do so will make the module more susceptible to noise, surge and induction.

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. If the terminal screws are loose, it could result in short circuits, fire, 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. Pulling the cables connected to the module can damage the module and cables or can cause a malfunction due to a cable connection fault.

[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.

[STARTUP AND MAINTENANCE PRECAUTIONS]

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, 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 in all directions.
Not doing so can cause a malfunction.

[DISPOSAL PRECAUTIONS]

CAUTION

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

REVISIONS

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

Print Date	*Manual Number	Revision
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Japanese Manual Version SH-080749-A

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INTRODUCTION

Thank you for choosing the ST1TD2 MELSEC-ST thermocouple input module.

Before using the module, please read this manual carefully to fully understand the functions and performance of the ST1TD2 MELSEC-ST thermocouple input module and use it correctly.

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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 configurations 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 CC-Link Head Module User's Manual Explains the system configurations, specifications, functions, handling, wiring and troubleshooting of the ST1H-BT head module. (Sold separately)	SH-080754ENG (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)
CC-Link System Master/Local Module User's Manual Describes the system configurations, performance specifications, functions, handling, wiring and troubleshooting of the QJ61BT11N master/local module. (Sold separately)	SH080394E (13JR64)

Compliance with the EMC and Low Voltage Directives

(1) For MELSEC-ST system

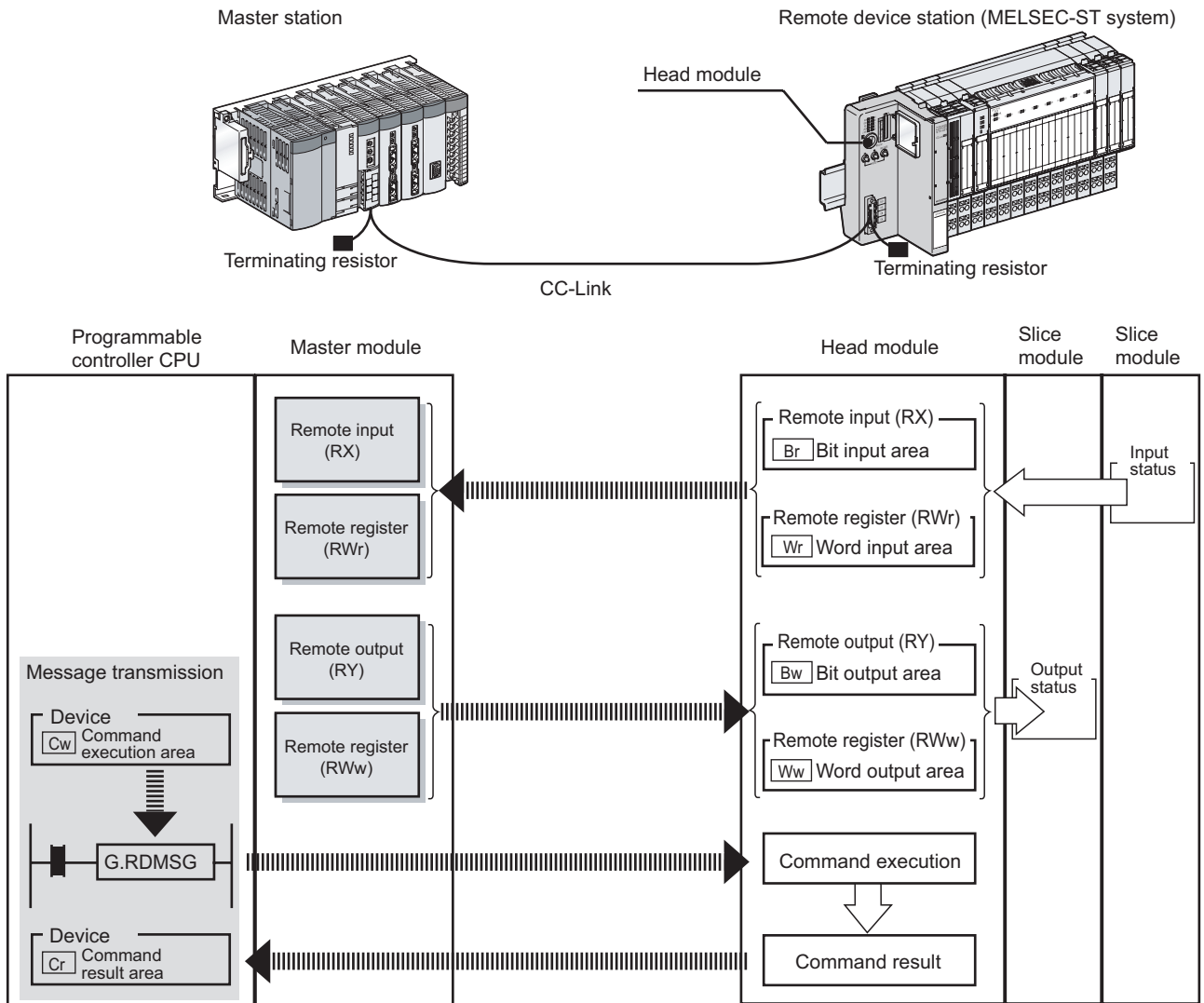
To configure a system meeting the requirements of the EMC and Low Voltage Directives when incorporating the Mitsubishi MELSEC system (EMC and Low Voltage Directives compliant) into other machinery or equipment, refer to Chapter 11 "EMC AND LOW VOLTAGE DIRECTIVES" of the MELSEC-ST System User's Manual. The CE mark, indicating compliance with the EMC and Low Voltage Directives, is printed on the rating plate of the MELSEC-ST system.

(2) For this product

No additional measures are necessary for the compliance of this product with the EMC and Low Voltage Directives.

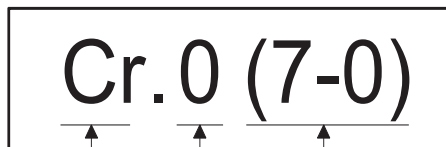
How to Read Manual

This manual explains each area for the CC-Link remote I/O, remote registers, and message transmission using **Br**, **Wr**, **Cr**, **Bw**, **Ww**, and **Cw**.



(1) Data symbol

<Example of **Cr** Command result area>



Range
When the unit of data is one word (16 bits),
the corresponding bits are indicated.
(0) : Bit 0
(7-0): Range of bit 0 to bit 7

Detail data No.

Abbreviated data symbol

(2) Head module → Master station, (3) Master station → Head module

(2) Head module → Master station

(a) Remote input (RX)

Data symbol	Area	Unit	Detail data No. notation
Br	Br.00 to Br.n	Bit Input Area	1 bit/symbol Hexadecimal

(b) Remote register (RWr)

Data symbol	Area	Unit	Detail data No. notation
Wr	Wr.00 to Wr.n	Word Input Area	1 word/symbol Hexadecimal

(c) Message transmission

Data symbol	Area	Unit	Detail data No. notation
Cr	Cr.0 to Cr.n	Command Result Area	1 word/symbol Decimal

(3) Master station → Head module

(a) Remote output (RY)

Data symbol	Area	Unit	Detail data No. notation
Bw	Bw.00 to Bw.n	Bit Output Area	1 bit/symbol Hexadecimal

(b) Remote register (RWw)

Data symbol	Area	Unit	Detail data No. notation
Ww	Ww.00 to Ww.n	Word Output Area	1 word/symbol Hexadecimal

(c) Message transmission

Data symbol	Area	Unit	Detail data No. notation
Cw	Cw.0 to Cw.n	Command Execution Area	1 word/symbol Decimal

Generic Terms and Abbreviations

This manual uses the following generic terms and abbreviations to describe the ST1TD2, unless otherwise specified.

Generic Term/ Abbreviation	Description
ST1TD2	Abbreviation for the ST1TD2 MELSEC-ST thermocouple input module.
Head module	ST1H-BT, MELSEC-ST CC-Link head module.
Bus refreshing module	Module that distributes external system power and auxiliary power to the head module and slice modules.
Power feeding module	Module that distributes external auxiliary power to 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	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	Configuration software dedicated to the MELSEC-ST system. The general name of SWnD5C-STPB-E type products.(n=1 or later)
CC-Link	Abbreviation for Control and Communication Link system.
Master module	Abbreviation for the QJ61BT11N when it is used as a master station.
RDMSG	Abbreviation for dedicated instruction of master station.

Term definition

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

Term	Definition
Cyclic transmission	A communication method by which remote I/O data and remote register data are transferred periodically.
Message transmission	A transmission method for writing parameters from the master station to a remote device station and reading the remote device station status.
Master station	This station controls the entire data link system. One master station is required for one system.
Remote I/O station	A remote station that can only use bit data. (Input from or output to external devices) (AJ65BTB1-16D, AJ65SBTB1-16D, etc.)
Remote device station	A remote station that can use both bit and word data. (Input from or output to external devices, or analog data conversion) (ST1H-BT, AJ65BT-64AD, AJ65BT-64DAV, AJ65BT-64DAI, etc.)
SB	Link special relay (for CC-Link). Bit data that indicate the module operating status and data link status of the master/local station.
SW	Link special register (for CC-Link) Data in units of 16 bits, which indicate the module operating status and data link status of the master/local station.
RX	Remote input (for CC-Link). Bit data that are input from remote stations to the master station.
RY	Remote output (for CC-Link) Bit data that are output from the master station to remote stations.
RWr	Remote register. (CC-Link data read area) 16-bit word data that are input from remote device stations to the master station.
RWw	Remote register. (CC-Link data write area) 16-bit word data that are output from the master station to remote device stations.
Remote net Ver.1 mode	Select this mode when extended cyclic setting is not needed or when the QJ65BT11 is replaced with the QJ65BT11N.
Remote net Ver.2 mode	Select this mode when creating a new system with extended cyclic setting.
I/O data	Data that are sent/received between the head module and the master station. Generic term for RX, RY, RWr, and RWw.
<input type="checkbox"/> Br.n bit input area	Bit input data of each module. Input data are sent from the head module to the master station through the remote input (RX).
<input type="checkbox"/> Bw.n bit output area	Bit output data of each module. Output data are sent from the master station and received to the head module through the remote output (RY).
<input type="checkbox"/> Wr.n word input area	Word (16-bit) input data of an intelligent function module. Input data are sent from the head module to the master station through the remote register (RWr).
<input type="checkbox"/> Ww.n word output area	Word (16-bit) output data of an intelligent function module. Output data are sent from the master station and received to the head module through the remote register (RWw).
<input type="checkbox"/> Cr.n command result area	An area for the information that indicates a command result. This information is stored in Setting data ((D1)+1 and after) of the RDMSG instruction of the master station.
<input type="checkbox"/> Cw.n command execution area	An area for the information for executing a command. This information is stored in Setting data ((S2)+1 and after) of the RDMSG instruction of the master station.

Term	Definition
Number of occupied I/O points	The area, that is equivalent to the occupied I/O points, is occupied in \boxed{Br} bit input area/ \boxed{Bw} bit output area.
Slice No.	The number assigned to every 2 occupied I/O points of each module. The numbers are assigned in ascending order, starting from "0" of the head module. (The maximum value is 127). This is used for specifying a command execution target.
Slice position No.	The number that shows where the slice module is physically installed. The numbers are assigned in ascending order, starting from "0" of the head module. (The maximum value is 63.) This is used for specifying a command execution target.
Start slice No.	The start slice No. assigned to the head module and slice modules.
Command	Generic term for requests that are executed by the master station for reading each module's operation status, setting intelligent function module command parameters or various controls.
Command parameter	Generic term for parameters set in commands or GX Configurator-ST. All of the parameters set for the head module and slice modules are command parameters.

Packing list

The following is included.

Model name	Product name	Quantity
ST1TD2	ST1TD2 MELSEC-ST thermocouple input module	1

CHAPTER1 OVERVIEW

This User's Manual provides the specifications, handling instructions, and programming methods for the ST1TD2 MELSEC-ST thermocouple input module (hereinafter referred to as the ST1TD2).

This manual includes descriptions of only the ST1TD2.

For information on the MELSEC-ST system, refer to the following.
MELSEC-ST System User's Manual.

The ST1TD2 converts external thermocouple input values into measured temperature values of signed 16-bit binary data, and micro voltage signals into signed 16-bit binary data.

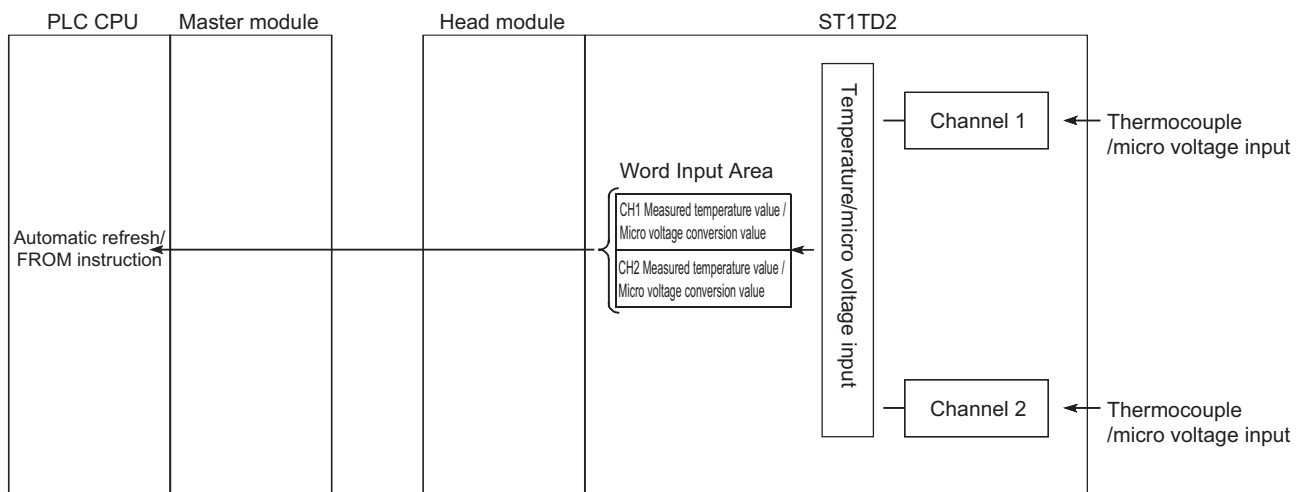


Figure 1.1

1.1 Features

(1) One ST1TD2 is capable of 2-channel temperature measurement/micro voltage conversion.

By using ST1TD2, the temperature measurement or micro voltage conversion can be performed for 2 channels.

(2) Up to 26 modules can be mounted.

For one head module, up to 26 ST1TD2 modules (52 channels) can be mounted.

(3) IEC/DIN/JIS-compliant thermocouples can be used.

Eight kinds of thermocouples (K,E,J,T,B,R,S,N), compliant with IEC/DIN/JIS standards, can be used.

Using GX Configurator-ST and commands, you can choose a desirable thermocouple type for each channel.

(4) Disconnection is detectable.

Disconnection of a thermocouple, compensation lead wire or micro voltage signal cable can be detected on each channel.

(5) Sampling/time averaging/count averaging is selectable.

As a conversion processing method, you can choose sampling, time averaging or count averaging for each channel.

(6) Cold junction temperature compensation using Pt1000 RTD

Cold junction temperature compensation will be performed automatically since a Pt1000 RTD is built in the dedicated base module.

(7) Pt1000 cold junction temperature compensation enable/disable setting

By disabling cold junction temperature compensation with Pt1000 RTD, cold junction temperature compensation can be performed outside the module.

If an error in the cold junction temperature compensation accuracy of Pt1000 RTD (Ambient air temperature $25\pm 5^{\circ}\text{C}$: $\pm 1.5^{\circ}\text{C}$, Ambient air temperature 0 to 55°C : $\pm 2.5^{\circ}\text{C}$) is not to be ignored, the accuracy can be improved by a high-precision ice bath applied externally.

(8) 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 "actual temperature/voltage" and "measured temperature/voltage", it can be compensated easily by setting a sensor compensation value.

(9) 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 preset to the module) for the offset/gain setting.

(10) Alarm output

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

(11) Online module change

The module can be changed without the system being stopped.

(12) Easy setting using GX Configurator-ST

A software package (GX Configurator-ST) is separately available.

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

However, using GX Configurator-ST enables on-screen parameter setting and offset/gain setting, which can reduce programming steps and makes the setting/operating status check easier.

CHAPTER2 SYSTEM CONFIGURATION

This chapter describes the system configuration for use of the ST1TD2.

2.1 Overall Configuration

The overall configuration for use of the ST1TD2 is shown below.

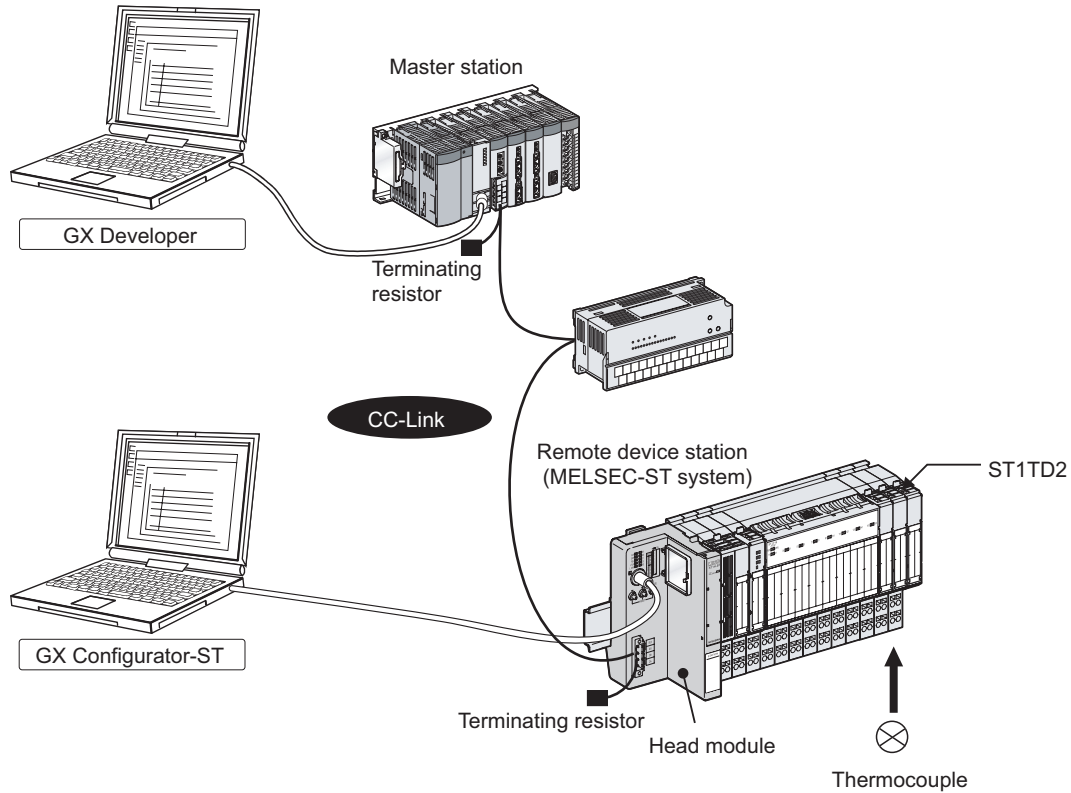


Figure 2.1

2.2 Applicable System

This section explains the applicable system.

2.2.1 Applicable head module

The head module applicable to the ST1TD2 is indicated below.

Table 2.1 Applicable head module

Product name	Model name
MELSEC-ST CC-Link Head Module	ST1H-BT

2.2.2 Applicable base module

The base modules applicable to the ST1TD2 are indicated below.

Table 2.2 Applicable base module

Type	Model name
Spring Clamp Type	ST1B-S4TD2
Screw Clamp Type	ST1B-E4TD2

2.2.3 Applicable coding element

The coding elements applicable to the ST1TD2 are indicated below.
 The coding element is fitted before shipment.
 It is also available separately in case it is lost.

Table 2.3 Applicable coding element

Description	Model name
ST1TD2 coding element	ST1A-CKY-16

2.2.4 Applicable software package

The software package applicable to the ST1TD2 is indicated below.

Table 2.4 Applicable software package

Model name	Product name	Compatible software version
SW1D5C-STPB-E	GX Configurator-ST	Version 1.02C or later

2.2.5 Applicable GSD file

The GSD file applicable to the ST1TD2 is indicated below.

Table 2.5 Applicable coding element

Description	Compatible version*
GSD file applicable to ST1TD2	rel. 1.01


* 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. 1.01 or later.

2.3 Precautions for System Configuration

For precautions for ST1TD2 system configuration, refer to Section 3.4 "Precautions for System Configuration" in MELSEC-ST system user's manual.

CHAPTER3 SPECIFICATIONS

This chapter provides the specifications of the ST1TD2.
For the general specifications of the ST1TD2, refer to the following.

 MELSEC-ST System User's Manual

3.1 Performance Specifications

This section indicates the performance specifications of the ST1TD2.

(1) Performance specifications list

Table 3.1 Performance specifications list

Item		Specifications													
Number of analog input points		2 channels/module													
Output	Temperature conversion value	16-bit signed binary (-2700 to 18200: Value to the first decimal place ×10)													
	Micro voltage conversion value	16-bit signed binary (-20000 to 20000)													
Standard with which thermocouple conforms		IEC584-1(1977), IEC584-2(1982), JIS C1602-1995													
Usable thermocouples and measured temperature range accuracies		Refer to Section 3.1 (3)													
Cold junction temperature compensation accuracy		Operating ambient temperature 25±5°C: ±1.5°C Operating ambient temperature 0 to 55°C: ±2.5°C													
Thermocouple input accuracy		Refer to Section 3.1 (2)													
Micro voltage input range		-80mV to 80mV (input resistance 1MΩ or more)													
Micro voltage input accuracy		Operating ambient temperature 25±5°C: ±0.16mV Operating ambient temperature 0 to 55°C: ±0.32mV													
Resolution	Thermocouple input	K, T: 0.3°C, E: 0.2°C, J: 0.1°C, B: 0.7°C, R, S: 0.8°C, N: 0.4°C													
	Micro voltage input	4μV													
Conversion speed		Cold junction temperature compensation setting: Not set: 30ms/channel, Set: 60ms/channel													
Disconnection detection		Yes (Channel independent)*1													
Absolute maximum input		± 4V													
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	<input type="checkbox"/> Br.n : Number of occupancy 4, <input type="checkbox"/> Wr.n : Number of occupancy 2													
	Output data	<input type="checkbox"/> Bw.n : Number of occupancy 4, <input type="checkbox"/> Ww.n : Number of occupancy 0													
Isolation	<table border="1"> <thead> <tr> <th>Specific isolated area</th> <th>Isolation method</th> <th>Dielectric withstand</th> <th>Insulation resistance</th> </tr> </thead> <tbody> <tr> <td>Between thermocouple input/micro voltage input channels and internal bus</td> <td>Photo coupler insulation</td> <td>560V AC rms/3 cycles (elevation 2000m)</td> <td>500V DC 10MΩ or more</td> </tr> <tr> <td>Between thermocouple input/micro voltage input channels</td> <td>No insulation</td> <td>-</td> <td>-</td> </tr> </tbody> </table>			Specific isolated area	Isolation method	Dielectric withstand	Insulation resistance	Between thermocouple input/micro voltage input channels and internal bus	Photo coupler insulation	560V AC rms/3 cycles (elevation 2000m)	500V DC 10MΩ or more	Between thermocouple input/micro voltage input channels	No insulation	-	-
	Specific isolated area	Isolation method	Dielectric withstand	Insulation resistance											
	Between thermocouple input/micro voltage input channels and internal bus	Photo coupler insulation	560V AC rms/3 cycles (elevation 2000m)	500V DC 10MΩ or more											
Between thermocouple input/micro voltage input channels	No insulation	-	-												
Applicable base module	Spring clamp type: ST1B-S4TD2 Screw clamp type: ST1B-E4TD2														
Applicable coding element	ST1A-CKY-16(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 At wire break detection, the measured temperature value/micro voltage conversion value right before wire break occurrence is held.

(2) The calculation formula for accuracy

The calculation formula for accuracy differs according to the relation between the measured temperature and the operating ambient temperature.

- (a) When the measured temperature is higher than the operating ambient temperature

(Accuracy) = (conversion accuracy) + (temperature characteristic) × (operating ambient temperature variation) + (cold junction temperature compensation accuracy)

Operating ambient temperature variation: A value of deviation from the operating ambient temperature range of $25 \pm 5^{\circ}\text{C}$

Example: When the thermocouple used is B (☞ Section 3.1 (2)), the operating ambient temperature is 35°C , the measured temperature is 1000°C , and the cold junction temperature compensation setting is set, the accuracy is:

$$(\pm 3.5^{\circ}\text{C}) + (\pm 0.35^{\circ}\text{C}) \times (35^{\circ}\text{C} - 30^{\circ}\text{C}) + (\pm 2.5^{\circ}\text{C}) = \pm 7.75^{\circ}\text{C}$$

- (b) When the measured temperature is lower than the operating ambient temperature

(Accuracy) = (conversion accuracy) + (temperature characteristic) × (operating ambient temperature variation) + (cold junction temperature compensation accuracy) × (compensation value for cold junction compensation accuracy)

Operating ambient temperature variation: A value of deviation from the operating ambient temperature range of $25 \pm 5^{\circ}\text{C}$

When the measured temperature is lower than the operating ambient temperature, the cold junction compensation accuracy is lowered because the thermocouple's thermal electromotive force does not have a linear characteristic. Based on the thermal electromotive force table (JIS C 1602-1995, IEC 584-1 and IEC 584-2 compliant), compensate for the cold junction compensation accuracy.

Example) In the case of the thermocouple E (☞ Section 3.1 (2)), operating ambient temperature of 25°C , measured temperature of -100°C and the cold junction temperature compensation setting is set,

Type E thermal electromotive force at around 25°C : $61\mu\text{V}/^{\circ}\text{C}$

Type E thermal electromotive force at around -100°C : $45\mu\text{V}/^{\circ}\text{C}$

The compensation value for cold junction compensation accuracy is:

$$[61\mu\text{V}/^{\circ}\text{C}]/[45\mu\text{V}/^{\circ}\text{C}] \doteq 1.4$$

And the accuracy is:

$$(\pm 1.5^{\circ}\text{C}) + (\pm 1.5^{\circ}\text{C}) 1.4 = \pm 3.6^{\circ}\text{C}$$

(3) Usable Thermocouples and Measured Temperature Range Accuracies

The usable thermocouples and measured temperature range accuracies will be explained.

Table 3.2

Usable Thermocouple Type	Measured Temperature Range ^{*1}	Conversion Accuracy (At operating ambient temperature 25±5 °C)	Temperature Characteristic (Per operating ambient temperature variation of 1 °C)	Max. Temperature Error at Ambient Temperature 55 °C ^{*4}
K	-270 to -200°C ^{*3}		-	
	-200 to 1200°C ^{*2}	±2.0°C	±0.2°C	±7.0°C
	1200 to 1372°C ^{*3}		-	
E	-270 to -200°C ^{*3}		-	
	-200 to 900°C ^{*2}	±1.5°C	±1.5°C	±5.5°C
	900 to 1000°C ^{*3}		-	
J	-210 to -40°C ^{*3}		-	
	-40 to 750°C ^{*2}	±1.0°C	±0.14°C	±4.5°C
	750 to 1200°C ^{*3}		-	
T	-270 to -200°C ^{*3}		-	
	-200 to 350°C ^{*2}	±2.0°C	±0.14°C	±5.5°C
	350 to 400°C ^{*3}		-	
B	0 to 600°C ^{*3}		-	
	600 to 1700°C ^{*2}	±3.5°C	±0.35°C	±12.25°C
	1700 to 1820°C ^{*3}		-	
R	-50 to 0°C ^{*3}		-	
	0 to 1600°C ^{*2}	±4.0°C	±0.35°C	±12.7°C
	1600 to 1768°C ^{*3}		-	
S	-50 to 0°C ^{*3}		-	
	0 to 1600°C ^{*2}	±4.0°C	±0.35°C	±12.7°C
	1600 to 1768°C ^{*3}		-	
N	-270 to -200°C ^{*3}		-	
	-200 to 1250°C ^{*2}	±2.5°C	±0.2°C	±7.5°C
	1250 to 1300°C ^{*3}		-	

- * 1 If a value entered from the thermocouple is outside the measured temperature range given in the table, it is handled as the maximum/minimum value of the measured temperature range.
- * 2 The accuracies in the shaded temperature ranges only are applied.
- * 3 Temperature measurement can be made, but accuracy is not guaranteed.
- * 4 It is the maximum temperature error in the case where the cold junction temperature compensation setting is set to "No".
If it is set to "Yes" for thermocouple K, for example, the maximum temperature error at the ambient temperature of 55°C is 9.5°C.

(4) Micro voltage input range and accuracies

The micro voltage input range and accuracies will be explained.

Table 3.3

Input Type	Measurable Voltage Range	Conversion Accuracy	
		(At 25±5 °C operating ambient temperature)	(At 0 to 55 °C operating ambient temperature)
Micro voltage input	-80 to 80mV	±0.16mV	±0.32mV

3.1.1 Micro voltage I/O conversion characteristic

The factory-set micro voltage I/O conversion characteristic is shown below.

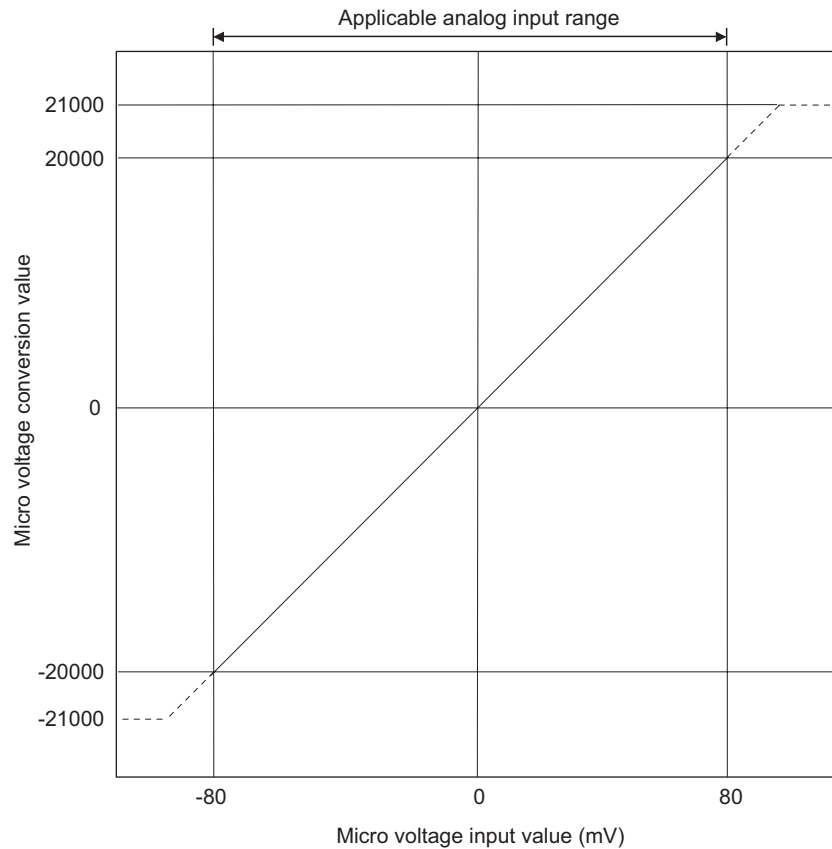


Figure 3.1

POINT

- (1) Use the module within the micro voltage input range and micro voltage conversion value.
Outside those ranges, the maximum resolution and accuracy may not fall within the ranges of the performance specifications. (Avoid using the dotted line areas in the chart.)
- (2) Do not input $\pm 4V$ or more. Doing so may damage the elements.
- (3) When a voltage exceeding the micro voltage conversion value range (-20000 to 20000) is input, the measured micro voltage value is fixed to the maximum (21000) or the minimum (-21000).

3.1.2 Conversion speed

The conversion speed of the ST1TD2 changes depending on the input type setting or the cold junction compensation setting.

[Thermocouple input and cold junction temperature compensation set to "No", or micro voltage input]

(Conversion speed) = 30ms/1channel


[Thermocouple input and cold junction temperature compensation set to "Yes"]

(Conversion speed) = 60ms/1channel

3.1.3 Intelligent function module processing time

The ST1TD2 intelligent function module processing time is (CH1 conversion speed) + (CH2 conversion speed).

For the input transmission delay time, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual.

3.2 Functions

This section explains the functions of the ST1TD2.

3.2.1 Function list

The following table lists the functions of the ST1TD2.

Table 3.4 ST1TD2 Function List

Item	Description	Reference section
Temperature conversion function	<ol style="list-style-type: none"> The "thermal EMF value" input from the thermocouple is converted into a "temperature value" to detect a temperature. Temperature data are 16-bit signed binary (-2700 to 18200) and stored into $[Wr]$ word input area. 	Section 3.2.2
Micro voltage conversion function	<ol style="list-style-type: none"> This function converts a micro voltage within -80mV to 80mV into a 16-bit signed binary (-20000 to 20000) and stores it into the $[Wr]$ word input area. 	Section 3.2.3
Conversion enable/disable function	<ol style="list-style-type: none"> This function specifies whether temperature/micro voltage conversion is enabled or disabled on each channel. Processing time can be reduced by setting the temperature or micro voltage conversion function to be enabled or disabled. <ul style="list-style-type: none"> Reduced time with cold junction temperature compensation: 60ms Reduced time without cold junction temperature compensation: 30ms In addition, it prevents unnecessary disconnection detection of unused channels. By default, conversion for all channels is enabled. [Setting method] <ul style="list-style-type: none"> GX Configurator-ST (☞ Section 5.3 Parameter Setting) Dedicated instruction from the master station (RDMSG instruction) (☞ Section 8.5.1 Conversion enable/disable setting write (Command No.: A300H/2300H)) 	-
Temperature/micro voltage conversion system	<ol style="list-style-type: none"> Sampling process A temperature/micro voltage input value is converted one by one on each channel and a measured temperature value/micro voltage value is stored after every conversion. Averaging process A temperature input value/micro voltage conversion value is averaged in terms of count or time on each channel and a digital average value is stored. Setting for averaging process specification, time/count averaging specification, average time/average number of times can be done on each channel. Sampling process/averaging process specification defaults to sampling process performed on all channels. Time averaging defaults to 480ms, and number of times averaging defaults to 480 times. [Sampling process/averaging process specification, time/count averaging specification method] <ul style="list-style-type: none"> GX Configurator-ST (☞ Section 5.3 Parameter Setting) Dedicated instruction from the master station (RDMSG instruction) (☞ Section 8.5.2 Operating condition setting write (Command No.: A302H/2302H)) [Average time/average number of times setting method] <ul style="list-style-type: none"> GX Configurator-ST (☞ Section 5.3 Parameter Setting) 	Section 3.2.4
Disconnection detection function	<ol style="list-style-type: none"> This function detects the disconnection of the connected thermocouple/micro voltage signal cable on each channel. Disconnection detection is made on only the channels set for conversion enabled. 	Section 3.2.5

Table 3.4 ST1TD2 Function List (Continued)

Item	Description	Reference section																				
Input type setting function	<p>(1) This function allows the input type setting for each channel. (2) The input type is selectable from the following.</p> <table border="1" data-bbox="443 394 975 786"> <thead> <tr> <th>Input type</th> <th>Measured range</th> </tr> </thead> <tbody> <tr> <td>Thermocouple K (default)</td> <td>-270 to 1327°C</td> </tr> <tr> <td>Thermocouple E</td> <td>-270 to 1000°C</td> </tr> <tr> <td>Thermocouple J</td> <td>-210 to 1200°C</td> </tr> <tr> <td>Thermocouple T</td> <td>-270 to 400°C</td> </tr> <tr> <td>Thermocouple B</td> <td>0 to 1820°C</td> </tr> <tr> <td>Thermocouple R</td> <td>-50 to 1768°C</td> </tr> <tr> <td>Thermocouple S</td> <td>-50 to 1768°C</td> </tr> <tr> <td>Thermocouple N</td> <td>-270 to 1300°C</td> </tr> <tr> <td>Micro voltage input</td> <td>-80 to 80mV</td> </tr> </tbody> </table> <p>[Setting method] • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) (☞ Section 8.3.1 Initial data batch write request (Command No.: 8106H), Section 8.3.2 Initial data individual write request (Command No.: 8107H/0107H))</p>	Input type	Measured range	Thermocouple K (default)	-270 to 1327°C	Thermocouple E	-270 to 1000°C	Thermocouple J	-210 to 1200°C	Thermocouple T	-270 to 400°C	Thermocouple B	0 to 1820°C	Thermocouple R	-50 to 1768°C	Thermocouple S	-50 to 1768°C	Thermocouple N	-270 to 1300°C	Micro voltage input	-80 to 80mV	
Input type	Measured range																					
Thermocouple K (default)	-270 to 1327°C																					
Thermocouple E	-270 to 1000°C																					
Thermocouple J	-210 to 1200°C																					
Thermocouple T	-270 to 400°C																					
Thermocouple B	0 to 1820°C																					
Thermocouple R	-50 to 1768°C																					
Thermocouple S	-50 to 1768°C																					
Thermocouple N	-270 to 1300°C																					
Micro voltage input	-80 to 80mV																					
Alarm output function	<p>(1) This function outputs an alarm when the temperature/micro voltage 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.</p> <p>[Alarm output setting method] • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) (☞ Section 8.5.2 Operating condition setting write (Command No.: A302H/2302H)) [Upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value setting method] • GX Configurator- ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) (☞ Section 8.5.4 CH[] upper upper limit/upper lower limit setting write (Command No.: A308H, A30AH/2308H, 230AH)) (☞ Section 8.5.5 CH[] lower upper limit/lower lower limit setting write (Command No.: A309H, A30BH/2309H, 230BH))</p>	Section 3.2.6																				
Pt1000 cold junction temperature compensation setting function	<p>(1) This is a function to set yes/no cold junction temperature compensation by Pt1000 built in the base module for ST1TD2. Setting can be done on each channel. This function is effective for high-precision temperature measurement, such as the case where an error in Pt1000 cold junction temperature compensation accuracy (Operating ambient temperature 25±5°C: ±1.5°C, Operating ambient temperature 0 to 55°C: ±2.5°C) can not be ignored. The cold junction temperature compensation accuracy can be improved by disabling the cold junction temperature compensation of the Pt1000 and providing a precision ice bath externally. (2) Default is set to cold junction temperature compensation - yes. (3) Cold junction temperature compensation setting will be invalid in the mode of micro voltage input.</p> <p>[Setting method] • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) (☞ Section 8.3.1 Initial data batch write request (Command No.: 8106H)) (☞ Section 8.3.2 Initial data individual write request (Command No.: 8107H/0107H))</p>	Section 3.2.7																				

1	OVERVIEW
2	SYSTEM CONFIGURATION
3	SPECIFICATIONS
4	SETUP AND PROCEDURES BEFORE OPERATION
5	GX Configurator-ST
6	PROGRAMMING
7	ONLINE MODULE CHANGE
8	COMMANDS

Table 3.4 ST1TD2 Function List (Continued)

Item	Description	Reference section
Command	(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.	CHAPTER 8
Compensation of measured temperature/micro voltage value	<p>(1) The ST1TD2 can compensate the error between the "actual temperature/voltage" and the "measured temperature/voltage", which occurs due to various thermocouple accuracies, compensating lead length, installation condition, etc.</p> <p>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.</p> <p>1) Sensor compensation function</p> <p>When the measurement range is less than 100°C or 100 digits, use the sensor compensation function.</p> <p>The compensation value can be easily obtained in 1-point temperature/voltage measurement only.</p> <p>2) Offset/gain setting function</p> <p>When the measurement range is not less than 100°C or 100 digits, use the offset/gain setting function.</p> <p>A wide-range compensation is available.</p> <p>(2) For the sensor compensation or the offset/gain setting, prepare a thermometer to measure the temperature of the object.</p> <p>Compensation is performed based on the difference between the temperature measured by the thermometer and the one measured by the ST1TD2.</p>	Section 3.2.4
Sensor compensation function	<p>(1) The measured temperature value or micro voltage conversion value is compensated based on the set sensor compensation value.</p> <p>The compensation is available for each channel.</p> <p>[Sensor compensation method]</p> <ul style="list-style-type: none"> • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) <p>(☞ Section 8.5.6 Sensor compensation value write (Command No.: A31AH/231AH))</p>	Section 3.2.8
Offset/gain setting function	<p>(1) Linear compensation is available by individually compensating any given 2 points (offset/gain value) within the valid range.</p> <p>The offset/gain values can be set for each channel.</p> <p>(2) To use the user range setting, it needs to be set in the offset/gain value selection in advance.</p> <p>The offset/gain value selection can be set for each channel.</p> <p>Default is set to "Factory default".</p> <p>[Offset/gain setting method]</p> <ul style="list-style-type: none"> • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) <p>(☞ Section 8.6.3 Operation mode setting (Command No.: B302H/3302H))</p> <p>(☞ Section 8.6.4 Offset channel specification (Command No.: B303H/3303H))</p> <p>(☞ Section 8.6.5 Gain channel specification (Command No.: B304H/3304H))</p> <p>(☞ Section 8.6.6 User range write (Command No.: B305H/3305H))</p> <p>[Offset/gain value selection]</p> <ul style="list-style-type: none"> • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Dedicated instruction from the master station (RDMSG instruction) <p>(☞ Section 8.3.1 Initial data batch write request (Command No.: 8106H))</p> <p>(☞ Section 8.3.2 Initial data individual write request (Command No.: 8107H/0107H))</p>	Section 4.5
Online module change	<p>(1) A module change is made without the system being stopped.</p> <p>[Execution procedure]</p> <ul style="list-style-type: none"> • GX Configurator-ST (☞ Section 5.3 Parameter Setting) • Button operation on the head module 	CHAPTER 7

3.2.2 Temperature conversion function

- (1) A "thermal EMF value" input from a thermocouple is converted into a "temperature value" to detect a temperature.
- (2) The measured temperature value to the first decimal place is multiplied by 10 and the result is stored into $Wr.n$ or $Wr.n+1$ CH□ measured temperature value/micro voltage value as a 16-bit signed binary number. (The value is rounded down to the nearest tenth.)

