MELSEC-ST Analog-Digital Converter Module

User's Manual

MITSUBISHI

MELSEC-ST

ST1AD2-V
ST1AD2-I

● 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. 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 medium or slight personal injury or physical 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

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

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

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[DESIGN PRECAUTIONS]

⚠ CAUTION

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

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

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

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

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

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

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

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

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

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- DIN rail must be conductive; make sure to ground it prior to use. Failure to do so may cause electric shocks or malfunctions. Undertightening can cause a 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.

⚠ 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. Disconnect the cables after loosening the screws in the portions connected to the module. Pulling the cables connected to the module can damage the module and cables or can cause a malfunction due to a cable connection fault.

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[STARTUP AND MAINTENANCE PRECAUTIONS]

⚠ DANGER

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

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

[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, make sure to touch a grounded metal object to discharge the static electricity from the human body.
  Failure to do say cause a failure or malfunctions of the module.

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

[DISPOSAL PRECAUTIONS]

⚠ CAUTION

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

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REVISIONS

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

Print Date	* Manual Number	Revision
Jan., 2004	SH(NA)-080442ENG-A	First edition
Jun., 2006	SH(NA)-080442ENG-B	Correction Section 3.3.1, 4.5, 6.1, 6.2, 8.4.5, 8.4.6, Appendix 2 Addition Section 2.4

Japanese Manual Version SH-080441-B

INTRODUCTION

Thank you for choosing the ST1AD2-V/ST1AD2-I type MELSEC-ST analog-digital conversion module. Before using the module, please read this manual carefully to fully understand the functions and performance of the ST1AD2-V/ST1AD2-I type MELSEC-ST analog-digital conversion module and use it correctly.

CONTENTS

About Manuals

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

Relevant Manuals

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

Compliance with the EMC Directive and the Low Voltage Directive

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

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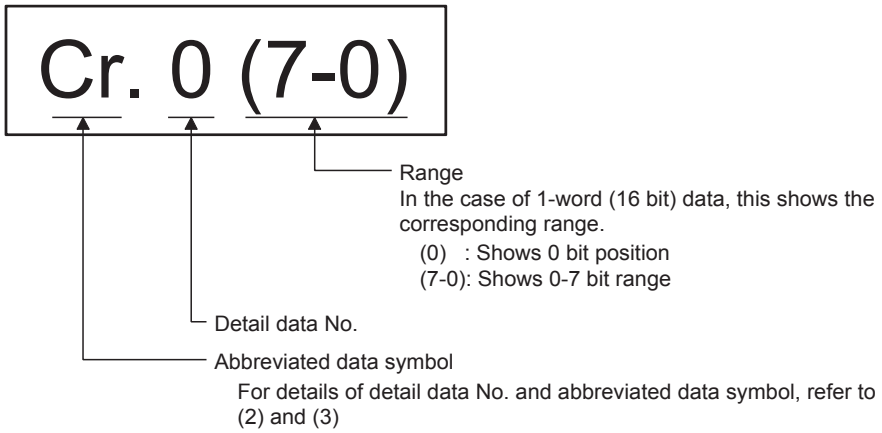
How to Read Manual

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

(1) Data symbol

<Example: Cr Command result area>



(2) Input data

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

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

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

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(3) Output data

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

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

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

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About the Generic Terms and Abbreviations

This manual uses the following generic terms and abbreviations to describe the ST1AD, unless otherwise specified.

Generic Term/Abbreviation	Description
ST1AD2-V	Abbreviation for ST1AD2-V type MELSEC-ST analog-digital conversion module.
ST1AD2-I	Abbreviation for ST1AD2-I type MELSEC-ST analog-digital conversion module.
ST1AD	Generic term for ST1AD2-V and ST1AD2-I.
Head module	ST1H-PB, MELSEC-ST PROFIBUS-DP compatible head module.
PROFIBUS-DP	PROFIBUS-DP network.
Bus refreshing module	Module that distributes the external SYS. power supply and external AUX. power supply among the head module and slice modules.
Power feeding module	Module that distributes external AUX. power supply among slice modules.
Power distribution module	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	SWnD5C-STPB-E type products. (n: 1 or later)
Configuration software	Software used to set slave parameters for head module and slice modules.(e.g., GX Configurator-DP)
Industrial shipment setting	Generic term for input ranges 1 to 5V, 0 to 5V, 0 to 10V, -10 to 10V, 4 to 20mA and 0 to 20mA.
User parameter	Generic term for setting items (Input range setting) set by the configuration software of the master station.
Command parameter	Generic term for setting items (A/D Conversion enable/disable setting, Averaging process specification, Time/count averaging specification, Alarm output setting, Upper upper limit value/Upper lower limit value/Lower upper limit value/Lower lower limit value setting, Disconnection detection setting, Notch filter setting) set by commands. They can also be set by GX Configurator-ST.
Parameter	Generic term for user parameters and command parameters.

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Term definition

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

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

1 OVERVIEW

This User's Manual provides the specifications, handling, programming methods, etc. for the ST1AD2-V type MELSEC-ST analog-digital converter module (hereinafter referred to as the ST1AD2-V) and ST1AD2-I type MELSEC-ST analog-digital converter module (hereinafter referred to as the ST1AD2-I).
In this manual, the ST1AD2-V and ST1AD2-I are collectively referred to as the ST1AD.
This manual describes only the ST1AD.
For information on the MELSEC-ST system, refer to the MELSEC-ST System User's Manual.

1.1 Features

(1) Available models

- ST1AD2-V····· 2-channel voltage input type.
- ST1AD2-I····· 2-channel current input type.

(2) Up to 26 modules can be mounted

For one head module, up to 26 ST1AD modules (52 channels) can be mounted.

(3) Input range can be changed for each channel

The analog input range*1 can be changed for each channel to change the I/O conversion characteristic.

*1 The input range refers to the type of offset/gain settings. The most frequently used range is set as the default, but the user can make offset/gain settings according to the purpose.

(4) Alarm output function

If a digital output value falls outside a setting range, an alarm is output for each channel.

(5) Disconnection detection function

Cable disconnection is detected for each channel.

(6) Notch filter processing

Notch filter processing removes the power supply noise (50Hz/60Hz) of external devices. (Within -60dB)

(7) Command function

By writing command parameters to the ROM using a command, A/D conversion can be made without setting the command parameters at module start (power-on).

(8) High-speed conversion processing

Conversion speed is as high as 0.1ms/channel when notch filter processing is not performed, or 0.2ms/channel when notch filter processing is performed.

(9) High degree of accuracy

This module performs A/D conversion at the accuracy of ± 0.8% relative to the maximum digital output value.

(10) Online module change

The module can be changed without the system being stopped.

(11) Easy settings using the GX Configurator-ST

The optional software package (GX Configurator-ST) is available.
GX Configurator-ST is not necessarily required for the system.
However, we recommend using GX Configurator-ST, as it enables parameter setting and offset/gain setting to be made on the screen, which reduces programs of master station and makes the setting/operating status check easier.

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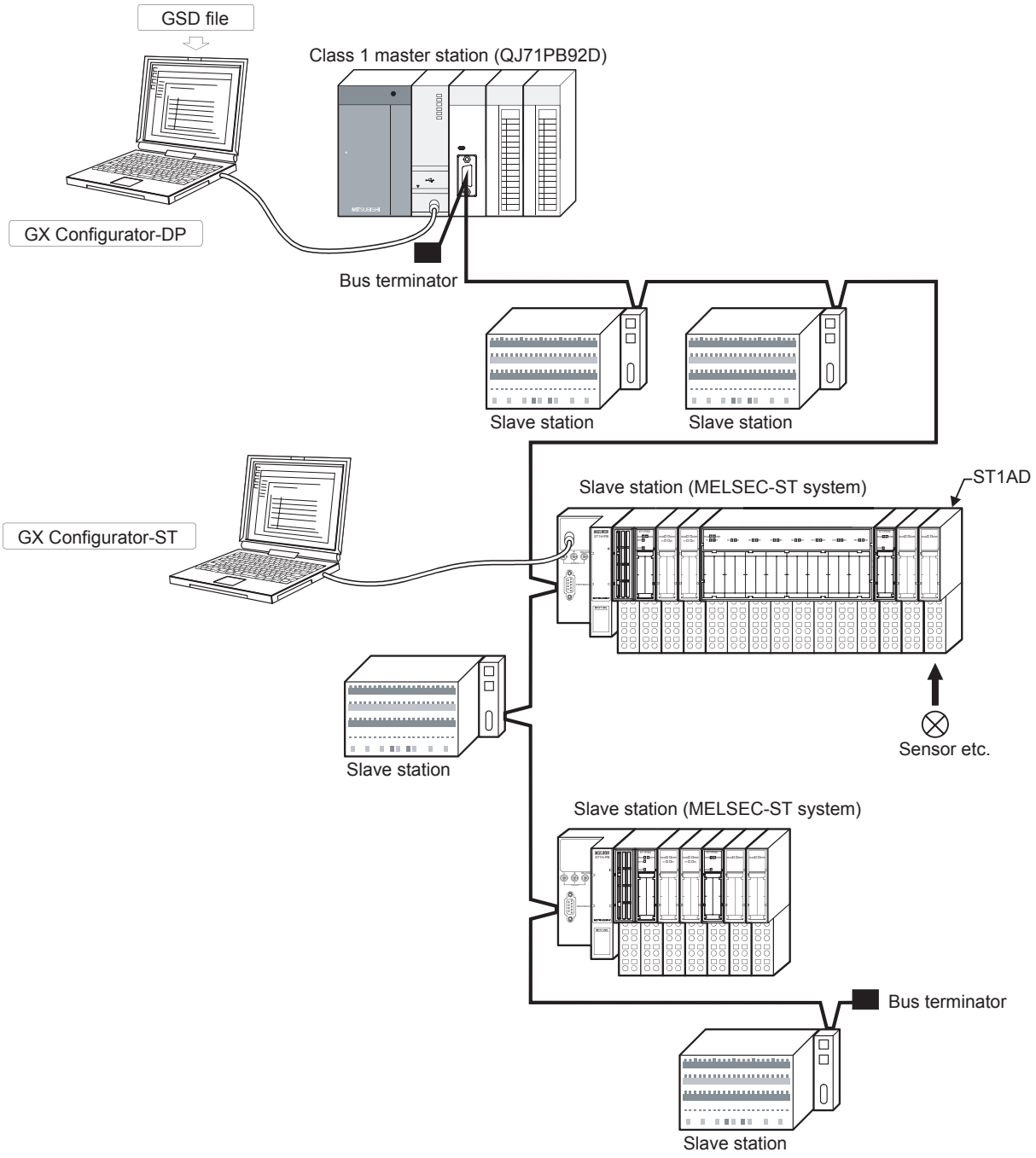
2 SYSTEM CONFIGURATION

This chapter describes the system configuration for use of the ST1AD.

2.1 Overall Configuration

The overall configuration for use of the ST1AD is shown below.

<The system which used QJ71PB92D>



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2.2 Applicable System

This section explains the applicable system.

2.2.1 Applicable head module

The head module applicable to the ST1AD is indicated below.

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

2.2.2 Applicable base module

The base modules applicable to the ST1AD are indicated below.

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

2.2.3 Applicable coding element

The coding elements applicable for the ST1AD are indicated below.
The coding element is fitted before shipment.
It is also available as an option in case it is lost.

Description	Model name
ST1AD2-V coding element	ST1A-CKY-13
ST1AD2-I coding element	ST1A-CKY-14

2.2.4 Applicable software package

The software package applicable to the ST1AD is indicated below.

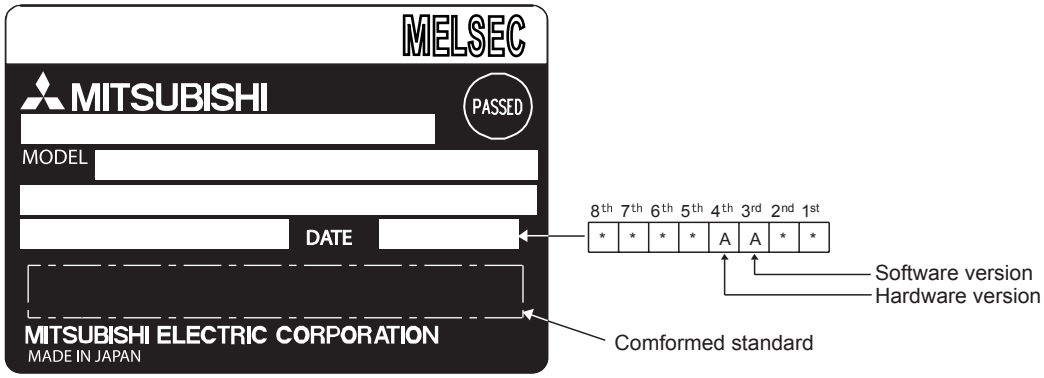
Product name	Model name
GX Configurator-ST	SW1D5C-STPB-E

2.3 Precautions for System Configuration

For precautions for ST1AD system configuration, refer to Section 3.4 "Precautions for System Configuration" in MELSEC-ST system user's manual.

2.4 Checking Hardware and Software Versions

The hardware and software versions of the ST1AD can be checked on the DATE section on the rating plate, which is situated on the side of the module.



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3 SPECIFICATIONS

This chapter provides the specifications of the ST1AD.
For the general specifications of the ST1AD, refer to the MELSEC-ST System User's Manual.

3.1 Performance Specifications

Table 3.1 indicates the general specifications of the ST1AD.

Table 3.1 Performance specifications list

<table>
<tr><td colspan="3">Item \ Model name</td><td>ST1AD2-V</td><td>ST1AD2-I</td></tr>
<tr><td colspan="3">Analog input points</td><td colspan="2">2 points (2 channels/module)</td></tr>
<tr><td rowspan="2">Analog input</td><td colspan="2">Voltage</td><td>DC–10 to 10V
(Input resistance value: 1MΩ)</td><td>—</td></tr>
<tr><td colspan="2">Current</td><td>—</td><td>DC0 to 20mA
(Input resistance value: 250Ω)</td></tr>
<tr><td colspan="3">Digital output</td><td>16-bit signed binaly (-4096 to 4095)</td><td>16-bit signed binaly (-96 to 4095)</td></tr>
<tr><td colspan="3">I/O characteristics,
Maximum resolution</td><td colspan="2"><table>
<tr><th colspan="2">Analog input range</th><th>Digital output value</th><th>Maximum resolution</th></tr>
<tr><td rowspan="5">ST1AD2-V
(Voltage)</td><td>0 to 10 V</td><td rowspan="3">0 to 4000</td><td>2.5 mV</td></tr>
<tr><td>0 to 5 V</td><td>1.25 mV</td></tr>
<tr><td>1 to 5 V</td><td>1.0 mV</td></tr>
<tr><td>-10 to 10V</td><td rowspan="2">-4000 to 4000</td><td>2.5 mV</td></tr>
<tr><td>User range setting</td><td>1.0 mV</td></tr>
<tr><td rowspan="3">ST1AD2-I
(Current)</td><td>0 to 20 mA</td><td rowspan="3">0 to 4000</td><td>5 μA</td></tr>
<tr><td>4 to 20 mA</td><td>4 μA</td></tr>
<tr><td>User range setting</td><td>4 μA</td></tr>
</table></td></tr>
<tr><td>Accuracy ＊
(Accuracy in respect to maximum digital output value)</td><td colspan="2">Ambient temperature
0 to 55 °C</td><td colspan="2">Within ± 0.8 % (±32digit)</td></tr>
<tr><td colspan="3">Conversion speed</td><td colspan="2">When notch filter processing is not performed: 0.1 ms/channel
When notch filter processing is performed: 0.2 ms/channel</td></tr>
<tr><td colspan="2" rowspan="2">Absolute maximum input</td><td>Voltage</td><td>±15 V</td><td>—</td></tr>
<tr><td>Current</td><td>—</td><td>±30 mA</td></tr>
<tr><td colspan="3">ROM write count</td><td colspan="2">ROM write count by user range write or parameter setting: Maximum 10,000 times</td></tr>
<tr><td colspan="3">Number of occupied I/O points</td><td colspan="2">4 points for each of input and output</td></tr>
<tr><td colspan="3">Number of Occupied Slices</td><td colspan="2">2</td></tr>
<tr><td rowspan="2">Information amount</td><td colspan="2">Input data</td><td colspan="2">Br.n : Number of occupancy 4, Er.n : Number of occupancy 4, Mr.n : Number of occupancy 2,
Wr.n : Number of occupancy 2</td></tr>
<tr><td colspan="2">Output data</td><td colspan="2">Bw.n : Number of occupancy 4, Ew.n : Number of occupancy 4, Ww.n : Number of occupancy 2</td></tr>
<tr><td colspan="3">Isolation specifications</td><td colspan="2"><table>
<tr><th>Specific isolated area</th><th>Isolation method</th><th>Dielectric with stand</th><th>Insulation resistance</th></tr>
<tr><td>Between analog input terminals 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 analog input channels</td><td>No insulation</td><td>—</td><td>—</td></tr>
</table></td></tr>
<tr><td colspan="3">Applicable base module</td><td colspan="2">Spring clamp type: ST1B-S4IR2, Screw clamp type: ST1B-E4IR2</td></tr>
<tr><td colspan="3">Applicable coding element</td><td>ST1A-CKY-13(green)</td><td>ST1A-CKY-14(green)</td></tr>
<tr><td colspan="3" rowspan="2">External AUX. power supply</td><td colspan="2">24V DC (+20/-15%, ripple ratio within 5%)</td></tr>
<tr><td colspan="2">24V DC current: 0.030A</td></tr>
<tr><td colspan="3">5V DC internal current consumption</td><td colspan="2">0.110 A</td></tr>
<tr><td colspan="3">External dimensions</td><td colspan="2">77.6 (3.06in.) (H) × 12.6 (0.50in.) (w) × 55.4 (2.18in.) (D) [mm]</td></tr>
<tr><td colspan="3">Weight</td><td colspan="2">0.04 kg</td></tr>
</table>

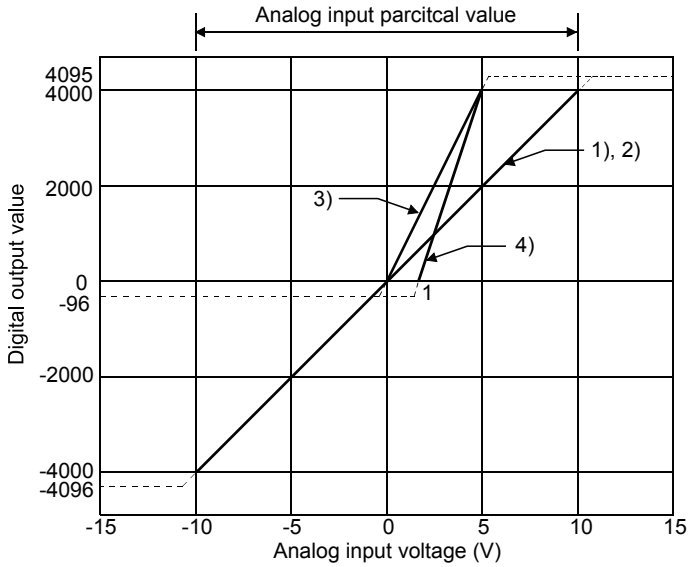
＊ ST1AD needs to be powered on 5 minutes prior to operation for compliance to the specification (accuracy).

3.2 I/O Conversion Characteristics

An I/O conversion characteristic indicates an inclination of a straight line that connects an offset value and a gain value at the time when an analog value (voltage or current input) from an external device is converted into a digital value.
The offset value is an analog input value (voltage or current) at which the digital output value is 0.
The gain value is an analog input value (voltage or current) at which the digital output value is 4000.

3.2.1 Input characteristics of ST1AD2-V

A graph of the ST1AD2-V input characteristic is shown below.



No.	Analog Input Range Setting	Offset Value	Gain Value	Digital Output Value*2	Maximum Resolution
1)	-10 to +10V	0V	10V	-4000 to +4000	2.5mV
2)	0 to 10V	0V	10V	0 to 4000	
3)	0 to 5V	0V	5V		1.25mV
4)	1 to 5V	1V	5V		1.0mV
—	User range setting	*1	*1	-4000 to +4000	1.0mV

Fig. 3.1 Input characteristics of ST1AD2-V

POINT

(1) Within the analog input and digital output scopes of each input range, the maximum resolution and accuracy are within the performance specification range. Outside those scopes, however, they may not fall within the performance specification range. (Avoid using the dotted line part in Fig. 3.1.)

(2) Do not input more than ±15V. The element may be damaged.

(3) Set the offset/gain values for the user setting range ＊1 within a range in which the following conditions are satisfied.

(a) (Setting range):-10 to 10V

(b) (Gain value) > (Offset value)

(c) (Gain value) – (Offset value) ≧ 4V

If condition (b) is not satisfied, ERR.LED turns on, the value will not be written to the module.

When the setting is outside the condition in (c), conversion is made but the resolution is within the maximum resolution range of the performance specifications.

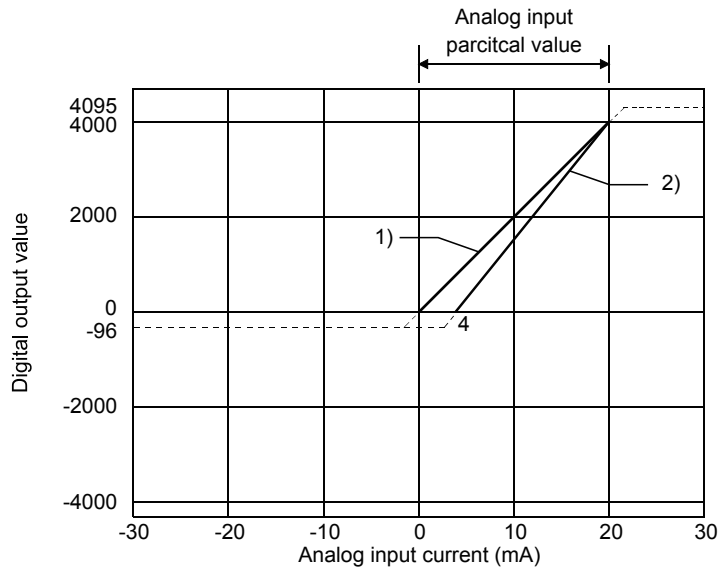
(4) When an analog value that exceeds the range for the digital output value ＊2 is entered, the digital output value will be fixed at the maximum or minimum value.

• For 0 to 4000, the digital output value is within the range -96 to 4095.

• For -4000 to +4000, the digital output value is within the range -4096 to 4095.

3.2.2 Input characteristics of ST1AD2-I

A graph of the ST1AD2-I input characteristic is shown below.



No.	Analog Input Range Setting	Offset Value	Gain Value	Digital Output Value*2	Maximum Resolution
1)	0 to 20mA	0mA	20mA	0 to 4000	5μA
2)	4 to 20mA	4mA	20mA		4μA
—	User range setting	*1	*1		4μA

Fig. 3.2 Input characteristics of ST1AD2-I

3 - 4

POINT

(1) Within the analog input and digital output scopes of each input range, the maximum resolution and accuracy are within the performance specification range. Outside those scopes, however, they may not fall within the performance specification range. (Avoid using the dotted line part in Fig. 3.1.)

(2) Do not input more than ±30mA. The element may be damaged.

(3) Set the offset/gain values for the user setting range ＊1 within a range in which the following conditions are satisfied.

(a) (Setting range): 0 to 20mA

(b) (Gain value) > (Offset value)

(c) (Gain value) – (Offset value) ≧ 16mA

If condition (b) is not satisfied, ERR.LED turns on, the value will not be written to the module.

When the setting is outside the condition in (c), conversion is made but the resolution is within the maximum resolution range of the performance specification.

(4) When an analog value that exceeds the range for the digital output value ＊2 is entered, the digital output value will be fixed at the maximum or minimum value.

• For 0 to 4000, the digital output value is within the range -96 to 4095.

3.2.3 Relation between the offset/gain setting and digital output value

The relation between the offset/gain setting and digital output value is described.

(1) Resolution

The resolution is obtained by the following formula:

$$\text{Resolution} = \frac{\text{(Gain value) - (Offset value)}}{4000}$$

(2) Relation between the maximum resolution and digital output value

The maximum resolution of the ST1AD is as indicated in the performance specification.

If the following is satisfied from the offset/gain setting, the digital output value does not increases /decreases by one.

$$\frac{\text{(Gain value) - (Offset value)}}{4000} < \text{Maximum resolution}$$

3.2.4 Accuracy

Accuracy is relative to the maximum value of the digital output value (4000).
If you change the offset/gain setting or input range to change the input characteristic, accuracy does not change and is held within the range indicated in the performance specifications.
Accuracy is within ±0.8% (±32 digit).

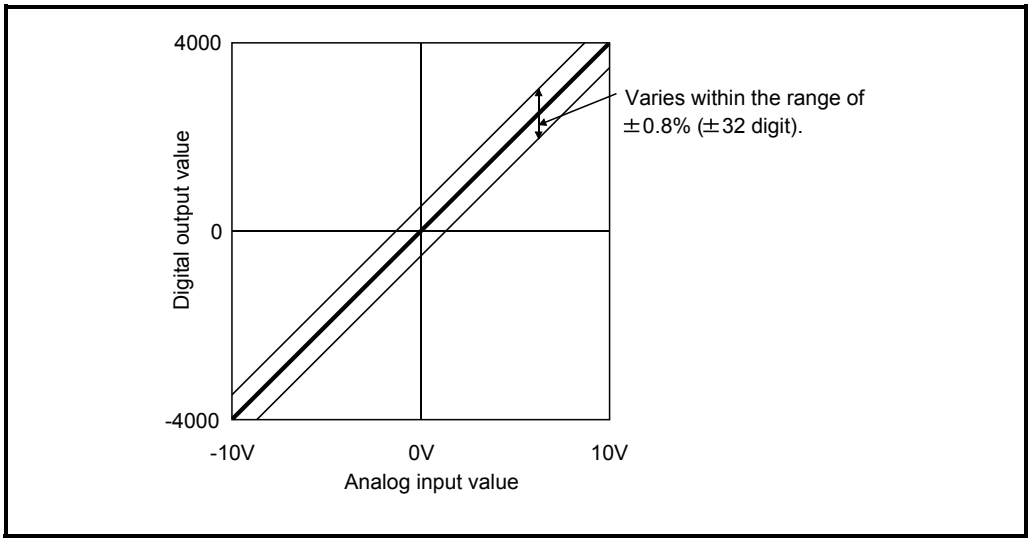


Fig. 3.3 Accuracy of ST1AD2-V

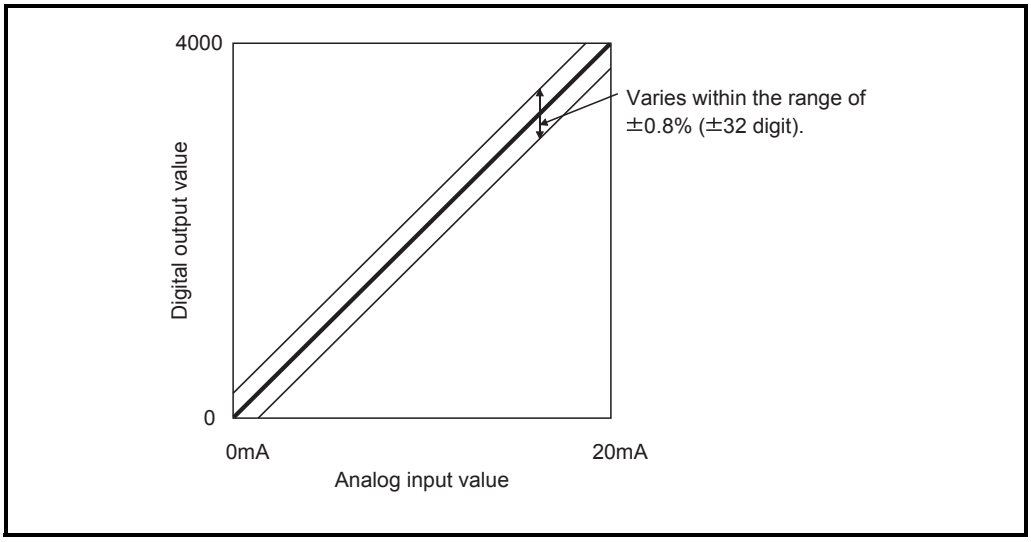


Fig. 3.4 Accuracy of ST1AD2-I

3.2.5 Conversion speed

The conversion speed of the ST1AD changes depending on whether notch filter processing is performed or not.

[When notch filter processing is not performed]
(Conversion speed) = 0.1ms × number of conversion enabled channels

[When notch filter processing is performed]
(Conversion speed) = 0.2ms × number of conversion enabled channels

3.2.6 Intelligent function module processing time

The intelligent function module processing time of the ST1AD changes depending on whether notch filter processing is performed or not.

[When notch filter processing is not performed]
(Processing time) = 0.1ms × number of conversion enabled channels

[When notch filter processing is performed]
(Processing time) = 0.2ms × number of conversion enabled channels

For the input transmission delay time, refer to the used head module user's manual.

3.3 Function

This section explains the functions of ST1AD.

3.3.1 Function list

Table 3.2 lists the functions of ST1AD.

