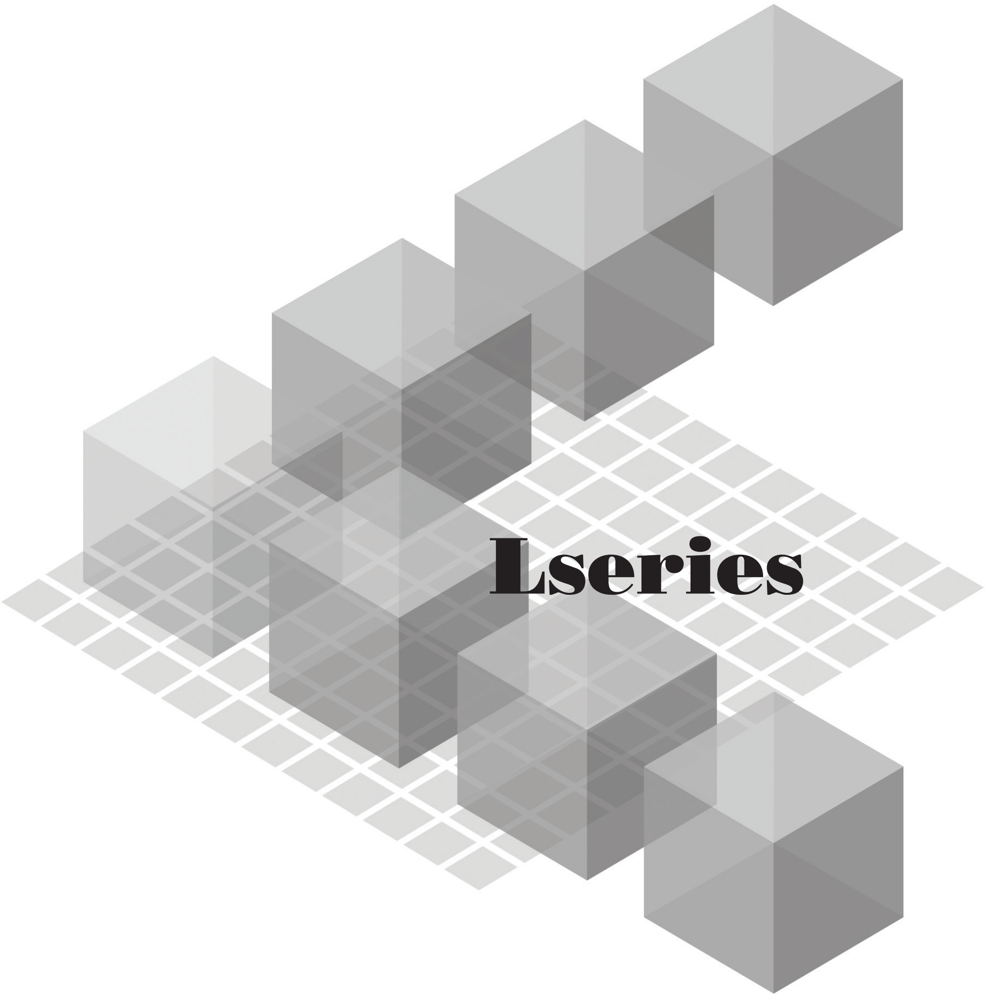
MITSUBISHI

Mitsubishi Programmable Controller

MELSEC *L* *series*

MELSEC-L Analog-Digital Converter Module User's Manual



-L60AD4

MODEL

●SAFETY PRECAUTIONS●

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the user's manual for the CPU module used.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠ CAUTION".

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Do not write any data to the "system area" and "write-protect area" (R) of the buffer memory in the intelligent function module.
Also, do not use any "use prohibited" signals as an output signal from the programmable controller CPU to the intelligent function module.
Doing so may cause malfunction of the programmable controller system.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables.
Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.

[Installation Precautions]

⚠WARNING

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

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection). Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To interconnect modules, engage the respective connectors and securely lock the module joint levers. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- Tighten the screw within the specified torque range.
  Undertightening can cause drop of the screw, short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Do not directly touch any conductive parts and electronic components of the module. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Ground the FG terminal to the protective ground conductor dedicated to the programmable controller. Failure to do so may result in electric shock or malfunction.
- Tighten the terminal block screw within the specified torque range. Undertightening can cause short circuit, fire, or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.

[Wiring Precautions]

⚠CAUTION

- Mitsubishi programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block.
  Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock.
  For wiring methods, refer to the MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection).

[Startup and Maintenance Precautions]

⚠WARNING

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

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not disassemble or modify the module. Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply for the system in all phases before mounting or removing a module. Failure to do so may cause the module to fail or malfunction.
- Tighten the terminal block screw within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[Disposal Precautions]

⚠CAUTION

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

●CONDITIONS OF USE FOR THE PRODUCT●

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

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

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

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

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-L series programmable controllers.
This manual describes the functions and programming of an analog-digital converter module (hereafter abbreviated as A/D converter module).

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

■Relevant module: L60AD4

Remark

Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y00 to X/Y0F are assigned for an A/D converter module.
For I/O number assignment, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

Operating procedures are explained using GX Works2. When using GX Developer or GX Configurator-AD, refer to the following.

- When using GX Developer or GX Configurator-AD (☞ Page 132, Appendix 8)

COMPLIANCE WITH THE EMC AND LOW VOLTAGE DIRECTIVES

(1) For programmable controller system

To configure a system meeting the requirements of the EMC and Low Voltage Directives when incorporating the Mitsubishi programmable controller (EMC and Low Voltage Directives compliant) into other machinery or equipment, refer to the MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection). The CE mark, indicating compliance with the EMC and Low Voltage Directives, is printed on the rating plate of the programmable controller.

(2) For the product

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

RELEVANT MANUALS

(1) CPU module user's manual

Manual name <manual number (model code)>	Description
MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection) <SH-080890ENG, 13JZ36>	Specifications of the CPU modules, power supply modules, display unit, SD memory cards, and batteries, information on how to establish a system, maintenance and inspection, and troubleshooting
MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals) <SH-080889ENG, 13JZ35>	Functions and devices of the CPU module, and programming

(2) Operating manual

Manual name <manual number (model code)>	Description
GX Works2 Version1 Operating Manual (Common) <SH-080779ENG, 13JU63>	System configuration, parameter settings, and online operations (common to Simple project and Structured project) of GX Works2
GX Developer Version 8 Operating Manual <SH-080373E, 13JU41>	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

CONTENTS

SAFETY PRECAUTIONS 1
CONDITIONS OF USE FOR THE PRODUCT 4
INTRODUCTION 5
COMPLIANCE WITH THE EMC AND LOW VOLTAGE DIRECTIVES 6
RELEVANT MANUALS 7
MANUAL PAGE ORGANIZATION 11
TERMS 14
PACKING LIST 14

CHAPTER 1 A/D CONVERTER MODULE 15

1.1 Application 15
1.2 Features 16

CHAPTER 2 PART NAMES 17

CHAPTER 3 SPECIFICATIONS 19

3.1 General Specifications 19
3.2 Performance Specifications 20
  3.2.1 Number of parameter settings 21
3.3 Function List 22
3.4 I/O Signal List 23
3.5 List of Buffer Memory Addresses 24

CHAPTER 4 PROCEDURES BEFORE STARTING THE OPERATION 30

CHAPTER 5 SYSTEM CONFIGURATION 32

5.1 Overall System Configuration 32
5.2 Applicable System 32

CHAPTER 6 INSTALLATION AND WIRING 34

6.1 Installation Environment and Installation Position 34
6.2 Terminal Block 35
6.3 Wiring 37
6.4 External Wiring 38

CHAPTER 7 VARIOUS SETTINGS 39

7.1 Addition of Modules 39
7.2 Switch Setting 40
7.3 Parameter Setting 41
7.4 Auto Refresh 43
7.5 Offset/Gain Setting 44

CHAPTER 8 FUNCTIONS 47

8.1 Digital Data Details 47
8.2 A/D Conversion Enable/Disable Function. 48
8.3 A/D Conversion Method 48
8.4 Conversion Speed Switch Function 52
8.5 Maximum and Minimum Values Hold Function. 52
8.6 Input Signal Error Detection Function. 53
8.7 Warning Output Function (Process Alarm) 56
8.8 Scaling Function 59
8.9 Error Log Function 62
8.10 Module Error Collection Function 64
8.11 Error Clear Function 65
8.12 Saving and Restoring Offset/Gain Values 66

CHAPTER 9 DISPLAY UNIT 71

9.1 Display Unit. 71
9.2 Menu Transition 71
9.3 List of Setting Value Change Screens 73
9.4 Checking and Clearing Errors. 78

CHAPTER 10 PROGRAMMING 80

10.1 Procedure for Programming 80
10.2 When Using the Module in a Standard System Configuration 81

CHAPTER 11 TROUBLESHOOTING 87

11.1 Checking on the Module Detailed Information 87
11.2 Checking by Latest Error Code (Un\G19). 88
11.3 Checking on the Module Error Collection Function 88
11.4 Error Code List 89
11.5 Alarm Code List 91
11.6 Troubleshooting 91
11.7 Checking the Status of the A/D Converter Module by the System Monitor 94

APPENDICES 95

Appendix 1 Details of I/O Signals 95
  Appendix 1.1 Input signal 95
  Appendix 1.2 Output signal 100
Appendix 2 Details of Buffer Memory Addresses 102
Appendix 3 I/O Conversion Characteristic of A/D Conversion 114
Appendix 4 A/D Conversion Accuracy. 117

Appendix 5 Dedicated Instruction 118
Appendix 5.1 Instruction list. 118
Appendix 5.2 G(P).OFFGAN 119
Appendix 5.3 G(P).OGLOAD. 121
Appendix 5.4 G(P).OGSTOR 125
Appendix 6 Checking Serial Number and Function Version 129
Appendix 7 Differences with Q Series 129
Appendix 7.1 Precautions for Applying Q Series Sequence Program. 130
Appendix 8 When Using GX Developer or GX Configurator-AD 132
Appendix 8.1 Operation of GX Developer 132
Appendix 8.2 Operation of GX Configurator-AD 138
Appendix 9 External Dimensions. 140

INDEX 141

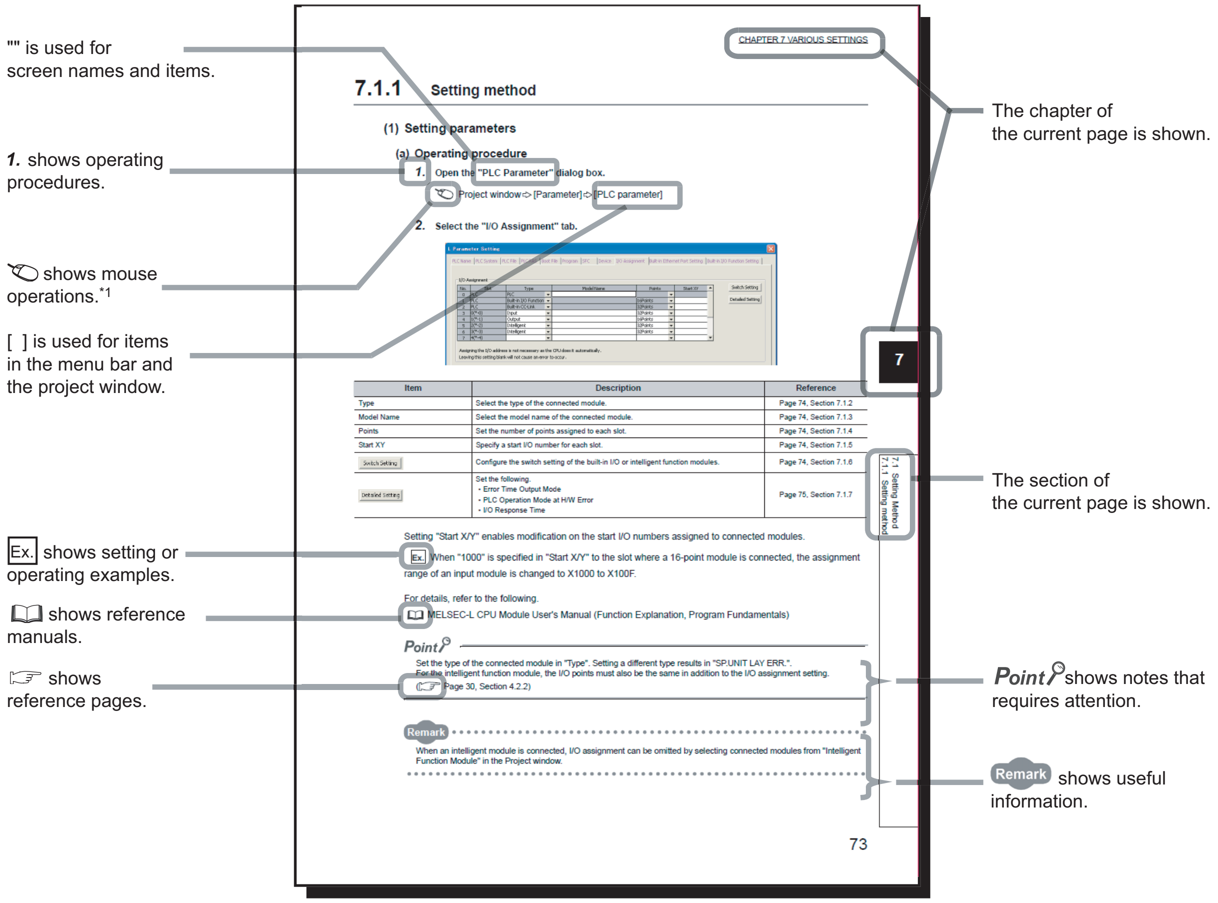
INSTRUCTION INDEX 143

REVISIONS 144
Warranty 145

MANUAL PAGE ORGANIZATION

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

The following page illustration is for explanation purpose only, and is different from the actual pages.



CHAPTER 7 VARIOUS SETTINGS

7.1.1 Setting method

(1) Setting parameters

(a) Operating procedure

1. Open the "PLC Parameter" dialog box.

🖱 Project window ⇨ [Parameter] ⇨ [PLC parameter]

2. Select the "I/O Assignment" tab.

Assigning the I/O address is not necessary as the CPU does it automatically.
Leaving this setting blank will not cause an error to occur.

Item	Description	Reference
Type	Select the type of the connected module.	Page 74, Section 7.1.2
Model Name	Select the model name of the connected module.	Page 74, Section 7.1.3
Points	Set the number of points assigned to each slot.	Page 74, Section 7.1.4
Start XY	Specify a start I/O number for each slot.	Page 74, Section 7.1.5
Switch Setting	Configure the switch setting of the built-in I/O or intelligent function modules.	Page 74, Section 7.1.6
Detailed Setting	Set the following. ・Error Time Output Mode ・PLC Operation Mode at H/W Error ・I/O Response Time	Page 75, Section 7.1.7

Setting "Start X/Y" enables modification on the start I/O numbers assigned to connected modules.

Ex. When "1000" is specified in "Start X/Y" to the slot where a 16-point module is connected, the assignment range of an input module is changed to X1000 to X100F.

For details, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

Point

Set the type of the connected module in "Type". Setting a different type results in "SP.UNIT LAY ERR.".
For the intelligent function module, the I/O points must also be the same in addition to the I/O assignment setting.
(☞ Page 30, Section 4.2.2)

Remark

When an intelligent module is connected, I/O assignment can be omitted by selecting connected modules from "Intelligent Function Module" in the Project window.

7

7.1 Setting Method
7.1.1 Setting method

73

"" is used for screen names and items.

1. shows operating procedures.

🖱 shows mouse operations.[*1]

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

Ex. shows setting or operating examples.

📖 shows reference manuals.

☞ shows reference pages.

The chapter of the current page is shown.

The section of the current page is shown.

Point shows notes that requires attention.

Remark shows useful information.

*1 The mouse operation example is provided below. (For GX Works2)

Menu bar

Ex. 🖱 [Online] ⇨ [Write to PLC...]

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

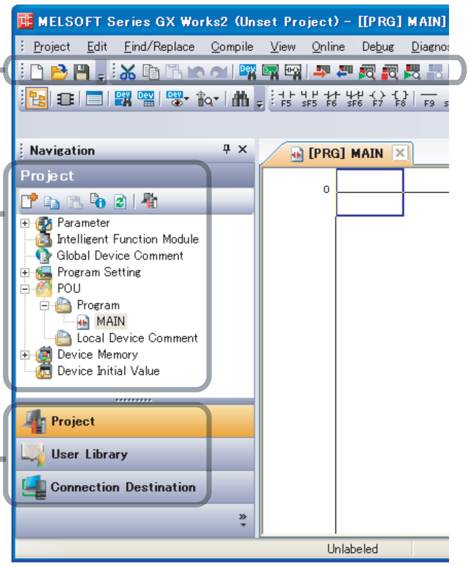
A window selected in the view selection area is displayed.

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

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

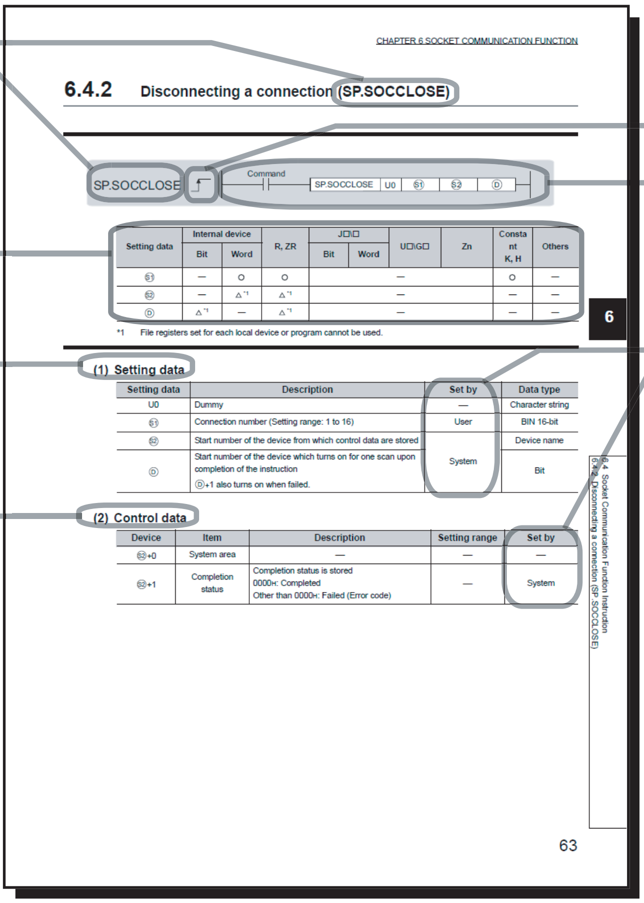
In the Project window, expand [Parameter] and select [PLC Parameter].

View selection area


MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]
Project
Edit
Find/Replace
Compile
View
Online
Debug
Diagnos
Navigation
[PRG] MAIN
Project
Parameter
Intelligent Function Module
Global Device Comment
Program Setting
POU
Program
MAIN
Local Device Comment
Device Memory
Device Initial Value
Project
User Library
Connection Destination
Unlabeled

Pages describing instructions are organized as shown below.

The following page illustrations are for explanation purpose only, and are different from the actual pages.



Instruction name

○ shows the devices applicable to the instruction

Descriptions of setting data and data type

Descriptions of control data (if any)

Execution condition of the instruction

Structure of the instruction in the ladder mode

Setting side

User : Device value is set by the user.

System: Device value is set by the CPU module.

CHAPTER 6 SOCKET COMMUNICATION FUNCTION

6.4.2 Disconnecting a connection (SP.SOCCLOSE)

SP.SOCCLOSE
Command
SP.SOCCLOSE U0 Ⓢ1 Ⓢ2 Ⓓ

Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H	Others
	Bit	Word		Bit	Word				
Ⓢ1	—	○	○	—				○	—
Ⓢ2	—	△*1	△*1	—				—	—
Ⓓ	△*1	—	△*1	—				—	—

*1 File registers set for each local device or program cannot be used.

(1) Setting data

Setting data	Description	Set by	Data type
U0	Dummy	—	Character string
Ⓢ1	Connection number (Setting range: 1 to 16)	User	BIN 16-bit
Ⓢ2	Start number of the device from which control data are stored	System	Device name
Ⓓ	Start number of the device which turns on for one scan upon completion of the instruction Ⓓ+1 also turns on when failed.		Bit

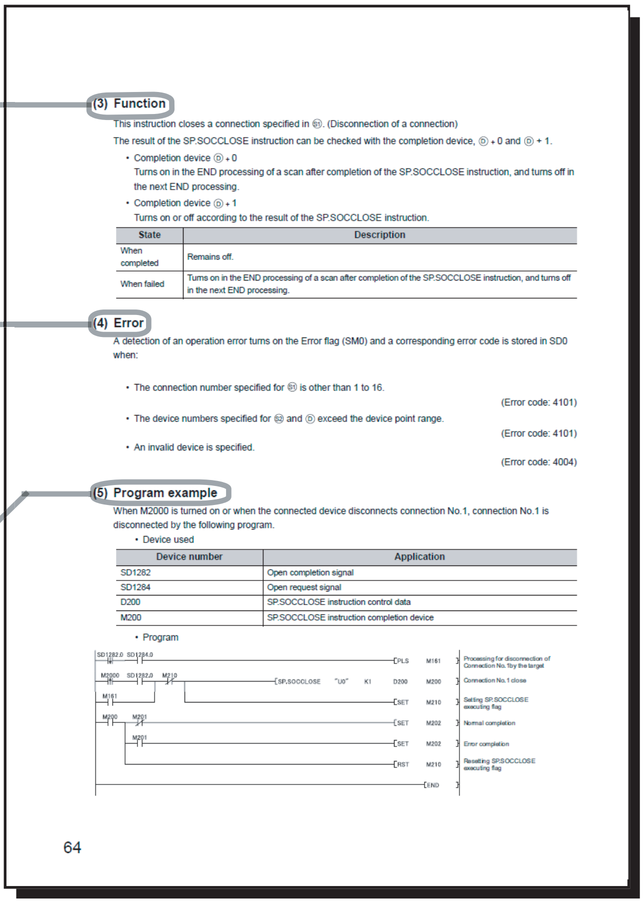
(2) Control data

Device	Item	Description	Setting range	Set by
Ⓢ2+0	System area	—	—	—
Ⓢ2+1	Completion status	Completion status is stored 0000H: Completed Other than 0000H: Failed (Error code)	—	System

6

6.4 Socket Communication Function Instruction
6.4.2 Disconnecting a connection (SP.SOCCLOSE)

63



Detailed descriptions of the instruction

Conditions for the error and error codes

For the errors not described in this manual, refer to the following.

MELSEC-Q/L Programming Manual (Common Instruction)

Simple program example(s) and descriptions of the devices used

(3) Function

This instruction closes a connection specified in Ⓢ1. (Disconnection of a connection)

The result of the SP.SOCCLOSE instruction can be checked with the completion device, Ⓓ + 0 and Ⓓ + 1.

- Completion device Ⓓ + 0
  Turns on in the END processing of a scan after completion of the SP.SOCCLOSE instruction, and turns off in the next END processing.
- Completion device Ⓓ + 1
  Turns on or off according to the result of the SP.SOCCLOSE instruction.

State	Description
When completed	Remains off.
When failed	Turns on in the END processing of a scan after completion of the SP.SOCCLOSE instruction, and turns off in the next END processing.

(4) Error

A detection of an operation error turns on the Error flag (SM0) and a corresponding error code is stored in SD0 when:

- The connection number specified for Ⓢ1 is other than 1 to 16.
  (Error code: 4101)
- The device numbers specified for Ⓢ2 and Ⓓ exceed the device point range.
  (Error code: 4101)
- An invalid device is specified.
  (Error code: 4004)

(5) Program example

When M2000 is turned on or when the connected device disconnects connection No.1, connection No.1 is disconnected by the following program.

- Device used

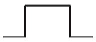
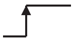
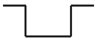
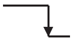
Device number	Application
SD1282	Open completion signal
SD1284	Open request signal
D200	SP.SOCCLOSE instruction control data
M200	SP.SOCCLOSE instruction completion device

- Program

SD1282.0 SD1284.0
PLS M161
Processing for disconnection of Connection No. 1by the target
M2000 SD1282.0 M210
SP.SOCCLOSE "U0" K1 D200 M200
Connection No. 1 close
M161
SET M210
Setting SP.SOCCLOSE executing flag
M200 M201
SET M202
Normal completion
M201
SET M202
Error completion
RST M210
Resetting SP.SOCCLOSE executing flag
END

64

- Instructions can be executed under the following conditions.

Execution condition	Any time	During on	On the rising edge	During off	On the falling edge
Symbol	No symbol				

- The following devices can be used.

Setting data	Internal device (system, user)		File register	Link direct device J□\□		Intelligent function module device U□\G□	Index register Zn	Con-stant[*3]	Others [*3]
	Bit	Word		Bit	Word				
Applicable device[*1]	X, Y, M, L, SM, F, B, SB, FX, FY[*2]	T, ST, C, D, W, SD, SW, FD, @□	R, ZR	-		U□\G□	Z	K, H, E, $	P, I, J, U, D, X, DY, N, BL, TR, BL\S, V

[*1] For details on each device, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

[*2] FX and FY can be used for bit data only, and FD for word data only.

[*3] In the "Constant" and "Others" columns, a device(s) that can be set for each instruction is shown.

- The following data types can be used.

Data type	Description
Bit	Bit data or the start number of bit data
BIN 16-bit	16-bit binary data or the start number of word device
BIN 32-bit	32-bit binary data or the start number of double-word device
BCD 4-digit	Four-digit binary-coded decimal data
BCD 8-digit	Eight-digit binary-coded decimal data
Real number	Floating-point data
Character string	Character string data
Device name	Device name data

TERMS

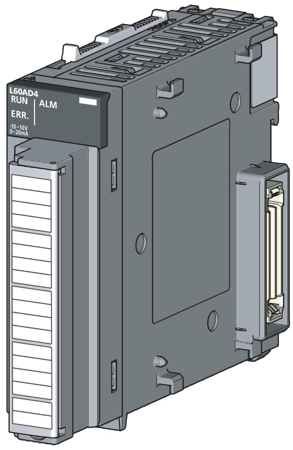
Unless otherwise specified, this manual uses the following terms.

Term	Description
A/D converter module	Another term for the MELSEC-L series analog-digital converter module
Display unit	A liquid crystal display to be attached to the CPU module
Programming tool	Generic term for GX Works2 and GX Developer
Factory default setting	Generic term for analog input ranges of 0 to 10V, 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA, and 4 to 20mA
GX Works2	Product name of the software package for the MELSEC programmable controllers
GX Developer	
GX Configurator-AD	A setting and monitoring tool added in GX Developer (for A/D converter modules)
Buffer memory	The memory of an intelligent function module used to store data (such as setting values and monitored values) for communication with a CPU module.

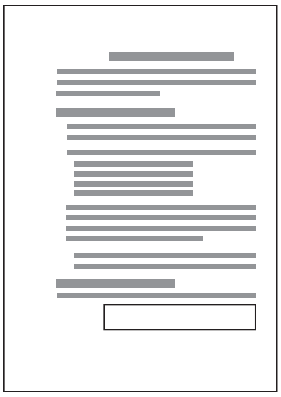
PACKING LIST

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

L60AD4



L60AD4



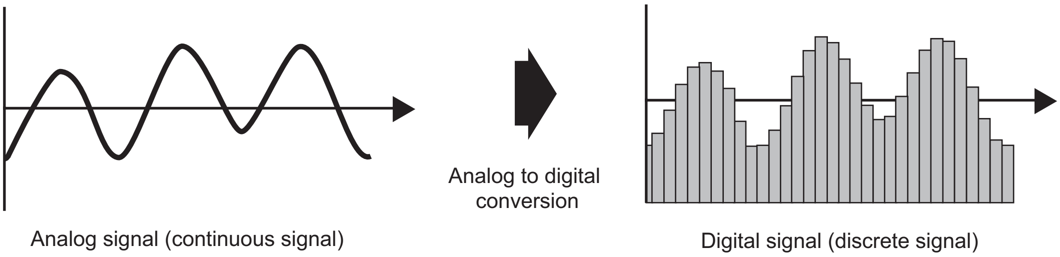
Before Using the Product

CHAPTER 1 A/D CONVERTER MODULE

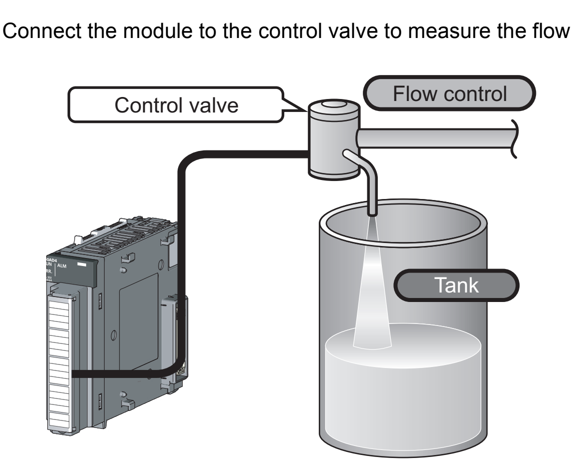
This chapter describes the applications and features of the A/D converter module.

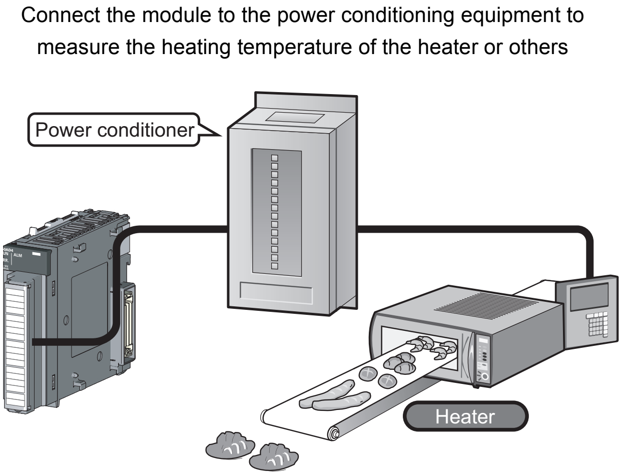
1.1 Application

This module converts the analog value input from external devices to the digital output value, and inputs the converted data to the CPU module. By converting the data, which has been processed through the A/D converter module, to a digital data, the input information can be sent to the CPU module.


Analog to digital
conversion
Analog signal (continuous signal)
Digital signal (discrete signal)

The A/D converter module enables works as follows.


Connect the module to the control valve to measure the flow
Control valve
Flow control
Tank


Connect the module to the power conditioning equipment to measure the heating temperature of the heater or others
Power conditioner
Heater

1.2 Features

(1) Response by high-speed conversion

The high-speed conversion of 20μs/channel is achieved.

(2) Detailed control by high resolution

In all analog input ranges, the high resolution of 1/20000 is achieved.

(3) Reliability by high accuracy

The accuracy for the maximum value of the digital output value is ±0.1% (25±5°C), ±0.2% (0 to 55°C).

(4) Scaling function

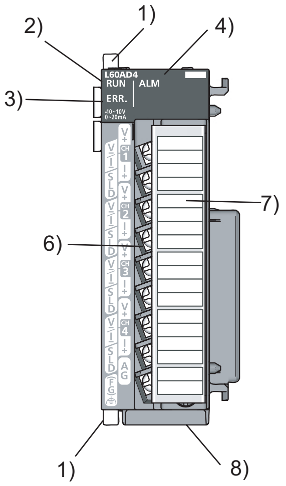
This function converts a digital output value to the ratio value (%) in any width to represent the digital value in a numeric value easy to understand.

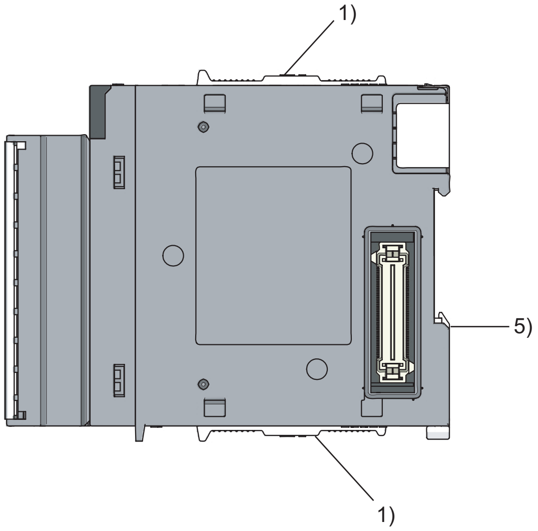
(5) Comparing/monitoring the measurement target

By using the input signal error detection function or alarm output function (process alarm), statuses of connected devices can be monitored easily.

CHAPTER 2 PART NAMES

The following table shows part names of the A/D converter module.





Number	Name	Description
1)	Module joint levers	Levers for connecting modules
2)	RUN LED (green)	Displays the operating status of the A/D converter module. On: The module is operating normally. Flashing: In the offset/gain setting mode Off: The 5V power off or watchdog timer error has occurred.
3)	ERR. LED (red)	Displays the errors and status of the A/D converter module. On: an error has occurred except for error code: 112[*1] Flashing: Error code: 112 has occurred.[*1] Off: The module is operating normally.
4)	ALM LED (red)	Displays the alarm status of the A/D converter module. On: Alarm (process alarm) is occurring[*2] Flashing: Input signal error detection is occurring Off: The module is operating normally.[*2]
5)	DIN rail hook	A hook used to mount the module to a DIN rail
6)	Terminal block	18-pin screw terminal block for connecting input signal lines of such as external devices
7)	Terminal block cover	Covers for preventing electric shock while the power is on
8)	Serial number display	Displays the serial number printed on the rating plate.

[*1] Error Code List (☞ Page 89, Section 11.4)

[*2] Alarm Code List (☞ Page 91, Section 11.5)

Memo

CHAPTER 3 SPECIFICATIONS

This chapter shows the general specifications, performance specifications, function list, list of I/O signals, and list of buffer memory addresses.

3.1 General Specifications

For the general specifications of the A/D converter module, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

3.2 Performance Specifications

The following table shows the performance specifications of the A/D converter module.

Item		Model			
		L60AD4			
Number of analog input points		4 points (4 channels)			
Analog input	Voltage	-10 to 10 VDC (input resistance 1M Ω)			
	Current	0 to 20mADC (input resistance 250 Ω)			
Digital output		-20480 to 20479			
	When using the scaling function	-32768 to 32767			
I/O characteristics, resolution		Analog input range		Digital output value	Resolution
		Voltage	0 to 10V	0 to 20000	500µV
			0 to 5V		250µV
			1 to 5V		200µV
			-10 to 10V	-20000 to 20000	500µV
			User range setting		307µV[*1]
		Current	0 to 20mA	0 to 20000	1000nA
			4 to 20mA		800nA
			User range setting	-20000 to 20000	1230nA[*1]
Accuracy (accuracy for the maximum value of the digital output value)[*2]	Ambient temperature 25±5°C	Within ±0.1% (±20digit)			
	Ambient temperature 0 to 55°C	Within ±0.2% (±40digit)			
Conversion speed[*3]		High-speed: 20µs/channel Medium speed: 80µs/channel Low speed: 1ms/channel			
Absolute maximum input		Voltage: ±15V, Current: 30mA[*4]			
Offset/gain setting count		Up to 50000 counts			
Isolation method		Between I/O terminals and programmable controller power supply: photocoupler isolation Between input channels: no isolation			
Dielectric withstand voltage		Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute			
Insulation resistance		Between I/O terminals and programmable controller power supply: 500VDC 10MΩ or higher			
Number of occupied I/O points		16 points (I/O assignment: Intelligent 16 points)			
Connected terminal		18-point terminal block			
Applicable wire size		0.3 to 0.75mm^2			
Applicable solderless terminal		R1.25-3 (solderless terminals with sleeve are not usable)			
Internal current consumption (5VDC)		0.52A			
Weight		0.19kg			

*1 Maximum resolution in the user range setting.