[Example 1] For a measured temperature value of 123.45°C, 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

Figure 3.2 Measured temperature of 123.45°C

- (3) A negative measured temperature value is represented as a two's complement.

[Example 2] For a measured temperature value of -123.45°C, -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

Figure 3.3 Measured temperature of -123.45°C

- (4) At power-on or reset, both channels are set to 0.
- (5) Processing time can be reduced by disabling conversion of an unused channel.

If conversion of an unused channel are disabled, reduced time changes depending on cold junction temperature compensation setting.

- Reduced time with cold junction temperature compensation set to "Yes": 60ms
- Reduced time with cold junction temperature compensation set to "No": 30ms

In addition, it prevents unnecessary disconnection detection of unused channels.

- (6) **The allowable input temperature range varies with each thermocouple.**
 If any out-of-range temperature is input, the measured temperature value will be fixed to the maximum or minimum of the values for the selected thermocouple.

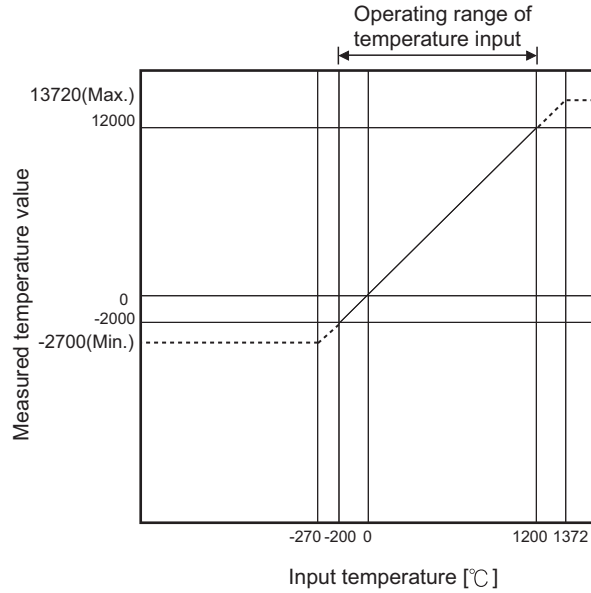


Figure 3.4 Conversion characteristic for thermocouple

3.2.3 Micro voltage conversion function

- (1) A micro voltage of -80 to 80mV is converted into a 16-bit signed binary value of -20000 to 20000, and it is then stored $\boxed{Wr.n}$ or $\boxed{Wr.n+1}$ CH□ measured temperature value/micro voltage conversion value.

[Example 1] For a micro voltage input value of 51.300mV, 12825 is stored.

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

Figure 3.5 Micro voltage input value of 51.300mV

- (2) A negative micro voltage conversion value is represented as a two's complement.

At power-on or reset, all channels are set to 0.

[Example 2] For a micro voltage input value of -51.300mV, -12825 is stored.

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

Figure 3.6 Micro voltage input value of -51.300mV

- (3) By disabling conversion of unused channels, a processing time of 30ms can be reduced.
- (4) If any out-of-range voltage is input, the micro voltage conversion value will be fixed to the maximum (21000) or minimum (-21000).

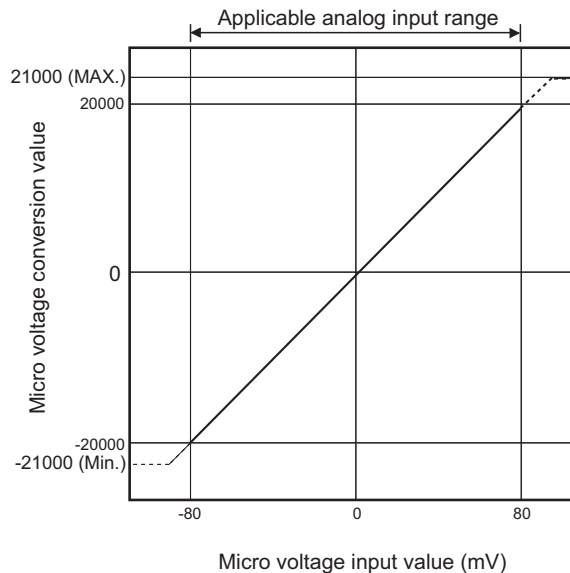


Figure 3.7 Micro voltage I/O conversion characteristic

3.2.4 Temperature/micro voltage conversion system

Sampling and averaging processing options are available for temperature/micro voltage conversion.

The following table shows the processing times that vary by combinations of the conversion enable/disable setting, the input type setting and the cold junction temperature compensation setting.

Table 3.5 CH□ processing time

Conversion enable/ disable setting	Input type setting	Cold junction temperature compensation setting	Processing time/ channel
Enable	Thermocouple K, E, J, T, B, R, S, N	Yes	60ms
		No	30ms
	Micro voltage input	-*	
Disable	Thermocouple K, E, J, T, B, R, S, N	Yes	0ms
		No	
	Micro voltage input	-*	

* Cold junction temperature compensation setting is invalid for micro voltage input.

(1) Sampling processing

Temperature or micro voltage input values are converted one by one, and a measured temperature value or micro voltage conversion value is stored into $Wr.n$ or $Wr.n+1$ CH□ measured temperature value/micro voltage conversion value each time.

(Sampling processing time) = (CH1 processing time*) + (CH2 processing time*)

* The processing time varies depending on the conversion enable/disable setting, the input type setting and the cold junction temperature compensation setting. (Table 3.5)

[Example] In the following case, the sampling processing time is 90ms.

CH1 setting

Conversion enable/disable setting: Enable

Input type setting: Thermocouple K

Cold junction temperature compensation setting: Yes

CH2 setting

Conversion enable/disable setting: Enable

Input type setting: Micro voltage input

Cold junction temperature compensation setting: -

60ms + 30ms = 90ms

(2) Averaging processing

Conversion is performed for the specified channel the specified number of times or for the specified period of time.

Then, the sum of the obtained values except the maximum and minimum is averaged and the result is stored in $Wr.n$ or $Wr.n+1$ CH□ measured temperature value / micro voltage conversion value.

The setting ranges are given below.

When the setting is outside the applicable range, the ERR. LED turns on and the conversion of the corresponding channel stops.

- Time averaging: 480 to 5000ms
- Count averaging: 4 to 500 times

(a) When time averaging is set

The formula calculating the average number of conversions within the set time is shown below.

$$\text{(Average number of conversion)} = \frac{\text{(Set time)}}{(\text{CH1 processing time}^*) - (\text{CH2 processing time}^*)}$$

* The processing time varies depending on the conversion enable/disable setting, the input type setting and the cold junction temperature compensation setting. (Table 3.5)

[Example] In the following case, the average number of conversions is 13.

Averaging time setting: 810ms

CH1 setting

Conversion enable/disable setting: Enable

Input type setting: Thermocouple K

Cold junction temperature compensation setting: No

CH2 setting

Conversion enable/disable setting: Enable

Input type setting: Micro voltage input

Cold junction temperature compensation setting: -

$810\text{ms}/(30\text{ms} + 30\text{ms}) = 13.5$ (Round down to the nearest integer)

(b) When count averaging is set

The formula expressing the relation of the set number of times and the average processing time is shown below.

$$\text{(Average processing time)} = (\text{Set number of times}) \times (\text{CH1 processing time}^* + \text{CH2 processing time}^*)$$

* The processing time varies depending on the conversion enable/disable setting, the input type setting and the cold junction temperature compensation setting. (Table 3.5)

[Example] In the following case, the average processing time is 30000ms.

Average number of times set: 500

CH1 setting

Conversion enable/disable setting: Enable

Input type setting: Thermocouple K

Cold junction temperature compensation setting: No

CH2 setting

Conversion enable/disable setting: Enable

Input type setting: Micro voltage input

Cold junction temperature compensation setting: -

$500 \times (30\text{ms} + 30\text{ms}) = 30000\text{ms}$

3.2.5 Disconnection detection function

- (1) **If disconnection of a thermocouple, compensation lead wire, or the micro voltage signal line is detected, the ERR.LED will light up, and Error status (RXnA) is set to on.**

When Error status (RXnA) is ON, the error module can be identified by executing the Error module information read request command (command No.: 0103H).

In order to obtain the error code, execute the Error code read request command (command No.: 8101H/0101H) to the identified error module.

To take actions to correct the error, refer to the following:

☞ Section 9.1 Error Code List

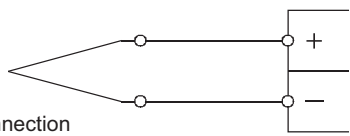
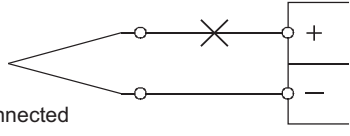
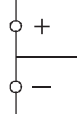
Error status (RXnA) is a remote input of the head module.

For details of Error status (RXnA), refer to the following.

MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

- (2) **Disconnection detection is available only for the conversion-enabled channels.**
- (3) **Disconnection can be detected for each channel.**
- (4) **If an unconnected channel is detected, the measured temperature value or micro voltage conversion value right before the disconnection will be held.**
- (5) **The relation between disconnection detection and conversion enable/disable setting are indicated below.**

Table 3.6 Relation between disconnection detection and conversion enable/disable setting

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

☒ POINT

- Any channel where no thermocouple, compensation lead wire or micro voltage signal line is connected must be set to "conversion disable". If unconnected channel is set as conversion-enabled, disconnection is detected.
- If a disconnection is detected, measured temperature value and micro voltage conversion value right before the disconnection is kept, then Br.n+2 conversion completion flag turns off (0). If the connection is then restored, the system will start updating the measured temperature value and micro voltage conversion value again, and Br.n+2 conversion completion flag will turn on (1).
- If a value greater than 80mV is entered, "disconnection detected" may be reported. Therefore, please use the module within the allowed range of the input type.
- For wiring of the thermocouple, compensation lead wire or micro voltage signal cable, refer to the following.
 - ☞ Section 4.4 Wiring
- For troubleshooting of disconnection detection, refer to the following.
 - ☞ Section 9.2.3 When line disconnection has been detected

3.2.6 Alarm output function

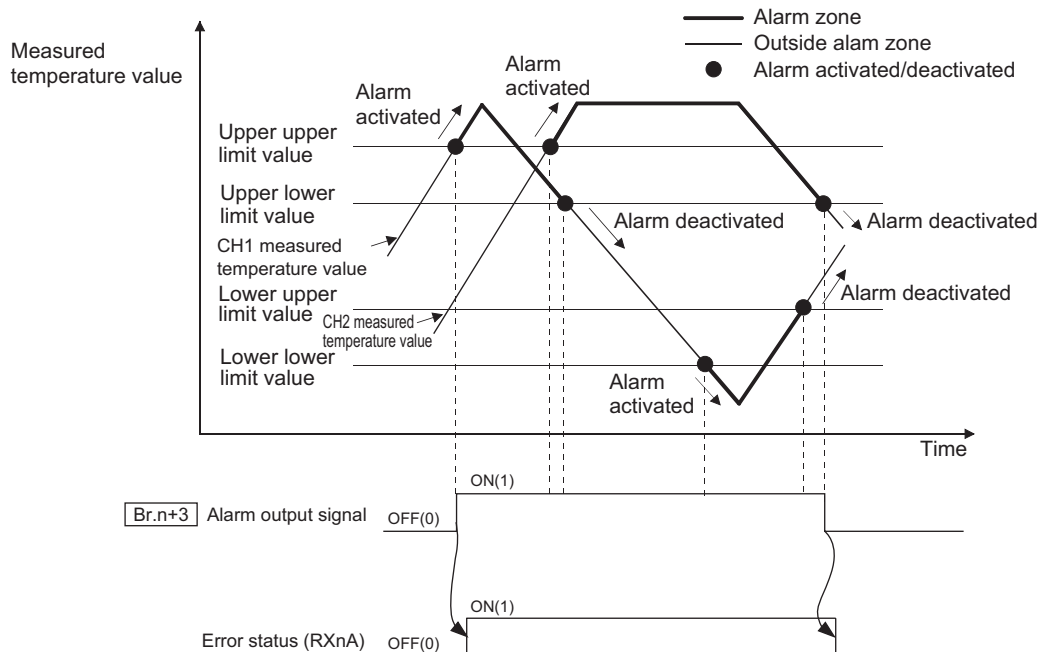


Figure 3.8

- (1) If a detected measured temperature value/micro voltage conversion 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+3 alarm output signal turns on (1) and Error status (RXnA) is set to on. Error status (RXnA) is a remote input of the head module. When Error status (RXnA) is ON, the error module can be identified by executing the Error module information read request command (command No.: 0103H). In order to obtain the error code, execute the Error code read request command (command No.: 8101H/0101H) to the identified error module. To take actions to correct the error, refer to the following:
- ☞ Section 9.1 Error Code List

For details of Error status (RXnA), refer to the following.
MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

- (2) When the measured temperature value/micro voltage conversion 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, Br.n+3 alarm output signal turns off (0) automatically.

Error status (RXnA) is also set to off automatically. *1

* 1 If another error has occurred in the ST1TD2, head module, or any other slice module, Error status (RXnA) is not set to off.

- (3) Alarm output can be enabled or disabled for each channel.

The default is set to No alarm output processing performed on all channels.

(4) Set the four limit value for the alarm output: upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value (Default: 0).

If a channel setting does not meet the conditions shown in (a) and (b), it is considered as an error, and the ERR. LED will light up.

(a) Setting range for each input type is shown below.

Setting of thermocouple input is performed in 0.1°C unit.

[Example] To set to 0.3°C, enter "3".

Table 3.7

Input type	Setting range (Accuracy guaranteed)
Thermocouple K	-2700 to 13720 (-2000 to 12000)
Thermocouple E	-2700 to 10000 (-2000 to 9000)
Thermocouple J	-2100 to 12000 (-400 to 7500)
Thermocouple T	-2700 to 4000 (-2000 to 3500)
Thermocouple B	0 to 18200 (6000 to 17000)
Thermocouple R	-500 to 17680 (0 to 16000)
Thermocouple S	-500 to 17680 (0 to 16000)
Thermocouple N	-2700 to 13000 (-2000 to 12500)
Micro voltage input	-21000 to 21000 (-20000 to 20000)

(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

(5) Alarms can be output only for channel, whose conversion is enabled.

3.2.7 Cold junction temperature compensation setting

The ST1TD2 can perform the following two kind of cold junction temperature compensation by selecting Yes/No for the command parameter.

(1) Using Pt1000 RTD to perform cold junction temperature compensation (cold junction temperature compensation set to "Yes")

Cold junction temperature compensation is performed automatically by the Pt1000 RTD built in the base module for the ST1TD2.

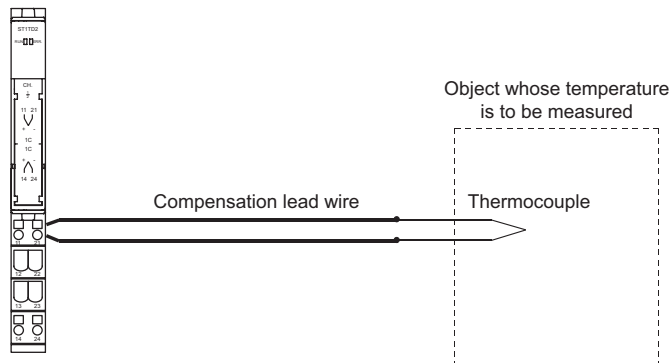


Figure 3.9

(2) Performing cold junction temperature compensation externally (cold junction temperature compensation set to "No")

Use this method for high-precision temperature measurement, such as the case where an error in cold junction temperature compensation accuracy (operating ambient temperature $25 \pm 5^\circ\text{C}$: $\pm 1.5^\circ\text{C}$, 0 to 55°C : $\pm 2.5^\circ\text{C}$) using the built-in Pt1000 RTD cannot be ignored.

By providing a precision ice bath externally, the thermo-electromotive force generated at the tip of the thermocouple can be led to the module without any change so that the cold junction temperature compensation accuracy can be improved.

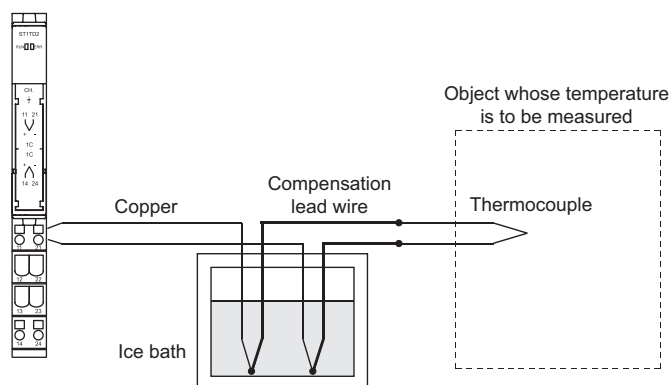


Figure 3.10 Cold junction temperature compensation outside the module

POINT

The ice bath is a pot which internal temperature is maintained at 0°C , and a thermocouple and a lead wire are connected in the pot. Hence, the thermo-electromotive force at points of the contact of the thermocouple and lead wires will be 0mV , preventing the generation of extra thermo-electromotive force which can cause an error.

3.2.8 Sensor compensation function

- (1) This function corrects the error between "actual temperature/voltage" and "measured temperature/voltage" that may be produced depending on various factors such as thermocouple accuracies, compensating lead length, installation condition.

The measured temperature values or micro voltage conversion values are compensated in all of the input range, based on the specified sensor compensation value.

The compensation is available for each channel.

- (2) The setting range is -500 to 500.

In the case of thermocouple input, set a value in units of 0.1°C.

For the micro voltage input, set a value in units of 4μV/digit.

Example1) When the measured temperature (501.5°C) is higher than the actual temperature (500.0°C) by 1.5°C, set -15 as the sensor compensation value.

$$500.0(^{\circ}\text{C}) - 501.5(^{\circ}\text{C}) = -1.5(^{\circ}\text{C})$$

$$-1.5(^{\circ}\text{C}) \times 10 = -15$$

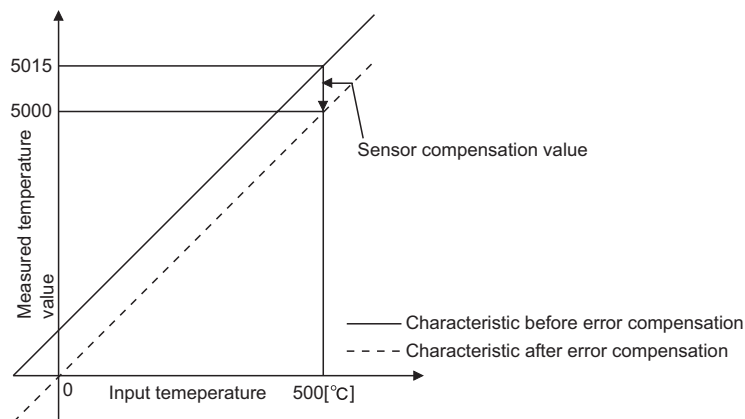


Figure 3.11 When the measured temperature (501.5°C) is higher than the actual temperature (500.0°C) by 1.5°C

Example2) When the micro voltage conversion value is 10003 at 40mV input, set -3 as the sensor compensation value.

$$10000 - 10003 = -3$$

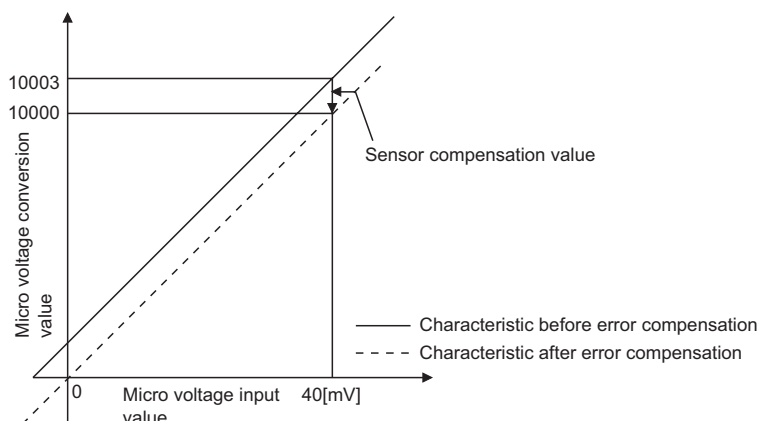


Figure 3.12 When the micro voltage conversion value is 10003 at 40mV input

3.3 I/O Data

The ST1TD2 has the areas for data transfer with the head module as indicated below. This section explains the composition of each area.

Table 3.8 I/O data list

Transfer direction	Item	Number of Occupancy	Default value	Reference section
ST1TD2 → Head module (Input Data)	Br Bit Input Area	4	0	Section 3.3.1
	Wr Word Input Area	2	0	Section 3.3.2
Head module → ST1TD2 (Output Data)	Bw Bit Output Area	4	0	Section 3.3.3
	Ww Word Output Area	0	0	-

3.3.1 Bit input area

This section explains the Br Bit input area.

(1) "Br.n" Module ready

- (a) Turns ON (1) when conversion is ready after the MELSEC-ST system (ST1TD2) is powered on or the head module is reset.
- (b) 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 a watchdog timer error occurred in ST1TD2
- During online module change
☞ CHAPTER 7 ONLINE MODULE CHANGE

(2) "Br.n+1" Convert setting completed flag

- (a) After Bw.n+1 Convert setting request has turned ON (1), this turns ON (1) when command parameter setting check is completed. (Turns ON (1) if a setting error is detected.)

[When parameter setting is normal]

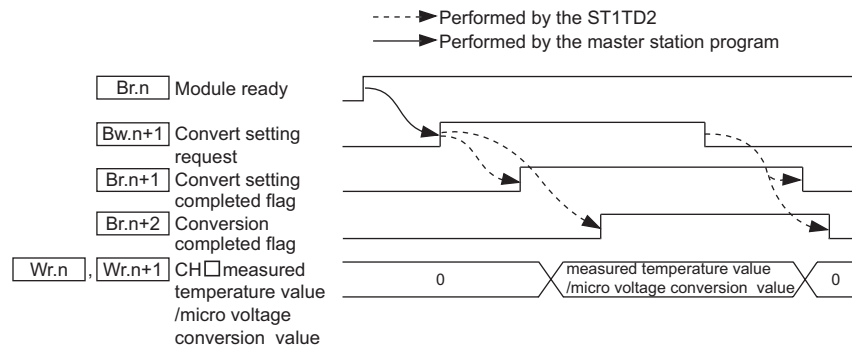


Figure 3.13 When parameter setting is normal

[When parameter setting is not normal]

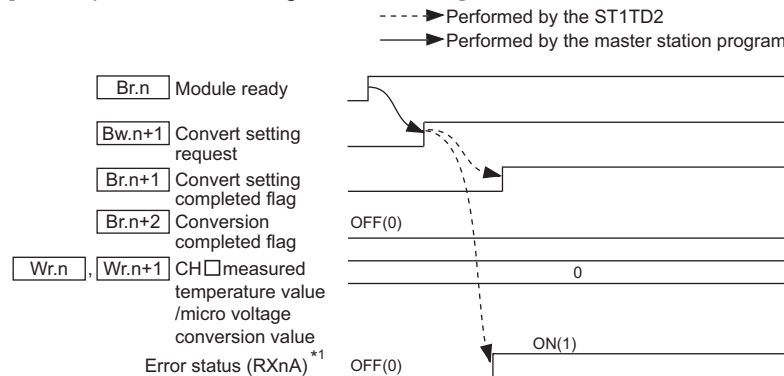


Figure 3.14 When parameter setting is not normal

* 1 Error status (RXnA) is a remote input of the head module.

When Error status (RXnA) is ON, the error module can be identified by executing the Error module information read request command (command No.: 0103H). In order to obtain the error code, execute the Error code read request command (command No.: 8101H/0101H) to the identified error module.

· To take actions to correct the error, refer to the following:

· Section 9.1 Error Code List

For details of the Error status (RXnA), refer to the following.

MELSEC-ST CC-Link Head Module User's Manual
 "3.4 Remote I/O, Remote Registers"

(3) "Br.n+2" Conversion completed flag

- (a) After Bw.n+1 Convert setting request has turned ON (1), Bw.n+2 Conversion completed flag turns ON (1) when conversion is completed on all conversion-enabled channels.
- (b) The Br.n+2 Conversion completed flag status changes only once when the Bw.n+1 Convert setting request status is changed.
- 1) When Bw.n+1 Convert setting request is turned from OFF (0) to ON (1)
 When a measured temperature value / micro voltage conversion value is stored into Br.n, Wr.n+1 CH measured temperature value/micro voltage conversion value, Br.n+2 Conversion completed flag turns ON (1).
 Specifying averaging processing will cause a delay in turning Br.n+2 Conversion completed flag ON (1) by the processing time.
 - 2) When Bw.n+1 Convert setting request is turned from ON (1) to OFF (0)
 Br.n+2 Conversion completed flag turns OFF (0).
- (c) When disconnection is detected on any of the conversion-enabled channels,
 Br.n+2 Conversion completed flag turns OFF (0).
 When connection is restored after the disconnection detection, updating of the measured temperature value/micro voltage conversion value is resumed and
 Br.n+2 Conversion completed flag turns ON (1) again.

(4) "Br.n+3" Alarm output signal

- (a) Turns ON (1) when the measured temperature value/micro voltage conversion 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 any channel where the alarm output and conversion is enabled.
- (b) Turns OFF (0) automatically when the measured temperature value/micro voltage conversion value returns to within the setting range on all conversion-enabled channels.

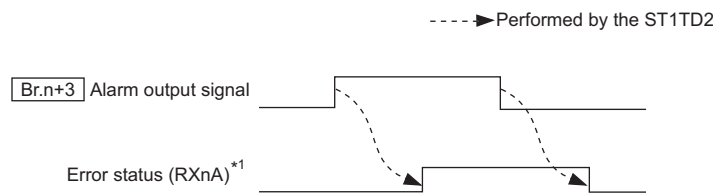


Figure 3.15 Alarm output signal

- * 1 Error status (RXnA) is a remote input of the head module.
When Error status (RXnA) is ON, the error module can be identified by executing the Error module information read request command (command No.: 0103H). In order to obtain the error code, execute the Error code read request command (command No.: 8101H/0101H) to the identified error module.
- To take actions to correct the error, refer to the following:
 - ▶ Section 9.1 Error Code List
 For details of the Error status (RXnA), refer to the following.
 - ▶ MELSEC-ST CC-Link Head Module User's Manual "3.4 Remote I/O, Remote Registers"

3.3.2 Word input area

This section explains the Wr Word input area.

(1) "Wr.n" CH1 measured temperature value/micro voltage conversion value, "Wr.n+1" CH2 measured temperature value/micro voltage conversion value

- (a) The measured temperature value/micro voltage conversion value is stored into $Wr.n$, or $Wr.n+1$ CH measured temperature value/micro voltage conversion value for each channel.
- (b) The measured temperature value/micro voltage conversion value to the first decimal place is multiplied by 10 and stored as a 16-bit signed binary. (The value is rounded down to the nearest tenth.)


3.3.3 Bit output area

This section explains the Bw Bit output area.

(1) "Bw.n" System area

Use of this area is prohibited (fixed to 0).

(2) "Bw.n+1" Convert setting request

- (a) Turn this ON (1) to start conversion for the conversion-enabled channels. When it is set to OFF (0), conversion is stopped.
- OFF (0): Conversion stop (Default)
 - ON (1): Conversion start
- (b) Set this from OFF (0) to ON (1) to validate the command parameter settings.
- 1) Before writing command parameters, set the $Bw.n+1$ Convert setting request to OFF (0) to stop the conversion. When it is ON (1), command parameters cannot be written.
- (c) For the ON (1)/OFF (0) timing, refer to the following.
-  Section 3.3.1 (2) "Br.n+1" Convert setting completed flag

(3) "Bw.n+2" System area, "Bw.n+3" System area

Use of these areas is prohibited (fixed to 0).

3.4 Memory and Parameters

This section explains the memory and parameters of the ST1TD2.

3.4.1 Memory

RAM and ROM can be used to store the parameter of ST1TD2.

(1) RAM

- (a) The ST1TD2 operates based on the parameter settings stored in the RAM.
- (b) The parameter settings stored in the RAM take effect when the Bw.n+1 Convert setting request turns from OFF to ON.

(2) ROM

- (a) The parameters stored in the ROM are not erased even if the power is turned off.
- (b) The parameters stored in the ROM are transferred to the RAM when:
 - The MELSEC-ST system (ST1TD2) is powered off, and then on.
 - The head module is reset.
 - Parameter setting read from ROM command (command number: 3300H) is executed.

3.4.2 Parameters

The setting items required to operate the ST1TD2 are called command parameters.

Setting command parameters

Use either of the following methods to set command parameters.

(a) GX Configurator-ST

GX Configurator-ST allows easy on-screen setup, reducing programming steps on the master station.

If the set values should be used every time when the MELSEC-ST system starts up, they must be written to the ROM. (Writing the set values to the RAM is used only for temporary testing.)

(b) Commands

1) Using the dedicated instruction (RDMSG) of the master station to execute a command, setting values can be written to RAM of the ST1TD2.

2) Then, using command "Parameter setting write to ROM" (command No.: B301H/3301H), the setting value stored in RAM can be written to the ROM. Writing command parameters to ROM in advance can reduce programming steps on the master station.

Command parameter list

Command parameters and corresponding command numbers are listed below.

The following command parameters can be set in GX Configurator-ST.

Table 3.9 Command parameter list

Setting item	Command
Input type setting	8106H
Offset/gain value selection	8107H/0107H
Cold junction temperature compensation setting	
Conversion enable/disable setting	A300H/2300H
Sampling/averaging processing specification	
Time/count averaging specification	A302H/2302H
Time/count setting	A304H/2304H
Alarm output setting	A302H/2302H
Upper upper/upper lower limit value setting	A308H/2308H
	A30AH/230AH
Lower upper/lower lower limit value setting	A309H/2309H
	A30BH/230BH
Sensor compensation value setting	A31AH/231AH

POINT

For commands with the number 8000H and greater, determine the head module and slice modules with their slice position number.

And for commands with the number 7FFFH and lower, determine them with their start slice number.

CHAPTER4 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.

4.2 Setup and Procedure before Operation

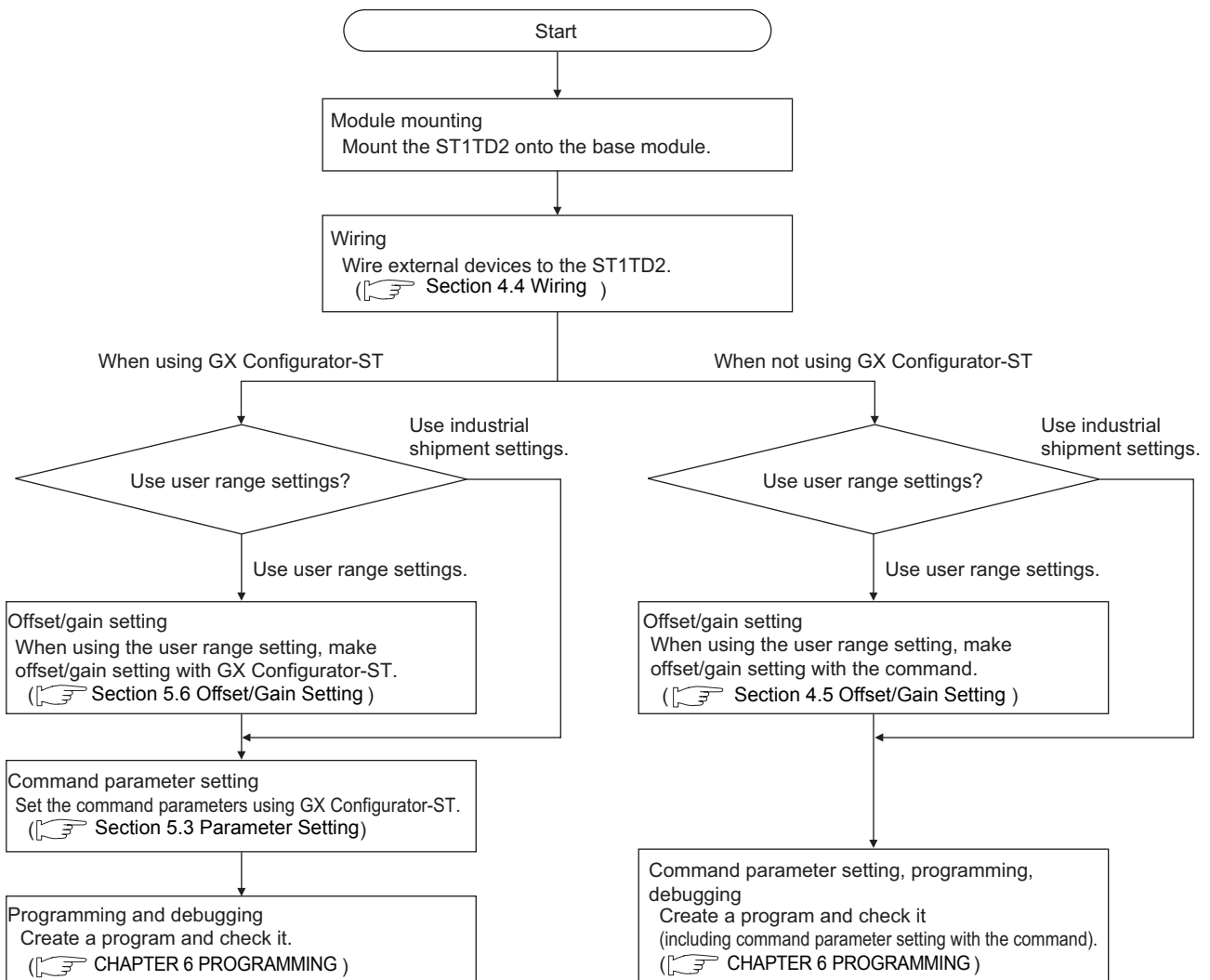


Figure 4.1

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 ST1TD2 is listed below.

The following shows the ST1TD2 mounted on the spring clamp type base module.