Table 3.2 ST1AD Function List (1/2)

<table>
<tr><th>Item</th><th>Description</th><th>Reference section</th></tr>
<tr><td>A/D conversion enable/disable function</td><td>(1) Specifies whether to enable or disable the A/D conversion for each channel.
(2) By default, the A/D conversion for all channel is enabled.
[Setting method]
• A/D conversion enable/disable setting write (Command number: 2100H, see Section 8.4.1)
• GX Configurator-ST (see Section 5.3)</td><td>——</td></tr>
<tr><td>A/D conversion method</td><td>(1) Sampling process
The input analog value is converted to digital value for each channel and the digital value is output.
(2) Averaging process
The A/D conversion is performed for the specified channel as many times as the setting or for the set time. Then the sum of the values other than the maximum and minimum ones is averaged and output to the digital value.
(3) Averaging process setting defaults to Sampling process performed on all channels.
(4) Time averaging defaults to 4ms, and number of times averaging defaults to 4 times.
[Averaging process specifying method]
• Operation condition specification value write (Command number: 2102H, see Section 8.4.2)
• GX Configurator-ST (see Section 5.3)
[Average time/average number of times setting method]
• CH□ average time/average number of times setting write (Command number: 2104H, see Section 8.4.4)
• GX Configurator-ST (see Section 5.3)</td><td>Section 3.3.2</td></tr>
<tr><td>Input range changing function</td><td>(1) The analog input range can be set for each channel to change the I/O conversion characteristics.
(2) The input range is selectable from the following.
<table>
<tr><th>Model</th><th>Input range</th></tr>
<tr><td rowspan="5">ST1AD2-V</td><td>-10 to 10V (default)</td></tr>
<tr><td>0 to 10V</td></tr>
<tr><td>0 to 5V</td></tr>
<tr><td>1 to 5V</td></tr>
<tr><td>User range setting</td></tr>
<tr><td rowspan="3">ST1AD1-I</td><td>4 to 20mA (default)</td></tr>
<tr><td>0 to 20 mA</td></tr>
<tr><td>User range setting</td></tr>
</table>
[Setting method]
• Master station configuration software
• GX Configurator-ST (see Section 5.3)</td><td>——</td></tr>
</table>

Table 3.2 ST1AD Function List (2/2)

Item	Description	Reference section
Alarm output function	(1) If a digital output value falls outside a setting range, an alarm is output for each channel. (2) Alarm output setting defaults to No alarm output processing performed on all channels. (3) Set the alarm output in 4 steps: upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value. The upper upper limit value and upper lower limit value default to 4000. The lower upper limit value and lower lower limit value default to -4000 for the ST1AD2-V 0 for the ST1AD2-I, respectively. [Alarm output setting method] • Operation condition specification value write (Command number: 2102H, see Section 8.4.2) • GX Configurator-ST (see Section 5.3) [Upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value setting method] • CH□ upper upper limit value/upper lower limit value setting write (Command number: 2108H, 210AH, see Section 8.4.5) • CH□ lower upper limit value/lower lower limit value setting write (Command number: 2109H, 210BH, see Section 8.4.6) • GX Configurator- ST (see Section 5.3)	Section 3.3.3
Disconnection detection function	(1) For the range of 1 to 5V or 4 to 20mA, cable disconnection is detected for each channel. (2) Defaults to No disconnection detection processing performed on all channels. [Setting method] • Operation condition specification value write (Command number: 2102H, see Section 8.4.2) • GX Configurator- ST (see Section 5.3)	Section 3.3.4
Notch filter processing	(1) Notch filter processing removes the power supply noise (50Hz/60Hz) of external devices. (Within -60dB) Use this function when the module seems to be affected by power supply noise. (2) Notch filter processing is batch-performed for all channels. (3) Notch filter processing can be used independently of sampling processing and averaging processing. (4) Select notch filter processing from among the following types. • No notch filter processing performed on all channels • Notch filter processing performed on all channels (50±3Hz) • Notch filter processing performed on all channels (60±3Hz) (5) Defaults to No notch filter processing performed on all channels. [Setting method] • Notch filter setting write (Command number: 2103H, see Section 8.4.3) • GX Configurator- ST (see Section 5.3)	——
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
Offset/gain settings	(1) Setting of any offset value/gain value optimizes the I/O conversion characteristic according to the system. [Setting method] • Master station program • GX Configurator-ST	Section 4.5 Section 5.6
Online module change	(1) A module change is made without the system being stopped. [Execution procedure] • Button operation of head module • GX Configurator-ST	Chapter 7

3.3.2 A/D conversion method

There are two conversion methods, sampling process and averaging process.

(1) Sampling process

The input analog value is converted to a digital value and the digital value is output. Then, the output value is stored in Wr.n, Wr.n+1 CH□ digital output value.
Sampling processing time changes depending on the number of channels used (number of channels set to A/D conversion enable) and whether notch filter processing is performed or not.

[When notch filter processing is not performed]
(Processing time) = (Number of channels used) × 0.1 (ms/1channel)

[When notch filter processing is performed]
(Processing time) = (Number of channels used) × 0.2 (ms/1channel)

[Example] When notch filter processing is not performed and channels 1, 2 are used, sampling processing time is 0.2ms.
2 × 0.1 = 0.2(ms)

(2) Averaging process

The A/D conversion is performed for the specified channel as many times as the setting or for the set time. Then the sum of the values other than the maximum and minimum ones is averaged and the result is stored in Wr.n, Wr.n+1 CH□ digital output value.
The applicable setting ranges for the time and number of times are given below. When the setting is outside the applicable range, the ERR. LED turns on and the A/D conversion of the corresponding channel stops.
• Averaging processing by time: 2 to 5000ms
• Averaging processing by the number of times: 4 to 62500

a) When averaging process is set to be performed for the set time

The number of processing times within the set time changes depending on the number of channels used (number of channels set to A/D conversion enable) and whether notch filter processing is performed or not.

[When notch filter processing is not performed]

$$\text{(Number of processing repetitions)} = \frac{\text{(set time)}}{\text{(Number of channels used)} \times 0.1\ \text{(ms/1channel)}}$$

[When notch filter processing is performed]

$$\text{(Number of processing repetitions)} = \frac{\text{(set time)}}{\text{(Number of channels used)} \times 0.2\ \text{(ms/1channel)}}$$

[Example] When notch filter processing is performed, channels 1, 2 are used, and the set time is 55ms, measurement is made 137 times and an average value is output.

$$\frac{55}{2 \times 0.2} = 137.5(\text{times})\cdots\text{Round down the number}$$

b) When the averaging process is set to be performed as many times as the setting

The result (average value) of averaging process that is performed as many times as the setting is stored in Wr.n, Wr.n+1 CH□ digital output value at certain intervals. The storage interval changes depending on the number of channels used (number of channels set to A/D conversion enable) and whether notch filter processing is performed or not.

[When notch filter processing is not performed]

(Processing time) = (Set number of times) × (Number of channels used) × 0.1 (ms/1channel)

(Unit:ms)

[When notch filter processing is performed]

(Processing time) = (Set number of times) × (Number of channels used) × 0.2 (ms/1channel)

(Unit:ms)

[Example] When notch filter processing is not performed, channels 1, 2 are used, and the set number of times is 500, the average value is output at 100ms intervals.

500 × 2 ×0.1 = 100(ms)

3.3.3 Alarm output function

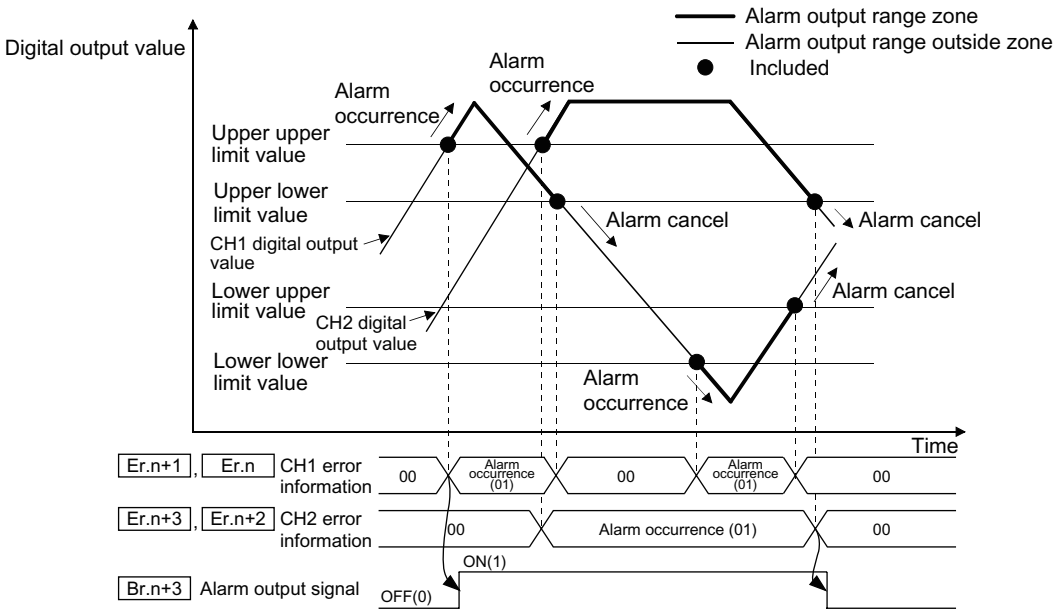
(1) If the detected digital value rises to or above the upper upper limit value or falls to or below the lower lower limit value and enters into the alarm output range, Br.n+1 alarm output signal turns on (1) and the error information is stored into
Er.n+3 to Er.n CH□ error information.

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

(3) Alarm output processing can be set to be performed or not for each channel.
Alarm output setting defaults to No alarm output processing performed on all channels.

(4) Set the alarm output in 4 steps: upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value.
The setting range is -4096 to 4095 for the ST1AD2-V or -96 to 4095 for the ST1AD2-I, respectively.
If a set value is outside the above setting range or the condition of lower lower limit value (lower upper limit value (upper lower limit value (upper upper limit value is not satisfied, that channel will result in an error and the ERR. LED will turn on.
The upper upper limit value and upper lower limit value default to 4000.
The lower upper limit value and lower lower limit value default to -4000 for the ST1AD2-V, 0 for the ST1AD2-I, respectively.

(5) An alarm is output for only the channel for which A/D conversion.



3.3.4 Disconnection detection function

(1) The disconnection detection function is usable in the range of 1 to 5V or 4 to 20mA only.

(2) If the analog input value falls to or below 0.5V in the 1 to 5V range, or to or below 2mA in the 4 to 20mA range, the ERR. LED turns on and the error information is stored into Er.n+3 to Er.n CH□ error information.

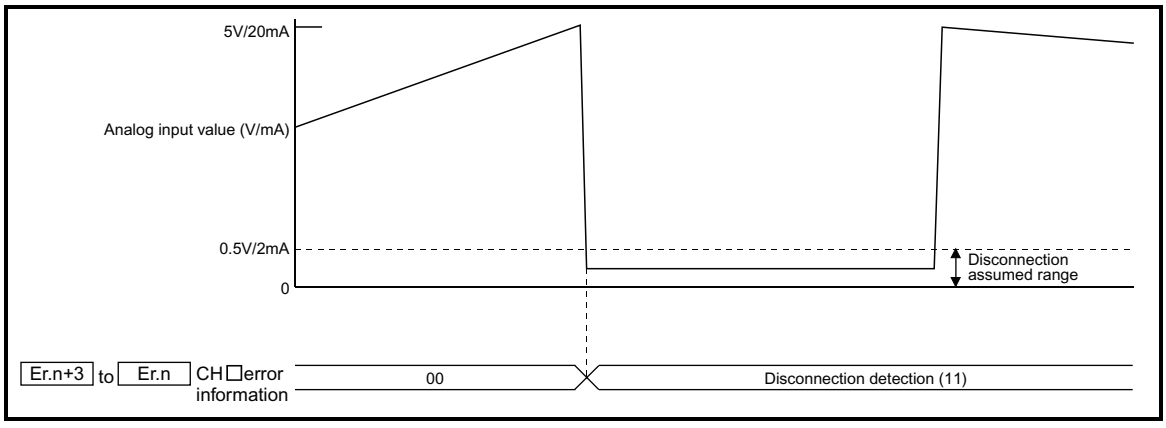
(3) Er.n+3 to Er.n CH□ error information is cleared by Ew.n error clear request. (Refer to Section 3.4.6.)

(4) Disconnection detection processing can be set to be performed or not for each channel.
Disconnection detection setting defaults to No disconnection detection processing performed on all channels.[Setting method]

(5) Disconnection is detected on only the channel for which A/D conversion is enabled.

(6) The accuracy of disconnection detection is the same as that of this module. (Refer to Section 3.2.4.)

(7) If a disconnection is detected during digital output, the digital output value prior to the disconnection detection is held.



3.4 I/O Data

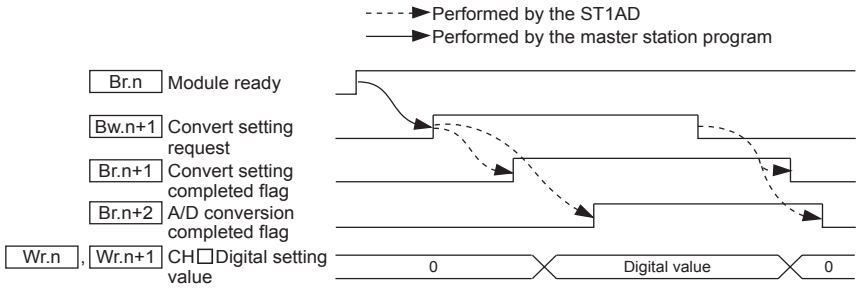
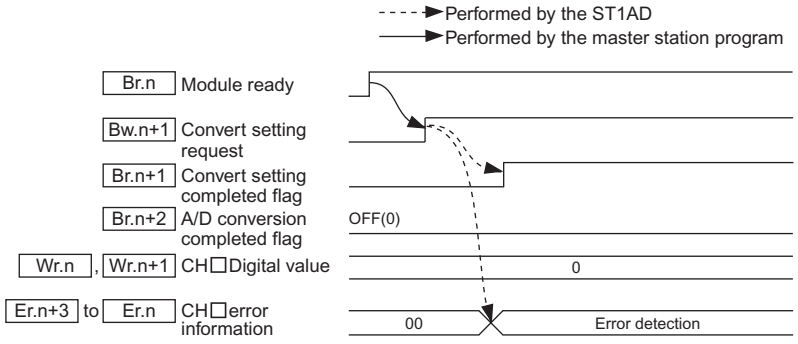
The ST1AD has the areas for data transfer with the head module as indicated in Table 3.3.
This section explains the composition of each area.

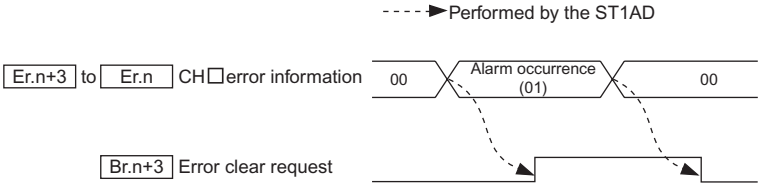
Table 3.3 I/O Data List

Transfer direction	Item		Number of Occupancy	Default value	Reference section
ST1AD → Head module (Input Data)	Br Bit Input Area		4	0	Section 3.4.1
	Information Area	Er Error Information Area	4	0	Section 3.4.2
		Mr Module Status Area	2	0	Section 3.4.3
	Wr Word Input Area		2	0	Section 3.4.4
Head module → ST1AD (Output Data)	Bw Bit Output Area		4	0	Section 3.4.5
	Request Area	Ew Error Clear Area	4	0	Section 3.4.6
	Ww Word Output Area		2	0	Section 3.4.7

3.4.1 Bit input area

This section explains the Br bit input area.

Bit input	Item	Description
Br.n	Module ready	(1) Turns on (1) when A/D conversion is ready after the MELSEC-ST system (ST1AD) is powered on or the head module is reset. (2) When the Br.n Module ready signal is off (0), A/D conversion processing is not performed. Br.n Module ready turns off (0) in the following situations: • In offset/gain setting mode • When the ST1AD has a watchdog timer error • In module change enabled status during online module change (refer to Chapter 7)
Br.n+1	Convert setting completed flag	(1) After Bw.n+1 convert setting request has turned on (1), this turns on (1) when user parameter and command parameter setting check is completed. (Turns on (1) if a setting error is detected.) [When parameter setting check result is normal]  [When parameter setting check result is abnormal] 

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

3.4.2 Error information area

This section explains the Er error information area.

Error information		Item	Description
Er.n+1	Er.n	CH1 error information	(1) Stores the error information or alarm information when an error or alarm occurs. (2) The stored error information can be cleared by turning on (1) the Ew.n error clear request. (Refer to Section 3.4.6) (3) The alarm information is automatically cleared when the digital output value returns to within the setting range. (Refer to Section 3.4.1.)
Er.n+3	Er.n+2	CH2 error information	

Er.n+1 / Er.n+3	Er.n / Er.n+2	Information
0	0	Normal
0	1	Alarm has occurred
1	1	System error has occurred

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3.4.3 Module status area

This section explains the [Mr] module status area.

<table>
<tr><th colspan="2">Module status</th><th>Item</th><th>Description</th></tr>
<tr><td>[Mr.n+1]</td><td>[Mr.n]</td><td>Module status</td><td>(1) The operating status of the ST1AD is stored.
<table>
<tr><th>[Mr.n+1]</th><th>[Mr.n]</th><th>Information</th></tr>
<tr><td>0</td><td>0</td><td>Online module change in progress or internal bus error occurred</td></tr>
<tr><td>1</td><td>1</td><td>Normal</td></tr>
</table></td></tr>
</table>

3.4.4 Word input area

This section explains the [Wr] word input area.

<table>
<tr><th>Word input</th><th>Item</th><th>Description</th></tr>
<tr><td>[Wr.n]</td><td>CH1 digital output value</td><td rowspan="2">(1) The digital value converted from an analog value is stored into [Wr.n], [Wr.n+1] CH□ digital output value for each channel.
(2) The digital value is stored in 16-bit, signed binary.</td></tr>
<tr><td>[Wr.n+1]</td><td>CH2 digital output value</td></tr>
</table>

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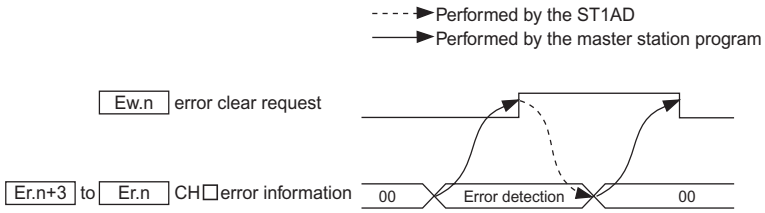
3.4.5 Bit output area

This section explains the Bw bit output area.

Bit output	Item	Description
Bw.n	System area	Use prohibited (fixed to 0)
Bw.n+1	Convert setting request	(1) Turn this item from off (0) to on (1) to validate the settings of the user parameters and command parameters. (a) When writing the command parameters, make sure to turn the Bw.n+1 convert setting request off (0) to stop the conversion. When it is on (1), the command parameters cannot be written. (b) Regardless of whether the Bw.n+1 convert setting request is on (1) or off (0), the user parameters are written but not validated. (Turn the Bw.n+1 convert setting request from off (0) to on (1).) (2) Turn this on (1) to start A/D conversion for the channel for which conversion set to be enabled in the A/D conversion enable/disable setting (command parameter). (3) For the on (1)/off (0) timing, refer to the Br.n+1 column in Section 3.4.1. OFF (0): A/D Conversion stop (Default) ON (1): A/D Conversion start
Bw.n+2	System area	Use prohibited (fixed to 0)
Bw.n+3		

3.4.6 Error clear area

This section explains the Ew error clear area.

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

3.4.7 Word output area

The ST1AD does not use the Ww word output area.
The ST1AD can operate the Ww word output area is secured for it.
To make effective use of the Ww word output area, select "ST1AD2-V (without Ww)" or "ST1AD2-I (without Ww)" using the configuration software of the master station or GX Configurator-ST. The number of occupancy of the Ww word output area in the ST1AD is 0.

3.5 Memory and Parameters

This section explains the memory and parameters of the ST1AD.

3.5.1 Memory

RAM and ROM are available as the parameter storage memory of the ST1AD.

(1) RAM

(a) The ST1AD operates based on the parameter settings stored in the RAM.

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

(2) ROM

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

(b) The parameters stored in the ROM are transferred to the RAM when:
- The MELSEC-ST system (ST1AD) is powered off, then on.
- The head module is reset.
- Parameter setting ROM read (command number: 3100_H) is executed.

3.5.2 Parameters

The ST1AD has user parameters and command parameters.

(1) User parameters

(a) Setting item

- Input range setting

(b) Setting method

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

(2) Command parameters

(a) Setting item

- A/D conversion enable/disable setting
- Averaging process setting
- Average time/average number of times setting
- Alarm output setting
- Upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value setting
- Disconnection detection setting
- Notch filter setting

(b) Setting method

1) Command

Execute a command from the master station to write the settings to the RAM of the ST1AD.
When the command parameters are written in advance using Parameter setting ROM write (command number: 3101H), master station programs can be reduced.

2) GX Configurator-ST

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

4 SETUP AND PROCEDURES BEFORE OPERATION

4.1 Handling Precautions

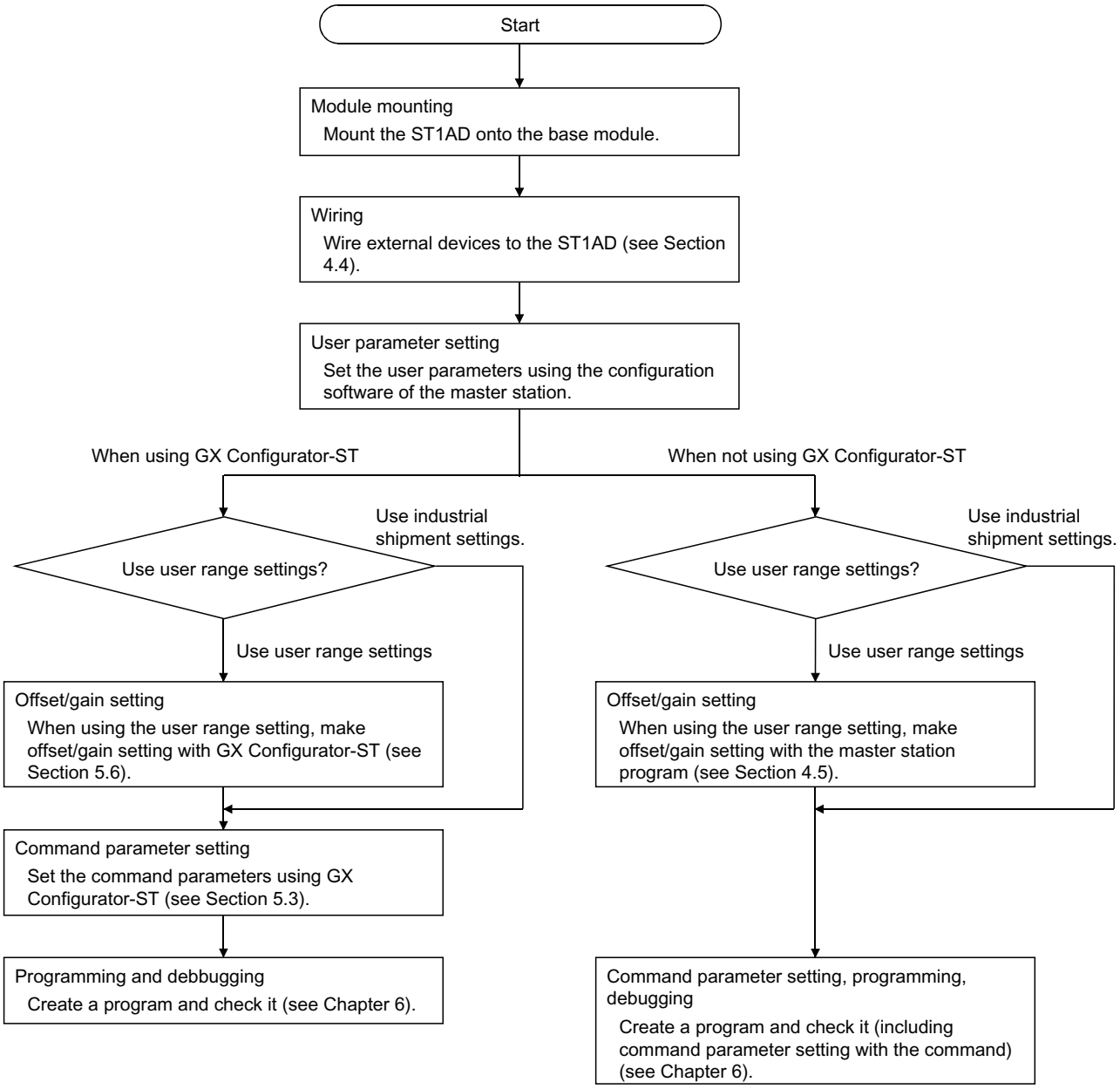
(1) Do not drop the module or give it hard impact since its case is made of resin.
Doing so can damage the module.

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

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

4 - 1

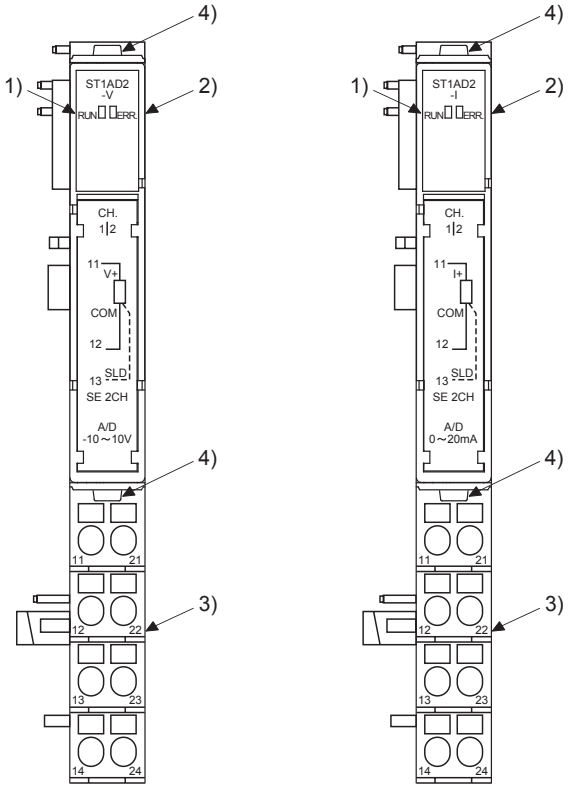
4.2 Setup and Procedure before Operation



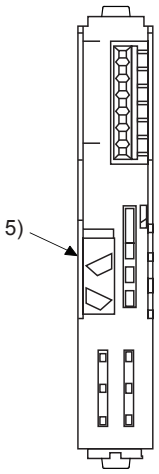
POINT
Refer to Section 3.5 for details of the user parameters and command parameters.

4.3 Part Names

The name of each part in the ST1AD is listed below.
The following shows the ST1AD mounted on the spring clamp type base module.



[Rear view of ST1AD2-V/ST1AD2-I]



No.	Name and appearance	Description
1)	RUN LED	RUN LED and ERR. LED (on/flashing/off) indicate various statuses of the ST1AD (see section 4.3.1).
2)	ERR. LED	
3)	Terminal block	The input signals of the ST1AD are wired to the terminal block of the base module. [Applicable base modules] Spring Clamp Type : ST1B-S4IR2 Screw Clamp Type : ST1B-E4IR2
4)	Slice module fixing hooks (at both ends)	Used for mounting/dismounting the ST1AD to/from the base module. While the hooks at both ends are pressed, mount/dismount the ST1AD.
5)	Coding element	Prevents the module from being mounted incorrectly. The coding element consists of two pieces, and its shape changes depending on the model name. When the ST1AD is mounted on the base module and then dismounted, one piece of the coding element remains on the base module, and the other remains on the ST1AD. The ST1AD can be mounted onto the base module that matches the ST1AD coding element. [Applicable coding element] ST1AD2-V : ST1A-CKY-13 ST1AD2-I : ST1A-CKY-14

POINT
In order to ensure safety, make sure to attach the coding element to the base module and ST1AD.

Terminal No.	Signal name			
	ST1AD2-V		ST1AD2-I	
11	CH1	V+	CH1	I+
12		COM		COM
13		SLD		SLD
14		Vacancy		Vacancy
21	CH2	V+	CH2	I+
22		COM		COM
23		SLD		SLD
24		Vacancy		Vacancy

4.3.1 Status confirmation by LED

Table 4.1 explains the LED indications.

Table 4.1 LED Indications

LED indication		Operating status
RUN LED	ERR.LED	
On	Off	Normal
	On	System error is occurring
Flashing (1s interval)	Off	The data communication has stopped and the parameter communication is faulty between the master module and head module, other slice module is faulty and an internal bus error is occurring.
	On	System error is occurring when the data communication has stopped and the parameter communication is faulty between the master module and head module, other slice module is faulty and 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 below.

4.4.1 Wiring precautions

In order to optimize the functions of the ST1AD 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 ST1AD to avoid the influence of the AC side surges and inductions.

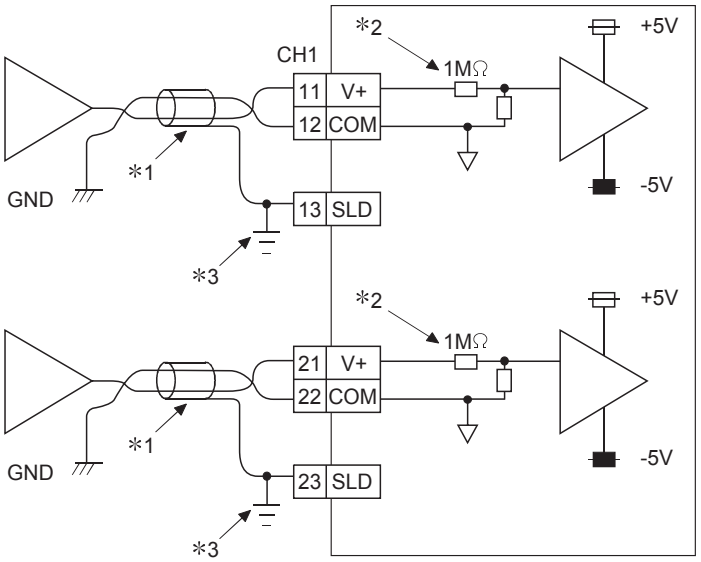
(2) Do not bring/install the cables closer to/together with the main circuit line, a high-voltage cable or a load cable from other than the MELSEC-ST system. This may increase the effects of noise, surges and induction.

(3) Ground the shield of the shielded wire or shielded cable at one point on the ST1AD side.
Depending on noise conditions, however, it is recommended to ground the shield on the external device side.

4.4.2 External wiring

Wire the cables to the base module (option).