*2 Except when receiving noise influence.

*3 The default value is 80µs/channel.

*4 This is a momentary current value which does not cause damage to internal resistors of the module. The maximum input current value for constant application is 24mA.

3.2.1 Number of parameter settings

Set the initial setting of A/D converter module and the parameter setting of auto refresh setting so that the number of parameters, including these of other intelligent function modules, does not exceed the number of parameters that can be set in the CPU module.
For the maximum number of parameters that can be set in the CPU module (maximum number of parameter settings), refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

(1) Number of A/D converter module parameters

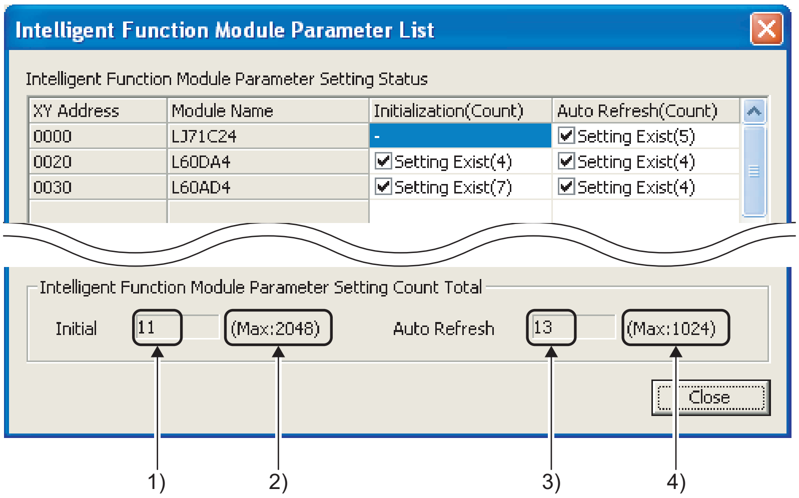
For A/D converter modules, the following number of parameters can be set per module.

Target module	Initial setting	Auto refresh setting
L60AD4	7	21 (maximum number of settings)

(2) Checking method

The maximum number of parameter settings and the number of parameter settings set for the intelligent function module can be checked with the following operation.

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



Intelligent Function Module Parameter List

Intelligent Function Module Parameter Setting Status

XY Address	Module Name	Initialization(Count)	Auto Refresh(Count)
0000	LJ71C24	-	☑Setting Exist(5)
0020	L60DA4	☑Setting Exist(4)	☑Setting Exist(4)
0030	L60AD4	☑Setting Exist(7)	☑Setting Exist(4)

Intelligent Function Module Parameter Setting Count Total

Initial: 11 (Max:2048)
Auto Refresh: 13 (Max:1024)

No.	Description
1)	The total number of parameters in the initial settings selected on the dialog box
2)	The maximum number of parameter settings in the initial settings
3)	The total number of parameters in the auto refresh settings selected on the dialog box
4)	The maximum number of parameter settings in the auto refresh settings

3.3 Function List

The following is the function list of the A/D converter module.

Item			Description	Reference
A/D conversion enable/disable function			Sets whether to enable or disable A/D conversion for each channel. Disabling the A/D conversion for unused channels reduces the conversion cycles.	Page 48, Section 8.2
A/D conversion method	Sampling processing		The A/D converter module executes the A/D conversion of the analog input value sequentially and stores the digital output value to the buffer memory.	Page 48, Section 8.3 (1)
	Averaging processing	Time average	The A/D converter module executes the A/D conversion by the period of the time for each channel, and stores in the buffer memory.	Page 49, Section 8.3 (2)(a)
		Count average	The A/D converter module executes the A/D conversion by the number of times for each channel, and stores in the buffer memory.	Page 49, Section 8.3 (2)(b)
		Moving average	The A/D converter module averages the digital output value of set number of times which is measured every sampling time period, and stores in the buffer memory.	Page 50, Section 8.3 (2)(c)
Range switching function			The input range to use can be selected from the factory default range (4mA to 20mA, 0mA to20mA, 1V to 5V, 0V to 5V, -10V to 10V or 0V to 10V) and user range (user range setting).	Page 40, Section 7.2
Offset/gain setting function			This function compensates for errors in digital output values.	Page 44, Section 7.5
Conversion speed switching function			The conversion speed can be selected from 20µs, 80µs or 1ms.	Page 52, Section 8.4
Maximum value/minimum value hold function			The A/D converter module stores the maximum and minimum values of the digital output value or the scaling values for each channel to the buffer memory. The maximum and minimum values are stored to the channels regardless the setting of the A/D conversion method.	Page 52, Section 8.5
Input signal error detection function			This function detects the analog input value which exceeds the setting range.	Page 53, Section 8.6
Alarm output function (process alarm)			This function outputs alarm when a digital output value is in the range set in advance.	Page 56, Section 8.7
Scaling function			The A/D converter module scale-converts the output digital value to the set range of the scaling upper limit value and scaling lower limit value. This omits the programming of the scale conversion.	Page 59, Section 8.8
Error history function			The function stores up to latest 16 recodes of errors and alarms occurred in the A/D converter module to the buffer memory.	Page 62, Section 8.9
Module error collection			This function collects errors and alarms occurred in the A/D converter module and stores to the CPU module.	Page 64, Section 8.10
Error clear function			Clearing the error from the system monitor at error occurrence is possible.	Page 65, Section 8.11
Save/restoration of offset/gain value			The offset/gain value of the user range setting can be saved or restored.	Page 66, Section 8.12

3.4 I/O Signal List

The following shows the list of the A/D converter module I/O signals.
For the details of I/O signals, refer to the followings.

- Details of I/O signals (☞ Page 95, Appendix 1)

Input signal		Output signal	
Device number	**Signal name**	**Device number**	**Signal name**
X0	Module READY	Y0	Use prohibited
X1	Use prohibited	Y1	
X2		Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8	Warning output signal	Y8	
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range write request
XB	Channel change completed flag	YB	Channel change request
XC	Input signal error detection signal	YC	Use prohibited
XD	Maximum value/minimum value reset completed flag	YD	Maximum value/minimum value reset request
XE	A/D conversion completed flag	YE	Use prohibited
XF	Error occurrence flag	YF	Error clear request

Point

The I/O number (X/Y) described above shows the case that the start I/O number of the A/D converter module is set to "0".

3.5 List of Buffer Memory Addresses

The following shows the list of the A/D converter module buffer memory.
For details of buffer memory addresses, refer to the following.

- Details of buffer memory addresses (☞ Page 102, Appendix 2)

Point

Do not write data to the system area and the area where the data cannot be written from the program in the buffer memory. Writing data to these areas may lead the module to malfunction.

(1) Un\G0 to Un\G1799

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
0	0_H	A/D conversion enable/disable setting	0	R/W
1	1_H	CH1 Average time/Average number of times/Move average settings	0	R/W
2	2_H	CH2 Average time/Average number of times/Move average settings	0	R/W
3	3_H	CH3 Average time/Average number of times/Move average settings	0	R/W
4	4_H	CH4 Average time/Average number of times/Move average settings	0	R/W
5 to 8	5_H to 8_H	System area	—	—
9	9_H	Averaging process specification (used to replace Q64AD)	0	R/W
10	A_H	A/D conversion completed flag	0	R
11	B_H	CH1 Digital output value	0	R
12	C_H	CH2 Digital output value	0	R
13	D_H	CH3 Digital output value	0	R
14	E_H	CH4 Digital output value	0	R
15 to 18	F_H to 12_H	System area	—	—
19	13_H	Latest error code	0	R
20	14_H	Setting range	0	R
21	15_H	System area	-	-
22	16_H	Offset/gain setting mode Offset specification	0	R/W
23	17_H	Offset/gain setting mode Gain specification	0	R/W
24	18_H	Averaging process specification	0	R/W
25	19_H	System area	—	—
26	$1A_H$	Conversion speed setting	0001_H	R/W

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
27 to 29	$1B_H$ to $1D_H$	System area	—	—
30	$1E_H$	CH1 Maximum value	0	R
31	$1F_H$	CH1 Minimum value	0	R
32	20_H	CH2 Maximum value	0	R
33	21_H	CH2 Minimum value	0	R
34	22_H	CH3 Maximum value	0	R
35	23_H	CH3 Minimum value	0	R
36	24_H	CH4 Maximum value	0	R
37	25_H	CH4 Minimum value	0	R
38 to 46	26_H to $2E_H$	System area	—	—
47	$2F_H$	Input signal error detection setting	$000F_H$	R/W
48	30_H	Process alarm output setting	$000F_H$	R/W
49	31_H	Input signal error detection flag	0	R
50	32_H	Warning output flag (Process alarm)	0	R
51	33_H	System area	—	—
52	34_H			
53	35_H	Scaling enable/disable setting	$000F_H$	R/W
54	36_H	CH1 Scaling value	0	R
55	37_H	CH2 Scaling value	0	R
56	38_H	CH3 Scaling value	0	R
57	39_H	CH4 Scaling value	0	R
58 to 61	$3A_H$ to $3D_H$	System area	—	—
62	$3E_H$	CH1 Scaling lower limit value	0	R/W
63	$3F_H$	CH1 Scaling upper limit value	0	R/W
64	40_H	CH2 Scaling lower limit value	0	R/W
65	41_H	CH2 Scaling upper limit value	0	R/W
66	42_H	CH3 Scaling lower limit value	0	R/W
67	43_H	CH3 Scaling upper limit value	0	R/W
68	44_H	CH4 Scaling lower limit value	0	R/W
69	45_H	CH4 Scaling upper limit value	0	R/W
70 to 85	46_H to 55_H	System area	—	—
86	56_H	CH1 Process alarm lower lower limit value	0	R/W
87	57_H	CH1 Process alarm lower upper limit value	0	R/W
88	58_H	CH1 Process alarm upper lower limit value	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
89	59_H	CH1 Process alarm upper upper limit value	0	R/W
90	$5A_H$	CH2 Process alarm lower lower limit value	0	R/W
91	$5B_H$	CH2 Process alarm lower upper limit value	0	R/W
92	$5C_H$	CH2 Process alarm upper lower limit value	0	R/W
93	$5D_H$	CH2 Process alarm upper upper limit value	0	R/W
94	$5E_H$	CH3 Process alarm lower lower limit value	0	R/W
95	$5F_H$	CH3 Process alarm lower upper limit value	0	R/W
96	60_H	CH3 Process alarm upper lower limit value	0	R/W
97	61_H	CH3 Process alarm upper upper limit value	0	R/W
98	62_H	CH4 Process alarm lower lower limit value	0	R/W
99	63_H	CH4 Process alarm lower upper limit value	0	R/W
100	64_H	CH4 Process alarm upper lower limit value	0	R/W
101	65_H	CH4 Process alarm upper upper limit value	0	R/W
102 to 141	66_H to $8D_H$	System area	—	—
142	$8E_H$	CH1 Input signal error detection setting value	50	R/W
143	$8F_H$	CH2 Input signal error detection setting value	50	R/W
144	90_H	CH3 Input signal error detection setting value	50	R/W
145	91_H	CH4 Input signal error detection setting value	50	R/W
146 to 157	92_H to $9D_H$	System area	—	—
158	$9E_H$	Mode switching setting	0	R/W
159	$9F_H$			
160 to 199	$A0_H$ to $C7_H$	System area	—	—
200	$C8_H$	Pass data classification setting	0	R/W
201	$C9_H$	System area	—	—
202	CA_H	CH1 Industrial shipment settings offset value (L)	0	R/W
203	CB_H	CH1 Industrial shipment settings offset value (H)	0	R/W
204	CC_H	CH1 Industrial shipment settings gain value (L)	0	R/W
205	CD_H	CH1 Industrial shipment settings gain value (H)	0	R/W
206	CE_H	CH2 Industrial shipment settings offset value (L)	0	R/W
207	CF_H	CH2 Industrial shipment settings offset value (H)	0	R/W
208	$D0_H$	CH2 Industrial shipment settings gain value (L)	0	R/W
209	$D1_H$	CH2 Industrial shipment settings gain value (H)	0	R/W
210	$D2_H$	CH3 Industrial shipment settings offset value (L)	0	R/W
211	$D3_H$	CH3 Industrial shipment settings offset value (H)	0	R/W
212	$D4_H$	CH3 Industrial shipment settings gain value (L)	0	R/W
213	$D5_H$	CH3 Industrial shipment settings gain value (H)	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
214	$D6_H$	CH4 Industrial shipment settings offset value (L)	0	R/W
215	$D7_H$	CH4 Industrial shipment settings offset value (H)	0	R/W
216	$D8_H$	CH4 Industrial shipment settings gain value (L)	0	R/W
217	$D9_H$	CH4 Industrial shipment settings gain value (H)	0	R/W
218	DA_H	CH1 User range settings offset value (L)	0	R/W
219	DB_H	CH1 User range settings offset value (H)	0	R/W
220	DC_H	CH1 User range settings gain value (L)	0	R/W
221	DD_H	CH1 User range settings gain value (H)	0	R/W
222	DE_H	CH2 User range settings offset value (L)	0	R/W
223	DF_H	CH2 User range settings offset value (H)	0	R/W
224	$E0_H$	CH2 User range settings gain value (L)	0	R/W
225	$E1_H$	CH2 User range settings gain value (H)	0	R/W
226	$E2_H$	CH3 User range settings offset value (L)	0	R/W
227	$E3_H$	CH3 User range settings offset value (H)	0	R/W
228	$E4_H$	CH3 User range settings gain value (L)	0	R/W
229	$E5_H$	CH3 User range settings gain value (H)	0	R/W
230	$E6_H$	CH4 User range settings offset value (L)	0	R/W
231	$E7_H$	CH4 User range settings offset value (H)	0	R/W
232	$E8_H$	CH4 User range settings gain value (L)	0	R/W
233	$E9_H$	CH4 User range settings gain value (H)	0	R/W
234 to 1799	EA_H to 707_H	System area	—	—

*1 The default value is a value set after power-on or after resetting the CPU module.

*2 This shows whether read or write from programs is possible.
R: Readable
W: Writable

(2) Error history (Un\G1800 to Un\G1969)

Address (decimal)	Address (hexadecimal)	Name				Default *1	Read/Write *2
1800	708_H	Latest error code address				0	R
1801 to 1809	709_H to 711_H	System area				—	—
1810	712_H	No.1	Error code			0	R
1811	713_H		Error time	First two digits of the year	Last two digits of the year	0	R
1812	714_H			Month	Day	0	R
1813	715_H			Hour	Minute	0	R
1814	716_H			Second	Day of the week	0	R
1815 to 1819	717_H to $71B_H$		System area			—	—
1820 to 1829	$71C_H$ to 725_H	No.2	Same as No. 1				
1830 to 1839	726_H to $72F_H$	No.3	Same as No. 1				
1840 to 1849	730_H to 739_H	No.4	Same as No. 1				
1850 to 1859	$73A_H$ to 743_H	No.5	Same as No. 1				
1860 to 1869	744_H to $74D_H$	No.6	Same as No. 1				
1870 to 1879	$74E_H$ to 757_H	No.7	Same as No. 1				
1880 to 1889	758_H to 761_H	No.8	Same as No. 1				
1890 to 1899	762_H to $76B_H$	No.9	Same as No. 1				

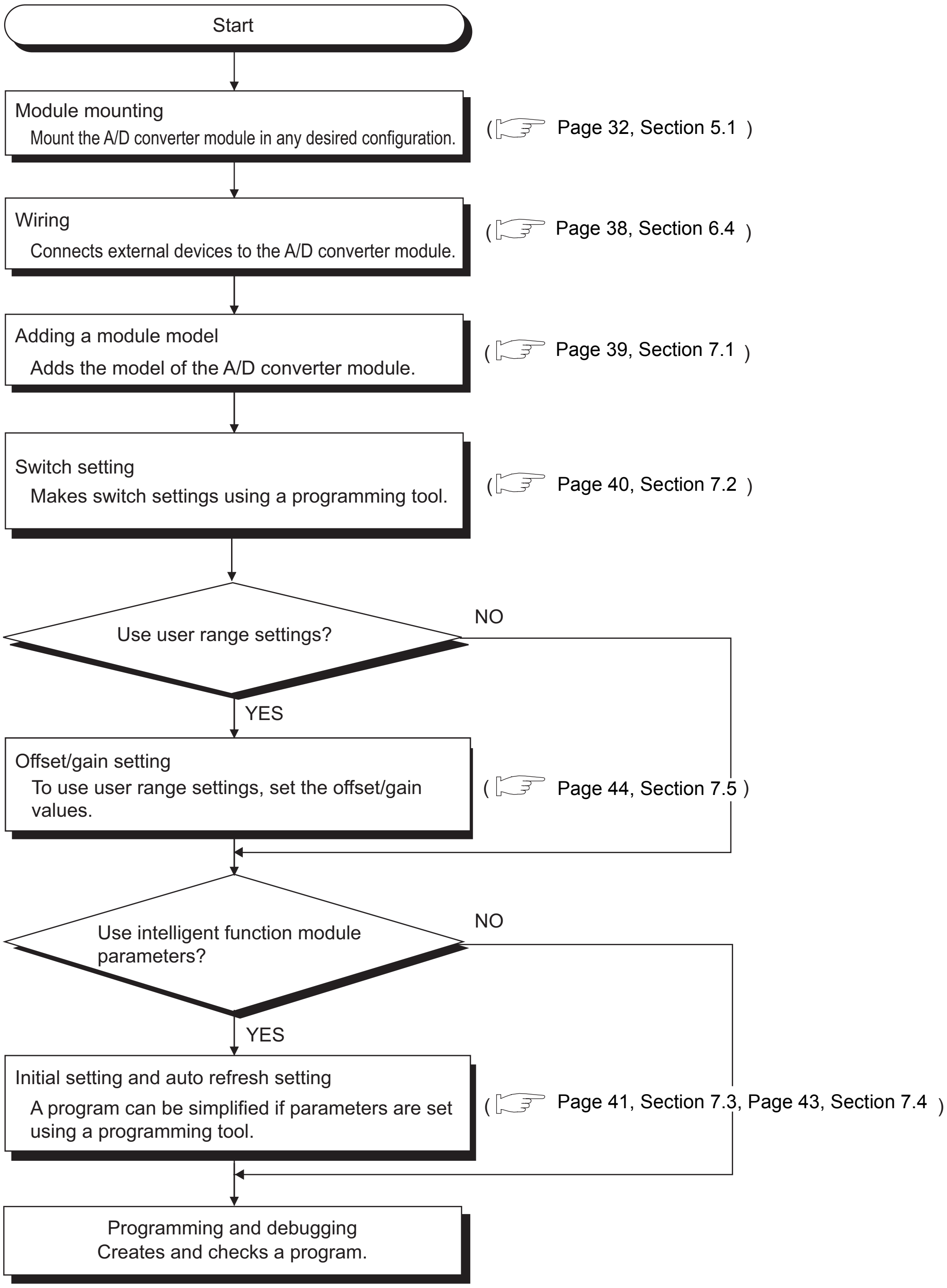
Address (decimal)	Address (hexadecimal)	Name		Default *1	Read/Write *2
1900 to 1909	$76C_H$ to 775_H	No.10	Same as No. 1		
1910 to 1919	776_H to $77F_H$	No.11	Same as No. 1		
1920 to 1929	780_H to 789_H	No.12	Same as No. 1		
1930 to 1939	$78A_H$ to 793_H	No.13	Same as No. 1		
1940 to 1949	794_H to $79D_H$	No.14	Same as No. 1		
1950 to 1959	$79E_H$ to $7A7_H$	No.15	Same as No. 1		
1960 to 1969	$7A8_H$ to $7B1_H$	No.16	Same as No. 1		

*1 The default value is a value set after power-on or after resetting the CPU module.

*2 This shows whether read or write from programs is possible.
R: Readable
W: Writable

CHAPTER 4 PROCEDURES BEFORE STARTING THE OPERATION

This chapter describes the procedures before starting the operation.


Start
Module mounting
Mount the A/D converter module in any desired configuration.
(☞ Page 32, Section 5.1)
Wiring
Connects external devices to the A/D converter module.
(☞ Page 38, Section 6.4)
Adding a module model
Adds the model of the A/D converter module.
(☞ Page 39, Section 7.1)
Switch setting
Makes switch settings using a programming tool.
(☞ Page 40, Section 7.2)
Use user range settings?
NO
YES
Offset/gain setting
To use user range settings, set the offset/gain values.
(☞ Page 44, Section 7.5)
Use intelligent function module parameters?
NO
YES
Initial setting and auto refresh setting
A program can be simplified if parameters are set using a programming tool.
(☞ Page 41, Section 7.3, Page 43, Section 7.4)
Programming and debugging
Creates and checks a program.

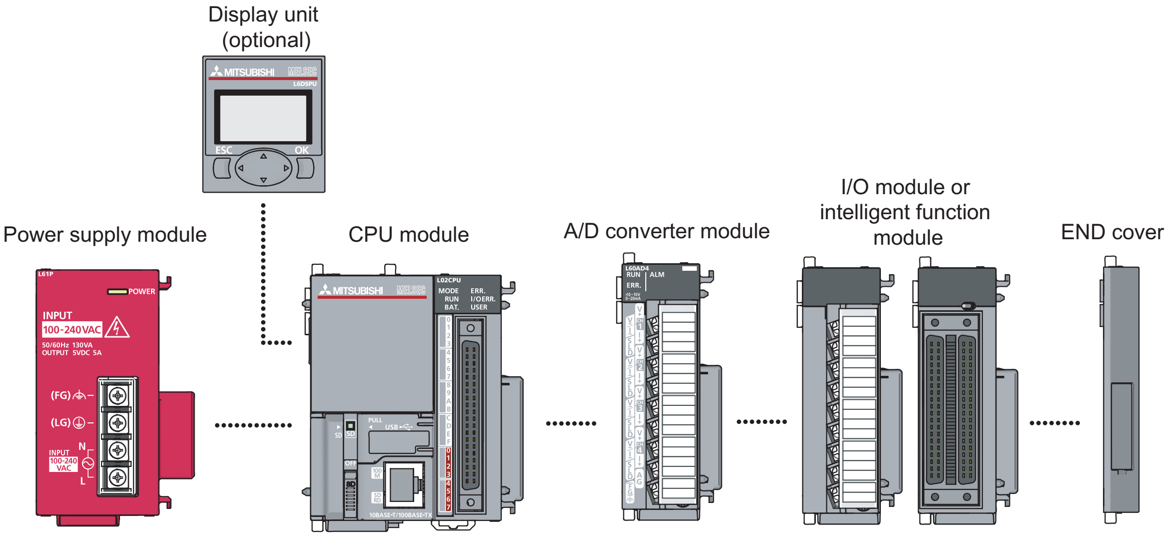
Memo

CHAPTER 5 SYSTEM CONFIGURATION

This chapter describes the overall configuration, number of connectable modules, and compatible software version of the A/D converter module.

5.1 Overall System Configuration

The following shows a system configuration example for using the A/D converter module.


Display unit
(optional)
Power supply module
CPU module
A/D converter module
I/O module or
intelligent function
module
END cover

5.2 Applicable System

(1) Number of connectable modules

For the number of connectable modules, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

(2) Compatible software version

For the compatible software versions, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

Memo

CHAPTER 6 INSTALLATION AND WIRING

This chapter describes the installation and wiring of the A/D converter module.

6.1 Installation Environment and Installation Position

For precautions for installation environment and installation position, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

6.2 Terminal Block

(1) Precautions

Tighten the terminal block screws within the following specified torque range.

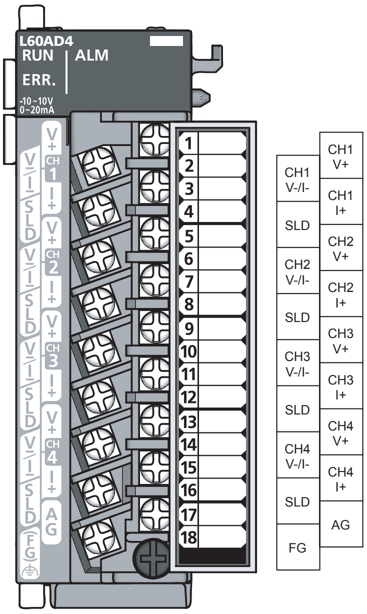
Screw type	Tightening torque range
Terminal screw (M3 screw)	0.42 to 0.58N • m
Terminal block mounting screw (M3.5 screw)	0.66 to 0.89N • m

The following table shows the applicable solderless terminal installed to the terminal block. For wiring, use the wire applicable to the following wire and mount with the applicable tightening torque. Use a UL-approved solderless terminal and tools recommended by the manufacturer of the solderless terminal. The sleeve solderless terminal cannot be used.

Solderless terminal		Wire			
Model	Applicable tightening torque	Wire diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N • m	22 to 18 AWG	Stranded wire	Copper wire	75°C or higher

(2) Signal names of the terminal block

The following shows signal names of the terminal block.

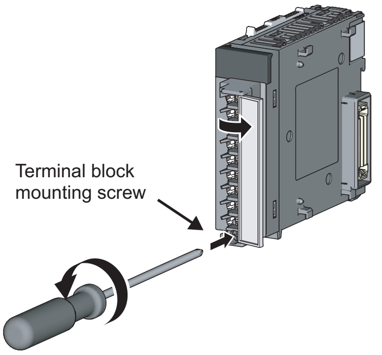

L60AD4
RUN
ALM
ERR.
-10~10V
0~20mA
V+ CH1 I+ V-I- SLD
V+ CH2 I+ V-I- SLD
V+ CH3 I+ V-I- SLD
V+ CH4 I+ V-I- SLD
AG
FG
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
CH1 V+
CH1 V-/I-
CH1 I+
SLD
CH2 V+
CH2 V-/I-
CH2 I+
SLD
CH3 V+
CH3 V-/I-
CH3 I+
SLD
CH4 V+
CH4 V-/I-
CH4 I+
SLD
AG
FG

Pin number	Signal name	
1	CH1	V+
2		V-/I-
3		I+
4		SLD
5	CH2	V+
6		V-/I-
7		I+
8		SLD
9	CH3	V+
10		V-/I-
11		I+
12		SLD
13	CH4	V+
14		V-/I-
15		I+
16		SLD
17	AG	
18	FG	

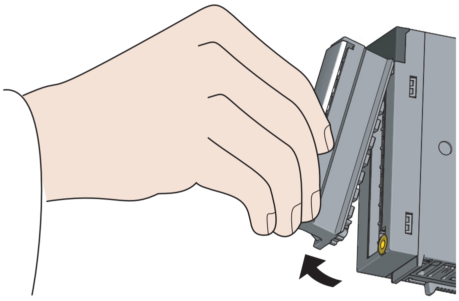
(3) Removal and installation of the terminal block

The following shows how to remove and install the terminal block.

(a) Removal procedure

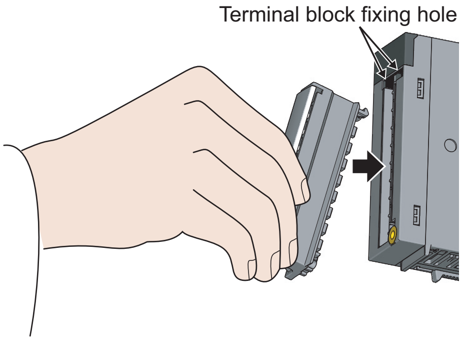

Terminal block
mounting screw

1. **Open the terminal cover and loosen the terminal block mounting screw.**

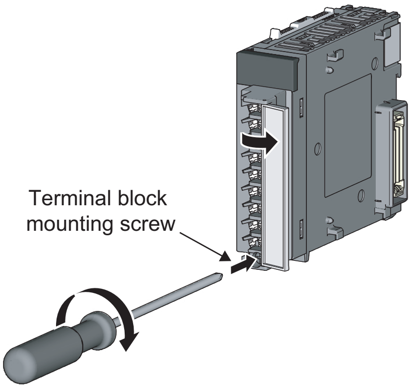


2. **Using the terminal block fixing holes as a fulcrum, remove the terminal block.**

(b) Installation procedure


Terminal block fixing hole

1. **Fully insert the projections on the top of the terminal block into the terminal block fixing holes and press the terminal block until it snaps into place.**


Terminal block
mounting screw

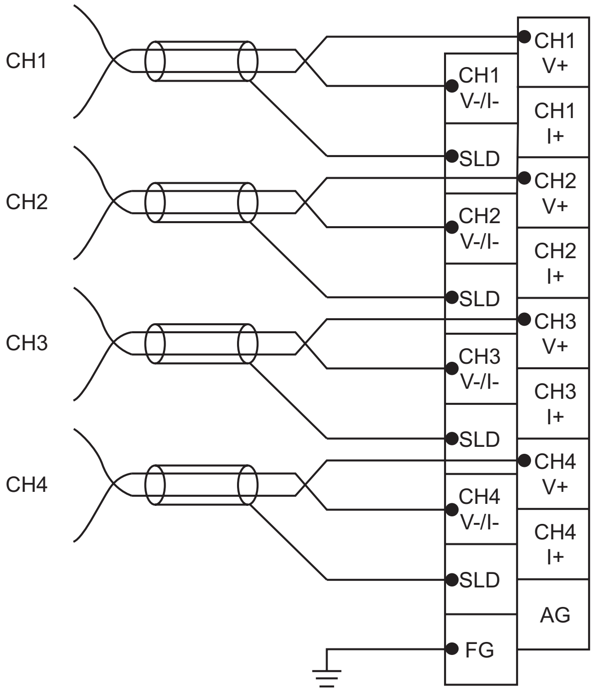
2. **Open the terminal cover and tighten the terminal block mounting screw.**

6.3 Wiring

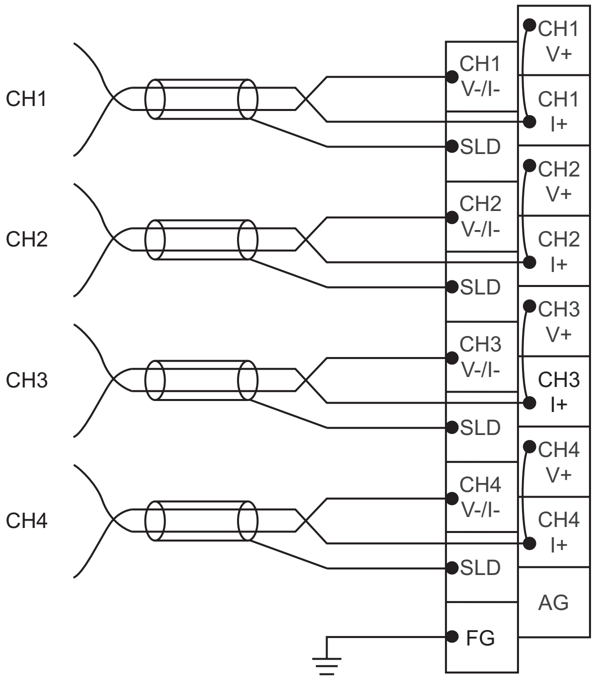
(1) Wiring to a terminal block

The following shows wirings to a terminal block.

(a) For the voltage input

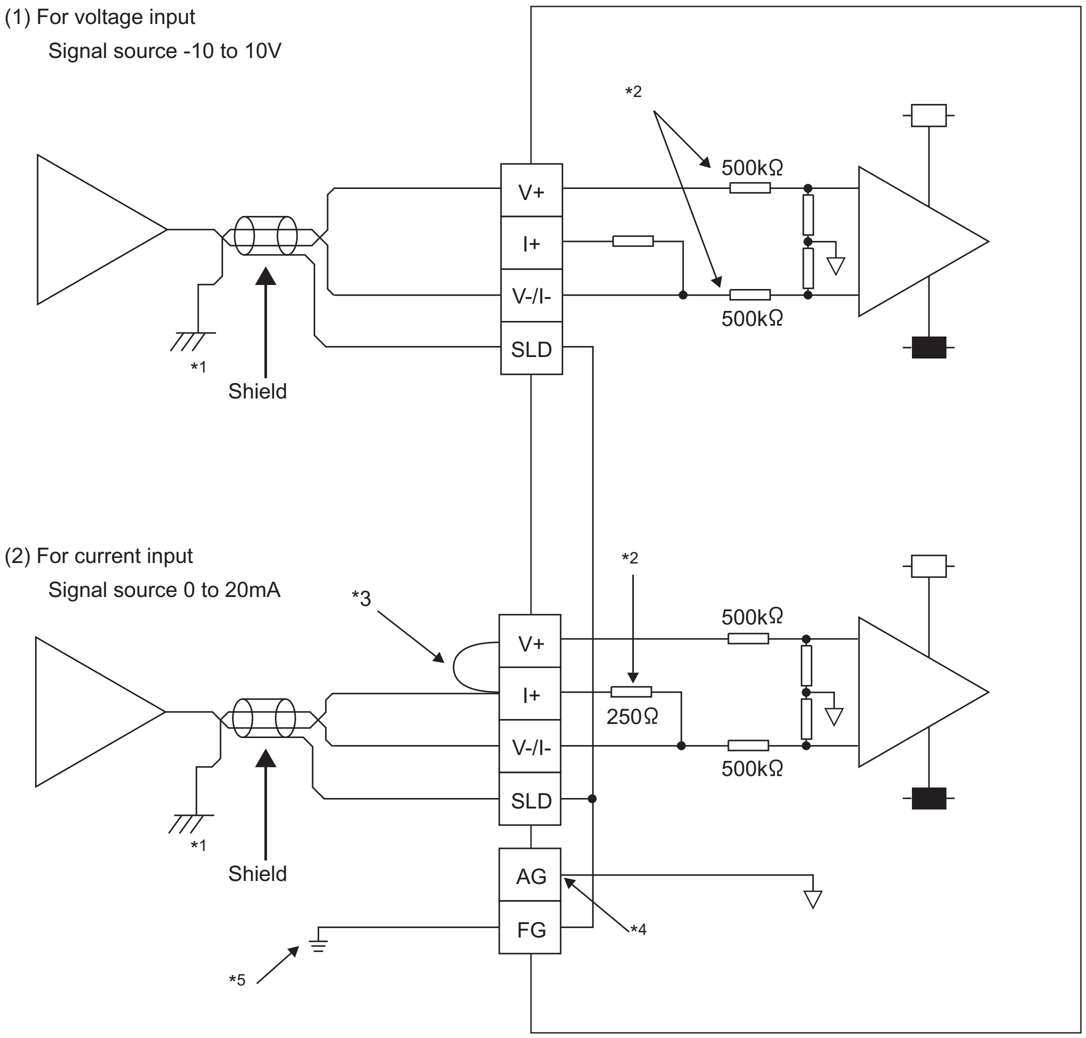

CH1
CH2
CH3
CH4
CH1 V+
CH1 V-/I-
CH1 I+
SLD
CH2 V+
CH2 V-/I-
CH2 I+
SLD
CH3 V+
CH3 V-/I-
CH3 I+
SLD
CH4 V+
CH4 V-/I-
CH4 I+
SLD
AG
FG

(b) For the current input


CH1
CH2
CH3
CH4
CH1 V+
CH1 V-/I-
CH1 I+
SLD
CH2 V+
CH2 V-/I-
CH2 I+
SLD
CH3 V+
CH3 V-/I-
CH3 I+
SLD
CH4 V+
CH4 V-/I-
CH4 I+
SLD
AG
FG

6.4 External Wiring

The following describes the external wiring.


(1) For voltage input
Signal source -10 to 10V
*2
500kΩ
V+
I+
V-/I-
SLD
500kΩ
*1
Shield
(2) For current input
Signal source 0 to 20mA
*3
*2
500kΩ
V+
I+
250Ω
V-/I-
500kΩ
SLD
*1
Shield
AG
FG
*4
*5

*1 For the wire, use the shielded twisted pair cable.

*2 This indicates the input resistance of the A/D converter module.