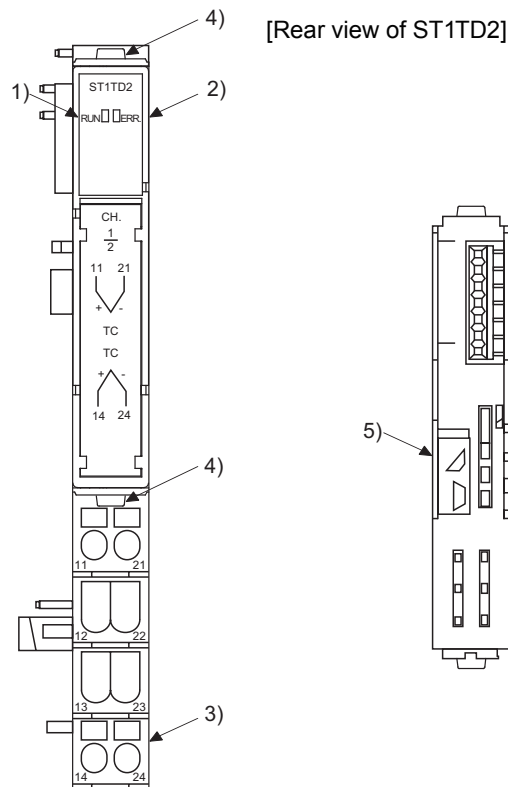


Figure 4.2

Table 4.1 Part names and functions

No.	Name and appearance	Description
1)	RUN LED	RUN LED and ERR. LED (on/flashing/off) indicate various statuses of the ST1TD2 (☞ Section 4.3.1 Status confirmation by LED).
2)	ERR. LED	
3)	Terminal block	The input signal wires of the ST1TD2 are connected to the terminal block of the base module. [Applicable base modules] Spring Clamp Type: ST1B-S4TD2 Screw Clamp Type: ST1B-E4TD2
4)	Slice module fixing hooks (at both ends)	Used for mounting/dismounting the ST1TD2 to/from the base module. While pressing the hooks at both ends, mount/dismount the ST1TD2.

Table 4.1 Part names and functions (Continued)

No.	Name and appearance	Description
5)	Coding element	<p>Prevents the module from being mounted incorrectly.</p> <p>The coding element consists of two pieces, and its shape varies depending on the model name.</p> <p>When the ST1TD2 is mounted on the base module and then dismantled, one piece of the coding element remains on the base module, and the other remains on the ST1TD2.</p> <p>The ST1TD2 can be mounted onto the base module only when the two pieces of the coding elements are matching.</p> <p>[Applicable coding element] ST1TD2: ST1A-CKY-16</p>

POINT

In order to ensure safety, make sure to attach the coding element to the base module and ST1TD2.

Table 4.2

Terminal No.	Signal name	
11	CH1	TC+
12	Vacancy	
13	Vacancy	
14	CH2	TC+
21	CH1	TC-
22	Vacancy	
23	Vacancy	
24	CH2	TC-

4.3.1 Status confirmation by LED

Table 4.1 explains the LED indications.

Table 4.3 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 ST1TD2 and ensure system reliability, external wiring, that is protected from noise, is required.

Please observe the following precautions for external wiring:

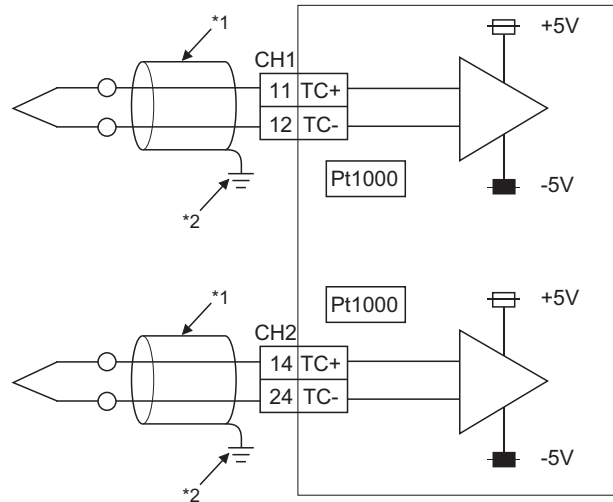
- (1) Use separate cables for the AC control circuit and the external input signals of the ST1TD2 to avoid the influence of the AC side surges and inductions.**
- (2) Do not bring/install the cables closer to/together with the main circuit line, a high-voltage cable or a load cable from other than the MELSEC-ST system. Doing so may increase the effects of noise, surges and induction.**
- (3) Always place the thermocouple/micro voltage 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).

(1) Thermocouples

(a) Connect the cables to the module.



* 1 As cables, use shielded compensation 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.

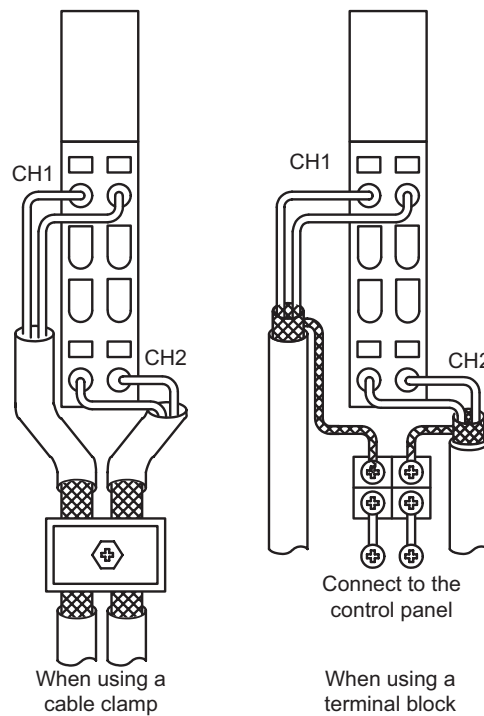
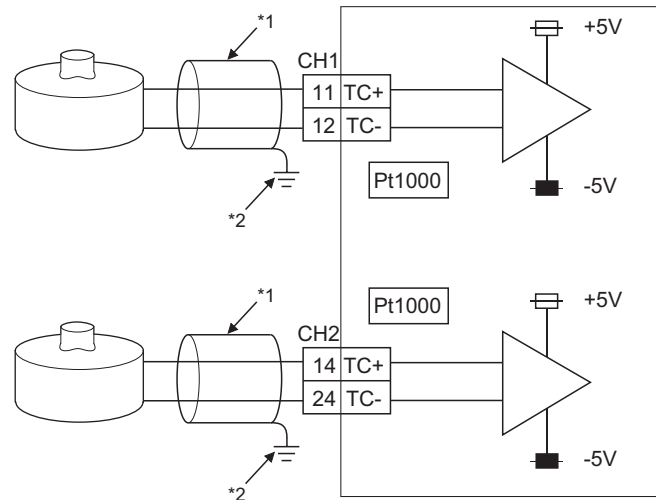


Figure 4.3

(2) Micro voltage signals



* 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.

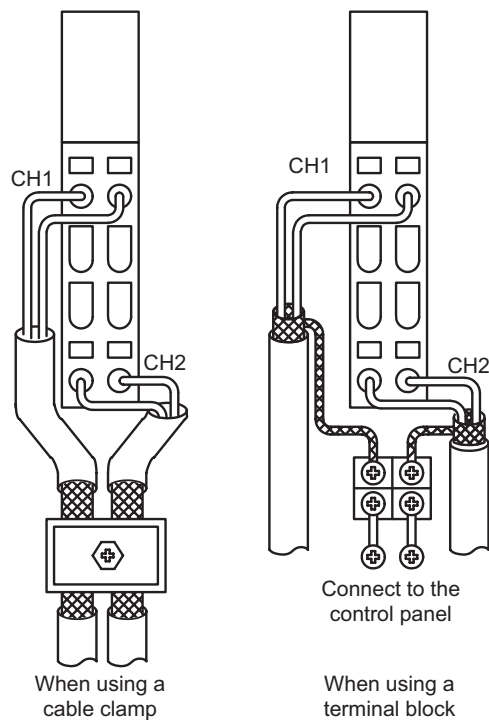


Figure 4.4

POINT

Any channel where no thermocouple, compensation conductor or micro voltage signal cable is connected must be set to "conversion disable".

If conversion of an unconnected channel is set to "Enable", disconnection is detected.

4.5 Offset/Gain Setting

This section explains the offset/gain setting.

(1) Offset/gain setting

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 a correct measured temperature value/micro voltage conversion value is not obtained at system startup or when the input type is changed.

(2) Offset and gain values

The following are the relations between the measured temperature value/ micro voltage conversion value and respective input value corrected by the offset value/gain value.

(a) Thermocouple input

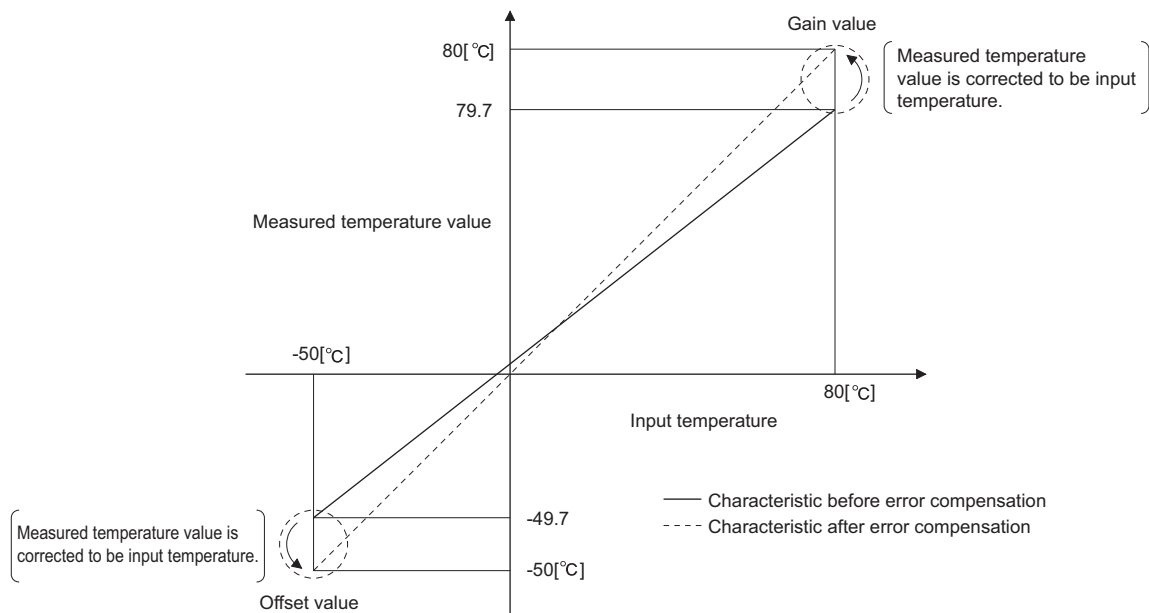


Figure 4.5

(b) micro voltage input

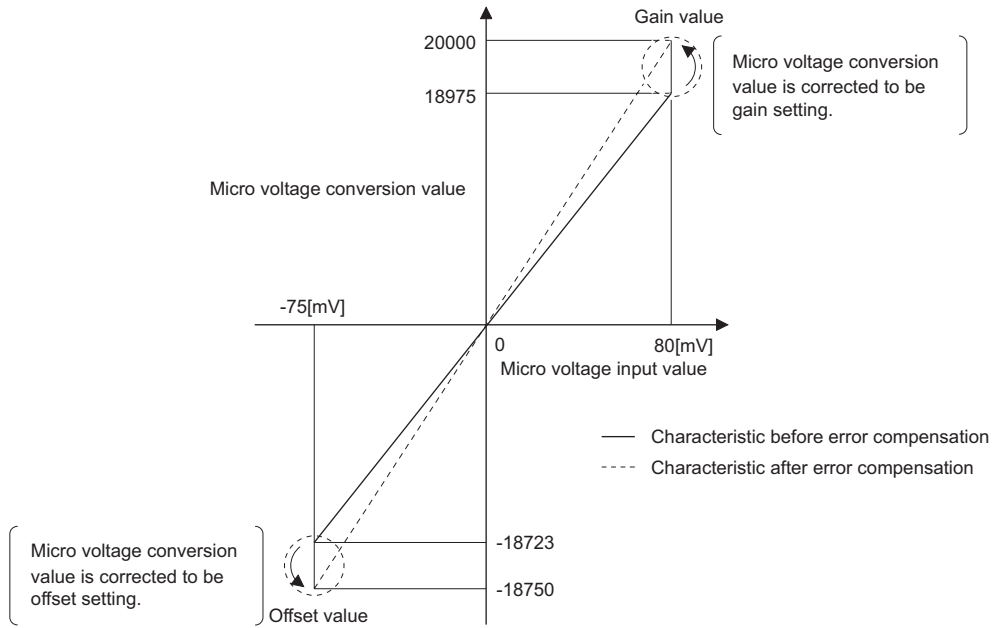


Figure 4.6

POINT

- (1) Set the offset/gain values within the guaranteed temperature range (☞ Section 3.1 (2)), or within the measurable voltage range (☞ Section 3.1 (3)). If the setting is out of range, the resolution and accuracy may not fall within the ranges of the performance specifications.
- (2) Set the offset/gain values according to the real application situation. After the setting is completed, check that the offset and gain values are set correctly.
- (3) The offset and gain values are stored into the ROM and are not erased even if the power is turned off.
- (4) Write the offset/gain values to the ROM using the User range write command (command number: B305H/3305H). Data can be written to the ROM up to 10,000 times.
To prevent accidental write to the ROM, the number of writes 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 ST1TD2.
Set correct offset and gain values again.
- (6) Higher accuracy can be obtained if the error is corrected at the minimum/maximum value of the operating range.
- (7) High accuracy can be obtained if the offset/gain setting is done after 30-minute power-up.
- (8) The offset and gain values must satisfy the following conditions. An error will occur if any of the conditions are not satisfied.
Condition 1: Within the allowable input range
Condition 2: Offset value < Gain value
Condition 3: (Gain value) - (Offset value) > 0.2 [°C] (for temperature input) or
(Gain value) - (Offset value) > 20 [μV] (for micro voltage input)
- (9) For thermocouple input, an error can be also corrected using a standard DC voltage generator instead of inputting a temperature directly to the thermocouple.

Thermo-electromotive force value of standard DC voltage generator

=


Thermocouple's thermo-electromotive force value relative to the input temperature set as offset/gain value

4.5.1 Offset/gain setting procedures

To utilize the user range setting, perform the offset/gain setting.
When the factory default is used, the offset/gain setting is not necessary.
The setting can be performed by either of the following methods.

(1) Using GX Configurator-ST

Configure the offset/gain settings in GX Configurator-ST.

 Section 5.6 Offset/Gain Setting

(2) Using commands

Follow the procedures on the next page to configure the offset/gain settings.

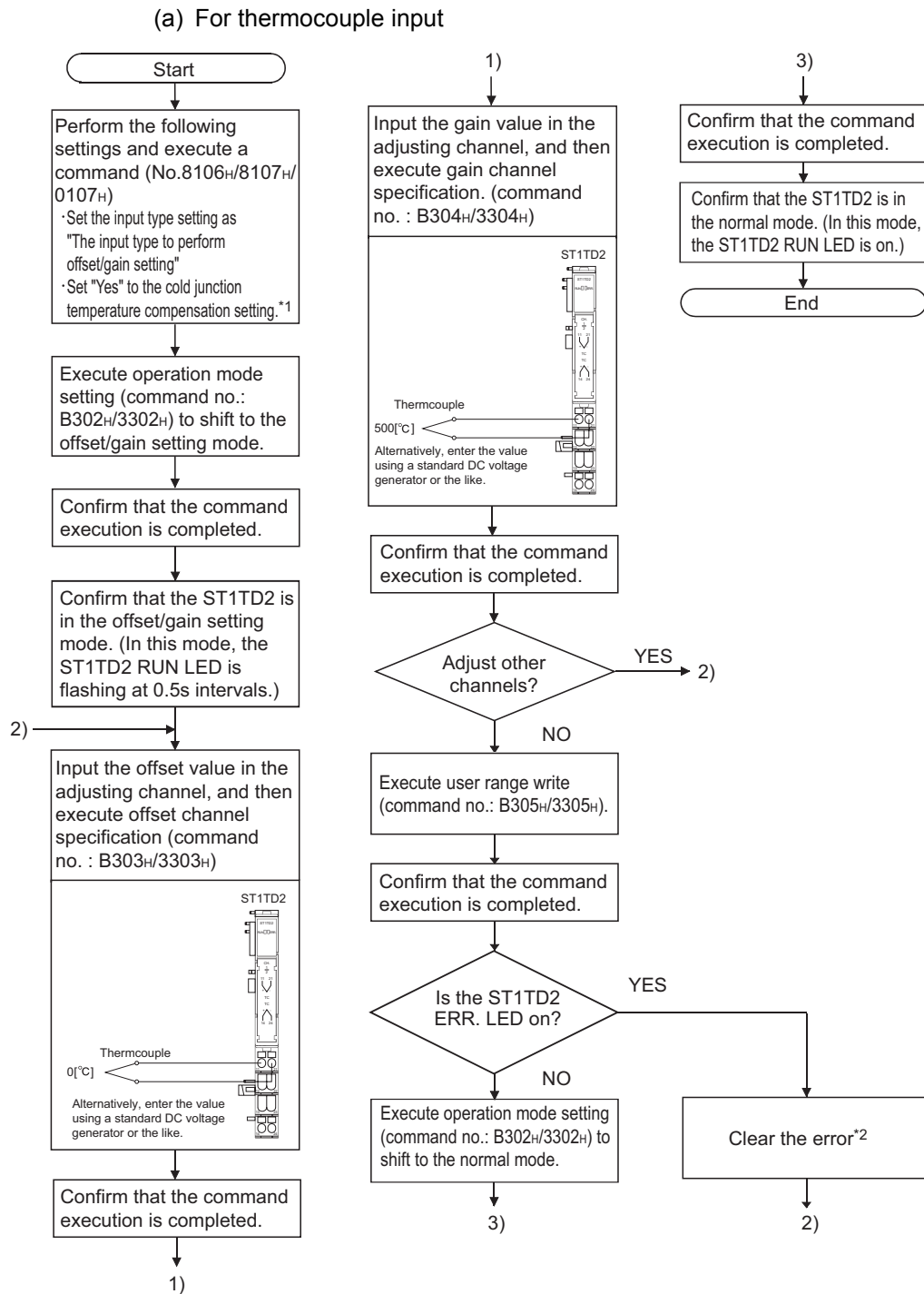


Figure 4.7 Offset/gain values for thermocouple input

* 1 When inputting a value with a standard D/C voltage generator or when actually using the module with the cold junction temperature compensation setting set to "No." set the cold junction temperature compensation setting to "No."

* 2 Errors can be cleared by either of the following methods.

- Error clear request (command No.: 8104H/0104H)
- Error reset request (RynA)

For details of the above methods, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "8.2.5 Error clear request (Command No.: 8104H/0104H)

☞ MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

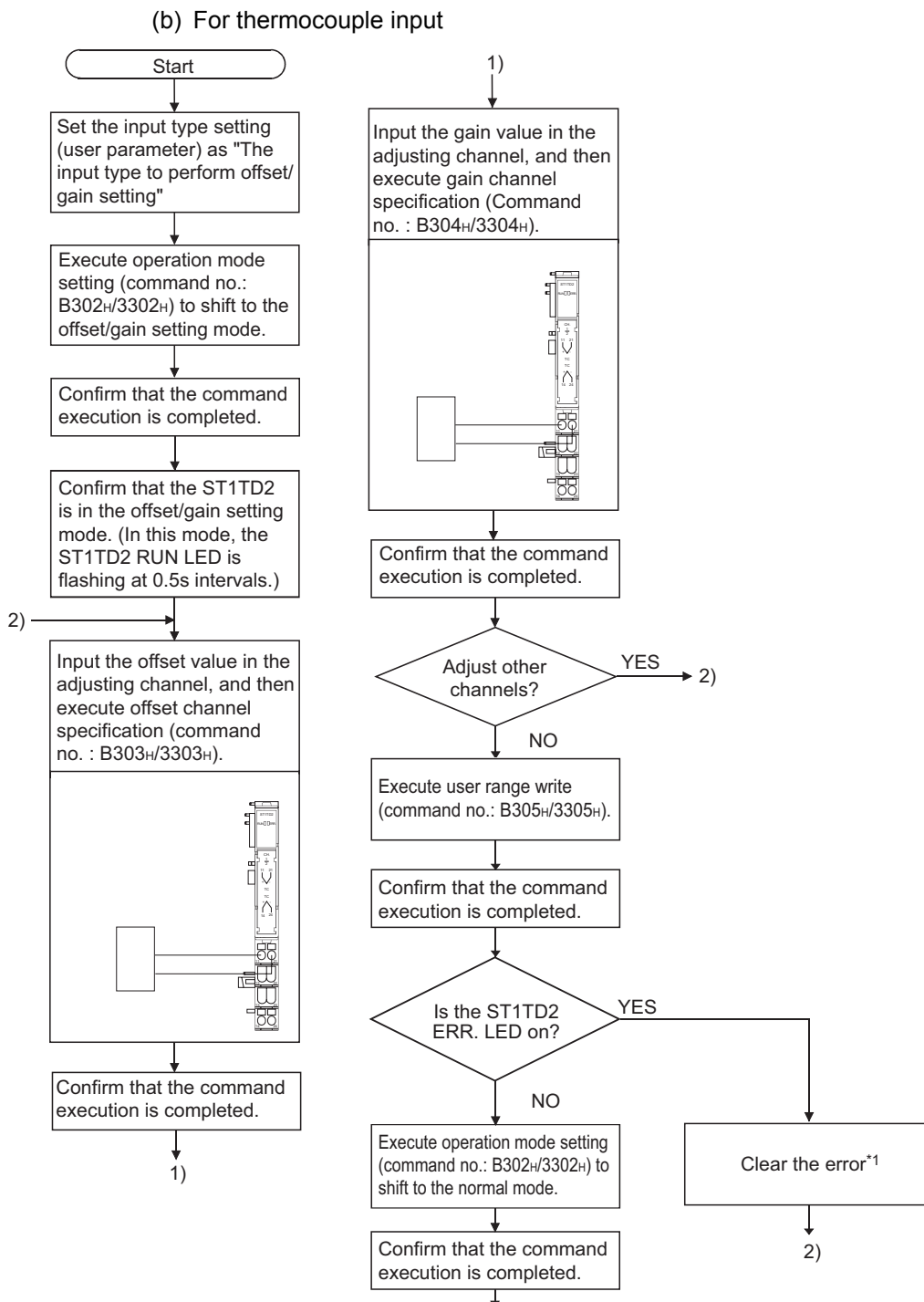


Figure 4.8 Offset/gain values for micro voltage input

* 1 Errors can be cleared by either of the following methods.

- Error clear request (command No.: 8104H/0104H)
- Error reset request (RynA)

For details of the above methods, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "8.2.5 Error clear request (Command No.: 8104H/0104H)

☞ MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

(3) Programming

A program example is given in this section, showing the mode switching (between the normal mode and the offset/gain setting mode), offset/gain setting channel specification, offset/gain value adjustment, and offset/gain value writing to the ST1TD2.

(a) Device assignments in the program example

For the devices used in common with other program examples, refer to the following.

☞ Section 6.4 (1) Device assignments in program examples

1) Device assignments in the program example

Table 4.4 Setting for Initial data write command

Device	Application	Device	Application
M1000	Other station data link status (Station No.1)	D1000 to D1004	Control data
M1001	Other station data link status (Station No.2)	D1100 to D1104	Send data (Command execution data)
M1002	Data link status of ST1H-BT (Station No.3)	D1300 to D1304	Receive data (Command result data)
M2000	Completion device	-	-
M2001	Completion status indicator device		
M3000	Offset/gain setting mode select flag		
M3001	Offset channel specification flag		
M3002	Gain channel specification flag		
M3003	User range write flag		
M3004	Normal mode select flag		
M4000	Error reset request flag		

2) Program example

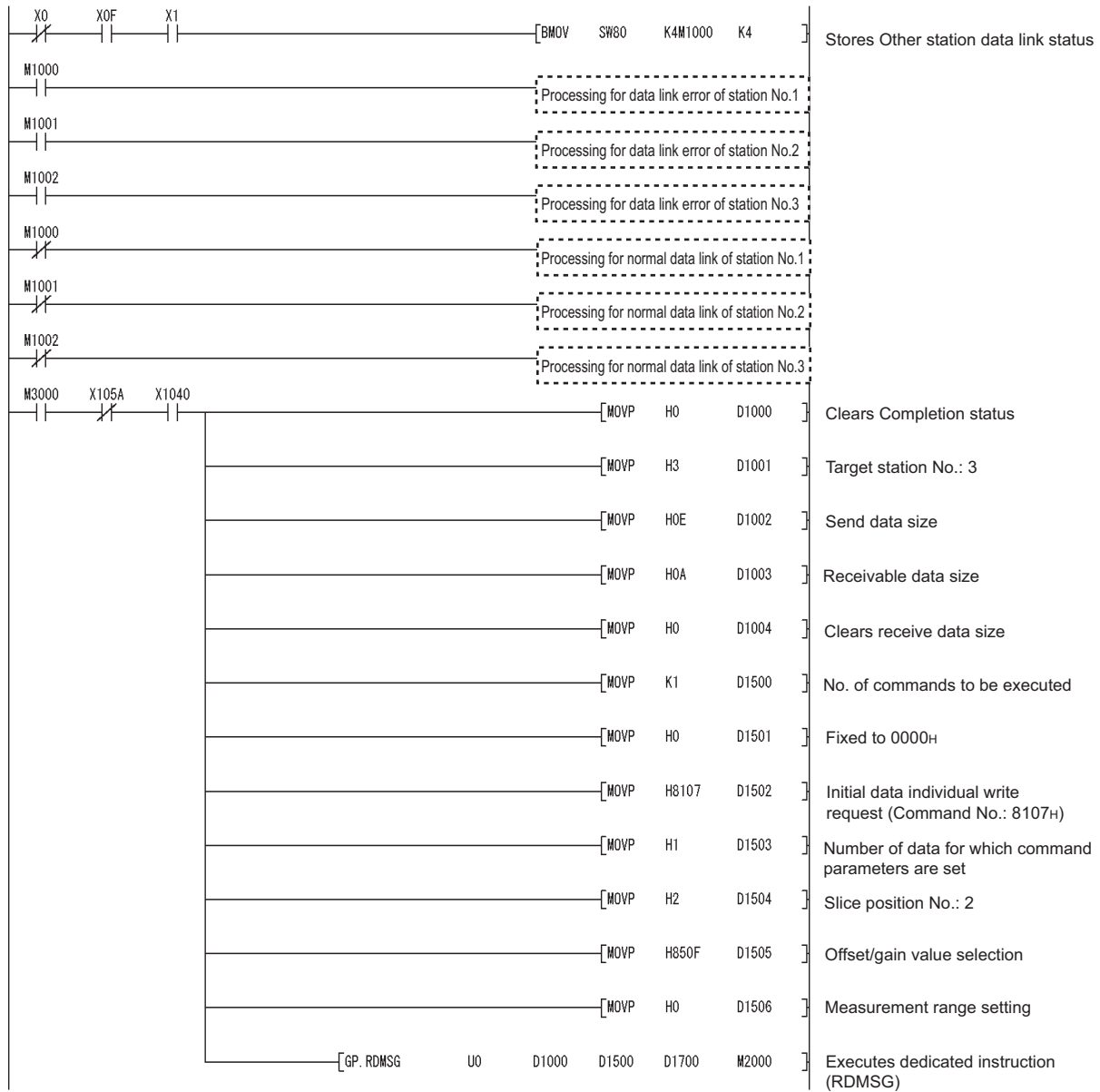


Figure 4.9 Offset/gain setting program example

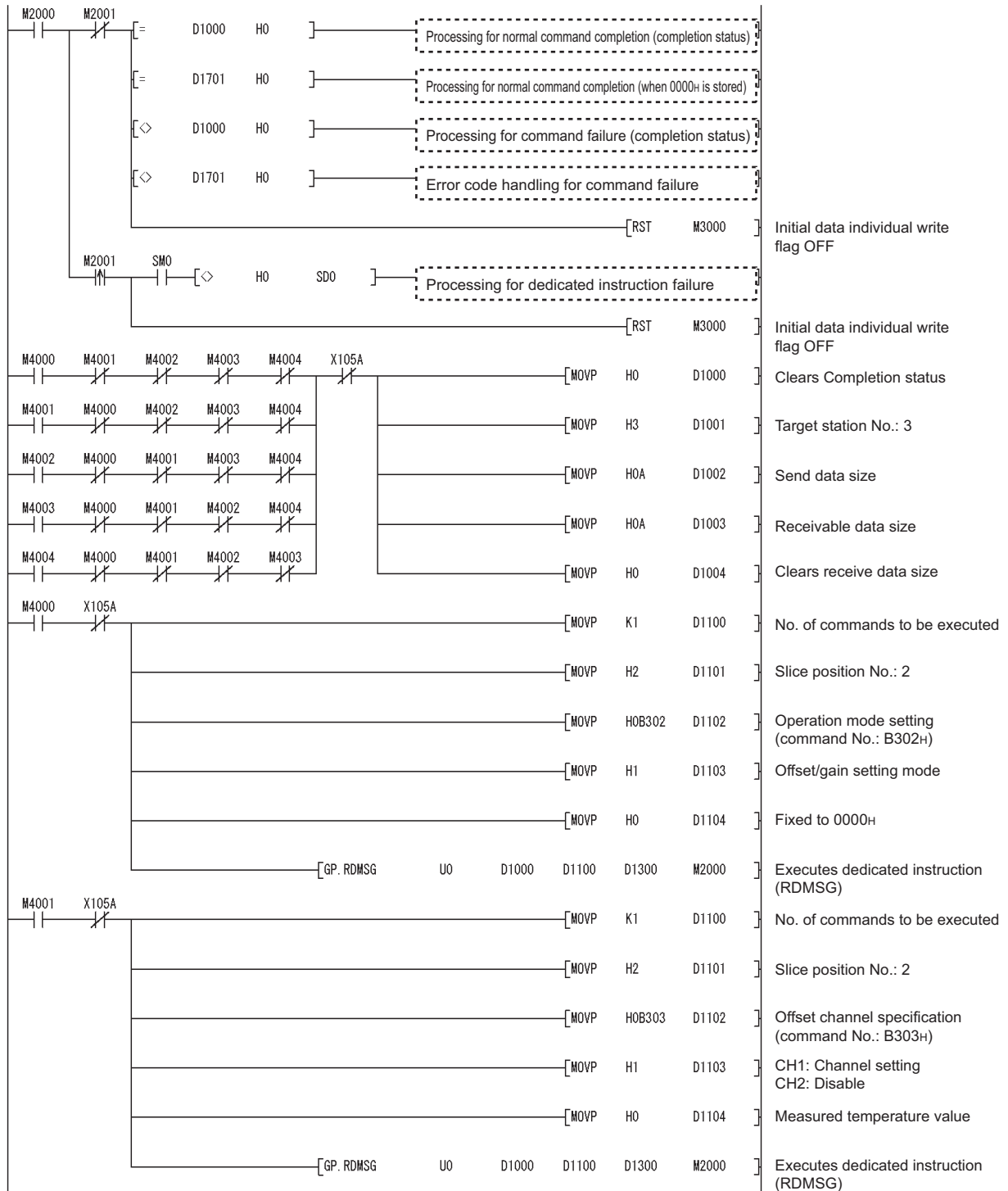


Figure 4.9 Offset/gain setting program example (Continued)

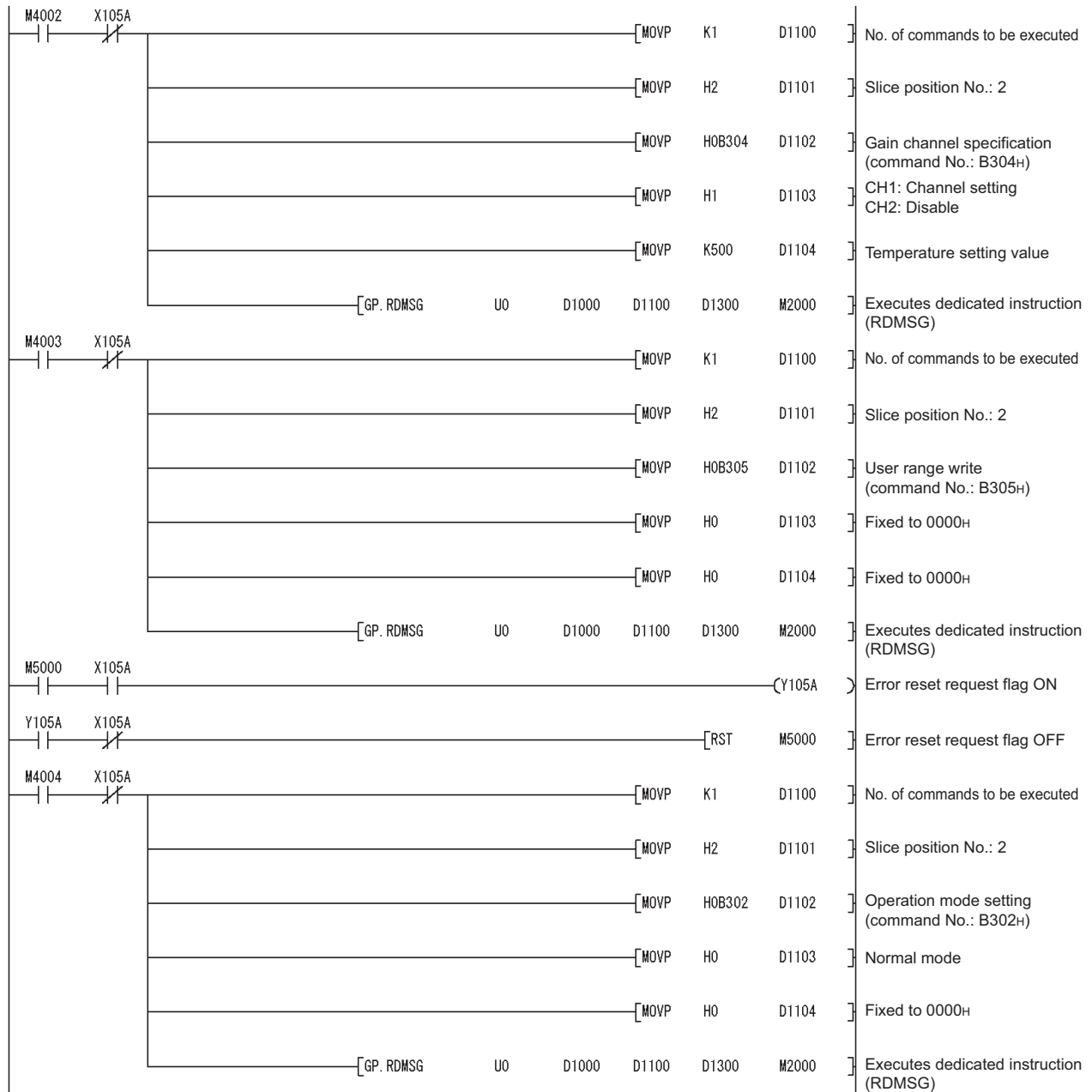


Figure 4.9 Offset/gain setting program example (Continued)

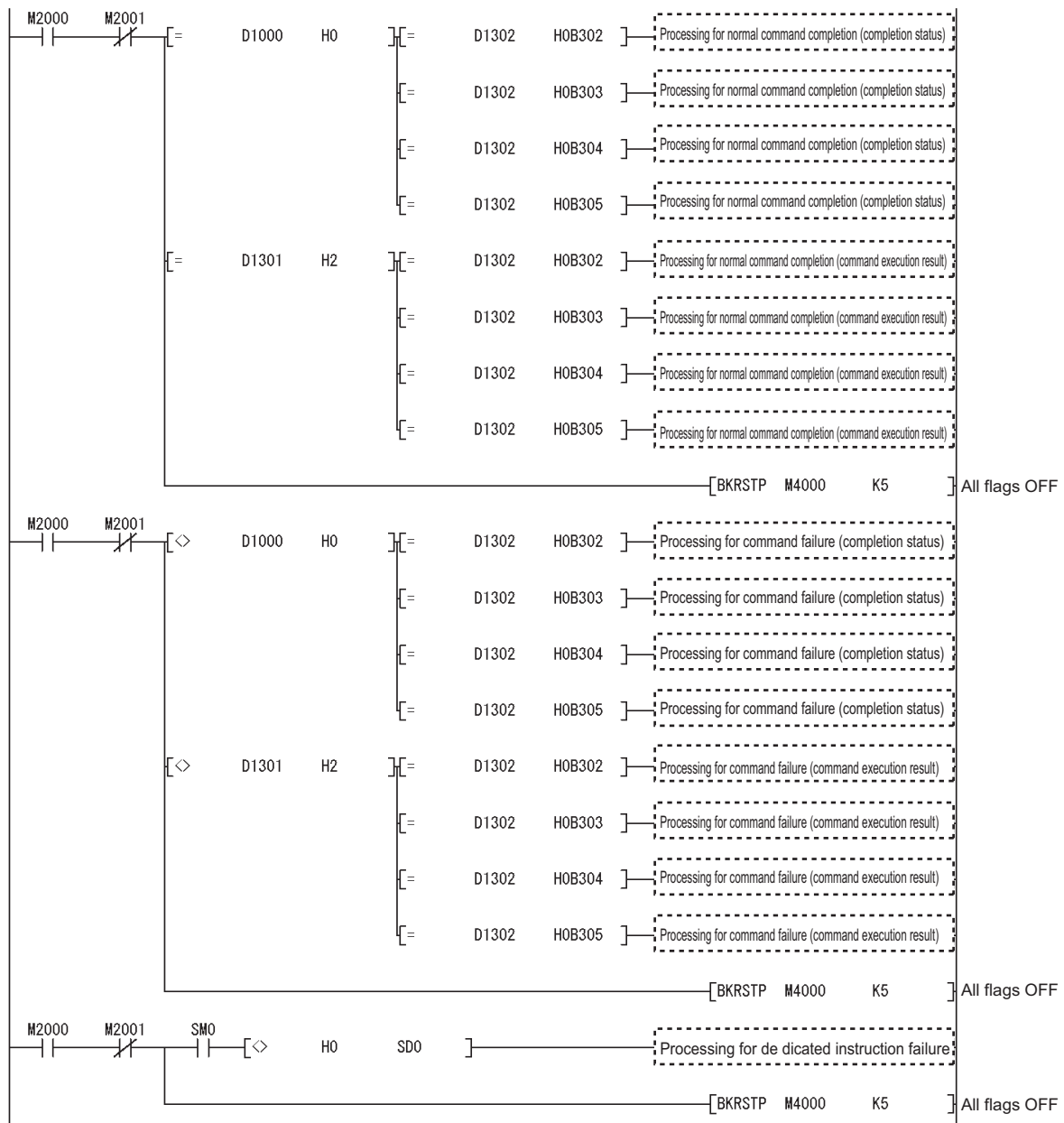


Figure 4.9 Offset/gain setting program example (Continued)

CHAPTER5 GX Configurator-ST

This chapter explains the functions of GX Configurator-ST used with the ST1TD2.
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 ST1TD2.