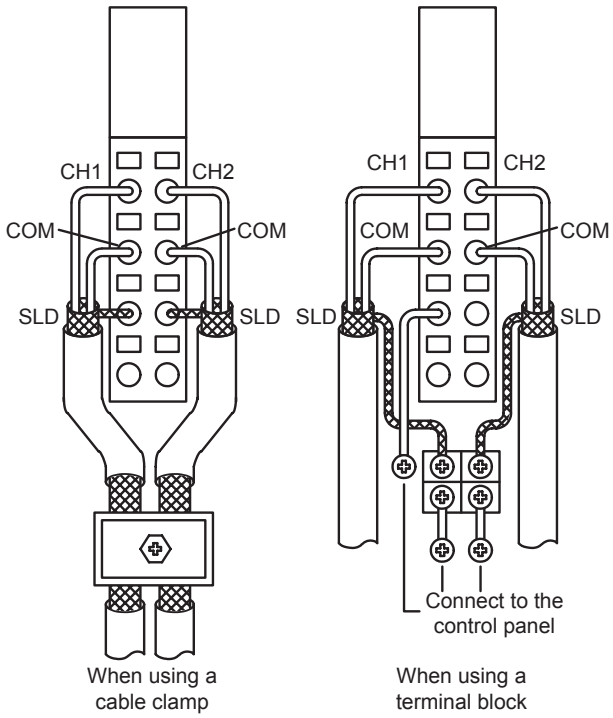
(a) ST1AD2-V



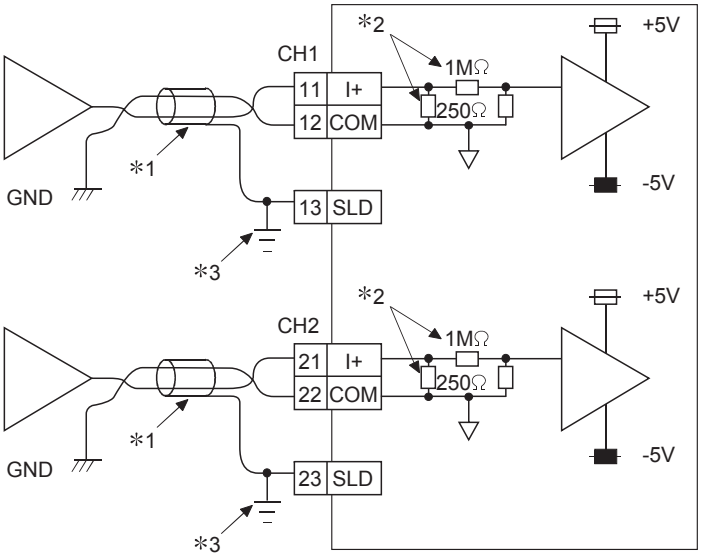
*1 Use a twisted two core shielded wire for the power wire.

*2 Shows input resistance of ST1AD2-V

*3 Connect the shield to the SLD terminal of base module, and then ground it using a cable clamp or terminal block.
The SLD terminal is not grounded to the FG of power distribution module inside the module. Depending on noise conditions, however, it is recommended to ground the shield on the external device side.



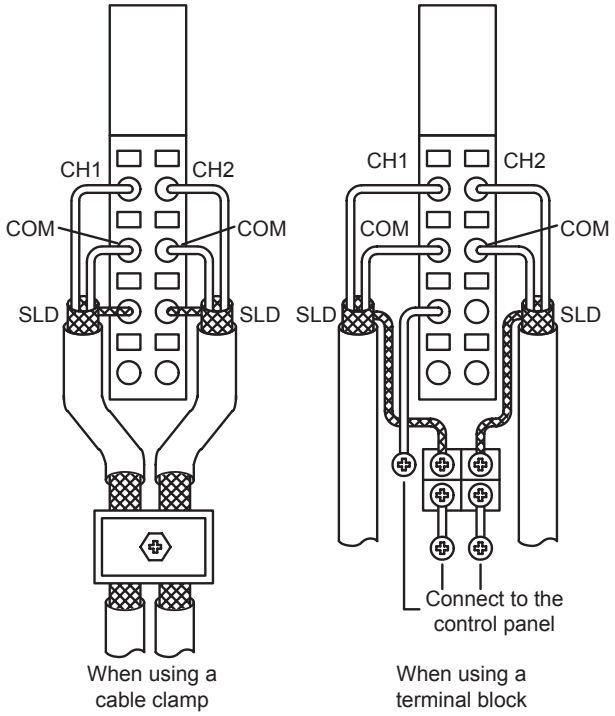
(b) ST1AD2-I



*1 Use a twisted two core shielded wire for the power wire.

*2 Shows input resistance of ST1AD2-I

*3 Connect the shield to the SLD terminal of base module, and then ground it using a cable clamp or terminal block.
The SLD terminal is not grounded to the FG of power distribution module inside the module. Depending on noise conditions, however, it is recommended to ground the shield on the external device side.

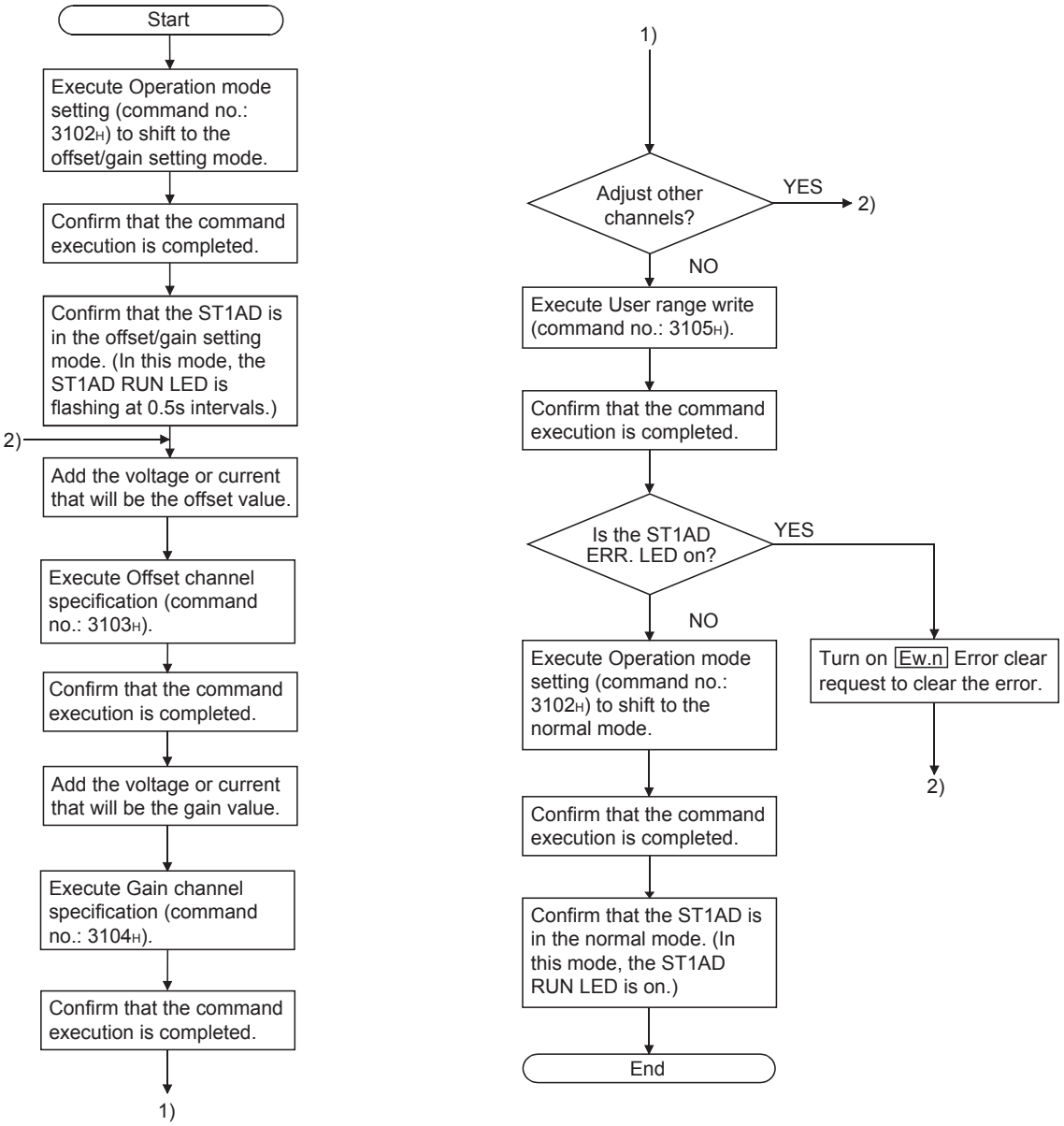


POINT
ST1AD needs to be powered on 5 minutes prior to operation for compliance to the specification (accuracy). Therefore, power on 5 minutes prior to offset/gain setting or after online module replacement.

4.5 Offset/Gain Settings

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

(1) Offset/gain setting procedure



POINT

(1) Make the offset/gain setting in the ranges that satisfy the conditions indicated in POINT (3) of Section 3.2.1 or POINT (3) of Section 3.2.2.
When the setting exceeds this range, the maximum resolution or total accuracy may not be within the range indicated in the performance specification.

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

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

(4) When making the offset/gain setting, write the values to the ROM using User range write (command number: 3105H).
Data can be written to the ROM up to 10,000 times.
To prevent accidental write to the ROM, write to ROM is counted, starting at power-on.

(5) If an error occurs during offset/gain setting, the offset and gain values are not written to the ST1AD.
Set the correct offset and gain values again.

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(2) Programming

The program example given here switches the modes (from normal mode to offset/gain setting mode, from offset/gain setting mode to normal mode), specifies the channel on which offset/gain setting will be made, adjusts the offset/gain values, and writes the offset/gain values to the ST1AD.

(a) When QJ71PB92D is used as master station

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

1) Device assignment to program examples

Devices used by QJ71PB92D

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

Devices used by user

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

Devices used in I/O data

Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	D1000.0	0	ST1H-PB
Br.01	Forced output test mode	D1000.1		
Br.02	Module being changed online	D1000.2	1	
Br.03	Command execution	D1000.3		
Br.04	External power supply status	D1000.4	2	ST1PSD
Br.05		D1000.5		
Br.06	Module ready	D1000.6	3	ST1AD2-V
Br.07	Convert setting completed flag	D1000.7		
Br.08	A/D conversion completed flag	D1000.8	4	
Br.09	Alarm output signal	D1000.9		
Br.0A	—	D1000.A	—	—
to				
Br.1F	—	D1001.F	—	—

Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	D1002.0	0	ST1H-PB
Er.01		D1002.1		
Er.02		D1002.2	1	
Er.03		D1002.3		
Er.04	Bus refreshing module error information	D1002.4	2	ST1PSD
Er.05		D1002.5		
Er.06	CH1 error information	D1002.6	3	ST1AD2-V
Er.07		D1002.7		
Er.08	CH2 error information	D1002.8	4	
Er.09		D1002.9		
Er.0A	_	D1002.A	_	_
to				
Er.1F	_	D1003.F	_	_

Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	D1004.0	0	ST1H-PB
Mr. 1		D1004.1	1	
Mr.2	Bus refreshing module existence information	D1004.2	2	ST1PSD
Mr.3	Module status	D1004.3	3	ST1AD2-V
Mr.4		D1004.4	4	
Mr.5	_	D1004.5	_	_
to				
Mr.15	_	D1004.F	_	_

Cr Command result area

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

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Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	D2000.0	0	ST1H-PB
Bw.01	System area (0 fixed)	D2000.1		
Bw.02	System area (0 fixed)	D2000.2	1	
Bw.03	Command request	D2000.3		
Bw.04	System area (0 fixed)	D2000.4	2	ST1PSD
Bw.05	System area (0 fixed)	D2000.5		
Bw.06	System area (0 fixed)	D2000.6	3	ST1AD2-V
Bw.07	Convert setting request	D2000.7		
Bw.08	System area (0 fixed)	D2000.8	4	
Bw.09	System area (0 fixed)	D2000.9		
Bw.0A	_	D2000.A	_	_
to				
Bw.1F	_	D2001.F	_	_

Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	D2002.0	0	ST1H-PB
Ew.01	System area (0 fixed)	D2002.1		
Ew.02	System area (0 fixed)	D2002.2	1	
Ew.03	System area (0 fixed)	D2002.3		
Ew.04	Error clear request	D2002.4	2	ST1PSD
Ew.05	System area (0 fixed)	D2002.5		
Ew.06	Error clear request	D2002.6	3	ST1AD2-V
Ew.07	System area (0 fixed)	D2002.7		
Ew.08	System area (0 fixed)	D2002.8	4	
Ew.09	System area (0 fixed)	D2002.9		
Ew.0A	_	D2002.A	_	_
to				
Ew.1F	_	D2003.F	_	_

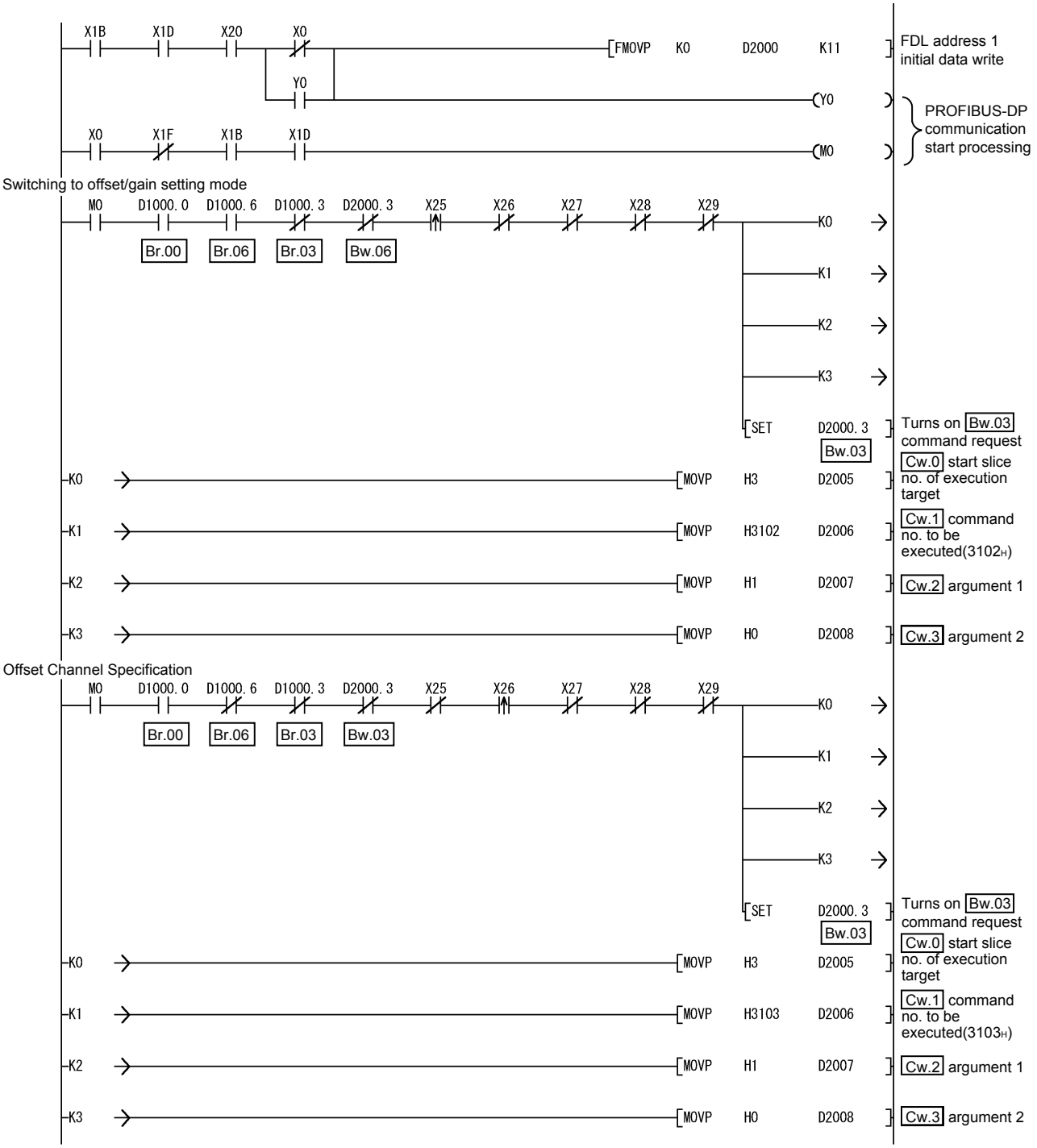
Sw System area

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

Cw Command execution area

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

2) Programming example



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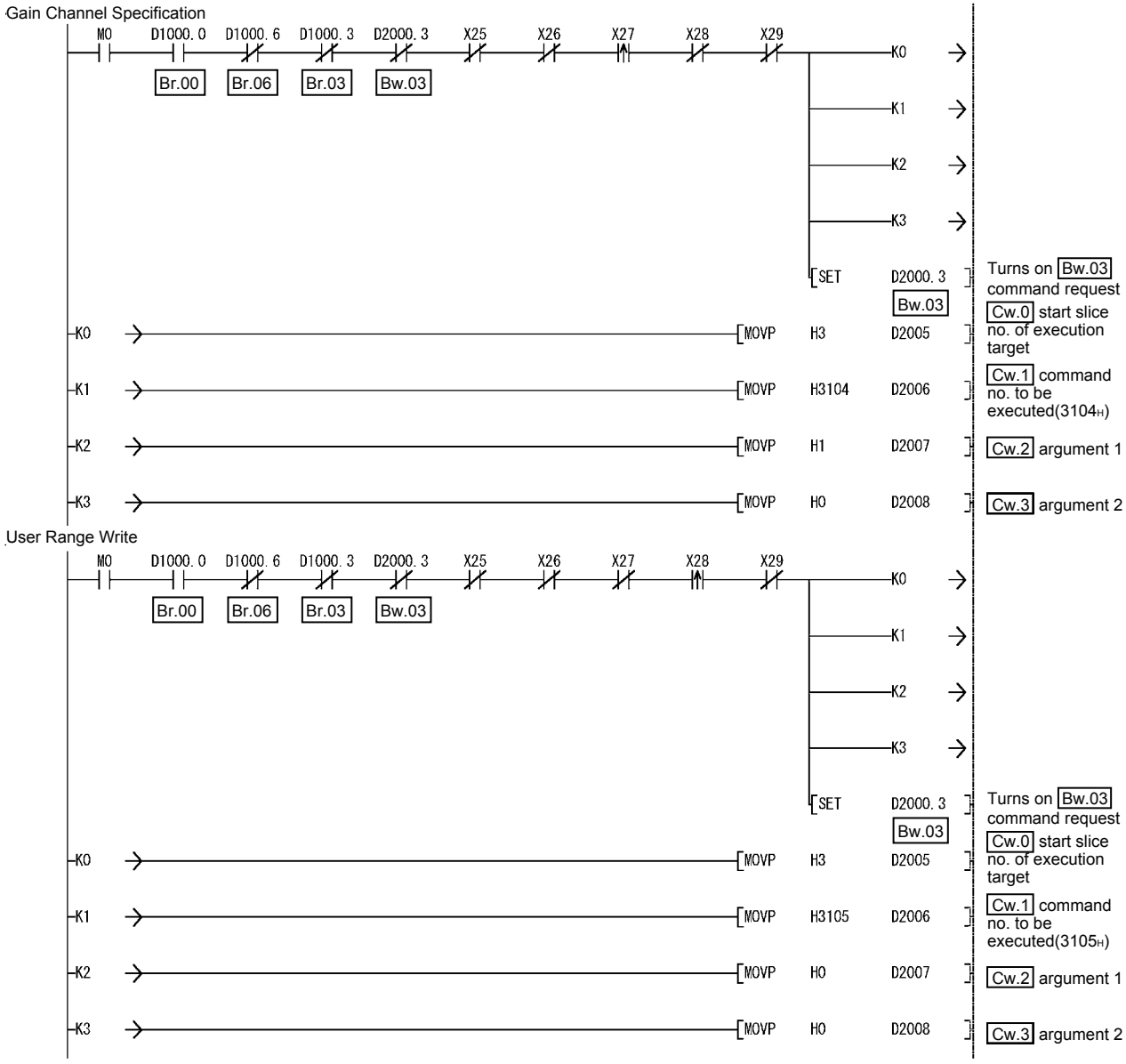
Gain Channel Specification
M0
D1000.0
D1000.6
D1000.3
D2000.3
X25
X26
X27
X28
X29
Br.00
Br.06
Br.03
Bw.03
K0
K1
K2
K3
SET
D2000.3
Bw.03
Turns on Bw.03 command request
MOVP
H3
D2005
Cw.0 start slice no. of execution target
H3104
D2006
Cw.1 command no. to be executed(3104H)
H1
D2007
Cw.2 argument 1
H0
D2008
Cw.3 argument 2
User Range Write
H3105

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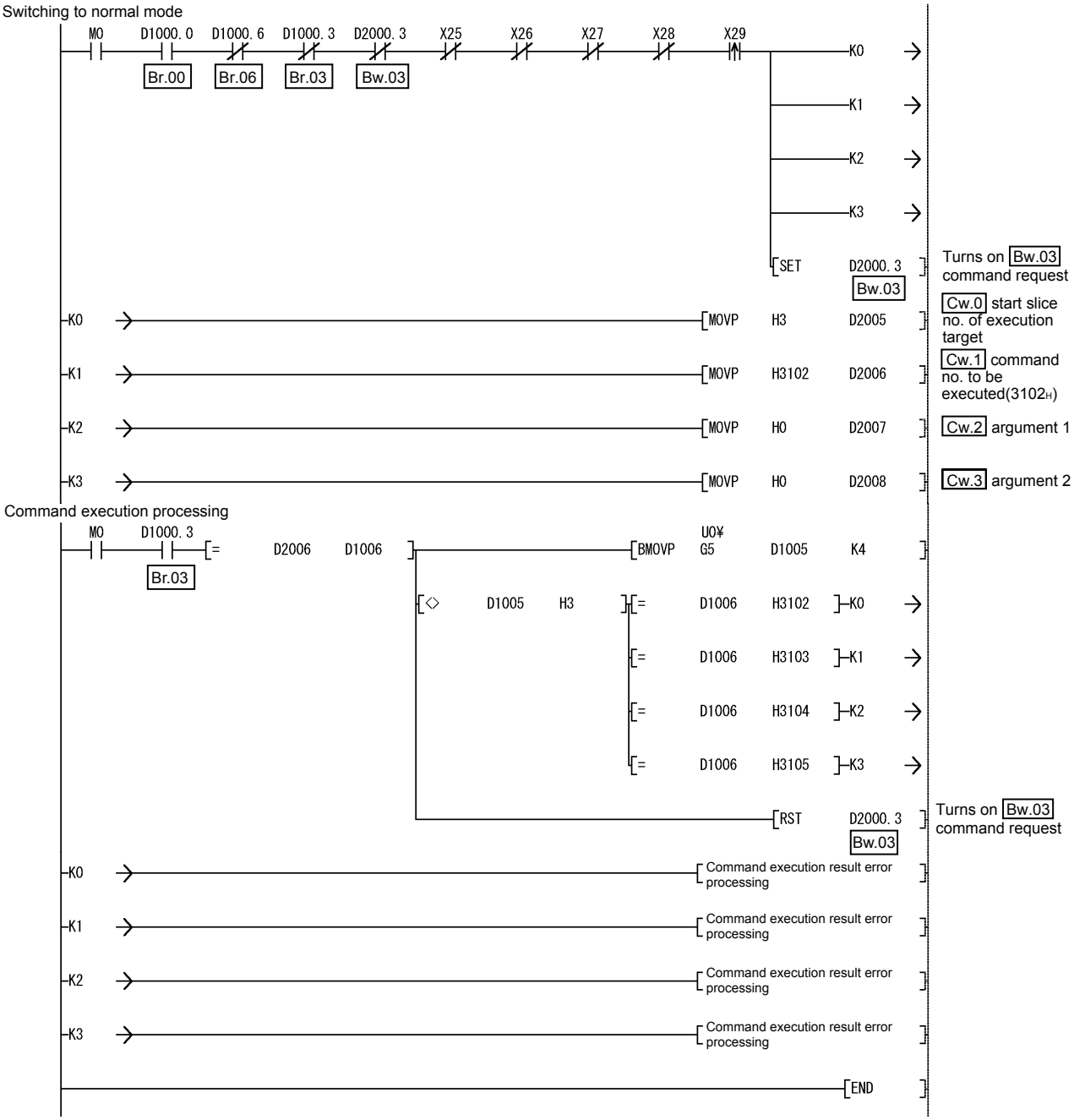
Switching to normal mode
M0
D1000.0
D1000.6
D1000.3
D2000.3
X25
X26
X27
X28
X29
Br.00
Br.06
Br.03
Bw.03
K0
K1
K2
K3
SET D2000.3 Bw.03
Turns on Bw.03 command request
K0 MOVP H3 D2005
Cw.0 start slice no. of execution target
K1 MOVP H3102 D2006
Cw.1 command no. to be executed(3102H)
K2 MOVP H0 D2007
Cw.2 argument 1
K3 MOVP H0 D2008
Cw.3 argument 2
Command execution processing
M0
D1000.3
Br.03
= D2006 D1006
BMOVP U0¥G5 D1005 K4
◇ D1005 H3
= D1006 H3102 K0
= D1006 H3103 K1
= D1006 H3104 K2
= D1006 H3105 K3
RST D2000.3 Bw.03
Turns on Bw.03 command request
K0 Command execution result error processing
K1 Command execution result error processing
K2 Command execution result error processing
K3 Command execution result error processing
END

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

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

1) Device assignment to program examples

Devices used by A1SJ71PB92D

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

Devices used by user

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

Devices used in I/O data

Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	B0	0	ST1H-PB
Br.01	Forced output test mode	B1		
Br.02	Module being changed online	B2	1	
Br.03	Command execution	B3		
Br.04	External power supply status	B4	2	ST1PSD
Br.05		B5		
Br.06	Module ready	B6	3	ST1AD2-V
Br.07	Convert setting completed flag	B7		
Br.08	A/D conversion completed flag	B8	4	
Br.09	Alarm output signal	B9		
Br.0A	—	BA	—	—
to				
Br.1F	—	B1F	—	—

Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	B20	0	ST1H-PB
Er.01		B21		
Er.02		B22	1	
Er.03		B23		
Er.04	Bus refreshing module error information	B24	2	ST1PSD
Er.05		B25		
Er.06	CH1 error information	B26	3	ST1AD2-V
Er.07		B27		
Er.08	CH2 error information	B28	4	
Er.09		B29		
Er.0A	_	B2A	_	_
to				
Er.1F	_	B3F	_	_

Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	B40	0	ST1H-PB
Mr. 1		B41	1	
Mr.2	Bus refreshing module existence information	B42	2	ST1PSD
Mr.3	Module status	B43	3	ST1AD2-V
Mr.4		B44	4	
Mr.5	_	B45	_	_
to				
Mr.15	_	B5F	_	_

Cr Command result area

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

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Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	B1000	0	ST1H-PB
Bw.01	System area (0 fixed)	B1001		
Bw.02	System area (0 fixed)	B1002	1	
Bw.03	Command request	B1003		
Bw.04	System area (0 fixed)	B1004	2	ST1PSD
Bw.05	System area (0 fixed)	B1005		
Bw.06	System area (0 fixed)	B1006	3	ST1AD2-V
Bw.07	Convert setting request	B1007		
Bw.08	System area (0 fixed)	B1008	4	
Bw.09	System area (0 fixed)	B1009		
Bw.0A	_	B100A	_	_
to				
Bw.1F	_	B101F	_	_

Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	B1020	0	ST1H-PB
Ew.01	System area (0 fixed)	B1021		
Ew.02	System area (0 fixed)	B1022	1	
Ew.03	System area (0 fixed)	B1023		
Ew.04	Error clear request	B1024	2	ST1PSD
Ew.05	System area (0 fixed)	B1025		
Ew.06	Error clear request	B1026	3	ST1AD2-V
Ew.07	System area (0 fixed)	B1027		
Ew.08	System area (0 fixed)	B1028	4	
Ew.09	System area (0 fixed)	B1029		
Ew.0A	_	B102A	_	_
to				
Ew.1F	_	B103F	_	_