*3 For the current input, always connect the terminals (V+) and (I+).

*4 If there are potential differences between the AG terminal and GND of the external device, connect the AG terminal to the GND of the external device.

*5 Always connect the shielded wire for each channel to the shield terminal (SLD) and ground the FG terminal (FG). In addition, ground the FG terminal of the power supply module.

Point

In unused channels, if the circuit between two terminals is kept open, an undefined digital value may be output.
To prevent this phenomenon, perform any of the following measures.

- Set the A/D conversion enable/disable setting in the unused channel to disable.
  Note that changing the A/D conversion enable/disable setting from A/D conversion enable to A/D conversion disable reduces the sampling time.
- Short-circuit the input terminal (V+) and (V-) of the unused channel.

CHAPTER 7 VARIOUS SETTINGS

This chapter describes the setting procedures of the A/D converter module.

Point

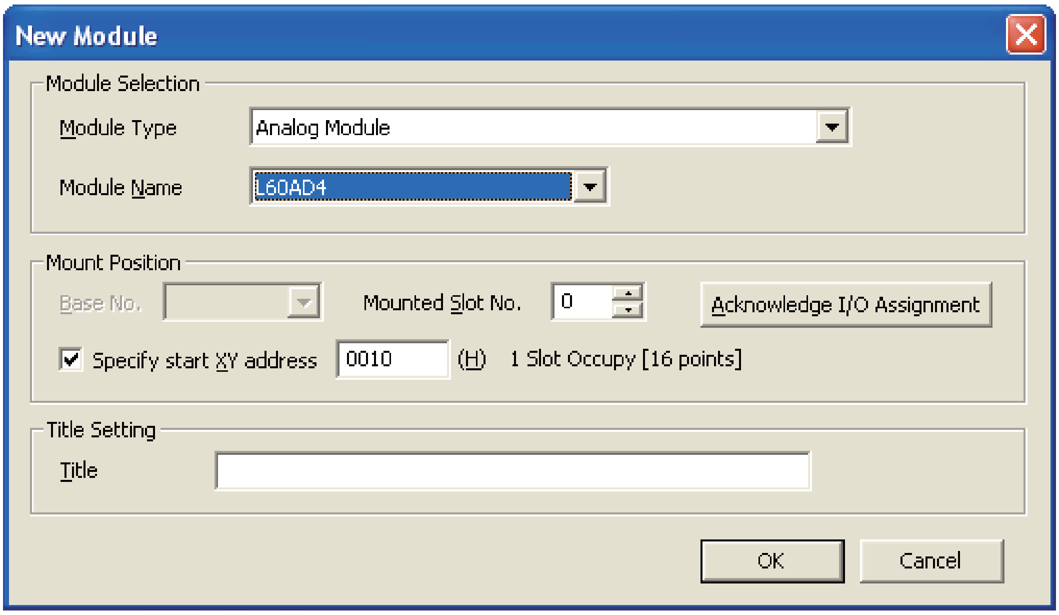
After writing the contents of new module, switch settings, parameter settings and auto refresh settings into the CPU module, reset the CPU module, switch STOP → RUN → STOP → RUN, or switch ON the power supply, to validate the setting contents.

7.1 Addition of Modules

Add the model name of A/D converter modules to use on the project.

(1) Addition procedure

Project window ⇨ [Intelligent Function Module] ⇨ "New Module"



New Module

Module Selection

Module Type: Analog Module

Module Name: L60AD4

Mount Position

Base No.:

Mounted Slot No.: 0

☑ Specify start XY address: 0010 (H) 1 Slot Occupy [16 points]

Title Setting

Title:

Item		Description
Module Selection	Module Type	Set "Analog Module".
	Module Name	Select the name of the module to connect.
Mount Position	Mounted Slot No.	Set the slot No. where the module is connected.
	Specify start X/Y address	The start I/O number (hexadecimal) of the target module is set, according to the slot No. Setting any start I/O number is also possible.
Title Setting	Title	Set any title.

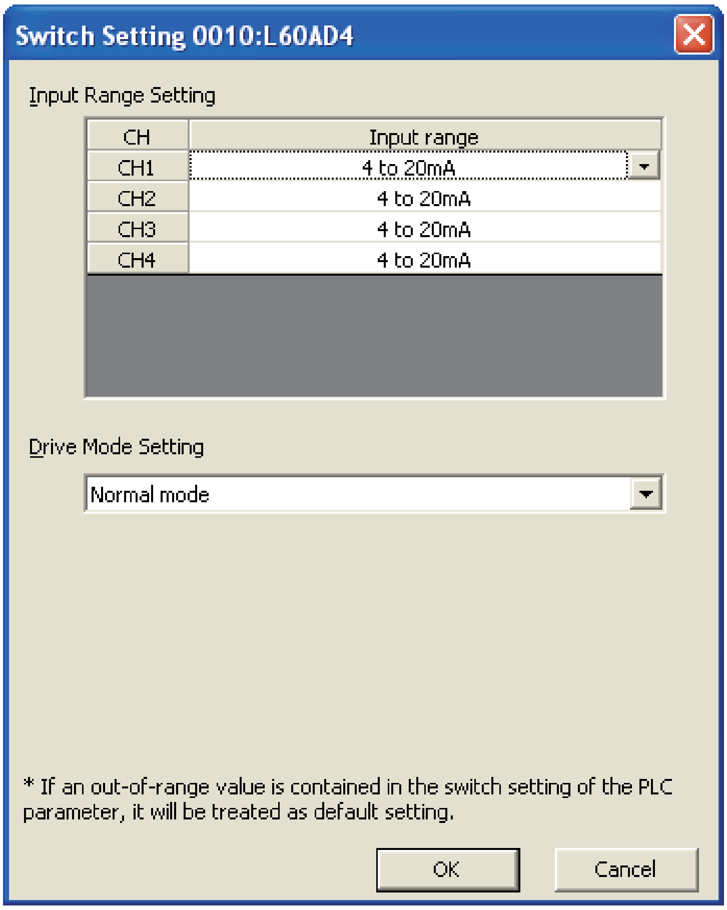
7.2 Switch Setting

Set the operation mode and the input range used in each CH.

(1) Setting procedure

Set from "Switch Setting" in the project window.

Project window ➪ [Intelligent Function Module] ➪ module name ➪ "Switch Setting"



Switch Setting 0010:L60AD4

Input Range Setting

CH	Input range
CH1	4 to 20mA
CH2	4 to 20mA
CH3	4 to 20mA
CH4	4 to 20mA

Drive Mode Setting: Normal mode

* If an out-of-range value is contained in the switch setting of the PLC parameter, it will be treated as default setting.

Item	Description	Setting value
Input Range Setting	Set the input range used in each CH.	• 4 to 20mA (default value) • 0 to 20mA • 1 to 5V • 0 to 5V • -10 to 10V • 0 to 10V • User range setting
Operation Mode Setting	Set the operation mode of the A/D converter module.	• Normal mode (default value) • Offset/gain setting mode

7.3 Parameter Setting

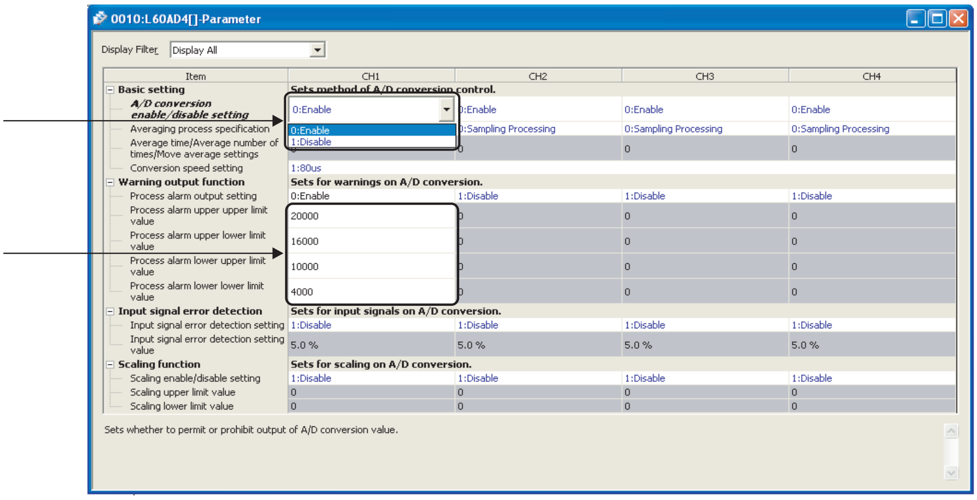
Set the parameters of each CH.

(1) Setting procedure

Set from "Parameter" in the project window.

1. Start "Parameter" from the project window.

Project window ➪ [Intelligent Function Module] ➪ module name ➪ "Parameter"



Pull-down list type

Text box type

0010:L60AD4[]-Parameter

Display Filter: Display All

Item	CH1	CH2	CH3	CH4
Basic setting	**Sets method of A/D conversion control.**			
A/D conversion enable/disable setting	0:Enable	0:Enable	0:Enable	0:Enable
Averaging process specification	0:Enable 1:Disable	0:Sampling Processing	0:Sampling Processing	0:Sampling Processing
Average time/Average number of times/Move average settings	0	0	0	0
Conversion speed setting	1:80us			
Warning output function	**Sets for warnings on A/D conversion.**			
Process alarm output setting	0:Enable	1:Disable	1:Disable	1:Disable
Process alarm upper upper limit value	20000	0	0	0
Process alarm upper lower limit value	16000	0	0	0
Process alarm lower upper limit value	10000	0	0	0
Process alarm lower lower limit value	4000	0	0	0
Input signal error detection	**Sets for input signals on A/D conversion.**			
Input signal error detection setting	1:Disable	1:Disable	1:Disable	1:Disable
Input signal error detection setting value	5.0 %	5.0 %	5.0 %	5.0 %
Scaling function	**Sets for scaling on A/D conversion.**			
Scaling enable/disable setting	1:Disable	1:Disable	1:Disable	1:Disable
Scaling upper limit value	0	0	0	0
Scaling lower limit value	0	0	0	0

Sets whether to permit or prohibit output of A/D conversion value.

2. Double-click the item to change the setting, and input the setting value.

- Items to input from the pull-down list

  Double-click the item to set, to display the pull-down list. Select the item.

- Items to input from the text box

  Double-click the item to set, and input the setting value.

3. Set CH2 to CH4 with the operation in step 2.

Item		Setting value		Reference
Basic setting	A/D conversion enable/disable setting	0: Enable (default value) 1: Disable		Page 48, Section 8.2
	Averaging process specification	0: Sampling Processing (default value) 1: Time Average 2: Count Average 3: Moving Average		Page 48, Section 8.3
	Average time/Average number of times/Move average settings	Average time	20μs: 2 to 1500ms (default value: 0) 80μs, 1ms: 2 to 5000ms (default value: 0)	
		Average number of times	4 to 62500 times (default value: 0)	
		Move average settings	2 to 1000 times (default value: 0)	
	Conversion speed setting	0: 20μs 1: 80μs (default value) 2: 1ms		Page 52, Section 8.4
Warning output function	Process alarm output setting	0: Enable 1: Disable (default value)		Page 56, Section 8.7
	Process alarm upper upper limit value	-32768 to 32767 (default value: 0)		
	Process alarm upper lower limit value	-32768 to 32767 (default value: 0)		
	Process alarm lower upper limit value	-32768 to 32767 (default value: 0)		
	Process alarm lower lower limit value	-32768 to 32767 (default value: 0)		
Input signal error detection	Input signal error detection setting	0: Enable 1: Disable (default value)		Page 53, Section 8.6
	Input signal error detection setting value	0 to 25.0% (default value: 5.0%)		
Scaling function	Scaling enable/disable setting	0: Enable 1: Disable (default value)		Page 59, Section 8.8
	Scaling upper limit value	-32000 to 32000 (default value: 0)		
	Scaling lower limit value	-32000 to 32000 (default value: 0)		

7.4 Auto Refresh

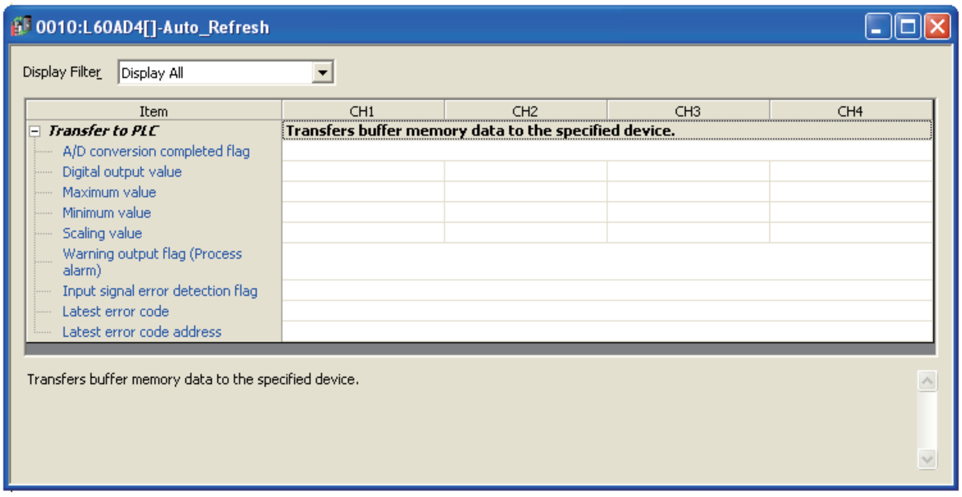
This function transfers data in the buffer memory to specified devices.

(1) Setting procedure

1. Start "Auto_Refresh" from the project window.

Project window ➪ [Intelligent Function Module] ➪ module name ➪ "Auto_Refresh"

2. Click the item to setup, and input the auto refresh target device.



0010:L60AD4[]-Auto_Refresh

Display Filter: Display All

Item	CH1	CH2	CH3	CH4
Transfer to PLC	**Transfers buffer memory data to the specified device.**			
A/D conversion completed flag				
Digital output value				
Maximum value				
Minimum value				
Scaling value				
Warning output flag (Process alarm)				
Input signal error detection flag				
Latest error code				
Latest error code address				

Transfers buffer memory data to the specified device.

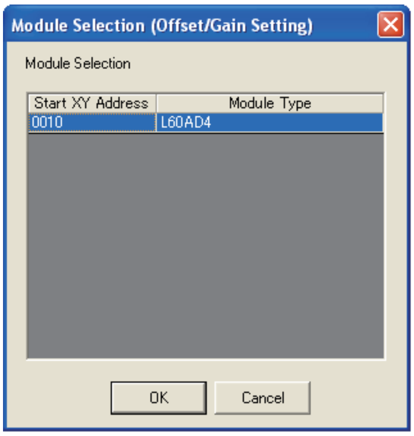
7.5 Offset/Gain Setting

When using the user range setting, configure the offset/gain setting with the following operations.
When using factory default settings, the offset/gain is not required.

(1) Setting procedure

[Tool] ➪ [Intelligent Function Module Tool] ➪ [Analog Module] ➪ [Offset/gain setting]

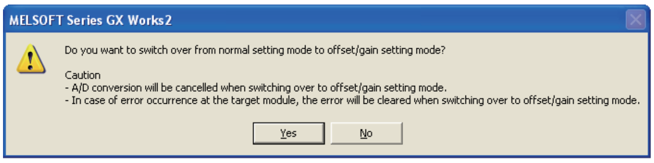
1. **Select the module to configure the offset/gain setting, and click the OK button.**


Module Selection (Offset/Gain Setting)
Module Selection
OK
Cancel

Start XY Address	Module Type
0010	L60AD4

↓

2. **Click the Yes button.**

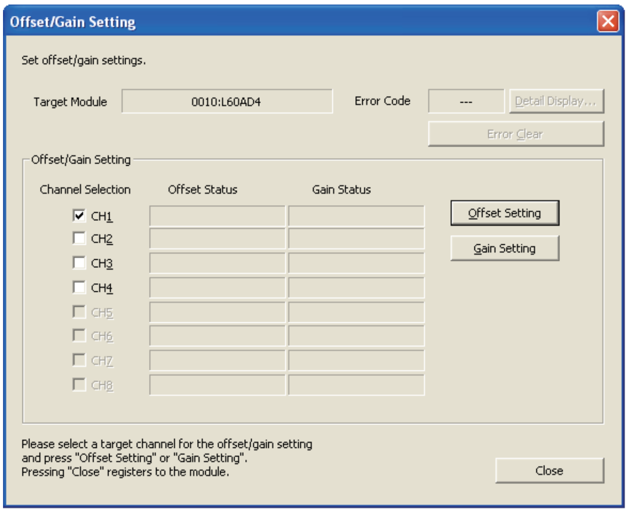

MELSOFT Series GX Works2
Yes
No

Do you want to switch over from normal setting mode to offset/gain setting mode?

Caution
- A/D conversion will be cancelled when switching over to offset/gain setting mode.
- In case of error occurrence at the target module, the error will be cleared when switching over to offset/gain setting mode.

↓

3. **Select the channel to use the offset/gain setting, and click the Offset Setting button.**

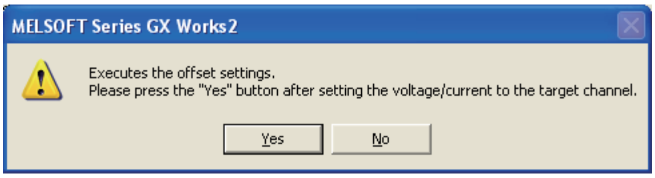

Offset/Gain Setting
Set offset/gain settings.
Detail Display...
Error Clear
Offset/Gain Setting
Channel Selection
Offset Status
Gain Status
☑ CH1
☐ CH2
☐ CH3
☐ CH4
☐ CH5
☐ CH6
☐ CH7
☐ CH8
Offset Setting
Gain Setting
Close

Target Module: 0010:L60AD4
Error Code: ---

Please select a target channel for the offset/gain setting
and press "Offset Setting" or "Gain Setting".
Pressing "Close" registers to the module.

↓

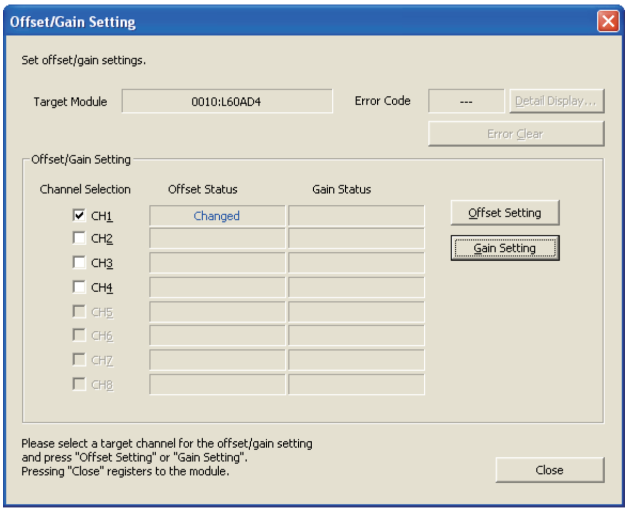
4. Input the offset value voltage or current in the target channel terminal, and click the Yes button.


MELSOFT Series GX Works2

Executes the offset settings.
Please press the "Yes" button after setting the voltage/current to the target channel.

↓

5. Check if "Offset Status" is changed to "Changed", and click the Gain Setting button.


Offset/Gain Setting

Set offset/gain settings.

Target Module: 0010:L60AD4
Error Code: ---

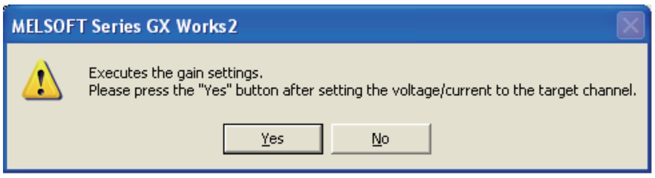
Offset/Gain Setting

Channel Selection	Offset Status	Gain Status
☑ CH1	Changed	
☐ CH2		
☐ CH3		
☐ CH4		
☐ CH5		
☐ CH6		
☐ CH7		
☐ CH8		

Please select a target channel for the offset/gain setting
and press "Offset Setting" or "Gain Setting".
Pressing "Close" registers to the module.

↓

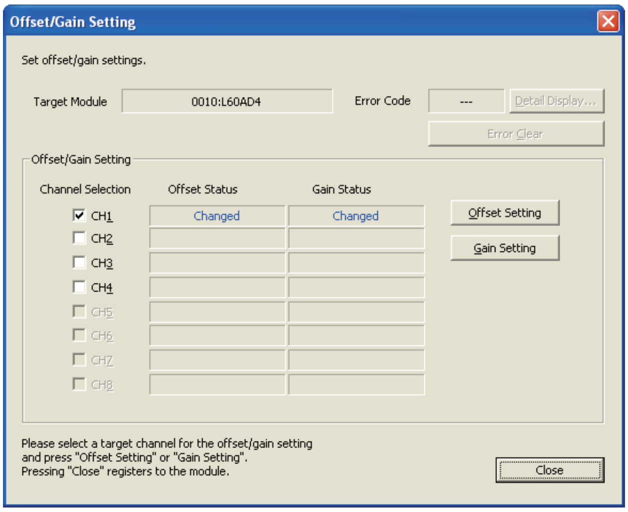
6. Input the gain value voltage or current in the target channel terminal, and click the Yes button.


MELSOFT Series GX Works2

Executes the gain settings.
Please press the "Yes" button after setting the voltage/current to the target channel.

↓

7. Check if "Gain Status" is changed to "Changed", and click the Close button.


Offset/Gain Setting

Set offset/gain settings.

Target Module: 0010:L60AD4
Error Code: ---

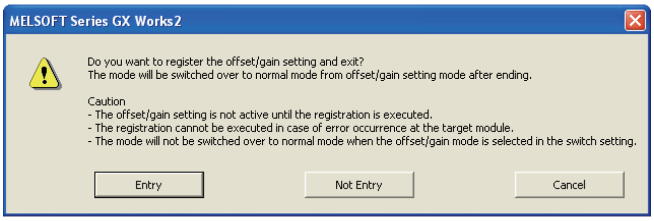
Offset/Gain Setting

Channel Selection	Offset Status	Gain Status
☑ CH1	Changed	Changed
☐ CH2		
☐ CH3		
☐ CH4		
☐ CH5		
☐ CH6		
☐ CH7		
☐ CH8		

Please select a target channel for the offset/gain setting
and press "Offset Setting" or "Gain Setting".
Pressing "Close" registers to the module.

↓

8. **Click the** Entry **button.**


MELSOFT Series GX Works2

Do you want to register the offset/gain setting and exit?
The mode will be switched over to normal mode from offset/gain setting mode after ending.

Caution
- The offset/gain setting is not active until the registration is executed.
- The registration cannot be executed in case of error occurrence at the target module.
- The mode will not be switched over to normal mode when the offset/gain mode is selected in the switch setting.

↓

End

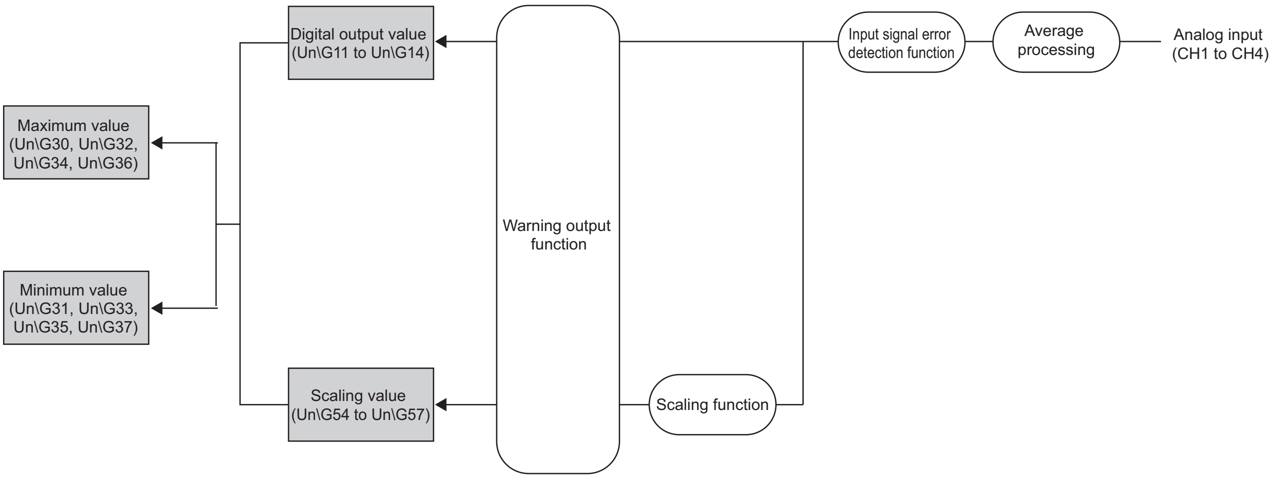
CHAPTER 8 FUNCTIONS

This chapter describes the details of the functions available in the A/D converter module, and the setting procedures for those functions.
For details on I/O signals and buffer memory, refer to the following.

- Details of I/O signals (☞ Page 95, Appendix 1)
- Details of buffer memory addresses (☞ Page 102, Appendix 2)

8.1 Digital Data Details

The functions are processed in the order shown below. If multiple functions are enabled, the output of the first processed function is used as the input of the next function.


Digital output value
(Un\G11 to Un\G14)
Maximum value
(Un\G30, Un\G32, Un\G34, Un\G36)
Minimum value
(Un\G31, Un\G33, Un\G35, Un\G37)
Scaling value
(Un\G54 to Un\G57)
Warning output function
Scaling function
Input signal error detection function
Average processing
Analog input
(CH1 to CH4)

(1) Digital output values

These are digital values after sampling processing or averaging processing has been performed.

(2) Scaling values

Values obtained by performing scale conversion on the digital output values are stored.

(3) Maximum and minimum values

Maximum and minimum values of the digital output values are stored.
However, if the scaling function is enabled, they are updated with the values from scale conversion.

Point

If averaging processing (time average/count average) is performed, the digital values are stored per averaging process cycle.

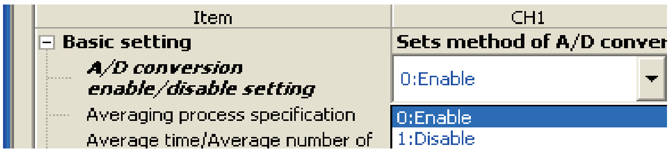
8.2 A/D Conversion Enable/Disable Function

Sets whether to enable or disable A/D conversion for each channel.
By disabling A/D conversion for the channels you are not using, the conversion cycle can be reduced.

(1) Setting procedure

Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ➪ [Intelligent Function Module] ➪ module name ➪ [Parameter]



Item	CH1
Basic setting	Sets method of A/D conver
A/D conversion enable/disable setting	0:Enable
Averaging process specification	0:Enable 1:Disable
Average time/Average number of	

8.3 A/D Conversion Method

Sets whether to perform sampling processing or averaging processing for each channel.

(1) Sampling processing

Sequentially performs A/D conversion on the analog input values and stores the digital output values to the buffer memory.

Point

The conversion cycle is calculated by "conversion speed setting x number of conversion enabled channels".
Conversion can be enabled or disabled per channel, allowing you to reduce the conversion cycle by disabling A/D conversion for the channels that are not used.

Ex. If the number of channels used (number of channels for which A/D conversion is enabled) is three channels total (CH1 to CH3), and the conversion speed is set to medium speed, CH1 Digital output value (Un\G11) to CH3 Digital output value (Un\G13) are updated every 240 μs.

80 × 3 = 240 (μs)

For details on conversion speed setting, refer to the following.

- Conversion Speed Setting (☞ Page 52, Section 8.4)

(2) Averaging processing

Performs averaging processing on the digital output values for each channel, and stores the average values to the buffer memory.
There are three processes in averaging processing, as follows:

- Time average
- Count average
- Moving average

(a) Time average

Performs A/D conversion for a set time, averages the total without the maximum and minimum values, and stores the average value to the buffer memory.
The processing count within the setting time varies depending on the number of channels used (number of channels for which A/D conversion is enabled).

$$\text{Number of processing times} = \frac{\text{Set period of time}}{(\text{Number of channels used} \times \text{Conversion speed})}$$

Ex. The processing count for the following settings is calculated below:

Item	Setting
Number of channels used (number of channels for which A/D conversion is enabled)	4 channels (CH1 to CH4)
Conversion speed	20 μs
Setting time	15 ms

$$\frac{15}{(4 \times 0.02)} = 187.5 \text{ (times)} \cdots \text{Drop the fractional part}$$

→ Time is measured 187 times and the averaged value is output.

Point

The valid lower limit setting value for the time average is calculated by "(minimum processing count of 4) x (conversion speed) × (number of channels used)".

Ex. If a maximum of 4 channels are used (conversion speed: low speed):

4 × 1.0 × 4 = 16 ms

If the processing count becomes less than 4 due to the setting time, an error occurs (error code: 20□), and a digital output value comes out to 0 (zero).

(b) Count average

Performs A/D conversion a set number of times, averages the total without the maximum and minimum values, and stores the average value to the buffer memory.
The time it takes for the count average value to be stored to the buffer memory varies depending on the number of channels used (number of channels for which A/D conversion is enabled).

$$\text{Processing time} = \text{Preset count} \times (\text{Number of channels used} \times \text{Conversion speed})$$

Ex. The processing time for the following settings is calculated below:

Item	Setting
Number of channels used (number of channels for which A/D conversion is enabled)	4 channels (CH1 to CH4)
Conversion speed	80 μs
Set number of times	20 times

20 × (4 x 0.08) = 6.4 (ms) → An average value is output every 6.4 ms.

Point

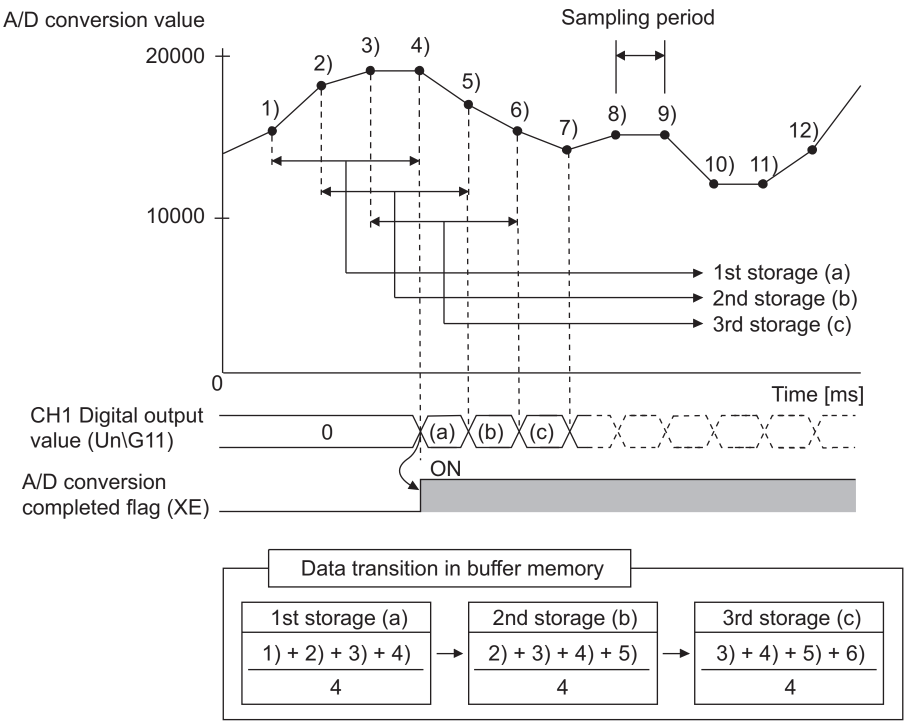
Because the count average requires a sum of at least two counts, not counting the maximum and minimum values, the set number of times should be set to 4 or more.

(c) Moving average

Takes the average of digital output values sampled over a set number of sampling time intervals, and stores it to the buffer memory.

Since the averaging processing is performed on a moving set of samples, the most current digital output values can be obtained.

The moving average processing for a set number of times of 4 is shown below:

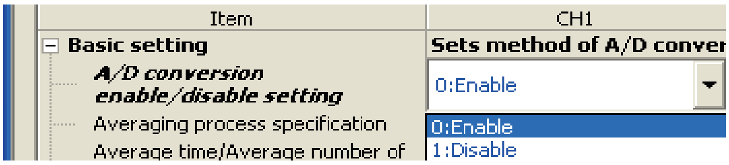

A/D conversion value
Sampling period
20000
10000
0
1)
2)
3)
4)
5)
6)
7)
8)
9)
10)
11)
12)
1st storage (a)
2nd storage (b)
3rd storage (c)
Time [ms]
CH1 Digital output value (Un\G11)
0
(a)
(b)
(c)
A/D conversion completed flag (XE)
ON
Data transition in buffer memory
1st storage (a)
1) + 2) + 3) + 4)
4
2nd storage (b)
2) + 3) + 4) + 5)
4
3rd storage (c)
3) + 4) + 5) + 6)
4

(3) Setting procedure

(a) Sampling processing

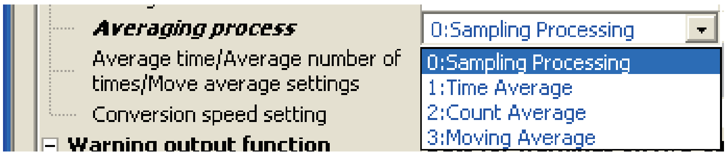
1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

Project window ➪ [Intelligent Function Module] ➪ module name ➪ [Parameter]



Item	CH1
Basic setting	**Sets method of A/D conver**
A/D conversion enable/disable setting	0:Enable
Averaging process specification	0:Enable
Average time/Average number of	1:Disable

2. **For "Average process specification", select "0: Sampling Processing".**



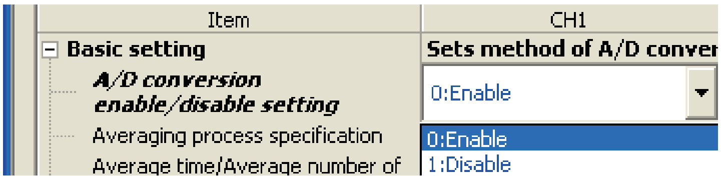
Averaging process	0:Sampling Processing
Average time/Average number of times/Move average settings	0:Sampling Processing 1:Time Average 2:Count Average
Conversion speed setting	3:Moving Average
Warning output function	

(b) Averaging processing

Ex. To select "1: Time" for "Averaging process specification":

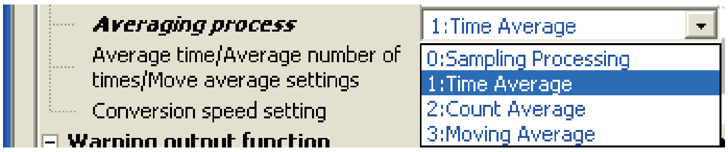
1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

Project window ➪ [Intelligent Function Module] ➪ module name ➪ [Parameter]



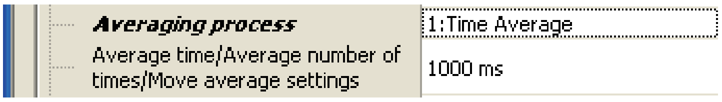
Item	CH1
Basic setting	Sets method of A/D conver
A/D conversion enable/disable setting	0:Enable
Averaging process specification	
Average time/Average number of	

2. **For "Averaging process specification", select "1: Time Average".**



Averaging process	1:Time Average
Average time/Average number of times/Move average settings	
Conversion speed setting	
Warning output function	

3. **For "Average time/Average number of times/Move average settings", enter the following:**



Averaging process	1:Time Average
Average time/Average number of times/Move average settings	1000 ms

Setting item	Conversion speed	Setting range
Average time	20 µs	2 to 1500 ms
	80 µs, 1 ms	2 to 5000 ms
Average number of times	20 µs, 80 µs, 1 ms	4 to 62500 times
Move average settings	20 µs, 80 µs, 1 ms	2 to 1000 times

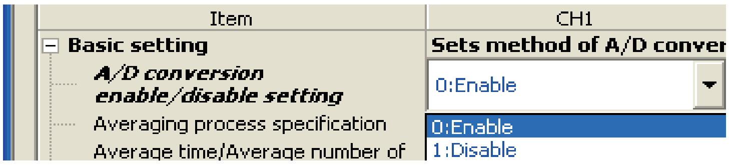
8.4 Conversion Speed Switch Function

You can select from three conversion speeds:

- High speed: 20 µs/channel
- Medium speed: 80 µs/channel
- Low speed: 1 ms/channel

(1) Setting procedure

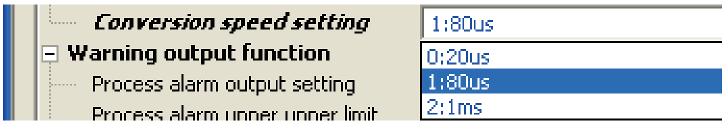
1. **Set "A/D conversion enable/disable setting" to "0: Enable".**



Item	CH1
Basic setting	**Sets method of A/D conver**
A/D conversion enable/disable setting	0:Enable
Averaging process specification	0:Enable
Average time/Average number of	1:Disable

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]

2. **For "Conversion speed setting", select the appropriate conversion speed.**



Conversion speed setting	1:80us
Warning output function	0:20us
Process alarm output setting	1:80us
Process alarm upper upper limit	2:1ms

8.5 Maximum and Minimum Values Hold Function

Stores the maximum and minimum digital output values (scaling value) for each channel to the buffer memory.
If averaging processing is specified, the values are updated per averaging process cycle. Otherwise they are updates per sampling cycle.
For a list of buffer memory addresses to which the values are stored, refer to the following.