Table 5.1 List of GX Configurator-ST Functions Used with ST1TD2

Item	Description	Reference section
Parameter Setting	<p>(1) The following parameter items can be set on GX Configurator-ST.</p> <ul style="list-style-type: none"> •CH□ input type setting •CH□ offset/gain value selection •CH□ cold junction compensation •CH□ conversion enable/disable setting •CH□ time/number of times specification •CH□ sampling process/averaging process setting •CH□ alarm output setting •CH□ average time/average number of times setting •CH□ upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value •CH□ sensor compensation value setting <p>(2) Specify the area (RAM or ROM) where parameter setting will be registered.</p> <p>(3) Using GX Configurator-ST, parameter setting can be made while online module change is performed.</p>	Section 5.3
Input/output monitor	(1) The I/O data of the ST1TD2 can be monitored.	Section 5.4
Forced output test	(1) Test can be conducted with the values set in the <input type="checkbox"/> Bw bit output area or <input type="checkbox"/> Ew error clear area of the ST1TD2.	Section 5.5
Offset/gain setting	<p>(1) The offset and gain values of the user range can be easily set on-screen.</p> <p>(2) Using GX Configurator-ST, gain/offset setting can be made while online module change is performed.</p>	Section 5.6
Online module change	(1) A module can be replaced without the system being stopped.	CHAPTER 7

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.

1

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5.3 Parameter Setting

This section explains how to set the parameters.

(1) Mode changing

The mode needs to be changed.

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

(2) Displaying "Parameter Setting" screen

- 1) Select ST1TD2 on the "Module Information List" screen or "System Monitor" screen.
- 2) Click [Edit] → [Parameter Setting].

(3) Display/Setting Screen

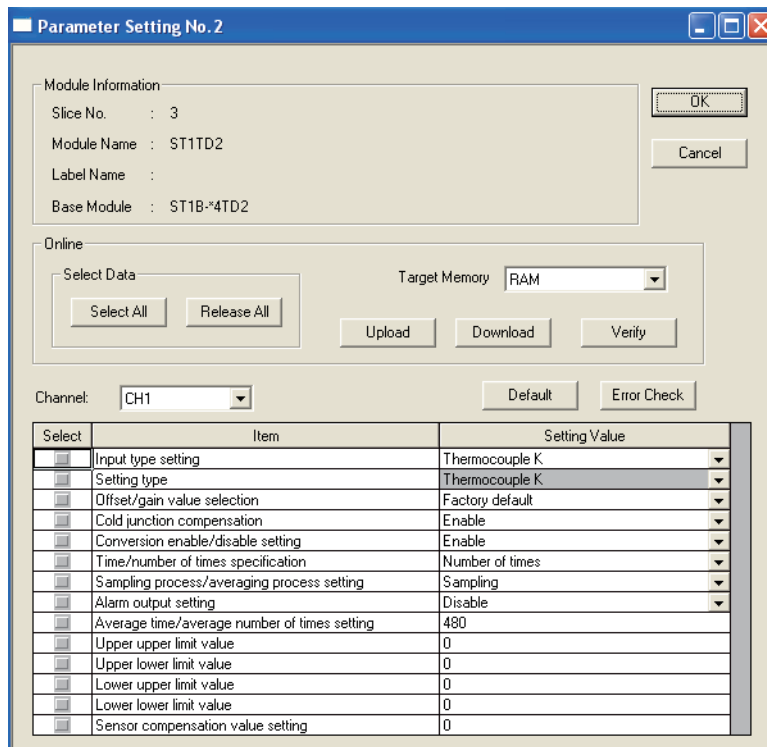


Figure 5.1

(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) Input type setting

Set the input type.

Select the input type from the following types.

Table 5.2

Input type	Measured temperature range
Thermocouple K	-270 to 1372°C
Thermocouple E	-270 to 1000°C
Thermocouple J	-210 to 1200°C
Thermocouple T	-270 to 400°C
Thermocouple B	0 to 1820°C
Thermocouple R	-50 to 1768°C
Thermocouple S	-50 to 1768°C
Thermocouple N	-270 to 1300°C
Micro voltage input	-80 to 80mV

2) Setting type

The input type setting currently valid is stored. Setting is not allowed.

3) Offset/gain value selection

Set the factory default or user range setting.

4) Cold junction compensation

Set whether cold junction temperature compensation is enable or disable.

Disable : Cold junction temperature compensation disabled

Enable : Cold junction temperature compensation enabled

(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) Time/number of times specification

Specify the time/number of times when the averaging processing is selected.

3) Sampling process/averaging process setting

Specify the sampling processing or averaging processing.

4) Alarm output setting

Set whether alarm output processing is performed or not.

Disable : Alarm output processing not performed

Enable : Alarm output processing performed

5) Average time/average number of times setting

Set the average time or average number of times.

Their setting ranges are indicated below.

Average number of times: 4 to 500 times

Average time: 480 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 input type is shown below.

In the case of thermocouple input, set the value in units of 0.1°C.

[Example] To set to 0.3°C Enter "3".

Table 5.3

Input type	Setting range (Accuracy guarantee range)
Thermocouple K	-2700 to 13720 (-2000 to 12000)
Thermocouple E	-2700 to 10000 (-2000 to 9000)
Thermocouple J	-2100 to 12000 (-400 to 7500)
Thermocouple T	-2700 to 4000 (-2000 to 3500)
Thermocouple B	-500 to 17680 (0 to 16000)
Thermocouple R	-500 to 17680 (0 to 16000)
Thermocouple S	-2700 to 13000 (-2000 to 12500)
Thermocouple N	-2700 to 13000 (-2000 to 12500)
Micro voltage input	-21000 to 21000 (-20000 to 20000)

7) Sensor compensation value setting

Set the sensor compensation value.

The setting range of the sensor compensation value is -500 to 500.

In the case of thermocouple input, set the value in units of 0.1°C.

[Example] To set to 0.3°C Enter "3".

The setting for the micro voltage input is performed in increments of 4μV/digit.

[Example] When the micro voltage conversion value is 10003 at 40mV input

..... 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 ST1TD2 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 button.

When writing the parameters of multiple channels to the ST1TD2, 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 ST1TD2.

(1) Mode changing

Click [Mode] → [Diagnosis].

(2) Displaying "Input/Output Monitor" screen

- 1) Select ST1TD2 on the "System Monitor" screen.
- 2) Click the button.

Monitor starts as soon as the "Input/Output Monitor" screen is displayed.

(3) Display/Setting Screen

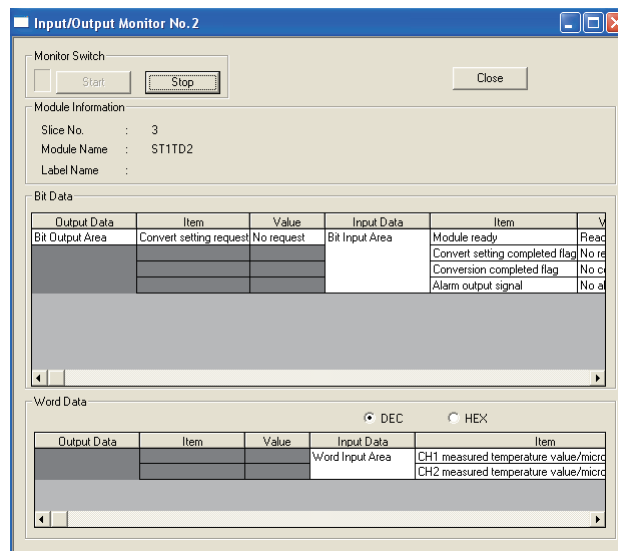


Figure 5.2

(4) Display/setting details

(a) Bit Data

Table 5.4 Bit Data list

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

(b) Word Data

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

Table 5.5 Word Data list

Input/Output Data	Item	Description
Word Input Area	CH□ measured temperature value/micro voltage value	The value of <input type="text" value="Wr.n"/> , <input type="text" value="Wr.n+1"/> CH□ measured temperature value/micro voltage 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 ST1TD2.

(1) Mode changing

Mode changing → [Diagnosis].

(2) Displaying "Forced Output Test" screen

- 1) Select ST1TD2 on the "System Monitor" screen.
- 2) Click the button.

(3) Display/Setting Screen

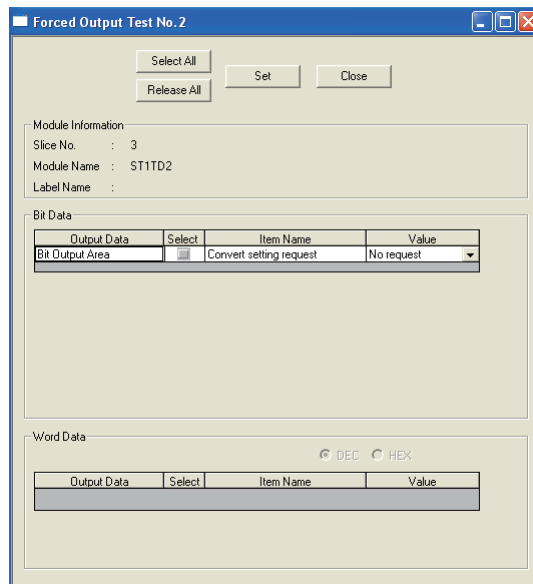


Figure 5.3

(4) Display/setting details

(a) Bit Data

Table 5.6 Bit Data list

Output Data	Item	Description
Bit Output Area	Convert setting request	The setting of <input type="text" value="Bw.n+1"/> Convert setting request can be changed.
Error Clear Area	Error clear request	The setting of <input type="text" value="Ew.n"/> Error clear request can be changed.

(b) Word Data

Unavailable for the ST1TD2.

(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 button.*

Clicking the 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 appears. Click the 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.

5.6 Offset/Gain Setting

This section explains how to make offset/gain setting.

(1) Input type setting

Set the input type 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 ST1TD2 on the "System Monitor" screen.

2) Click the button.*¹

* 1 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 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 button to switch to the offset/gain setting mode.

After being switched to the offset/gain setting mode, the RUN LED of ST1TD2 flashes (0.5s interval) and the ST1TD2 stops.

(4) Display/Setting Screen

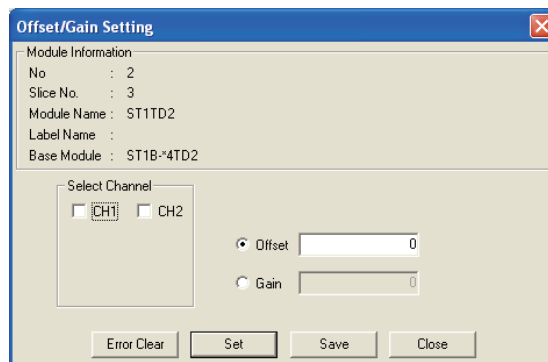


Figure 5.4

(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 ST1TD2, perform it only once at the end.

(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 or voltage setting value, which suits the input, and then click the button.
 - The setting for the temperature setting value is performed in units of 0.1°C.
[Example] To set to 0.3°C Enter "3".
 - The setting for the voltage setting value is performed in units of 0.01mV.
[Example] To set to 3mV Enter "300".

Setting range on each input type is shown below.

Table 5.7

Input type	Setting range (Accuracy guarantee range)
Thermocouple K	-2700 to 13720 (-2000 to 12000)
Thermocouple E	-2700 to 10000 (-2000 to 9000)
Thermocouple J	-2100 to 12000 (-400 to 7500)
Thermocouple T	-2700 to 4000 (-2000 to 3500)
Thermocouple B	0 to 18200 (6000 to 17000)
Thermocouple R	-500 to 17680 (0 to 16000)
Thermocouple S	-500 to 17680 (0 to 16000)
Thermocouple N	-2700 to 13000 (-2000 to 12500)
Micro voltage input	-8000 to 8000 (-8000 to 8000)

(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 or voltage setting value, which suits the input, and then click the button.

- The setting for the temperature setting value is performed in units of 0.1°C.

[Example] To set to 0.3°CEnter "3".

- The setting for the voltage setting value is performed in units of 0.01mV.
- [Example] To set to 3mV Enter "300".

Setting range on each input type is shown below.

Table 5.8

Input type	Setting range (Accuracy guarantee range)
Thermocouple K	-2700 to 13720 (-2000 to 12000)
Thermocouple E	-2700 to 10000 (-2000 to 9000)
Thermocouple J	-2100 to 12000 (-400 to 7500)
Thermocouple T	-2700 to 4000 (-2000 to 3500)
Thermocouple B	0 to 18200 (6000 to 17000)
Thermocouple R	-500 to 17680 (0 to 16000)
Thermocouple S	-500 to 17680 (0 to 16000)
Thermocouple N	-2700 to 13000 (-2000 to 12500)
Micro voltage input	-8000 to 8000 (-8000 to 8000)

(c) Offset/gain setting writing

Click the button.

The offset/gain settings for all channels are written to the ST1TD2.

POINT

- (1) Clicking the 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[°C] (for temperature input)
(Error code : 410□H)
- (Gain value) - (Offset value) = 20[μV] (for micro voltage input)
(Error code : 410□H)

In this case, click the 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 button to change to the normal mode.

When the module is put in the normal mode, the RUN LED of the ST1TD2 turns on.

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

CHAPTER6 PROGRAMMING

This chapter describes example programs available when the QJ61BT11N is used as a master station.

Remark

For details of the QJ61BT11N, refer to the following manual.

 CC-Link System Master/Local module User's Manual

6.1 Programming Procedure

Create a program for executing temperature or micro voltage conversion of the ST1TD2 according to the following procedure.

When applying any of the program examples introduced in this chapter to the actual system, verify the applicability and confirm that no problems will occur in the system control.

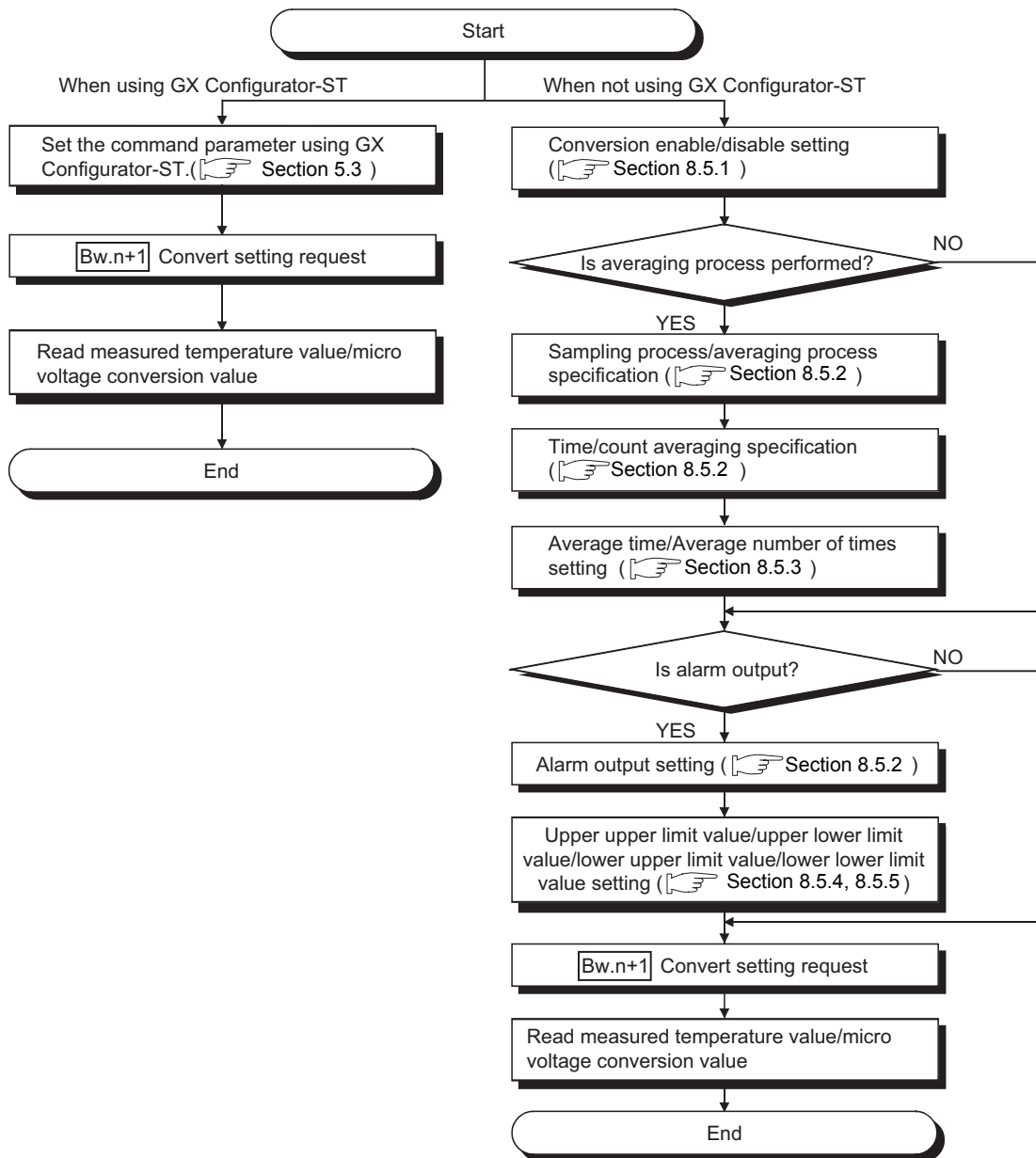



Figure 6.1 Programming procedure

POINT

- (1) With one dedicated instruction (RDMSG), up to eight commands can be simultaneously executed.
However, the following commands cannot be executed with any other command at the same time.
Initial data batch write request (command No.: 8106H)
Initial data individual write request (command No.: 8107H/0107H)
If executed simultaneously, an error will occur.
 - (2) The sizes of **[Cw]** Command execution area and **[Cr]** Command result area vary depending on the command.
 - (3) In the following cases, commands cannot be executed. Therefore, execute the command after completion of the processing.
 - The head module is executing the self-diagnostics function.
 - A slice module is being replaced online.
 - Another command is in execution. (The dedicated instruction (RDMSG) is not completed.)
 - (4) For online module change, advance preparation may be required depending on the operating conditions. For details, refer to the following.
 Section 7.2 Preparations for Online Module Change
-

6.2 System Configuration Example

The following system example is used for the programs described in this chapter.

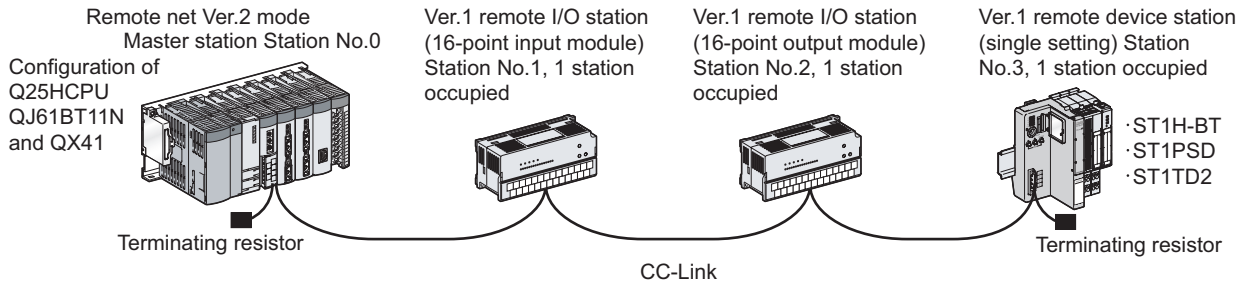


Figure 6.2 System configuration example

(1) System configuration of master station

Table 6.1 System configuration of master station

Module	Input signal	Output signal
Q25HCPU	-	-
QJ61BT11N	X00 to X1F	Y00 to 1F
QX41	X20 to X3F	-

(2) MELSEC-ST system configuration

Table 6.2 I/O points sheet

Slice position No.	Start slice No. (No. of occupied slices)	Module name	Br.n	Bw.n	Wr.n	Ww.n	5V DC internal current consumption (Total)	24V DC current (Total)	Slot width (Total)
	0(2)	ST1H-BT	0	0	0	0	0.410A(0.410A)	0A(0A)	-
	2(1)	ST1PSD	0	0	0	0	-	-	25.2mm (25.2mm)
	3(2)	ST1TD2	4	4	2	0	0.080A(0.490A)	*1	12.6mm (37.8mm)
Total			4 (252 bits or less)*2	4 (252 bits or less)*2	2 (52 words or less)	0 (52 words or less)	-	-	37.8mm (850mm or more)

* 1 The 24V DC current varies depending on the external device connected to each slice module. Check the current consumption of external devices connected to slice modules, and calculate the total value. (MELSEC-ST System User's Manual)

* 2 The number of available points reduces by two points for each additional power distribution module.

6.3 Settings and Communication Data

After determining the system configuration, set parameters of the programmable controller CPU of the master station.

(1) Setting PLC parameters (I/O assignment)

Connect GX Developer to the programmable controller CPU of the master station, and set PLC parameters as shown below.

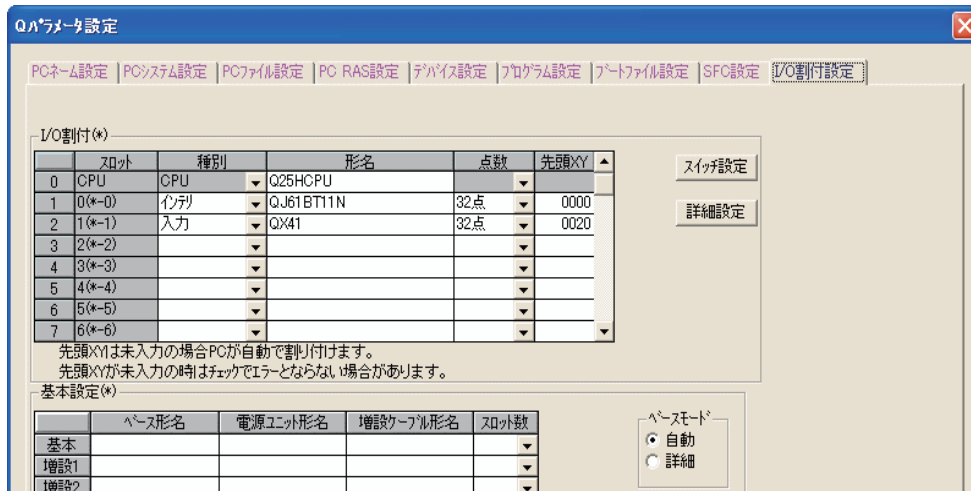


Figure 6.3 I/O assignment

(2) Network parameters

Connect GX Developer to the programmable controller CPU of the master station, and set network parameters as shown below.

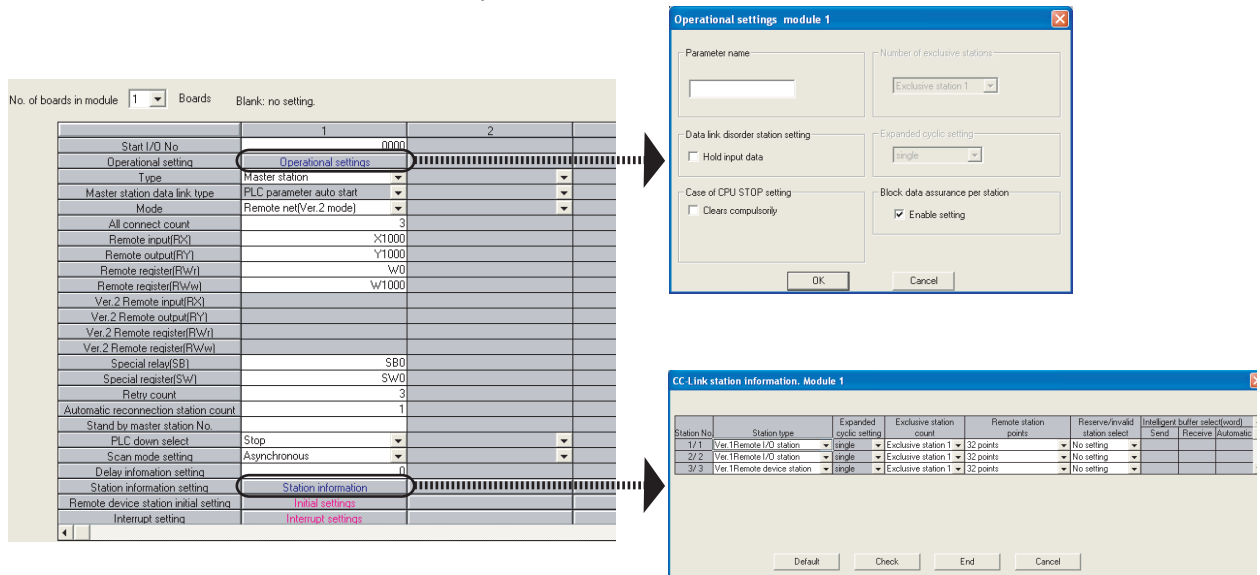


Figure 6.4 Setting network parameters

(3) I/O data assignment

The following are I/O data assignment results for the system configuration example in this chapter.

The I/O points sheet is useful for I/O data assignment.

For details of the I/O data assignment sheet, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "Appendix 3.2 Input data assignment sheet, Appendix 3.3 Output data assignment sheet"

(a) "Br" Bit input area (Remote input (RX))

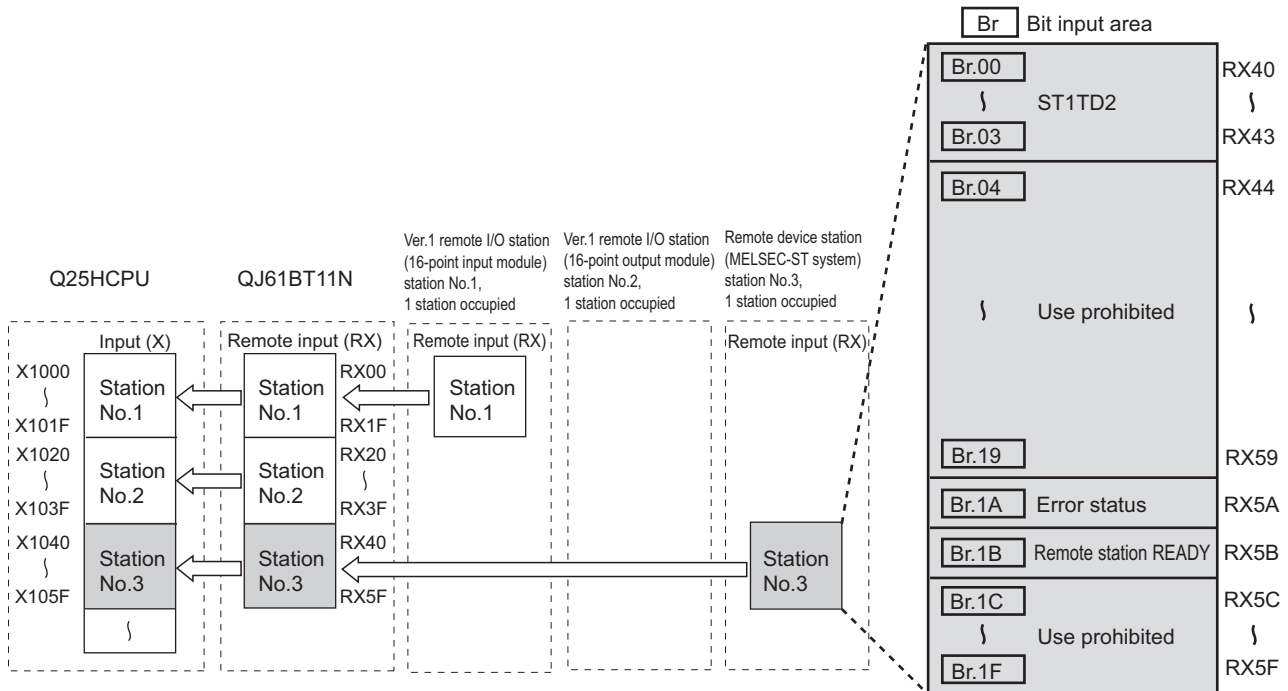


Figure 6.5 "Br" Bit input area (remote input (RX))

Table 6.3 "Br" Bit input area assignment sheet

Master station		Remote device station (MELSEC-ST system)			
Device	Remote input (RX)	Slice position No.	Module name	Br.n	Data name
X1040	RX40	2	ST1TD2	Br.00	Module READY
X1041	RX41			Br.01	Convert setting completion flag
X1042	RX42			Br.02	Conversion complete flag
X1043	RX43			Br.03	Alarm output signal
X1044	RX44			-	-
to		to			
X1059	RX59	-	-	Br.19	Use prohibited
X105A	RX5A	-	-	Br.1A	Error status *1
X105B	RX5B	-	-	Br.1B	Remote station READY *1
X105C	RX5C	-	-	Br.1C	Use prohibited
to		to			
X105F	RX5F	-	-	Br.1F	Use prohibited

* 1 Error status (RXnA) and Remote station READY (RXnB) are remote input areas of the head module. For details of remote input, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

(b) "Bw" Bit output area (Remote output (RY))

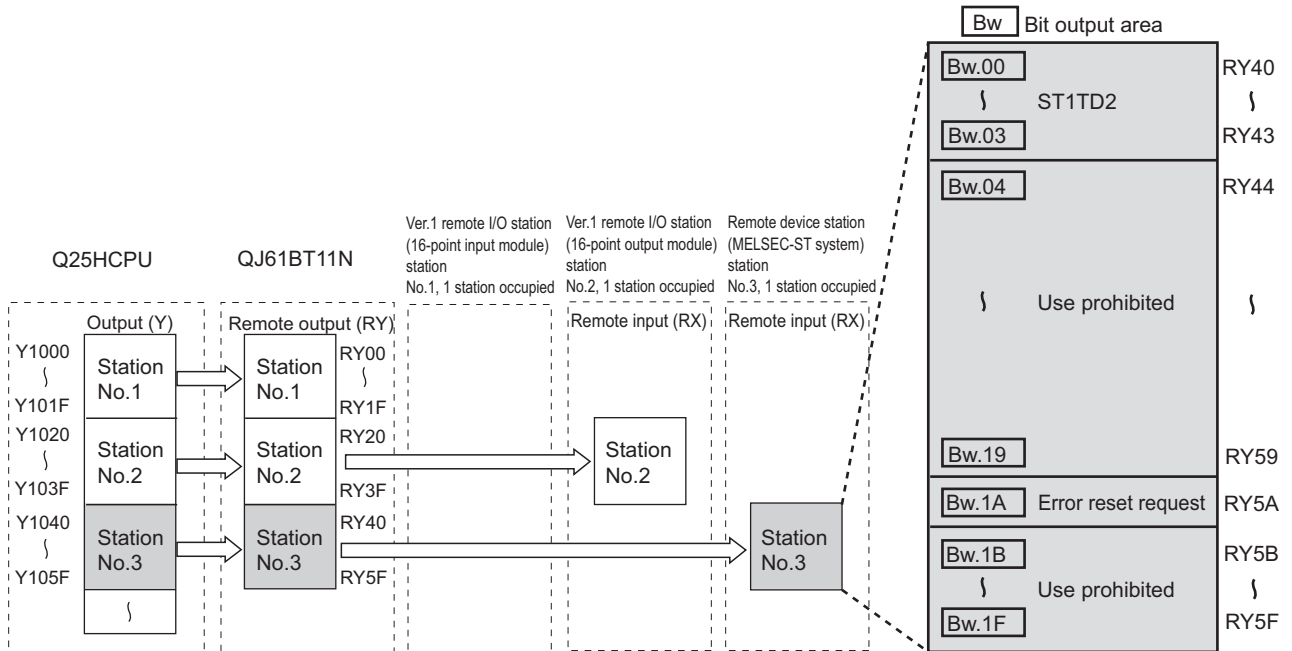


Figure 6.6 "Bw" Bit output area (Remote output (RY))

Table 6.4 "Bw" Bit output area assignment sheet

Master station		Remote device station (MELSEC-ST system)			
Device	Remote output (RY)	Slice position No.	Module name	Bw.n	Data name
Y1040	RY40	2	ST1TD2	Bw.00	Use prohibited
Y1041	RY41			Bw.01	Convert setting request
Y1042	RY42			Bw.02	Use prohibited
Y1043	RY43			Bw.03	Use prohibited
Y1044	RY44	-	-	Bw.04	Use prohibited
to		to			
Y1059	RY59	-	-	Bw.19	Use prohibited
Y105A	RY5A	-	-	Bw.1A	Error reset request ^{*1}
Y105B	RY5B	-	-	Bw.1B	Use prohibited
to		to			
Y105F	RY5F	-	-	Bw.1F	Use prohibited

* 1 Error reset request (RYnA) is a remote output area of the head module. For details of Error reset request (RYnA), refer to the following.

👉 MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

(c) "Wr" Word input area (remote input (RWr))

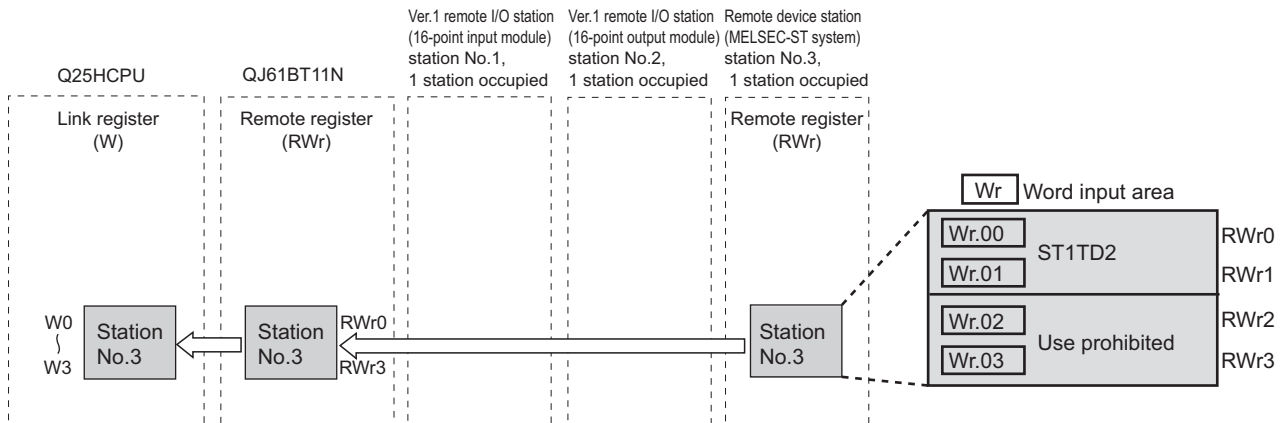


Figure 6.7 "Wr" Word input area (remote input (RWr))

Table 6.5 "Wr" Word input area assignment sheet

Master station		Remote device station (MELSEC-ST system)			
Device	Remote register (RWr)	Slice position No.	Module name	Wr.n	Data name
W1000	RWr0	2	ST1TD2	Wr.00	CH1 measured temperature value/micro voltage conversion value
W1001	RWr1			Wr.01	CH2 measured temperature value/micro voltage conversion value
W1002	RWr2	-	-	Wr.02	Use prohibited
W1003	RWr3			Wr.03	Use prohibited

6.4 Program Examples

A program example is shown below.

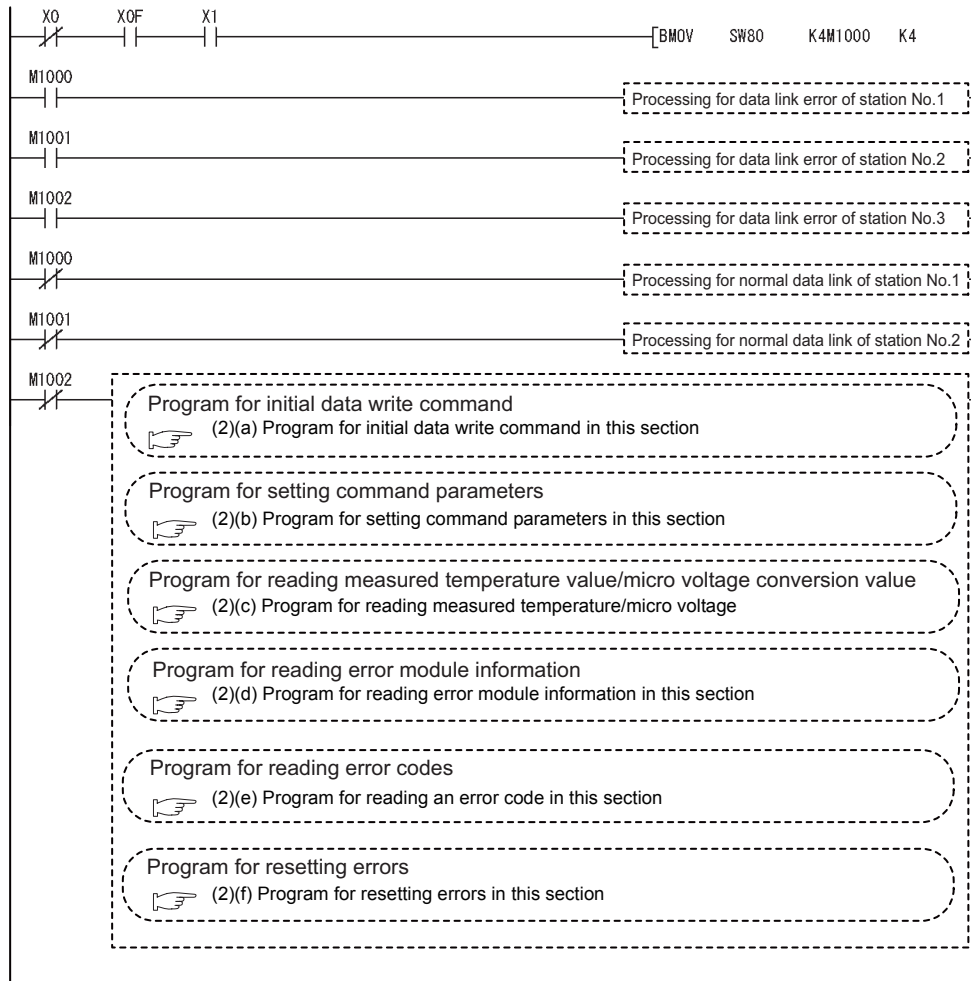



Figure 6.8 Program example

(1) Device assignments in program examples

The devices used common to the program examples (2) in this section and later are shown below.