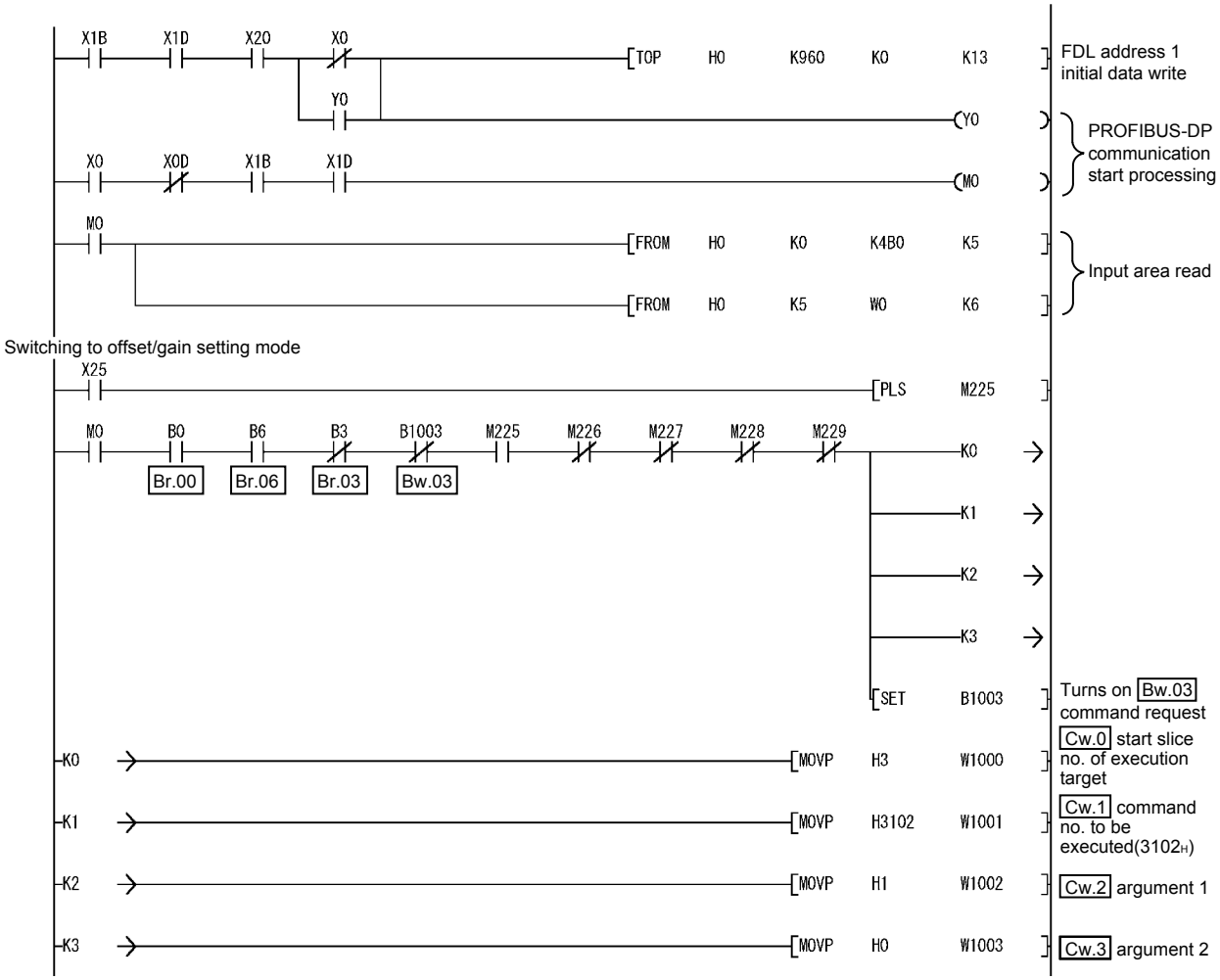
Sw System area

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

Cw Command execution area

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

2) Program example



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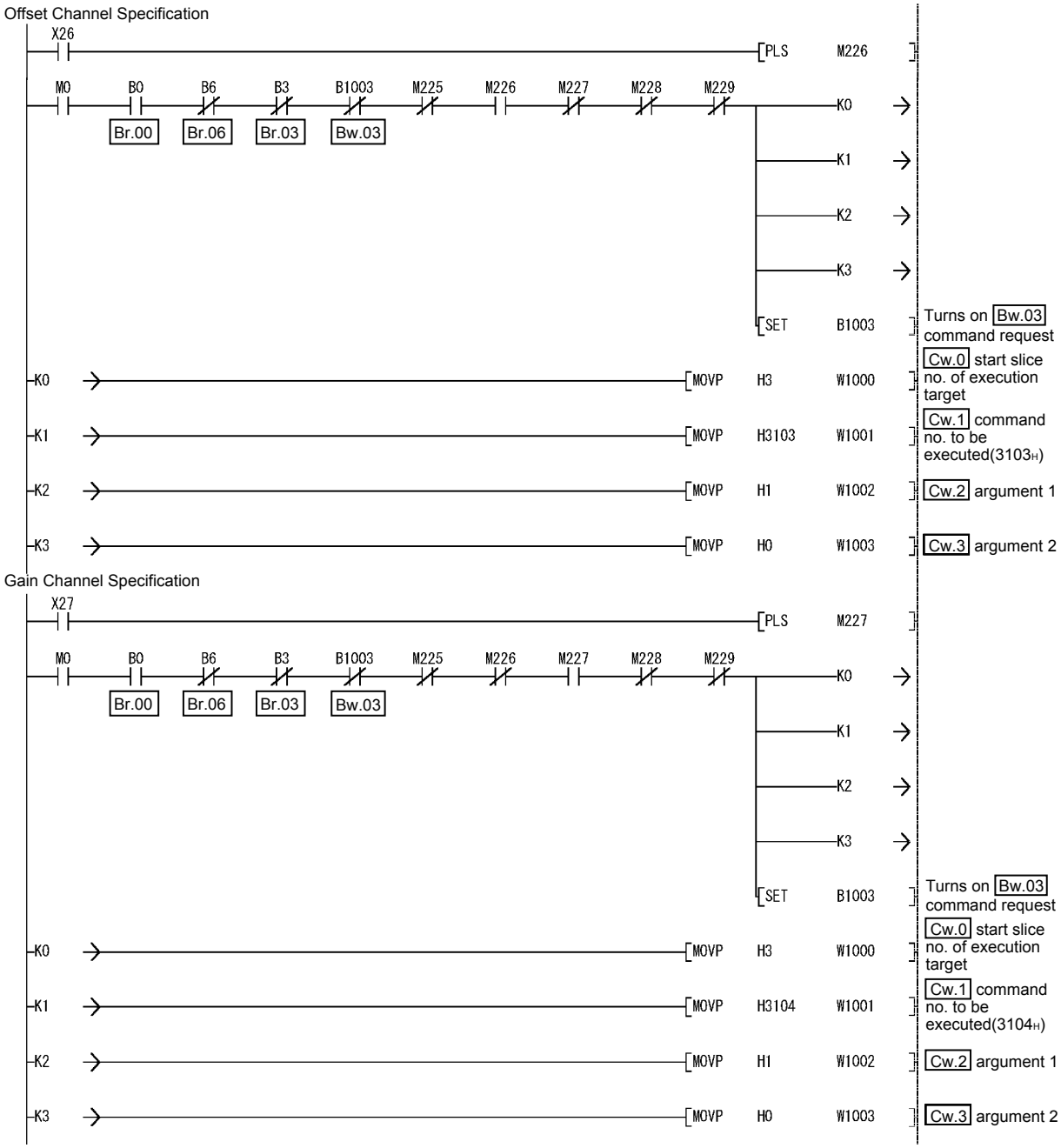
Offset Channel Specification
X26
PLS M226
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3103 W1001
Cw.1 command no. to be executed(3103H)
K2 MOVP H1 W1002
Cw.2 argument 1
K3 MOVP H0 W1003
Cw.3 argument 2
Gain Channel Specification
X27
PLS M227
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3104 W1001
Cw.1 command no. to be executed(3104H)
K2 MOVP H1 W1002
Cw.2 argument 1
K3 MOVP H0 W1003
Cw.3 argument 2

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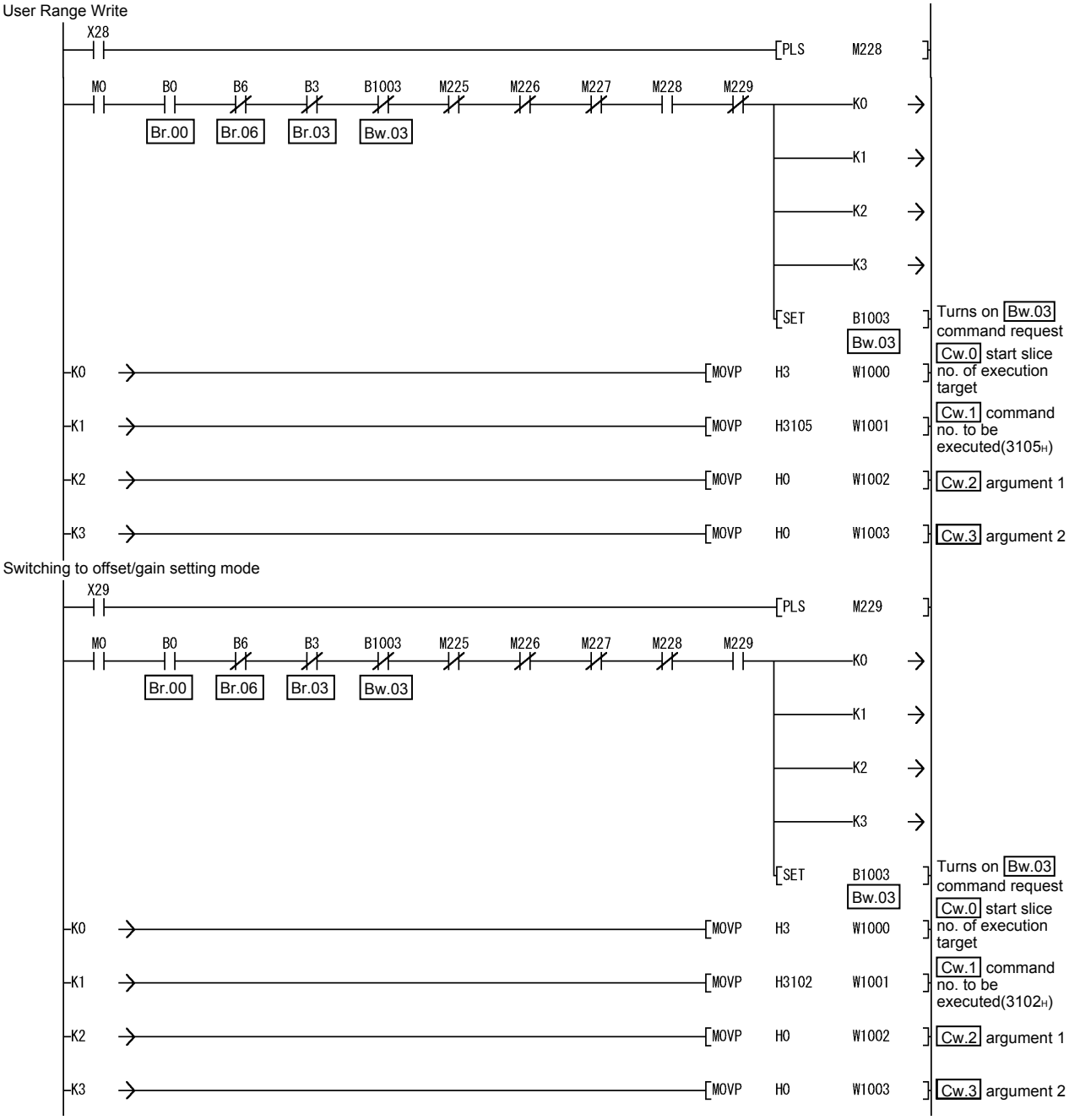
User Range Write
X28
PLS M228
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003 Bw.03
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3105 W1001
Cw.1 command no. to be executed(3105H)
K2 MOVP H0 W1002
Cw.2 argument 1
K3 MOVP H0 W1003
Cw.3 argument 2
Switching to offset/gain setting mode
X29
PLS M229
M0 B0 B6 B3 B1003 M225 M226 M227 M228 M229
Br.00 Br.06 Br.03 Bw.03
K0
K1
K2
K3
SET B1003 Bw.03
Turns on Bw.03 command request
K0 MOVP H3 W1000
Cw.0 start slice no. of execution target
K1 MOVP H3102 W1001
Cw.1 command no. to be executed(3102H)
K2 MOVP H0 W1002
Cw.2 argument 1
K3 MOVP H0 W1003
Cw.3 argument 2

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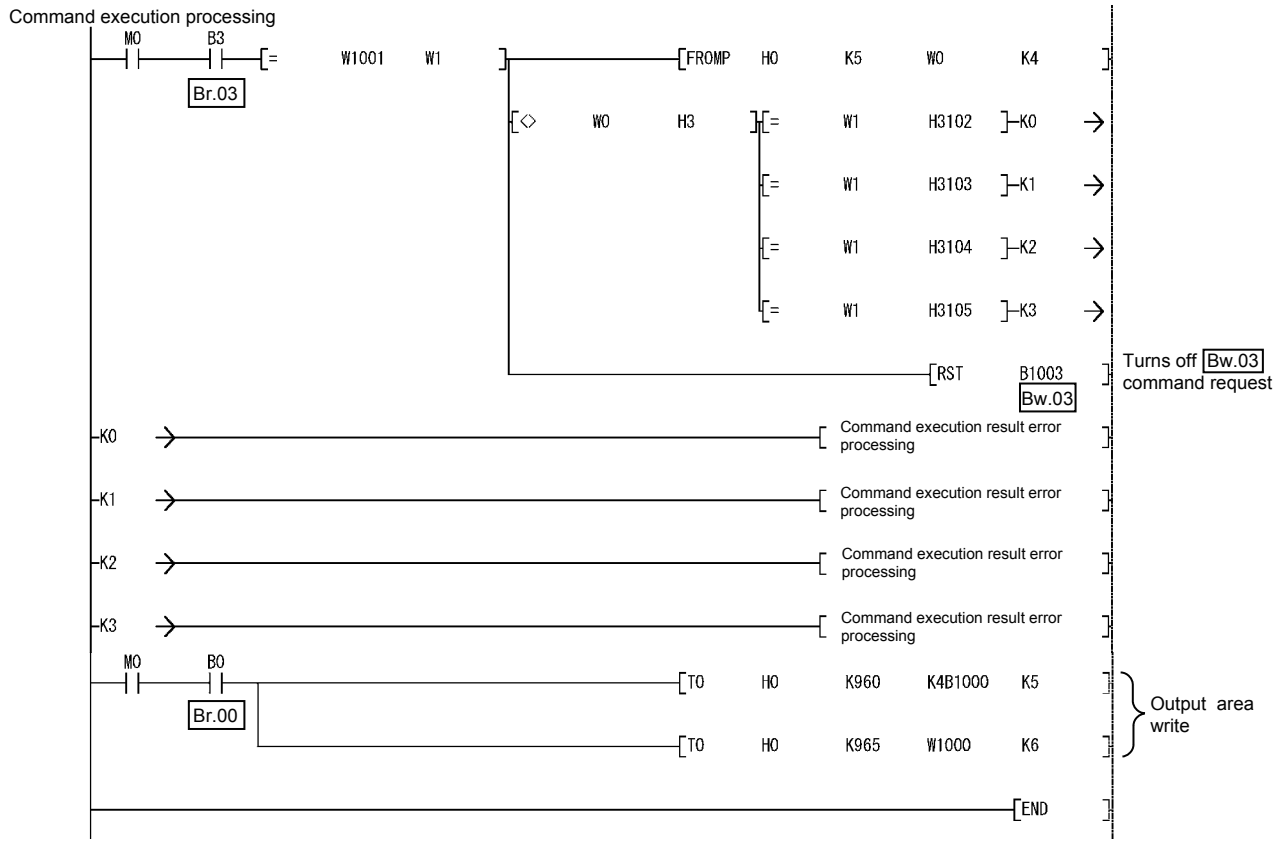

Command execution processing
M0
B3
Br.03
W1001
W1
FROMP
H0
K5
W0
K4
W0
H3
H3102
K0
H3103
K1
H3104
K2
H3105
K3
RST
B1003
Bw.03
Turns off Bw.03 command request
K0
K1
K2
K3
Command execution result error processing
M0
B0
Br.00
T0
H0
K960
K4B1000
K5
K965
W1000
K6
Output area write
END

4 - 24

5 GX Configurator-ST

This chapter explains the functions of GX Configurator-ST used with the ST1AD.
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 ST1AD.

Table 5.1 List of GX Configurator-ST Functions Used with ST1AD

Item	Description	Reference section
Parameter Setting	(1) The following parameter items can be set on GX Configurator-ST. • CH□ input range setting • CH□ time/number of times specification • CH□ sampling process/averaging process setting • CH□ alarm output setting • CH□ disconnection detection setting • CH□ A/D conversion enable/disable setting • 50/60Hz notch filter specification • 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 (2) Specify the area (RAM or ROM) where parameter setting will be registered. (3) Using GX Configurator-ST, parameter setting can be made while online module change is performed.	Section 5.3
Input/output monitor	(1) The I/O data of the ST1AD can be monitored.	Section 5.4
Forced output test	(1) Test can be conducted with the values set in the Bw bit output area, Ew error clear area and Ww word output area of the ST1AD.	Section 5.5
Offset/gain setting	(1) The offset and gain values of the user range can be easily set on-screen. (2) Using GX Configurator-ST, gain/offset setting can be made while online module change is performed.	Section 5.6
Online module change	(1) A module change is made without the system being stopped.	Chapter 7

5 - 1

5.2 Project Creation

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

5.3 Parameter Setting

This section explains how to set the parameters.

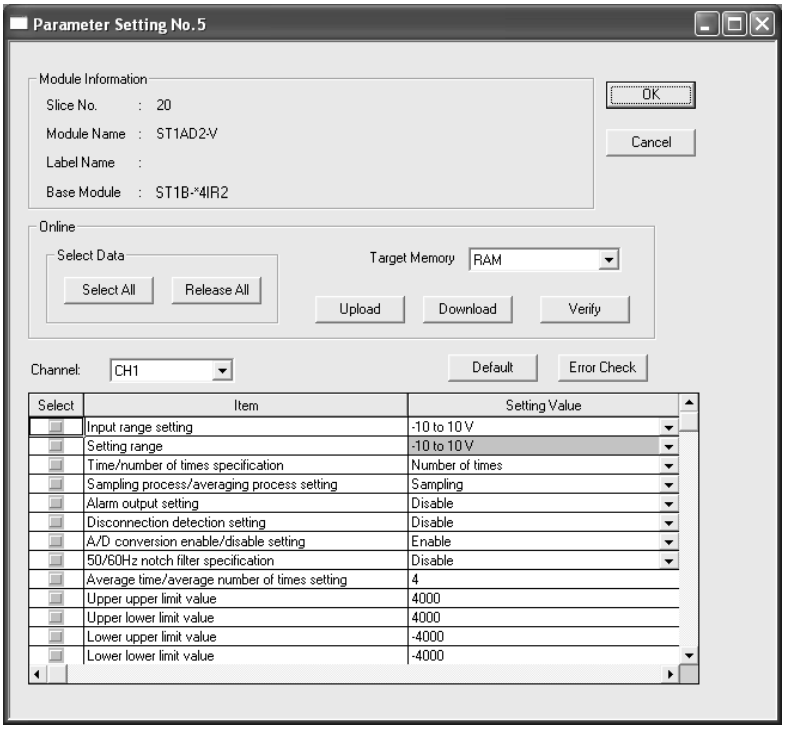
(1) Mode changing

The mode need not be changed.
Either the edit mode or diagnosis mode can be set.

(2) "Parameter Setting" screen displaying operation

1) Select ST1AD on the "Module Information List" screen or "System Monitor" screen.
2) Click the [Edit] → [Parameter Setting] menu.

(3) Display/Setting Screen



(4) Display/setting details

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

(a) User parameters

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

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

1) Input range setting

Set the input range.

Select the input range from among the following types.

Corresponding module	Input range
ST1AD2-V	-10 to 10V
	0 to 10V
	0 to 5V
	1 to 5V
	User range setting
ST1AD2-I	4 to 20mA
	0 to 20mA
	User range setting

2) Setting range

The input range setting currently valid is stored.

Setting cannot be made.

(b) Command parameters

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

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

1) Time/number of times specification

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

2) Sampling process/averaging process setting

Specify the sampling processing/averaging processing.

3) Alarm output setting

Set whether alarm output processing is performed or not.

Disable : Alarm output processing not performed

Enable : Alarm output processing performed

4) Disconnection detection setting

Set whether disconnection detection processing is performed or not.

Disable : Disconnection detection processing not performed

Enable : Disconnection detection processing performed

5) A/D conversion enable/disable setting

Set whether A/D conversion is enabled or disabled.

Disable : A/D conversion enable

Enable : A/D conversion disable

6) 50/60Hz notch filter specification

Set the notch filter processing.

Notch filter processing is batch-performed on all channels.

Set the notch filter to channel 1.

Disable : No notch filter processing performed on all channels

Enable (50Hz) : Notch filter processing performed on all channels (50 ± 3Hz)

Enable (60Hz) : Notch filter processing performed on all channels (60 ± 3Hz)

7) Average time/average number of times setting

Set the average time or average number of times.

Their setting ranges area indicated below.

Average number of times : 4 to 62500 times

Average time : 2 to 5000ms

8) 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.

The setting range of the ST1AD2-V is -4096 to 4095.

The setting range of the ST1AD2-I is -96 to 4095.

(5) Parameter writing operation

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 ST1AD by checking the corresponding "select" check box.
3) Make setting in the "Setting Value" field.
4) Select the target memory (RAM or ROM) of parameter write from the pull-down menu of "Target Memory".
5) Click the Download button.

When writing the parameters of multiple channels to the ST1AD, 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 ST1AD.

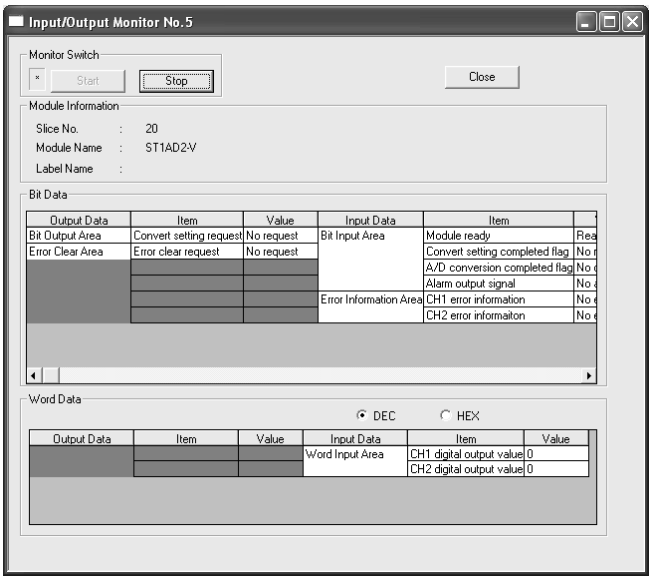
(1) Mode changing

Click the [Mode] → [Diagnosis] menu.

(2) "Input/Output Monitor" screen displaying operation

1) Select ST1AD on the "System Monitor" screen.
2) Click the Input/Output Monitor button.
   Monitor starts as soon as the "Input/Output Monitor" screen is displayed.

(3) Display/Setting Screen



(4) Display/setting details

(a) Bit Data

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

(b) Word Data

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

Input/Output Data	Item	Description
Word Input Area	CH□ digital output value	The value of Wr.n , Wr.n+1 CH□ digital output 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 ST1AD.

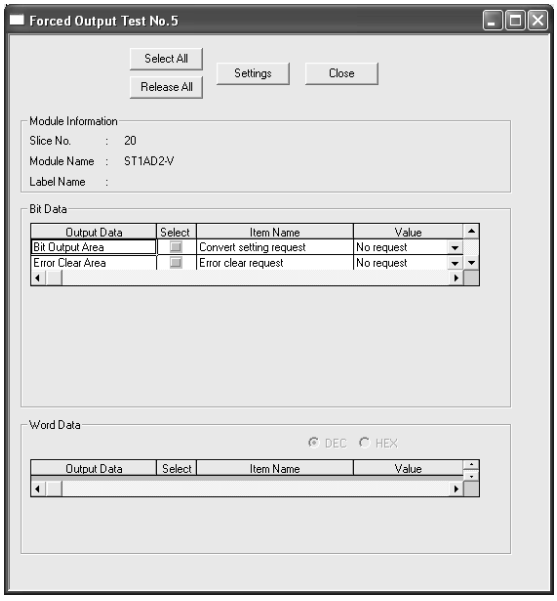
(1) Mode changing

Click the [Mode] → [Diagnosis] menu.

(2) "Forced Output Test" screen displaying operation

1) Select ST1AD on the "System Monitor" screen.
2) Click the Forced Output Test button.

(3) Display/Setting Screen



(4) Display/setting details

(a) Bit Data

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

(b) Word Data

Unavailable for the ST1AD.

(5) Test operation

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

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

5.6 Offset/Gain Setting

This section explains how to make offset/gain setting.

(1) Mode changing

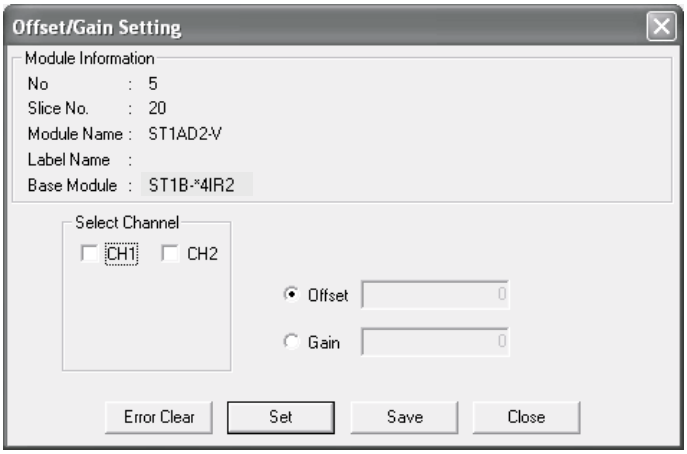
Click the [Mode] → [Diagnosis] menu.

(2) "Offset/Gain Setting" screen displaying operation

1) Select ST1AD on the "System Monitor" screen.
2) Click the Offset/Gain Setting button. *

   *: When the module is not in the forced output test mode, a screen appears asking whether to switch to the forced output test mode. Click the OK button to switch to the forced output test mode.
   When the module is switched to the forced output test mode, the RUN LED of the head module flashes.
3) As a screen appears asking whether to switch to the offset/gain setting mode, click the OK button to switch to the offset/gain setting mode.
   After switched to the offset/gain setting mode, the RUN LED of ST1AD flashes (0.5s interval) and the ST1AD stops.

(3) Display/Setting Screen



(4) Offset/gain setting operation

When setting different offset and gain values for different channels, perform the operations in (a), (b) for each channel.

Perform the operation in (c) only once at the last since it writes the offset/gain settings of all channels to the ST1AD.

(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) Set the voltage or current as an offset value, and click the Set button.

(b) Gain value setting operation

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) Set the voltage or current as an gain value, and click the Set button.

(c) Offset/gain setting writing operation

Click the Save button.

The offset/gain settings of all channels are written to the ST1AD.

POINT

(1) An error occurs if the Save button is clicked when the offset value is equal to/greater than the gain value.
In this case, click the Error Clear button to clear the error, and make setting again.

(2) When the offset/gain setting screen is closed, the screen displays a message that asks if you are sure to change to the normal mode. Click the OK button to change to the normal mode.
When the module is put in the normal mode, the RUN LED of the ST1AD turns on.

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

6 PROGRAMMING

This chapter explains program examples available when the QJ71PB92D and AJ71PB92D/A2SJ71PB92D are used as the master station.

REMARK

Refer to the following manuals for details of the QJ71PB92D and AJ71PB92D/A1SJ71PB92D.
<QJ71PB92D>
- PROFIBUS-DP Interface Module User's Manual
- SH-080127 (13JR22)

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

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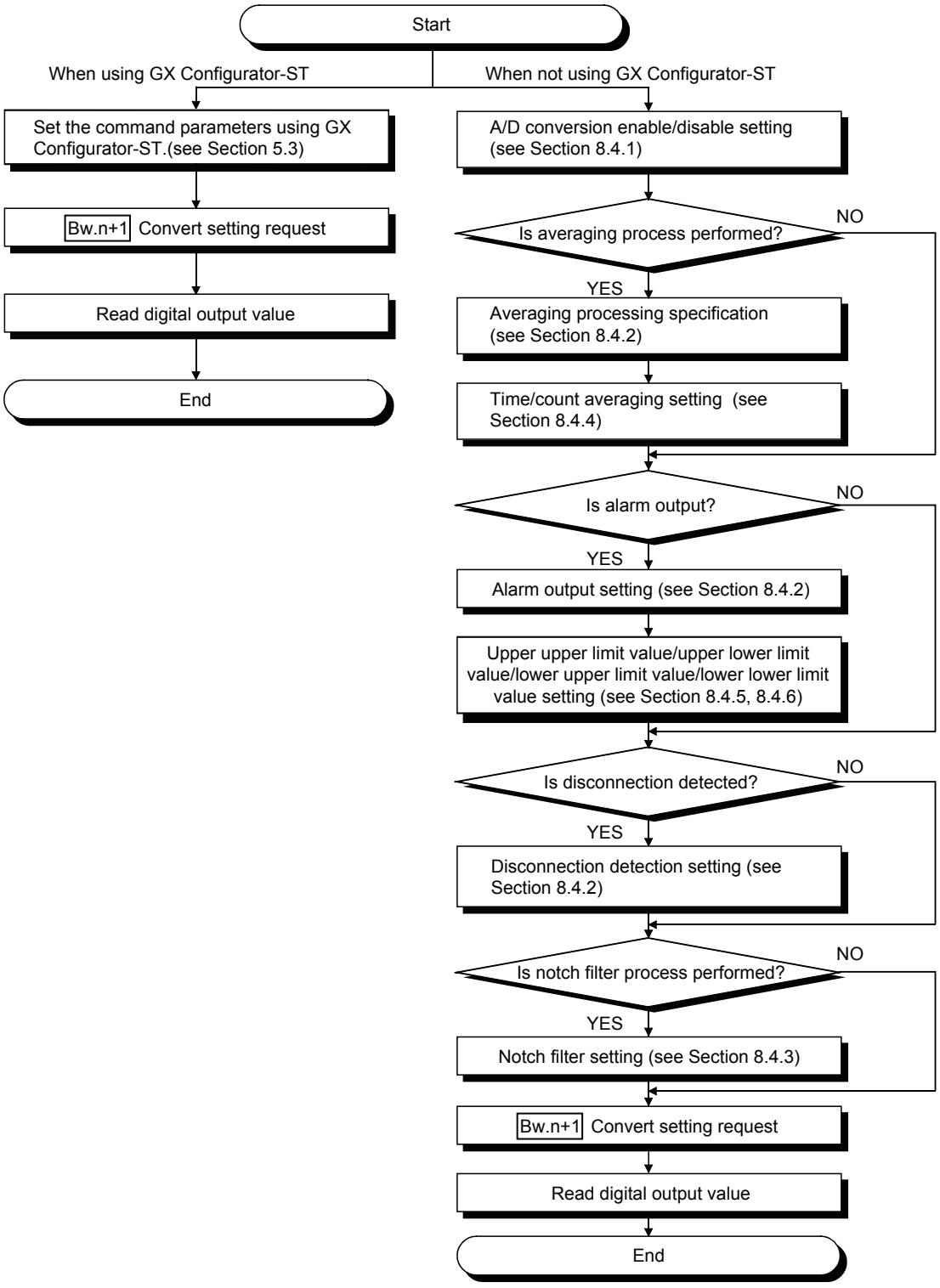
6.1 Programming Procedure

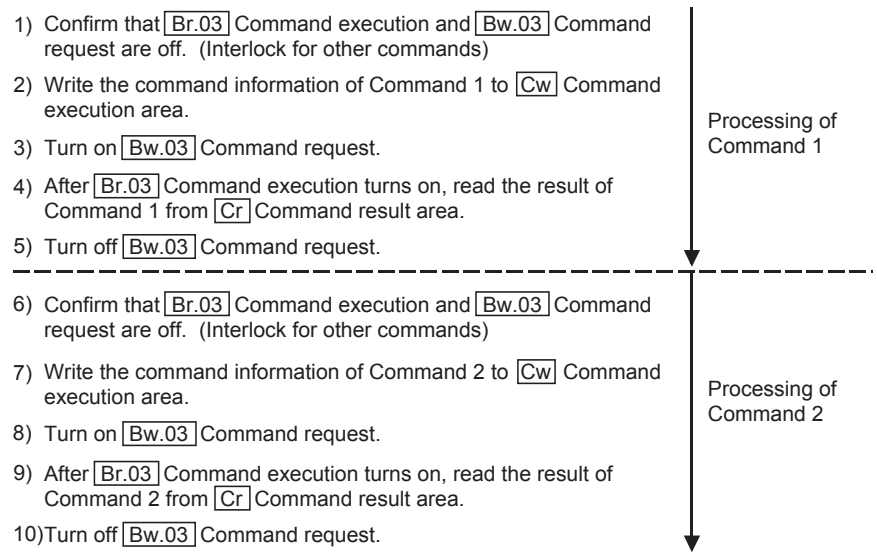
In the following procedure, create a program that will execute the D/A conversion of the ST1AD.
When utilizing the program example introduced in this chapter for an actual system, fully verify that there are no problems in control in the target system.



POINT

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

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



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

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

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

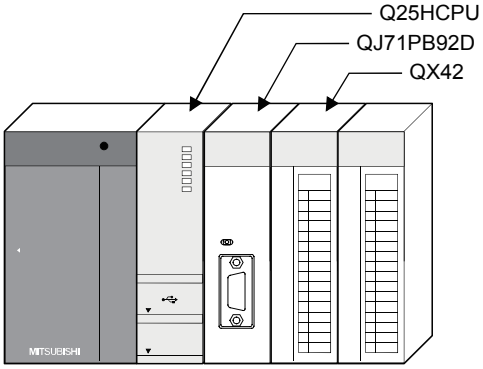
6.2 When QJ71PB92D is Used as Master Station

This section explains program examples available when the QJ71PB92D is used as the master station.
Section 6.2.1 uses the following system configuration example for explanation.