- Buffer Memory Assignment List (☞ Page 24, Section 3.5)

(1) Resetting maximum and minimum values

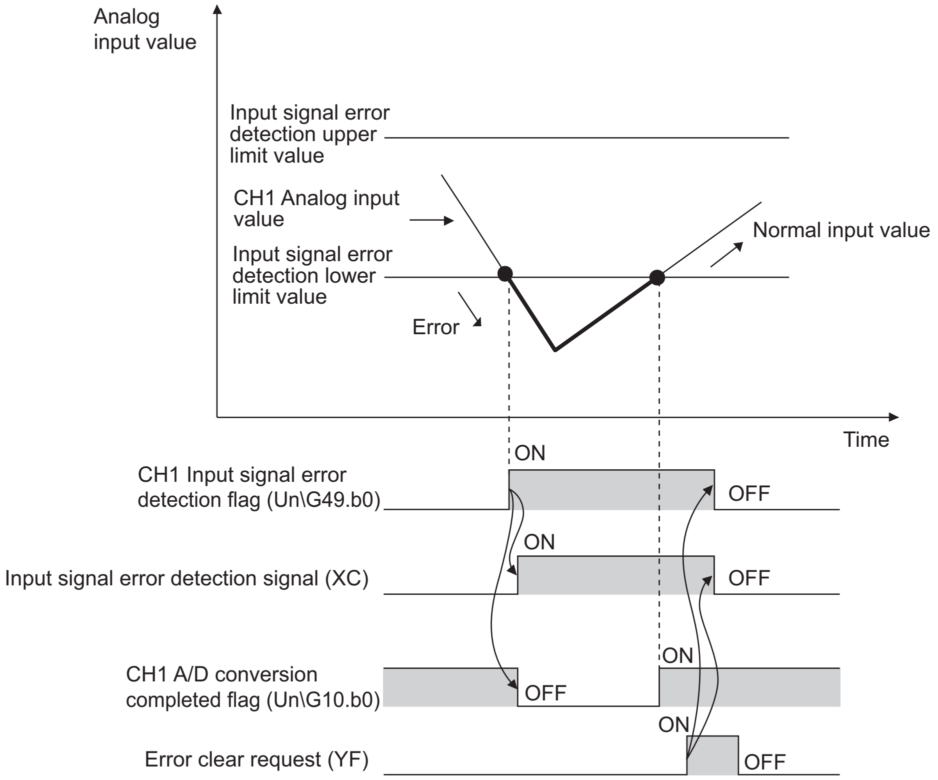
Switching Maximum value/minimum value reset request (YD) or Operating condition setting request (Y9) from OFF → ON → OFF updates the maximum and minimum values with the current values.

(2) If the scaling function is enabled

If the scaling function is enabled, maximum and minimum scaling values are stored.

8.6 Input Signal Error Detection Function

Detects any analog input value that is outside the setting range.

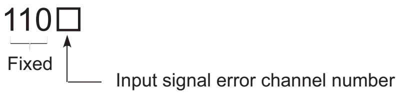

Analog input value
Input signal error detection upper limit value
CH1 Analog input value
Input signal error detection lower limit value
Normal input value
Error
Time
CH1 Input signal error detection flag (Un\G49.b0)
ON
OFF
Input signal error detection signal (XC)
ON
OFF
CH1 A/D conversion completed flag (Un\G10.b0)
OFF
ON
Error clear request (YF)
ON
OFF

(1) Notification of input signal error detection

If the analog input value is above the input signal error detection upper limit value, or below the input signal error detection lower limit value, the error is notified by Input signal error detection flag (Un\G49), Input signal error detection signal (XC), and the flashing ALM LED.

In addition, alarm code 110□ gets stored in Latest error code (Un\G19).

The alarm code that is stored is shown below:


110□
Fixed
Input signal error channel number

(2) Operation of the input signal error detection function

The digital output value on the channel on which the error was detected is held at the value just before the error was detected, and A/D conversion completed flag (Un\G10) and A/D conversion completed flag (XE) are turned OFF.

In addition, once the analog input value returns within the setting range, A/D conversion resumes regardless of the reset of Input signal error detection flag (Un\G49) and Input signal error detection signal (XC). After the first update, A/D conversion completed flag (Un\G10) for this channel turns back ON. (ALM LED remains flashing.)

(3) Detection cycle

This function is executed per sampling cycle or averaging process cycle.

(4) Clearing the input signal error detection

After the analog input value returns within the setting range, turn Error clear request (YF) OFF → ON → OFF.

When you clear the input signal error detection, the A/D converter module results in the following state:

- Input signal error detection flag (Un\G49) is cleared.
- Input signal error detection signal (XC) turns OFF.
- The ALM LED turns off.
- The alarm code 110□, which is stored in Latest error code (Un\G19), is cleared.

(5) Example of input signal error detection

The formula for calculating the input signal error detection lower limit value is shown below.

Ex. To detect an error when the analog input value becomes lower than 3.84mA for a channel with an input range of 4mA to 20mA:

$$\text{Input signal error detection lower limit value} = \text{Lower limit value of input range to be used} - \left(\text{Gain value of input range to be used} - \text{Offset value of input range to be used}\right) \times \left(\frac{\text{Input signal error detection setting value}}{1000}\right)$$

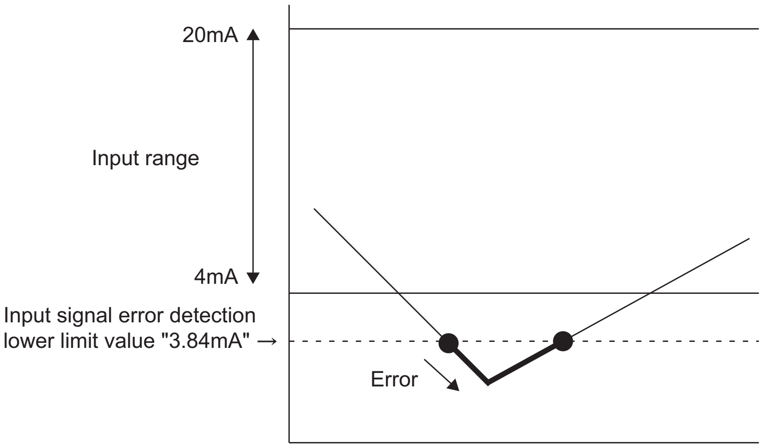
- Input signal error detection lower limit value: 3.84mA
- Offset value: 4.0mA
- Gain value: 20.0mA

$$3.84 = 4.0 - \left(20.0 - 4.0\right) \times \left(\frac{\text{Input signal error detection setting value}}{1000}\right)$$

As a result, the input signal error detection setting value = 10.

Therefore, set the input signal error detection setting value to "10 (1.0%)".

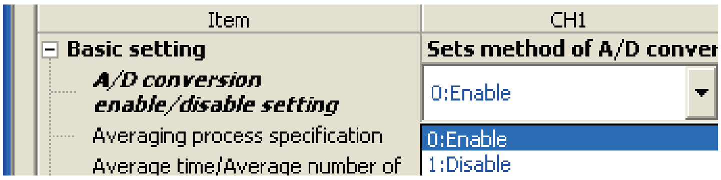
In this case, the operation of the input signal error detection looks like the following:



(6) Setting procedure

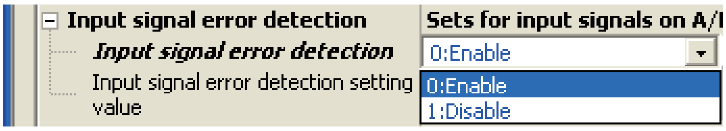
1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



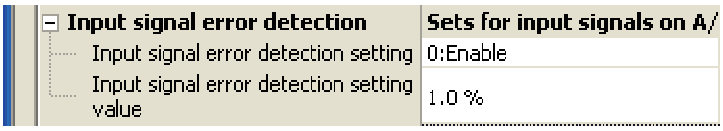
Item | CH1
Basic setting | Sets method of A/D conver
A/D conversion enable/disable setting | 0:Enable
Averaging process specification
Average time/Average number of

2. **Set "Input signal error detection" to "0: Enable".**



Input signal error detection | Sets for input signals on A/I
Input signal error detection | 0:Enable
Input signal error detection setting value

3. **Set a value for "Input signal error detection setting value".**

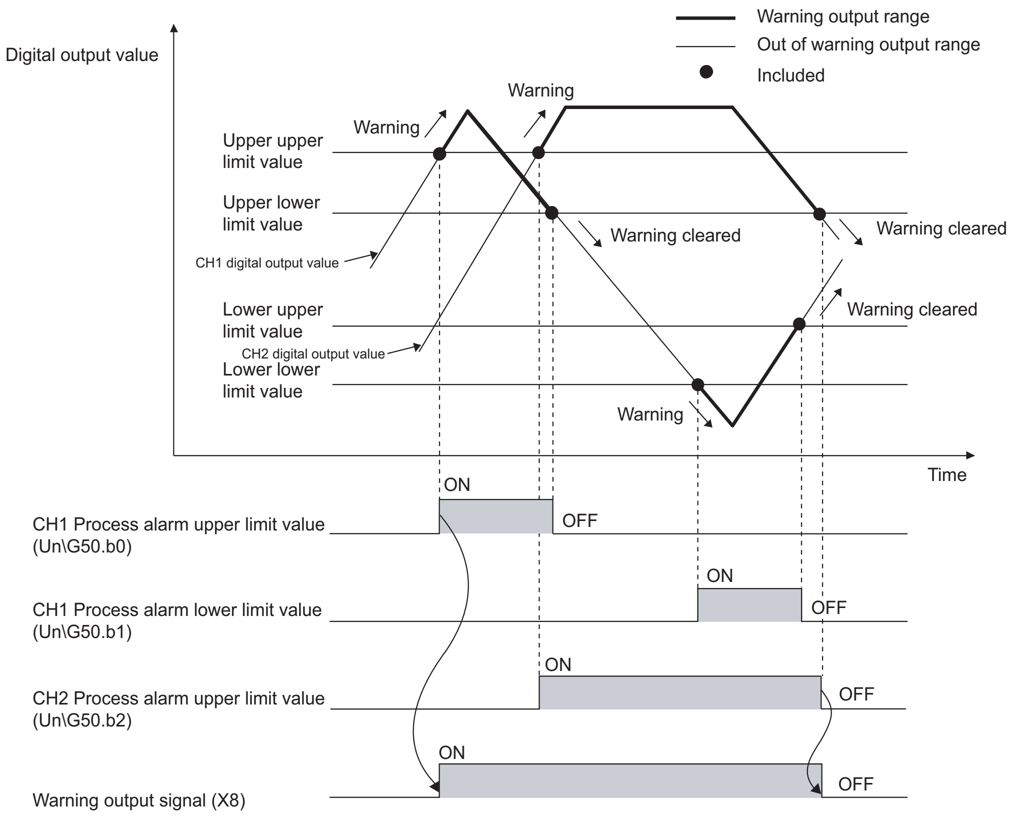


Input signal error detection | Sets for input signals on A/
Input signal error detection setting | 0:Enable
Input signal error detection setting value | 1.0 %

Item	Setting range
Input signal error detection setting	0 to 25.0%

8.7 Warning Output Function (Process Alarm)

Outputs an alarm when the digital output value enters a preset range.

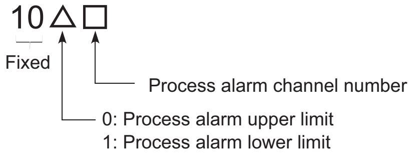

Warning output range
Out of warning output range
Included
Digital output value
Warning
Warning
Upper upper limit value
Upper lower limit value
Warning cleared
Warning cleared
CH1 digital output value
Lower upper limit value
Warning cleared
CH2 digital output value
Lower lower limit value
Warning
Time
ON
CH1 Process alarm upper limit value (Un\G50.b0)
OFF
ON
CH1 Process alarm lower limit value (Un\G50.b1)
OFF
ON
CH2 Process alarm upper limit value (Un\G50.b2)
OFF
ON
Warning output signal (X8)
OFF

(1) Process alarm notification

When the digital output value moves above the process alarm upper upper limit value, or below the process alarm lower lower limit value, thus entering the alarm output range, alarm notifications are made by Warning output flag (Process alarm) (Un\G50), Warning output signal (X8) and the ALM LED turning ON.

In addition, alarm code 10△□ gets stored in Latest error code (Un\G19).

The alarm code that is stored is shown below:


10△□
Fixed
Process alarm channel number
0: Process alarm upper limit
1: Process alarm lower limit

(2) Operation of the Warning output function (Process alarm)

After the alarm is output, once the digital output value returns within the setting range, below the process alarm upper lower limit value and above the process alarm lower upper limit value, a "0" (zero) is stored in the bit position corresponding to the channel number for Warning output flag (Process alarm) (Un\G50).

Once all channels are within the setting range, Warning output signal (X8) and the ALM LED turn OFF.

(3) Detection cycle

When time average is specified, the function is executed per set time (for averaging). When count average is specified, the function is executed per set count (for averaging).

In addition, when sampling processing and moving average processing are specified, the function is executed per sampling time.

(4) Clearing the alarm code

After the digital output value returns within the setting range, turn Error clear request (YF) OFF → ON → OFF.

This clears the alarm code 10△□, which was stored in Latest error code (Un\G19).

(5) If the scaling function is enabled

If Scaling enable/disable setting (Un\G53) is set to "Enable", the alarm output function monitors CH□ Scaling value (Un\G54 to Un\G57) for alarm output.

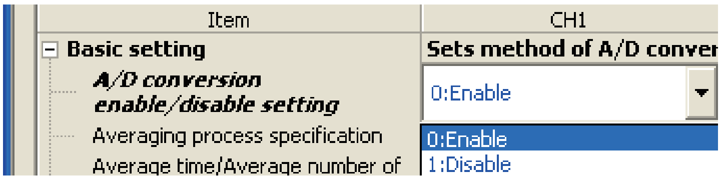
When setting CH1 Process alarm lower lower limit value (Un\86) through CH4 Process alarm upper upper limit value (Un\G101), make sure to specify values that reflect scale conversion.

Item		Digital values monitored for alarm output
Scaling enable/disable setting (Un\G53)	0: Enable	CH□ Scaling value (Un\G54 to Un\G57)
	1: Disable	CH□ Digital output value (Un\G11 to Un\G14)

(6) Setting procedure

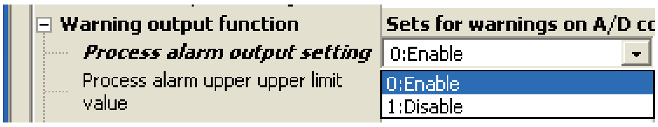
1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

Project window ➪ [Intelligent Function Module] ➪ module name ➪ [Parameter]



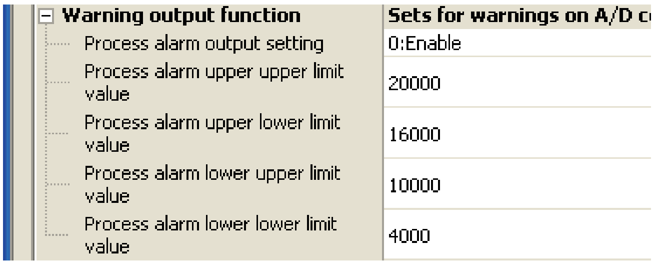
Item	CH1
Basic setting	Sets method of A/D conver
A/D conversion enable/disable setting	0:Enable
Averaging process specification	0:Enable
Average time/Average number of	1:Disable

2. **Set "Process alarm output setting" to "0: Enable".**



Warning output function	Sets for warnings on A/D cc
Process alarm output setting	0:Enable
Process alarm upper upper limit value	0:Enable 1:Disable

3. **Specify the values for "Process alarm upper upper limit", "Process alarm upper lower limit value", "Process alarm lower upper limit value", and "Process alarm lower lower limit value".**



Warning output function	Sets for warnings on A/D c
Process alarm output setting	0:Enable
Process alarm upper upper limit value	20000
Process alarm upper lower limit value	16000
Process alarm lower upper limit value	10000
Process alarm lower lower limit value	4000

Item	Setting range
Process alarm upper upper limit value	-32768 to 32767
Process alarm upper lower limit value	
Process alarm lower upper limit value	
Process alarm lower lower limit value	

Point

Process alarm output settings must meet the following condition:
Process alarm upper upper limit value ≥ Process alarm upper lower limit value ≥ Process alarm lower upper limit value ≥ Process alarm lower lower limit value

8.8 Scaling Function

Performs scale conversion on the digital values that are output. The values are converted in the range between the scaling upper limit value and the scaling lower limit value.
The converted values are stored to CH☐ Scaling value (Un\G54 to Un\G57).

(1) If the input range is set to the factory default setting

Ex. If the input range is set to -10V to 10V:
For the scaling lower limit value, set it to a value corresponding to the lower limit of the input range (-20000), and for the scaling upper limit value, set it to a value corresponding to the upper limit of the input range (20000).

(2) Calculation of the scaling value

(a) If the factory default setting is used for the input range

- When the voltage and current are as follows:
  Voltage: 0V to 10V, 0V to 5V, 1V to 5V
  Current: 0mA to 20mA, 4mA to 20mA

$$\text{Scaling value} = \frac{D_X \times (S_H - S_L)}{D_{Max}} + S_L$$

- When voltage is -10V to 10V

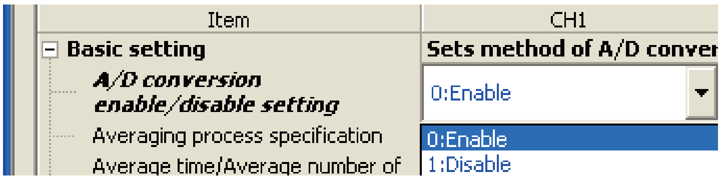
$$\text{Scaling value} = \frac{D_X \times (S_H - S_L)}{D_{Max} - D_{Min}} + \frac{(S_H + S_L)}{2}$$

- D_x : Digital output value
- D_{Max} : Maximum digital output value of the input range used
- D_{Min} : Minimum digital output value of the input range used
- S_H : Scaling upper limit value
- S_L : Scaling lower limit value

(3) Setting procedure

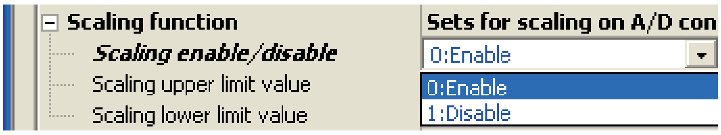
1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

Project window ➪ [Intelligent Function Module] ➪ module name ➪ [Parameter]



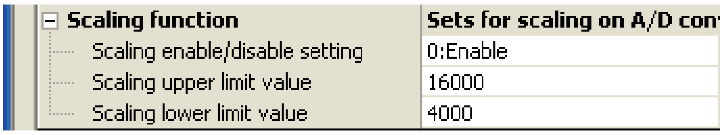
Item	CH1
Basic setting	Sets method of A/D conver
A/D conversion enable/disable setting	0:Enable
Averaging process specification	
Average time/Average number of	

2. **Set "Scaling enable/disable setting" to "0: Enable".**



Scaling function	Sets for scaling on A/D con
Scaling enable/disable	0:Enable
Scaling upper limit value	
Scaling lower limit value	

3. **Set values for "Scaling upper limit value" and "Scaling lower limit value".**



Scaling function	Sets for scaling on A/D con
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

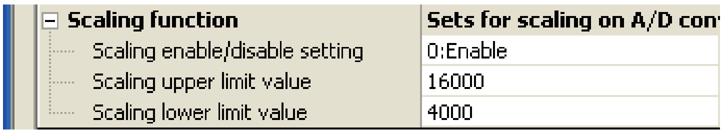
Item	Setting range
Scaling upper limit value	-32000 to 32000
Scaling lower limit value	

Point

- Even if you set the scaling upper limit value and the scaling lower limit value in such a way that the change is larger than the resolution, the resolution will not increase. In addition, the scaling function cannot be used on a channel that is using user range settings.
- Your scaling settings must meet the following condition:
  Scaling upper limit value > Scaling lower limit value

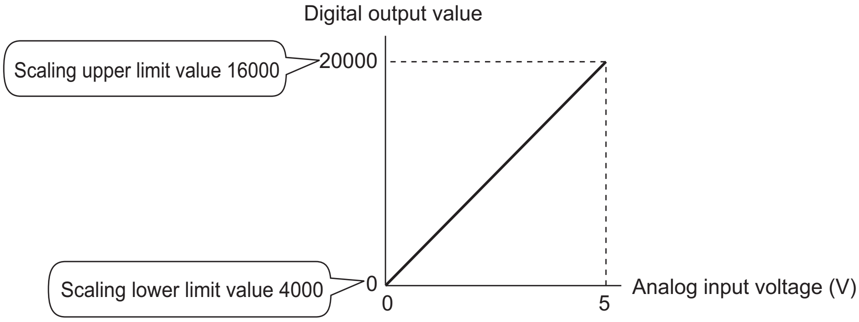
(4) Example of scaling setting

Ex. 1. When setting the "Scaling upper limit value" to "16000" and the "Scaling lower limit value" to "4000" for a channel with input range of 0V to 5V:



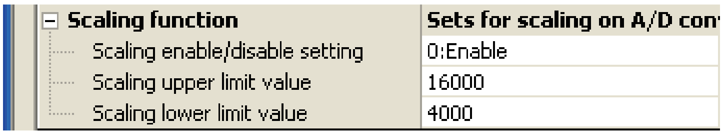
Scaling function	Sets for scaling on A/D con
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

The digital output values and scaling values are as follows:



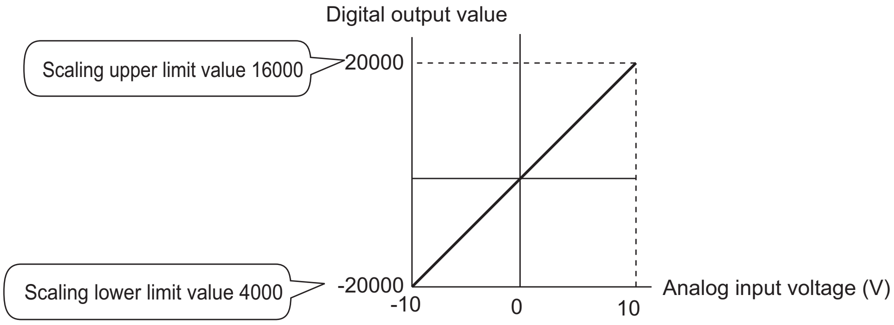
Analog input voltage (V)	Digital output value	Scaling value
0	0	4000
1	4000	6400
2	8000	8800
3	12000	11200
4	16000	13600
5	20000	16000

Ex. 2. When setting the "Scaling upper limit value" to "16000" and the "Scaling lower limit value" to "4000" for a channel with input range of -10V to 10V:



Scaling function	Sets for scaling on A/D con
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

The digital output values and scaling values are as follows:



Analog input voltage (V)	Digital output value	Scaling value
-10	-20000	4000
-5	-10000	7000
0	0	10000
5	10000	13000
10	20000	16000

8.9 Error Log Function

Stores a history of errors and alarms that occurred in the A/D converter module to the buffer memory (Un\G1810 to Un\G1969).
A maximum of 16 errors and alarms can be stored.

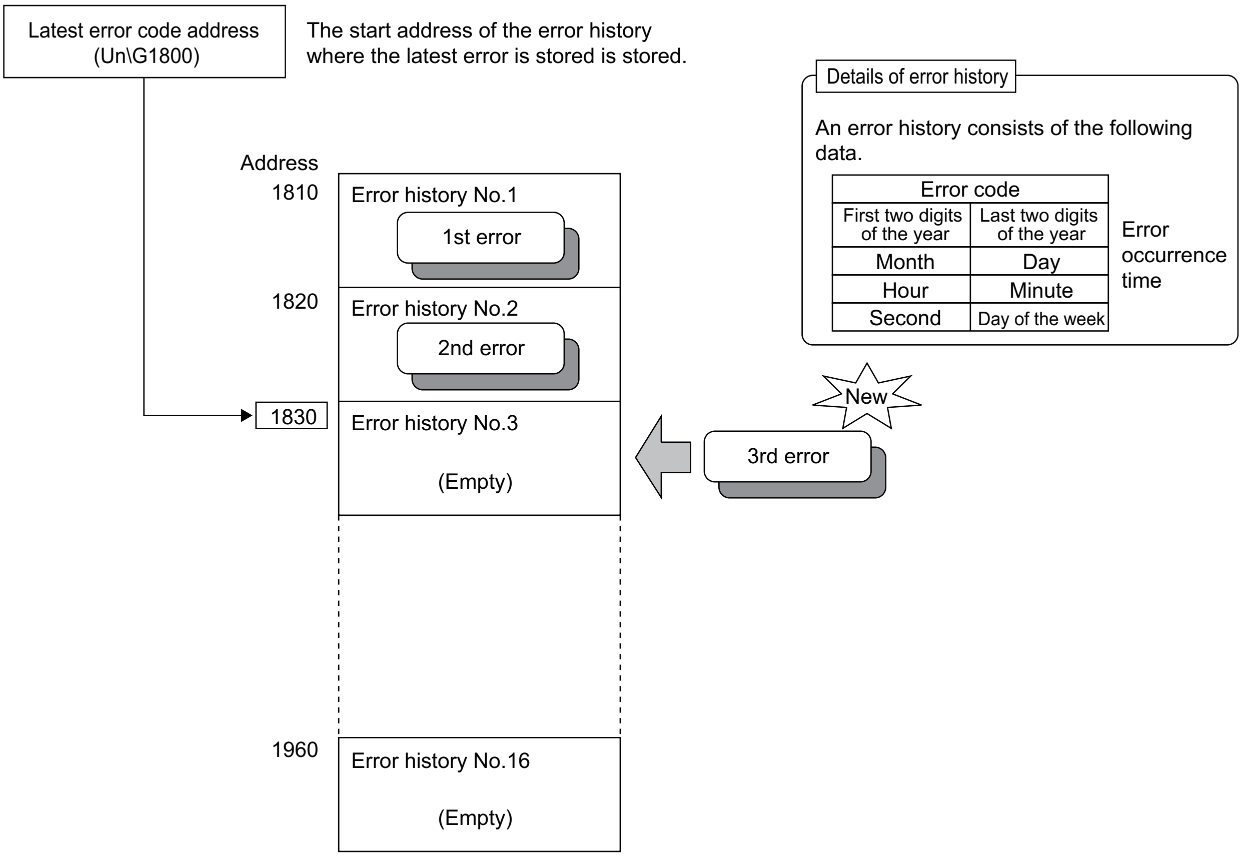
(1) Process of the error log function

The error code and the time of error occurrence are stored in the buffer memory address, starting from error history No.1 (start address Un\G1810) and sequentially thereafter.

(2) Checking error history

You can check the start address of the latest stored error at Latest error code address (Un\G1800)

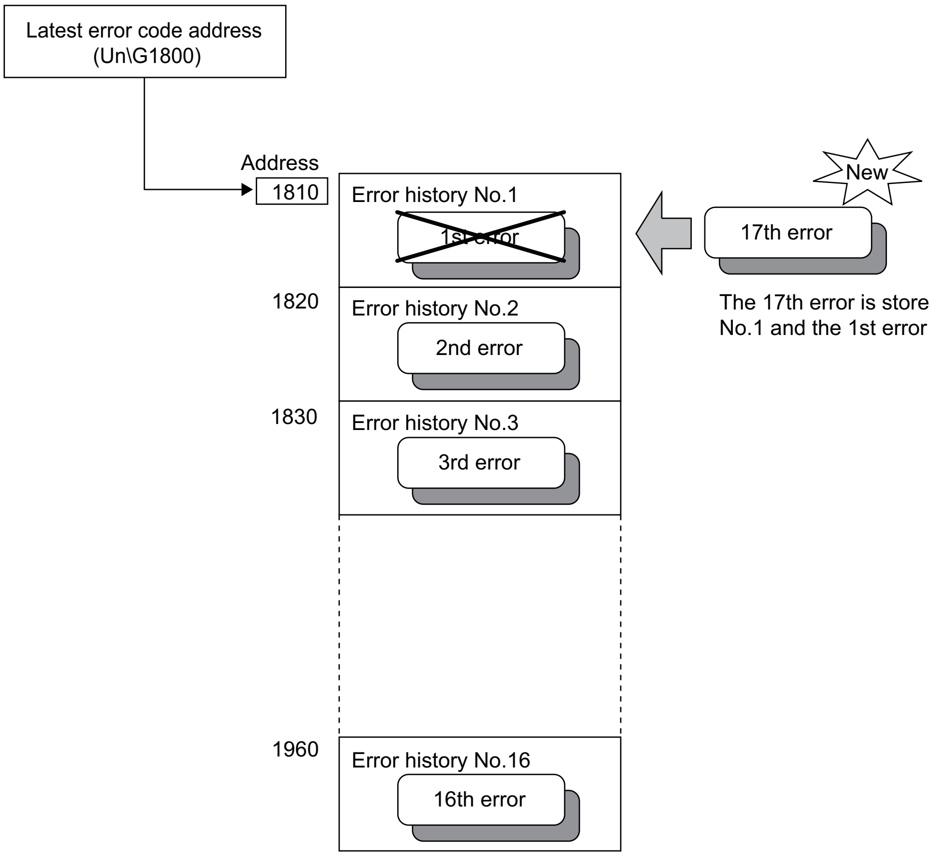
Ex. 1. When the third error occurs:
The third error is stored in error history No.3, and the value "1830" (start address of error history No.3) is stored to Latest error code address (Un\G1800).


Latest error code address (Un\G1800)
The start address of the error history where the latest error is stored is stored.
Address
1810
Error history No.1
1st error
1820
Error history No.2
2nd error
1830
Error history No.3
(Empty)
1960
Error history No.16
(Empty)
New
3rd error
Details of error history
An error history consists of the following data.

Error code		
First two digits of the year	Last two digits of the year	Error occurrence time
Month	Day	
Hour	Minute	
Second	Day of the week	

Ex. 2. When a 17th error occurs:

The 17th error is stored in error history No.1, and the value "1810" (start address of error history No.1) gets stored to Latest error code address (Un\G1800).


Latest error code address (Un\G1800)
Address
1810
Error history No.1
~~1st error~~
1820
Error history No.2
2nd error
1830
Error history No.3
3rd error
1960
Error history No.16
16th error
New
17th error

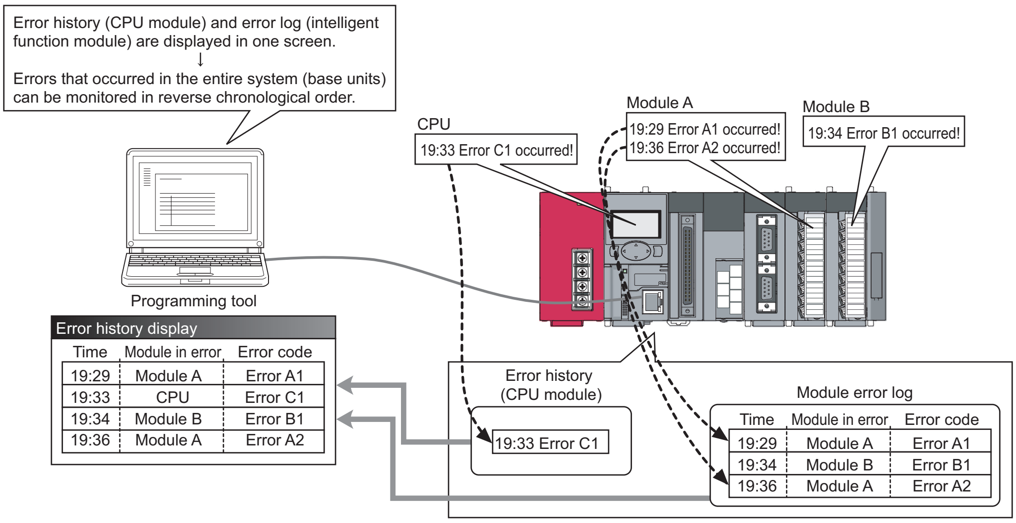
The 17th error is stored in Error history No.1 and the 1st error history will be erased.

Point

- The same process for errors is used when an alarm occurs.
- Once the error history storage area becomes full, subsequent errors will overwrite the previous errors, starting from error history No.1, and continues sequentially thereafter (Un\G1810 to Un\G1819). (The overwritten history is deleted.)
- The stored error history is cleared when power supply is turned OFF, or when the CPU module is reset.

8.10 Module Error Collection Function

Collects the errors and alarms that occurred in the A/D converter module, into the CPU module. By holding the module errors in a memory that can hold data in the event of power failure, the errors can be held even after power-off or reset.



Error history (CPU module) and error log (intelligent function module) are displayed in one screen.
↓
Errors that occurred in the entire system (base units) can be monitored in reverse chronological order.