For devices used for each program example, refer to the following.

 (2) Program examples in this section

(a) Special relay (SM) and special register (SD)

Table 6.6 Special relay (SM) and special register (SD)

Device	Application	Device	Application
SM0	Diagnostic error	SD0	Diagnostic error

(b) Devices used by the QJ61BT11N (master station)

Table 6.7 Devices used by the QJ61BT11N (master station)

Device	Application	Device	Application
X00	Module error		
X01	Own data link status		-
X0F	Module READY		
SB0 to SB1FF	Link special relay (SB) of the QJ61BT11N	SW0 to SW1FF	Link special register (SW) of the QJ61BT11N

(c) Devices used by the user

Table 6.8 Devices for checking Other station data link status

Device	Application	Device	Application
M1000	Other station data link status (station No.1)	M1002	Data link status of the ST1H-BT (station No.3)
M1001	Other station data link status (station No.2)		-

(2) Program examples

(a) Program for initial data write command

Execute the Initial data individual write request (command No.: 8107H) with the dedicated instruction (RDMSG) of the master station to set command parameters.

1) Setting details of command parameters

In this program, the following parameters are set.

Table 6.9 Setting details of command parameters

Item		Setting	Reference section
ST1TD2	CH1 Offset/gain value selection	User range setting	Section 8.3.2
	CH2 Offset/gain value selection	Factory default	
	CH1 Cold junction compensation	Yes	
	CH2 Cold junction compensation	Yes	

2) Device assignments in the program example

Table 6.10 Device assignments in the program example

Device	Application	Device	Application
M2010	Completion device	D1000 to D1004	Control data
M2011	Completion status indicator device	D1500 to D1506	Send data (execution data of the command)
M3000	Initial data individual write flag	D1700 to D1704	Receive data (result data of the command)

3) Program example

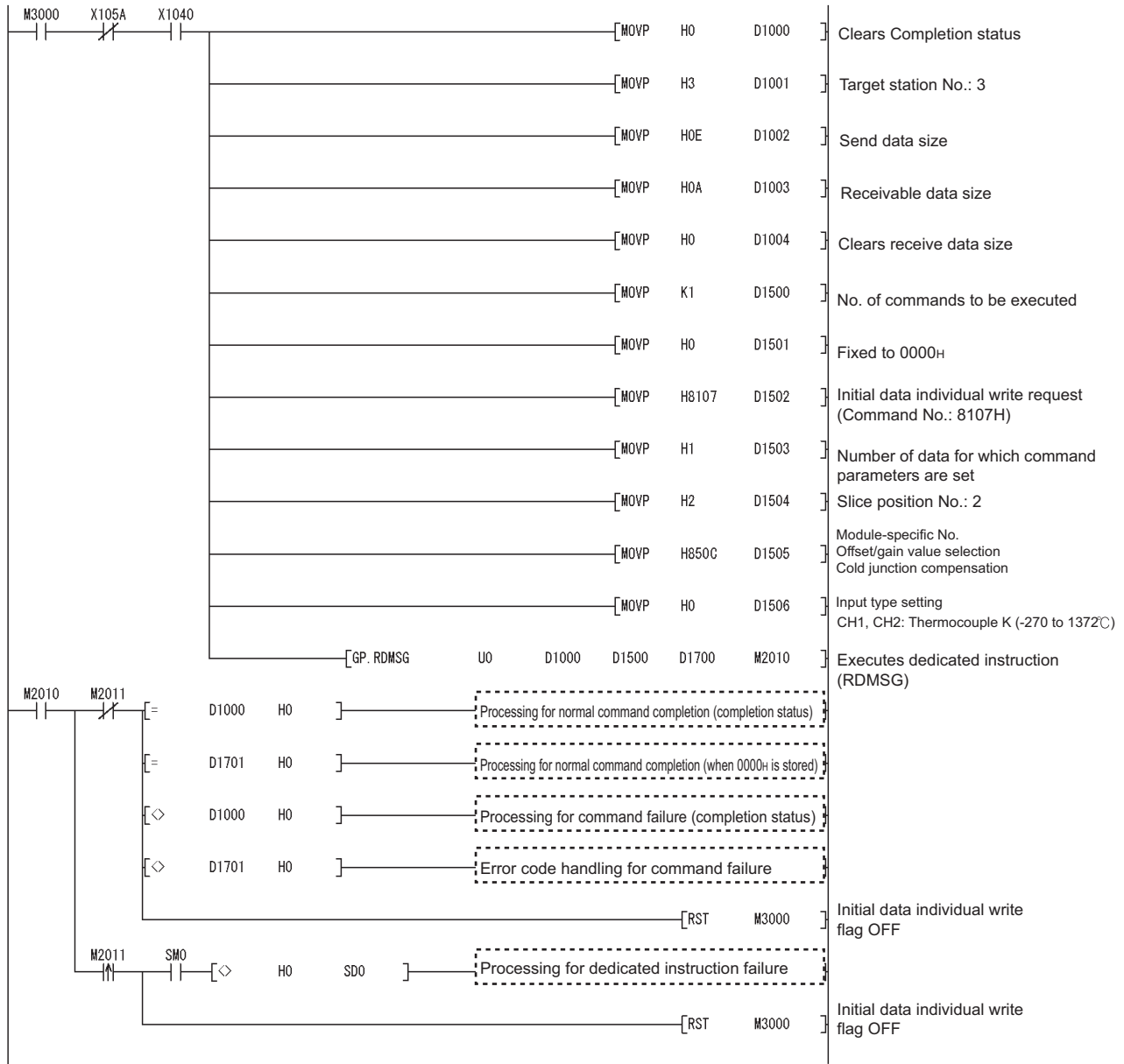


Figure 6.9 Program for the initial data write command

(b) Program for setting command parameters
Execute a command of the ST1TD2 with the dedicated instruction (RDMSG) of the master station to set command parameters.

1) Setting details of command parameters

In this program, the following command parameters are set.

Table 6.11 Setting details of command parameters

	Item	Setting	Reference section
ST1TD2	CH1 Conversion enable/disable setting	Conversion enabled	Section 8.5.1
	CH2 Conversion enable/disable setting	Conversion enabled	
	CH1 Time/number of times specification, Sampling process/averaging process setting	Time/number of times specification: Time averaging	Section 8.5.2
		Sampling process/averaging process setting: Averaging process	
	CH2 Time/number of times specification, Sampling process/averaging process setting	Time/number of times specification: Number of times	Section 8.5.2
		Sampling process/averaging process setting: Sampling process	
	CH1 Average time/average number of times setting	500ms	Section 8.5.3
	CH2 Average time/average number of times setting	No setting	
	CH1 Alarm output setting	Alarm output enabled	Section 8.5.2
	CH2 Alarm output setting	No alarm output	
	CH1 Upper upper limit value, Upper lower limit value	Upper upper limit value: 300°C	Section 8.5.4
		Upper lower limit value: 300°C	
CH2 Upper upper limit value, Upper lower limit value	No setting	Section 8.5.5	
CH1 Lower upper limit value, Lower lower limit value	Lower upper limit value: 10°C		
	Lower lower limit value: 10°C		
CH2 Lower upper limit value, Lower lower limit value	No setting		
	CH1 Sensor compensation value setting	Thermocouple input: 2 Micro voltage input: No setting	Section 8.5.6
	CH2 Sensor compensation value setting	Thermocouple input: No setting Micro voltage input: No setting	

2) Device assignments in the program example

Table 6.12 Device assignments in the program example

Device	Application	Device	Application
M2020	Completion device (for simultaneous execution of multiple commands)	D1000 to D1004	Control data
M2021	Completion status indicator device (for simultaneous execution of multiple commands)	D1100 to D1104	Send data (for separate execution of each command)
M2030	Completion device (for separate execution of each command)		
M2031	Completion status indicator device (for separate execution of each command)		
M4000	Conversion enable/disable setting write flag	D1300 to D1304	Receive data (for separate execution of each command)
M4001	Operation condition specification value write flag	D2000 to D2024	Send data (for simultaneous execution of multiple commands)
M4002	Time/number of times setting write flag	D3000 to D3024	Receive data (for simultaneous execution of multiple commands)
M4003	CH1 upper upper limit value/upper lower limit value setting write flag	-	-
M4004	CH1 lower upper limit value/lower lower limit value setting write flag		
M4005	Command parameter write flag (for simultaneous execution of multiple commands)		

3) Program example (when multiple commands are simultaneously executed)
 The following is a program example for simultaneous execution of multiple commands.

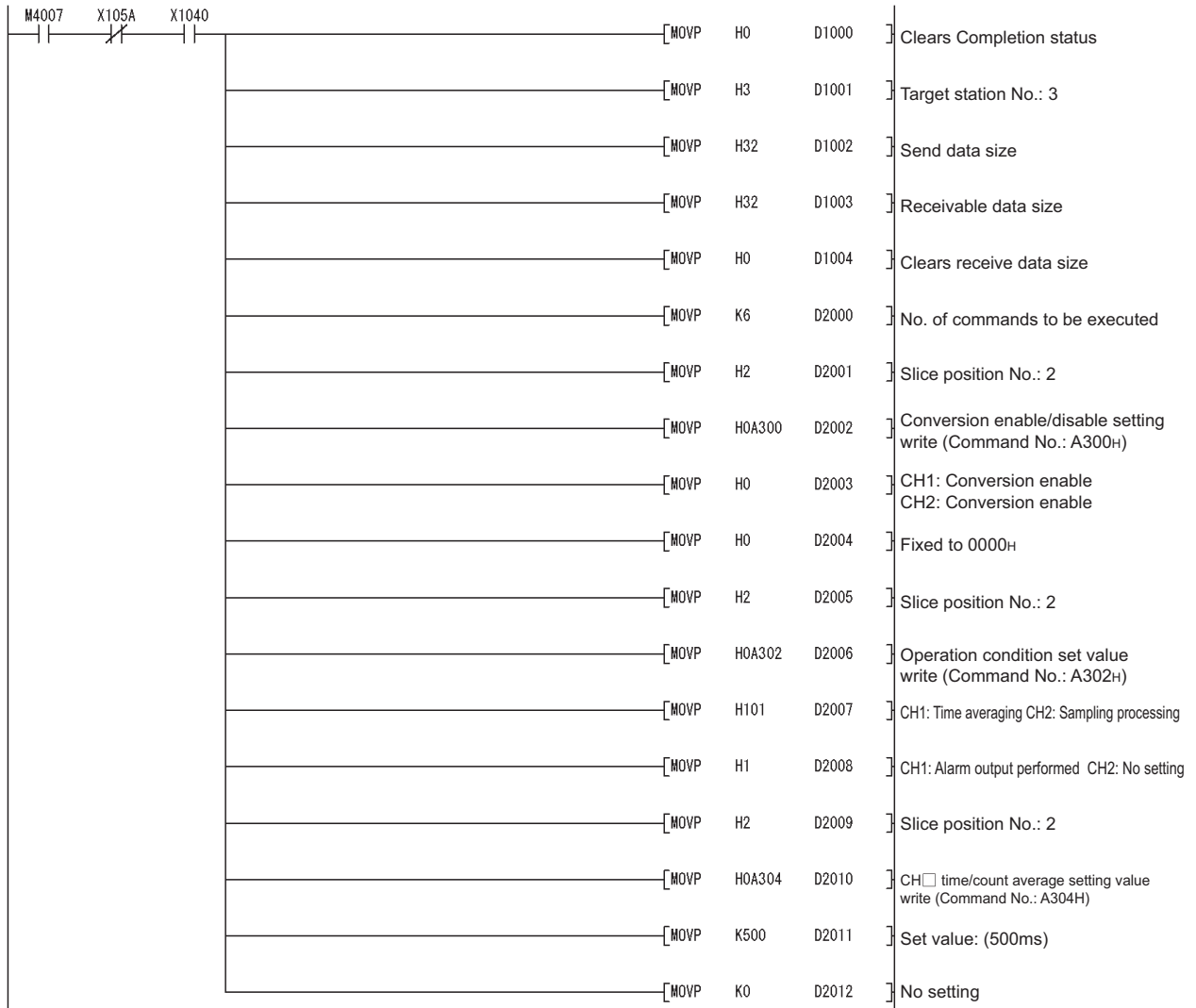


Figure 6.10 Program for setting command parameters (when multiple commands are simultaneously executed)

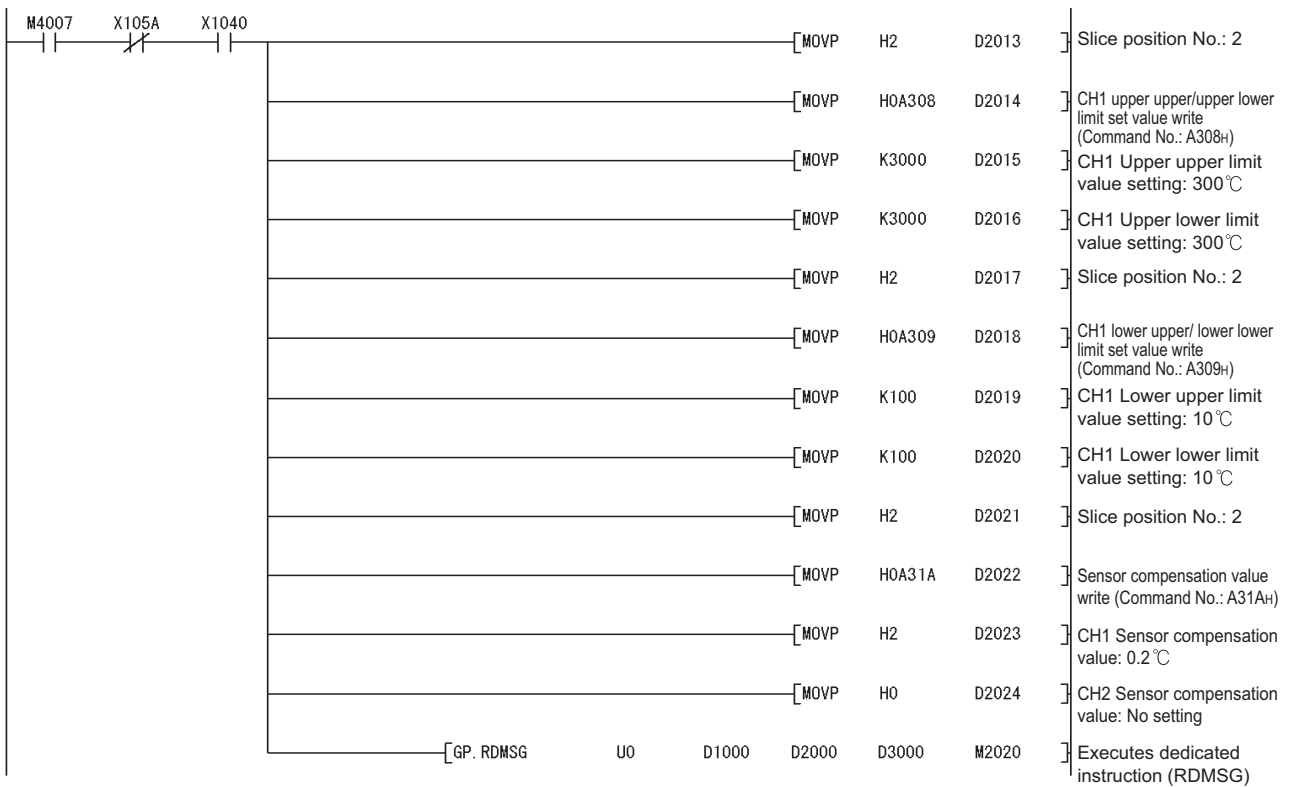


Figure 6.10 Program for setting command parameters (when multiple commands are simultaneously executed) (continued)

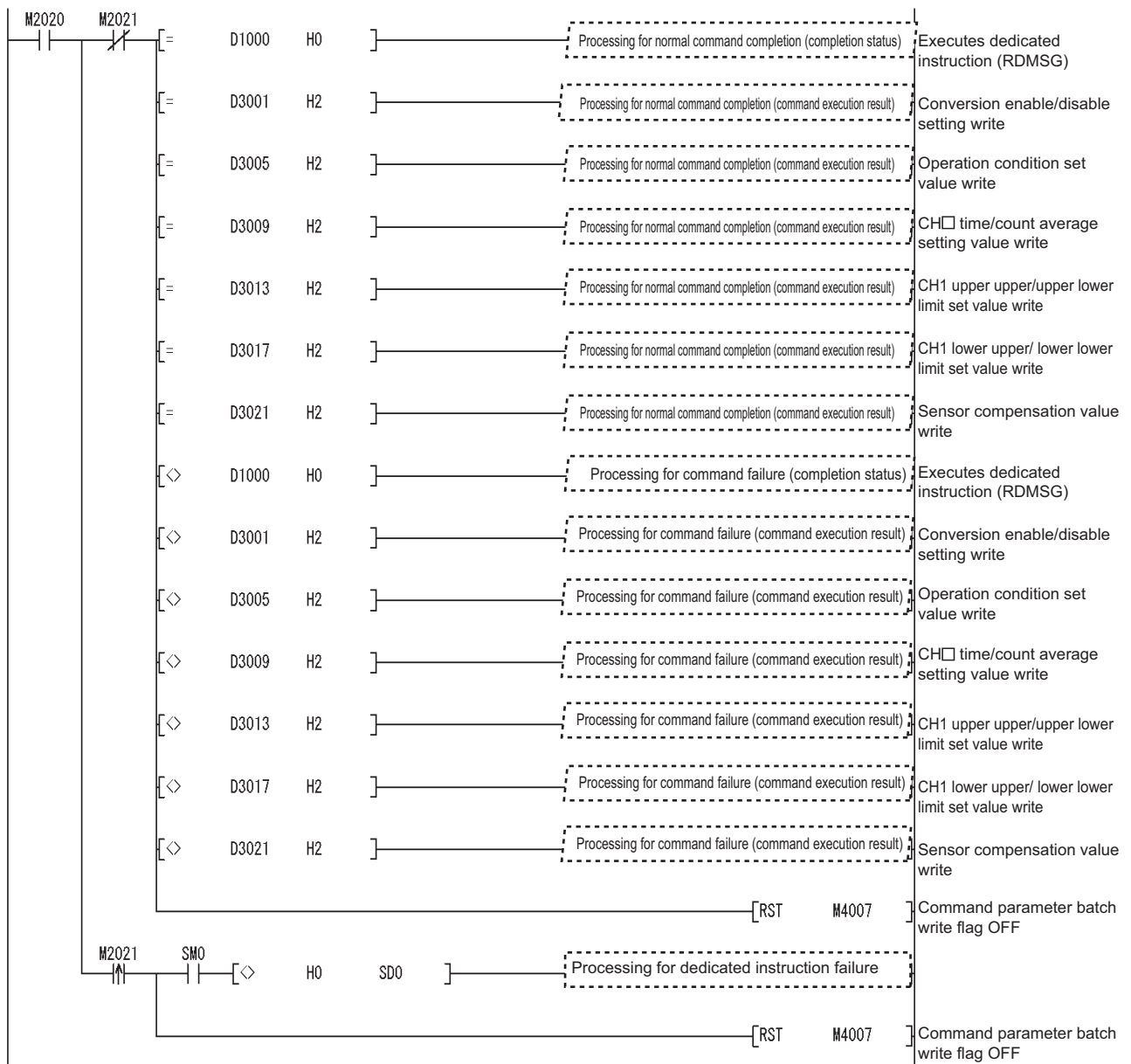


Figure 6.10 Program for setting command parameters (when multiple commands are simultaneously executed) (continued)

4) Program example (when one command is executed at a time)
 The following is a program example for executing a command at a time.

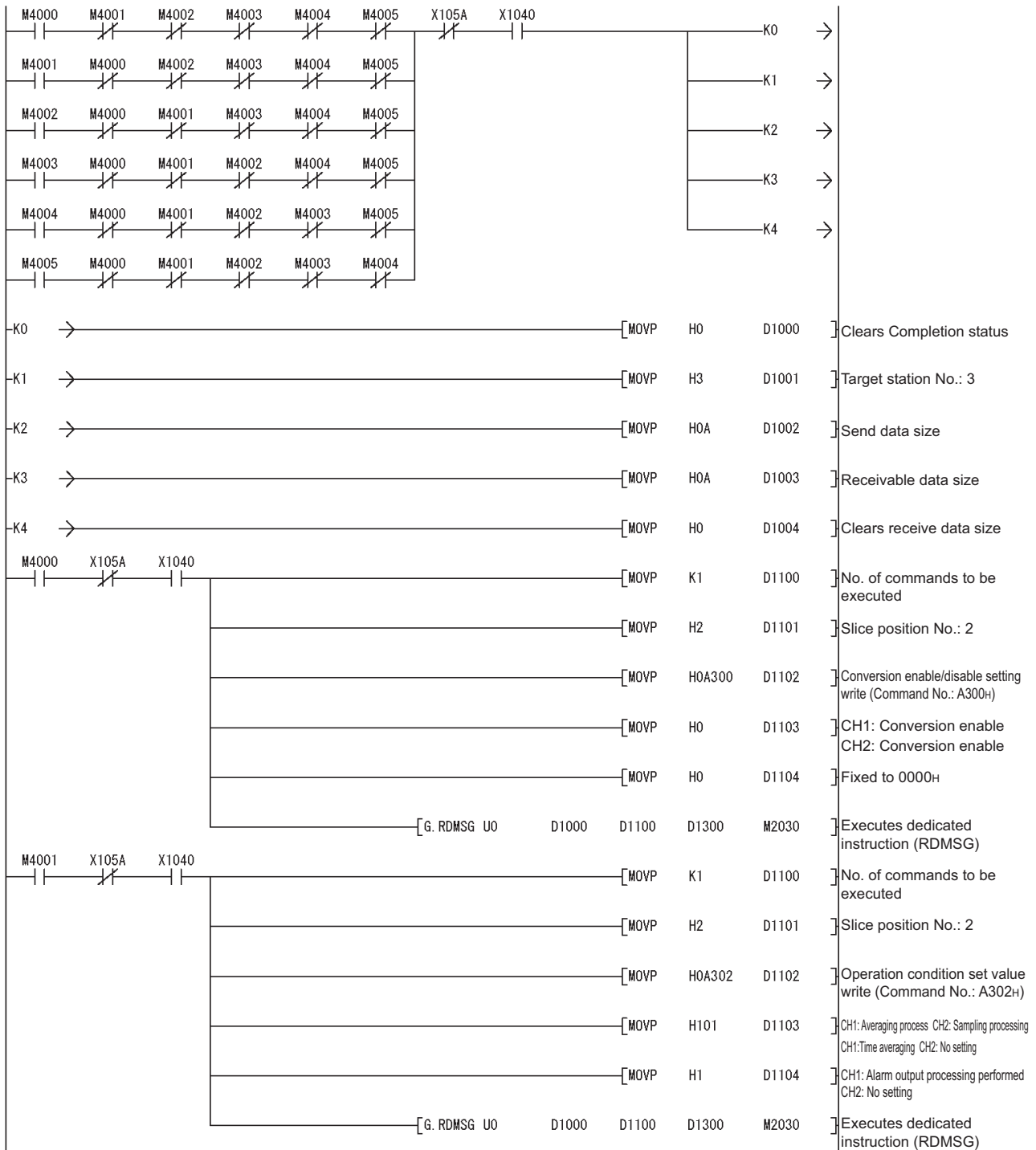


Figure 6.11 Program for setting command parameters (when one command is executed at a time)

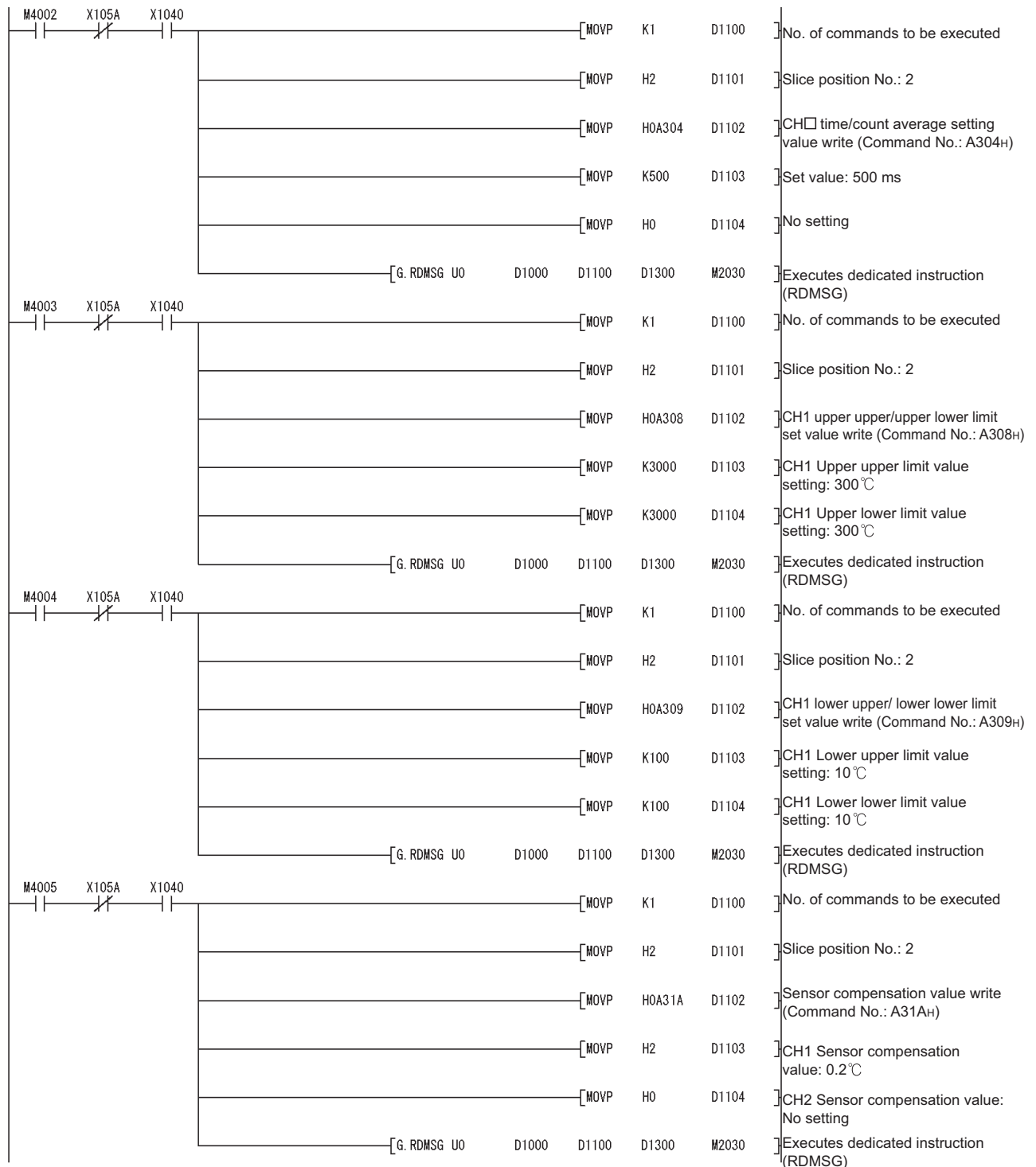


Figure 6.11 Program for setting command parameters (when one command is executed at a time) (continued)

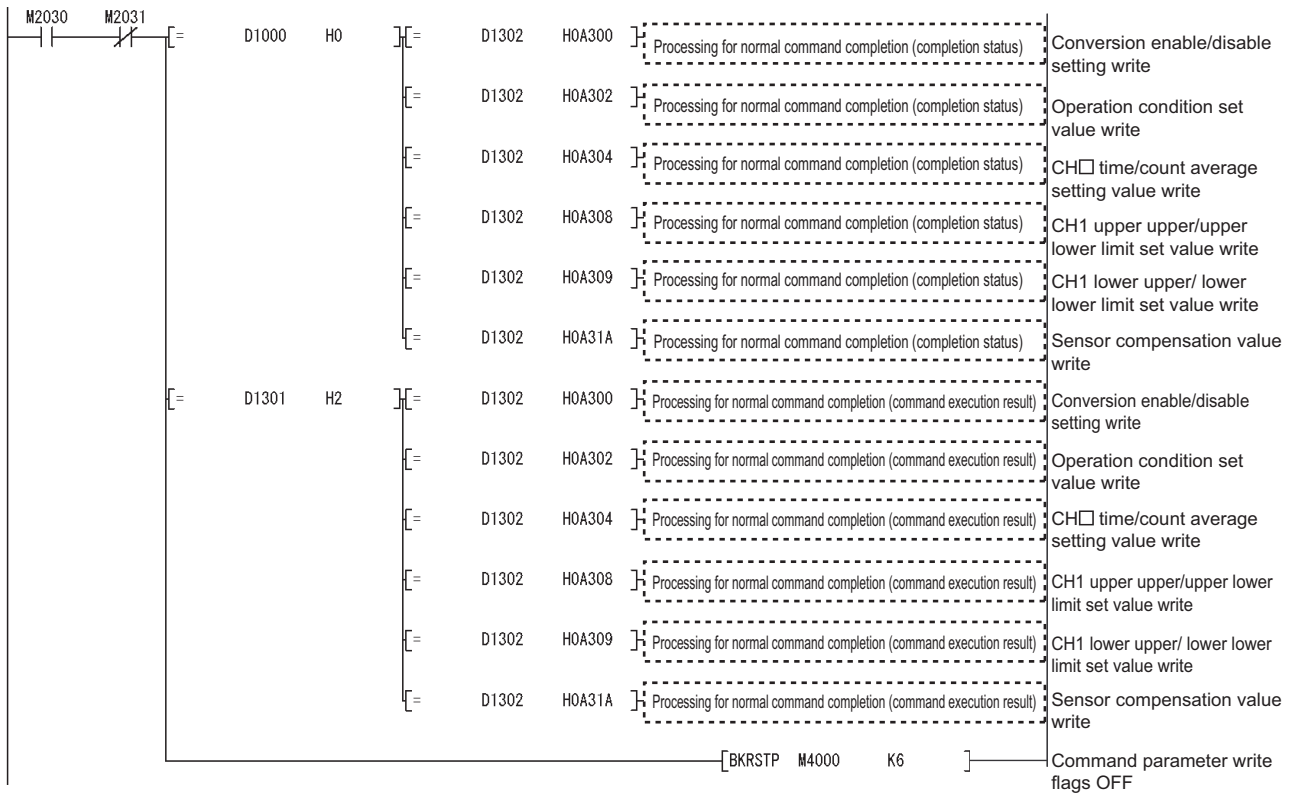


Figure 6.11 Program for setting command parameters (when one command is executed at a time) (continued)

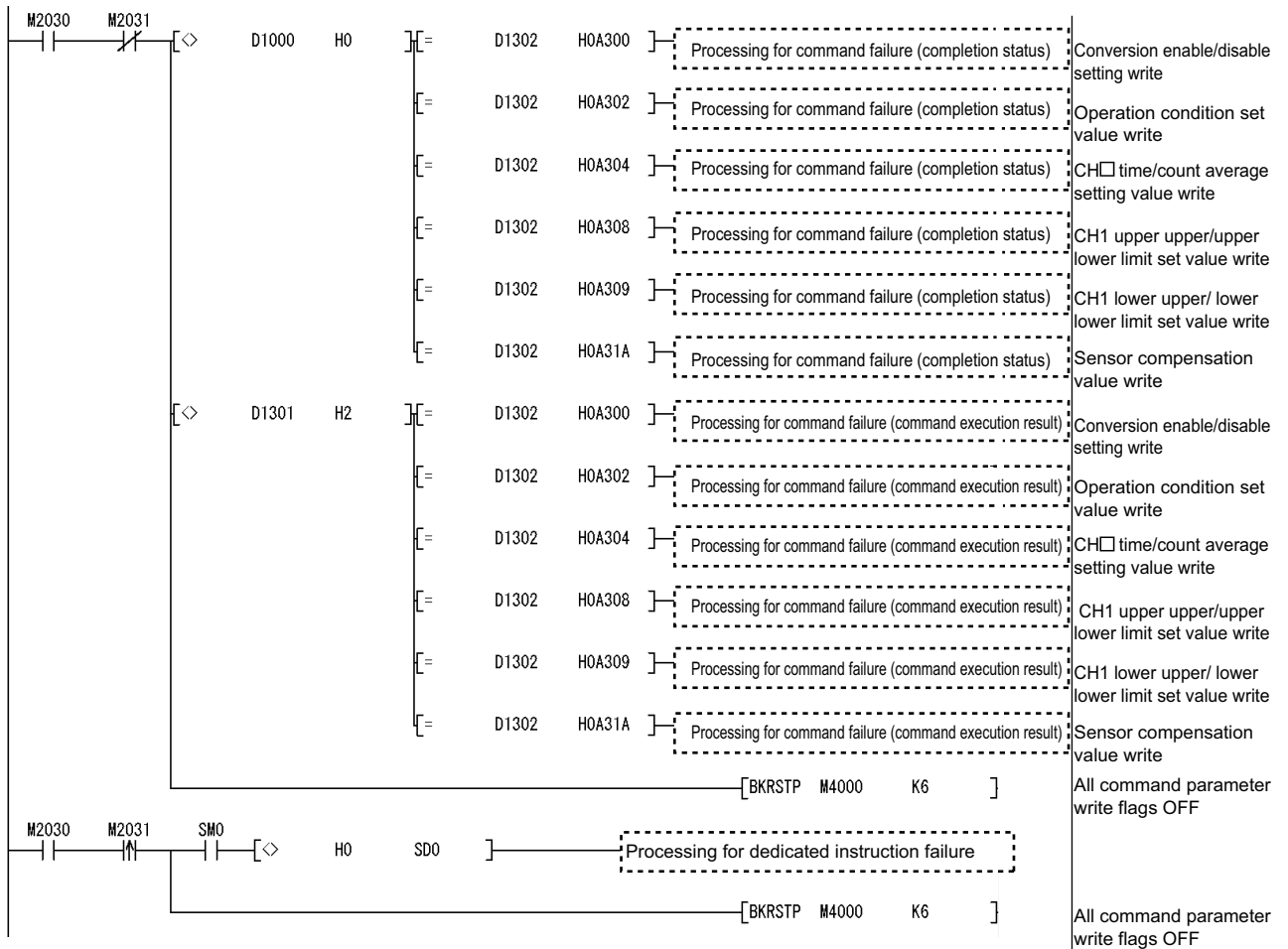


Figure 6.11 Program for setting command parameters (when one command is executed at a time) (continued)

(c) Program for reading measured temperature/micro voltage conversion values
 Using the "Br.n+2" Conversion complete flag, measured temperature/micro voltage conversion values are read out.

1) Device assignment in the program example

Table 6.13 Device assignment in the program example

Device	Application	Device	Application
M4100	Conversion enable/disable setting write flag		

2) Program example

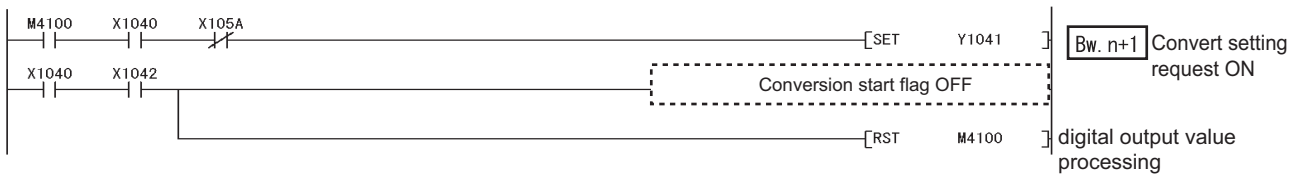



Figure 6.12 Program for reading measured temperature/micro voltage conversion values

(d) Program for reading error module information

Execute the Error module information read request (command No.: 0103H) with the dedicated instruction (RDMSG) of the master station to read the error module information.