(1) System configuration of master station (QJ71PB92D)

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

(a) System configuration of master station (QJ71PB92D)



(b) Settings of master station (QJ71PB92D)

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

REMARK

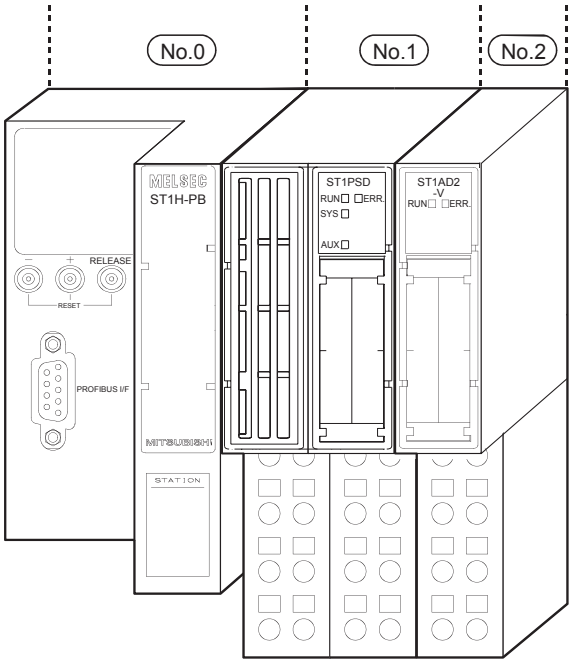
The MELSEC-ST system changes in I/O data size depending on the maximum input/output points and the number of mounted intelligent function modules. Hence, the master station operation mode is set to the extended service mode (MODE E) variable in data size.

(2) System configuration of MELSEC-ST system

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

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

1) FD address: 1
2) Maximum input/output points: 32-point mode

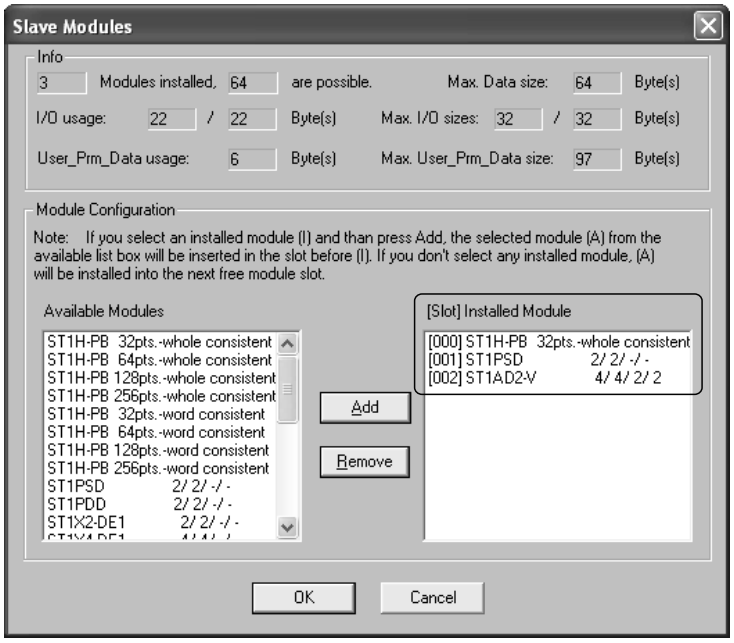


The following table uses the maximum input/output points setting sheet given in the Head Module User's Manual.

No.	Module Name	Number of Occupied I/O Points	Start Slice No. (Number of occupied slices)	Wr.n	Ww.n	5V DC Internal Current Consumption (Total)	24V DC Current (Total)	System Length (Total)
0	ST1H-PB	4	0(2)	—	—	0.530A(0.530A)	0A(0A)	—
1	ST1PSD	2	2(1)	—	—	—	—	25.2mm(25.2mm)
2	ST1AD2-V	4	3(2)	2	2	0.110A(0.640A)	＊1	12.6mm(37.8mm)
Total		10	—	2	2	—	—	—

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

(b) GX Configurator-DP setting



(c) ST1AD2-V setting

The input range is set by GX Configurator-DP.

- Convert enable channel CH1, CH2
- CH1 Input range setting ..... 1 to 5V
- CH2 Input range setting ..... -10 to 10V
- Sampling process channel CH1
- Count-based averaging process channel
  .....CH1 (average number of times: 50)
- Alarm output channel
  ..... CH1 (upper upper limit value, upper lower limit value: 3000)
  (lower upper limit value, lower lower limit value: 100)
- Disconnection detection channel CH1

(3) I/O data assignment

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

(a) Input data

Buffer memory address Decimal (Hexadecimal)	b15							b8	b7							b0	
0 (0H)	Br.0F	Br.0E	Br.0D	Br.0C	Br.0B	Br.0A	Br.09	Br.08	Br.07	Br.06	Br.05	Br.04	Br.03	Br.02	Br.01	Br.00	Br Bit input area
	0						No.2				No.1		No.0				
1 (1H)	Br.1F	Br.1E	Br.1D	Br.1C	Br.1B	Br.1A	Br.19	Br.18	Br.17	Br.16	Br.15	Br.14	Br.13	Br.12	Br.11	Br.10	
	0																
2 (2H)	Er.0F	Er.0E	Er.0D	Er.0C	Er.0B	Er.0A	Er.09	Er.08	Er.07	Er.06	Er.05	Er.04	Er.03	Er.02	Er.01	Er.00	Er Error information area
	0						No.2				No.1		No.0				
3 (3H)	Er.1F	Er.1E	Er.1D	Er.1C	Er.1B	Er.1A	Er.19	Er.18	Er.17	Er.16	Er.15	Er.14	Er.13	Er.12	Er.11	Er.10	
	0																
4 (4H)	Mr.15	Mr.14	Mr.13	Mr.12	Mr.11	Mr.10	Mr.9	Mr.8	Mr.7	Mr.6	Mr.5	Mr.4	Mr.3	Mr.2	Mr.1	Mr.0	Mr Module status area
	0											No.2		No.1		No.0	
5 (5H)	Cr.0(15-8) Command execution result										Cr.0(7-0) Start slice No. of execution target						Cr Command result area
6 (6H)	Cr.1 Executed command No.																
7 (7H)	Cr.2 Response data 1																
8 (8H)	Cr.3 Response data 2																
9 (9H)	Wr.00 CH1 digital output value (Wr.n)																Wr Word input area
10 (AH)	Wr.01 CH2 digital output value (Wr.n+1)																

No. 0: Head module (ST1H-PB)
No. 1: Bus refreshing module (ST1PSD)
No. 2: Intelligent Function Module (ST1AD2-V)

(b) Output data

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

No.0: Head Module(ST1H-PB)
No.1: Bus refreshing module (ST1PSD)
No.2: Intelligent Function Module (ST1AD2-V)

(4) Device assignment to program examples

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

(a) Devices used by QJ71PB92D

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

(b) Devices used by user

Device	Application	Device	Application
X20	PROFIBUS-DP exchange start command	M0	Refresh start request
X30	ST1AD2-V error code read request	M200	Operation condition set value write signal
X31	ST1AD2-V error clear request	M201	Time/count averaging setting write signal
D500	CH1 digital output read destination	M202	CH1 upper upper/upper lower limit set value write signal
D501	CH2 digital output read destination	M203	CH1 lower upper/lower lower limit set value write signal
D600, D601	ST1AD2-V error code read destination	M204	A/D conversion enable/disable setting write signal
—		M210	A/D conversion start signal
		M230	ST1AD2-V error clear request signal

(c) Devices used in I/O data

1) Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	D1000.0	0	ST1H-PB
Br.01	Forced output test mode	D1000.1		
Br.02	Module being changed online	D1000.2	1	
Br.03	Command execution	D1000.3		
Br.04	External power supply status	D1000.4	2	ST1PSD
Br.05		D1000.5		
Br.06	Module ready	D1000.6	3	ST1AD2-V
Br.07	Convert setting completed flag	D1000.7		
Br.08	A/D conversion completed flag	D1000.8	4	
Br.09	Alarm output signal	D1000.9		
Br.0A	—	D1000.A	—	—
to				
Br.1F	—	D1001.F	—	—

2) Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	D1002.0	0	ST1H-PB
Er.01		D1002.1		
Er.02		D1002.2	1	
Er.03		D1002.3		
Er.04	Bus refreshing module error information	D1002.4	2	ST1PSD
Er.05		D1002.5		
Er.06	CH1 error information	D1002.6	3	ST1AD2-V
Er.07		D1002.7		
Er.08	CH2 error information	D1002.8	4	
Er.09		D1002.9		
Er.0A	_	D1002.A	_	_
to				
Er.1F	_	D1003.F	_	_

3) Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	D1004.0	0	ST1H-PB
Mr. 1		D1004.1	1	
Mr.2	Bus refreshing module existence information	D1004.2	2	ST1PSD
Mr.3	Module status	D1004.3	3	ST1AD2-V
Mr.4		D1004.4	4	
Mr.5	_	D1004.5	_	_
to				
Mr.15	_	D1004.F	_	_

4) Cr Command result area

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

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5) Wr Word input area

Wr.n Word input	Information	Master station side device	Slice No.	Module name
Wr.00	CH1 digital output value (Wr.n)	D1009	3	ST1AD2-V
Wr.01	CH2 digital output value (Wr.n+1)	D1010		

6) Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	D2000.0	0	ST1H-PB
Bw.01	System area (0 fixed)	D2000.1		
Bw.02	System area (0 fixed)	D2000.2	1	
Bw.03	Command request	D2000.3		
Bw.04	System area (0 fixed)	D2000.4	2	ST1PSD
Bw.05	System area (0 fixed)	D2000.5		
Bw.06	System area (0 fixed)	D2000.6	3	ST1AD2-V
Bw.07	Convert setting request	D2000.7		
Bw.08	System area (0 fixed)	D2000.8	4	
Bw.09	System area (0 fixed)	D2000.9		
Bw.0A	_	D2000.A	_	_
to				
Bw.1F	_	D2001.F	_	_

7) Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	D2002.0	0	ST1H-PB
Ew.01	System area (0 fixed)	D2002.1		
Ew.02	System area (0 fixed)	D2002.2	1	
Ew.03	System area (0 fixed)	D2002.3		
Ew.04	Error clear request	D2002.4	2	ST1PSD
Ew.05	System area (0 fixed)	D2002.5		
Ew.06	Error clear request	D2002.6	3	ST1AD2-V
Ew.07	System area (0 fixed)	D2002.7		
Ew.08	System area (0 fixed)	D2002.8	4	
Ew.09	System area (0 fixed)	D2002.9		
Ew.0A	_	D2002.A	_	_
to				
Ew.1F	_	D2003.F	_	_

6 - 10

8) Sw System area

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

9) Cw Command execution area

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

10) Ww Word output area

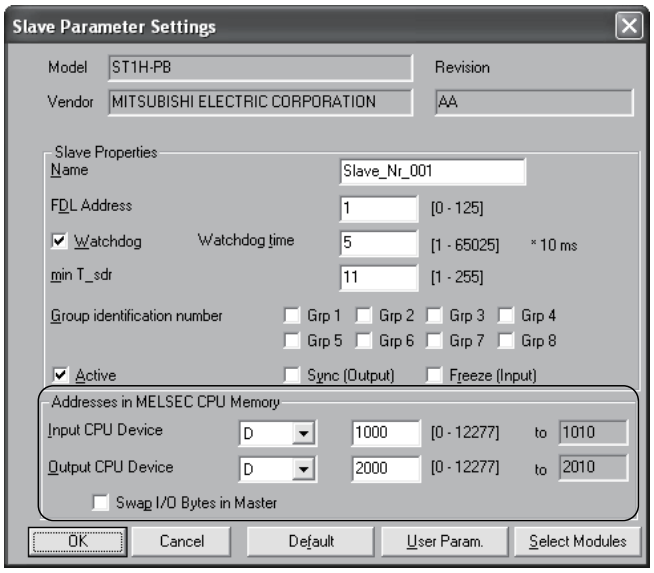
Ww Word output	Information	Master station side device	Slice No.	Module name
Ww.00	System area (0 fixed) (Ww.n)	D2009	3	ST1AD2-V
Ww.01	System area (0 fixed) (Ww.n+1)	D2010		

6.2.1 Program example available when auto refresh is used in QJ71PB92D

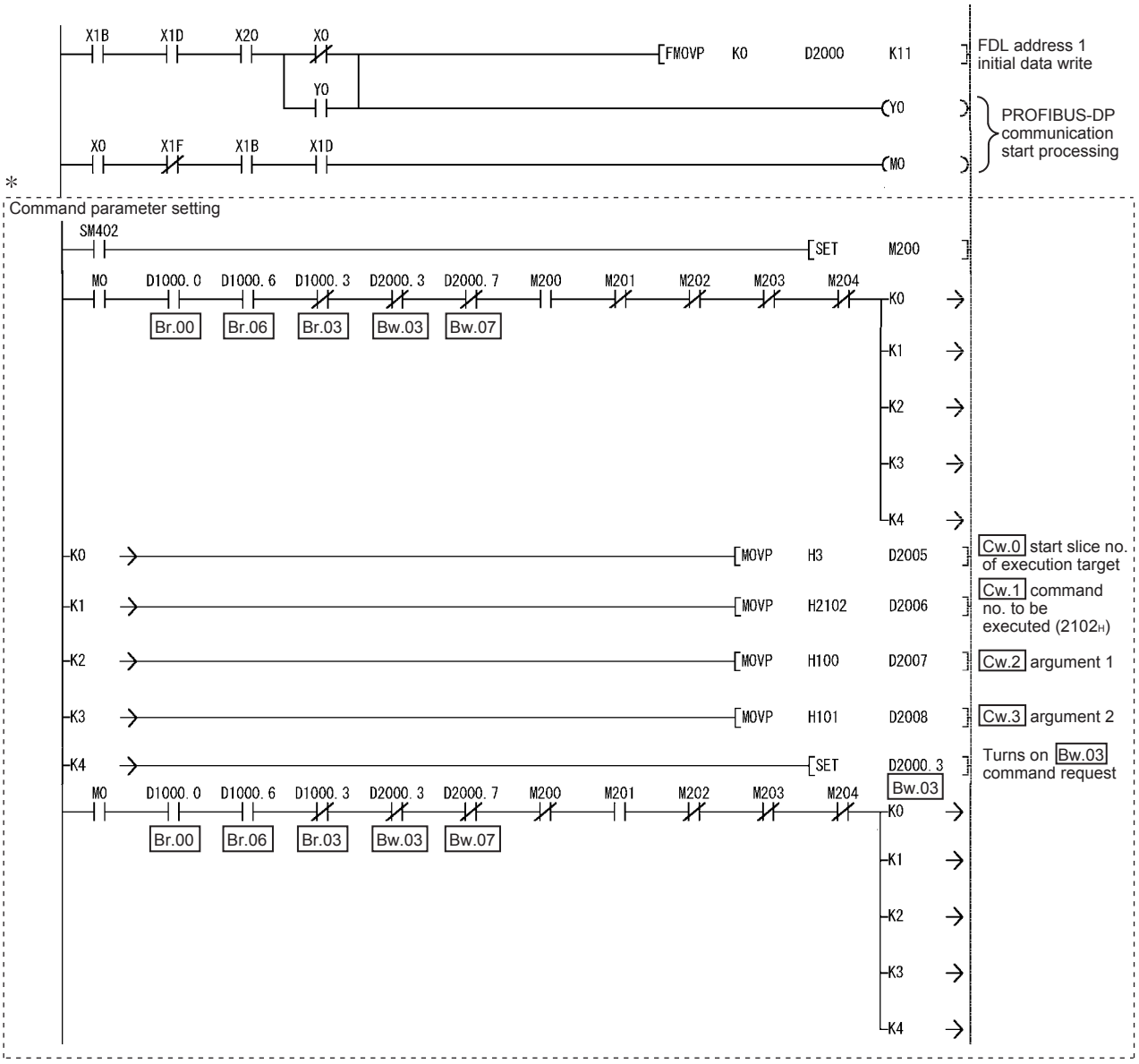
This section explains a program example available when auto refresh is used in the QJ71PB92D to communicate with the MELSEC-ST system.
The program example in this section is based on the system configuration in Section 6.2.

(1) Auto refresh setting

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

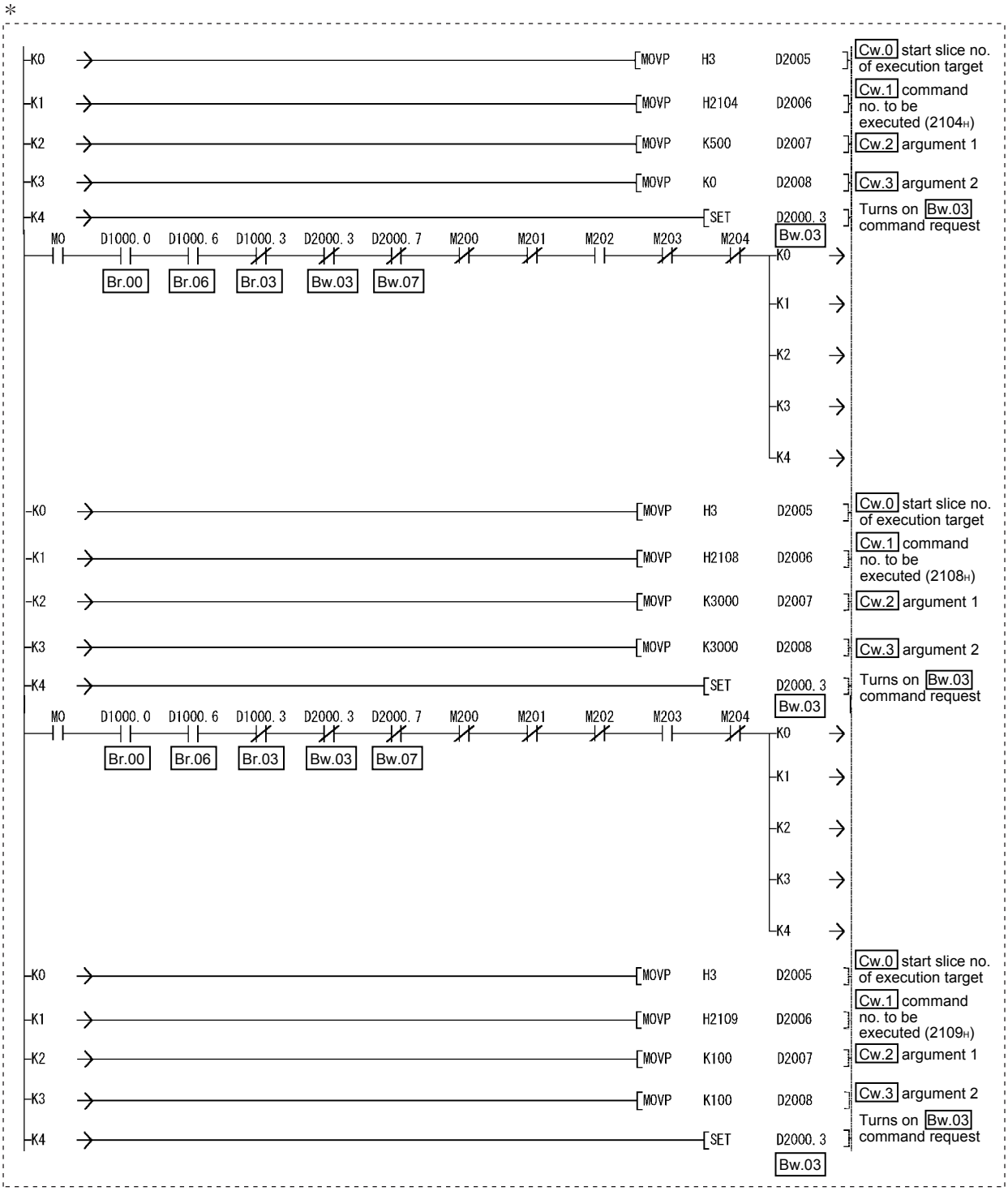


(2) Programming example



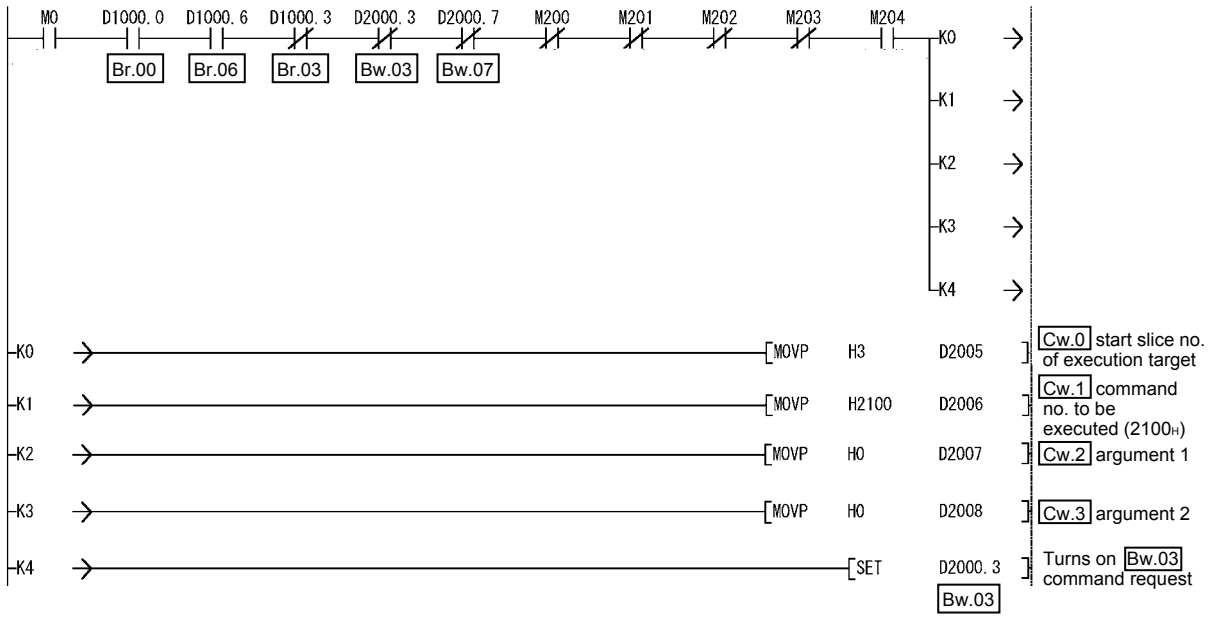
* The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.

*



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

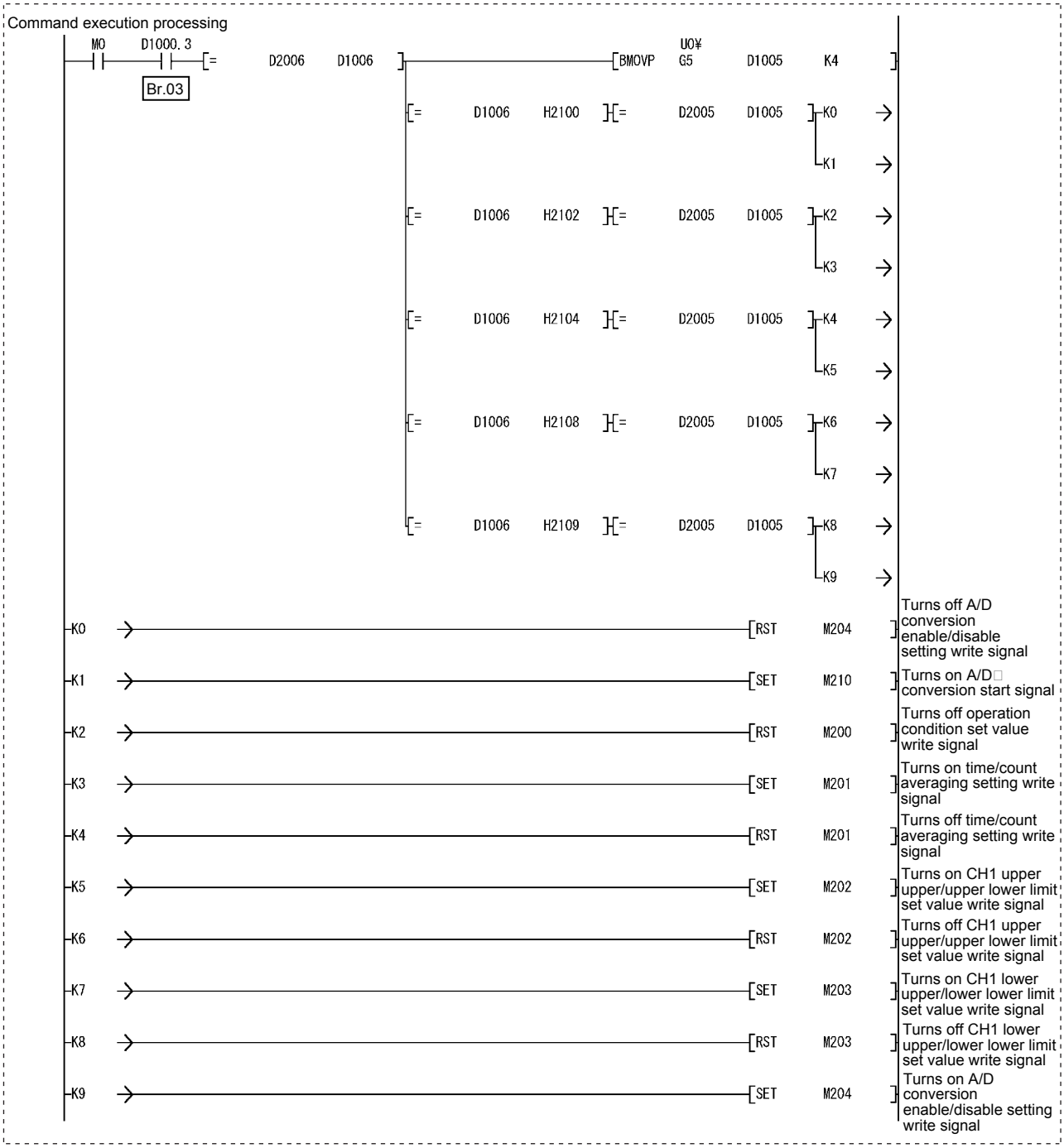
*



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

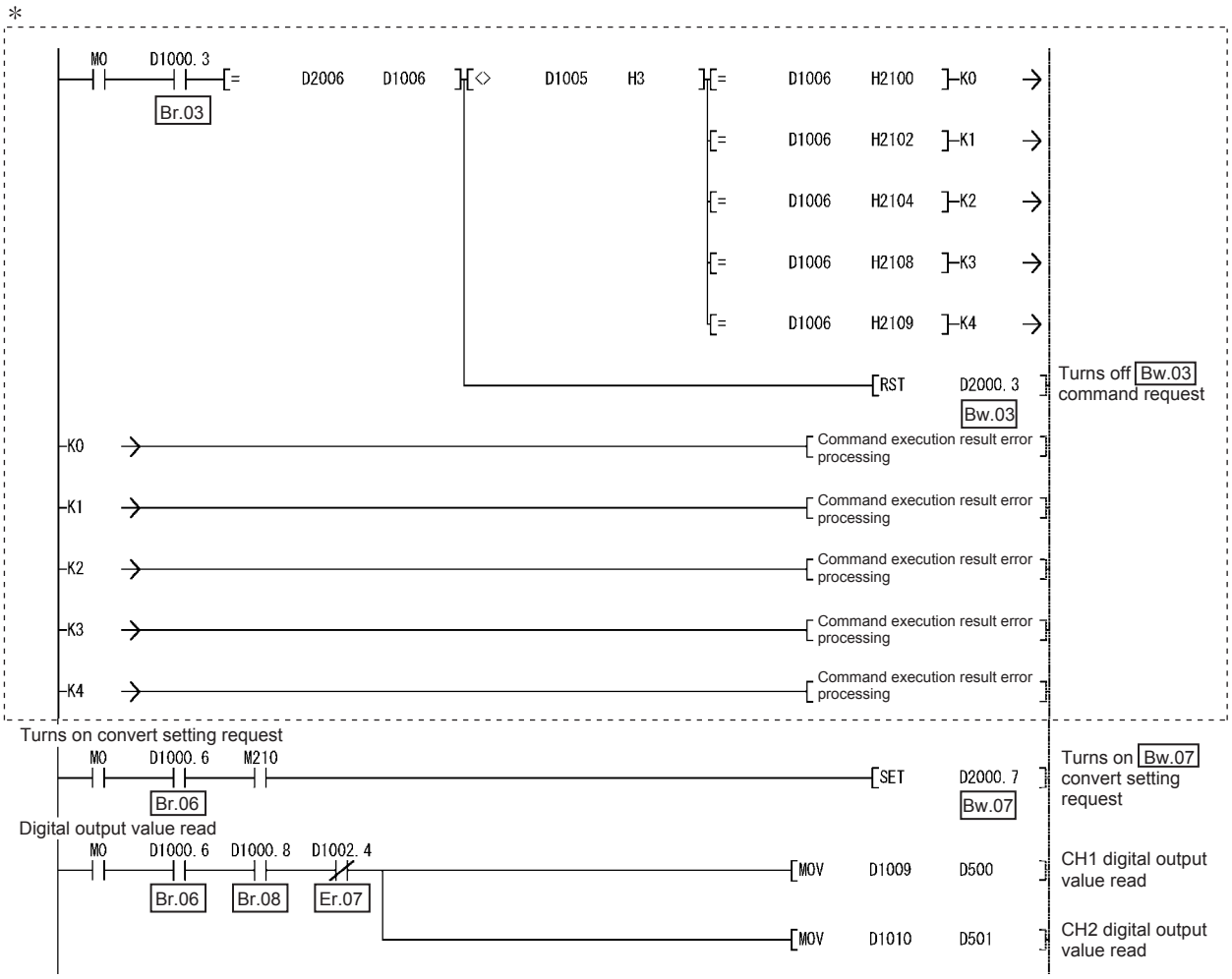
6 - 15

*

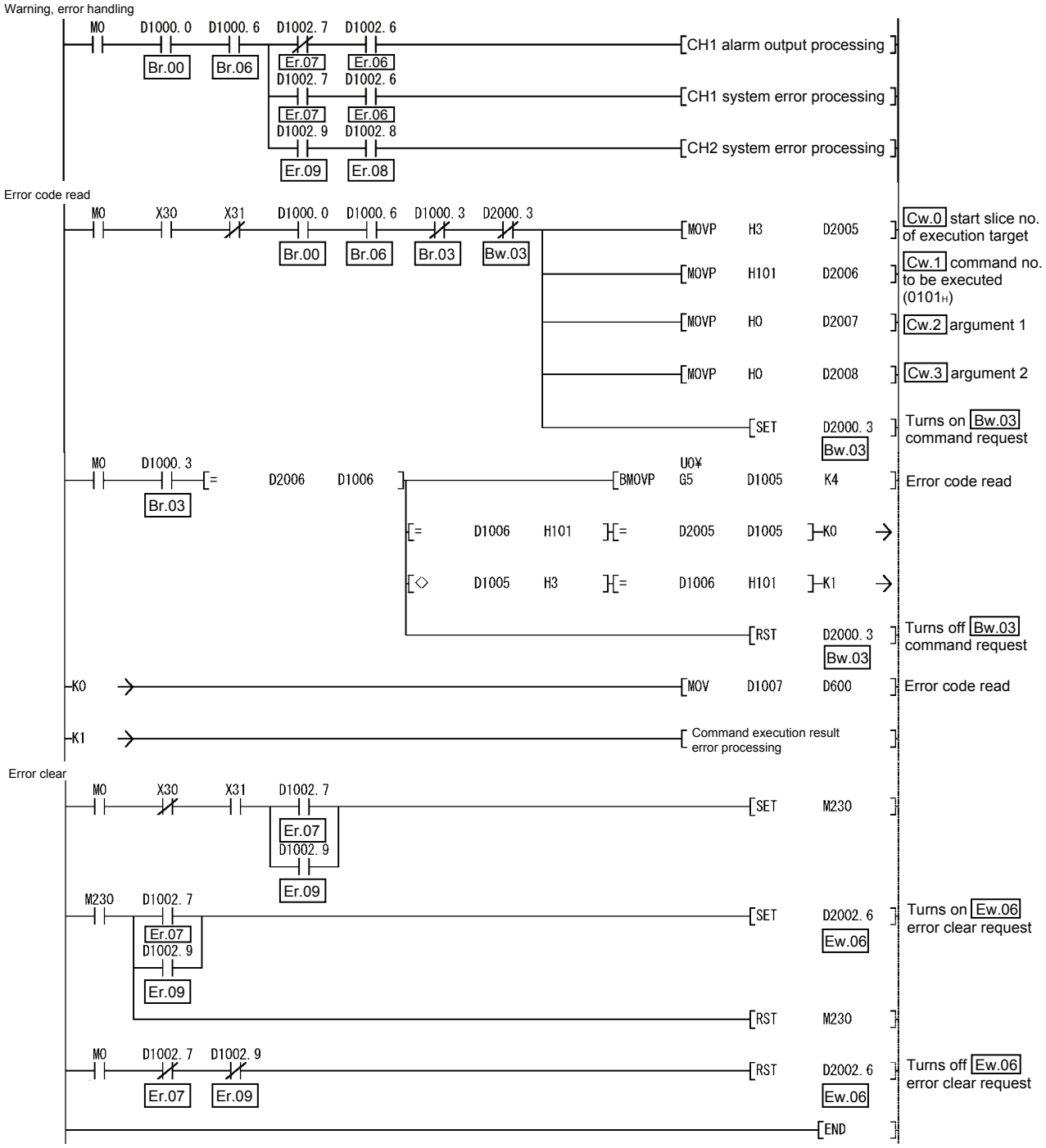


* The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.