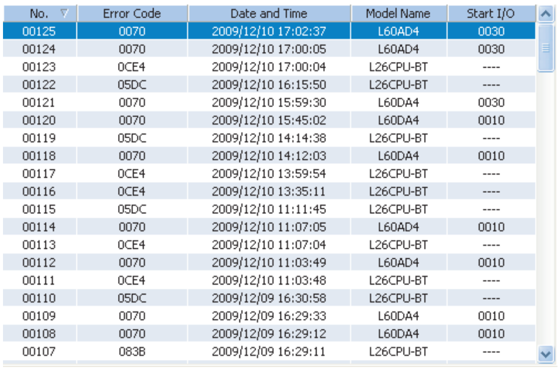
Error history display

Time	Module in error	Error code
19:29	Module A	Error A1
19:33	CPU	Error C1
19:34	Module B	Error B1
19:36	Module A	Error A2

Module error log

Time	Module in error	Error code
19:29	Module A	Error A1
19:34	Module B	Error B1
19:36	Module A	Error A2

[Example of screen display]



No.	Error Code	Date and Time	Model Name	Start I/O
00125	0070	2009/12/10 17:02:37	L60AD4	0030
00124	0070	2009/12/10 17:00:05	L60AD4	0030
00123	0CE4	2009/12/10 17:00:04	L26CPU-BT	----
00122	05DC	2009/12/10 16:15:50	L26CPU-BT	----
00121	0070	2009/12/10 15:59:30	L60DA4	0030
00120	0070	2009/12/10 15:45:02	L60DA4	0010
00119	05DC	2009/12/10 14:14:38	L26CPU-BT	----
00118	0070	2009/12/10 14:12:03	L60DA4	0010
00117	0CE4	2009/12/10 13:59:54	L26CPU-BT	----
00116	0CE4	2009/12/10 13:35:11	L26CPU-BT	----
00115	05DC	2009/12/10 11:11:45	L26CPU-BT	----
00114	0070	2009/12/10 11:07:05	L60AD4	0010
00113	0CE4	2009/12/10 11:07:04	L26CPU-BT	----
00112	0070	2009/12/10 11:03:49	L60AD4	0010
00111	0CE4	2009/12/10 11:03:48	L26CPU-BT	----
00110	05DC	2009/12/09 16:30:58	L26CPU-BT	----
00109	0070	2009/12/09 16:29:33	L60DA4	0010
00108	0070	2009/12/09 16:29:12	L60DA4	0010
00107	083B	2009/12/09 16:29:11	L26CPU-BT	----

Point

For details on the module error collection function, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

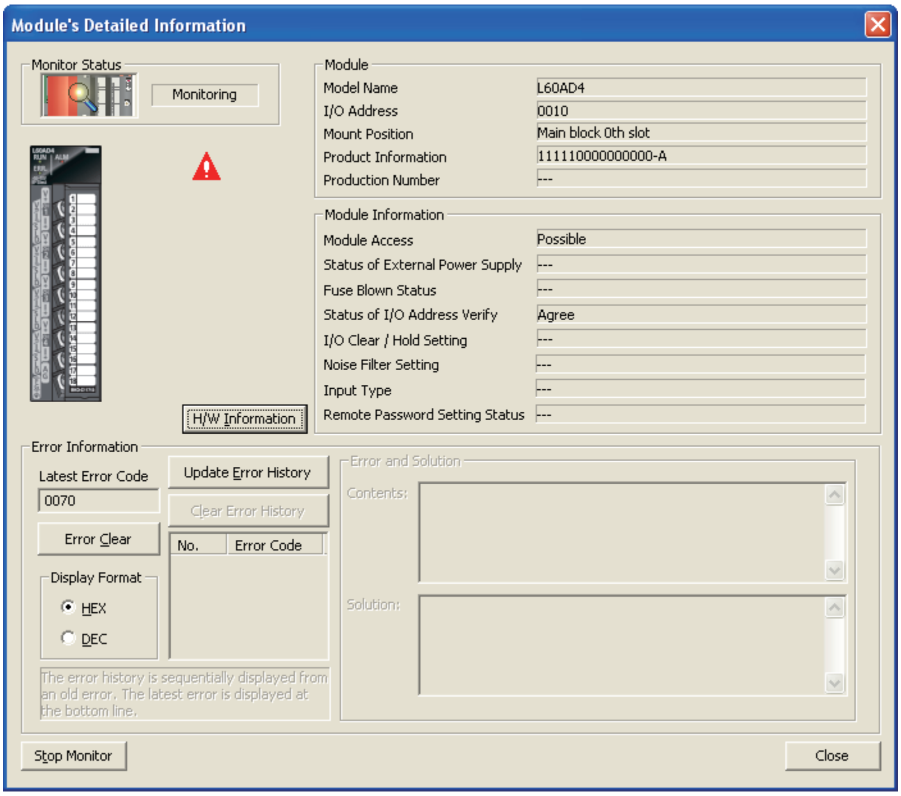
8.11 Error Clear Function

When an error occurs, you can clear the error from the system monitor.

By clicking the Error Clear button in the system monitor, the latest error code stored in Latest error code (Un\G19) is cleared and the ERR. LED is also turned off. The operation is the same as Error clear request (YF) as well as executing error clear from the display unit.
However, error history cannot be cleared.
For instructions on Error clear request (YF) and executing error clear from the display unit, refer to the following.

- Error clear request (YF) (☞ Page 95, Appendix 1)
- Checking/Clearing an Error (☞ Page 78, Section 9.4)

[Diagnostics] ⇨ [System monitor] ⇨ Error Module


Module's Detailed Information
Monitor Status
Monitoring
H/W Information
Update Error History
Clear Error History
Error Clear
Stop Monitor
Close

Module

Model Name: L60AD4
I/O Address: 0010
Mount Position: Main block 0th slot
Product Information: 111110000000000-A
Production Number: ---

Module Information

Module Access: Possible
Status of External Power Supply: ---
Fuse Blown Status: ---
Status of I/O Address Verify: Agree
I/O Clear / Hold Setting: ---
Noise Filter Setting: ---
Input Type: ---
Remote Password Setting Status: ---

Error Information

Latest Error Code: 0070

No.	Error Code

Display Format: ● HEX ○ DEC

The error history is sequentially displayed from an old error. The latest error is displayed at the bottom line.

Error and Solution

Contents:

Solution:

8.12 Saving and Restoring Offset/Gain Values

With the A/D converter module, you can save and restore offset/gain values in the user range setting.

In the event that the A/D converter module fails and need to be replaced, you can restore the offset/gain values of the failed A/D converter module onto a replacement A/D converter module.

In addition, if multiple A/D converter modules are connected on a system, you can apply the offset/gain settings of one of the modules to the other modules.

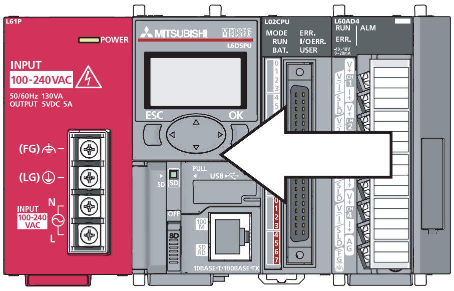
However, if you save and restore the offset/gain values, the accuracy after the restoration decreases by approximately three times compared to that before the restoration.

Reconfigure the offset/gain as necessary.

(1) Procedure for saving and restoring offset/gain values

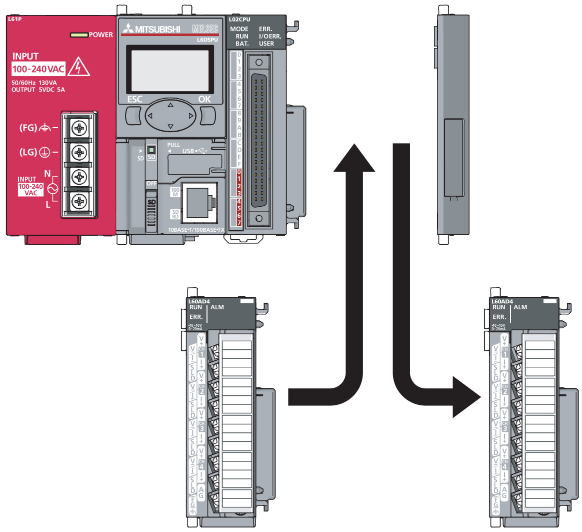
(a) To restore offset/gain values onto a new replacement module:

1. **Save the offset/gain values.**


L61P
POWER
INPUT
100-240VAC
50/60Hz 130VA
OUTPUT 5VDC 5A
(FG)
(LG)
INPUT
100-240
VAC
MITSUBISHI
L6DSPU
ESC
OK
L02CPU
MODE
RUN
BAT.
ERR.
I/O ERR.
USER
L60AD4
RUN
ALM
ERR.
PULL
USB
10BASE-T/100BASE-TX

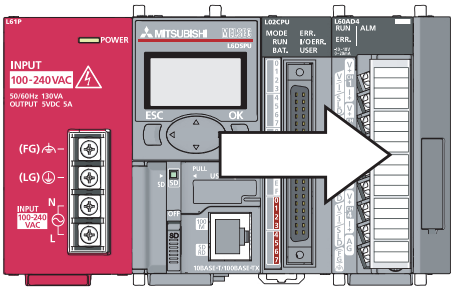
↓

2. **Replace A/D converter unit.**


L61P
POWER
INPUT
100-240VAC
MITSUBISHI
L02CPU
L60AD4
RUN
ALM
ERR.

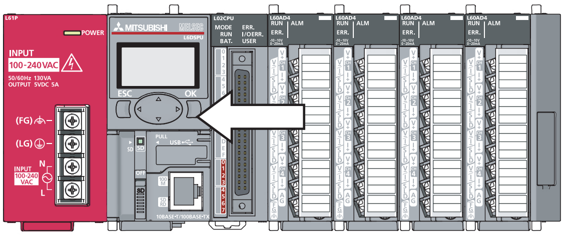
↓

3. **Restore the offset/gain values.**


L61P
POWER
INPUT
100-240VAC
50/60Hz 130VA
OUTPUT 5VDC 5A
(FG)
(LG)
MITSUBISHI
L6DSPU
ESC
OK
L02CPU
MODE
RUN
BAT.
ERR.
I/O ERR.
USER
L60AD4
RUN
ALM
ERR.
10BASE-T/100BASE-TX

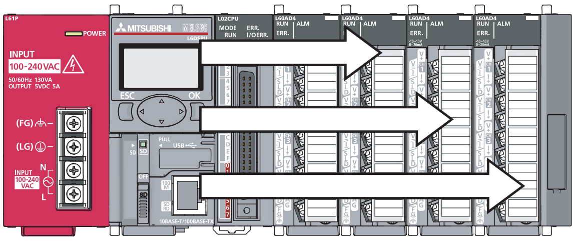
(b) To apply the offset/gain values of one module to the other modules in the same system:

Ex. Here, the offset/gain setting of module No.1 is applied to modules No.2 to No.4.



1. **Save the offset/gain values of module No.1.**

↓



2. **Apply the offset/gain values to modules No.2 to No.4.**

(2) Methods for saving and restoring offset/gain values

There are two methods for saving and restoring offset/gain values.

- Saving and restoring by dedicated instructions
- Saving and restoring by reading from and writing to the buffer memory

(a) Saving and restoring by a dedicated instruction

Use the dedicated instruction G(P).OGLOAD to temporarily save the offset/gain values of the source A/D converter module to the CPU module's internal device, then use G(P).OGSTOR to write to the destination A/D converter module.

You can prevent the saved offset/gain value data from getting deleted, by doing one of the following before replacing the modules:

- Use latch settings for the internal device of the destination module.
- Save the data onto an SD card
  To write data: use SP.FWRITE instruction
  To read data: use SP.FREAD instruction
- Store the saved data

For use of dedicated instructions, refer to the following.

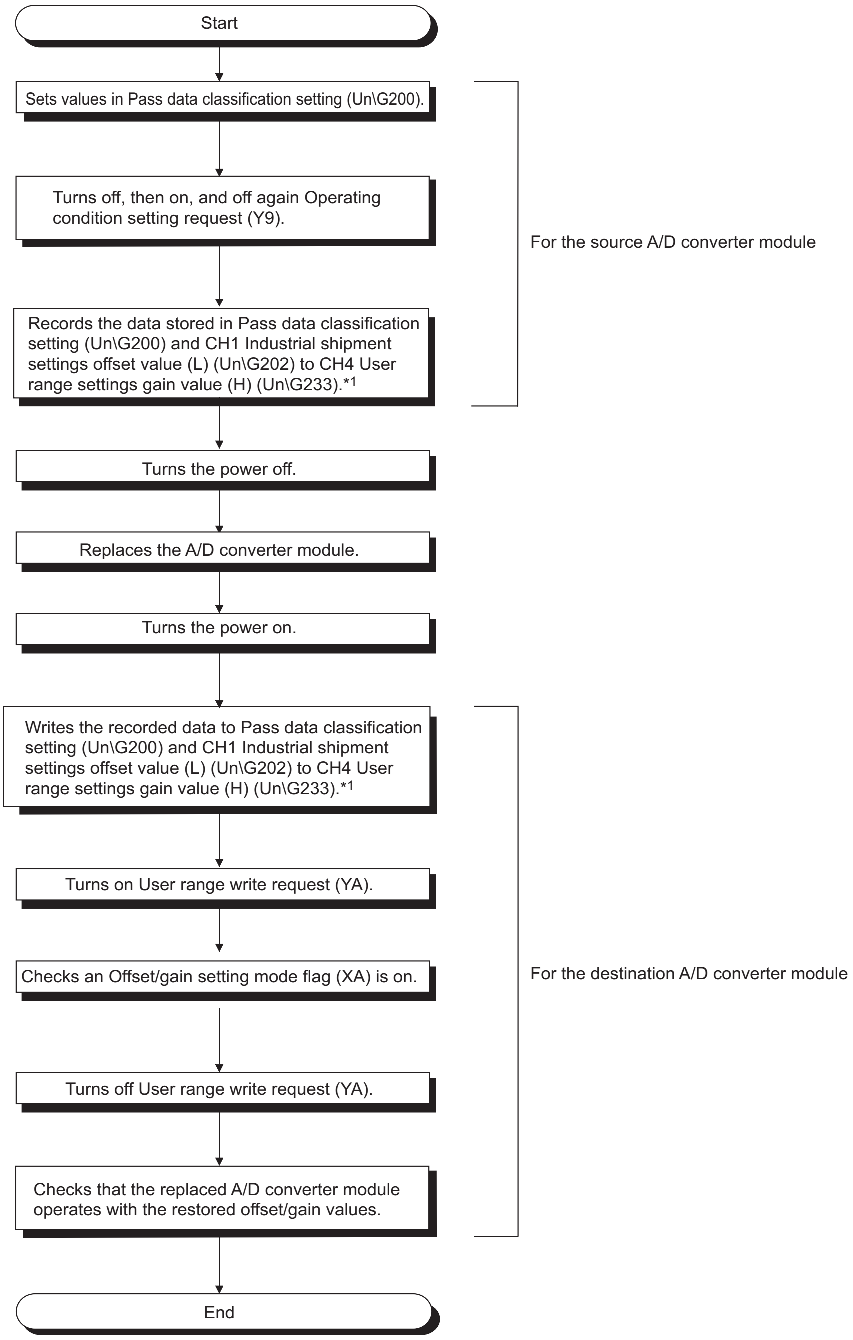
- Dedicated Instructions (☞ Page 118, Appendix 5)

(b) Saving and restoring by reading from and writing to the buffer memory

In the buffer memory, use Pass data classification setting (Un\G200), CH1 Industrial shipment settings offset value (L)(Un\G202) to CH4 User range settings gain value (H)(Un\G233), and User range write request (YA) to read the offset/gain values from the source A/D converter module, then use the buffer memory again to write to the destination A/D converter module.

The procedure for using the buffer memory is described below.

- To restore offset/gain values onto a new replacement module:



Start

Sets values in Pass data classification setting (Un\G200).

Turns off, then on, and off again Operating condition setting request (Y9).

Records the data stored in Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).*1

For the source A/D converter module

Turns the power off.

Replaces the A/D converter module.

Turns the power on.

Writes the recorded data to Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).*1

Turns on User range write request (YA).

Checks an Offset/gain setting mode flag (XA) is on.

Turns off User range write request (YA).

Checks that the replaced A/D converter module operates with the restored offset/gain values.

For the destination A/D converter module

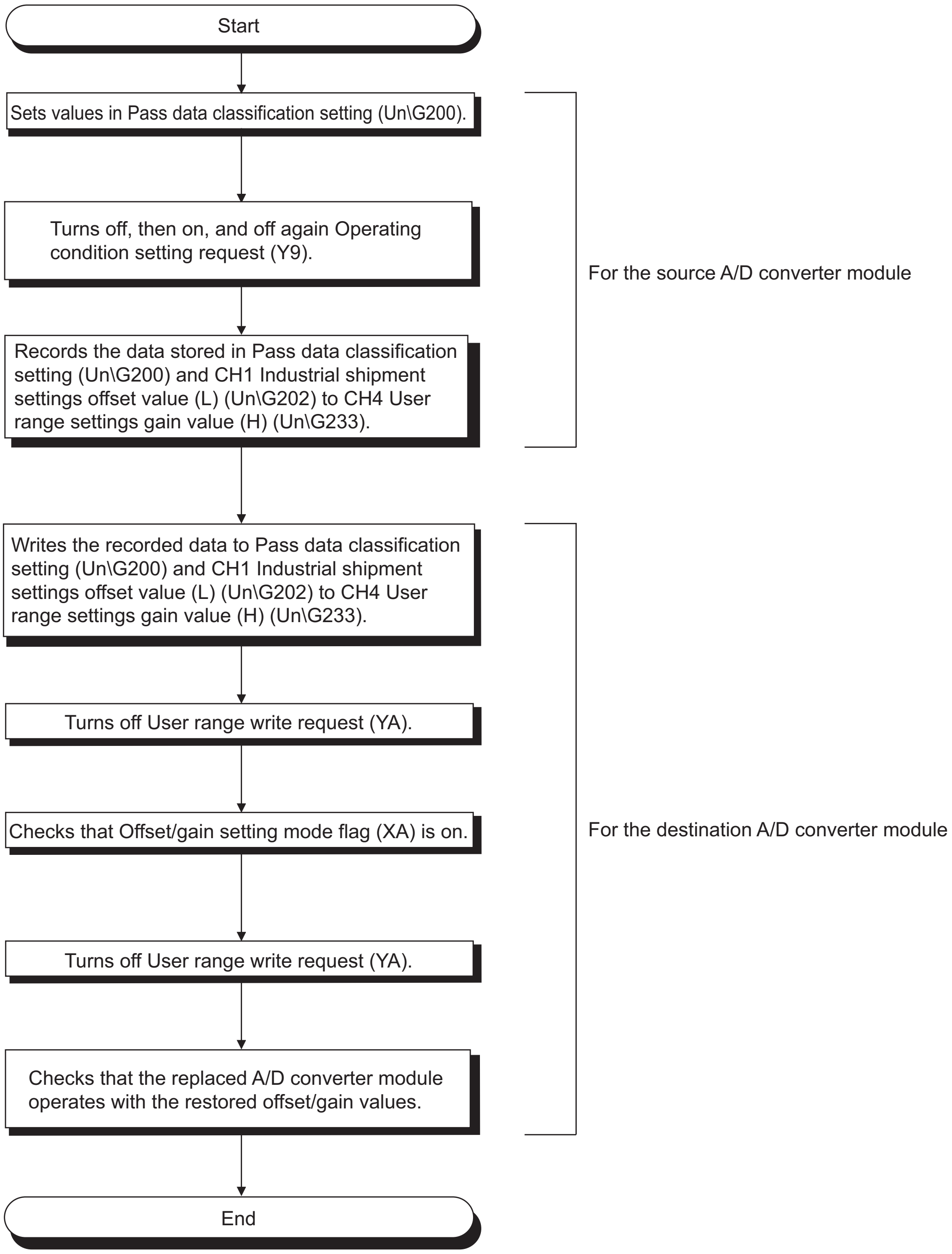
End

---

*1 When replacing modules, you can prevent the saved offset/gain value data from getting deleted, by doing one of the following before turning the power off:

- Use latch settings for the internal device of the destination module.
- Save the data onto an SD card
  To write data: use SP.FWRITE instruction
  To read data: use SP.FREAD instruction
- Store the saved data

- To apply the offset/gain values of one module to the other modules:



Start

Sets values in Pass data classification setting (Un\G200).

Turns off, then on, and off again Operating condition setting request (Y9).

Records the data stored in Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).

For the source A/D converter module

Writes the recorded data to Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).

Turns off User range write request (YA).

Checks that Offset/gain setting mode flag (XA) is on.

Turns off User range write request (YA).

Checks that the replaced A/D converter module operates with the restored offset/gain values.

For the destination A/D converter module

End

(3) Range reference tables

Below are reference ranges to be used for saving and restoring offset/gain values.

(a) Reference table for CH1 Industrial shipment settings offset value (L)(Un\G202) to CH4 Industrial shipment settings gain value (H)(Un\G217)

The reference values will vary depending on Pass data classification setting (Un\G200) (voltage or current).

Address (decimal)				Description	Pass data classification setting	Reference value (hexadecimal)
CH1	CH2	CH3	CH4			
202, 203	206, 207	210, 211	214, 215	Industrial shipment settings offset value	Voltage	Approx. 00000007_H
					Current	Approx. $0000000E_H$
204, 205	208, 209	212, 213	216, 217	Industrial shipment settings gain value	Voltage	Approx. 00008011_H
					Current	Approx. 00008018_H

(b) Reference table for CH1 User range settings offset value (L)(Un\G218) to CH4 User range settings gain value (H)(Un\G233)

Offset/gain value		Reference value (hexadecimal)
Voltage	0V	Approx. 00000007_H
	1V	Approx. $00000CD4_H$
	5V	Approx. $0000400C_H$
	10V	Approx. 00008011_H
Current	0mA	Approx. 00000007_H
	4mA*1	Approx. $00000CD4_H$
	20mA*2	Approx. $0000400C_H$

*1 This is the value that is stored in user range offset value at the time of shipping.

*2 This is the value that is stored in user range gain value at the time of shipping.

CHAPTER 9 DISPLAY UNIT

This chapter describes the functions of the display unit that can be used with the A/D converter module.
For instruction on operating the display unit, or for details on the functions and menu configuration, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

9.1 Display Unit

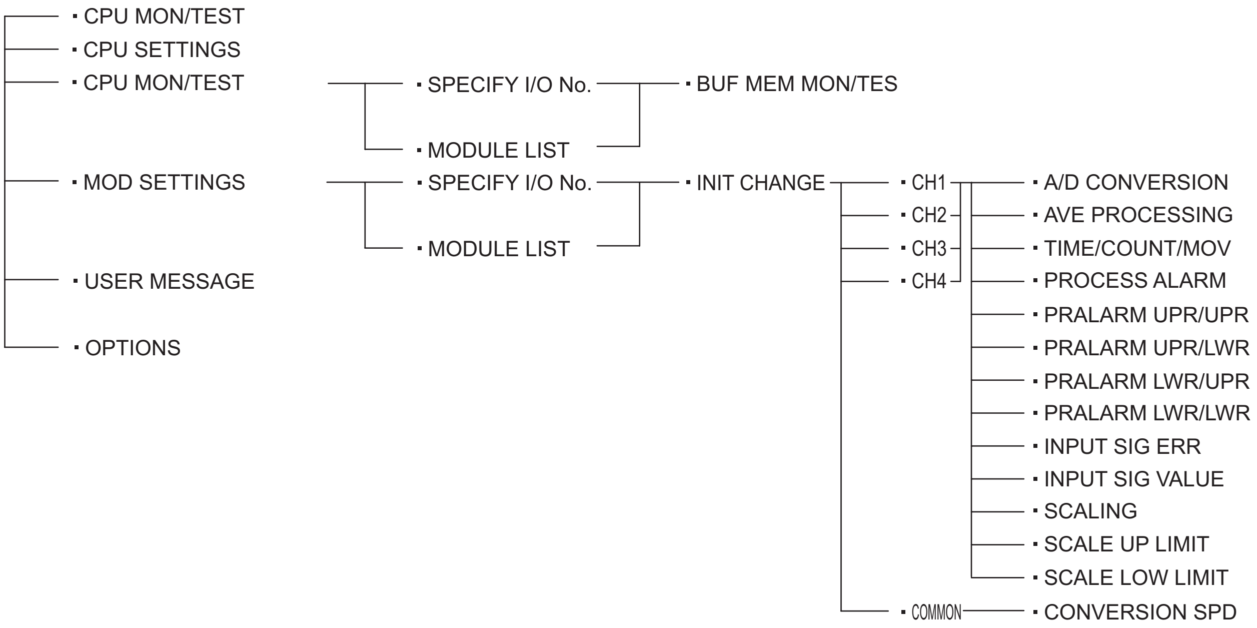
The display unit is an LCD to be attached to the CPU module. By attaching it to the CPU unit, you can check the status of the system and change system settings without the software package.
In addition, in the event a problem occurs, you can identify the cause of the problem by displaying the error information.
For details on how to check and clear an error from the display unit, refer to the following.

- Checking/Clearing an Error (☞ Page 78, Section 9.4)

9.2 Menu Transition

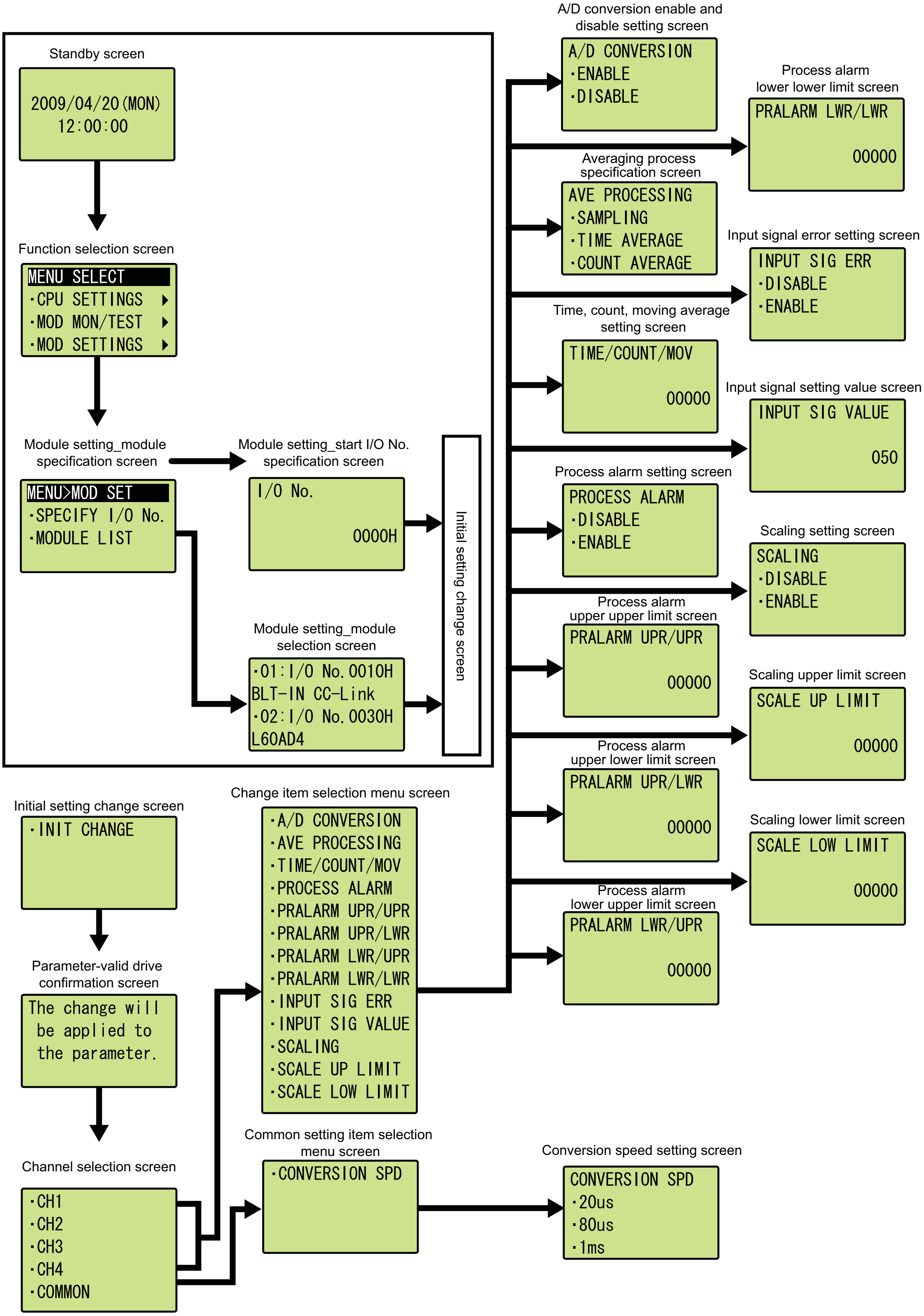
(1) Organization

The diagram below shows how the "MOD MON/TEST" and "MOD SETTINGS" menus are organized.


▪ CPU MON/TEST
▪ CPU SETTINGS
▪ CPU MON/TEST
▪ SPECIFY I/O No.
▪ BUF MEM MON/TES
▪ MODULE LIST
▪ MOD SETTINGS
▪ SPECIFY I/O No.
▪ INIT CHANGE
▪ CH1
▪ CH2
▪ CH3
▪ CH4
▪ A/D CONVERSION
▪ AVE PROCESSING
▪ TIME/COUNT/MOV
▪ PROCESS ALARM
▪ PRALARM UPR/UPR
▪ PRALARM UPR/LWR
▪ PRALARM LWR/UPR
▪ PRALARM LWR/LWR
▪ INPUT SIG ERR
▪ INPUT SIG VALUE
▪ SCALING
▪ SCALE UP LIMIT
▪ SCALE LOW LIMIT
▪ MODULE LIST
▪ USER MESSAGE
▪ OPTIONS
▪ COMMON
▪ CONVERSION SPD

(2) Screen transitions up to the initial setting change screen

The diagram below shows how the screens transition to the initial setting change screen.


Standby screen
2009/04/20 (MON)
12:00:00
Function selection screen
MENU SELECT
·CPU SETTINGS
·MOD MON/TEST
·MOD SETTINGS
Module setting_module specification screen
MENU>MOD SET
·SPECIFY I/O No.
·MODULE LIST
Module setting_start I/O No. specification screen
I/O No.
0000H
Module setting_module selection screen
·01:I/O No.0010H
BLT-IN CC-Link
·02:I/O No.0030H
L60AD4
Initial setting change screen
Initial setting change screen
·INIT CHANGE
Parameter-valid drive confirmation screen
The change will be applied to the parameter.
Channel selection screen
·CH1
·CH2
·CH3
·CH4
·COMMON
Change item selection menu screen
·A/D CONVERSION
·AVE PROCESSING
·TIME/COUNT/MOV
·PROCESS ALARM
·PRALARM UPR/UPR
·PRALARM UPR/LWR
·PRALARM LWR/UPR
·PRALARM LWR/LWR
·INPUT SIG ERR
·INPUT SIG VALUE
·SCALING
·SCALE UP LIMIT
·SCALE LOW LIMIT
Common setting item selection menu screen
·CONVERSION SPD
Conversion speed setting screen
CONVERSION SPD
·20us
·80us
·1ms
A/D conversion enable and disable setting screen
A/D CONVERSION
·ENABLE
·DISABLE
Averaging process specification screen
AVE PROCESSING
·SAMPLING
·TIME AVERAGE
·COUNT AVERAGE
Time, count, moving average setting screen
TIME/COUNT/MOV
00000
Process alarm setting screen
PROCESS ALARM
·DISABLE
·ENABLE
Process alarm upper upper limit screen
PRALARM UPR/UPR
00000
Process alarm upper lower limit screen
PRALARM UPR/LWR
00000
Process alarm lower upper limit screen
PRALARM LWR/UPR
00000
Process alarm lower lower limit screen
PRALARM LWR/LWR
00000
Input signal error setting screen
INPUT SIG ERR
·DISABLE
·ENABLE
Input signal setting value screen
INPUT SIG VALUE
050
Scaling setting screen
SCALING
·DISABLE
·ENABLE
Scaling upper limit screen
SCALE UP LIMIT
00000
Scaling lower limit screen
SCALE LOW LIMIT
00000

9.3 List of Setting Value Change Screens

The following is a list of setting value change screens.

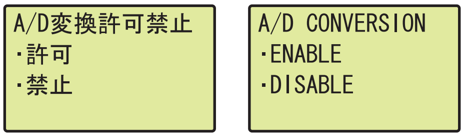
(1) Displayed in English:

Name		Screen format	Input limits	
Setting item	Screen display		Upper limit	Lower limit
A/D conversion enable/disable setting	A/D CONVERSION	Selection	—	—
Average processing specification	AVE PROCESSING	Selection	—	—
Time Average/ Count Average/Moving Average	TIME/COUNT/MOV	Numeric	62500	2
Process alarm output setting	PROCESS ALARM	Selection	—	—
Upper upper process alarm limit value	PRALARM UPR/UPR	Numeric	32767	-32768
Upper lower process alarm limit value	PRALARM UPR/LWR	Numeric	32767	-32768
Lower upper process alarm limit value	PRALARM LWR/UPR	Numeric	32767	-32768
Lower lower process alarm limit value	PRALARM LWR/LWR	Numeric	32767	-32768
Input signal error detection setting	INPUT SIG ERR	Selection	—	—
Input signal error detection setting value	INPUT SIG VALUE	Numeric	250	0
Scaling function	SCALING	Selection	—	—
Upper limit scaling value	SCALE UP LIMIT	Numeric	32000	-32000
Lower limit scaling value	SCALE LOW LIMIT	Numeric	32000	-32000
Conversion speed setting	CONVERSION SPD	Selection	—	—

(2) A/D CONVERSION

Select "ENABLE" or "DISABLE" in the "A/D conversion enable/disable" screen.

"A/D conversion enable/disable" screen



A/D変換許可禁止
･許可
･禁止

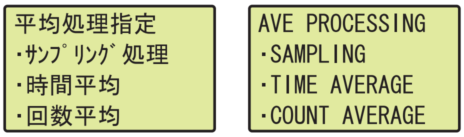
A/D CONVERSION
･ENABLE
･DISABLE

1. **Use the ▲ and ▼ buttons to select "ENABLE" or "DISABLE", and then confirm with the OK button.**

(3) AVE PROCESSING

In the "Average processing specification" screen, select whether to perform sampling processing or averaging processing (time average, count average, moving average).

"Average processing specification" screen

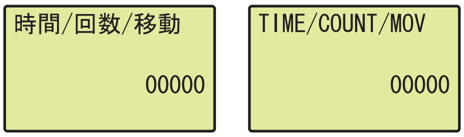


平均処理指定
･ｻﾝﾌﾟﾘﾝｸﾞ処理
･時間平均
･回数平均

AVE PROCESSING
･SAMPLING
･TIME AVERAGE
･COUNT AVERAGE

↓

"Time/Count/Moving" screen



時間/回数/移動
00000

TIME/COUNT/MOV
00000

1. **Use the ▲ and ▼ buttons to select "SAMPLING", "TIME AVERAGE", or "COUNT AVERAGE", and then confirm with the OK. (If you selected any item other than "SAMPLING", proceed to step 2.)**

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.**

Table of input items

Input item	Conversion speed	Input range	
		Input upper limit	Input lower limit
TIME	20μs	1500	2
	80μs/1ms	5000	2
COUNT	20μs/80μs/1ms	62500	4
MOV	20μs/80μs/1ms	1000	2

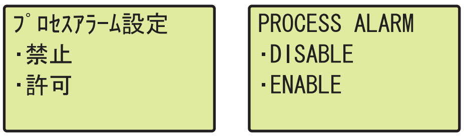
Point

The display unit allows you to input between 2 to 62500 for any type of averaging processing, however, if the value is outside the setting range of the averaging processing that you selected, an error will occur on the A/D converter module side.

(4) PROCESS ALARM

Select "DISABLE" or "ENABLE" in the "Process alarm setting" screen.