Error module information read request is a command of the head module. For details of the command, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual, "8.2.4 Error module information read request"

1) Device assignments in the program example

Table 6.14 Device assignments in the program example

Device	Application	Device	Application
M2000	Completion device	D1000 to D1004	Control data
M2001	Completion status indicator device	D1100 to D1106	Send data (execution data of the command)
M6000	Error module information storage enabled	D1300 to D1318	Receive data (result data of the command)
-	-	D4000	Error module information read target

2) Program example

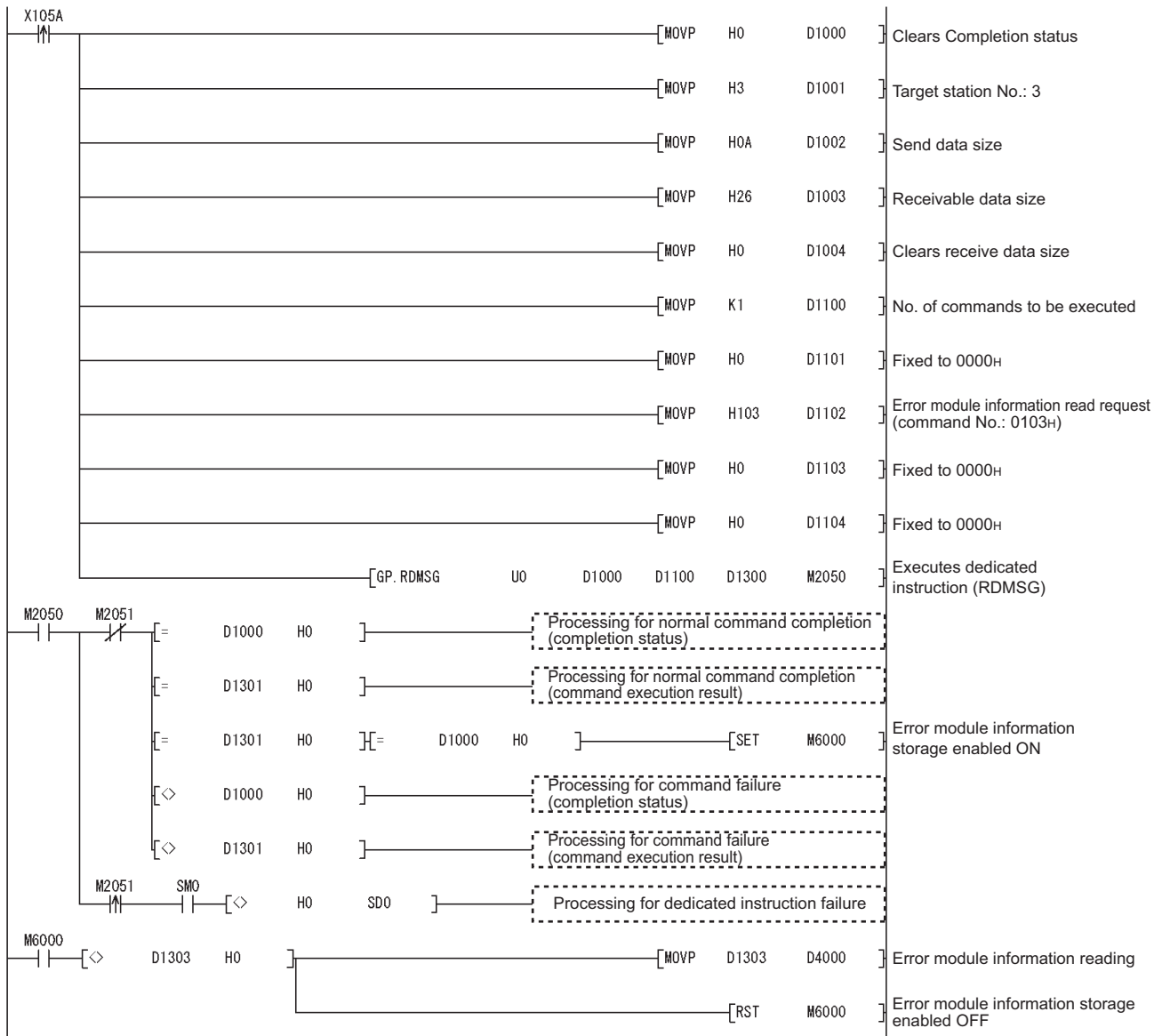



Figure 6.13 Program for reading error module information

(e) Program for reading an error code

Execute the Error code read request (command No.: 8101H/0101H) with the dedicated instruction (RDMSG) of the master station to read an error code.

1) Device assignments in the program example

Table 6.15 Device assignments in the program example

Device	Application	Device	Application
M2000	Completion device	D1000 to D1004	Control data
M2001	Completion status indicator device	D1100 to D1104	Send data (execution data of the command)
M5002	Error handling flag	D1300 to D1304	Receive data (result data of the command)
M6001	Error code storage enabled	D4000	Error module information read target  (2)(d) Program for reading error module information in this section
-	-	D4001	Error code read target

2) Program example

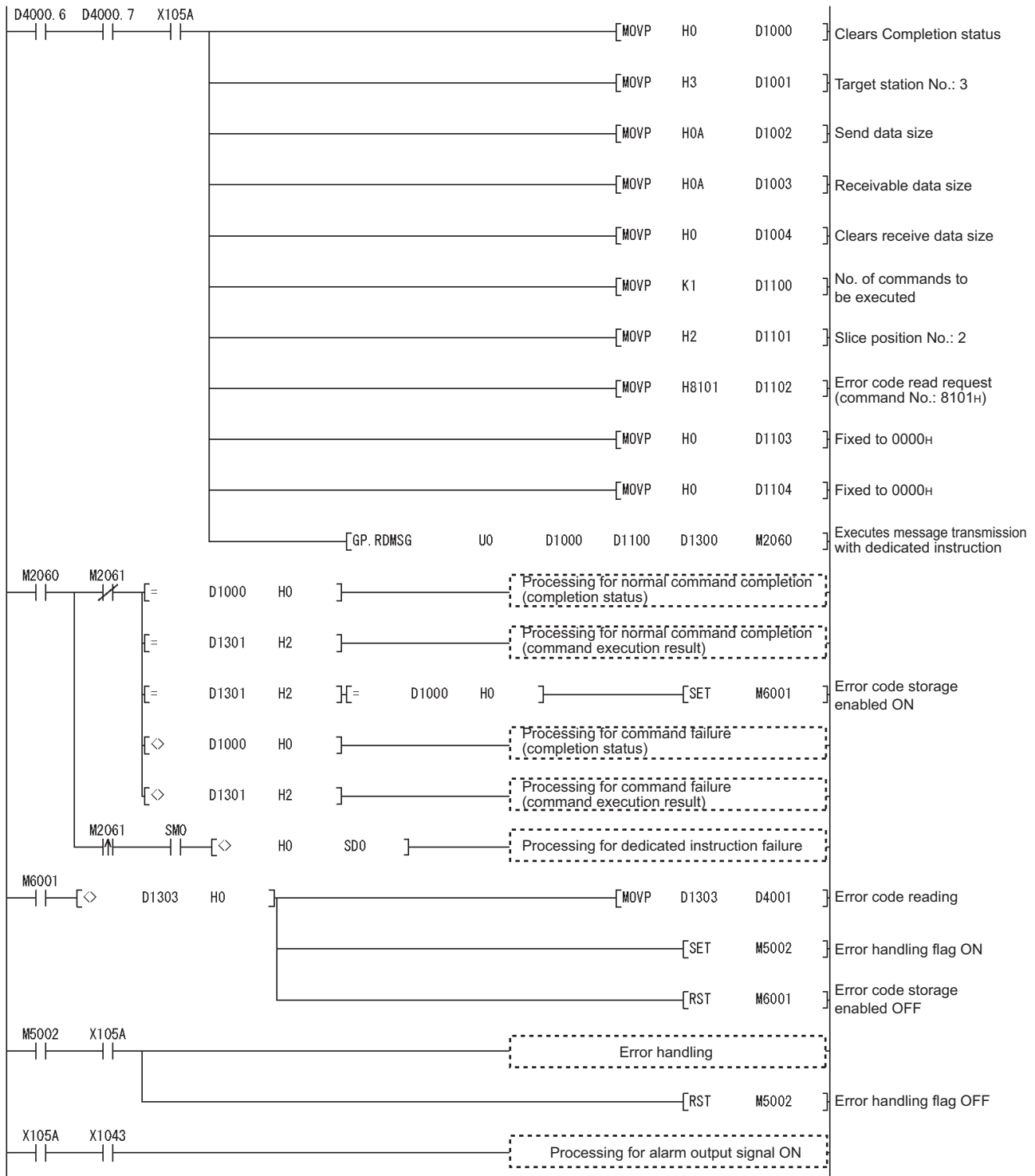



Figure 6.14 Program for reading an error code

(f) Program for resetting errors

Execute the Error clear request (command No.: 8104H/0104H) with the dedicated instruction (RDMSG) of the master station to reset errors.

Error clear request is a command of the head module.

For details of the command, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual, "8.2.5 Error clear request"

1) Device assignments in the program example

Table 6.16 Device assignments in the program example

Device	Application	Device	Application
M2000	Completion device	D1000 to D1004	Control data
M2001	Completion status indicator device	D1100 to D1106	Send data (execution data of the command)
M5003	Error reset request flag	D1300 to D1304	Receive data (result data of the command)

2) Program example

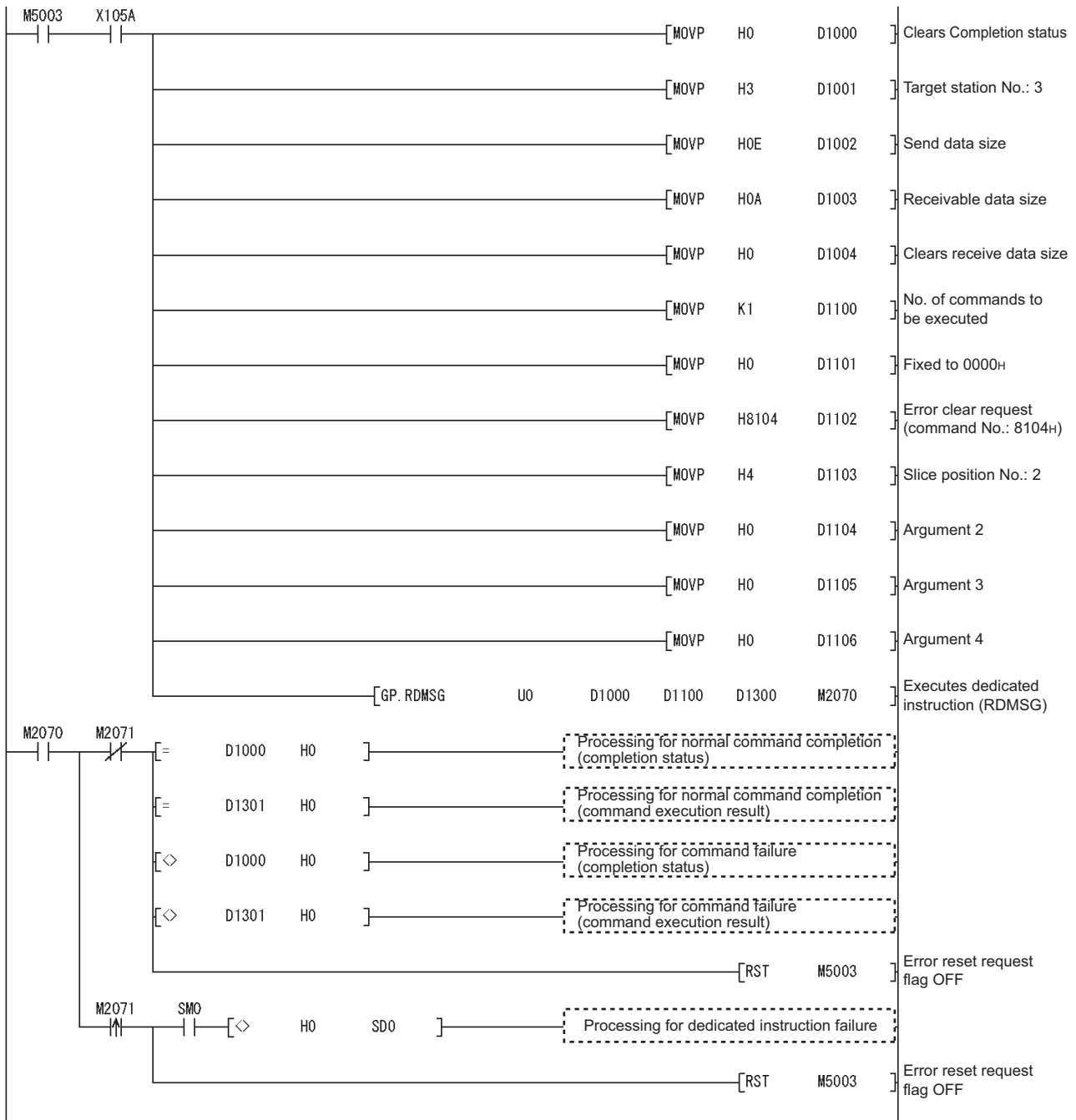


Figure 6.15 Program for resetting errors

CHAPTER 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

Take the following precautions for an 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), the new setting is not validated. 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 may be 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 ST1TD2 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 with default settings.

Remark

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 ST1TD2 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 (c)

Click the button on the screen to terminate online module change.

(2) When you noticed on the screen in step (d)

Do not change the slice module, click the button, and perform the operations in steps (g), (l), (m) to complete the online module change once.

(3) To restart the operation at step (g)

Mount the removed slice module again, click the button, and perform the operations in steps (l), (m) to complete the online module change once.

[Preparation for replacing ST1TD2]

- (a) Select the ST1TD2 to be replaced online on the "System Monitor" screen.

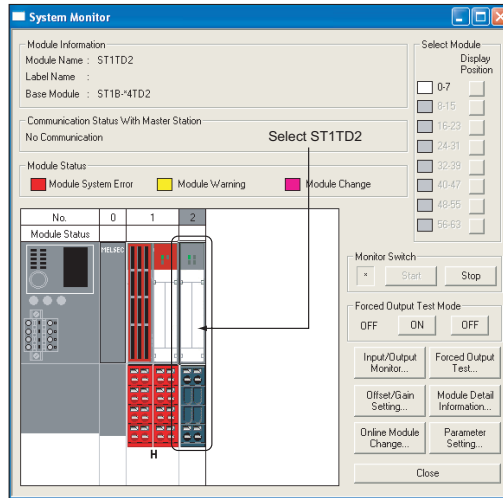


Figure 7.1 System Monitor screen

- (b) Click the Online Module Change button on the "System Monitor" screen. Then, confirm that the RUN LED of the selected ST1TD2 is flashing at 0.25s intervals.

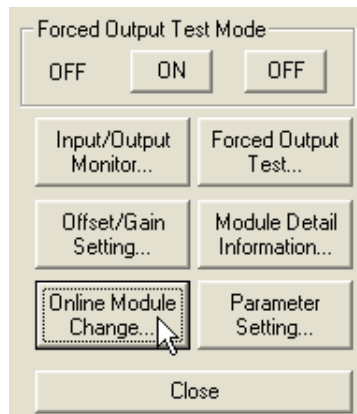


Figure 7.2 "Online Module Change" button

Remark

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

- Select [Diagnostics] → [Online Module Change].
- Right-click the ST1TD2 selected at step (a), and click [Online Module Change] on the menu.

- (c) Confirm that the ST1TD2 displayed as "Target Module" is the ST1TD2 to be replaced and click the button.

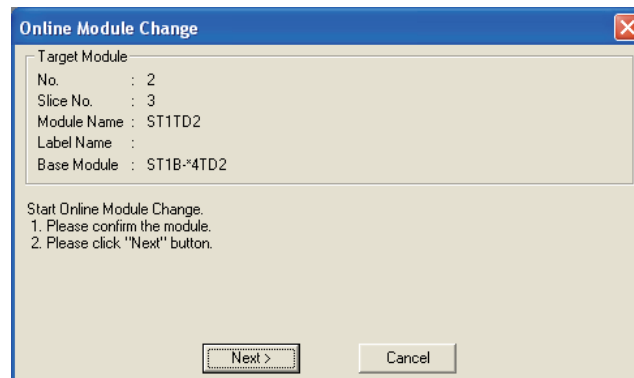


Figure 7.3 Online Module Change screen

- 1) Clicking the 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 ST1TD2 to be changed into the head module.
- 2) After clicking the button, confirm the following module statuses.
 - The REL. LED of the head module is on.
 - The RUN LED of the target ST1TD2 is off.
 - The "Module Status" indicator of the target module has turned purple. This applies only when monitoring from the "System Monitor" screen.
- 3) If the user parameter, command parameter and user range setting's offset/gain setting values could not be read from the ST1TD2, 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 (g).

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 ST1TD2, perform the operations in step (d), and later.

When not executing online module change, click the button.

- 1) Clicking the button causes the screen to show that online module change is cancelled.

Clicking the button returns to the step (a).

[Disconnection from external device]

- (d) As below screen appears, power off the external device connected with the ST1TD2 to be removed.

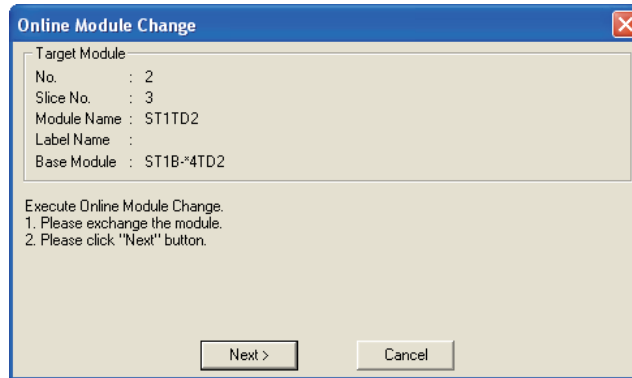


Figure 7.4 Disconnection from external device

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 ST1TD2.

[Replacing ST1TD2]

- (e) Remove the ST1TD2 and replace with new one.

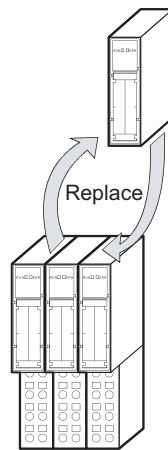


Figure 7.5 Replacing ST1TD2

[Connection to external device after replacement]

- (f) Mount a new ST1TD2. And then, power on the external device.

[Operations after external device connection]

(g) After connecting to the external device, click the button on the screen at step (d).

1) Clicking the 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 (c), to the mounted ST1TD2.

2) After clicking the button, confirm the following module statuses.

- The REL. LED of the head module is flashing.
- The RUN LED of the newly mounted ST1TD2 is flashing (at 0.25s intervals).

Clicking the button, i.e., interrupting online module change returns to step (a) 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 ST1TD2, the REL. LED and ERR.

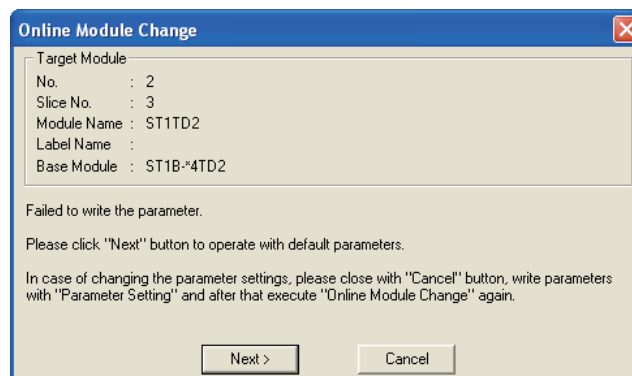


Figure 7.6 Error screen

LED of the head module turn on and the screen shown above 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.

[Parameter setting/offset/gain setting]

- (h) Click the button to stop the online module change.

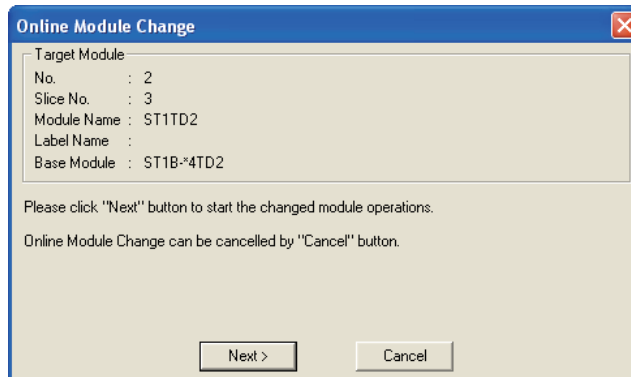


Figure 7.7 Stop of online module change

- (i) Click the button.

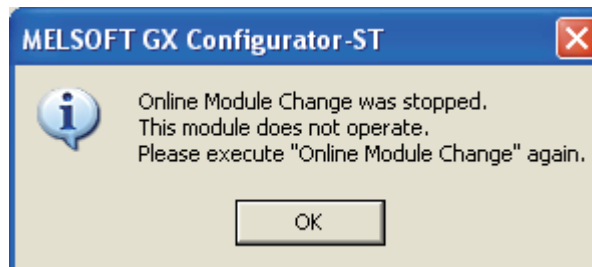


Figure 7.8 Confirmation dialog

- (j) 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 operate 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 ST1TD2, the user parameter have been written when the operation in step (g), 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 ST1TD2 flickers at 0.25s intervals even in the offset/gain setting mode.

[Processing after parameter setting or offset/gain setting]

- (k) After parameter setting or offset/gain setting, execute the operations in steps (a), (b) to resume the online module change.

* Select the same ST1TD2 as before the online module change was stopped. If the selected ST1TD2 is different, an error will occur.

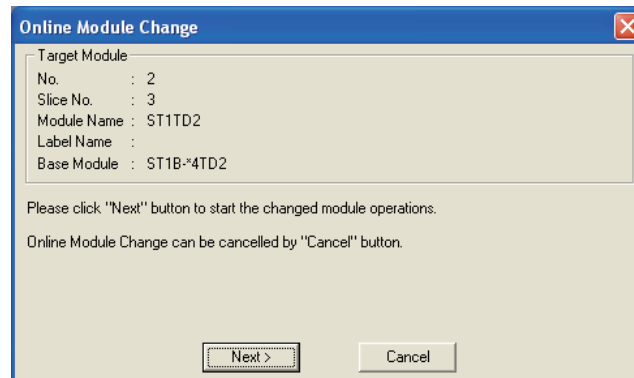


Figure 7.9 Online Module Change window

- (l) Clicking the button releases the head module from the online module change mode.
- 1) Clicking the button performs the following.
 - Releases the head module from the online module change mode.
 - Restarts refreshing the I/O data, etc.
 - 2) After clicking the button, confirm the following module statuses.
 - The REL. LED of the head module is off.
 - The RUN LED of the newly mounted ST1TD2 is on.
 - The "Module Status" indicator of the target ST1TD2 has turned white. This applies only when monitoring from the "System Monitor" screen.
 - 3) 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 button.

- 1) Clicking the 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.

(m) Below screen appears showing that online module change has been completed.
Click the button.

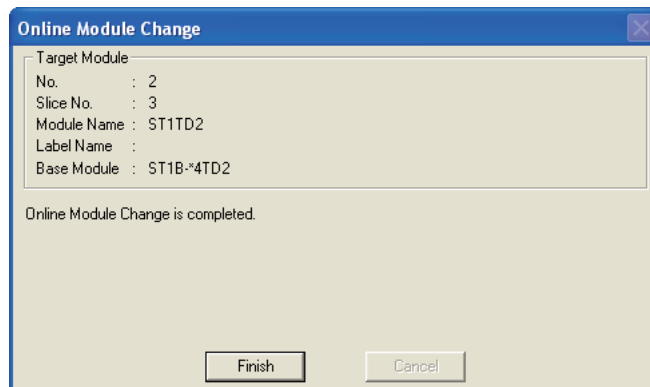


Figure 7.10 Completion of online module change

CHAPTER8 COMMANDS


This chapter explains the commands.

8.1 Command List

(1) About commands

A command is executed by transmitting a message to the MELSEC-ST system with a dedicated instruction (RDMSG) of the master station.

For the command execution procedure, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual, "8.1 Command execution method and procedures"

(2) When two command numbers are assigned to one command

Use command number 8000H or higher.

Commands, with the number 7FFFH and smaller, are used for importing existing sequence programs from the ST1H-PB (MELSEC-ST PROFIBUS-DP head module) to ST1H-BT (MELSEC-ST CC-Link head module).

(3) Command list

The list of commands that are executable in the ST1TD2 and conditions for respective command executions are shown in Table 8.1.

Table 8.1 Command list (1/2)

Command type	Command		Description	Execution condition	Reference section
	Command No.	Command name			
Common command	8100H 0100H	Operating status read request	Reads the operating status of the ST1TD2.	-	Section 8.2.1
	8101H 0101H	Error code read request	Reads an error code and alarm information of the ST1TD2.	-	Section 8.2.2
Initial data write command	8106H	Initial data batch write request	Writes command parameters to multiple ST1TD2s all at once.	Condition 1	Section 8.3.1
	8107H 0107H	Initial data individual write request	Writes command parameters to a single ST1TD2.	Condition 1	Section 8.3.2
ST1TD2 parameter setting read command	9300H 1300H	Conversion enable/disable setting read	Reads the A/D conversion enable/disable setting from RAM of the ST1TD2.	-	Section 8.4.1
	9301H 1301H	Conversion channel read	Reads current Conversion enable/disable setting and Conversion completion status.	-	Section 8.4.2
	9302H 1302H	Operation condition setting read	Reads averaging process setting, alarm output setting, and disconnection detection setting from RAM of the ST1TD2.	-	Section 8.4.3
	9304H 1304H	CH □ time/count averaging setting read	Reads time or number of times set for averaging processing from RAM of the ST1TD2.	-	Section 8.4.4
	9308H 1308H	CH1 upper upper limit/upper lower limit setting read	Reads the upper upper limit value, upper lower limit value, lower upper limit value, or lower lower limit value of alarm output from RAM of the ST1TD2.	-	Section 8.4.5
	9309H 1309H	CH1 lower upper limit/lower lower limit setting read		-	Section 8.4.6
	930AH 130AH	CH2 upper upper limit/upper lower limit setting read		-	Section 8.4.5
	930BH 130BH	CH2 lower upper limit/lower lower limit setting read		-	Section 8.4.6
	9318H 1318H	Initial data setting read	Reads the input type setting, offset/gain value selection, and cold junction compensation setting from RAM of the ST1TD2.	-	Section 8.4.7
	931AH 131AH	Sensor compensation value read	Reads a compensation value set for an error between "actual temperature/voltage" and "measured temperature/voltage" from RAM of the ST1TD2.	-	Section 8.4.8

Table 8.2 Command list (2/2)

Command type	Command		Description	Execution condition	Reference section
	Command No.	Command name			
ST1TD2 parameter setting write command	A300H 2300H	Conversion enable/disable setting write	Writes the Conversion enable/disable setting to RAM of the ST1TD2.	Condition 1	Section 8.5.1
	A302H 2302H	Operation condition setting write	Writes the sampling/averaging process specification and alarm output setting to RAM of the ST1TD2.	Condition 1	Section 8.5.2
	A304H 2304H	CH □ time/count averaging setting write	Writes time or number of times for averaging processing to RAM of the ST1TD2.	Condition 1	Section 8.5.3
	A308H 2308H	CH1 upper upper limit/upper lower limit setting write	Writes the upper upper limit value, upper lower limit value, lower upper limit value, or lower lower limit value of alarm output to RAM of the ST1TD2.	Condition 1	Section 8.5.4
	A309H 2309H	CH1 lower upper limit/lower lower limit setting write			Section 8.5.5
	A30AH 230AH	CH2 upper upper limit/upper lower limit setting write			Section 8.5.4
	A30BH 230BH	CH2 lower upper limit/lower lower limit setting write			Section 8.5.5
	A31AH 231AH	Sensor compensation value write	Writes a compensation value set for an error between "actual temperature/voltage" and "measured temperature/voltage" to RAM of the ST1TD2.	Condition 1	Section 8.5.6
ST1TD2 control command	B300H 3300H	Parameter setting read from ROM	Reads parameters from ROM to RAM in the ST1TD2.	Condition 1	Section 8.6.1
	B301H 3301H	Parameter setting write to ROM	Writes parameters from RAM to ROM in the ST1TD2.	Condition 1	Section 8.6.2
	B302H 3302H	Operation mode setting	Switches the mode of the ST1TD2.	Condition 2	Section 8.6.3
	B303H 3303H	Offset channel specification	Specifies an offset channel of offset/gain setting and adjusts the offset value.	Condition 3	Section 8.6.4
	B304H 3304H	Gain channel specification	Specifies a gain channel of offset/gain setting and adjusts the gain value.	Condition 3	Section 8.6.5
	B305H 3305H	User range write	Writes adjusted offset/gain settings to ROM of the ST1TD2.	Condition 3	Section 8.6.6

Table 8.3 Conditions for execution

Condition	Description
-	Commands are always executable.
Condition 1	Commands are executable in normal mode and when <input type="checkbox"/> Bw.n+1 Convert setting request is OFF (0).
Condition 2	Commands are only executable in normal mode and when <input type="checkbox"/> Bw.n+1 Convert setting request is OFF (0), or in offset/gain setting mode.
Condition 3	Commands are executable only in offset/gain setting mode.

☒ POINT

If a command execution is attempted while the required condition is not met, it will fail and "06H" or "13H" will be stored in Cr.n(15-8) Command execution result.

8.2 Common Commands

8.2.1 Operating status read request (Command No.: 8100H/0100H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the operating status of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.4 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.8100H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
	[For execution of command No.0100H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1	Set a command No. to be executed (8100H/0100H). (Hexadecimal)
Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3	

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.5 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	[For execution of command No.8100H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
	[For execution of command No.0100H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below <div style="text-align: center;"> </div>
Cr.1	The executed command No. (8100H/0100H) is stored. (Hexadecimal)

Table 8.5 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	<p>The operating status of the ST1TD2 is stored.</p> <div style="text-align: center;"> </div>
	Cr.3	<p>The current operation mode of the ST1TD2 is stored.</p> <div style="text-align: center;"> </div>

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

Table 8.6 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.8100H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below</p> <div style="text-align: center;"> </div>
	Cr.0	<p>[For execution of command No.0100H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
	Cr.1	The executed command No. (8100H/0100H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Start slice No. or Slice position No.

8.2.2 Error code read request (Command No.: 8101H/0101H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads an error code of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.7 Values set to "Cw" Command execution area

Cw	Command execution area	Setting value
Cw.0		[For execution of command No.8101H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
		[For execution of command No.0101H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1		Set a command No. to be executed (8101H/0101H). (Hexadecimal)
Cw.2		Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3		

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.8 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
Cr.0		[For execution of command No.8101H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
		[For execution of command No.0101H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
Cr.1		The executed command No. (8101H/0101H) is stored. (Hexadecimal)

Table 8.8 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	<p>The error code of the error that is currently occurring in the ST1TD2 is stored. (Hexadecimal)</p> <p>For details of error codes, refer to the following.</p> <p>☞ Section 9.1 Error Code List</p> <p>When no error is detected, 0000H is stored.</p>
	Cr.3	<p>Alarm information is stored for each channel.</p> <p>Fixed to 000H.</p> <ul style="list-style-type: none"> CH1 Alarm status Upper limit value 0: Normal 1: Alarm has occurred. CH1 Alarm status Lower limit value 0: Normal 1: Alarm has occurred. CH2 Alarm status Upper limit value 0: Normal 1: Alarm has occurred. CH2 Alarm status Lower limit value 0: Normal 1: Alarm has occurred.

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

Table 8.9 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.8101H]</p> <p>The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	Cr.0	<p>[For execution of command No.0101H]</p> <p>The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	Cr.1	The executed command No. (8101H/0101H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Start slice No. or Slice position No.

1 OVERVIEW
2 SYSTEM CONFIGURATION
3 SPECIFICATIONS
4 SETUP AND PROCEDURES BEFORE OPERATION
5 GX Configurator-ST
6 PROGRAMMING
7 ONLINE MODULE CHANGE
8 COMMANDS

8.3 Initial Data Write Commands

8.3.1 Initial data batch write request (Command No.: 8106H)

Data size	
Cw	6 to 20 words (12 to 40 bytes)
Cr	6 words (12 bytes)

This command batch-writes command parameters to the following modules of the same type.

- Head module
- Input module
- Output module
- Intelligent function module

The input range setting is written to RAMs of multiple ST1TD2s all at once.

(1) Values set to "Cw" Command execution area

Table 8.10 Values set to "Cw" Command execution area

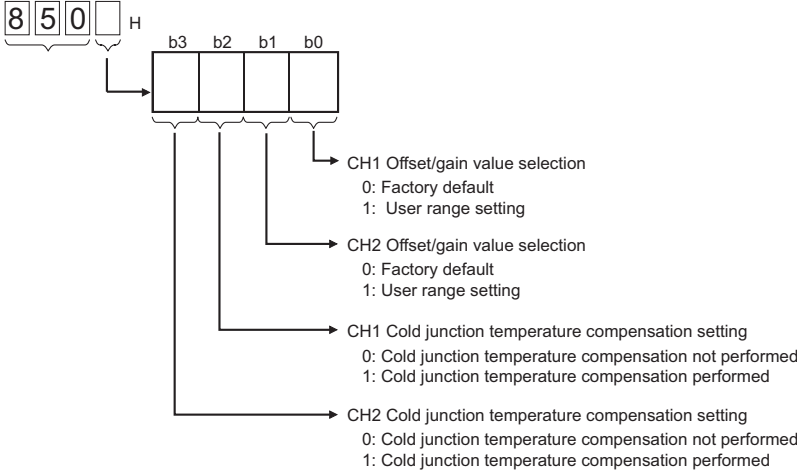
Cw Command execution area	Setting value
Cw.0	Fixed to 0000H.
Cw.1	Set a command No. to be executed (8106H). (Hexadecimal)
Cw.2	Set command parameters of the head module. (Hexadecimal)* ¹
Cw.3	Set command parameters of input modules. (Hexadecimal)* ¹
Cw.4	Set command parameters of output modules. (Hexadecimal)* ¹
Cw.5	Set the number of the command parameter settings for intelligent function modules in Cw.6 to Cw.19 (number of module types: 0 to 7).
Cw.6	<p>Set a number specific to the ST1TD2 module and command parameters. (Hexadecimal)</p> <p>This setting is required only when one or more value is set in Cw.5.</p> 

Table 8.10 Values set to "Cw" Command execution area (Continued)

Cw	Command execution area	Setting value																				
		Set command parameters of the ST1TD2. (Hexadecimal) This setting is required only when one or more value is set in Cw.5 .																				
	Cw.7	<div style="text-align: center;"> </div> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Input type</th> <th>Measured temperature</th> </tr> </thead> <tbody> <tr> <td>0H: Thermocouple K</td> <td>-270 to 1372°C</td> </tr> <tr> <td>1H: Thermocouple E</td> <td>-270 to 1000°C</td> </tr> <tr> <td>2H: Thermocouple J</td> <td>-210 to 1200°C</td> </tr> <tr> <td>3H: Thermocouple T</td> <td>-270 to 400°C</td> </tr> <tr> <td>4H: Thermocouple B</td> <td>0 to 1820 °C</td> </tr> <tr> <td>5H: Thermocouple R</td> <td>-50 to 1768°C</td> </tr> <tr> <td>6H: Thermocouple S</td> <td>-50 to 1768°C</td> </tr> <tr> <td>7H: Thermocouple N</td> <td>-270 to 1300°C</td> </tr> <tr> <td>FH: Micro voltage input</td> <td>-80 to 80mV</td> </tr> </tbody> </table>	Input type	Measured temperature	0H: Thermocouple K	-270 to 1372°C	1H: Thermocouple E	-270 to 1000°C	2H: Thermocouple J	-210 to 1200°C	3H: Thermocouple T	-270 to 400°C	4H: Thermocouple B	0 to 1820 °C	5H: Thermocouple R	-50 to 1768°C	6H: Thermocouple S	-50 to 1768°C	7H: Thermocouple N	-270 to 1300°C	FH: Micro voltage input	-80 to 80mV
Input type	Measured temperature																					
0H: Thermocouple K	-270 to 1372°C																					
1H: Thermocouple E	-270 to 1000°C																					
2H: Thermocouple J	-210 to 1200°C																					
3H: Thermocouple T	-270 to 400°C																					
4H: Thermocouple B	0 to 1820 °C																					
5H: Thermocouple R	-50 to 1768°C																					
6H: Thermocouple S	-50 to 1768°C																					
7H: Thermocouple N	-270 to 1300°C																					
FH: Micro voltage input	-80 to 80mV																					
	Cw.8 to Cw.19	In the same way as in Cw.6 or Cw.7 , set command parameters for other ST1TD2s and intelligent function modules. (Two words each) ²																				

* 1 For settings of each module, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "8.2.7 Initial data batch write request (Command No.: 8106H)"

* 2 For settings of intelligent function modules other than the ST1TD2, refer to the following.

☞ Intelligent Function Module User's Manual, "Initial data batch write request (Command No.: 8106H)"

(2) Values stored in "Cr" Command result area

The command execution result data vary depending on the data (normal completion or failure) in Cr.0.

(a) When completed normally ("Cr.0" is 0000H.)

Table 8.11 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details																																																																																					
	Cr.0	Error code (0000H when completed normally)																																																																																					
	Cr.1	The executed command No. (8106H) is stored. (Hexadecimal)																																																																																					
	Cr.2	The command parameter setting status after writing is stored for each slice module.																																																																																					
	Cr.3	<table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 2px;">Cr.2</td> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">Cr.3</td> <td>31</td><td>30</td><td>29</td><td>28</td><td>28</td><td>26</td><td>25</td><td>24</td><td>23</td><td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">Cr.4</td> <td>47</td><td>46</td><td>45</td><td>44</td><td>43</td><td>42</td><td>41</td><td>40</td><td>39</td><td>38</td><td>37</td><td>36</td><td>35</td><td>34</td><td>33</td><td>32</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">Cr.5</td> <td>63</td><td>62</td><td>61</td><td>60</td><td>59</td><td>58</td><td>57</td><td>56</td><td>55</td><td>54</td><td>53</td><td>52</td><td>51</td><td>50</td><td>49</td><td>48</td> </tr> </tbody> </table> <p style="text-align: right;">← Each bit indicates each slice position No.</p> <p style="text-align: right;">0: Parameter not set 1: Parameter set</p>		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	Cr.2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Cr.3	31	30	29	28	28	26	25	24	23	22	21	20	19	18	17	16	Cr.4	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	Cr.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
	b15		b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0																																																																						
Cr.2	15		14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																																						
Cr.3	31		30	29	28	28	26	25	24	23	22	21	20	19	18	17	16																																																																						
Cr.4	47		46	45	44	43	42	41	40	39	38	37	36	35	34	33	32																																																																						
Cr.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48																																																																							
	Cr.4																																																																																						
	Cr.5																																																																																						

(b) When failed ("Cr.0" is other than 0000H.)