6 - 16



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


Warning, error handling
M0
D1000. 0
D1000. 6
D1002. 7
D1002. 6
Br.00
Br.06
Er.07
Er.06
CH1 alarm output processing
CH1 system error processing
D1002. 9
D1002. 8
Er.09
Er.08
CH2 system error processing
Error code read
X30
X31
D1000. 3
D2000. 3
Br.03
Bw.03
MOVP
H3
D2005
Cw.0 start slice no. of execution target
H101
D2006
Cw.1 command no. to be executed (0101H)
H0
D2007
Cw.2 argument 1
D2008
Cw.3 argument 2
SET
Turns on Bw.03 command request
BMOVP
U0¥G5
D1005
K4
Error code read
D2006
D1006
D1007
H3
K0
K1
RST
Turns off Bw.03 command request
MOV
D600
Command execution result error processing
Error clear
M230
D2002. 6
Ew.06
Turns on Ew.06 error clear request
Turns off Ew.06 error clear request
END

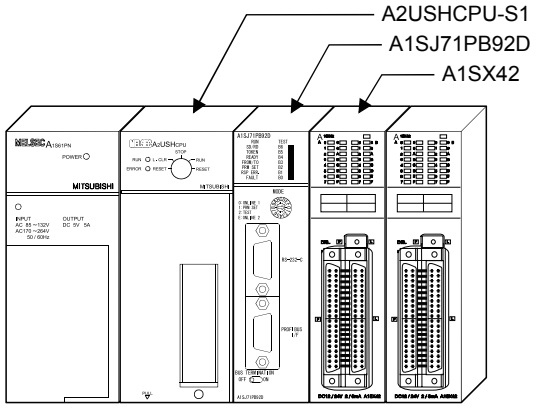
6.3 When AJ71PB92D/A1SJ71PB92D is Used as Master Station

This section explains a program example available when the AJ71PB92D/A1SJ71PB92D is used as the master station.
This section provides the program example available when the A1SJ71PB92D is used as the master station.

(1) System configuration of master station (A1SJ71PB92D)

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

(a) System configuration of master station (A1SJ71PB92D)



(b) Settings of master station (A1SJ71PB92D)

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

REMARK

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

(2) System configuration of MELSEC-ST system

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

(3) I/O data assignment

The I/O data assignment result is the same as that described in Section 6.2 (3).

(4) Device assignment to program examples

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

(a) Devices used by A1SJ71PB92D

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

(b) Devices used by user

Device	Application	Device	Application
X20	PROFIBUS-DP exchange start command	M0	Refresh start request
X30	ST1AD2-V error code read request	M200	Operation condition set value write signal
X31	ST1AD2-V error clear request	M201	Time/count averaging setting write signal
D500	CH1 digital output read destination	M202	CH1 upper upper/upper lower limit set value write signal
D501	CH2 digital output read destination	M203	CH1 lower upper/lower lower limit set value write signal
D600, D601	ST1AD2-V error code read destination	M204	A/D conversion enable/disable setting write signal
—		M210	A/D conversion start signal
		M230	ST1AD2-V error clear request signal

(c) Devices used in I/O data

1) Br Bit input area

Br.n Bit input	Information	Master station side device	Slice No.	Module name
Br.00	Module READY	B0	0	ST1H-PB
Br.01	Forced output test mode	B1		
Br.02	Module being changed online	B2	1	
Br.03	Command execution	B3		
Br.04	External power supply status	B4	2	ST1PSD
Br.05		B5		
Br.06	Module ready	B6	3	ST1AD2-V
Br.07	Convert setting completed flag	B7		
Br.08	A/D conversion completed flag	B8	4	
Br.09	Alarm output signal	B9		
Br.0A	—	BA	—	—
to				
Br.1F	—	B1F	—	—

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2) Er Error information area

Er.n Error information	Information	Master station side device	Slice No.	Module name
Er.00	Head module error information	B20	0	ST1H-PB
Er.01		B21		
Er.02		B22	1	
Er.03		B23		
Er.04	Bus refreshing module error information	B24	2	ST1PSD
Er.05		B25		
Er.06	CH1 error information	B26	3	ST1AD2-V
Er.07		B27		
Er.08	CH2 error information	B28	4	
Er.09		B29		
Er.0A	_	B2A	_	_
to				
Er.1F	_	B3F	_	_

3) Mr Module status area

Mr.n Module status	Information	Master station side device	Slice No.	Module name
Mr. 0	Head module existence information	B40	0	ST1H-PB
Mr. 1		B41	1	
Mr.2	Bus refreshing module existence information	B42	2	ST1PSD
Mr.3	Module status	B43	3	ST1AD2-V
Mr.4		B44	4	
Mr.5	_	B45	_	_
to				
Mr.15	_	B5F	_	_

4) Cr Command result area

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

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5) Wr Word input area

Wr.n Word input	Information	Master station side device	Slice No.	Module name
Wr.00	CH1 digital output value (Wr.n)	W4	3	ST1AD2-V
Wr.01	CH2 digital output value (Wr.n+1)	W5		

6) Bw Bit output area

Bw.n Bit output	Information	Master station side device	Slice No.	Module name
Bw.00	System area (0 fixed)	B1000	0	ST1H-PB
Bw.01	System area (0 fixed)	B1001		
Bw.02	System area (0 fixed)	B1002	1	
Bw.03	Command request	B1003		
Bw.04	System area (0 fixed)	B1004	2	ST1PSD
Bw.05	System area (0 fixed)	B1005		
Bw.06	System area (0 fixed)	B1006	3	ST1AD2-V
Bw.07	Convert setting request	B1007		
Bw.08	System area (0 fixed)	B1008	4	
Bw.09	System area (0 fixed)	B1009		
Bw.0A	_	B100A	_	_
to				
Bw.1F	_	B101F	_	_

7) Ew Error clear area

Ew.n Error clear	Information	Master station side device	Slice No.	Module name
Ew.00	Error clear request	B1020	0	ST1H-PB
Ew.01	System area (0 fixed)	B1021		
Ew.02	System area (0 fixed)	B1022	1	
Ew.03	System area (0 fixed)	B1023		
Ew.04	Error clear request	B1024	2	ST1PSD
Ew.05	System area (0 fixed)	B1025		
Ew.06	Error clear request	B1026	3	ST1AD2-V
Ew.07	System area (0 fixed)	B1027		
Ew.08	System area (0 fixed)	B1028	4	
Ew.09	System area (0 fixed)	B1029		
Ew.0A	_	B102A	_	_
to				
Ew.1F	_	B103F	_	_

8) Sw System area

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

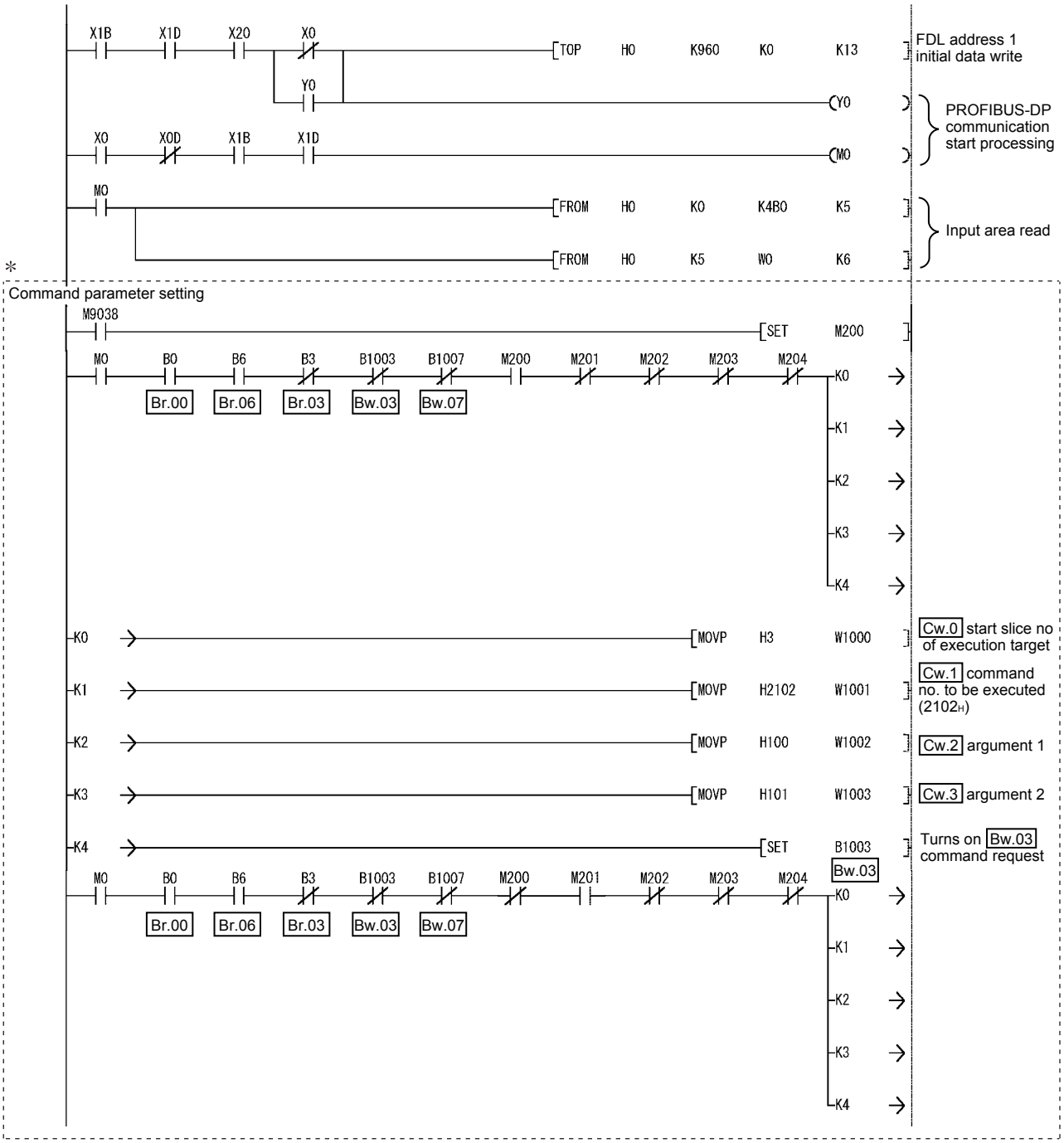
9) Cw Command execution area

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

10) Ww Word output area

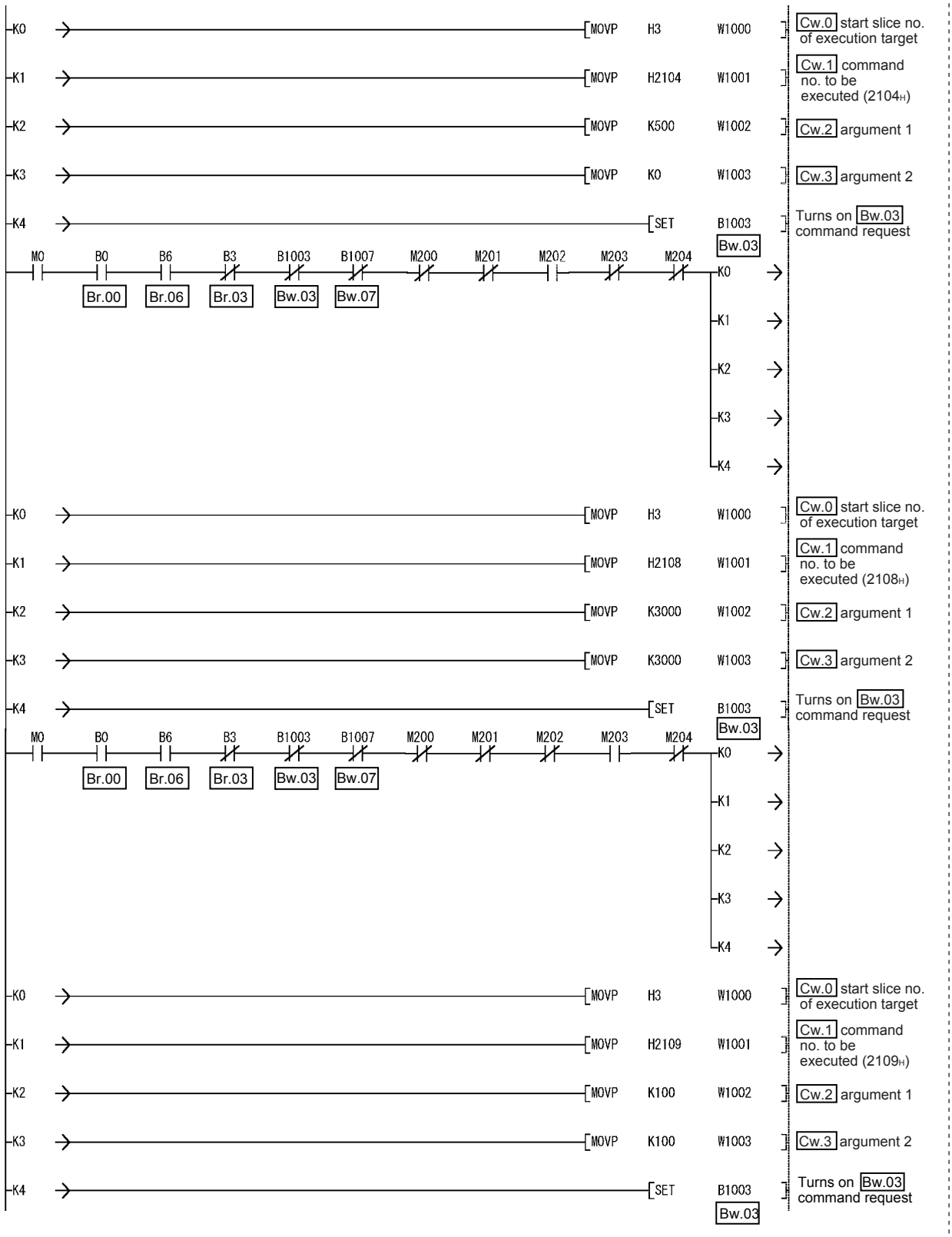
Ww Word output	Information	Master station side device	Slice No.	Module name
Ww.00	System area (0 fixed) (Ww.n)	W1004	3	ST1AD2-V
Ww.01	System area (0 fixed) (Ww.n+1)	W1005		

(5) Program example



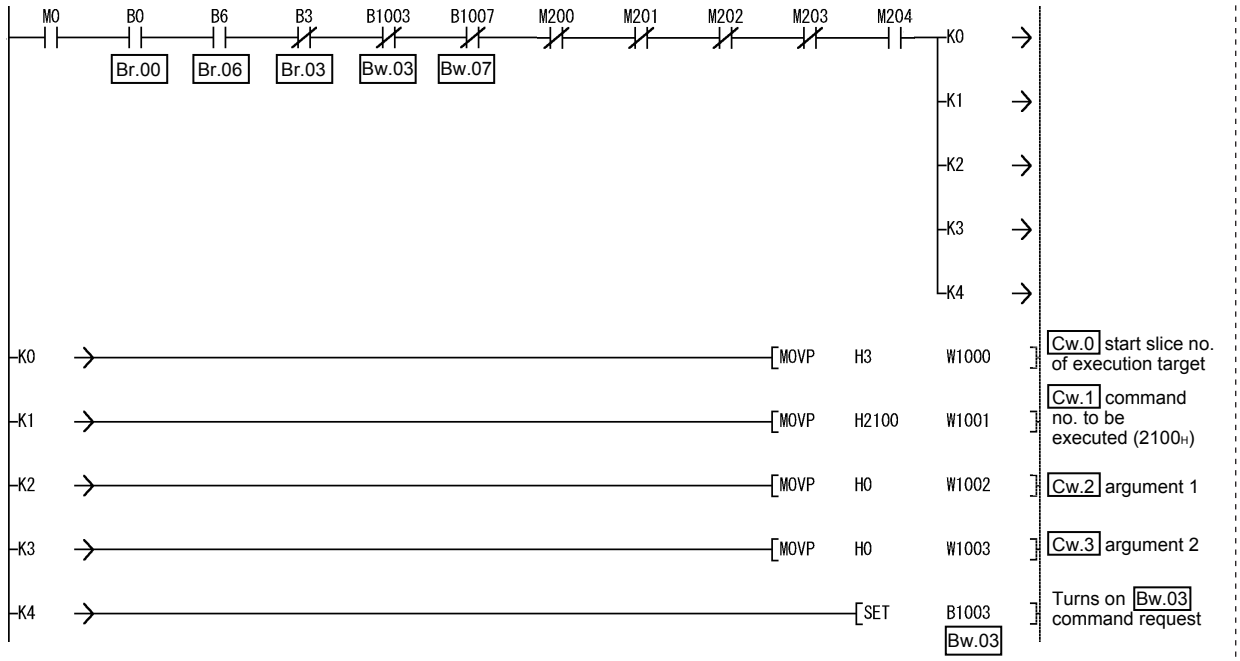
* The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.

*



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

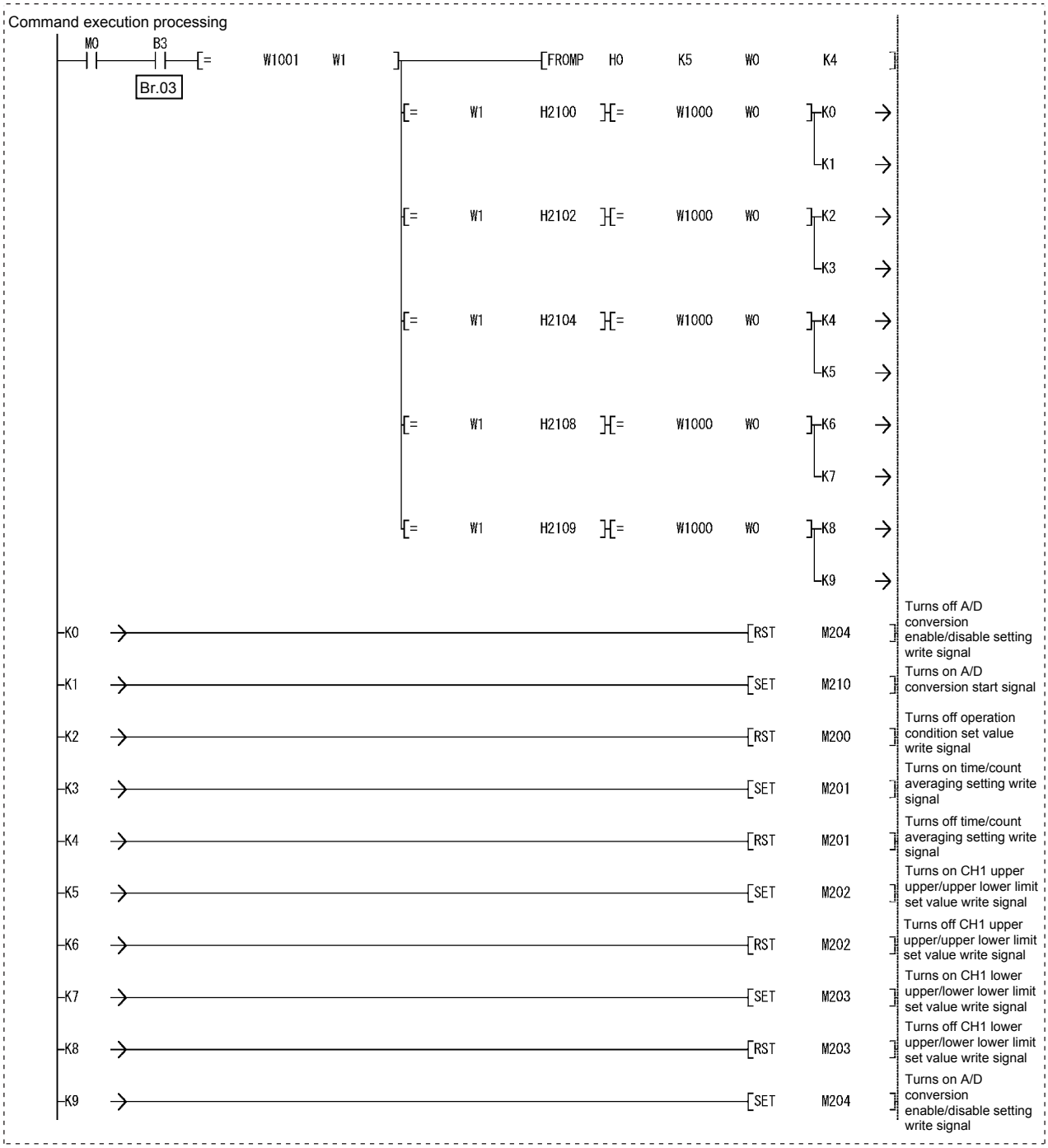
*



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

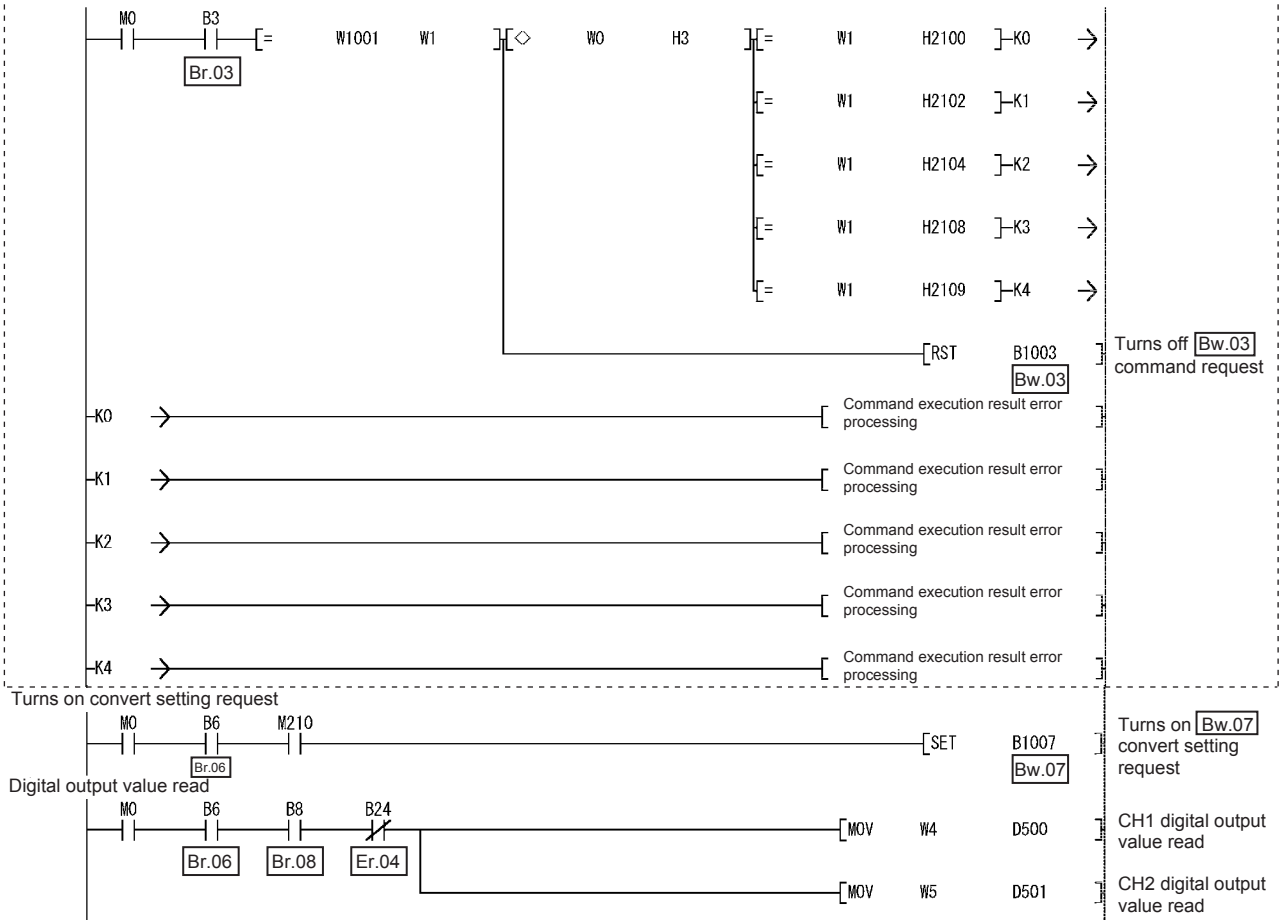
6 - 26

*



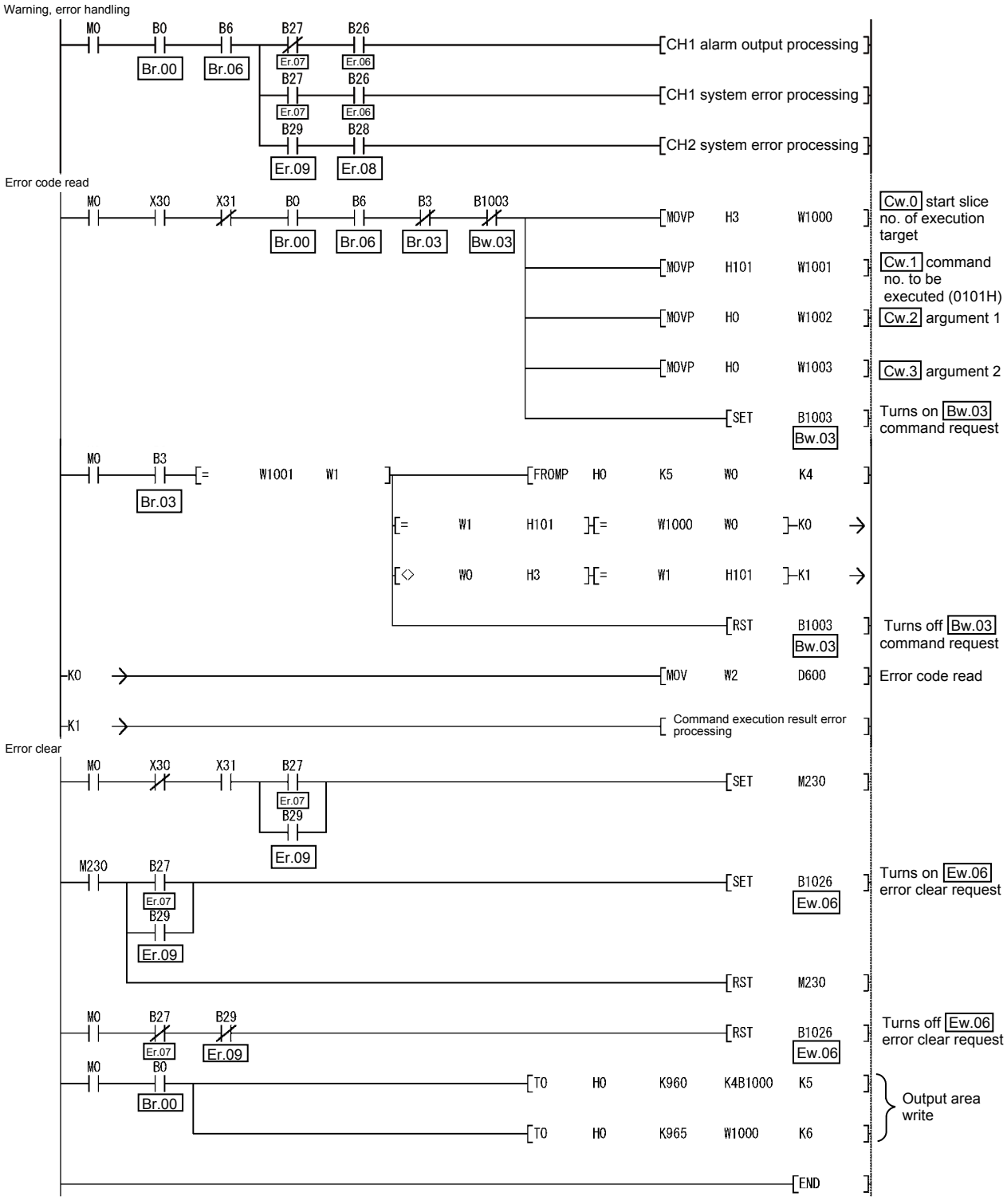
* The program area enclosed by the dotted line is not required when GX Configurator-ST is used to set the command parameters.