"Process alarm setting" screen



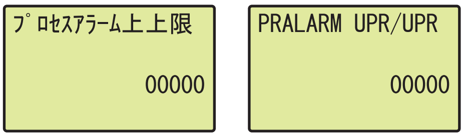
ﾌﾟﾛｾｽｱﾗｰﾑ設定
・禁止
・許可

PROCESS ALARM
・DISABLE
・ENABLE

1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm with the OK button. (If you selected "ENABLE", follow the rest of the procedure.)**

↓

"Process alarm upper upper limit" screen



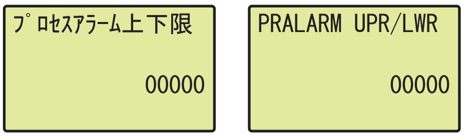
ﾌﾟﾛｾｽｱﾗｰﾑ上上限
00000

PRALARM UPR/UPR
00000

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.**

↓

"Process alarm upper lower limit" screen



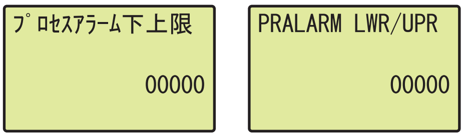
ﾌﾟﾛｾｽｱﾗｰﾑ上下限
00000

PRALARM UPR/LWR
00000

3. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.**

↓

"Process alarm lower upper limit" screen



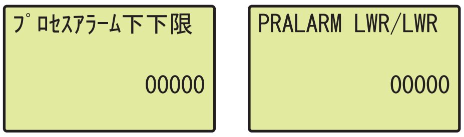
ﾌﾟﾛｾｽｱﾗｰﾑ下上限
00000

PRALARM LWR/UPR
00000

4. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.**

↓

"Process alarm lower lower limit" screen



ﾌﾟﾛｾｽｱﾗｰﾑ下下限
00000

PRALARM LWR/LWR
00000

5. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.**

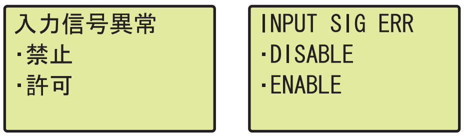
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
PRALARM UPR/UPR	32767	-32768
PRALARM UPR/LWR		
PRALARM LWR/UPR		
PRALARM LWR/LWR		

(5) INPUT SIG ERR

Select "DISABLE" or "ENABLE" in the "Input signal error" screen.

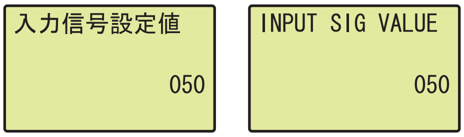
"Input signal error" screen


入力信号異常
･禁止
･許可

INPUT SIG ERR
･DISABLE
･ENABLE

↓

"Input signal setting value" screen


入力信号設定値
050

INPUT SIG VALUE
050

1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm with the OK button. (If you selected "ENABLE", proceed to step 2.)**

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.**

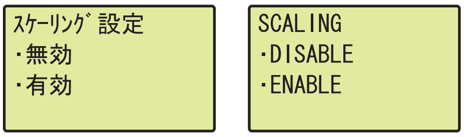
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
INPUT SIG VALUE	250	0

(6) SCALING

Select "DISABLE" or "ENABLE" in the "Scaling setting" screen.

"Scaling setting" screen



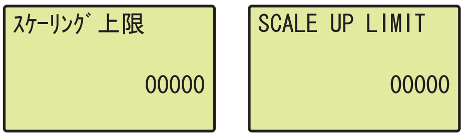
ｽｹｰﾘﾝｸﾞ 設定
･無効
･有効

SCALING
･DISABLE
･ENABLE

1. Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm with the OK button. (If you selected "ENABLE", follow the rest of the procedure.)

↓

"Scaling upper limit" screen



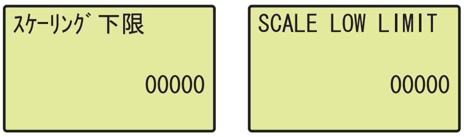
ｽｹｰﾘﾝｸﾞ 上限
00000

SCALE UP LIMIT
00000

2. Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.

↓

"Scaling lower limit" screen



ｽｹｰﾘﾝｸﾞ 下限
00000

SCALE LOW LIMIT
00000

3. Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the OK button.

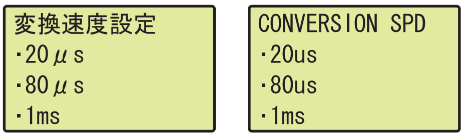
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
SCALE UP LIMIT	32000	-32000
SCALE LOW LIMIT		

(7) CONVERSION SPD

In the "Conversion speed setting" screen, specify the conversion speed of the A/D conversion processing.

"Conversion speed setting" screen



変換速度設定
･20μs
･80μs
･1ms

CONVERSION SPD
･20us
･80us
･1ms

1. Use the ▲ and ▼ buttons to select the conversion speed, and then confirm with the OK button.

9.4 Checking and Clearing Errors

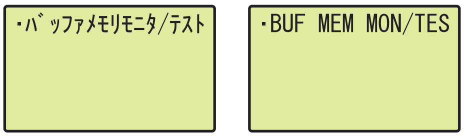
You can check the errors that occurred in the A/D converter module, from the display unit. In addition, you can also clear an error during its occurrence.

(1) Checking the error

You can check the error that occurred in the A/D converter module, by specifying Latest error code (Un\G19) from "buffer memory monitor/test".

Ex. Suppose an error occurred in the A/D converter module with start I/O number of X/Y10 to 1F.

"Buffer memory monitor/test" screen



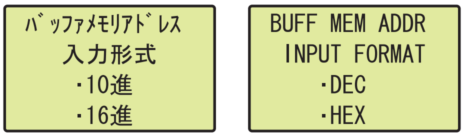
```
･ﾊﾞｯﾌｧﾒﾓﾘﾓﾆﾀ/ﾃｽﾄ
```

```
･BUF MEM MON/TES
```

1. **Press the OK button.**

↓

"Buffer memory address input format selection" screen



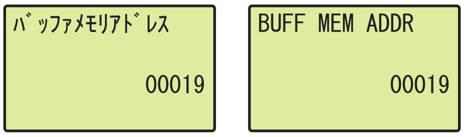
```
ﾊﾞｯﾌｧﾒﾓﾘｱﾄﾞﾚｽ
  入力形式
   ･10進
   ･16進
```

```
 BUFF MEM ADDR
  INPUT FORMAT
     ･DEC
     ･HEX
```

2. **Use the ▲ and ▼ buttons to select "DEC" for the input format of the buffer memory address, and then confirm with the OK button.**

↓

"Buffer memory address setting" screen



```
ﾊﾞｯﾌｧﾒﾓﾘｱﾄﾞﾚｽ

          00019
```

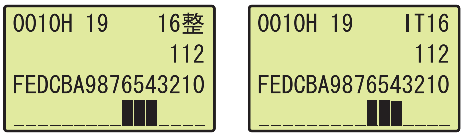
```
BUFF MEM ADDR

          00019
```

3. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, and set the value to 19.Confirm with the OK button.**

↓

"Buffer memory monitor" screen



```
0010H 19    16整
            112
FEDCBA9876543210
_________■■■____
```

```
0010H 19    IT16
            112
FEDCBA9876543210
_________■■■____
```

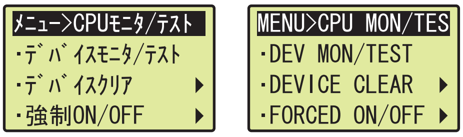
4. **You can check the error that occurred, in the "Buffer memory monitor" screen.**

(2) Clearing errors

You can clear an error by eliminating the cause of the error, and turning Error clear request (YF) OFF → ON → OFF from "Device Monitor/Test".

Ex. Suppose an error occurred in the A/D converter module with start I/O number of X/Y10 to 1F.

"CPU monitor/test" screen

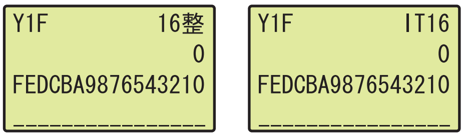


```
ﾒﾆｭｰ>CPUﾓﾆﾀ/ﾃｽﾄ      MENU>CPU MON/TES
･ﾃﾞﾊﾞｲｽﾓﾆﾀ/ﾃｽﾄ      ･DEV MON/TEST
･ﾃﾞﾊﾞｲｽｸﾘｱ    ▶     ･DEVICE CLEAR  ▶
･強制ON/OFF   ▶     ･FORCED ON/OFF ▶
```

1. **Use the ▲ and ▼ buttons to select "DEV MON/TEST", and then confirm with the OK button.**

↓

"Device monitor" screen

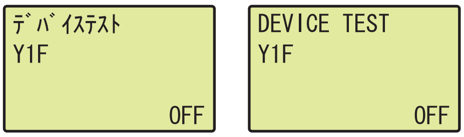


```
Y1F          16整   Y1F          IT16
                0                   0
FEDCBA9876543210    FEDCBA9876543210
________________    ________________
```

2. **Set the device to Y and press the OK button.**

↓

"Device test" screen

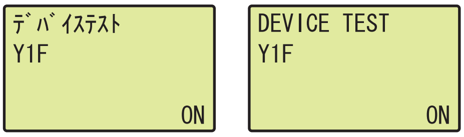


```
ﾃﾞﾊﾞｲｽﾃｽﾄ           DEVICE TEST
Y1F                 Y1F

              OFF                 OFF
```

3. **Use the ▲ and ▼ buttons to set the device to Y1F, and then confirm with the OK button.**

↓



```
ﾃﾞﾊﾞｲｽﾃｽﾄ           DEVICE TEST
Y1F                 Y1F

               ON                  ON
```

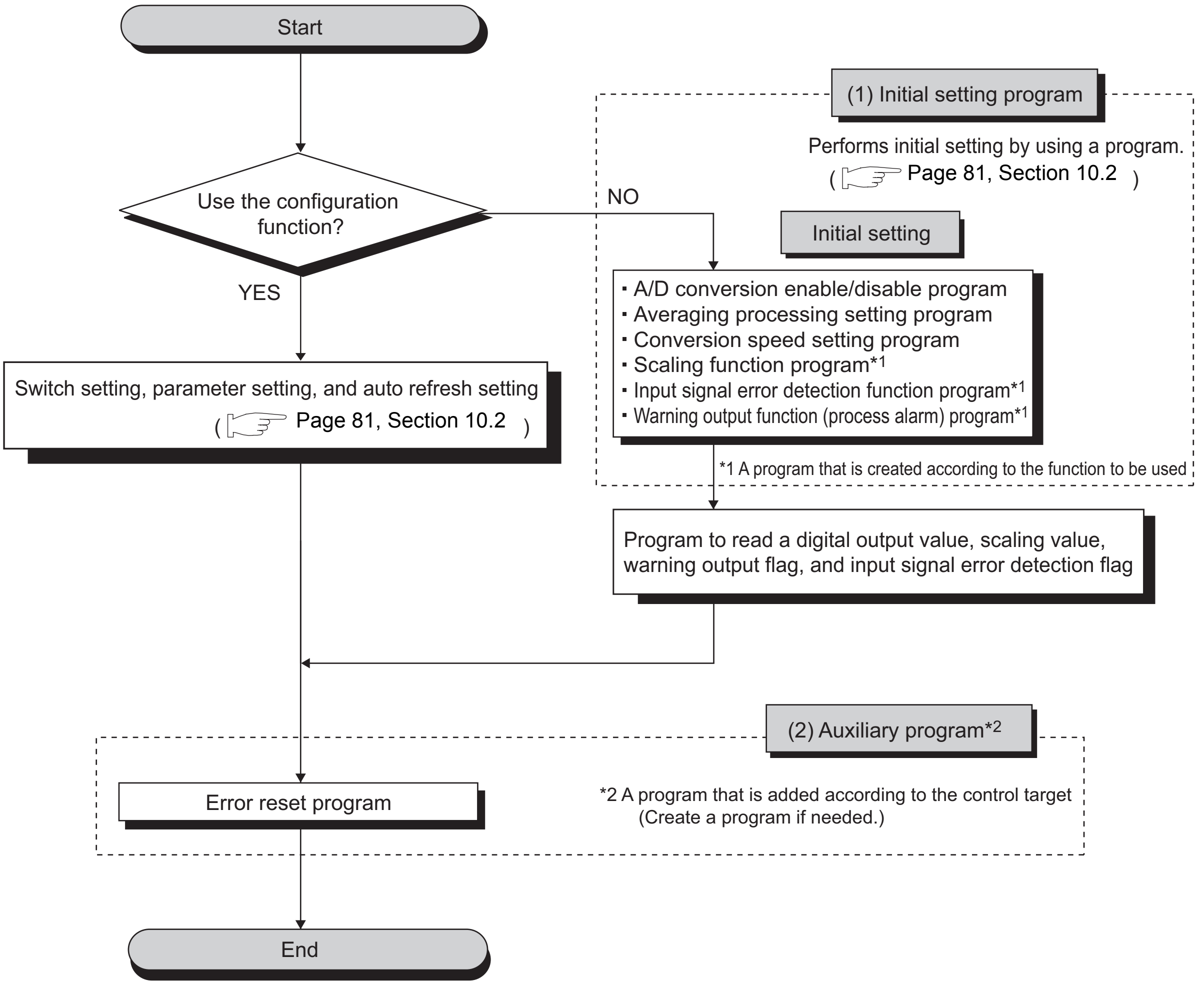
4. **Use the ▲ and ▼ buttons to switch ON/OFF. Press the OK button to set the value at the device test setting.**

CHAPTER 10 PROGRAMMING

This chapter describes the procedure for programming and the basic program of the A/D converter module.

10.1 Procedure for Programming

Create a program to execute A/D conversion, according to the following procedure.

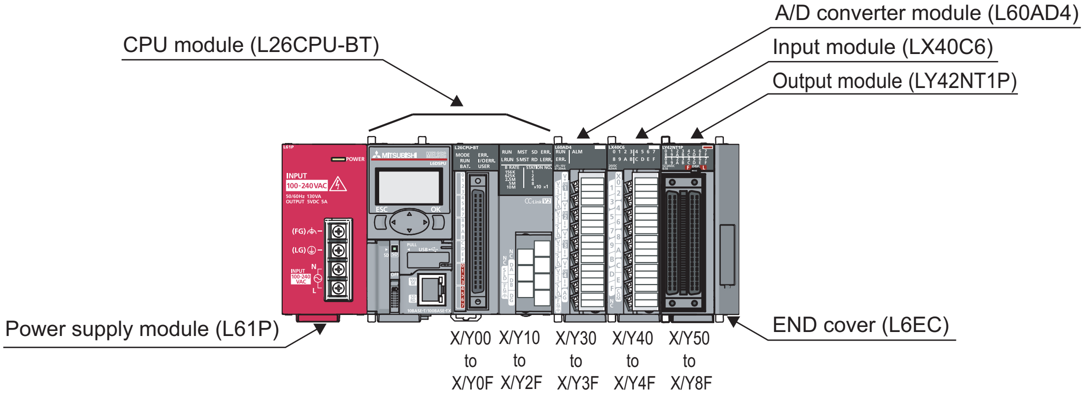

Start
Use the configuration function?
NO
YES
(1) Initial setting program
Performs initial setting by using a program.
(Page 81, Section 10.2)
Initial setting
· A/D conversion enable/disable program
· Averaging processing setting program
· Conversion speed setting program
· Scaling function program*1
· Input signal error detection function program*1
· Warning output function (process alarm) program*1
*1 A program that is created according to the function to be used
Switch setting, parameter setting, and auto refresh setting
(Page 81, Section 10.2)
Program to read a digital output value, scaling value, warning output flag, and input signal error detection flag
(2) Auxiliary program*2
Error reset program
*2 A program that is added according to the control target
(Create a program if needed.)
End

10.2 When Using the Module in a Standard System Configuration

The following shows program examples for the system configuration and usage conditions of the A/D converter module.

(1) System configuration

The following shows an example of the system configuration when using the module in a standard system configuration.


A/D converter module (L60AD4)
Input module (LX40C6)
Output module (LY42NT1P)
CPU module (L26CPU-BT)
Power supply module (L61P)
END cover (L6EC)
X/Y00 to X/Y0F
X/Y10 to X/Y2F
X/Y30 to X/Y3F
X/Y40 to X/Y4F
X/Y50 to X/Y8F

Point

For configuring the same I/O assignment as the system above, when using the L02CPU, set the I/O assignment of the A/D converter module within X/Y30 to 3F. Also, set the I/O assignment of the LX40C6 within X/Y40 to 4F, and the same of the LY42NT1P, within X/Y50 to 8F.

(2) Programming condition

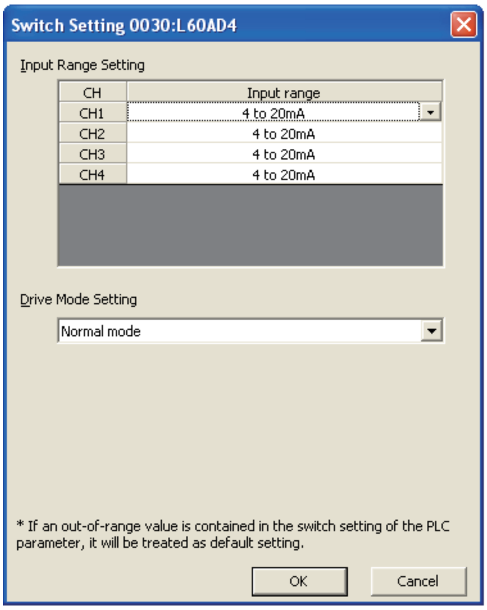
This program reads digital output values enabled for A/D conversion at CH1 to CH3 in the A/D converter module.

CH1 executes sampling processing, CH2 executes averaging processing every 50 times and CH3 executes A/D conversion every 10 moving averages. If an error occurs in the module, an error code is displayed in BCD notation.

(3) Switch setting

Set the input range and the operation mode.

Project window ➪ [Intelligent Function Module] ➪ module name ➪ "Switch Setting"



Switch Setting 0030:L60AD4

Input Range Setting

CH	Input range
CH1	4 to 20mA
CH2	4 to 20mA
CH3	4 to 20mA
CH4	4 to 20mA

Drive Mode Setting

Normal mode

* If an out-of-range value is contained in the switch setting of the PLC parameter, it will be treated as default setting.

(4) Initial setting description

(a) Channel setting

Item	Description			
	CH1	CH2	CH3	CH4
A/D conversion enable/disable setting	Enable	Enable	Enable	Disable
Averaging process specification	Sampling processing	Count average	Moving average	Sampling processing
Average time/Average number of times/Move average settings	0	50 times	10 times	0
Conversion speed setting	20µs			
Process alarm output setting	Disable	Enable	Disable	Disable
Process alarm upper upper limit value	0	20000	0	0
Process alarm upper lower limit value	0	18000	0	0
Process alarm lower upper limit value	0	3000	0	0
Process alarm lower lower limit value	0	0	0	0
Input signal error detection setting	Enable	Disable	Disable	Disable
Input signal error detection setting value	10.0%	5.0%	5.0%	5.0%
Scaling enable/disable setting	Disable	Disable	Enable	Disable
Scaling upper limit value	0	0	32000	0
Scaling lower limit value	0	0	0	0

(b) Device for user

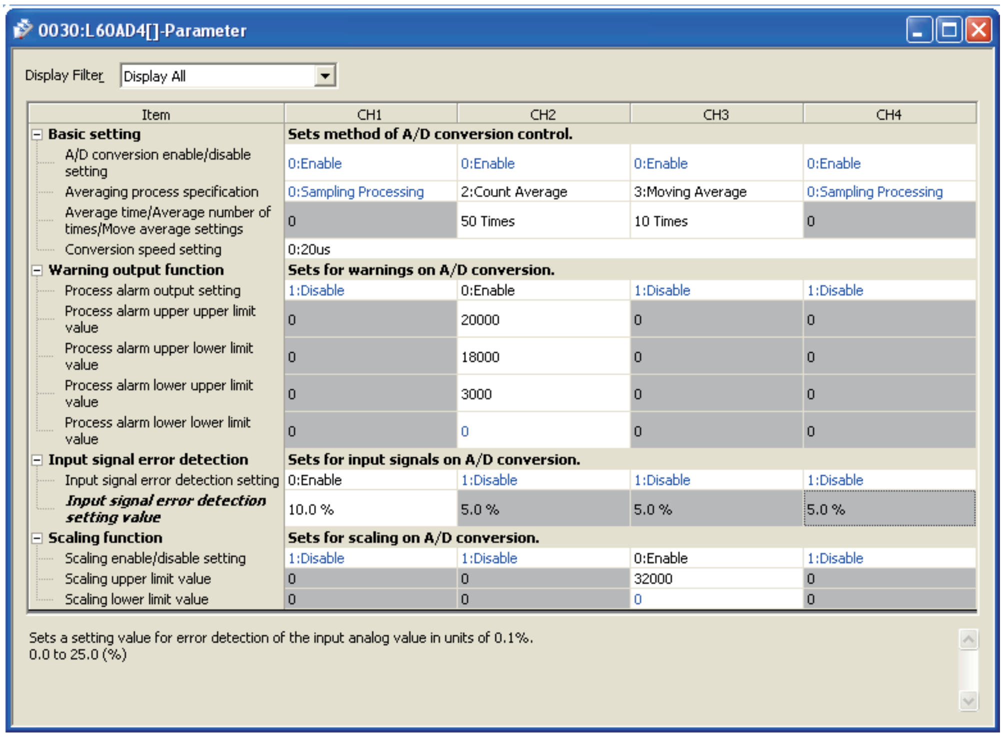
Device	Description	
D1(D11)	CH1 Digital output value	
D2(D12)	CH2 Digital output value	
D3	CH3 Digital output value	
D8	Input signal error detection flag	
D10	Error code	
D18	Warning output flag	
D28(D13)	CH3 Scaling value	
M0	CH1 A/D conversion completed flag	
M1	CH2 A/D conversion completed flag	
M2	CH3 A/D conversion completed flag	
M20 to 27	Warning output flag	
M50 to 53	Input signal error detection flag	
M100	Module READY checking flag	
X40	Digital output value read command input signal	LX40C6 (X40 to 4F)
X43	Input signal error detection reset signal	
X44	Error reset signal	
Y50 to 5F	Error code notation (BCD 3 digits)	LY42NT1P (Y50 to 5F)

(5) Program example when using the parameter of intelligent function module

(a) Parameter setting

Set the contents of initial settings in the parameter.

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



0030:L60AD4[]-Parameter

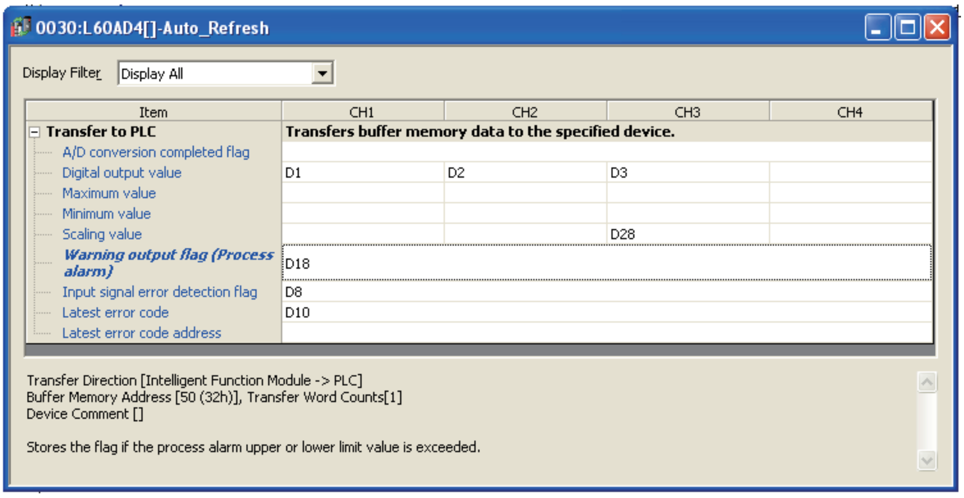
Display Filter: Display All

Item	CH1	CH2	CH3	CH4
Basic setting	**Sets method of A/D conversion control.**			
A/D conversion enable/disable setting	0:Enable	0:Enable	0:Enable	0:Enable
Averaging process specification	0:Sampling Processing	2:Count Average	3:Moving Average	0:Sampling Processing
Average time/Average number of times/Move average settings	0	50 Times	10 Times	0
Conversion speed setting	0:20us			
Warning output function	**Sets for warnings on A/D conversion.**			
Process alarm output setting	1:Disable	0:Enable	1:Disable	1:Disable
Process alarm upper upper limit value	0	20000	0	0
Process alarm upper lower limit value	0	18000	0	0
Process alarm lower upper limit value	0	3000	0	0
Process alarm lower lower limit value	0	0	0	0
Input signal error detection	**Sets for input signals on A/D conversion.**			
Input signal error detection setting	0:Enable	1:Disable	1:Disable	1:Disable
Input signal error detection setting value	10.0 %	5.0 %	5.0 %	5.0 %
Scaling function	**Sets for scaling on A/D conversion.**			
Scaling enable/disable setting	1:Disable	1:Disable	0:Enable	1:Disable
Scaling upper limit value	0	0	32000	0
Scaling lower limit value	0	0	0	0

Sets a setting value for error detection of the input analog value in units of 0.1%.
0.0 to 25.0 (%)

(b) Auto refresh setting

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [auto refresh]



0030:L60AD4[]-Auto_Refresh

Display Filter: Display All

Item	CH1	CH2	CH3	CH4
Transfer to PLC	**Transfers buffer memory data to the specified device.**			
A/D conversion completed flag				
Digital output value	D1	D2	D3	
Maximum value				
Minimum value				
Scaling value			D28	
Warning output flag (Process alarm)	D18			
Input signal error detection flag	D8			
Latest error code	D10			
Latest error code address				

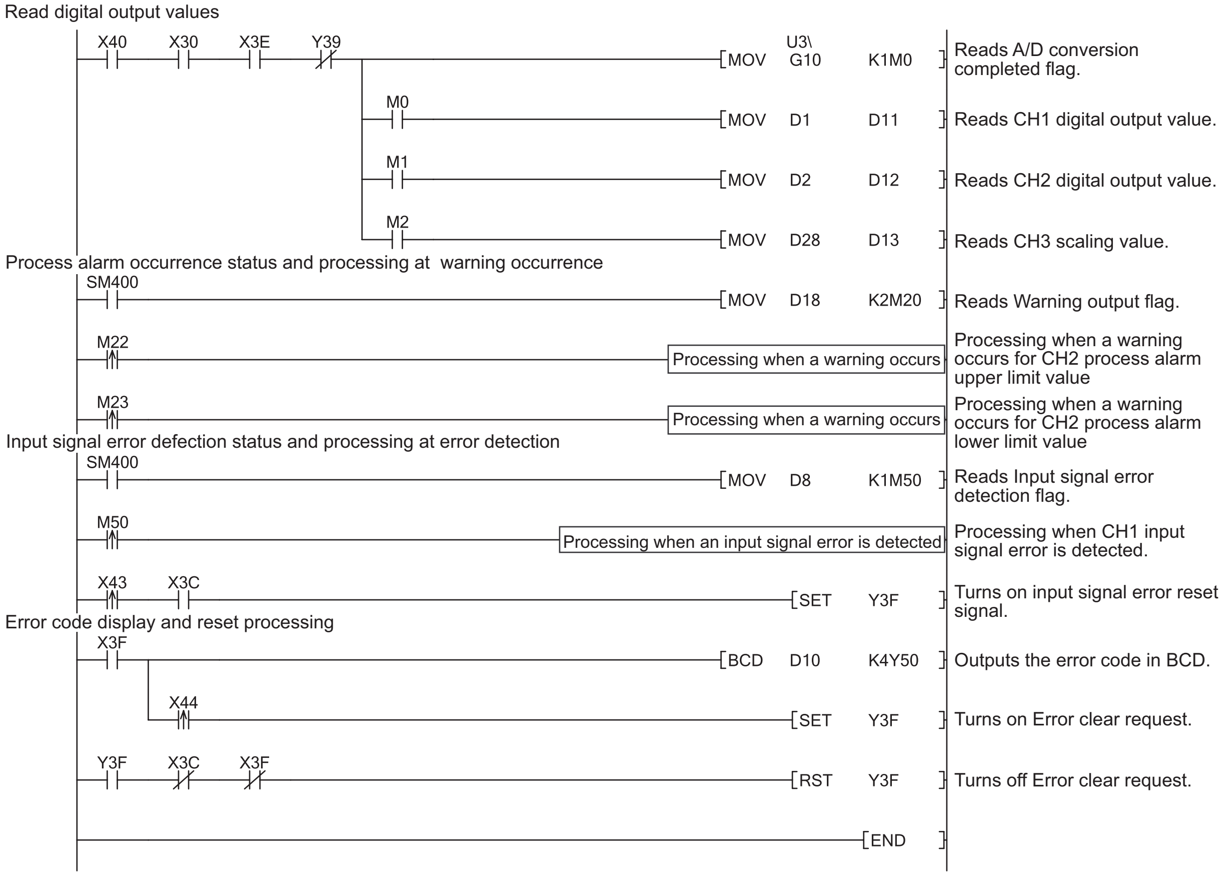
Transfer Direction [Intelligent Function Module -> PLC]
Buffer Memory Address [50 (32h)], Transfer Word Counts[1]
Device Comment []

Stores the flag if the process alarm upper or lower limit value is exceeded.

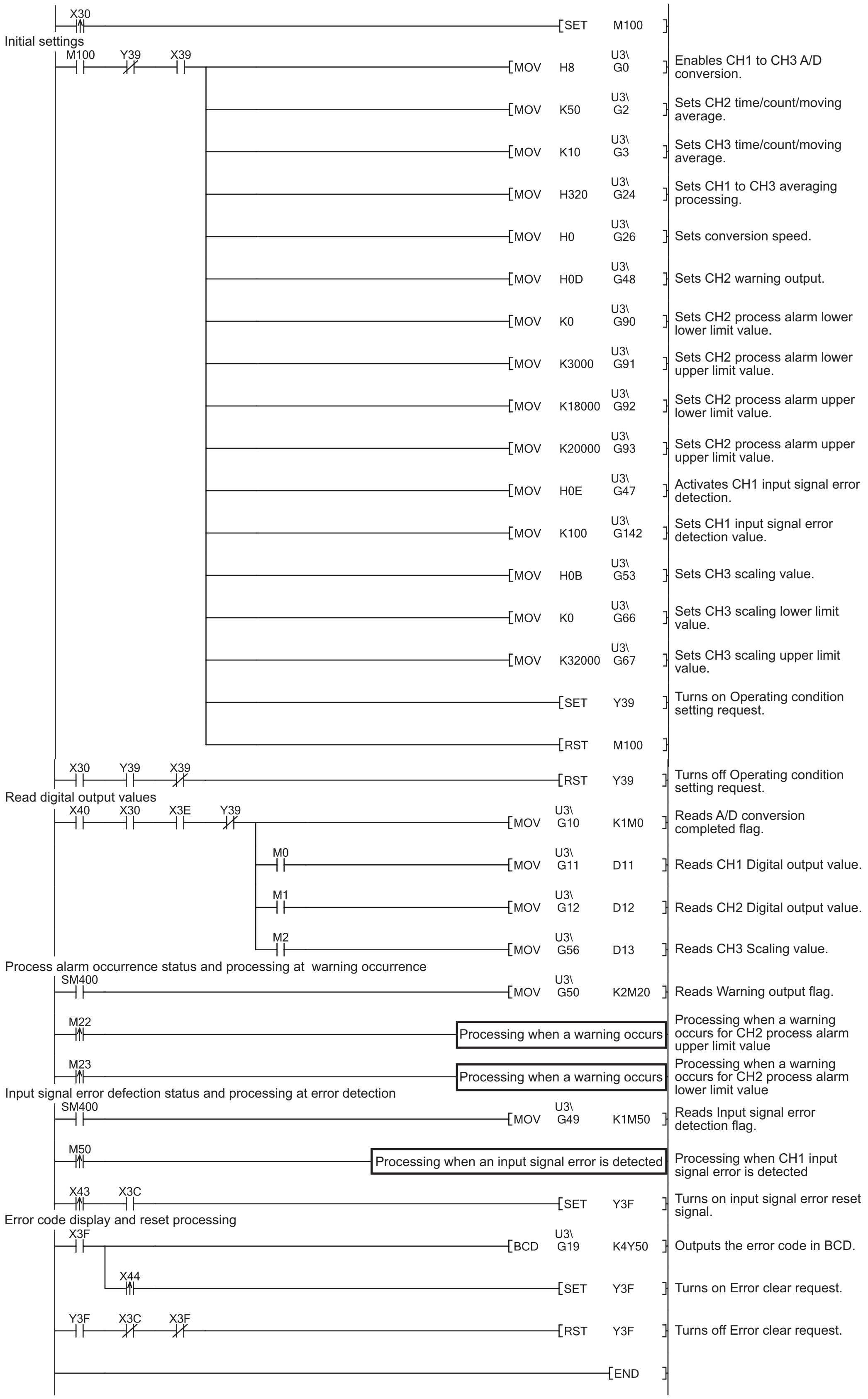
(c) Writing parameter of intelligent function module

Write the parameters of the intelligent function module in the CPU module.

(d) Program example


Read digital output values
X40
X30
X3E
Y39
MOV U3\G10 K1M0
Reads A/D conversion completed flag.
M0
MOV D1 D11
Reads CH1 digital output value.
M1
MOV D2 D12
Reads CH2 digital output value.
M2
MOV D28 D13
Reads CH3 scaling value.
Process alarm occurrence status and processing at warning occurrence
SM400
MOV D18 K2M20
Reads Warning output flag.
M22
Processing when a warning occurs
Processing when a warning occurs for CH2 process alarm upper limit value
M23
Processing when a warning occurs
Processing when a warning occurs for CH2 process alarm lower limit value
Input signal error defection status and processing at error detection
SM400
MOV D8 K1M50
Reads Input signal error detection flag.
M50
Processing when an input signal error is detected
Processing when CH1 input signal error is detected.
X43
X3C
SET Y3F
Turns on input signal error reset signal.
Error code display and reset processing
X3F
BCD D10 K4Y50
Outputs the error code in BCD.
X44
SET Y3F
Turns on Error clear request.
Y3F
X3C
X3F
RST Y3F
Turns off Error clear request.
END

(6) Program example when not using the parameter of intelligent function module


X30
Initial settings
M100
Y39
X39
X30
Y39
X39
Read digital output values
X40
X30
X3E
Y39
M0
M1
M2
Process alarm occurrence status and processing at warning occurrence
SM400
M22
M23
Input signal error defection status and processing at error detection
SM400
M50
X43
X3C
Error code display and reset processing
X3F
X44
Y3F
X3C
X3F

```
[SET M100]
[MOV H8 U3\G0]          Enables CH1 to CH3 A/D conversion.
[MOV K50 U3\G2]         Sets CH2 time/count/moving average.
[MOV K10 U3\G3]         Sets CH3 time/count/moving average.
[MOV H320 U3\G24]       Sets CH1 to CH3 averaging processing.
[MOV H0 U3\G26]         Sets conversion speed.
[MOV H0D U3\G48]        Sets CH2 warning output.
[MOV K0 U3\G90]         Sets CH2 process alarm lower lower limit value.
[MOV K3000 U3\G91]      Sets CH2 process alarm lower upper limit value.
[MOV K18000 U3\G92]     Sets CH2 process alarm upper lower limit value.
[MOV K20000 U3\G93]     Sets CH2 process alarm upper upper limit value.
[MOV H0E U3\G47]        Activates CH1 input signal error detection.
[MOV K100 U3\G142]      Sets CH1 input signal error detection value.
[MOV H0B U3\G53]        Sets CH3 scaling value.
[MOV K0 U3\G66]         Sets CH3 scaling lower limit value.
[MOV K32000 U3\G67]     Sets CH3 scaling upper limit value.
[SET Y39]               Turns on Operating condition setting request.
[RST M100]
[RST Y39]               Turns off Operating condition setting request.
[MOV U3\G10 K1M0]       Reads A/D conversion completed flag.
[MOV U3\G11 D11]        Reads CH1 Digital output value.
[MOV U3\G12 D12]        Reads CH2 Digital output value.
[MOV U3\G56 D13]        Reads CH3 Scaling value.
[MOV U3\G50 K2M20]      Reads Warning output flag.
Processing when a warning occurs    Processing when a warning occurs for CH2 process alarm upper limit value
Processing when a warning occurs    Processing when a warning occurs for CH2 process alarm lower limit value
[MOV U3\G49 K1M50]      Reads Input signal error detection flag.
Processing when an input signal error is detected    Processing when CH1 input signal error is detected
[SET Y3F]               Turns on input signal error reset signal.
[BCD U3\G19 K4Y50]      Outputs the error code in BCD.
[SET Y3F]               Turns on Error clear request.
[RST Y3F]               Turns off Error clear request.
[END]
```

CHAPTER 11 TROUBLESHOOTING

This chapter describes errors that may occur while the use of the A/D converter module, those troubleshooting.