Table 8.12 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	An error code is stored. (Hexadecimal)* ¹
	Cr.1	The executed command No. (8106H) is stored. (Hexadecimal)
	Cr.2	The command parameter setting status after writing is stored for each slice module.
	Cr.3	
	Cr.4	
	Cr.5	
	Cr.5	

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cr.2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Cr.3	31	30	29	28	28	26	25	24	23	22	21	20	19	18	17	16
Cr.4	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
Cr.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

← Each bit indicates each slice position No.
0: Parameter not set
1: Parameter set

* 1 For details of error codes, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual, "9.7.2 Error code list"

POINT

- (1) In to , intelligent function module's command parameter settings exceeding the quantity set in are not executed.
- (2) Initial data batch write request (Command No.: 8106H) cannot be executed with another command at the same time.
Doing so will cause an error.

8.3.2 Initial data individual write request (Command No.: 8107H/0107H)

Data size	
Cw	6 to 99 words (12 to 198 bytes)
Cr	4 to 35 words (8 to 70 bytes)

This command writes command parameters of the following modules to RAM for each module.

- Head module
- Input module
- Output module
- Intelligent function module

The input type setting, offset/gain value selection, and cold junction compensation setting are written to RAM of a single ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.13 Values set to "Cw" Command execution area

Cw	Command execution area	Setting value												
	Cw.0	Fixed to 0000H.												
	Cw.1	Set a command No. to be executed (8107H/0107H). (Hexadecimal)												
	Cw.2	Set the number of the command parameter settings for slice modules (number of the modules: 1 to 32). (Hexadecimal)												
	Cw.3	[For execution of command No.8107H] Set a slice position No. of the target ST1TD2. (Hexadecimal)												
		[For execution of command No.0107H] Set a start slice No. of the target ST1TD2. (Hexadecimal)												
	Cw.4	Set a number specific to the ST1TD2 module and command parameters. (Hexadecimal) <div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">b15</td> <td style="text-align: center;">~</td> <td style="text-align: center;">b8</td> <td style="text-align: center;">b7</td> <td style="text-align: center;">~</td> <td style="text-align: center;">b0</td> </tr> <tr> <td colspan="3" style="text-align: center;">Cr.3(15-8) Command execution result</td> <td colspan="3" style="text-align: center;">Cr.3(7-0) Slice position No.</td> </tr> </table> <p style="text-align: center;">→ 00H: Normal completion</p> </div>	b15	~	b8	b7	~	b0	Cr.3(15-8) Command execution result			Cr.3(7-0) Slice position No.		
b15	~	b8	b7	~	b0									
Cr.3(15-8) Command execution result			Cr.3(7-0) Slice position No.											

Table 8.13 Values set to "Cw" Command execution area (Continued)

Cw	Command execution area	Setting value
	Cw.5	Set respective command parameters for the ST1TD2. (Hexadecimal) This setting is required only when one or more value is set in Cw.2 . <div style="text-align: center; margin-top: 10px;"> </div>
	Cw.6 to Cw.98	In the same way as in Cw.3 to Cw.5 , set command parameters for each module.*1 (Three words each)

* 1 For settings of the head module and I/O modules, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "8.2.8 Initial data individual write request (Command No.: 8107H/0107H)"

For settings of intelligent function modules other than the ST1TD2, refer to the following.

☞ Intelligent Function Module User's Manual, "Initial data individual write request (Command No.: 8107H/0107H)"

(2) Values stored in "Cr" Command result area

The command execution result data vary depending on the data (normal completion or failure) in Cr.0.

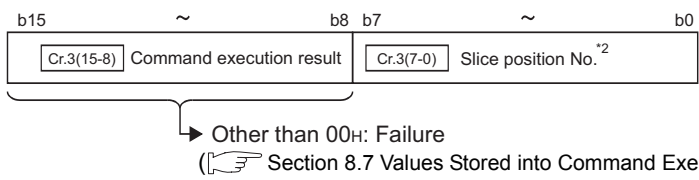
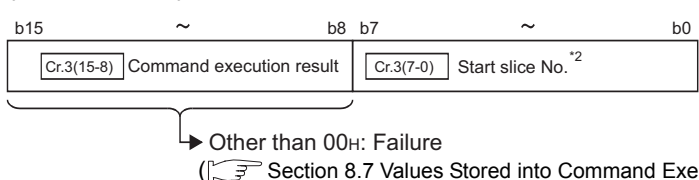
(a) When completed normally ("Cr.0" is 0000H.)

Table 8.14 Values stored in "Cr" Command result area (When completed normally)


Cr	Command result area	Result details
	Cr.0	Error code (0000H when completed normally)
	Cr.1	The executed command No. (8107H/0107H) is stored. (Hexadecimal)
	Cr.2	The number of command parameter settings of the intelligent function module is stored.
	Cr.3	[For execution of command No.8107H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center; margin-top: 10px;"> </div>
	Cr.3	[For execution of command No.0107H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below <div style="text-align: center; margin-top: 10px;"> </div>
	Cr.4 to Cr.34	Detailed results for the intelligent function modules set in Cr.2 are stored in the same way as in Cr.3 . (One word each)

(b) When failed ("Cr.0" is other than 0000H.)

Table 8.15 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	An error code is stored. (Hexadecimal)*1
	Cr.1	The executed command No. (8107H/0107H) is stored. (Hexadecimal)
	Cr.2	The number of command parameter settings of the intelligent function module is stored.
	Cr.3	<p>[For execution of command No.8107H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;">  </div>
		<p>[For execution of command No.0107H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;">  </div>
	Cr.4 to Cr.34	Detailed results for the intelligent function modules set in Cr.2 are stored in the same way as in Cr.3. (One word each)

* 1 For details of error codes, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual, "9.7.2 Error code list"

* 2 When 0FH is stored in Cr.3(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.3(7-0) Slice position No. or start slice No.

POINT

- (1) Cw.3 to Cw.98, intelligent function module's command parameter settings exceeding the quantity set in Cw.2 are not executed.
- (2) Initial data individual write request (Command No.: 8107H/0107H) cannot be executed with another command at the same time. Doing so will cause an error.
- (3) When the slice position No. or start slice No. is duplicated, the module with the duplicate setting is detected as an error module.

8.4 ST1TD2 Parameter Setting Read Commands

8.4.1 Conversion enable/disable setting read (Command No.: 9300H/1300H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the conversion enable/disable setting from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.16 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.9300H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
Cw.1	[For execution of command No.1300H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.2	Set a command No. to be executed (9300H/1300H). (Hexadecimal)
Cw.3	Fixed to 0000H. (Any other value is treated as 0000H.)

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.17 Values stored in "Cr" Command result area (When completed normally)

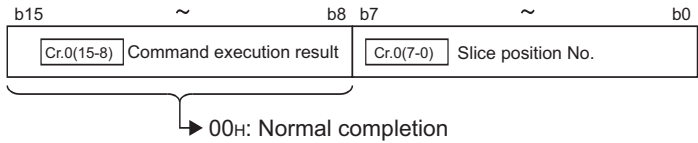
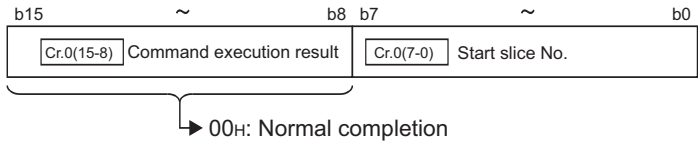
Cr Command result area	Result details
Cr.0	<p>[For execution of command No.9300H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p>[For execution of command No.1300H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> 
Cr.1	The executed command No. (9300H/1300H) is stored. (Hexadecimal)

Table 8.17 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
Cr.2		<p>The conversion enable/disable setting in RAM is stored for each channel.</p>
Cr.3		0000H is stored.

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

Table 8.18 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.9300H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>[For execution of command No.1300H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>
Cr.1		The executed command No. (9300H/1300H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.2 Conversion channel read (Command No.: 9301H/1301H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the current conversion enable/disable setting and the conversion completion status.

(1) Values set to "Cw" Command execution area

Table 8.19 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.9301H] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.1301H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1	Set a command No. to be executed (9301H/1301H). (Hexadecimal)
Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3	

(2) Values stored in "Cr" Command result area

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.20 Values stored in "Cr" Command result area (When completed normally)

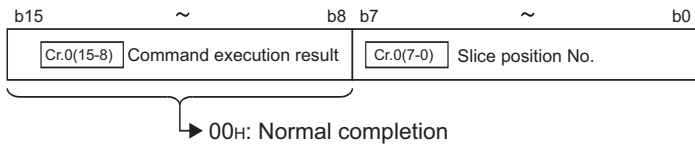
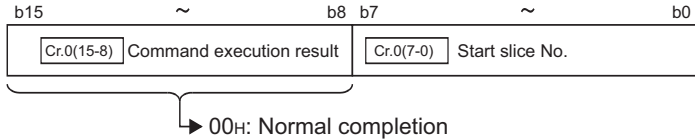
Cr Command result area	Setting value
Cr.0	<p>[For execution of command No.9301H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p>[For execution of command No.1301H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> 
Cr.1	The executed command No. (9301H/1301H) is stored. (Hexadecimal)

Table 8.20 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Setting value
Cr.2		<p>The current conversion enable/disable setting is stored for each channel.</p> <p>Fixed to 0.</p> <p>b3 b2 b1 b0</p> <p>0 0</p> <p>Fixed to 0.</p> <p>CH1: Conversion enable/disable setting 0: Conversion enable 1: Conversion disable</p> <p>CH2: Conversion enable/disable setting 0: Conversion enable 1: Conversion disable</p>
Cr.3		<p>The conversion completion status is stored for each channel.</p> <p>Fixed to 0.</p> <p>b3 b2 b1 b0</p> <p>0 0</p> <p>Fixed to 0.</p> <p>CH1 Conversion completed status 0: Conversion being executed or not used 1: Conversion completed</p> <p>CH2 Conversion completed status 0: Conversion being executed or not used 1: Conversion completed</p>

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

Table 8.21 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.9301H]</p> <p>The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>b15 ~ b8 b7 ~ b0</p> <p>Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.*1</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
Cr.0		<p>[For execution of command No.1301H]</p> <p>The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>b15 ~ b8 b7 ~ b0</p> <p>Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.*1</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
Cr.1		The executed command No. (9301H/1301H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.3 Operation condition setting read (Command No.: 9302H/1302H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads averaging process setting and alarm output setting from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.22 Values set to "Cw" Command execution area

Cw	Command execution area	Setting value
	Cw.0	[For execution of command No.9302H] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.1302H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
	Cw.1	Set a command No. to be executed (9302H/1302H). (Hexadecimal)
	Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
	Cw.3	

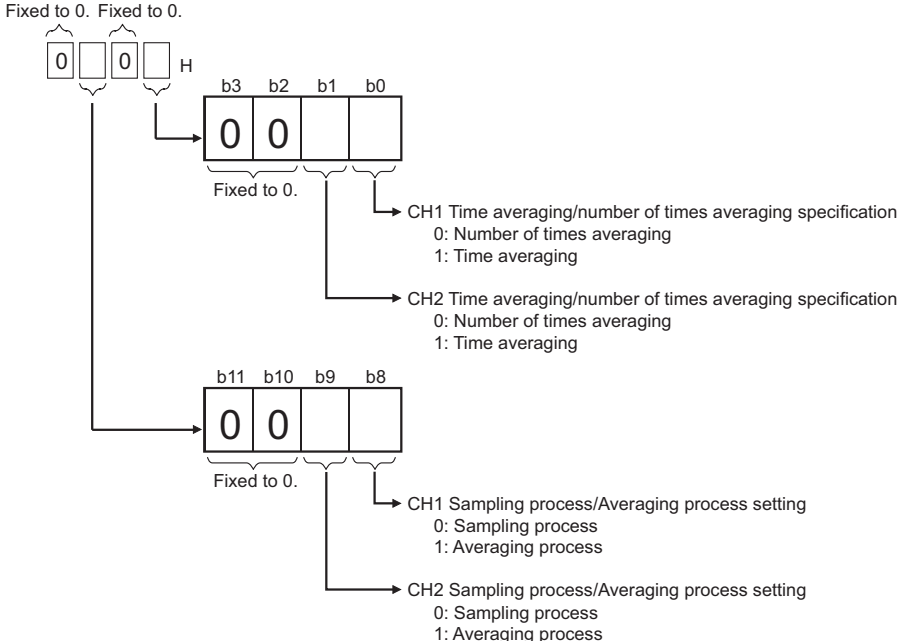
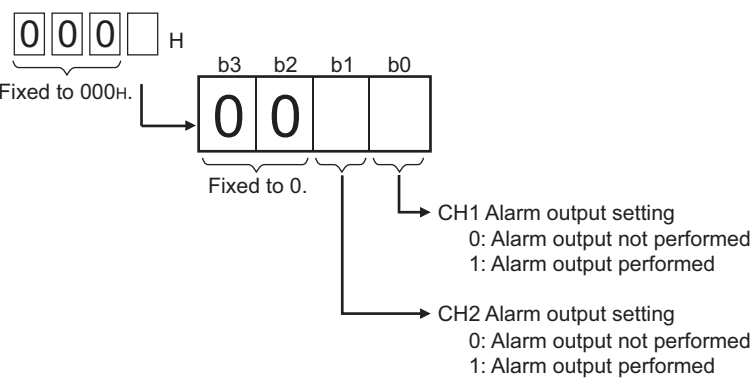
(2) Values stored in "Cr" Command result area

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.23 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.9302H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>[For execution of command No.1302H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>
	Cr.1	The executed command No. (9302H/1302H) is stored. (Hexadecimal)

Table 8.23 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
Cr.2		<p>The averaging process setting is stored for each channel.</p> 
Cr.3		<p>The alarm output setting is stored for each channel.</p> 

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

Table 8.24 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
Cr.0	<p>[For execution of command No.9302H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;"> Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.*1 </p> <p style="text-align: center;"> ↳ Other than 00H: Failure (↳ Section 8.7 Values Stored into Command Execution Result) </p> </div> <hr/> <p>[For execution of command No.1302H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;"> Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.*1 </p> <p style="text-align: center;"> ↳ Other than 00H: Failure (↳ Section 8.7 Values Stored into Command Execution Result) </p> </div>	
Cr.1		The executed command No. (9302H/1302H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.4 CH[] time/count averaging setting read (Command No.: 9304H/1304H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the number of times or the period of time set for averaging process from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.25 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.9304H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
Cw.1	[For execution of command No.1304H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.2	Set a command No. to be executed (9304H/1304H). (Hexadecimal)
Cw.3	Fixed to 0000H. (Any other value is treated as 0000H.)

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.26 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	[For execution of command No.9304H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.</p> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
	[For execution of command No.1304H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.</p> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
Cr.1	The executed command No. (9304H/1304H) is stored. (Hexadecimal)

Table 8.26 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	The number of times or the period of time set for averaging process of channel 1 is stored. The value ranges are as follows: Count averaging: 4 to 62500 (times) Time averaging: 2 to 5000 (ms)
	Cr.3	The number of times or the period of time set for averaging process of channel 2 is stored. The value ranges are the same as Cr.2 Response data 1.

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

Table 8.27 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.9304H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p> </div> <p>[For execution of command No.1304H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p> </div>
	Cr.1	The executed command No. (9304H/1304H) is stored. (Hexadecimal)
	Cr.2	Cr.2 Argument 1 at command execution is stored.
	Cr.3	Cr.3 Argument 2 at command execution is stored.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.5 CH[] upper upper limit/upper lower limit setting read (Command No.: 9308H, 930AH/1308H, 130AH)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the upper upper limit value or upper lower limit value set for alarm output from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.28 Values set to "Cw" Command execution area

Cw	Command execution area	Setting value
Cw.0		[For execution of command No.9308H, 930AH] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.1308H, 130AH] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1		Set a command No. to be executed. (Hexadecimal) CH1 upper upper limit/upper lower limit setting read: 9308H, 1308H CH2 upper upper limit/upper lower limit setting read: 930AH, 130AH
Cw.2		Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3		

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.29 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
Cr.0		[For execution of command No.9308H, 930AH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
Cr.0		[For execution of command No.1308H, 130AH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
Cr.1		The executed command No. (9308H/1308H, 930AH/130AH) is stored. (Hexadecimal)

Table 8.29 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	CH □ upper upper limit value is stored. (16-bit signed binary) The value range is -32768 to 32767.
	Cr.3	CH □ upper lower limit value is stored. (16-bit signed binary) The value range is the same as that of Cr.2 Response data.

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

Table 8.30 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.9308H, 930AH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p>b15 ~ b8 b7 ~ b0</p> <p>Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No. *1</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p> </div> <p>[For execution of command No.1308H, 130AH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p>b15 ~ b8 b7 ~ b0</p> <p>Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No. *1</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p> </div>
	Cr.1	The executed command No. (9308H/1308H, 930AH/130AH) is stored. (Hexadecimal)
	Cr.2	Cr.w.2 Argument 1 at command execution is stored.
	Cr.3	Cr.w.3 Argument 2 at command execution is stored.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.6 CH[] lower upper limit/lower lower limit setting read (Command No.: 9309H, 930BH/1309H, 130BH)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the lower upper limit value or lower lower limit value set for alarm output from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.31 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.9309H, 930BH] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.1309H, 130BH] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1	Set a command No. to be executed. (Hexadecimal) CH1 lower upper limit/lower lower limit setting read: 9309H, 1309H CH2 lower upper limit/lower lower limit setting read: 930BH, 130BH
Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3	

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.32 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	[For execution of command No.9309H, 930BH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.</p> <p style="text-align: center;">▶ 00H: Normal completion</p> </div>
	[For execution of command No.1309H, 130BH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.</p> <p style="text-align: center;">▶ 00H: Normal completion</p> </div>
Cr.1	The executed command No. (9309H/1309H, 930BH/130BH) is stored. (Hexadecimal)

Table 8.32 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	CH □ lower upper limit value is stored. (16-bit signed binary) The value range is -32768 to 32767.
	Cr.3	CH □ lower lower limit value is stored. (16-bit signed binary) The value range is the same as that of Cr.2 Response data.

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

Table 8.33 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.9309H, 930BH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	Cr.0	<p>[For execution of command No.1309H, 130BH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	Cr.1	The executed command No. (9309H/1309H, 930BH/130BH) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.7 Initial data setting read (Command No.: 9318H/1318H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads the input type setting, offset/gain value selection, and cold junction compensation setting from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.34 Values set to "Cw" Command execution area

Cw	Command execution area	Setting value
Cw.0		[For execution of command No.9318H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
		[For execution of command No.1318H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1		Set a command No. to be executed (9318H/1318H). (Hexadecimal)
Cw.2		Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3		

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.35 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
Cr.0		[For execution of command No.9318H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
		[For execution of command No.1318H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
Cr.1		The executed command No. (9318H/1318H) is stored. (Hexadecimal)

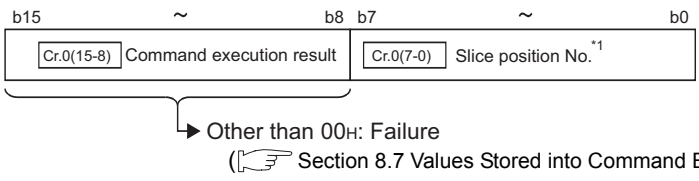
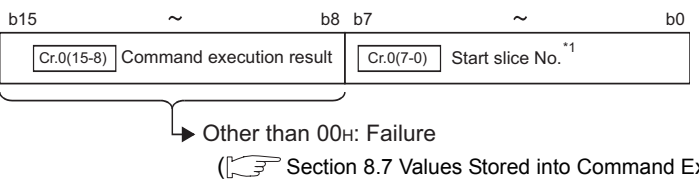
Table 8.35 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
Cr.2	*1	<p>The input type setting, offset/gain value selection, and cold junction compensation setting written to RAM are stored for each channel.</p> <p> CH1 Cold junction temperature compensation setting 0 : Cold junction temperature compensation not performed 1 : Cold junction temperature compensation performed </p> <p> CH2 Cold junction temperature compensation setting 0 : Cold junction temperature compensation not performed 1 : Cold junction temperature compensation performed </p> <p> CH1 Input type setting 0H : Thermocouple K 5H : Thermocouple R 1H : Thermocouple E 6H : Thermocouple S 2H : Thermocouple J 7H : Thermocouple N 3H : Thermocouple T FH : Micro voltage input 4H : Thermocouple B </p> <p> CH1 Offset/gain value selection 0 : Factory default 1 : User range setting </p> <p> CH2 Offset/gain value selection 0 : Factory default 1 : User range setting </p> <p> CH2 Input type setting 0H : Thermocouple K 5H : Thermocouple R 1H : Thermocouple E 6H : Thermocouple S 2H : Thermocouple J 7H : Thermocouple N 3H : Thermocouple T FH : Micro voltage input 4H : Thermocouple B </p>
Cr.3	*1	<p>The current input type setting, offset/gain value selection, and cold junction compensation setting are stored for each channel.</p> <p>The stored value is the same as Cr.2 Response data 1.</p>

* 1 If the stored values differ between Cr.2 and Cr.3, the parameters written to the RAM with the command have not taken effect in the module. Set Bw.n+1 Convert setting request to ON (1) for the parameters on the RAM to take effect in the module.

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

Table 8.36 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.9318H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
		<p>[For execution of command No.1318H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
Cr.1		The executed command No. (9318H/1318H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.4.8 Sensor compensation value read (Command No.: 931AH/131AH)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads a compensation value, which is set for an error between "actual temperature/voltage" and "measured temperature/voltage", from RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.37 Values set to "Cw" Command execution area

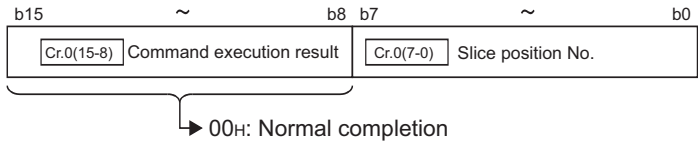
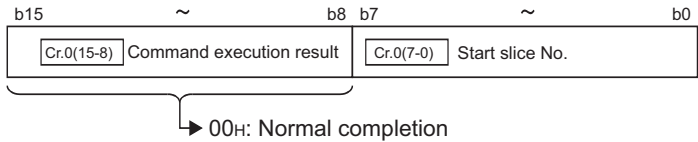
Cw	Command execution area	Setting value
	Cw.0	[For execution of command No.931AH] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.131AH] Set a start slice No. of the target ST1TD2. (Hexadecimal)
	Cw.1	Set a command No. to be executed (931AH/131AH). (Hexadecimal)
	Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
	Cw.3	

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.38 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
	Cr.0	[For execution of command No.931AH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. 
	Cr.0	[For execution of command No.131AH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. 
	Cr.1	The executed command No. (931AH/131AH) is stored. (Hexadecimal)
	Cr.2 *1	A sensor compensation value for channel 1 is stored. The value range is -500 to 500.
	Cr.3 *1	A sensor compensation value for channel 2 is stored. The value range is the same as Cr.2 Response data 1.

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

Table 8.39 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details	
Cr.0		<p>[For execution of command No.931AH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="font-size: small;">b15 ~ b8 b7 ~ b0</p> <p style="font-size: small;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No. *1</p> </div> <p style="text-align: center;">Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>	
		<p>[For execution of command No.131AH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="font-size: small;">b15 ~ b8 b7 ~ b0</p> <p style="font-size: small;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No. *1</p> </div> <p style="text-align: center;">Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>	
	Cr.1	The executed command No. (931AH/131AH) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.5 ST1TD2 Parameter Setting Write Commands

8.5.1 Conversion enable/disable setting write (Command No.: A300H/2300H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command writes the conversion enable/disable setting to RAM of the ST1TD2, and can be executed only in normal mode and when Bw.n+1 Convert setting request is off (0).

(1) Values set to "Cw" Command execution area

Table 8.40 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.A300H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
Cw.1	[For execution of command No.2300H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.2	Set a command No. to be executed (A300H/2300H). (Hexadecimal) Set a conversion enable/disable setting for each channel. <div style="margin-left: 20px;"> </div>
Cw.3	Fixed to 0000H. (Any other value is treated as 0000H.)

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.41 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.A300H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
		<p>[For execution of command No.2300H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
	Cr.1	The executed command No. (A300H/2300H) is stored. (Hexadecimal)
	Cr.2	Cr.w.2 Argument 1 at command execution is stored.
	Cr.3	0000H is stored.

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

Table 8.42 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.A300H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">→ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p> </div>
		<p>[For execution of command No.2300H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">→ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p> </div>

Table 8.42 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.1	The executed command No. (A300H/2300H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.5.2 Operating condition setting write (Command No.: A302H/2302H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command writes the averaging process setting and alarm output setting to RAM of the ST1TD2, and can be executed only in normal mode and when Bw.n+1 Convert setting request is OFF (0).

(1) Values set to "Cw" Command execution area

Table 8.43 Values set to "Cw" Command execution area

<input type="checkbox"/> Cw Command execution area	Setting value
<input type="checkbox"/> Cw.0	<p>[For execution of command No.A302H] Set a slice position No. of the target ST1TD2. (Hexadecimal)</p> <p>[For execution of command No.2302H] Set a start slice No. of the target ST1TD2. (Hexadecimal)</p>
<input type="checkbox"/> Cw.1	Set a command No. to be executed (A302H/2302H). (Hexadecimal)
<input type="checkbox"/> Cw.2	<p>Specify sampling or averaging process for each channel. For averaging process, specify a period of time or number of times applied to the averaging.</p> <p>Fixed to 0. Fixed to 0.</p> <p>CH1 Time averaging/number of times averaging specification 0: Number of times averaging 1: Time averaging</p> <p>CH2 Time averaging/number of times averaging specification 0: Number of times averaging 1: Time averaging</p> <p>CH1 Sampling process/Averaging process setting 0: Sampling process 1: Averaging process</p> <p>CH2 Sampling process/Averaging process setting 0: Sampling process 1: Averaging process</p>

Table 8.43 Values set to "Cw" Command execution area (Continued)

Cw Command execution area	Setting value
Cw.3	<p>Specify the channel(s) for which alarm output is to be performed.</p> <p>Fixed to 0. Fixed to 0.</p> <p>CH1 Time averaging/number of times averaging specification 0: Number of times averaging 1: Time averaging</p> <p>CH2 Time averaging/number of times averaging specification 0: Number of times averaging 1: Time averaging</p> <p>CH1 Sampling process/Averaging process setting 0: Sampling process 1: Averaging process</p> <p>CH2 Sampling process/Averaging process setting 0: Sampling process 1: Averaging process</p>

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.44 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.A302H]</p> <p>The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>00H: Normal completion</p>
Cr.0	<p>[For execution of command No.2302H]</p> <p>The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>00H: Normal completion</p>
Cr.1	The executed command No. (A302H/2302H) is stored. (Hexadecimal)

Table 8.44 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	0000H is stored.
	Cr.3	

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

Table 8.45 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.A302H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result)</p> </div>
	Cr.0	<p>[For execution of command No.2302H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result)</p> </div>
	Cr.1	The executed command No. (A302H/2302H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.5.3 CH[] time/count averaging setting write (Command No.: A304H/2304H)

Data size	
<input type="text" value="Cw"/>	4 words (8 bytes)
<input type="text" value="Cr"/>	4 words (8 bytes)

This command writes the number of times or period of time set for averaging process to RAM of the ST1TD2, and can be executed only in normal mode and when Convert setting request is OFF (0).

(1) Values set to "Cw" Command execution area

Table 8.46 Values set to "Cw" Command execution area

<input type="text" value="Cw"/> Command execution area	Setting value
<input type="text" value="Cw.0"/>	[For execution of command No.A304H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
<input type="text" value="Cw.1"/>	[For execution of command No.2304H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
<input type="text" value="Cw.2"/>	Set the number of times or the period of time set for averaging process of channel 1. The setting ranges are as follows: Count averaging: 4 to 500 (times) Time averaging: 480 to 5000 (ms)
<input type="text" value="Cw.3"/>	Set the number of times or the period of time set for averaging process of channel 2. The setting range is the same as <input type="text" value="Cw.2"/> Argument 1.

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.47 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.A304H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
	<p>[For execution of command No.2304H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
Cr.1	The executed command No. (A304H/2304H) is stored. (Hexadecimal)
Cr.2	0000H is stored.
Cr.3	

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

Table 8.48 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.A304H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
	<p>[For execution of command No.2304H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>

Table 8.48 Values stored in "Cr" Command result area (When failed) (Continued)

Cr Command result area	Result details
Cr.1	The executed command No. (A304H/2304H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.5.4 CH[] upper upper limit/upper lower limit setting write (Command No.: A308H, A30AH/2308H, 230AH)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command writes the upper upper limit value and upper lower limit value for alarm output to RAM of the ST1TD2, and can be executed only in normal mode and when

Bw.n+1 Convert setting request is OFF (0).

(1) Values set to "Cw" Command execution area

Table 8.49 Values set to "Cw" Command execution area

<input type="checkbox"/> Cw Command execution area	Setting value																				
<input type="checkbox"/> Cw.0	[For execution of command No.A308H, A30AH] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.2308H, 230AH] Set a start slice No. of the target ST1TD2. (Hexadecimal)																				
<input type="checkbox"/> Cw.1	Set a command No. to be executed. (Hexadecimal) CH1 upper upper limit/upper lower limit setting write: A308H, 2308H CH2 upper upper limit/upper lower limit setting write: A30AH, 230AH																				
<input type="checkbox"/> Cw.2	Set an upper upper limit value for alarm output. The setting range for each input type is shown below. For thermocouple input, set a value in units of 0.1°C. [Example] For 0.3°C, set "3". <table border="1" data-bbox="555 1288 1262 1626"> <thead> <tr> <th>Input type</th> <th>Setting range (Accuracy guaranteed)</th> </tr> </thead> <tbody> <tr> <td>Thermocouple K</td> <td>-2700 to 13720 (-2000 to 12000)</td> </tr> <tr> <td>Thermocouple E</td> <td>-2700 to 10000 (-2000 to 9000)</td> </tr> <tr> <td>Thermocouple J</td> <td>-2100 to 12000 (-400 to 7500)</td> </tr> <tr> <td>Thermocouple T</td> <td>-2700 to 4000 (-2000 to 3500)</td> </tr> <tr> <td>Thermocouple B</td> <td>0 to 18200 (6000 to 17000)</td> </tr> <tr> <td>Thermocouple R</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple S</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple N</td> <td>-2700 to 13000 (-2000 to 12500)</td> </tr> <tr> <td>Micro voltage input</td> <td>-21000 to 21000 (-20000 to 20000)</td> </tr> </tbody> </table>	Input type	Setting range (Accuracy guaranteed)	Thermocouple K	-2700 to 13720 (-2000 to 12000)	Thermocouple E	-2700 to 10000 (-2000 to 9000)	Thermocouple J	-2100 to 12000 (-400 to 7500)	Thermocouple T	-2700 to 4000 (-2000 to 3500)	Thermocouple B	0 to 18200 (6000 to 17000)	Thermocouple R	-500 to 17680 (0 to 16000)	Thermocouple S	-500 to 17680 (0 to 16000)	Thermocouple N	-2700 to 13000 (-2000 to 12500)	Micro voltage input	-21000 to 21000 (-20000 to 20000)
Input type	Setting range (Accuracy guaranteed)																				
Thermocouple K	-2700 to 13720 (-2000 to 12000)																				
Thermocouple E	-2700 to 10000 (-2000 to 9000)																				
Thermocouple J	-2100 to 12000 (-400 to 7500)																				
Thermocouple T	-2700 to 4000 (-2000 to 3500)																				
Thermocouple B	0 to 18200 (6000 to 17000)																				
Thermocouple R	-500 to 17680 (0 to 16000)																				
Thermocouple S	-500 to 17680 (0 to 16000)																				
Thermocouple N	-2700 to 13000 (-2000 to 12500)																				
Micro voltage input	-21000 to 21000 (-20000 to 20000)																				
<input type="checkbox"/> Cw.3	Set an upper lower limit value for alarm output. The setting range is the same as <input type="checkbox"/> Cw.2 Argument 1.																				

The condition, Upper upper limit value \geq Upper lower limit value \geq Lower upper limit value \geq Lower lower limit value, must be met.

(2) Values stored in "Cr" Command result area

The command execution result data vary depending on the result data (normal completion or failure) in $\boxed{\text{Cr.0(15-8)}}$ Command execution result.

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.50 Values stored in "Cr" Command result area (When completed normally)

$\boxed{\text{Cr}}$ Command result area	Result details
$\boxed{\text{Cr.0}}$	<p>[For execution of command No.A308H, A30AH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
	<p>[For execution of command No.2308H, 230AH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
$\boxed{\text{Cr.1}}$	The executed command No. (A308H/2308H, A30AH/230AH) is stored. (Hexadecimal)
$\boxed{\text{Cr.2}}$	0000H is stored.
$\boxed{\text{Cr.3}}$	

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

Table 8.51 Values stored in "Cr" Command result area (When failed)

$\boxed{\text{Cr}}$ Command result area	Result details
$\boxed{\text{Cr.0}}$	<p>[For execution of command No.A308H, A30AH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
	<p>[For execution of command No.2308H, 230AH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>

Table 8.51 Values stored in "Cr" Command result area (When failed) (Continued)

Cr Command result area	Result details
Cr.1	The executed command No. (A308H/2308H, A30AH/230AH) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.5.5 CH[] lower upper limit/lower lower limit setting write (Command No.: A309H, A30BH/2309H, 230BH)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command writes the lower upper limit value and lower lower limit value for alarm output to RAM of the ST1TD2, and can be executed only in normal mode and when

Bw.n+1 Convert setting request is OFF (0).

(1) Values set to "Cw" Command execution area

Table 8.52 Values set to "Cw" Command execution area

<input type="checkbox"/> Cw Command execution area	Setting value																				
<input type="checkbox"/> Cw.0	[For execution of command No.A309H, A30BH] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.2309H, 230BH] Set a start slice No. of the target ST1TD2. (Hexadecimal)																				
<input type="checkbox"/> Cw.1	Set a command No. to be executed. (Hexadecimal) CH1 lower upper limit/lower lower limit setting write: A309H, 2309H CH2 lower upper limit/lower lower limit setting write: A30BH, 230BH																				
<input type="checkbox"/> Cw.2	Set a lower upper limit value for alarm output. The setting range for each input type is shown below. For thermocouple input, set a value in units of 0.1°C. [Example] For 0.3°C, set "3". <table border="1"> <thead> <tr> <th>Input type</th> <th>Setting range (Accuracy guaranteed)</th> </tr> </thead> <tbody> <tr> <td>Thermocouple K</td> <td>-2700 to 13720 (-2000 to 12000)</td> </tr> <tr> <td>Thermocouple E</td> <td>-2700 to 10000 (-2000 to 9000)</td> </tr> <tr> <td>Thermocouple J</td> <td>-2100 to 12000 (-400 to 7500)</td> </tr> <tr> <td>Thermocouple T</td> <td>-2700 to 4000 (-2000 to 3500)</td> </tr> <tr> <td>Thermocouple B</td> <td>0 to 18200 (6000 to 17000)</td> </tr> <tr> <td>Thermocouple R</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple S</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple N</td> <td>-2700 to 13000 (-2000 to 12500)</td> </tr> <tr> <td>Micro voltage input</td> <td>-21000 to 21000 (-20000 to 20000)</td> </tr> </tbody> </table> <p>The condition, Upper upper limit value \geq Upper lower limit value \geq Lower upper limit value \geq Lower lower limit value, must be met.</p>	Input type	Setting range (Accuracy guaranteed)	Thermocouple K	-2700 to 13720 (-2000 to 12000)	Thermocouple E	-2700 to 10000 (-2000 to 9000)	Thermocouple J	-2100 to 12000 (-400 to 7500)	Thermocouple T	-2700 to 4000 (-2000 to 3500)	Thermocouple B	0 to 18200 (6000 to 17000)	Thermocouple R	-500 to 17680 (0 to 16000)	Thermocouple S	-500 to 17680 (0 to 16000)	Thermocouple N	-2700 to 13000 (-2000 to 12500)	Micro voltage input	-21000 to 21000 (-20000 to 20000)
Input type	Setting range (Accuracy guaranteed)																				
Thermocouple K	-2700 to 13720 (-2000 to 12000)																				
Thermocouple E	-2700 to 10000 (-2000 to 9000)																				
Thermocouple J	-2100 to 12000 (-400 to 7500)																				
Thermocouple T	-2700 to 4000 (-2000 to 3500)																				
Thermocouple B	0 to 18200 (6000 to 17000)																				
Thermocouple R	-500 to 17680 (0 to 16000)																				
Thermocouple S	-500 to 17680 (0 to 16000)																				
Thermocouple N	-2700 to 13000 (-2000 to 12500)																				
Micro voltage input	-21000 to 21000 (-20000 to 20000)																				
<input type="checkbox"/> Cw.3	Set an upper lower limit value for alarm output. The setting range is the same as <input type="checkbox"/> Cw.2 Argument 1.																				

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.53 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.A309H, A30BH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;"> Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No. </p> </div> <p style="text-align: center;">→ 00H: Normal completion</p>
	<p>[For execution of command No.2309H, 230BH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;"> Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No. </p> </div> <p style="text-align: center;">→ 00H: Normal completion</p>
Cr.1	The executed command No. (A309H/2309H, A30BH/230BH) is stored. (Hexadecimal)
Cr.2	0000H is stored.
Cr.3	

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

Table 8.54 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.A309H, A30BH] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;"> Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.^{*1} </p> </div> <p style="text-align: center;">→ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	<p>[For execution of command No.2309H, 230BH] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;"> Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.^{*1} </p> </div> <p style="text-align: center;">→ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>

Table 8.54 Values stored in "Cr" Command result area (When failed) (Continued)

Cr Command result area	Result details
Cr.1	The executed command No. (A309H/2309H, A30BH/230BH) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.5.6 Sensor compensation value write (Command No.: A31AH/231AH)

Data size	
<input type="text" value="Cw"/>	4 words (8 bytes)
<input type="text" value="Cr"/>	4 words (8 bytes)

This command writes a compensation value, which is set for an error between "actual temperature value/voltage" and "measured temperature/voltage", to RAM of the ST1TD2.