*



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

6 - 28


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

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7 ONLINE MODULE CHANGE

When performing online module change, make sure to read through the 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 parameters, command parameters and user range setting's offset/gain setting values are automatically handed down to the new module.

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

7.1 Precautions for Online Module Change

The following are the precautions for online module change.

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

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

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

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

(5) Only one slice module can be replaced in a single online module change.
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) While the slice module is being changed online (while the head module's REL. LED is on), change its user parameter setting from the master station 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 user parameters saved in the head module are overwritten by the new user parameter values when the online module change is finished.

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

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

(10) After an online module change, the accuracy of the user range setting is about three times lower than that 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 ST1AD online.
Depending on the module failure status, the user parameters, command parameters 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 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 value of user range setting and others to the new module, if these settings cannot be transferred to the head module.

(1) Command parameters

When GX Configurator-ST is unavailable, the command parameters must be set by the commands after an online module change is finished. Provide 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, offset/gain setting must be made by the commands after an online module change is finished. Provide 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 parameters and offset/gain setting values after the module has operated once by default.

REMARK

The above preparations are not necessary since the user parameter 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 ST1AD external device according to the following procedure.

(1) Disconnection

Power off the external device.

(2) Connection

Power on the external device.

7.4 Online Module Change Procedure

This section explains the parameter setting or offset/gain setting procedure used during an online module change when the user parameters, command parameters 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 used head module.

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

POINT

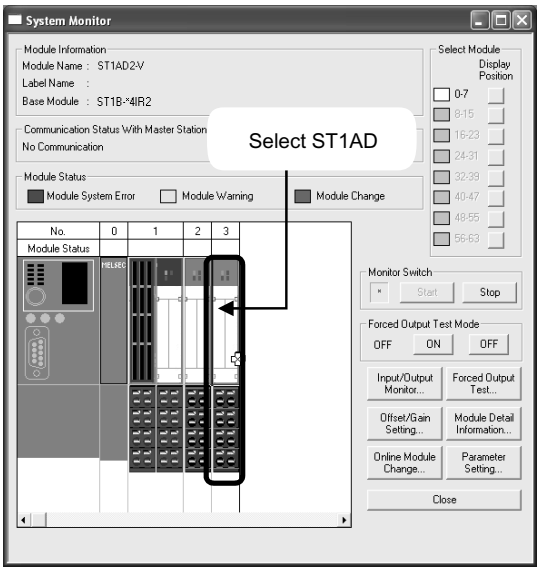
If a slice module different from the target one is selected by mistake, restart the operation as instructed below.

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

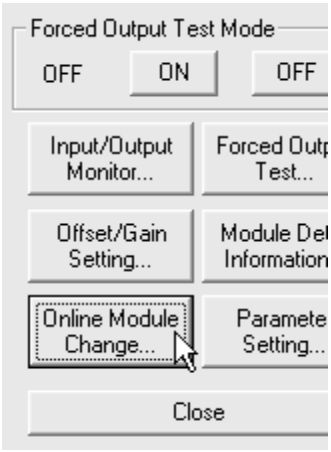
(2) When you noticed while the screen in 4) was being displayed
Do not change the slice module, click the Next button, and perform the operations in steps 7), 12), 13) to complete the online module change once.

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

Preparation for replacing ST1AD



↓



↓

(Continued to next page.)

1) Select the ST1AD to be replaced online on the "System Monitor" screen.

2) Click the Online Module Change button on the "System Monitor" screen.
Then, confirm that the RUN LED of the selected ST1AD is flashing at 0.25s intervals.

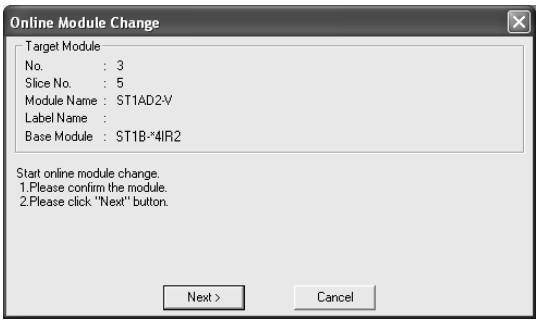
REMARK

In addition to above, the following operations are also available.

- Select [Diagnostics] → [Online Module Change].
- Right-click the ST1AD selected at step 1), and click [Online Module change] on the menu.

(From the previous page.)

↓



3) Confirm that the ST1AD displayed as "Target Module" is the ST1AD to be replaced and click the Next button.

(a) Clicking the Next button validates the settings and the following will be performed.
- Puts the head module into the online module change mode.
- Save the user parameters, command parameters and user range setting's offset/gain setting values of the ST1AD to be changed into the head module.

(b) After clicking the Next button, confirm the following module statuses.
- The REL. LED of the head module is on.
- The RUN LED of the target ST1AD is off.
- The "Module Status" indicator of the target module has turned purple. This applies only when monitoring from the "System Monitor" screen.

(c) If the user parameters, command parameters and user range setting's offset/gain setting values could not be read from the ST1AD, the REL. LED and ERR. LED of the head module turn on and the corresponding error message is displayed on the screen by the operation in step 7).
Confirm the error definition.
For details of the error code reading operation and error code of the head module, refer to the user's manual of the used head module.
When making parameter setting and offset/gain setting to the new ST1AD, perform the operations in step 4 and later.

When not executing online module change, click the Cancel button.

(a) Clicking the Cancel button causes the screen to show that online module change is cancelled.

Clicking the Exit button returns to the step 1).

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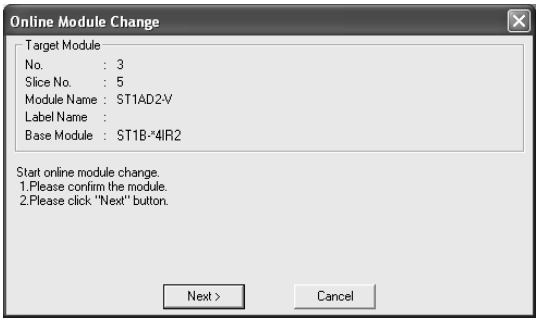
Disconnection from external device



4) As the left screen appears, power off the external device connected with the ST1AD to be removed.

POINT
If the external device cannot be powered off, shut off all phases of the external power for the MELSEC-ST system and replace the ST1AD.

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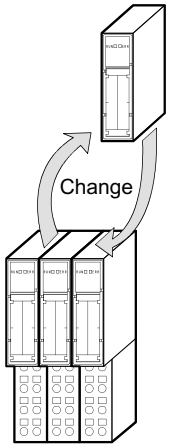
Replacing ST1AD



5) Remove the ST1AD and replace with new one.

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Connection to external device after replacement

6) Mount a new ST1AD. And then, power on the external device.

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Operations after external device connection

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

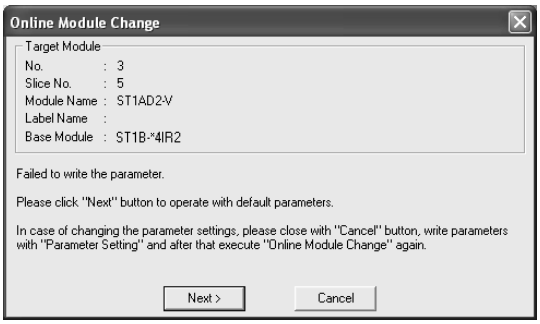
(a) Clicking the Next button performs the following.

- Checks whether the module name of the newly mounted slice module is the same as that of the removed one.
- Write the user parameters, command parameters and user range setting's offset/gain setting values, which were saved in the head module in step 3), to the mounted ST1AD.

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

- The REL. LED of the head module is flashing.
- The RUN LED of the newly mounted ST1AD is flashing (at 0.25s intervals).

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



If the parameter setting or user range setting's offset/gain setting values could not be written to the ST1AD, the REL. LED and ERR. LED of the head module turn on and the screen shown on the left appears.
Confirm the error definition.
For details of the error code reading operation and error code of the head module, refer to the user's manual of the used head module.

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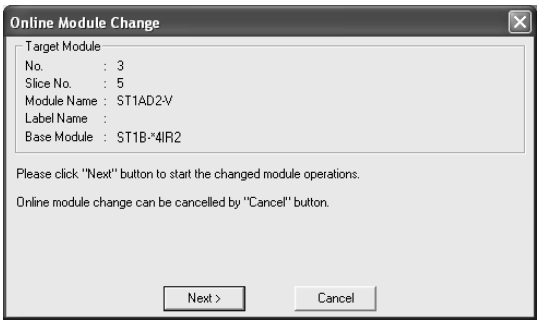
Parameter setting/offset/gain setting



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

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9) Click the OK button.

↓

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

POINT

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

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

(3) If the parameter setting or user range setting's offset/gain setting values could not be read from the old ST1AD, the user parameters have been written when the operation in step 7 was performed.
Using GX Configurator-ST, check whether the user parameters have been written.

(4) When offset/gain setting was made during an online module change, the RUN LED of the ST1AD flickers at 0.25s intervals even in the offset/gain setting mode.

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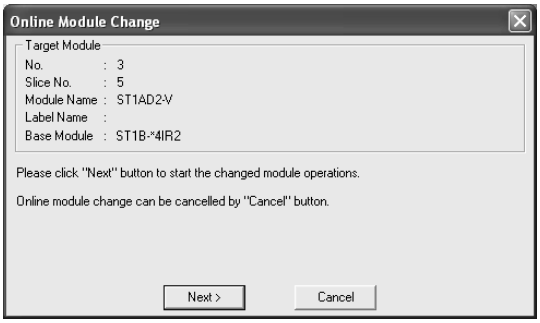
Processing after parameter setting or offset/gain setting

11) After parameter setting or offset/gain setting, execute the operations in steps 1), 2) to resume the online module change.
* Select the same ST1AD as before the online module change was stopped.
If the selected ST1AD is different, an error will occur.



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

(b) After clicking the Next button, confirm the following module statuses.
- The REL. LED of the head module is off.
- The RUN LED of the newly mounted ST1AD is on.
- The "Module Status" indicator of the target ST1AD has turned white. This applies only when monitoring from the "System Monitor" screen.

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

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

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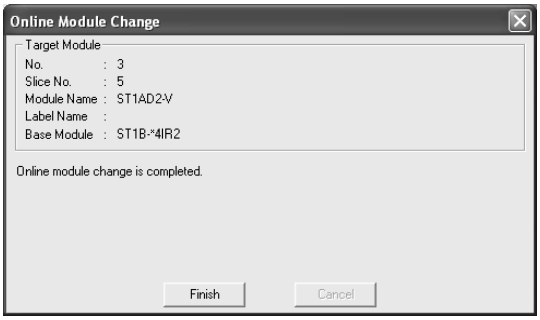

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(Completed)

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

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8 COMMAND

This chapter explains the commands.

8.1 Command List

The ST1AD supports command execution that uses the Cw Command execution area/Cr Command result area of the head module.
For the command execution procedure, refer to the user's manual of the used head module.
A list of commands that can be executed by the ST1AD is given in Table 8.1.

Table 8.1 Command List (1/2)

Command			Description	Executability			Reference section
Command classification	Command No.	Command name		1)	2)	3)	
Common command	0100H	Operating status read request	Reads the operating status of the ST1AD.	○	○	○	Section 8.2.1
	0101H	Error code read request	Reads the error code of the ST1AD.	○	○	○	Section 8.2.2
ST1AD parameter setting read command	1100H	A/D conversion enable/disable setting read	Reads the A/D conversion enable/disable setting from the RAM of the ST1AD.	○	○	○	Section 8.3.1
	1101H	A/D conversion completion channel read	Reads the currently valid A/D conversion enable/disable setting and A/D conversion completed status.	○	○	○	Section 8.3.2
	1102H	Operation condition set value read	Reads the averaging process specification, alarm output setting and disconnection detection setting from the RAM of the ST1AD.	○	○	○	Section 8.3.3
	1103H	Notch filter set value read	Reads the notch filter setting from the RAM of the ST1AD.	○	○	○	Section 8.3.4
	1104H	CH□ time/count averaging setting read	Reads the set number of times or time amount of the averaging process from the RAM of the ST1AD.	○	○	○	Section 8.3.5
	1108H	CH1 upper upper/upper lower limit set value read	Reads the upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value of the alarm output.	○	○	○	Section 8.3.6
	1109H	CH1 lower upper/lower lower limit set value read					Section 8.3.7
	110AH	CH2 upper upper/upper lower limit set value read					Section 8.3.6
	110BH	CH2 lower upper/lower lower limit set value read					Section 8.3.7
	1118H	Input range set value read	Reads the Input range setting from the RAM of the ST1AD.	○	○	○	Section 8.3.8

○: Can be executed ×: Cannot be executed

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

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Table 8.1 Command List (2/2)

Command			Description	Executability *			Reference section
Command classification	Command No.	Command name		1)	2)	3)	
ST1AD parameter setting write command	2100H	A/D conversion enable/disable setting write	Writes the A/D conversion enable/disable setting to the RAM of the ST1AD.	○	×	×	Section 8.4.1
	2102H	Operation condition set value write	Writes the averaging processing specification, alarm output setting and disconnection detection setting to the RAM of the ST1AD.	○	×	×	Section 8.4.2
	2103H	Notch filter set value write	Writes the notch filter setting to the RAM of the ST1AD.	○	×	×	Section 8.4.3
	2104H	CH□ time/count averaging setting write	Writes the set number of times or time amount of the averaging processing to the RAM of the ST1AD.	○	×	×	Section 8.4.4
	2108H	CH1 upper upper/upper lower limit set value write	Writes the upper upper limit value/upper lower limit value or lower upper limit value/lower lower limit value of the alarm output.	○	×	×	Section 8.4.5
	2109H	CH1 lower upper/lower lower limit set value write					Section 8.4.6
	210AH	CH2 upper upper/upper lower limit set value write					Section 8.4.5
	210BH	CH2 lower upper/lower lower limit set value write					Section 8.4.6
ST1AD control command	3100H	Parameter setting ROM read	Reads the parameters from the ROM of the ST1AD to the RAM.	○	×	×	Section 8.5.1
	3101H	Parameter setting ROM write	Writes the parameters from the RAM of the ST1AD to the ROM.	○	×	×	Section 8.5.2
	3102H	Operation mode setting	Changes the mode of the ST1AD.	○	×	○	Section 8.5.3
	3103H	Offset channel specification	Specifies the offset channel of offset/gain setting and adjusts the offset value.	×	×	○	Section 8.5.4
	3104H	Gain channel specification	Specifies the gain channel of offset/gain setting and adjusts the gain value.	×	×	○	Section 8.5.5
	3105H	User range write	Writes the adjusted offset/gain settings to the ROM of the ST1AD	×	×	○	Section 8.5.6

○: Can be executed ×: Cannot be executed

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

8.2 Common Command

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

Reads the operating status of the ST1AD.

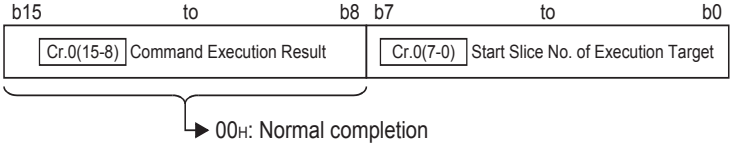
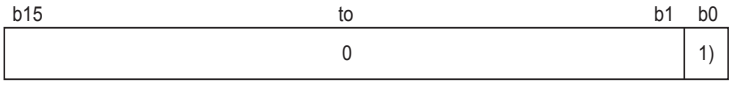
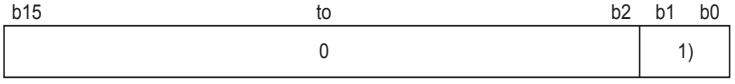
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	0100H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

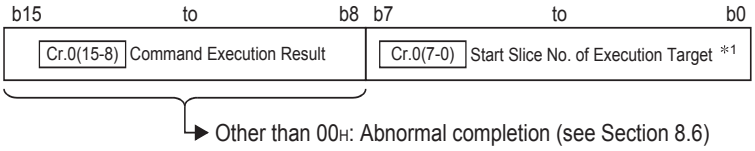
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The operating status of the ST1AD is stored.  1) 0: Normal 1: System error
Cr.3	The current operation mode of the ST1AD is stored.  1) 01: Normal mode 10: Offset/gain setting mode

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

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

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

Reads the error code of the ST1AD.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	0101H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

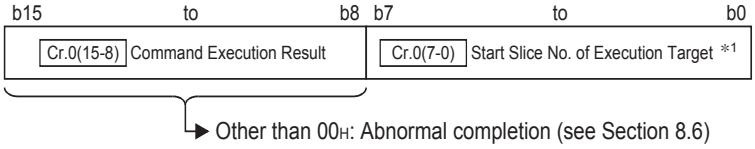
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. b15 to b8 b7 to b0 Cr.0(15-8) Command Execution Result | Cr.0(7-0) Start Slice No. of Execution Target 00H: Normal completion
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The error code currently occurring in the ST1AD is stored. (Hexadecimal) Refer to Section 9.1 for details of the error code.
Cr.3	The alarm information is stored for each channel. b15 to b4 b3 to b0 0 | 1) 1) CH☐ alarm status (b0: CH1 upper limit value, b1: CH1 lower limit value, b2: CH2 upper limit value, b3: CH2 lower limit value) 0: Normal 1: Alarm occurrence

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

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

8.3 ST1AD Parameter Setting Read Command

8.3.1 A/D conversion enable/disable setting read (Command No.: 1100H)

Reads the A/D conversion enable/disable setting from the RAM of the ST1AD.

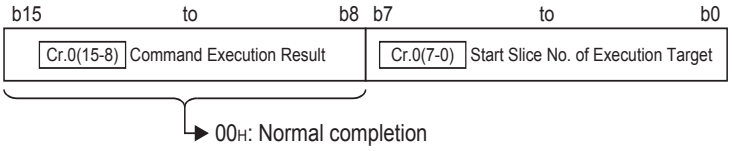
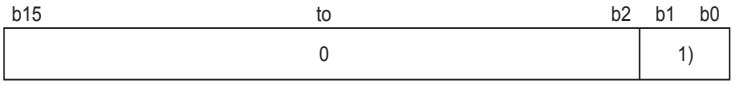
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	1100H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

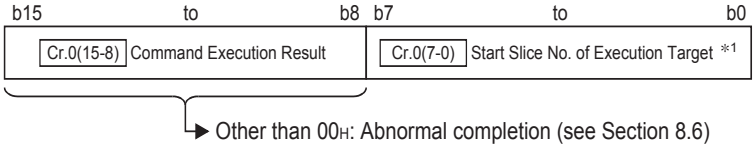
(2) Execution result in Cr Command result area

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

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

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

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

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

8.3.2 A/D conversion completion channel read (Command No.: 1101H)

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

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	1101H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

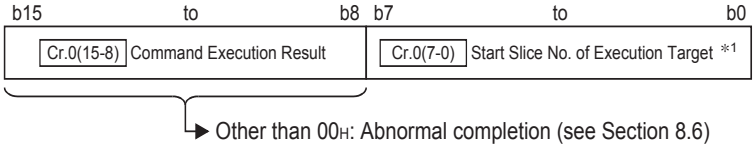
(2) Execution result in Cr Command result area

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

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

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

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

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

8.3.3 Operation condition set value read (Command No.: 1102H)

Reads the averaging process specification, alarm output setting and disconnection detection setting from the RAM of the ST1AD.

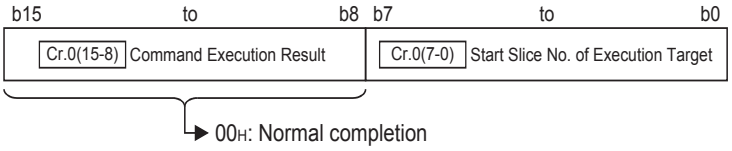
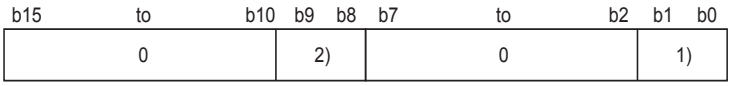
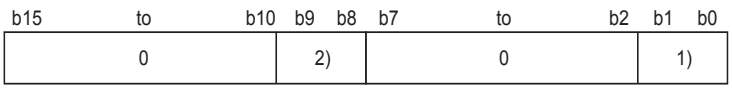
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	1102H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

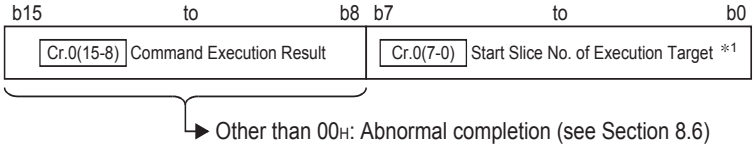
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The averaging process specification is stored for each channel.  1) Time averaging/number of times averaging specification (b0: CH1, b1: CH2) 0: Number of times averaging 1: Time averaging 2) Averaging-processed channel specification (b8: CH1, b9: CH2) 0: Sampling process 1: Averaging process
Cr.3	The alarm output setting and disconnection detection setting are stored for each channel.  1) Alarm output setting (b0: CH1, b1: CH2) 0: Alarm output processing not performed 1: Alarm output processing performed 2) Disconnection detection setting (b8: CH1, b9: CH2) 0: Disconnection detection processing not performed 1: Disconnection detection processing performed

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

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

8.3.4 Notch filter set value read (Command No.: 1103H)

Reads the notch filter setting from the RAM of the ST1AD.

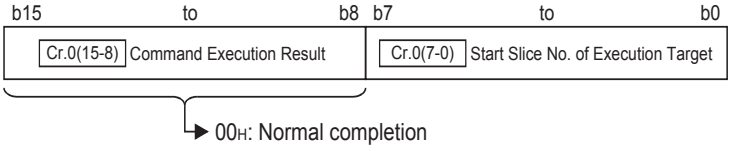
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	1103H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

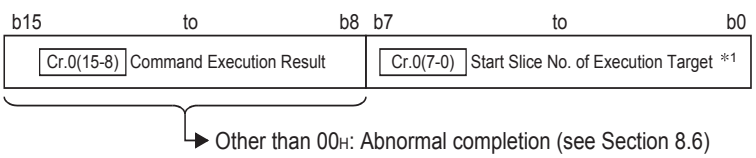
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The notch filter setting is stored. (Hexadecimal) 0: No notch filter processing performed on all channels 1: Notch filter processing performed on all channels (50 ± 3Hz) 2: Notch filter processing performed on all channels (60 ± 3Hz)
Cr.3	0000H

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

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

8.3.5 CH□ time/count averaging setting read (Command No.: 1104H)

Reads the set number of times or time amount of the averaging process from the RAM of the ST1AD.

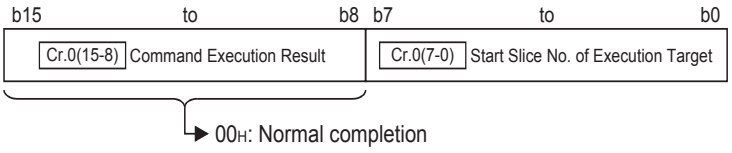
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	1104H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

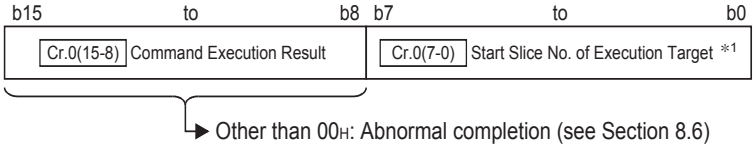
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The set number of times or time of the averaging process for channel 1 is stored. The value in the following range is stored. The range for number of times-based averaging processing is 4 to 62500 (times). The range for time-based averaging processing is 2 to 5000 (ms).
Cr.3	The set number of times or time of the averaging process for channel 2 is stored. The range of the stored value is the same as in Cr.2 Response data 1.

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

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

8.3.6 CH□ upper upper/upper lower limit set value read (Command No.: 1108H, 110AH)

Reads the upper upper limit value/upper lower limit value of the alarm output from the RAM of the ST1AD.

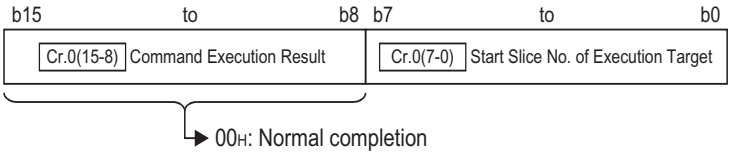
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	CH1 upper upper/upper lower limit set value read: 1108H CH2 upper upper/upper lower limit set value read: 110AH
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

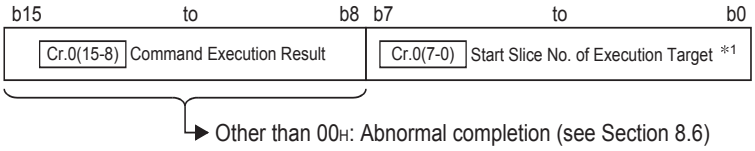
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The CH□ upper upper limit value is stored. (16-bit signed binary) The value in the following range is stored. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095
Cr.3	The CH□ upper lower limit value is stored. (16-bit signed binary) The value in the following range is stored. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095

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

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

8.3.7 CH□ lower upper/lower lower limit set value read (Command No.: 1109H, 110BH)

Reads the lower upper limit value/ lower lower limit value of the alarm output from the RAM of the ST1AD.

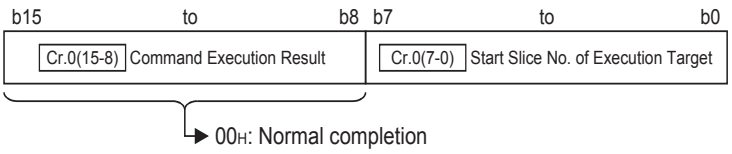
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	CH1 lower upper/ lower lower limit set value read: 1109H CH2 lower upper/ lower lower limit set value read: 110BH
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

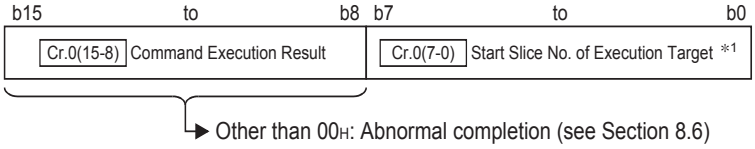
(2) Execution result in Cr Command result area

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

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2	The CH□ lower upper limit value is stored. (16-bit signed binary) The value in the following range is stored. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095
Cr.3	The CH□ lower lower limit value is stored. (16-bit signed binary) The value in the following range is stored. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095

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

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

8.3.8 Input range set value read (Command No.: 1118H)

Reads the Input range setting from the RAM of the ST1AD.

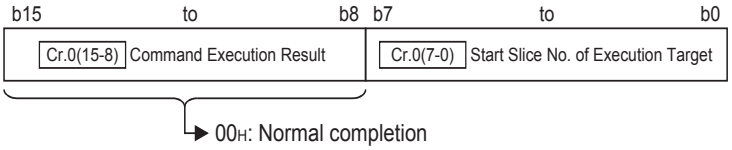
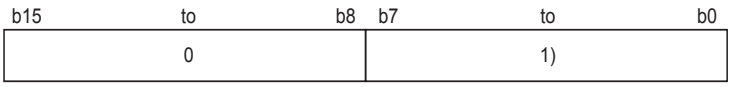
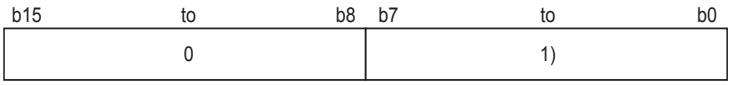
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	1118H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

(2) Execution result in Cr Command result area

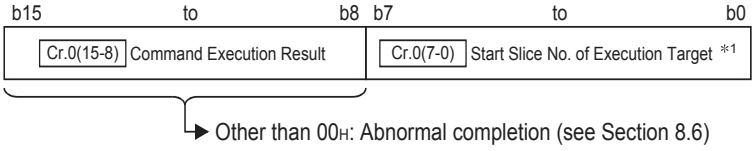
The execution result of the command changes depending on the result (normal completion or abnormal completion) in Cr.0(15-8) Command execution result.

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

Cr Command result area	Result details
Cr.0	The command execution result is stored into the higher byte, and the start slice No. of execution target into the lower byte in hexadecimal as shown below. 
Cr.1	The executed command no. is stored. (Hexadecimal)
Cr.2 *	The Input range setting written to the RAM are stored for each channel. <In the case of ST1AD2-V>  1) CH☐ input range setting (b0 to b3: CH1, b4 to b7: CH2) 0000: -10 to 10V 0001: 0 to 10V 0010: 0 to 5V 0011: 1 to 5V 0111: User range setting <In the case of ST1AD2-I>  1) CH☐ input range setting (b0 to b3: CH1, b4 to b7: CH2) 0000: 4 to 20mA 0001: 0 to 20mA 0111: User range setting
Cr.3 *	The currently valid input range setting are stored for each channel. The stored values are the same as those of Cr.2 Response data 1.

* If the stored values differ between Cr.2 Response data 1 and Cr.3 Response data 2, refer to Section 3.5 and take corrective action.

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

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

8.4 ST1AD Parameter Setting Write Command

8.4.1 A/D conversion enable/disable setting write (Command No.: 2100H)

Writes the A/D conversion enable/disable setting to the RAM of the ST1AD.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	2100H
Cw.2	Set the A/D conversion enable/disable setting for each channel. b15 to b2 b1 b0 0 | 1) CH☐ A/D Conversion enable/disable setting (b0: CH1, b1: CH2) 0: A/D Conversion enable 1: A/D Conversion disable
Cw.3	Fixed to 0000H (Any value other than 0000H is ignored.)