(1) Checking the error codes and the alarm codes

Errors and alarms occurred in the A/D converter module can be checked by any of the following methods:

- Checking on the module detailed Information
- Checking Latest error code (Un\G19) of the buffer memory
- Checking on the module error collection function

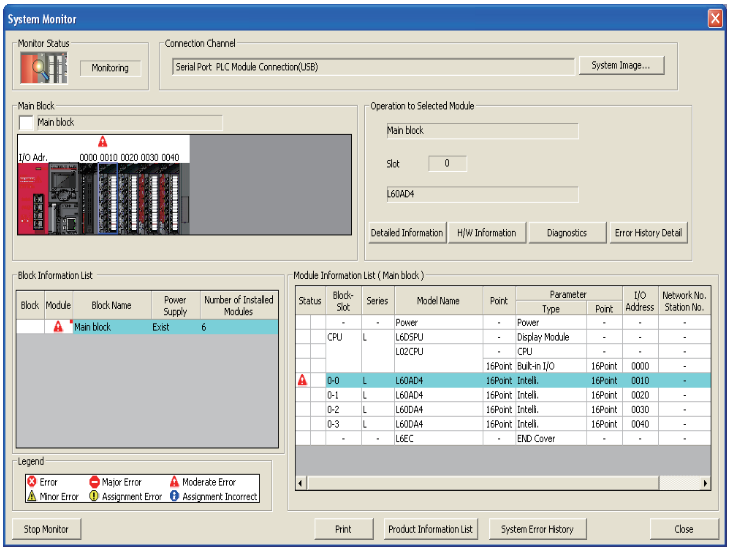
Choose the checking method by the purpose and application.

11.1 Checking on the Module Detailed Information

The following describes how to check the errors on the module detailed information.

[Diagnostics] ➪ [System Monitor…]

1. Select the A/D converter module in "Main Block" and click the Detailed Information **button.**


System Monitor
Monitor Status
Monitoring
Connection Channel
System Image...
Main Block
Operation to Selected Module
Detailed Information
H/W Information
Diagnostics
Error History Detail
Legend
Error
Major Error
Moderate Error
Minor Error
Assignment Error
Assignment Incorrect
Stop Monitor
Print
Product Information List
System Error History
Close

Connection Channel: Serial Port PLC Module Connection(USB)

Main Block: ☐ Main block

I/O Adr. 0000 0010 0020 0030 0040

Operation to Selected Module: Main block; Slot 0; L60AD4

Block Information List

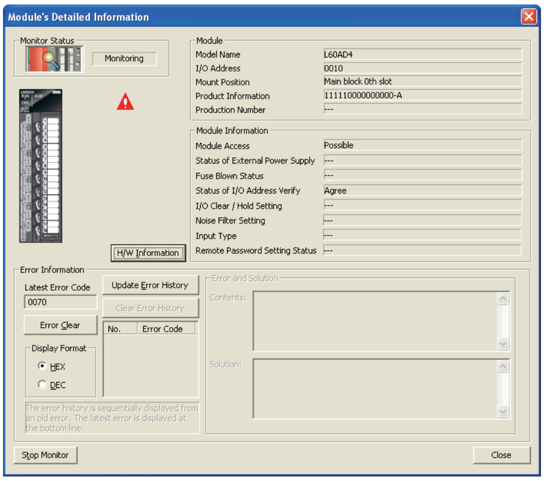
Block	Module	Block Name	Power Supply	Number of Installed Modules
		Main block	Exist	6

Module Information List (Main block)

Status		Block-Slot	Series	Model Name	Point	Parameter Type	Parameter Point	I/O Address	Network No. Station No.
		-	-	Power	-	Power	-	-	-
		CPU	L	L6DSPU	-	Display Module	-	-	-
				L02CPU	-	CPU	-	-	-
					16Point	Built-in I/O	16Point	0000	-
⚠		0-0	L	L60AD4	16Point	Intelli.	16Point	0010	-
		0-1	L	L60AD4	16Point	Intelli.	16Point	0020	-
		0-2	L	L60DA4	16Point	Intelli.	16Point	0030	-
		0-3	L	L60DA4	16Point	Intelli.	16Point	0040	-
		-	-	L6EC	-	END Cover	-	-	-

↓

2. "Module's Detailed Information" of the A/D converter module is displayed.


Module's Detailed Information
Monitor Status
Monitoring
H/W Information
Error Information
Update Error History
Clear Error History
Error Clear
Display Format
HEX
DEC
Error and Solution
Contents:
Solution:
Stop Monitor
Close

Module

Model Name	L60AD4
I/O Address	0010
Mount Position	Main block 0th slot
Product Information	111110000000000-A
Production Number	---

Module Information

Module Access	Possible
Status of External Power Supply	---
Fuse Blown Status	---
Status of I/O Address Verify	Agree
I/O Clear / Hold Setting	---
Noise Filter Setting	---
Input Type	---
Remote Password Setting Status	---

Error Information: Latest Error Code 0070

Display Format: ● HEX ○ DEC

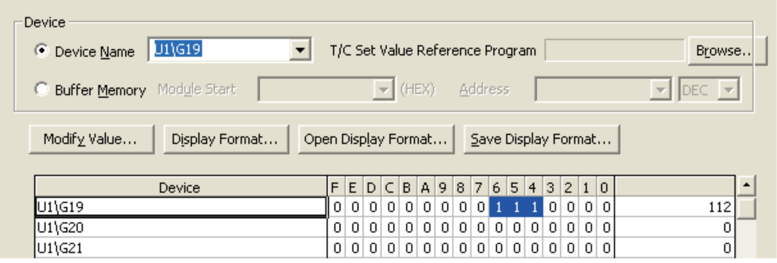
No.	Error Code

The error history is sequentially displayed from an old error. The latest error is displayed at the bottom line.

11.2 Checking by Latest Error Code (Un\G19)

The following describes how to check the error codes and alarm codes in Latest error code (Un\G19).

[Online] ➪ [Monitor] ➪ [Device/Buffer Memory Batch]


Device
T/C Set Value Reference Program
Browse...
Module Start
(HEX)
Address
DEC
Modify Value...
Display Format...
Open Display Format...
Save Display Format...

● Device Name: U1\G19

○ Buffer Memory

Device	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
U1\G19	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	112
U1\G20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U1\G21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

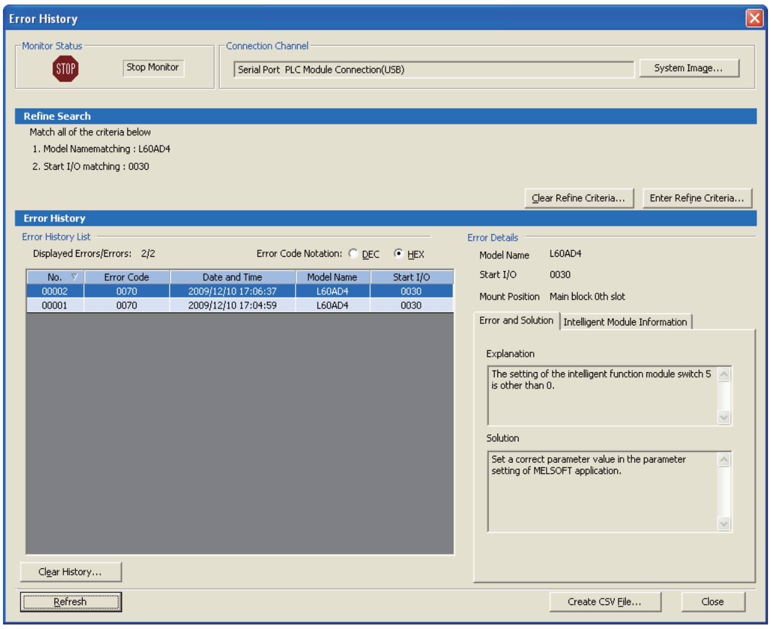
11.3 Checking on the Module Error Collection Function

Using the module error collection function stores the errors occurred in the A/D converter module to the CPU module. Once being stored, the errors remain even after power-off or reset of the CPU module.

(1) How to check the errors by the module error collection function

To check the errors of the A/D converter module collected by the CPU module, open the "Error History" dialog box.

[Diagnostics] ➪ [System Monitor...] ➪ click the Error History Detail button


Error History
Monitor Status
STOP
Stop Monitor
Connection Channel
System Image...
Refine Search
Clear Refine Criteria...
Enter Refine Criteria...
Error History
Error History List
Error Details
Error and Solution
Intelligent Module Information
Clear History...
Refresh
Create CSV File...
Close

Serial Port PLC Module Connection(USB)

Match all of the criteria below
1. Model Namematching : L60AD4
2. Start I/O matching : 0030

Displayed Errors/Errors: 2/2

Error Code Notation: ○ DEC ● HEX

No.	Error Code	Date and Time	Model Name	Start I/O
00002	0070	2009/12/10 17:06:37	L60AD4	0030
00001	0070	2009/12/10 17:04:59	L60AD4	0030

Model Name L60AD4
Start I/O 0030
Mount Position Main block 0th slot

Explanation
The setting of the intelligent function module switch 5 is other than 0.

Solution
Set a correct parameter value in the parameter setting of MELSOFT application.

(2) Errors to be collected

The A/D converter module reports the following information to the CPU module:

- Error code list (☞ Page 89, Section 11.4)
- Alarm code list (☞ Page 91, Section 11.5)

11.4 Error Code List

When errors in the A/D converter module occurs while writing data to or reading data from the CPU module, the following error codes are stored in Latest error code (Un\G19).

At the same time, the A/D converter module reports the errors to the CPU module.

Error code (decimal)	Description and cause of error	Action
10☐	A value outside the range is set to Switch 1 (input range) in the Switch Setting for I/O and Intelligent Function Module screen of GX Works2. ☐ indicates the number of a channel where an invalid value is set.	Correct the value in the parameter setting of GX Works2.
111	A hardware failure occurs in the module.	Power off and then on the module. If the same error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi service center or representative, explaining a detailed description of the problem.
112	Other than "0" is set to the intelligent function module switch 5.	Set "0" for Switch 5 in the Switch Setting for I/O and Intelligent Function Module screen of GX Works2.
113[*1]	The flash memory data is an error.	Check the digital output value. If the same error occurs again, please consult your local Mitsubishi service center or representative, explaining a detailed description of the problem.
120[*1]	An invalid value is set to the offset/gain setting. The number of an error channel cannot be identified.	Perform offset/gain setting again for all channels where the user range setting has been configured. If the same error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi service center or representative, explaining a detailed description of the problem.
12☐[*1]	An invalid value is set to the offset/gain setting. ☐ indicates the number of a channel where an error occurs.	Perform offset/gain setting again for the error channel. If the same error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi service center or representative, explaining a detailed description of the problem.
161[*1][*2]	The G(P).OGSTOR instruction was executed in the offset/gain setting mode.	Do not execute the G(P).OGSTOR instruction in the offset/gain setting mode.
162[*1]	• The G(P).OGSTOR instruction has been consecutively executed. • In offset/gain setting, a setting value has been consecutively written to the flash memory more than 25 times.	• Execute the G(P).OGSTOR instruction once per module. • Do not write a setting value consecutively.
163[*1]	The G(P).OGSTOR instruction was executed for the module different from the one to which the G(P).OGLOAD instruction had been executed.	Execute the G(P).OGLOAD and G(P).OGSTOR instructions to the same module.
170	The offset/gain setting is configured exceeding the maximum number of times.	The offset/gain setting will not be performed according to the setting.

Error code (decimal)	Description and cause of error	Action
20☐[*1]	A value outside 2 to 5000 is set to Time Average of CH☐ Average time/Average number of times/Move average settings (Un\G1 to Un\G4). ☐ indicates the number of a channel where an error occurs.	Correct the value within the range of 2 to 5000. Also, set a value greater than or equal to the value calculated by "4 × Number of used channels × Conversion speed" (ms).
30☐[*1]	A value outside 4 to 62500 is set to Count Average of CH☐ Average time/Average number of times/Move average settings (Un\G1 to Un\G4). ☐ indicates the number of a channel where an error occurs.	Correct the value within the range of 4 to 62500.
31☐[*1]	A value outside 2 to 1000 is set to Moving average of CH☐ Average time/Average number of times/Move average settings (Un\G1 to Un\G4). ☐ indicates the number of a channel where an error occurs.	Correct the value within the range of 2 to 1000.
360[*1]	A value outside 0 to 2 is set to Conversion speed setting (Un\G26).	Correct the value within the range of 0 to 2.
40☐[*1]	When the user range setting is performed or restored, the offset value is greater than or equal to the gain value. ☐ indicates the number of a channel where an error occurs.	Correct the value so that the offset value may be smaller than the gain value.
500[*1]	In offset/gain setting, channel numbers or "0" is set for both Offset/gain setting mode Offset specification (Un\G22) and Offset/gain setting mode Gain specification (Un\G23).	Correct the Offset/gain setting mode Offset specification (Un\G22) value and/or the Offset/gain setting mode Gain specification (Un\G23) value.
6△☐[*1]	Among CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101), any two of the values in the same channel is inconsistent. ☐ indicates the number of a channel where an error occurs. △ indicates a setting value representing the following status: 2: Process alarm lower lower limit value > Process alarm lower upper limit value 3: Process alarm lower upper limit value > Process alarm upper lower limit value 4: Process alarm upper lower limit value > Process alarm upper upper limit value	Correct the value(s).
80☐[*1]	A value outside 0 to 250 is set to CH☐ Input signal error detection setting value (Un\G142 to Un\G145). ☐ indicates the number of a channel where an error occurs.	Correct the value within the range of 0 to 250.
90☐[*1]	A value outside -32000 to 32000 is set to any of CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69). ☐ indicates the number of a channel where an error occurs.	Correct the value within the range of -32000 to 32000.
91☐[*1]	Among CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69), any of the scaling lower limit value is greater than or equal to the corresponding scaling upper limit value. ☐ indicates the number of a channel where an error occurs.	Correct the value so that the scaling upper limit value may be greater than the scaling lower limit value.
99☐[*1]	The scaling function is set to be enabled for a channel where user range setting has been configured. ☐ indicates the number of a channel where an invalid value is set.	Disable the scaling function for the channel where user range setting has been configured.

[*1] This error code can be cleared by turning off, on, and then off Error clear request (YF).

[*2] An error code is not stored in Latest error code (Un\G19) but in the completion status of the G(P). OGSTOR instruction (Ⓢ + 1).

11.5 Alarm Code List

The following shows an alarm code list.

Alarm code (decimal)	Description and cause of alarm	Action
10△□	A process alarm occurs. □ indicates the number of a channel where a process alarm occurs. △indicates a value representing the following status: 0: Upper limit of a process alarm 1: Lower limit of a process alarm	When a digital output value returns within the setting range, the corresponding bit of Warning output flag (Process alarm) (Un\G50) and Warning output signal (X8) turn off. An alarm code can be cleared by turning off, on, and then off Error clear request (YF) after a digital output value returns within the setting range.
110□	An input signal error occurs. □ indicates the number of a channel where an input signal error occurs.	The corresponding bit of Input signal error detection flag (Un\G49) and Input signal error detection signal (XC) turn off by turning off, on, and then off Error clear request (YF) after an analog input value returns within the setting range.

11.6 Troubleshooting

(1) When the RUN LED flashes or turns off

(a) When flashing

Check item	Action
Is the operation mode setting in the offset/gain setting mode?	Take the either of the following actions: • switch the operation mode setting in the intelligent function module switch setting of GX Works2 to the normal mode, or • correct Switch4 in the intelligent function module switch setting to switch the operation mode setting to the normal mode.

(b) When turning off

Check item	Action
Is the power supplied?	Check that the supply voltage of power supply module is within the rated range.
Is the capacity of power supply module enough?	Make sure that the power capacity is enough by calculating the current consumption such as a connected CPU module, an I/O module, and an intelligent function modules.
Is there any watchdog timer error?	Reset the CPU module, and check if the RUN LED turns on. If the RUN LED remains off, the module may be failed. Please consult your local Mitsubishi service center or representative, explaining a detailed description of the problem.
Is the module connected properly?	Check the module connection.

(2) When the ERR. LED turns on or flashes

(a) When turning on

Check item	Action
Does any error occur?	Check Latest error code (Un\G19), and take actions in the error code list. • Error Code List (☞ Page 89, Section 11.4)

(b) When flashing

Check item	Action
Is the value other than 0 set for Switch 5 of the intelligent function module switch setting?	With the parameter setting of GX Works2, set 0 for Switch 5 in the intelligent function module switch setting.

(3) When the ALM LED turns on or flashes

(a) When turning on

Check item	Action
Is there any alarm output?	Check Warning output flag (Process alarm) (Un\G50).

(b) When flashing

Check item	Action
Is there any input signal error?	Check Input signal error detection flag (Un\G49)

(4) When digital output value cannot be read

Check item	Action
Is there any problem with wiring, such as off or disconnection of analog signal lines?	Check the faulty area by checking signal line visually or conductively.
Is the CPU module in the STOP status?	Change the status of the CPU module to RUN.
Is the offset/gain setting correct?	Check if the offset/gain setting is correct. When the user range setting is selected, change the input range to the factory default setting. Then check if the A/D conversion executes. If the A/D conversion is properly executed, perform the offset/gain setting again.
Is input range setting correct?	Check Setting range (Un\G20) through the monitoring screen of GX Works2. When the setting range is wrong, perform the intelligent function module switch setting again.
Of the channels to input the analog value, is there any channel, whose A/D conversion enable/disable setting (Un\G0) set to the A/D conversion disable?	Check A/D conversion enable/disable setting (Un\G0) through the monitoring screen of GX Works2. Then, set the A/D conversion enable for Un\G0 with the sequence program or the parameter of the intelligent function module.
Is Operating condition setting request (Y9) performed?	Check if the digital output value is stored in the CH□ Digital output value (Un\G11 to Un\G14) after turning Operating condition setting request (Y9) from OFF to ON, then to OFF with GX Works2. If the problem is solved, correct the initial setting of the parameter in the intelligent function module or the sequence program.
Are the (V+) and (I+) terminals connected if the input source is current?	Make sure to connect the (V+) and (I+) terminals while inputting current as shown in the external wiring.
Are the setting values correct when the average processing is specified?	When selecting the time average processing, set the values satisfy the following condition. • Setting value ≥ "4 (times) × conversion speed × number of channels" If the condition above is not met, digital output values remain 0.
Is there any potential difference between the AG terminal and the external device GND?	Connect the AG terminal and the external device GND

Point

If digital output value cannot be read even after taking the above actions, module may be failed. Please consult your local Mitsubishi service center or representative, explaining a detailed description of the problem.

(5) When an A/D conversion completed flag does not turn on in the normal mode

Check item	Action
Isn't there any input signal error?	Check Input signal error detection flag (Un\G49)

11.7 Checking the Status of the A/D Converter Module by the System Monitor

To check the LED status or the setting status of the intelligent function module switch setting, select the H/W information of the A/D converter module on the system monitor of GX Works2.

(1) Hardware LED information

LED status is displayed.

No.	LED name	Status
1)	RUN LED	0000_H : Indicates the LED off. 0001_H : Indicates the LED on. Alternating indication between 0000_H and 0001_H : Indicates the LED flashing. (GX Works2 displays the communication status with the A/D converter module, so that the displaying intervals of 0000_H and 0001_H are not always even.)
2)	ERR. LED	
3)	ALM LED	

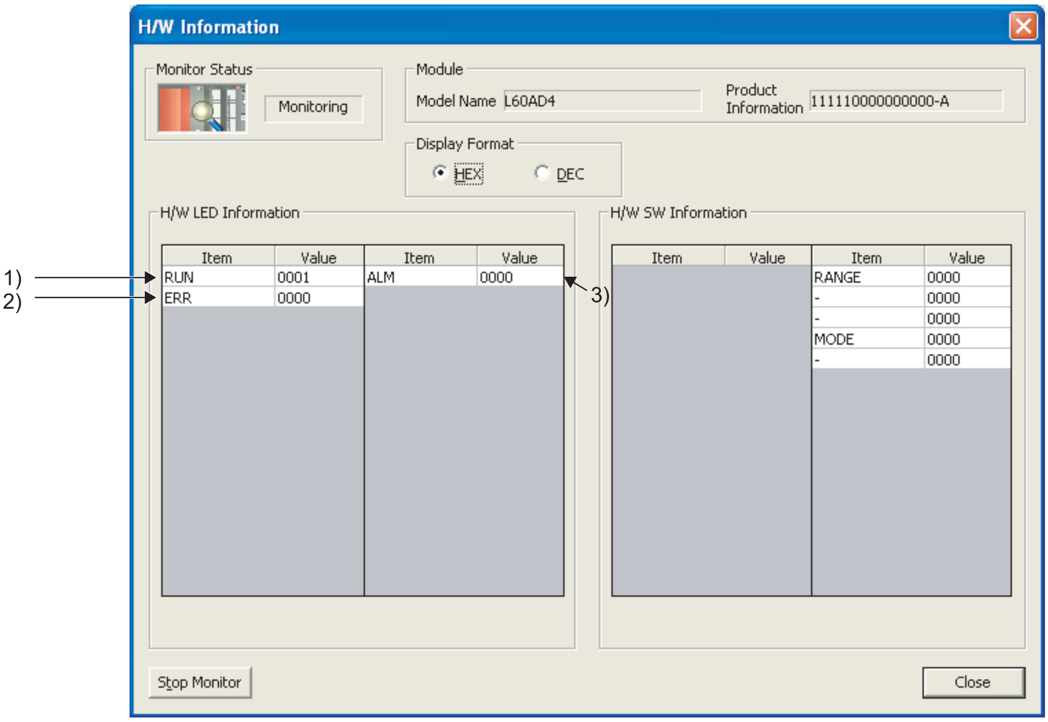
(2) Hardware switch information

The setting status of the intelligent function module switch setting is displayed.

For details on the setting status, refer to the following.

- Intelligent function module switch setting (☞ Page 133, Appendix 8.1(2))

Item	Intelligent function module switch
RANGE	Switch1
—	Switch2
—	Switch3
MODE	Switch4
—	Switch5



Model Name L60AD4

Product Information 111110000000000-A

Display Format: ● HEX ○ DEC

H/W LED Information

Item	Value	Item	Value
RUN	0001	ALM	0000
ERR	0000		

H/W SW Information

Item	Value	Item	Value
		RANGE	0000
		-	0000
		-	0000
		MODE	0000
		-	0000

APPENDICES

Appendix 1 Details of I/O Signals

The following describes the details of the A/D converter module I/O signals assigned to the CPU module.
The I/O number described in Appendix 1 shows the case that the start I/O number of the A/D converter module is set to "0".

Appendix 1.1 Input signal

(1) Module READY (X0)

Module READY (X0) turns ON to indicate the preparation for the A/D conversion is completed after the power-on or after the reset operation of the CPU module, and then the A/D conversion is proceeded.
In the following cases, Module READY (X0) turns off.

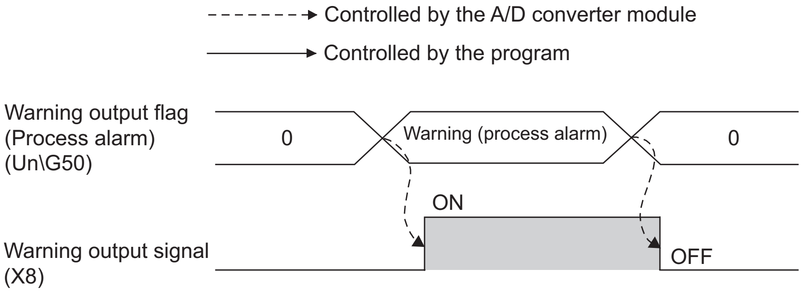
- In the offset/gain setting mode (In this case, the A/D conversion processing is executed)
- When a watch dog timer error occurs to the A/D converter module (In this case, the A/D conversion processing is not executed)

(2) Warning output signal (X8)

Warning output signal (X8) turns ON when the process alarm has been detected.

(a) Process alarm

- Warning output signal (X8) turns ON when digital output values of the A/D conversion enabled channels exceed the ranges set for CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101) after validating the alarm output setting (process alarm).
- Warning output signal (X8) turns OFF when the digital output values fall within the setting range for all the A/D conversion enabled channels.
  The ALM LED also turns off along with the off of the signal.


Controlled by the A/D converter module
Controlled by the program
Warning output flag (Process alarm) (Un\G50)
0
Warning (process alarm)
0
ON
Warning output signal (X8)
OFF

(3) Operating condition setting completed flag (X9)

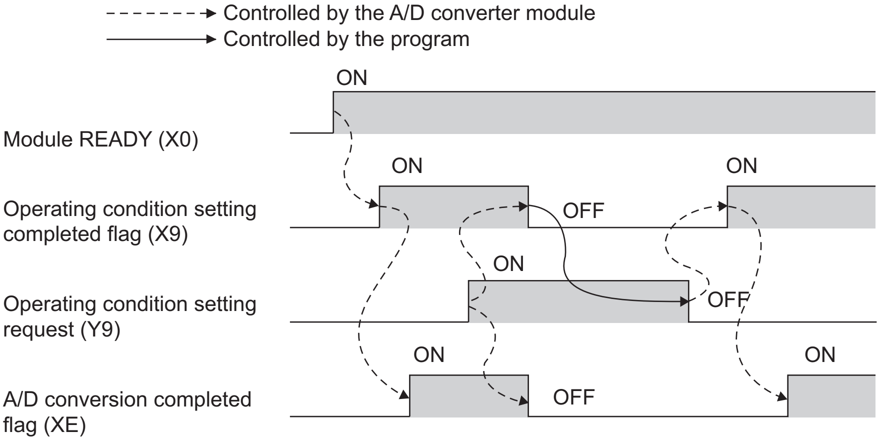
When changing the following settings, use Operating condition setting completed flag (X9) as an interlock condition to turn Operating condition setting request (Y9) OFF → ON → OFF.

- A/D conversion enable/disable setting (Un\G0)
- CH☐ Average time/Average number of times/Move average settings (Un\G1 to Un\G4)
- Averaging process specification (used to replace Q64AD) (Un\G9)
- Averaging process specification (Un\G24)
- Conversion speed setting (Un\G26)
- Input signal error detection setting (Un\G47)
- Process alarm output setting (Un\G48)
- Scaling enable/disable setting (Un\G53)
- CH☐ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68)
- CH☐ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69)
- CH☐ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98)
- CH☐ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99)
- CH☐ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100)
- CH☐ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101)
- CH☐ Input signal error detection setting value (Un\G142 to Un\G145)

When Operating condition setting completed flag (X9) is OFF, the A/D conversion processing is not executed.

In the case of the following status, Operating condition setting completed flag (X9) turns OFF.

- When Operating condition setting request (Y9) is ON

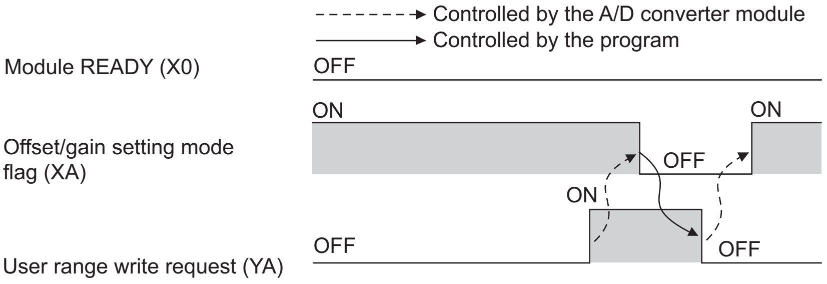

Controlled by the A/D converter module
Controlled by the program
Module READY (X0)
ON
Operating condition setting completed flag (X9)
ON
OFF
ON
Operating condition setting request (Y9)
ON
OFF
A/D conversion completed flag (XE)
ON
OFF
ON

(4) Offset/gain setting mode flag (XA)

(a) Offset/gain setting mode

When registering the value, which was adjusted with the offset/gain setting, to the module, use Offset/gain setting mode flag (XA) as an interlock condition to turn User range write request (YA) OFF → ON → OFF.
For the offset/gain setting, refer to the following.

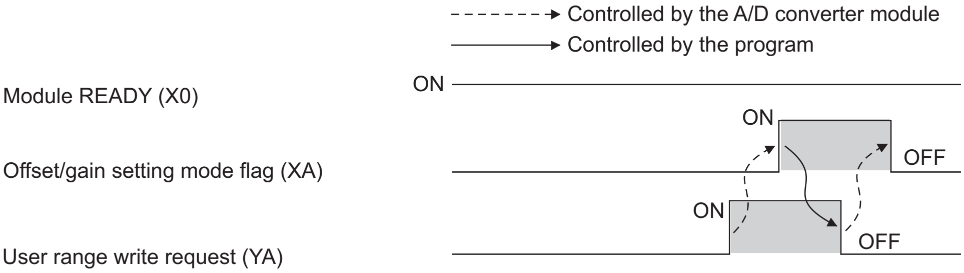
- Offset/gain setting (☞ Page 44, Section 7.5)


Controlled by the A/D converter module
Controlled by the program
Module READY (X0)
OFF
ON
ON
Offset/gain setting mode flag (XA)
OFF
ON
OFF
User range write request (YA)
OFF

(b) Normal mode

In the user range restoration, use Offset/gain setting mode flag (XA) as an interlock condition to turn User range write request (YA) OFF → ON → OFF.
For user range restoration, refer to the following.

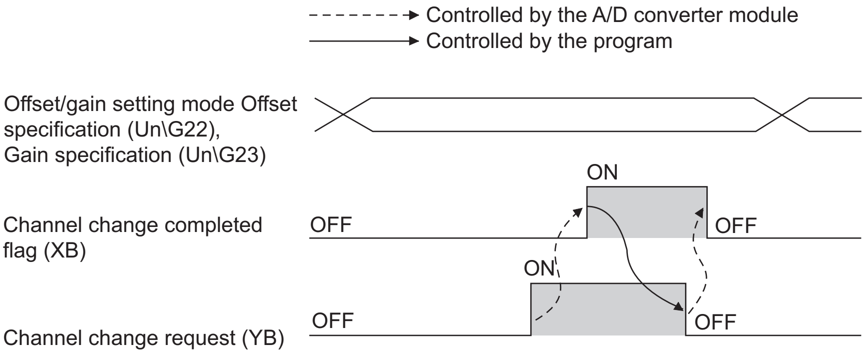
- Save/restoration of offset/gain value (☞ Page 66, Section 8.12)


Controlled by the A/D converter module
Controlled by the program
Module READY (X0)
ON
ON
Offset/gain setting mode flag (XA)
OFF
ON
User range write request (YA)
OFF

(5) Channel change completed flag (XB)

When changing a channel to perform the offset/gain setting, use Channel change completed flag (XB) as an interlock condition to turn Channel change request (YB) OFF → ON → OFF.
For the offset/gain setting, refer to the following.

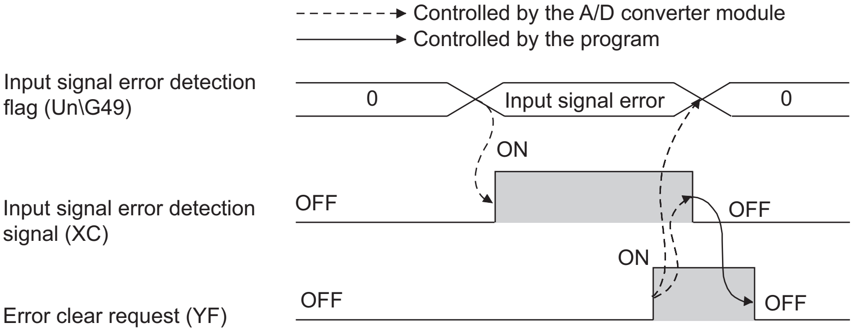
- Offset/gain setting (☞ Page 44, Section 7.5)


Controlled by the A/D converter module
Controlled by the program
Offset/gain setting mode Offset specification (Un\G22), Gain specification (Un\G23)
ON
Channel change completed flag (XB)
OFF
OFF
ON
Channel change request (YB)
OFF
OFF

(6) Input signal error detection signal (XC)

- Input signal error detection signal (XC) turns to ON when an analog input value exceeds the range set with CH☐ Input signal error detection setting value (Un\G142 to Un\G145) in any channel which has been A/D conversion-enabled, after validating the input signal error detection.
- After setting the analog input value within the range set, turn Error clear request (YF) OFF → ON → OFF to turn OFF Input signal error detection signal (XC) and the ALM LED, and clear Latest error code (Un\G19).
- When the analog input value falls within the range set, A/D conversion resumes regardless of Input signal error detection signal (XC) reset, and A/D conversion completed flag (Un\G10) for the corresponding channels turns back to ON.

  The averaging processing time count is reset to zero after the resumption of the A/D conversion.

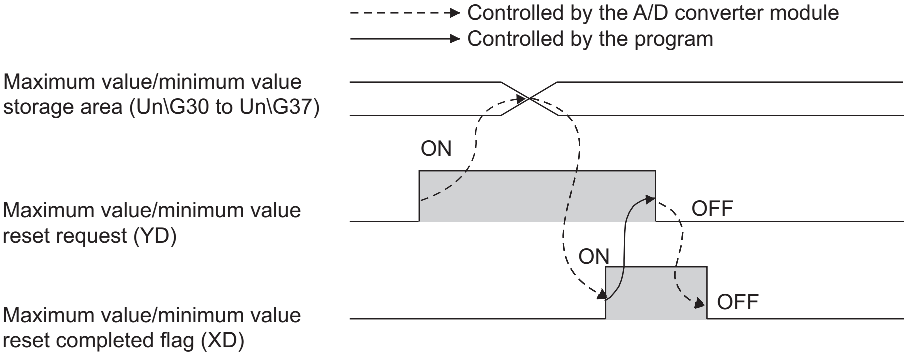

Controlled by the A/D converter module
Controlled by the program
Input signal error detection flag (Un\G49)
0
Input signal error
0
ON
Input signal error detection signal (XC)
OFF
OFF
ON
Error clear request (YF)
OFF
OFF

(a) When Input signal error detection signal (XC) turns ON

- A/D conversion completed flag (Un\G10) for the corresponding channels turns OFF.
- For the error detected channel, the digital output value immediately before the error detection is held in the buffer memory.
- ALM LED flashes.

(7) Maximum value/minimum value reset completed flag (XD)

Maximum value/minimum value reset completed flag (XD) turns ON after resetting the maximum or minimum values stored in CH☐ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH☐ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37) by turning Maximum value/minimum value reset request (YD) OFF → ON → OFF.

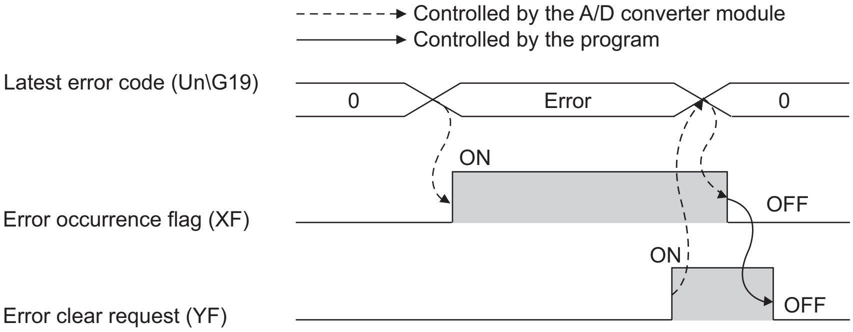

Controlled by the A/D converter module
Controlled by the program
Maximum value/minimum value storage area (Un\G30 to Un\G37)
ON
Maximum value/minimum value reset request (YD)
OFF
ON
Maximum value/minimum value reset completed flag (XD)
OFF

(8) A/D conversion completed flag (XE)

A/D conversion completed flag (XE) turns ON when all A/D conversion-enabled channels are converted.