(1) Values set to "Cw" Command execution area

Table 8.55 Values set to "Cw" Command execution area

<input type="text" value="Cw"/> Command execution area	Setting value
<input type="text" value="Cw.0"/>	[For execution of command No.A31AH] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.231AH] Set a start slice No. of the target ST1TD2. (Hexadecimal)
<input type="text" value="Cw.1"/>	Set a command No. to be executed (A31AH/231AH). (Hexadecimal)
<input type="text" value="Cw.2"/>	Set a sensor compensation value for channel 1. The setting range is -500 to 500. For thermocouple input, set a value in units of 0.1°C. [Example] For 0.3°C, set "3". For micro voltage input, set a value in units of 4°C/digit. [Example] When a micro voltage conversion value at 40mV input is 10003, set "-3".
<input type="text" value="Cw.3"/>	Set a sensor compensation value for channel 2. The setting range is the same as <input type="text" value="Cw.2"/> Argument 1.

(2) Values stored in "Cr" Command result area

The command execution result data vary depending on the result data (normal completion or failure) in Command execution result.

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.56 Values stored in "Cr" Command result area (When completed normally)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.A31AH]</p> <p>The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
		<p>[For execution of command No.231AH]</p> <p>The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
	Cr.1	The executed command No. (A31AH/231AH) is stored. (Hexadecimal)
	Cr.2	0000H is stored.
	Cr.3	

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

Table 8.57 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details	
Cr.0		<p>[For execution of command No.A31AH]</p> <p>The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>	
		<p>[For execution of command No.231AH]</p> <p>The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>	
	Cr.1	The executed command No. (A31AH/231AH) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.6 ST1TD2 Control Commands

8.6.1 Parameter setting read from ROM (Command No.: B300H/3300H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command reads parameters from ROM to RAM in the ST1TD2, and can be executed only in normal mode and when Bw.n+1 Convert setting request is OFF (0).

(1) Values set to "Cw" Command execution area

Table 8.58 Values set to "Cw" Command execution area

<input type="checkbox"/> Cw Command execution area	Setting value
<input type="checkbox"/> Cw.0	[For execution of command No.B300H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
	[For execution of command No.3300H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
<input type="checkbox"/> Cw.1	Set a command No. to be executed (B300H/3300H). (Hexadecimal)
<input type="checkbox"/> Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
<input type="checkbox"/> Cw.3	

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.59 Values stored in "Cr" Command result area (When completed normally)

<input type="checkbox"/> Cr Command result area	Result details
<input type="checkbox"/> Cr.0	<p>[For execution of command No.B300H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div> <p style="text-align: center;">→ 00H: Normal completion</p>
	<p>[For execution of command No.3300H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div> <p style="text-align: center;">→ 00H: Normal completion</p>

Table 8.59 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr Command result area	Result details
Cr.1	The executed command No. (B300H/3300H) is stored. (Hexadecimal)
Cr.2	0000H is stored.
Cr.3	

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

Table 8.60 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B300H]</p> <p>The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="font-size: small;">b15 ~ b8 b7 ~ b0</p> <p style="font-size: small;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No. *1</p> </div> <p style="text-align: center;"> ↳ Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result) </p>
	<p>[For execution of command No.3300H]</p> <p>The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="font-size: small;">b15 ~ b8 b7 ~ b0</p> <p style="font-size: small;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No. *1</p> </div> <p style="text-align: center;"> ↳ Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result) </p>
Cr.1	The executed command No. (B300H/3300H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.6.2 Parameter setting write to ROM (Command No.: B301H/3301H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command writes parameters from RAM to ROM in the ST1TD2, and can be executed only in normal mode and when Bw.n+1 Convert setting request is OFF (0).

(1) Values set to "Cw" Command execution area

Table 8.61 Values set to "Cw" Command execution area

<input type="checkbox"/> Cw Command execution area	Setting value
<input type="checkbox"/> Cw.0	[For execution of command No.B301H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
	[For execution of command No.3301H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
<input type="checkbox"/> Cw.1	Set a command No. to be executed (B301H/3301H). (Hexadecimal)
<input type="checkbox"/> Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
<input type="checkbox"/> Cw.3	

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.62 Values stored in "Cr" Command result area (When completed normally)

<input type="checkbox"/> Cr Command result area	Result details
<input type="checkbox"/> Cr.0	[For execution of command No.B301H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
	[For execution of command No.3301H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> </div>
<input type="checkbox"/> Cr.1	The executed command No. (B301H/3301H) is stored. (Hexadecimal)

Table 8.62 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr	Command result area	Result details
	Cr.2	0000H is stored.
	Cr.3	

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

Table 8.63 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
	Cr.0	<p>[For execution of command No.B301H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <div style="text-align: center;"> </div> <p style="text-align: center;">→ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	Cr.0	<p>[For execution of command No.3301H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <div style="text-align: center;"> </div> <p style="text-align: center;">→ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
	Cr.1	The executed command No. (B301H/3301H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

☒ POINT

Check that the module operates normally with the set values written to RAM, before executing the Parameter setting write to ROM (command No.: B301H/3301H).

8.6.3 Operation mode setting (Command No.: B302H/3302H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

The mode of the ST1TD2 can be changed. (From normal mode to offset/gain setting mode, or from offset/gain setting mode to normal mode)

This command can be executed in normal mode and when Bw.n+1 Convert setting request is off (0), or in offset/gain setting mode.

(1) Values set to "Cw" Command execution area

Table 8.64 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.B302H] Set a slice position No. of the target ST1TD2. (Hexadecimal)
	[For execution of command No.3302H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1	Set a command No. to be executed (B302H/3302H). (Hexadecimal)
Cw.2	Set an operation mode. (Hexadecimal) 0000H: Normal mode 0001H: Offset/gain setting mode
Cw.3	Fixed to 0000H. (Any other value is treated as 0000H.)

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.65 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B302H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.</p> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
	<p>[For execution of command No.3302H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.</p> <p style="text-align: center;">→ 00H: Normal completion</p> </div>

Table 8.65 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr Command result area	Result details
Cr.1	The executed command No. (B302H/3302H) is stored. (Hexadecimal)
Cr.2	Cw.2 Argument 1 at command execution is stored.
Cr.3	0000H is stored.

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

Table 8.66 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B302H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result)</p>
Cr.0	<p>[For execution of command No.3302H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <p>Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result)</p>
Cr.1	The executed command No. (B302H/3302H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.6.4 Offset channel specification (Command No.: B303H/3303H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command specifies a channel and adjusts the offset value for the channel. When this command is executed, the value of the voltage or current applied to the ST1TD2 is written to RAM as an offset value.

This command can be executed only in offset/gain setting mode.

(1) Values set to "Cw" Command execution area

Table 8.67 Values set to "Cw" Command execution area

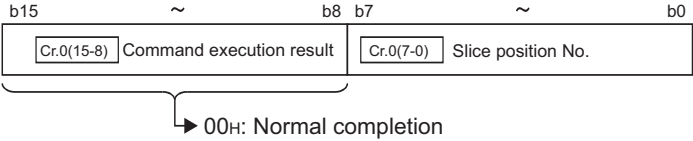
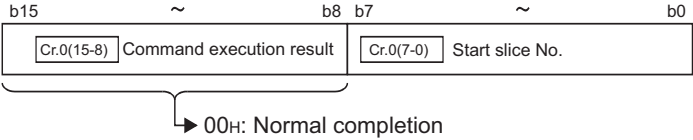
Cw Command execution area	Setting value																				
Cw.0	<p>[For execution of command No.B303H] Set a slice position No. of the target ST1TD2. (Hexadecimal)</p> <p>[For execution of command No.3303H] Set a start slice No. of the target ST1TD2. (Hexadecimal)</p>																				
Cw.1	Set a command No. to be executed (B303H/3303H). (Hexadecimal)																				
Cw.2	<p>Specify a channel for which values are adjusted by the offset value set in the offset/gain setting. Multiple channels can be set at the same time.</p> <p> CH1 Offset channel specification 0: Invalid 1: Channel to be set CH2 Offset channel specification 0: Invalid 1: Channel to be set </p>																				
Cw.3	<p>Set a temperature or voltage value that is equivalent to the input.</p> <p>* Set a temperature value in units of 0.1°C. [Example] For 0.3°C, set "3".</p> <p>* Set a voltage value in units of 0.01mV. [Example] For 3mV, set "300".</p> <p>The following lists the setting range for each input type.</p> <table border="1"> <thead> <tr> <th>Input type</th> <th>Setting range (Accuracy guaranteed)</th> </tr> </thead> <tbody> <tr> <td>Thermocouple K</td> <td>-2700 to 13720 (-2000 to 12000)</td> </tr> <tr> <td>Thermocouple E</td> <td>-2700 to 10000 (-2000 to 9000)</td> </tr> <tr> <td>Thermocouple J</td> <td>-2100 to 12000 (-400 to 7500)</td> </tr> <tr> <td>Thermocouple T</td> <td>-2700 to 4000 (-2000 to 3500)</td> </tr> <tr> <td>Thermocouple B</td> <td>0 to 18200 (6000 to 17000)</td> </tr> <tr> <td>Thermocouple R</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple S</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple N</td> <td>-2700 to 13000 (-2000 to 12500)</td> </tr> <tr> <td>Micro voltage input</td> <td>-8000 to 8000 (-8000 to 8000)</td> </tr> </tbody> </table>	Input type	Setting range (Accuracy guaranteed)	Thermocouple K	-2700 to 13720 (-2000 to 12000)	Thermocouple E	-2700 to 10000 (-2000 to 9000)	Thermocouple J	-2100 to 12000 (-400 to 7500)	Thermocouple T	-2700 to 4000 (-2000 to 3500)	Thermocouple B	0 to 18200 (6000 to 17000)	Thermocouple R	-500 to 17680 (0 to 16000)	Thermocouple S	-500 to 17680 (0 to 16000)	Thermocouple N	-2700 to 13000 (-2000 to 12500)	Micro voltage input	-8000 to 8000 (-8000 to 8000)
Input type	Setting range (Accuracy guaranteed)																				
Thermocouple K	-2700 to 13720 (-2000 to 12000)																				
Thermocouple E	-2700 to 10000 (-2000 to 9000)																				
Thermocouple J	-2100 to 12000 (-400 to 7500)																				
Thermocouple T	-2700 to 4000 (-2000 to 3500)																				
Thermocouple B	0 to 18200 (6000 to 17000)																				
Thermocouple R	-500 to 17680 (0 to 16000)																				
Thermocouple S	-500 to 17680 (0 to 16000)																				
Thermocouple N	-2700 to 13000 (-2000 to 12500)																				
Micro voltage input	-8000 to 8000 (-8000 to 8000)																				

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.68 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B303H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p style="text-align: center;">→ 00H: Normal completion</p>
	<p>[For execution of command No.3303H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p style="text-align: center;">→ 00H: Normal completion</p>
Cr.1	The executed command No. (B303H/3303H) is stored. (Hexadecimal)
Cr.2	
Cr.3	0000H is stored.

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

Table 8.69 Values stored in "Cr" Command result area (When failed)

Cr	Command result area	Result details
Cr.0		<p>[For execution of command No.B303H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="font-size: small;">b15 ~ b8 b7 ~ b0</p> <p style="font-size: small;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No. *1</p> </div> <p style="text-align: center;"> ↳ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result) </p>
		<p>[For execution of command No.3303H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p style="font-size: small;">b15 ~ b8 b7 ~ b0</p> <p style="font-size: small;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No. *1</p> </div> <p style="text-align: center;"> ↳ Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result) </p>
	Cr.1	The executed command No. (B303H/3303H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.6.5 Gain channel specification (Command No.: B304H/3304H)

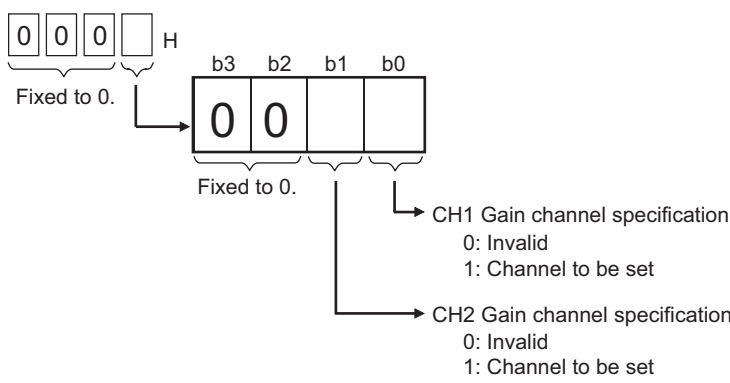
Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command specifies a channel and adjusts the gain value for the channel.
When this command is executed, the value of the voltage or current applied to the ST1TD2 is written to RAM as a gain value.

This command can be executed only in offset/gain setting mode.

(1) Values set to "Cw" Command execution area

Table 8.70 Values set to "Cw" Command execution area

Cw Command execution area	Setting value																				
Cw.0	[For execution of command No.B304H] Set a slice position No. of the target ST1TD2. (Hexadecimal)																				
Cw.1	[For execution of command No.3304H] Set a start slice No. of the target ST1TD2. (Hexadecimal)																				
Cw.2	Set a command No. to be executed (B304H/3304H). (Hexadecimal) Specify a channel for which values are adjusted by the gain value set in the offset/gain setting. Multiple channels can be set at the same time. 																				
Cw.3	Set a temperature or voltage value that is equivalent to the input. * Set a temperature value in units of 0.1°C. [Example] For 0.3°C, set "3". * Set a voltage value in units of 0.01mV. [Example] For 3mV, set "300". The following lists the setting range for each input type. <table border="1" data-bbox="510 1724 1212 2060"> <thead> <tr> <th>Input type</th> <th>Setting range (Accuracy guaranteed)</th> </tr> </thead> <tbody> <tr> <td>Thermocouple K</td> <td>-2700 to 13720 (-2000 to 12000)</td> </tr> <tr> <td>Thermocouple E</td> <td>-2700 to 10000 (-2000 to 9000)</td> </tr> <tr> <td>Thermocouple J</td> <td>-2100 to 12000 (-400 to 7500)</td> </tr> <tr> <td>Thermocouple T</td> <td>-2700 to 4000 (-2000 to 3500)</td> </tr> <tr> <td>Thermocouple B</td> <td>0 to 18200 (6000 to 17000)</td> </tr> <tr> <td>Thermocouple R</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple S</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple N</td> <td>-2700 to 13000 (-2000 to 12500)</td> </tr> <tr> <td>Micro voltage input</td> <td>-8000 to 8000 (-8000 to 8000)</td> </tr> </tbody> </table>	Input type	Setting range (Accuracy guaranteed)	Thermocouple K	-2700 to 13720 (-2000 to 12000)	Thermocouple E	-2700 to 10000 (-2000 to 9000)	Thermocouple J	-2100 to 12000 (-400 to 7500)	Thermocouple T	-2700 to 4000 (-2000 to 3500)	Thermocouple B	0 to 18200 (6000 to 17000)	Thermocouple R	-500 to 17680 (0 to 16000)	Thermocouple S	-500 to 17680 (0 to 16000)	Thermocouple N	-2700 to 13000 (-2000 to 12500)	Micro voltage input	-8000 to 8000 (-8000 to 8000)
Input type	Setting range (Accuracy guaranteed)																				
Thermocouple K	-2700 to 13720 (-2000 to 12000)																				
Thermocouple E	-2700 to 10000 (-2000 to 9000)																				
Thermocouple J	-2100 to 12000 (-400 to 7500)																				
Thermocouple T	-2700 to 4000 (-2000 to 3500)																				
Thermocouple B	0 to 18200 (6000 to 17000)																				
Thermocouple R	-500 to 17680 (0 to 16000)																				
Thermocouple S	-500 to 17680 (0 to 16000)																				
Thermocouple N	-2700 to 13000 (-2000 to 12500)																				
Micro voltage input	-8000 to 8000 (-8000 to 8000)																				

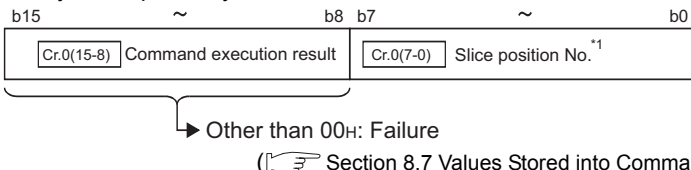
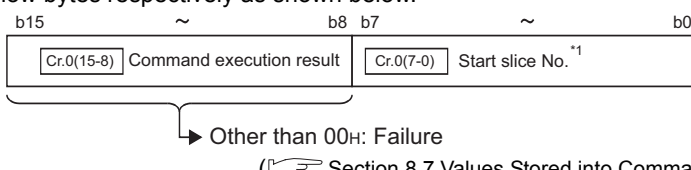
(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.71 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B304H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
Cr.1	<p>[For execution of command No.3304H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> </div>
Cr.2	The executed command No. (B304H/3304H) is stored. (Hexadecimal)
Cr.3	0000H is stored.

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

Table 8.72 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B304H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p>Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result)</p> <hr/> <p>[For execution of command No.3304H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p>  <p>Other than 00H: Failure (Section 8.7 Values Stored into Command Execution Result)</p>
Cr.1	The executed command No. (B304H/3304H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.6.6 User range write (Command No.: B305H/3305H)

Data size	
Cw	4 words (8 bytes)
Cr	4 words (8 bytes)

This command writes adjusted offset/gain setting values to ROM of the ST1TD2, and can be executed only in offset/gain setting mode.

(1) Values set to "Cw" Command execution area

Table 8.73 Values set to "Cw" Command execution area

Cw Command execution area	Setting value
Cw.0	[For execution of command No.B305H] Set a slice position No. of the target ST1TD2. (Hexadecimal) [For execution of command No.3305H] Set a start slice No. of the target ST1TD2. (Hexadecimal)
Cw.1	Set a command No. to be executed (B305H/3305H). (Hexadecimal)
Cw.2	Fixed to 0000H. (Any other value is treated as 0000H.)
Cw.3	

(2) Values stored in "Cr" Command result area

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

(a) When completed normally ("Cr.0(15-8)" Command execution result is 00H.)

Table 8.74 Values stored in "Cr" Command result area (When completed normally)

Cr Command result area	Result details
Cr.0	[For execution of command No.B305H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No.</p> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
	[For execution of command No.3305H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below. <div style="text-align: center;"> <p style="text-align: center;">b15 ~ b8 b7 ~ b0</p> <p style="text-align: center;">Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No.</p> <p style="text-align: center;">→ 00H: Normal completion</p> </div>
Cr.1	The executed command No. (B305H/3305H) is stored. (Hexadecimal)

Table 8.74 Values stored in "Cr" Command result area (When completed normally) (Continued)

Cr Command result area	Result details
Cr.2	0000H is stored.
Cr.3	

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

Table 8.75 Values stored in "Cr" Command result area (When failed)

Cr Command result area	Result details
Cr.0	<p>[For execution of command No.B305H] The command execution result and slice position No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p>Cr.0(15-8) Command execution result Cr.0(7-0) Slice position No. *1</p> </div> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
Cr.0	<p>[For execution of command No.3305H] The command execution result and start slice No. in hexadecimal are stored in the high and low bytes respectively as shown below.</p> <div style="text-align: center;"> <p>Cr.0(15-8) Command execution result Cr.0(7-0) Start slice No. *1</p> </div> <p>Other than 00H: Failure (☞ Section 8.7 Values Stored into Command Execution Result)</p>
Cr.1	The executed command No. (B305H/3305H) 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.

* 1 When 0FH is stored in Cr.0(15-8) Command execution result, 00H (slice position No. or start slice No. of the head module) is stored in Cr.0(7-0) Slice position No. or start slice No.

8.7 Values Stored into Command Execution Result

The following table indicates the values stored into $\boxed{\text{Cr.n(15-8)}}$ Command execution result in $\boxed{\text{Cr}}$ Command result area.

Table 8.76 Command execution results and actions

Command execution result	Description	Action
00H	Normal completion	-
01H	The requested command is not available for the specified module.	Check Table 8.1 to see if the requested command No. is applicable for the ST1TD2 or not. Check if the specified $\boxed{\text{Cw.0}}$ Slice position No. or start slice No. matches $\boxed{\text{Cw.0}}$ Slice position No. or start slice No. of the ST1TD2.
02H	The value is out of range.	Check if the values set in $\boxed{\text{Cw.2}}$ and subsequent area in the command execution area are within the range available for the requested command No.
03H	The specified "Cw.0" slice position No. or start slice No. is incorrect.	Check if the ST1TD2 is mounted in the position of the specified $\boxed{\text{Cw.0}}$ slice position No. or start slice No. Check if the specified $\boxed{\text{Cw.0}}$ slice position No. or start slice No. matches start slice No. of the ST1TD2.
04H	There is no response from the specified module.	Check Table 8.1 to see if the requested command No. can be used for the ST1TD2 or not. If the requested command No. is applicable, the ST1TD2 may be faulty. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
05H	No communication is available with the specified module.	The ST1TD2 may be faulty. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
06H	The requested command is not executable in the current operation mode of the module.	Check Table 8.1 to see if the requested command No. can be used in the operation mode or not. The number of user range writes (command No.: B305H/3305H) or parameter writes to ROM (command No.: B301H/3301H) exceeded 25 after power ON (error code: 1200H). Clear the error ^{*1} , and then execute the command. In the offset/gain setting, Offset value \geq Gain value (error code: 400□H). Clear the error ^{*1} , and then redo the offset/gain setting so that the offset value is less than the gain value. In the offset/gain setting, Gain value - Offset value \leq 0.2°C, or Gain value - Offset value \leq 20μV (error code: 410□H). Clear the error ^{*1} , and then redo the offset/gain setting so that Gain value - Offset value > 0.2°C, or Gain value - Offset value > 20μV.


Table 8.76 Command execution results and actions (Continued)

Command execution result	Description	Action
07H	The module has already been in the specified mode.	Continue the processing since the ST1TD2 specified by <input type="text" value="Cw.0"/> slice position No. or start slice No. is already in the requested mode.
08H	The mode of the module cannot be changed to the specified mode.	Set <input type="text" value="Bw.n+1"/> Convert setting request to OFF (0), and then execute the command.
09H	The specified module is in the online module change status.	Execute the command after completion of the online module change.
0AH	The specified module No. is different, or does not exist.	Check if the command parameter setting of the intelligent function module is appropriate to the specified module No.
0FH	The value of <input type="text" value="Cw.0"/> slice position No. or start slice No. is out of range.	Check if the value set for <input type="text" value="Cw.0"/> slice position No. or start slice No. is 7FH or less.
10H	Data cannot be read from the specified module.	Execute the command again. If the problem on the left occurs again, the ST1TD2 may be faulty.
11H	Data cannot be written to the specified module.	Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
13H	The specified module is not in the status available for command parameter writing.	Set <input type="text" value="Bw.n+1"/> Convert setting request to OFF (0), and then execute the command.

* 1 Clear the error by either of the following methods.

- Error clear request (command No.: 8104H/0104H)
- Error reset request (RYnA)

For details of the above, refer to the following.

 MELSEC-ST CC-Link Head Module User's Manual, "8.2.5 Error clear request (Command No.: 8104H/0104H)"

 MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

CHAPTER9 TROUBLESHOOTING

This chapter explains the errors that may occur when the ST1TD2 is used, and how to troubleshoot them.


9.1 Error Code List

When an error occurs due to data writing to the master module, executing the Error code read request command (command No.: 8101H/0101H) stores an 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 off and then on the ST1TD2, or reset the head module. If this error code is still stored, the possible cause is a ST1TD2 failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
1200H	System error	ROM write count error	Parameter setting write to ROM (command No.: B301H/3301H) or User range write (command No.: B305H/3305H) was executed more than 25 times after power-on. Offset/gain settings were written to the ROM using GX Configurator-ST 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.
1300H	System error	Converter error	A converter error has occurred.	Set the convert setting request to off to clear the error. Then, set it to on again.
1400H	System error	Base module error	A base module is faulty.	Power off and then on the ST1TD2, or reset the head module. If this error code is still stored, the possible cause is a base module failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
200□H	System error	Input type setting error	The input type setting is outside the valid range. □ indicates the channel number of the error channel.	Set a value that is within the valid range.
210□H	System error	Average setting error	The average time setting is outside the range of 480 to 5000ms. □ indicates the channel number of the error channel.	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 of 4 to 500 times. □ indicates the channel number of the error channel.	Set a value that is within the valid range.

Table 9.1 Error code list (2/2)

Error code (Hexadecimal)	Error level	Error name	Description	Corrective action																				
300□H	System error	Alarm setting error	<p>The value set to the upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value for alarm output is outside the valid range. The setting range for each input type is indicated below.</p> <table border="1"> <thead> <tr> <th>Input type</th> <th>Setting range (Accuracy guaranteed)</th> </tr> </thead> <tbody> <tr> <td>Thermocouple K</td> <td>-2700 to 13720 (-2000 to 12000)</td> </tr> <tr> <td>Thermocouple E</td> <td>-2700 to 10000 (-2000 to 9000)</td> </tr> <tr> <td>Thermocouple J</td> <td>-2100 to 12000 (-400 to 7500)</td> </tr> <tr> <td>Thermocouple T</td> <td>-2700 to 4000 (-2000 to 3500)</td> </tr> <tr> <td>Thermocouple B</td> <td>0 to 18200 (6000 to 17000)</td> </tr> <tr> <td>Thermocouple R</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple S</td> <td>-500 to 17680 (0 to 16000)</td> </tr> <tr> <td>Thermocouple N</td> <td>-2700 to 13000 (-2000 to 12500)</td> </tr> <tr> <td>Micro voltage input</td> <td>-21000 to 21000 (-20000 to 20000)</td> </tr> </tbody> </table> <p>□ indicates the channel number of the error channel.</p>	Input type	Setting range (Accuracy guaranteed)	Thermocouple K	-2700 to 13720 (-2000 to 12000)	Thermocouple E	-2700 to 10000 (-2000 to 9000)	Thermocouple J	-2100 to 12000 (-400 to 7500)	Thermocouple T	-2700 to 4000 (-2000 to 3500)	Thermocouple B	0 to 18200 (6000 to 17000)	Thermocouple R	-500 to 17680 (0 to 16000)	Thermocouple S	-500 to 17680 (0 to 16000)	Thermocouple N	-2700 to 13000 (-2000 to 12500)	Micro voltage input	-21000 to 21000 (-20000 to 20000)	Set a value that is within the valid range.
Input type	Setting range (Accuracy guaranteed)																							
Thermocouple K	-2700 to 13720 (-2000 to 12000)																							
Thermocouple E	-2700 to 10000 (-2000 to 9000)																							
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Thermocouple N	-2700 to 13000 (-2000 to 12500)																							
Micro voltage input	-21000 to 21000 (-20000 to 20000)																							
312 □H	System error	Alarm setting error	<p>The lower upper limit value is less than the lower lower limit value. □ indicates the channel number of the error channel.</p>	Re-set the limit values so that the condition of upper upper limit value \geq upper lower limit value \geq lower upper limit value \geq lower lower limit value is satisfied.																				
313□H	System error	Alarm setting error	<p>The upper lower limit value is less than the lower upper limit value. □ indicates the channel number of the error channel.</p>																					
314□H	System error	Alarm setting error	<p>The upper upper limit value is less than the upper lower limit value. □ indicates the channel number of the error channel.</p>																					
400□H	System error	User range setting error	<p>In User range setting, offset value is equal to or greater than gain value. □ indicates the channel number of the error channel.</p>	Reset the range so that offset value is smaller than gain value.																				
410□H	System error	User range setting error	<p>In User range setting, gain value - offset value \leq 0.2 [°C] or gain value - offset value \leq 20 [μV]. □ indicates the channel number of the error channel.</p>	Reset the values so that the condition, gain value - offset value $>$ 0.2 [°C] or gain value - offset value $>$ 20 [μ V], will be satisfied.																				
500□H	System error	Disconnection detection error	<p>Line disconnection has been detected. □ indicates the channel number of the error channel.</p>	Check for any abnormality on the signal lines by doing a visual check and performing a continuity check.																				
B10□H to FFFF	-	(Error detected by head module)	-	<p>Refer to the following and take corrective actions.</p> <p> MELSEC-ST CC-Link Head Module User's Manual, "9.7.2 Error code list"</p>																				

☒ POINT

- (1) When multiple errors of the same level occur, the code of the error first found by the ST1TD2 is stored.
- (2) The error can be cleared by either of the following methods:
 - Error clear request (command No.: 8104H/0104H)
 - Error reset request (RYnA)

For details of the above methods, refer to the following.

☞ MELSEC-ST CC-Link Head Module User's Manual, "8.2.5 Error clear request (Command No.: 8104H/0104H)


☞ MELSEC-ST CC-Link Head Module User's Manual, "3.4 Remote I/O, Remote Registers"

9.2 Troubleshooting

9.2.1 When the RUN LED is flashing or turned off


(1) When flashing at 0.5s intervals

Table 9.2 When flashing at 0.5s intervals

Check item	Corrective action
Is the mode set to the offset/gain setting mode?	Execute the Operation mode setting command (command No.: B302H/3302H) to enter the normal mode.  Section 8.6.3 Operation mode setting (Command No.: B302H/3302H)


(2) When flashing at 0.25s intervals

Table 9.3 When flashing at 0.25s intervals

Check item	Corrective action
Is the module selected as the target of online module change?	Refer to the following and take corrective action.  CHAPTER 7 ONLINE MODULE CHANGE


(3) When flashing at 1s intervals

Table 9.4 When flashing at 1s intervals

Check item	Corrective action
Has cyclic transmission been stopped between the master station and head module?	Refer to the following and take corrective action.  MELSEC-ST System User's Manual
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 turned off

Table 9.5 When turned off

Check item	Corrective action
Is a module change enabled during an online module change?	Refer to the following and take corrective action.  CHAPTER 7 ONLINE MODULE CHANGE
Is External SYS. power 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 ST1TD2 correctly mounted on the base module?	Check the mounting condition of the ST1TD2.
Has a watchdog timer error occurred?	Power off and then on the ST1TD2, 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 ST1TD2 failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

9.2.2 When the RUN and ERR. LEDs are turned on

Table 9.6 When the RUN and ERR. LEDs turned on

Check item	Corrective action
Has an error occurred?	Confirm the error code and take corrective action described in the error code list.  Section 9.1 Error Code List

9.2.3 When line disconnection has been detected

Table 9.7 When digital output values cannot be read

Check item	Corrective action
Check whether the thermocouple, compensation lead wire or micro voltage signal cable is connected incompletely or not.	Connect the thermocouple, compensation lead wire or micro voltage signal cable 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, refer to the MELSEC-ST System User's Manual.
Check the connected thermocouple, compensation lead wire or micro voltage signal cable for disconnection.	Make continuity check on the thermocouple, compensation lead wire or micro voltage signal cable, and replace it if it is broken.
Check whether conversion of the channel where no thermocouple or micro voltage signal cable is connected is enabled.	Check the conversion-enabled channels and the channels where thermocouples or micro voltage signal cables are connected, and correct the setting.

9.2.4 Measured temperature value/micro voltage conversion value cannot be read

Table 9.8 When digital output values cannot be read

Check item	Corrective action
Is external AUX. power being supplied?	Check whether 24V DC power is supplied to the power distribution module.
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?	<p>Verify that the offset/gain settings are correct.</p> <ul style="list-style-type: none"> •Check the offset/gain setting using GX Configurator-ST. <ul style="list-style-type: none"> ☞ Section 5.6 Offset/Gain Setting •Check the offset/gain setting with a command. <ul style="list-style-type: none"> ☞ Section 4.5 Offset/Gain Setting <p>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.</p>
Is the input type setting correct?	<p>Execute the Initial data setting read command (command number: 9318H/1318H) and confirm the input type setting.</p> <p>☞ Section 8.4.7 Initial data setting read (Command No.: 9318H/1318H)</p> <p>If the input type setting is wrong, make the setting again.</p>
Is the conversion enable/disable setting for the channel, where data was input, set to Disable?	<p>Execute the Conversion enable/disable setting read command (command number: 9300H/1300H) and confirm the conversion enable/disable setting.</p> <p>☞ Section 8.4.1 Conversion enable/disable setting read (Command No.: 9300H/1300H)</p> <p>If conversion is disabled, enable it by GX Configurator-ST or by the executing Conversion enable/disable setting write command (command number: A300H/2300H).</p> <p>☞ Section 5.3 Parameter Setting</p> <p>☞ Section 8.5.1 Conversion enable/disable setting write (Command No.: A300H/2300H)</p>
Are <input type="checkbox"/> Bw.n+1 Convert setting request and <input type="checkbox"/> Br.n+1 Convert setting completed flag ON?	<p>Check whether <input type="checkbox"/> Bw.n+1 Convert setting request and <input type="checkbox"/> 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</p> <p>☞ Section 5.4 Input/Output Monitor</p> <p>If <input type="checkbox"/> Bw.n+1 Convert setting request and <input type="checkbox"/> Br.n+1 Convert setting completed flag are off, reexamine the program of the master station.</p> <p>☞ Section 3.3.1 Bit input area</p> <p>☞ Section 3.3.3 Bit output area</p>

9.2.5 When the measured temperature value is abnormal

Table 9.9 When digital output values cannot be read

Check item	Corrective action
Check whether the connected thermocouple or compensation lead wire differs from the setting.	Change the input type setting (command parameter) to the connected thermocouple type.
Check whether the thermocouple or compensation lead wire is connected reversely.	Connect the thermocouple or compensation lead wire correctly.
Check for noise in the thermocouple input.	Check for any influence caused from the grounding and adjacent devices, and take action to prevent noise.
Is the cold junction temperature compensation setting correct?	Set the cold junction temperature compensation setting (command parameter) correctly.
Check whether a thermocouple was set after the offset/gain setting.	Make offset/gain setting again for the thermocouple changed.

9.2.6 When the micro voltage conversion value is abnormal

Table 9.10 When digital output values cannot be read

Check item	Corrective action
Check whether the input type is set to a thermocouple or not.	Set the input type (command parameter) to the micro voltage input.
Check the micro voltage signal cable for noise.	Check for any influence caused from the grounding and adjacent equipment, and take noise reduction measures.
After offset/gain value setting, another signal cable was connected.	Make offset/gain setting again with the newly connected signal cable.

☒ POINT

If the normal measured temperature value/measured micro voltage 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 ST1TD2.

(1) Wiring marker

For how to use the wiring marker, refer to the following.

 MELSEC-ST System User's Manual, "10.2 Mounting the Modules"

Table App.1 Wiring marker list



Model name	Description	Color
ST1A-WMK-BL	Terminal marker (-, 0V, N)	Blue
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.

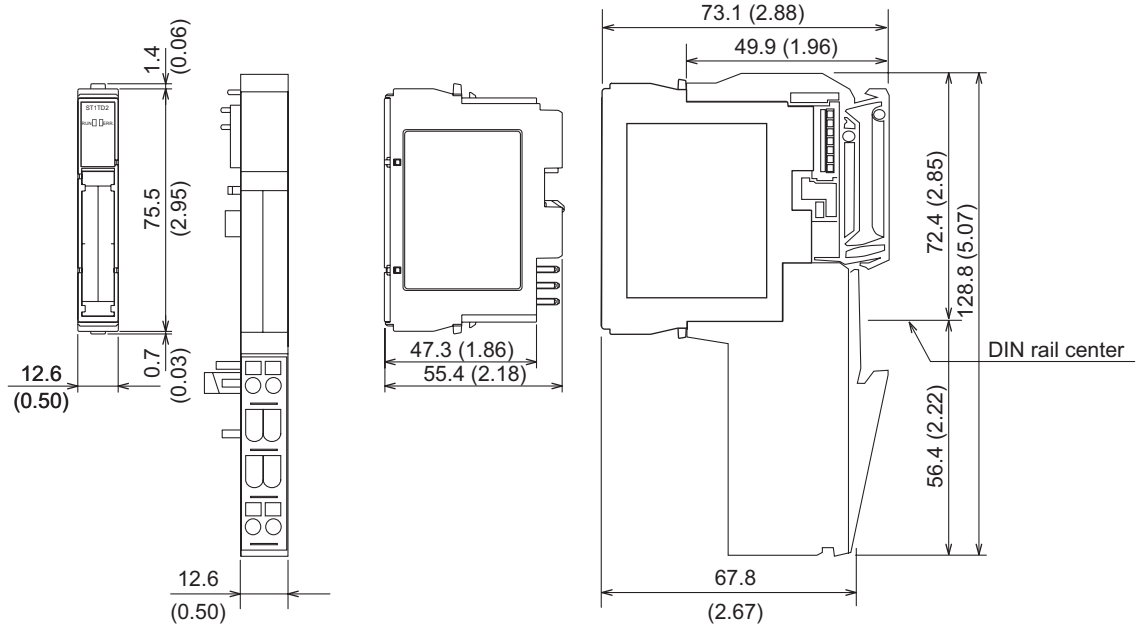
Table App.2

Model name	Description	Shape ^{*1}		Color
		Base module side	Slice module side	
ST1A-CKY-16	Coding element for ST1TD2			Dustygray

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

 : Protection  : Hole

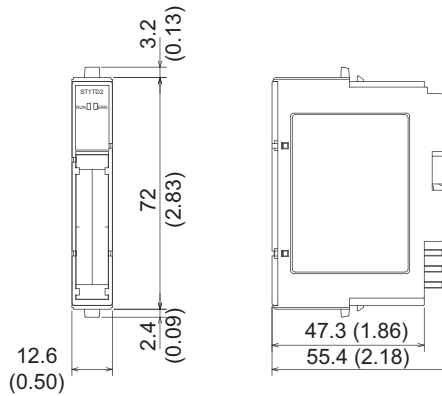
Appendix 2 External Dimensions



Unit: mm (inch)

Remark

For ST1TD2 of hardware version B or before, side face diagram of the module is as follows.



Unit: mm (inch)

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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 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 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 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 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 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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MELSEC-ST Thermocouple Input Module

User's Manual (CC-Link)

MODEL	ST1TD-BT-U-SY-E
MODEL CODE	13JZ14
SH(NA)-080757ENG-A(0809)KWIX	

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