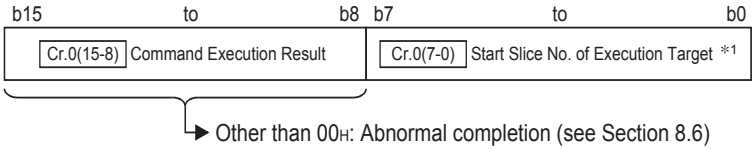
(2) Execution result in Cr Command result area

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

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

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

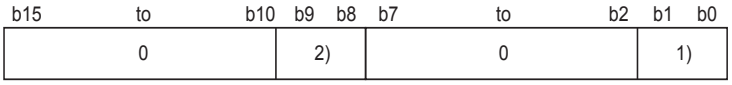
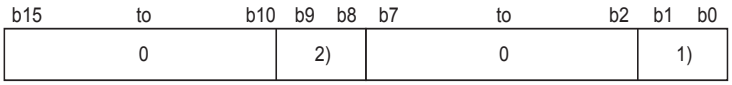
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

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

8.4.2 Operation condition set value write (Command No.: 2102H)

Writes the averaging process specification, alarm output setting and disconnection detection setting to the RAM of the ST1AD.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

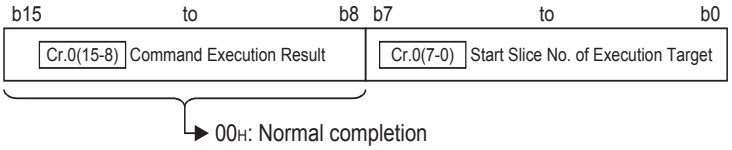
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	2102H
Cw.2	Specify the channel where sampling process or averaging process will be performed. When averaging process is specified, specify time or number of times.  1) Time/number of times specification (b0: CH1, b1: CH2) 0: Number of times averaging 1: Time averaging 2) Averaging-processed channel specification (b8: CH1, b9: CH2) 0: Sampling process 1: Averaging process
Cw.3	Specify the channel where alarm output or disconnection detection will be executed.  1) Alarm output setting (b0: CH1, b1: CH2) 0: Alarm output processing not performed 1: Alarm output processing performed 2) Disconnection detection setting (b8: CH1, b9: CH2) 0: Disconnection detection processing not performed 1: Disconnection detection processing performed

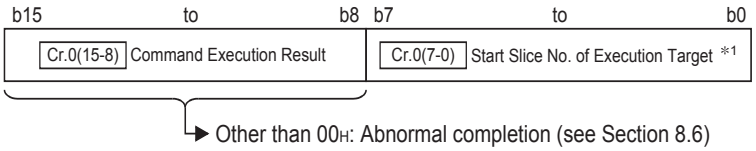
(2) Execution result in Cr Command result area

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

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

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

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

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

8.4.3 Notch filter set value write (Command No.: 2103H)

Writes the notch filter setting to the RAM of the ST1AD.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

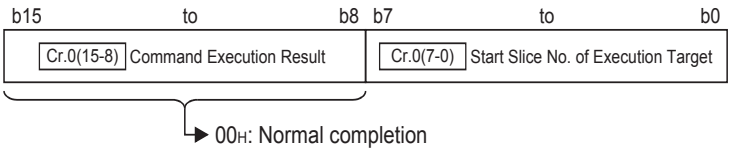
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	2103H
Cw.2	Set the notch filter setting. 0: No notch filter processing performed on all channels 1: Notch filter processing performed on all channels (50 ± 3Hz) 2: Notch filter processing performed on all channels (60 ± 3Hz)
Cw.3	Fixed to 0000H (Any value other than 0000H is ignored.)

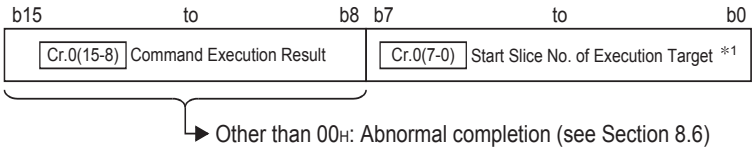
(2) Execution result in Cr Command result area

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

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

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

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

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

8.4.4 CH□ time/count averaging setting write (Command No.: 2104H)

Writes the set number of times or time amount of the averaging processing to the RAM of the ST1AD.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

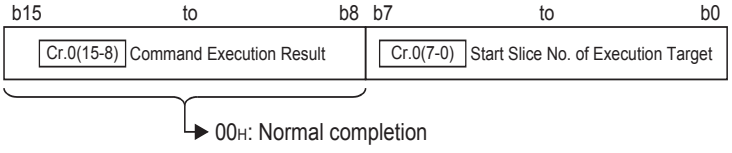
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	2104H
Cw.2	Set the number of times or time of the averaging process for channel 1. The value in the following range is stored. The range for number of times-based averaging process is 4 to 62500 (times). The range for time-based averaging processing is 2 to 5000 (ms).
Cw.3	Set the number of times or time of the averaging process for channel 2. The setting range is the same as in Cw.2 Argument 1.

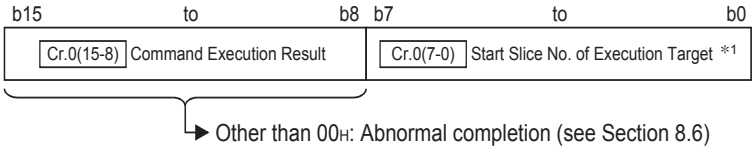
(2) Execution result in Cr Command result area

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

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

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

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

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

8.4.5 CH□ upper upper/upper lower limit set value write (Command No.: 2108H, 210AH)

Writes the upper upper limit value/upper lower limit value of the alarm output to the RAM of the ST1AD.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

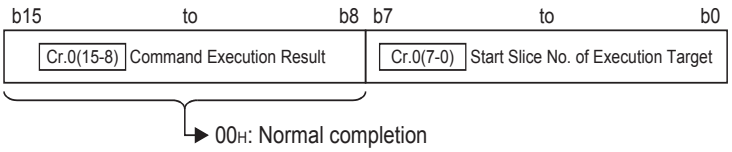
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	CH1 upper upper/upper lower limit set value write: 2108H CH2 upper upper/upper lower limit set value write: 210AH
Cw.2	Set the upper upper limit value of the alarm output. The value in the following range can be set. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095 Make setting to satisfy the condition of upper upper value ≧ upper lower value ≧ lower upper value ≧ lower lower value.
Cw.3	Set the upper lower limit value of the alarm output. The setting range is the same as in Cw.2 Argument 1.

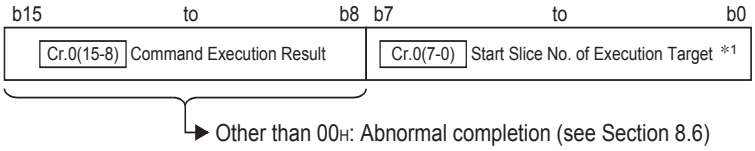
(2) Execution result in Cr Command result area

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

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

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

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

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

8.4.6 CH□ lower upper/ lower lower limit set value write (Command No.: 2109H, 210BH)

Writes the lower upper limit value/lower lower limit value of the alarm output to the RAM of the ST1AD.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

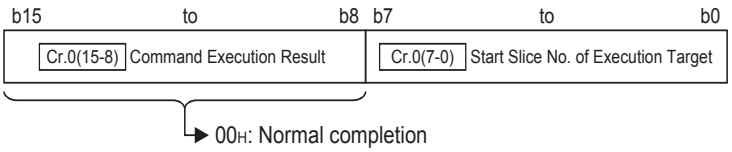
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	CH1 lower upper/ lower lower limit set value write: 2109H CH2 lower upper/ lower lower limit set value write: 210BH
Cw.2	Set the lower upper limit value of the alarm output. The value in the following range can be set. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095 Make setting to satisfy the condition of upper upper value ≧ upper lower value ≧ lower upper value ≧ lower lower value.
Cw.3	Set the lower lower limit value of the alarm output. The setting range is the same as in Cw.2 Argument 1.

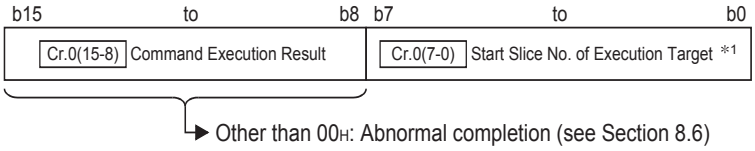
(2) Execution result in Cr Command result area

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

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

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

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

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

8.5 ST1AD Control Command

8.5.1 Parameter setting ROM read (Command No.: 3100H)

Reads the parameters from the ROM of the ST1AD to the RAM.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	3100H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

(2) Execution result in Cr Command result area

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

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

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

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

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

8.5.2 Parameter setting ROM write (Command No.: 3101H)

Writes the parameters from the RAM of the ST1AD to the ROM.
This command can be executed only when Bw.n+1 convert setting request is off (0) in the normal mode.

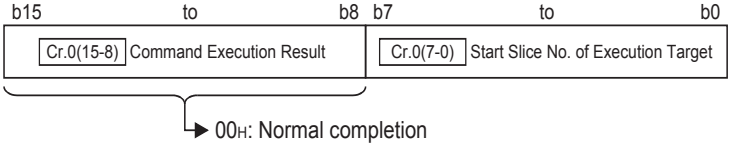
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	3101H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

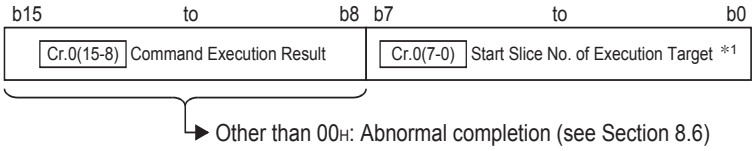
(2) Execution result in Cr Command result area

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

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

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

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

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

POINT

Execute Parameter setting ROM write (command number: 3101H) after confirming that normal operation is performed with the settings written to the RAM.

8.5.3 Operation mode setting (Command No.: 3102H)

Changes the mode of the ST1AD. (Normal mode to offset/gain setting mode, offset/gain setting mode to normal mode)
This command can be executed when Bw.n+1 convert setting request is off (0) in the normal mode or when the module is in the offset/gain setting mode.

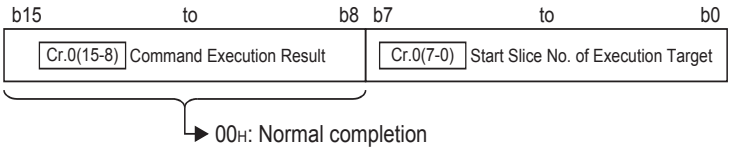
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	3102H
Cw.2	Set the operation mode. 0000H : Normal mode 0001H : Offset/gain setting mode
Cw.3	Fixed to 0000H (Any value other than 0000H is ignored.)

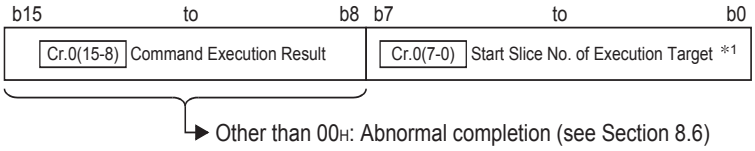
(2) Execution result in Cr Command result area

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

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

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

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

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

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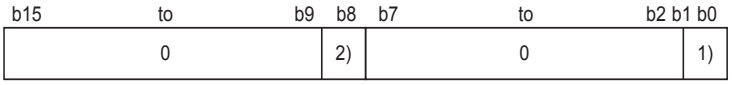
8.5.4 Offset channel specification (Command No.: 3103H)

Specify the channel where the offset value will be adjusted.
When this command is executed, the voltage or current applied to the ST1AD is written to the RAM as the offset value.
This command can be executed only in the offset/gain setting mode.

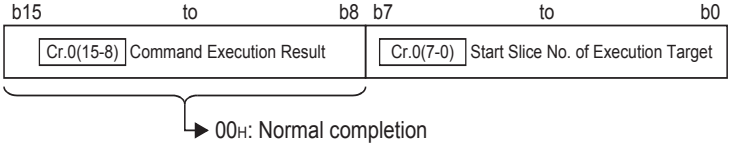
(1) Values set to [Cw] Command execution area

[Cw] Command execution area	Setting value
[Cw.0]	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
[Cw.1]	3103H
[Cw.2]	Specify the channel where the offset value of offset/gain setting will be adjusted. Values can be set to multiple channels at a time.  1) Offset channel specification (b0: CH, b1: CH2) 0: Invalid 1: Channel to set 2) System area Set "0" to b8. If "1" is set, this command fails and "02H " is stored into [Cr. 0(15-8)] Command execution result.
[Cw.3]	Fixed to 0000H (Any value other than 0000H is ignored.)

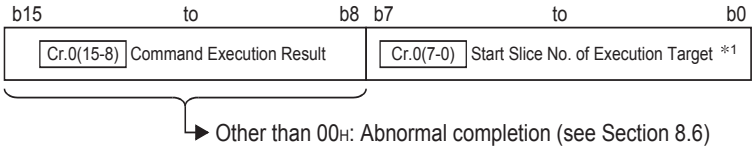
(2) Execution result in [Cr] Command result area

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

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

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

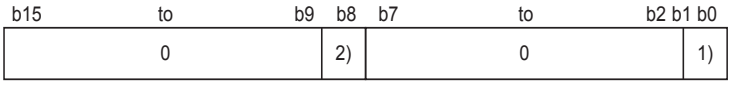
(b) Abnormal completion (When Cr.0(15-8) Command execution result is other than 00H)

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

8.5.5 Gain channel specification (Command No.: 3104H)

Specify the channel where the gain value will be adjusted.
When this command is executed, the voltage or current applied to the ST1AD is written to the RAM as the gain value.
This command can be executed only in the offset/gain setting mode.

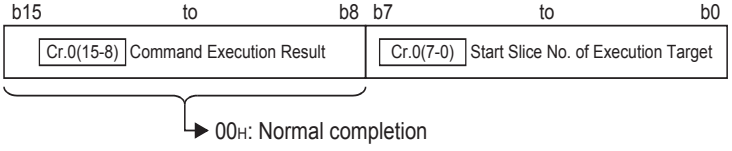
(1) Values set to [Cw] Command execution area

[Cw] Command execution area	Setting value
[Cw.0]	Set the start slice no. of the ST1AD where the command will be executed. (Hexadecimal)
[Cw.1]	3104H
[Cw.2]	Specify the channel where the gain value of offset/gain setting will be adjusted. Values can be set to multiple channels at a time.  1) Gain channel specification (b0: CH1, b1: CH2) 0: Invalid 1: Channel to set 2) System area Set "0" to b8. If "1" is set, this command fails and "02H" is stored into [Cr. 0(15-8)] Command execution result.
[Cw.3]	Fixed to 0000H (Any value other than 0000H is ignored.)

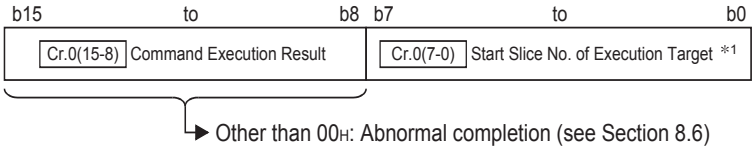
(2) Execution result in [Cr] Command result area

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

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

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

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

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

8.5.6 User range write (Command No.: 3105H)

Writes the adjusted offset/gain settings to the ROM of the ST1AD.
This command can be executed only in the offset/gain setting mode.

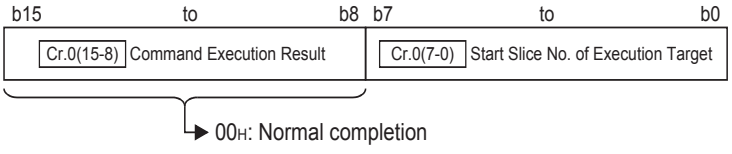
(1) Values set to Cw Command execution area

Cw Command execution area	Setting value
Cw.0	Set the start slice number of the ST1AD where the command will be executed. (Hexadecimal)
Cw.1	3105H
Cw.2	Fixed to 0000H (Any value other than 0000H is ignored.)
Cw.3	

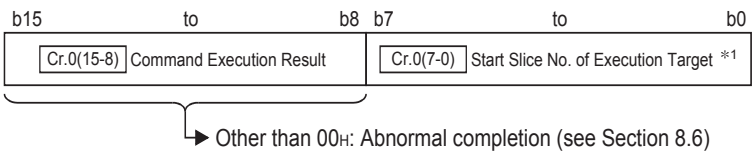
(2) Execution result in Cr Command result area

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

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

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

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

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

8.6 Values Stored into Command Execution Result

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

Cr.0 (15-8) Command execution result	Description	Corrective action
00H	Normal completion	—
01H	The requested command is not available for the specified module.	Check Table 8.1 to see if the requested command no. can be used with the ST1AD or not.
		Check whether the specified start slice No. of execution target is the start slice No. of the ST1AD.
02H	The value set in Cw.2 Argument 1 or Cw.3 Argument 2 is outside the range.	Check whether the value set to Cw.2 Argument 1 or Cw.3 Argument 2 in the command execution area is within the range usable for the requested command no.
03H	The start slice No. of the execution target is wrong.	Check whether the ST1AD is mounted to the specified start slice No. of execution target.
		Check whether the specified start slice No. of execution target is the start slice No. of the ST1AD.
04H	There is no response from the specified module.	Check Table 8.1 to see if the requested command no. can be used with the ST1AD or not. When the requested command no. can be used, the possible cause is a ST1AD failure. Contact the nearest distributor or branch office with a description of the problem.
05H	No communication is available with the specified module.	The possible cause is a ST1AD failure. Contact the nearest distributor or branch office with a description of the problem.
06H	The requested command is not executable in the current operating status (operation mode) of the module.	Check Table 8.1 to see if the requested command number can be used with the ST1AD or not.
		User range write (command number: 3105H) or Parameter setting ROM write (command number: 3101H) was executed more than 25 times after power-on. (Error code: 1200H) Execute the command after clearing the error using Ew.n error clear request.
		When offset/gain setting was made, the offset value was greater than or equal to the gain value (Error code: 400□H).After clearing the error using Ew.n error clear request, make offset/gain setting again so that the offset value is less than the gain value.
07H	The module has already been in the specified mode.	Continue the processing since the operation mode of the ST1AD specified by the start slice No. of execution target is the mode already requested.
08H	The module cannot be changed into the specified mode.	Execute the command after turning Bw.n+1 convert setting request to OFF (0).

Cr.0 (15-8) Command execution result	Description	Corrective action
09H	The specified module is in the online module change status.	Execute the command after online module change is completed.
10H	Parameters cannot be read from the specified module.	Execute the command again. If the phenomenon given on the left still occurs, the possible cause is a ST1AD failure. Contact the nearest distributor or branch office with a description of the problem.
11H	Parameters cannot be written to the specified module.	
13H	The specified module is not in the status available for parameter writing.	Execute the command after turning Bw.n+1 convert setting request to OFF (0).
0FH	The value of Cw.0 Start Slice No. of Execution Target is outside the applicable range.	Check whether the value set at Cw.0 Start Slice No. of Execution Target is within 7FH.

9 TROUBLESHOOTING

This chapter explains the errors that may occur when the ST1AD is used, and how to troubleshoot them.

9.1 Error Code List

In the ST1AD, when an error occurs due to write of data to the master module, executing error code read request (command no.: 0101H) stores the error code into Cr Command result area of the head module.

Table 9.1 Error code list (1/2)

Error code (Hexadecimal)	Error level	Error name	Description	Corrective action
1100H	System error	ROM error	ROM fault.	Power the ST1AD off and then on, or reset the head module. If the error code given on the left is still stored, the possible cause is a ST1AD failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.
1200H	System error	Number of writes for ROM error	Parameter setting ROM write (command no.: 3101H) or User range write (command no.: 3105H) 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.	Turn the convert setting request off to clear the error. Then, turn the convert setting request on again.
200□H	System error	Input range setting error	The value set to input range setting is outside the valid range. □ indicates the channel number causing the error.	Set a value that is within the valid range.
210□H	System error	Average setting error	The average time setting is outside the range 2 to 5000ms. □ indicates the channel number causing the error.	Set a value that is within the valid range.
220□H	System error	Average setting error	The average number of times setting is outside the range 4 to 62500 times. □ indicates the channel number causing the error.	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	The value set to the upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value of the alarm output is outside the valid range. The setting range is indicated below. ST1AD2-V: -4096 to 4095 ST1AD2-I: -96 to 4095 □ indicates the channel number causing the error.	Set a value that is within the valid range.
312□H	System error	Alarm setting error	In the lower upper limit value/lower lower limit value of the alarm output, the lower upper limit value is less than the lower lower limit value. □ indicates the channel number causing the error.	Re-set the limit values so that the condition of upper upper limit value≧ upper lower limit value ≧ lower upper limit value ≧ lower lower limit value is satisfied.
313□H	System error	Alarm setting error	In the upper lower limit value/lower upper limit value of the alarm output, the upper lower limit value is less than the lower upper limit value. □ indicates the channel number causing the error.	
314□H	System error	Alarm setting error	In the upper upper limit value/upper lower limit value of the alarm output, the upper upper limit value is less than the upper lower limit value. value.□ indicates the channel number causing the error.	
400□H	System error	User range setting error	In User range setting, offset value is equal to or greater than gain value. □ indicates the channel number causing the error.	Reset the range so that offset value is smaller than gain value.
500□H	System error	Disconnection detection error	Line break down has been detected. □ indicates the channel number causing the error.	Check for any abnormality on the signal lines by doing a visual check and performing a continuity check.

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POINT

(1) When multiple errors of the same level occur, the code of the error first found by the ST1AD is stored.
(2) The error can be cleared by turning on Ew.n error clear request.

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9.2 Troubleshooting

9.2.1 When the RUN LED is flashing or turned off

(1) When flashing at 0.5s intervals

Check item	Corrective action
Is the mode set to the offset/gain setting mode?	Execute Operation mode setting (command number: 3202_H) to select the normal mode. (see Section 8.5.3).

(2) When flashing at 0.25s intervals

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

(3) When flashing at 1s intervals

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

(4) When off

Check item	Corrective action
Is a module change enabled during an online module change?	Refer to Chapter 7 and take corrective action.
Is External SYS. power supply being supplied?	Check whether the supply voltage of the bus refreshing module is within the rated range.
Is the capacity of the bus refreshing module adequate?	Calculate the current consumption of the mounted module, and check that the power supply capacity is sufficient.
Is the ST1AD correctly mounted on the base module?	Check the mounting condition of the ST1AD.
Has a watchdog timer error occurred?	Power the ST1AD off and then on, or reset the head module, and check whether the LED turns on. If the LED still does not turn on, the possible cause is a ST1AD failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

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

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

9.2.3 When an digital output values can not be read

Check item	Corrective action
Is external AUX. power supply being supplied?	Check whether the power distribution modules is supplied with a 24V DC voltage.
Is there any fault with the analog signal lines such as broken or disconnected line?	Check for any abnormality on the signal lines by doing a visual check and performing a continuity check.
Are the offset/gain settings correct?	Verify that the offset/gain settings are correct. (see section 4.5 and 5.6) When the user range setting is used, switch to the factory-set output range and check whether A/D conversion is performed correctly or not. If it is correctly performed, redo the offset/gain setting.
Is the input range setting correct?	Execute input range set value read (command number: 1118H) and confirm the input range setting. (see section 8.3.1) If the input range setting is wrong, make the input range setting again using the configuration software of the master station .
Is the A/D conversion enable/disable setting for the channel, where data was input, set to Disable?	Execute A/D conversion enable/disable setting read (command number: 1100H) and confirm the A/D conversion enable/disable setting. (see section 8.3.1) If conversion is disabled, enable conversion by executing A/D conversion enable/disable setting write (command number: 2100H) or using GX Configurator-ST (see section 5.3 and 8.4.1).
Are Bw.n+1 convert setting request and Br.n+1 convert setting completed flag on?	Check whether Bw.n+1 convert setting request and Br.n+1 convert setting completed flag are on or off using the program of the master station or the I/O monitor of GX Configurator-ST (see section 5.4). If Bw.n+1 convert setting request and Br.n+1 convert setting completed flag are off, reexamine the program of the master station (see section 3.4.1 and 3.4.5).

POINT

The module may be faulty if the digital output values cannot be read after proper corrective action have been taken according to the above check items. 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 ST1AD.

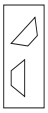
(1) Wiring maker

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

Model name	Description	Color
ST1A-WMK-BL	Terminal marker (-, 0V, N)	Blue
ST1A-WMK-GN	Terminal marker (Shield)	Green
ST1A-WMK-BK	Terminal marker (Signal wire)	Black

(2) Coding element

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

Model name	Description	Shape*		Color
		Base module side	Slice module side	
ST1A-CKY-13	Coding element for ST1AD2-V			Green
ST1A-CKY-14	Coding element for ST1AD2-I			

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

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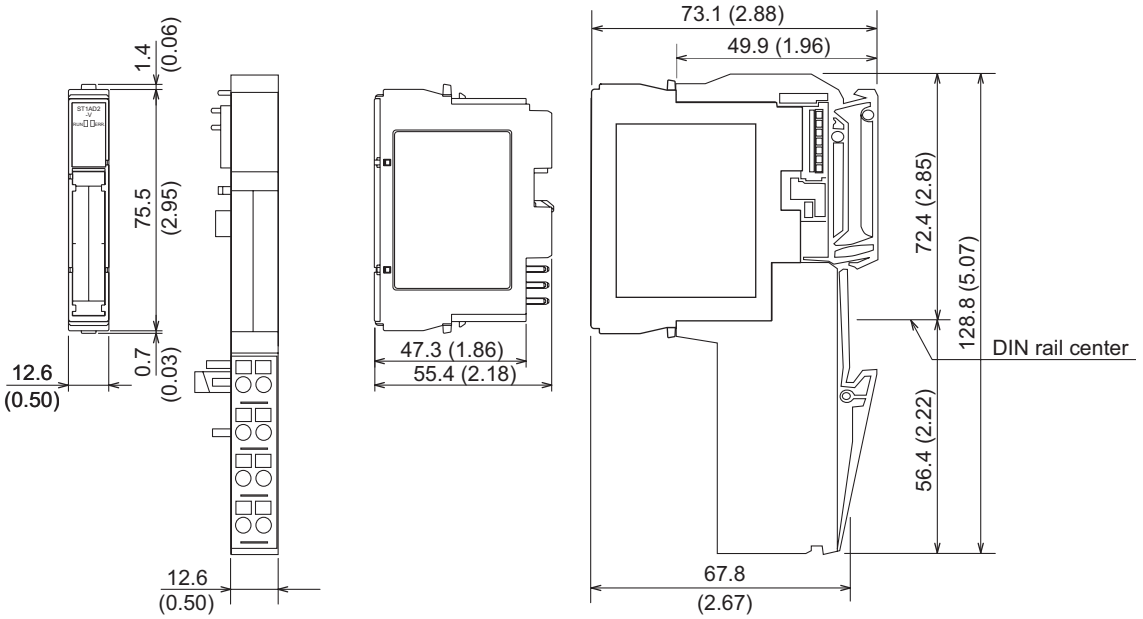
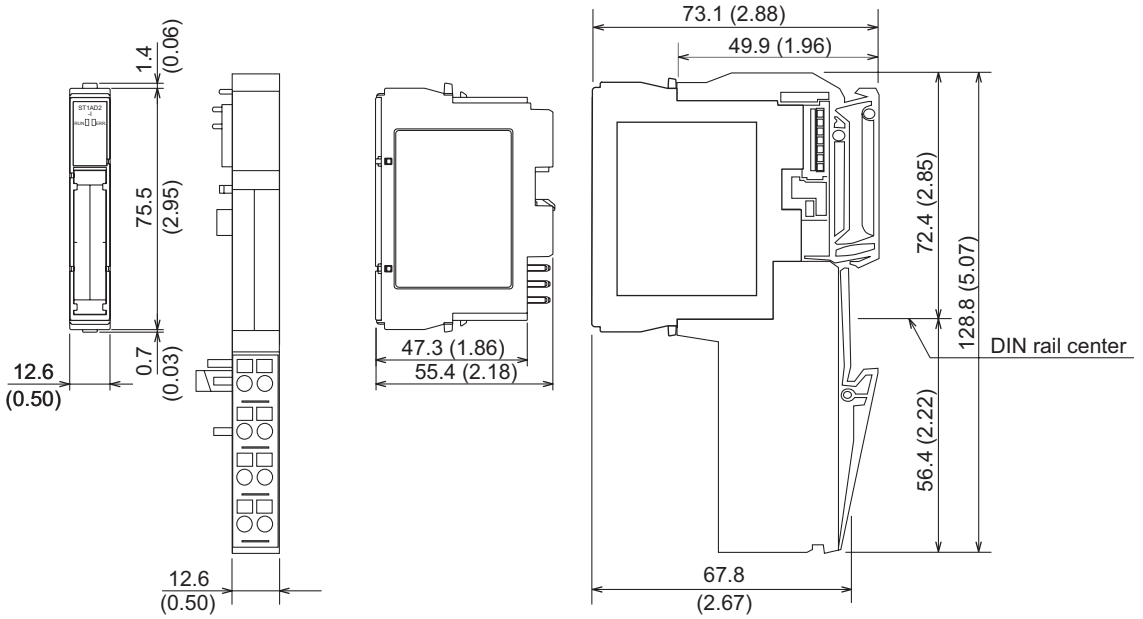
Appendix 2 External Dimensions

(1) ST1AD2-V



Unit: mm (inch)

(2) ST1AD2-I



Unit: mm (inch)

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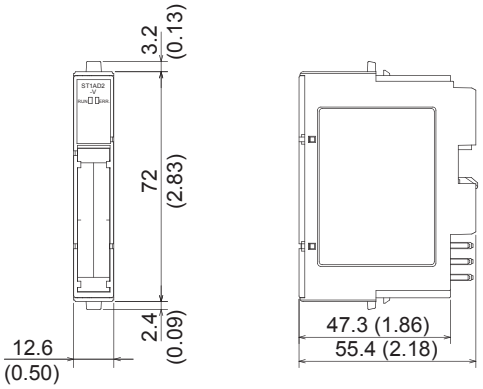
REMARK

For ST1AD2-V, ST1AD2-I of hardware version C 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 starting use.

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 dealer or Mitsubishi Service Company. Note that if repairs are required at a site overseas, on a detached island or remote place, expenses to dispatch an engineer shall be charged for.

[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 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 possible 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 chance loss and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, chance losses, lost profits incurred to the user by Failures of Mitsubishi products, damages and secondary damages caused from special reasons regardless of Mitsubishi's expectations, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other duties.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or National Defense purposes shall be excluded from the programmable logic controller applications.

Note that even with these applications, if the user approves that the application is to be limited and a special quality is not required, application shall be possible.

When considering use in aircraft, medical applications, railways, incineration and fuel devices, manned transport devices, equipment for recreation and amusement, and safety devices, in which human life or assets could be greatly affected and for which a particularly high reliability is required in terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

MELSEC-ST Analog-Digital Converter Module

User's Manual

MODEL	ST1AD-U-SY-E
MODEL CODE	13JR69
SH(NA)-080442ENG-B(0606)MEE	

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