(9) Error occurrence flag (XF)

Error occurrence flag (XF) turns ON when an error occurs.


Controlled by the A/D converter module
Controlled by the program
Latest error code (Un\G19)
0
Error
0
ON
Error occurrence flag (XF)
OFF
ON
Error clear request (YF)
OFF

(a) Clearing the latest error code and Error occurrence flag (XF)

Turn Error clear request (YF) OFF → ON → OFF.

Appendix 1.2 Output signal

(1) Operating condition setting request (Y9)

To validate the following settings, turn Operating condition setting request (Y9) OFF→ ON → OFF.

- A/D conversion enable/disable setting (Un\G0)
- CH□ Average time/Average number of times/Move average settings (Un\G1 to Un\G4)
- Averaging process specification (used to replace Q64AD) (Un\G9)
- Averaging process specification (Un\G24)
- Conversion speed setting (Un\G26)
- Input signal error detection setting (Un\G47)
- Process alarm output setting (Un\G48)
- Scaling enable/disable setting (Un\G53)
- CH□ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68)
- CH□ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69)
- CH□ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98)
- CH□ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99)
- CH□ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100)
- CH□ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101)
- CH□ Input signal error detection setting value (Un\G142 to Un\G145)

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Operating condition setting completed flag (X9) (☞ Page 95, Appendix 1.1)

(2) User range write request (YA)

(a) Offset/gain setting mode

Turn User range write request (YA) OFF → ON → OFF to register the adjusted offset/gain setting values in the A/D converter module.

The data is written to the module at the moment the signal is turned from OFF to ON.

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Offset/gain setting mode flag (XA) (☞ Page 95, Appendix 1.1)

(b) Normal mode

Turn User range write request (YA) OFF → ON → OFF to perform the user range restoration.

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Offset/gain setting mode flag (XA) (☞ Page 95, Appendix 1.1)

(3) Channel change request (YB)

Turn Channel change request (YB) OFF → ON → OFF to change a channel to perform the offset/gain setting.

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Channel change completed flag (XB) (☞ Page 95, Appendix 1.1)

(4) Maximum value/minimum value reset request (YD)

Turn Maximum value/minimum value reset request (YD) OFF → ON → OFF to clear the maximum or minimum values stored in CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37).

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Maximum value/minimum value reset completed flag (XD) (☞ Page 95, Appendix 1.1)

(5) Error clear request (YF)

To clear Error occurrence flag (XF), Input signal error detection signal (XC), and Latest error code (Un\G19), turn Error clear request (YF) OFF → ON → OFF.

For the timing of turning the signal OFF → ON → OFF, refer to the following.

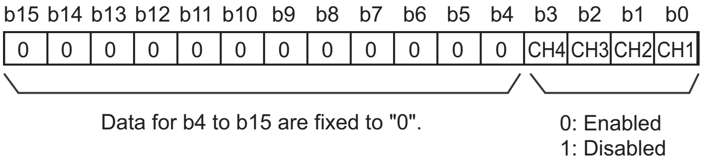
- Input signal error detection signal (XC) (☞ Page 95, Appendix 1.1)
- Error occurrence flag (XF) (☞ Page 95, Appendix 1.1)

Appendix 2 Details of Buffer Memory Addresses

The following describes the details of buffer memory addresses of the A/D converter module.

(1) A/D conversion enable/disable setting (Un\G0)

Set if the A/D conversion is enabled or disabled for each channel.



b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".

0: Enabled
1: Disabled

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to A/D conversion enable (0) as the default value.

(2) CH□ Average time/Average number of times/Move average settings (Un\G1 to Un\G4)

Configure the time/count/moving average setting for each channel to which the averaging processing is specified. The following shows the setting range.

Processing method	Conversion speed setting	Setting range
Time average	20μs	2 to 1500 (ms)
	80μs, 1ms	2 to 5000 (ms)
Count average	20μs, 80μs, 1ms	4 to 62500 (times)
Moving average	20μs, 80μs, 1ms	2 to 1000 (times)

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

0 is set as the default value.

Point

- When the value out of the setting range above is written, an error occurs in the channel to which the value is written, the error code is stored in Latest error code (Un\G19) and Error occurrence flag (XF) is turned ON. The A/D conversion is processed in the setting configured before the error occurrence.
- 0 is set as default value, so change the value according to the processing method.
- When the sampling is set to the channel to which the setting value has been set, the setting value is ignored.

(3) Averaging process specification (used to replace Q64AD) (Un\G9)

Write the setting for averaging processing when using the sequence program for initial setting of the Q64AD.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	CH4	CH3	CH2	CH1	0	0	0	0	CH4	CH3	CH2	CH1

b11 to b8: Averaging processing channel specification
1: Averaging processing
0: Sampling processing

b3 to b0: Time/number of times specification
1: Time
0: Number of times

(a) Enabling the setting

To enable the setting, turn OFF → ON → OFF Operating condition setting request (Y9) after setting Averaging process specification (Un\G24) to sampling processing (0).

Point

When selecting the moving average, it is necessary to write 0 to Averaging process specification (used to replace Q64AD) (Un\G9), and write the moving average to Averaging process specification (Un\G24).

(b) Default value

All channels are set to sampling (0) as the default value.

(4) A/D conversion completed flag (Un\G10)

A/D conversion status can be checked with this flag.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

b15 to b4: Data for b4 to b15 are fixed to "0".

b3 to b0:
1: Conversion completed
0: During conversion or unused

(a) A/D conversion completion

When the first A/D conversion is completed in the channel where the A/D conversion is enabled, the flag is turned to A/D conversion completion (1).
A/D conversion completed flag (XE) is turned to ON when the conversion of all the channels where the A/D conversion is enabled are completed.
Turning OFF → ON → OFF Operating condition setting request (Y9) turns the flag to 0 (default value), and the flag is turned to A/D conversion completion (1) when the first A/D conversion is completed.

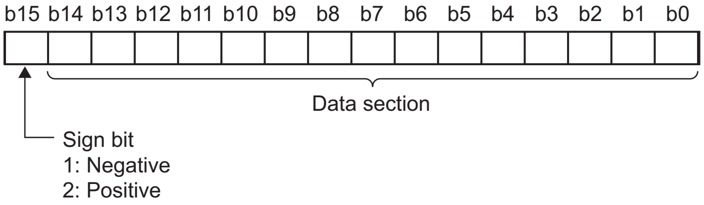
Ex. When A/D conversion enable is set to CH1 and CH2 and all the A/D conversions in CH1 and CH2 are completed, 0003$_H$(3) is stored in A/D conversion completed flag (Un\G10), as shown below.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
												CH4	CH3	CH2	CH1

b15 to b12: 0
b11 to b8: 0
b7 to b4: 0
b3 to b0: 3

(5) CH□ Digital output value (Un\G11 to Un\G14)

The A/D-converted digital output value is stored as a signed 16-bit binary value.



(a) Updating cycle

When performing the average processing, the value is updated in each specified averaging processing cycle. When the average processing is not performed, the value is updated in each sampling cycle.

(6) Latest error code (Un\G19)

Error codes or alarm codes detected in the A/D converter module are stored.

For details on error code and alarm code, refer to the following.

- Error code list (☞ Page 89, Section 11.4)
- Alarm code list (☞ Page 91, Section 11.5)

(a) Clearing an error

Turn OFF → ON → OFF Error clear request (YF).

(7) Setting range (Un\G20)

The setting content for input range can be checked.

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

Setting range of A/D converter module

Input range	Setting value
4 to 20mA	0_H
0 to 20mA	1_H
1 to 5V	2_H
0 to 5V	3_H
-10 to 10V	4_H
0 to 10V	5_H
User range setting	F_H

Point

The setting cannot be changed with Setting range (Un\G20).
For changing the setting, refer to the following.

- Switch setting (☞ Page 40, Section 7.2)

(8) Offset/gain setting mode Offset specification (Un\G22), Offset/gain setting mode Gain specification (Un\G23)

Specify the channel to perform the offset/gain setting adjustment.

Offset/gain setting mode Offset specification (Un\G22): channel to adjust the offset

Offset/gain setting mode Gain specification (Un\G23): channel to adjust the gain

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Offset/gain setting mode Offset specification (Un\G22)	0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1
Offset/gain setting mode Gain specification (Un\G23)	0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".

1: Setting-target channel
0: Invalid

Point

- The settings for multiple channels can be configured at the same time. However, set either of Offset/gain setting mode Offset specification (Un\G22) or Offset/gain setting mode Gain specification (Un\G23) to be disabled (0).
  When the settings for both of them are configured at the same time, a gain setting mode error (error code: 500) occurs.
- For details on offset/gain setting, refer to the following.
  - Offset/gain setting (☞ Page 43, Section 7.4)

(9) Averaging process specification (Un\G24)

Configure the setting when selecting sampling or averaging processing for each channel.

Averaging processing includes time average, count average and moving average.

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

Setting range

Processing method	Setting value
Sampling processing	0_H
Time average	1_H
Count average	2_H
Moving average	3_H

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to sampling (0) as the default value.

Point

- When using Averaging process specification (used to replace Q64AD) (Un\G9), the value set in Averaging process specification (Un\G24) is ignored. (The operation is performed in the averaging processing specification in Averaging process specification (used to replace Q64AD) (Un\G9).)
- The channel to which a value out of the setting range is written performs the operation in the sampling processing.

(10)Conversion speed setting (Un\G26)

Set the conversion speed for all channels.
When the value of 3 to FFFF_H is set, an error occurs and the operation is performed in the previous setting.

Setting range

Conversion speed	Setting value
20μs	0_H
80μs	1_H
1ms	2_H

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

80μs (1) is set as the default value.

(11)CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36), CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37)

The maximum and minimum values of converted digital output value are stored as signed 16-bit binary.
In the following cases, CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37) are updated with the current value.

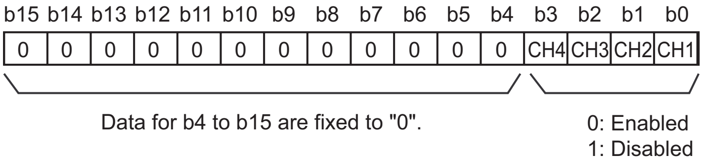
- When turning OFF → ON → OFF Operating condition setting request (Y9) changes the setting
- When Maximum value/minimum value reset request (YD) is turned OFF → ON → OFF

Point

- For the channel to which the averaging processing is specified, the maximum and minimum values are stored at averaging processing time intervals.
- When the scaling function is enabled, the scale-converted value is stored to the maximum and minimum values.

(12)Input signal error detection setting (Un\G47)

Set whether the alarm output of input signal error detection is enabled or disabled for each channel.



b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".

0: Enabled
1: Disabled

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to disable (1) as the default value.

(13)Process alarm output setting (Un\G48)

Set whether the alarm output of process alarm is enabled or disabled for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".

0: Enabled
1: Disabled

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to disable (1) as the default value.

(14)Input signal error detection flag (Un\G49)

Input signal status can be checked with this flag.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".

0: Normal
1: Error

(a) Input signal error detection flag (Un\G49) status

- When the analog input value out of the setting range for CH□ Input signal error detection setting value (Un\G142 to Un\G145) is detected, Input signal error detection flag (Un\G49) corresponding to each channel is turned to input signal error (1).
- When an error is detected in any A/D conversion enable or input signal error detection enable channels, Input signal error detection signal (XC) is turned to ON.

(b) Clearing Input signal error detection flag (Un\G49)

Input signal error detection flag (Un\G49) can be cleared in the following two procedures.

- Turn OFF → ON → OFF Operating condition setting request (Y9)
- Turn OFF → ON → OFF Error clear request (YF)

(15)Warning output flag (Process alarm) (Un\G50)

Alarms can be checked if the alarm is the upper limit alarm or lower limit alarm, for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH4 lower limit value	CH4 upper limit value	CH3 lower limit value	CH3 upper limit value	CH2 lower limit value	CH2 upper limit value	CH1 lower limit value	CH1 upper limit value

Data for b4 to b15 are fixed to "0".

0: Normal
1: Alarm on

(a) Warning output flag (Process alarm) (Un\G50) status

- When the value is out of the range specified in CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101), Warning output flag (Process alarm) (Un\G50) corresponding to each channel is turned to alarm ON (1).
- Alarms can be checked if the alarm is the upper limit alarm or lower limit alarm, for each channel.
- When an error is detected in any A/D conversion enable or alarm output enable channels, Warning output signal (X8) is also turned to ON.
- When the digital output value returns to the setting range, the flag is automatically cleared.

(16)Scaling enable/disable setting (Un\G53)

Set whether the scaling is enabled or disabled, for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".

0: Valid
1: Invalid

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

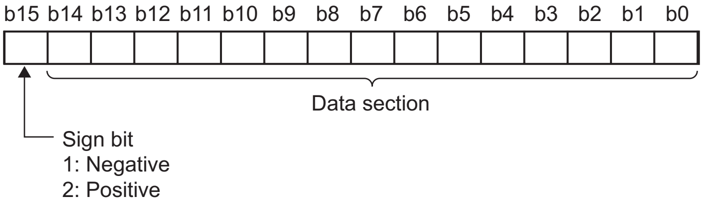
All channels are set to disable (1) as the default value.

Point

The scaling function cannot be used for the channel in which the user range setting is used.
If the scaling is enabled to a channel in which the user range setting is used, an error occurs, the error code is stored in Latest error code (Un\G19), and Error occurrence flag (XF) is turned to ON. The operation is performed in the setting configured before the error occurrence.

(17)CH□ Scaling value (Un\G54 to Un\G57)

The digital output value which is scale-converted using the CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69) is stored as signed 16-bit binary.



(18)CH□ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68), CH□ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69)

Set the range of scale conversion for each channel.

For details on scaling function, refer to the following.

- Scaling Function (☞ Page 59, Section 8.8)

(a) Setting range

Setting range: -32000 to 32000 (scaling upper limit value > scaling lower limit value)

(b) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

Point

- When a value set to a channel is out of the setting range above or a value does not satisfy "scaling upper limit value > scaling lower limit value", an error occurs to the channel.
  Then, an error code is stored in Latest error code (Un\G19), Error occurrence flag (XF) is turned ON and the operation is performed in the setting configured before the error occurrence.
- Change the setting value, since 0 is set as the default value.
- When Scaling enable/disable setting (Un\G53) is set to "disable", the setting for CH□ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68) and CH□ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69) are ignored.

(19)CH☐ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98), CH☐ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99), CH☐ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100), CH☐ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101)

Set the digital output value range for each channel.

For details on warning output function (process alarm), refer to the following.

- Warning Output Function (Process Alarm) (☞ Page 56, Section 8.7)

(a) Setting range

- Setting range is -32768 to 32767.
- Configure the 4-step setting of process alarm upper upper limit value, process alarm upper lower limit value, process alarm lower upper limit value and process alarm lower lower limit value.

(b) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(c) Default value

0 is set as the default value.

Point

- ● When a value out of the setting range above or a value which does not satisfy the formula of process alarm upper upper limit value ≥ process alarm upper lower limit value ≥ process alarm lower upper limit value ≥ process alarm lower lower limit value is set to a channel, an error occurs in the channel. The error code is stored in Latest error code (Un\G19), and Error occurrence flag (XF) is turned to ON. The operation is performed in the setting configured before the error occurrence.
- ● Change the setting value, since 0 is set as the default value.
- ● When Scaling enable/disable setting (Un\G53) is "enable", be sure to set a value considering the scale conversion.

(20)CH□ Input signal error detection setting value (Un\G142 to Un\G145)

Set the setting value to detect an input analog value error for each channel.

For details on input signal error detection function, refer to the following.

- Input Signal Error Detection Function (☞ Page 53, Section 8.6)

(a) Setting procedure

- Setting range is 0 to 250 (0 to 25.0%) and a value can be set in increments of 1 (0.1%).

Ex. When setting the input signal error detection setting value to 15%

150 is stored in buffer memory.

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

- Based on the input signal error detection setting value, the upper and lower limit values of input signal error detection are calculated as follows. The calculated upper and lower limit values of input signal error detection change depending on the input range to be used.

Upper limit value of input signal error detection

$$= \text{Gain value of each range} + (\text{Gain value of each range} - \text{Offset value of each range}) \times \frac{\text{Input signal error detection setting value}}{1000}$$

Lower limit value of input signal error detection

$$= \text{Lower limit value of each range} - (\text{Gain value of each range} - \text{Offset value of each range}) \times \frac{\text{Input signal error detection setting value}}{1000}$$

Ex. When setting the input signal error detection setting value to 150 (15%)

Range to be used: user range setting (offset value: 1 mA, gain value: 19 mA)

In this setting, the value is -17 mA as it is the analog value when the lower limit value is -20000.

Thus, the upper and lower limit values of input signal error detection are as follows:

$$\text{Input signal error detection upper limit value} = 19 + (19 - 1) \times \frac{150}{1000} = 21.7\text{mA}$$

$$\text{Input signal error detection lower limit value} = -17 - (19 - 1) \times \frac{150}{1000} = -19.7\text{mA}$$

Point

When a value out of the setting range above is set to a channel, an error occurs in the channel, an error code is stored in Latest error code (Un\G19) and Error occurrence flag (XF) is turned to ON. The operation is performed in the setting configured before the error occurrence.

(b) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(21)Mode switching setting (Un\G158, Un\G159)

Set the setting value for the mode to be switched to.
When the mode is switched, this area is cleared to zero and Operating condition setting completed flag (X9) is turned to OFF.
After checking that the operating condition setting complete/completion flag is OFF, turn Operating condition setting request (Y9) to OFF.

Mode switching to	Setting value	
	Un\G158	Un\G159
Normal mode	0964_H	4144_H
Offset/gain setting mode	4144_H	0964_H

(a) Enabling the setting

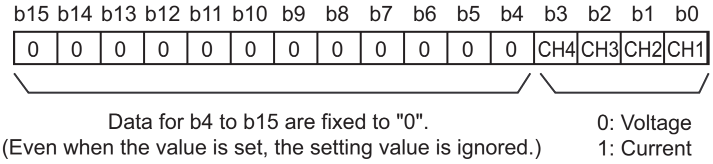
Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

Point

When a value out of the setting range above is written, the mode is not switched and only the operating condition is changed.

(22)Pass data classification setting (Un\G200)

This is the area for saving and restoring the offset/gain setting value in user range setting.
Specify if the offset/gain setting value to be saved or restored is either voltage or current.



b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to "0".
(Even when the value is set, the setting value is ignored.)

0: Voltage
1: Current

(23)CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233)

This is the area for restoring the offset/gain setting value in user range setting.

The data to be used when restoring the offset/gain setting value in user range setting is stored.

The data is stored when;

- Writing the initial setting by utility
- Turning OFF → ON Operating condition setting request (Y9) *1
- Turning OFF → ON User range write request (YA) (in offset/gain setting mode)

*1 The data is not saved when the setting value is written to Mode switching setting (Un\G158, Un\G159).

When restoring the offset/gain setting value in user range setting, set the data saved in this area to the same area in the A/D converter module where the data is restored.

(a) Procedure for recording the buffer memory save of offset/gain value

1. **Configure Pass data classification setting (Un\G200)**
2. **Turn OFF → ON Operating condition setting request (Y9)**
3. **Compare the values in CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233) with the range table.**
4. **When the value is appropriate, record the values in Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).**

For details on the offset/gain value setting, refer to the following.

- Offset/gain setting (☞ Page 44, Section 7.5)

(24)Latest error code address (Un\G1800)

The latest address of error log is stored.

(25)Error history No.□ (Un\G1810 to Un\G1969)

Up to 16 errors occurred in the module are recorded.

	b15 to b8	b7 to b0
Un\G1810	Error code	
Un\G1811	First two digits of the year	Last two digits of the year
Un\G1812	Month	Day
Un\G1813	Hour	Minute
Un\G1814	Second	Day of the week
Un\G1815 to Un\G1819	System area	

Appendix 3 I/O Conversion Characteristic of A/D Conversion

I/O conversion characteristic of A/D conversion means the slope of the line connected between the offset value and gain value when converting the analog signal (voltage or current input) from outside of programmable controller to digital value.

(1) Offset value

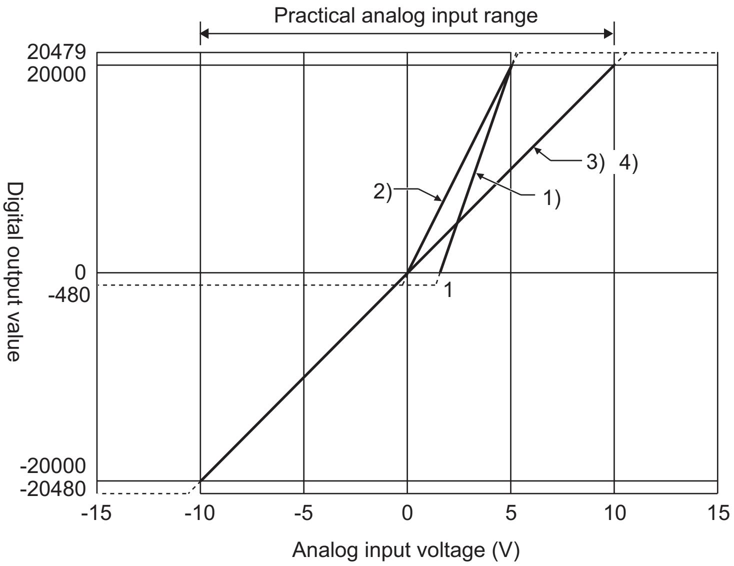
This is the analog input value (voltage or current) when the digital output value becomes 0.

(2) Gain value

This is the analog input value (voltage or current) when the digital output value becomes 20000.

(3) Voltage input characteristic

The following graph shows the voltage input characteristic.



No.	Input range setting	Offset value	Gain value	Digital output value *2	Resolution
1)	1 to 5V	1V	5V	0 to 20000	200µV
2)	0 to 5V	0V	5V		250µV
3)	-10 to 10V	0V	10V	-20000 to 20000	500µV
4)	0 to 10V	0V	10V	0 to 20000	
—	User range setting	*1	*1	-20000 to 20000	307µV *3

*1 Set the offset value and gain value in user range setting within the range satisfying the following conditions.
If the following conditions are not satisfied, A/D conversion may not be properly performed.
- Setting range for offset value and gain value: -10 to 10 V
- ((gain value)-(offset value)) ≥ 4.0 V

*2 When analog input is performed exceeding the range of digital output value, the digital output value is fixed to the maximum or minimum.

Input range setting	Digital output value	
	Minimum	Maximum
1 to 5V	-480	20479
0 to 5V		
-10 to 10V	-20480	
0 to 10V	-480	
User range setting	-20480	

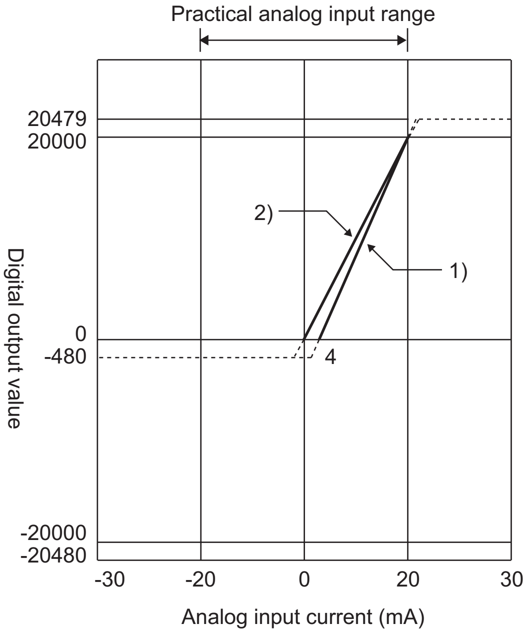
*3 This is the maximum resolution in user range setting.

Point

- ● Use the value within the practical analog input range and practical digital output range. If a value is out of the range, the resolution and accuracy may not fall within the range of performance specifications. (Do not use the value in the dotted line region in the graph above.)
- ● Do not input a value of ±15 V or more. This may damage the elements.

(4) Current input characteristic

The following graph shows the current input characteristic.



No.	Input range setting	Offset value	Gain value	Digital output value *2	Resolution
1)	4 to 20mA	4mA	20mA	0 to 20000	800nA
2)	0 to 20mA	0mA	20mA		1000nA
3)	User range setting	*1	*1	-20000 to 20000	1230nA *3

*1 Set the offset value and gain value in the user range setting within the range satisfying the following conditions.
If the following conditions are not satisfied, A/D conversion may not be properly performed.
• gain value 20 mA, offset value ≥ 0 mA
• ((gain value) - (offset value)) ≥ 16.0 mA

*2 When analog input is performed exceeding the range of digital output value, the digital output value is fixed to the maximum or minimum.

Input range setting	Digital output value	
	Minimum	Maximum
4 to 20mA	-480	20479
0 to 20mA		
User range setting	-20480	

*3 This is the maximum resolution in user range setting.

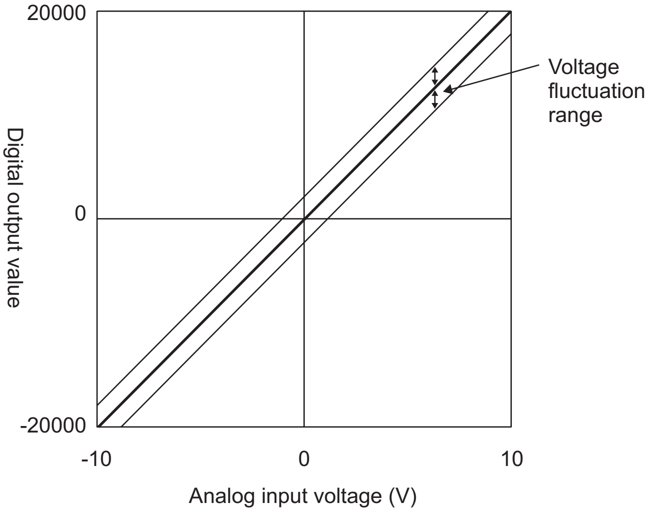
Point

- Use the value within the practical analog input range and practical digital output range. If a value is out of the range, the resolution and accuracy may not fall within the range of performance specifications. (Do not use the value in the dotted line region in the graph above.)
- Do not input a value of ±30mA or more. This may damage the elements.

Appendix 4 A/D Conversion Accuracy

The A/D conversion accuracy is the accuracy for the maximum value of digital output value.
Even when changing the offset/gain setting and input range to change the input characteristics, the accuracy does not change and is kept within the range of described performance specifications.

The following graph shows the fluctuation range of accuracy when the range of -10 to 10V is selected.
The accuracy is ±0.1% (±20digit) when the ambient temperature is 25 ±5°C and ±0.2% (±40digit) when the ambient temperature is 0 to 55°C. (Excluding the case under noise effect.)



Appendix 5 Dedicated Instruction

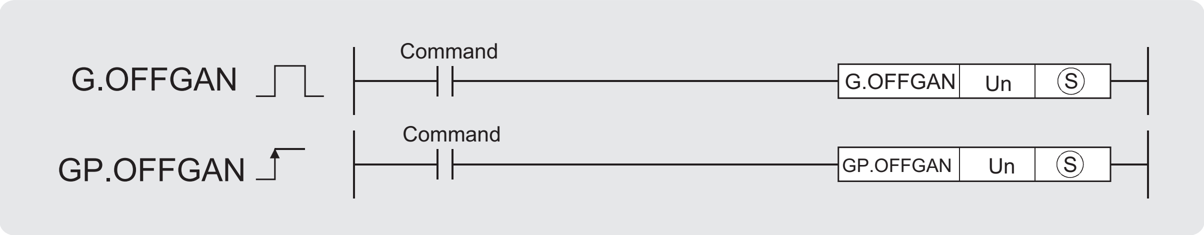
This chapter describes the dedicated instructions that can be used in A/D converter module.

Appendix 5.1 Instruction list

The following shows the dedicated instructions that can be used in the A/D converter module.

Instruction	Description
G(P).OFFGAN	• The operation mode is changed to the offset/gain setting mode. • The operation mode is changed to the normal mode.
G(P).OGLOAD	The offset/gain set value in the user range setting is read out to the CPU module.
G(P).OGSTOR	The offset/gain set value in the user range setting stored in the CPU module is restored to the A/D converter module.

Appendix 5.2 G(P).OFFGAN



Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	—	○		—					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FE_H	BIN 16 bits
Ⓢ	Mode change 0: changed to the normal mode 1: changed to the offset/gain setting mode When a value other than above is set, the mode is changed to the offset/gain setting mode.	0, 1	BIN 16 bits

(2) Functions

This instruction switches the operation mode of the A/D converter module.

- Normal mode → offset/gain setting mode (Offset/gain setting mode flag (XA) is ON)
- Offset/gain setting mode → normal mode (Offset/gain setting mode flag (XA) is OFF)

Point

- When the mode is switched from the offset/gain setting mode to the normal mode, Module READY (X0) turns from OFF to ON.
  Note that if a program includes the initial settings to be executed at ON of Module READY (X0), this instruction performs the initial setting process.
- When the mode is switched from the offset/gain setting mode to the normal mode, the A/D converter module operates under the previous operating condition.

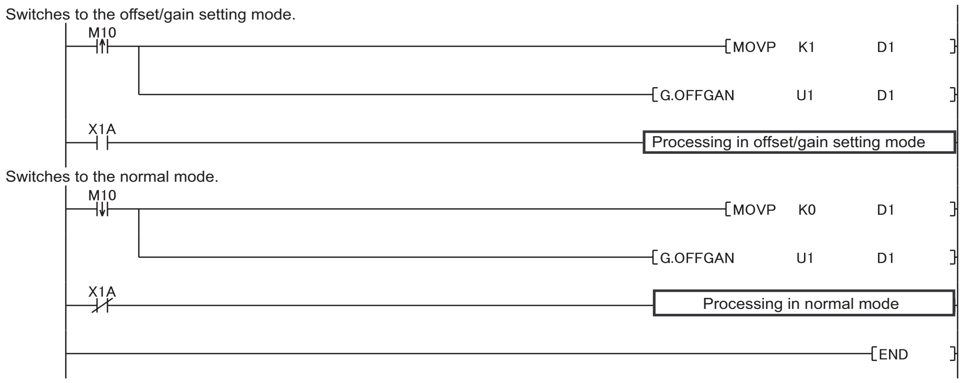
(3) Errors

The instruction has no errors.

(4) Program example

The following shows the program of the A/D converter module, installed in I/O number X/Y10 to X/Y1F, with the following conditions:

- turning ON M10 switches the operation mode to the offset/gain setting mode, and
- turning OFF M10 restores the operation mode to the normal mode.


Switches to the offset/gain setting mode.
M10
MOVP K1 D1
G.OFFGAN U1 D1
X1A
Processing in offset/gain setting mode
Switches to the normal mode.
M10
MOVP K0 D1
G.OFFGAN U1 D1
X1A
Processing in normal mode
END

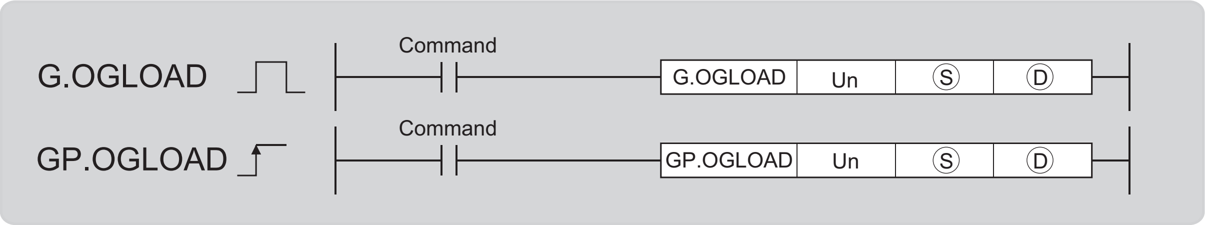
Stores the setting data of the dedicated instruction (G.OFFGAN) in D1.

Dedicated instruction (G.OFFGAN)

Stores the setting data of the dedicated instruction (G.OFFGAN) in D1.

Dedicated instruction (G.OFFGAN)

Appendix 5.3 G(P).OGLOAD



Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	—	○		—					
Ⓓ	○			—					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FE_H	BIN 16 bits
Ⓢ	Start number of device where the control data is stored	Within the range of specified device	Device name
Ⓓ	Device which turns ON for one scan at the processing completion of the dedicated instruction. In error completion, Ⓓ +1 also turns ON.	within the range of specified device	Bit

(2) Control data [*1]

Device	Item	Setting data	Setting range	Set by
ⓢ	System area	—	—	—
ⓢ+1	Completion status	The status on instruction completion is stored. 0 : normal completion Other than 0: error completion (error code)	—	System
ⓢ+2	Pass data classification setting	Specify the type of offset/gain setting value to read out. 0: voltage 1: current b15 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1	0000_H to $000F_H$	User
ⓢ+3	System area	—	—	—
ⓢ+4	CH1 Industrial shipment settings offset value (L)	—	—	System
ⓢ+5	CH1 Industrial shipment settings offset value (H)	—	—	System
ⓢ+6	CH1 Industrial shipment settings gain value (L)	—	—	System
ⓢ+7	CH1 Industrial shipment settings gain value (H)	—	—	System
ⓢ+8	CH2 Industrial shipment settings offset value (L)	—	—	System
ⓢ+9	CH2 Industrial shipment settings offset value (H)	—	—	System
ⓢ+10	CH2 Industrial shipment settings gain value (L)	—	—	System
ⓢ+11	CH2 Industrial shipment settings gain value (H)	—	—	System
ⓢ+12	CH3 Industrial shipment settings offset value (L)	—	—	System
ⓢ+13	CH3 Industrial shipment settings offset value (H)	—	—	System
ⓢ+14	CH3 Industrial shipment settings gain value (L)	—	—	System
ⓢ+15	CH3 Industrial shipment settings gain value (H)	—	—	System
ⓢ+16	CH4 Industrial shipment settings offset value (L)	—	—	System
ⓢ+17	CH4 Industrial shipment settings offset value (H)	—	—	System
ⓢ+18	CH4 Industrial shipment settings gain value (L)	—	—	System
ⓢ+19	CH4 Industrial shipment settings gain value (H)	—	—	System
ⓢ+20	CH1 User range settings offset value (L)	—	—	System
ⓢ+21	CH1 User range settings offset value (H)	—	—	System
ⓢ+22	CH1 User range settings gain value (L)	—	—	System
ⓢ+23	CH1 User range settings gain value (H)	—	—	System
ⓢ+24	CH2 User range settings offset value (L)	—	—	System
ⓢ+25	CH2 User range settings offset value (H)	—	—	System
ⓢ+26	CH2 User range settings gain value (L)	—	—	System
ⓢ+27	CH2 User range settings gain value (H)	—	—	System
ⓢ+28	CH3 User range settings offset value (L)	—	—	System
ⓢ+29	CH3 User range settings offset value (H)	—	—	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+30	CH3 User range settings gain value (L)	—	—	System
Ⓢ+31	CH3 User range settings gain value (H)	—	—	System
Ⓢ+32	CH4 User range settings offset value (L)	—	—	System
Ⓢ+33	CH4 User range settings offset value (H)	—	—	System
Ⓢ+34	CH4 User range settings gain value (L)	—	—	System
Ⓢ+35	CH4 User range settings gain value (H)	—	—	System

*1 Configure the setting of Pass data classification setting Ⓢ +2 only.
When the data is written to the area to be set by system, offset/gain setting value is not correctly read out.

(3) Functions

- This instruction reads out the offset/gain set value in the user range setting of the A/D converter module to the CPU module.
- The interlock signal of G(P).OGLOAD includes a completion device Ⓓ and a completion status indication device Ⓓ+1.

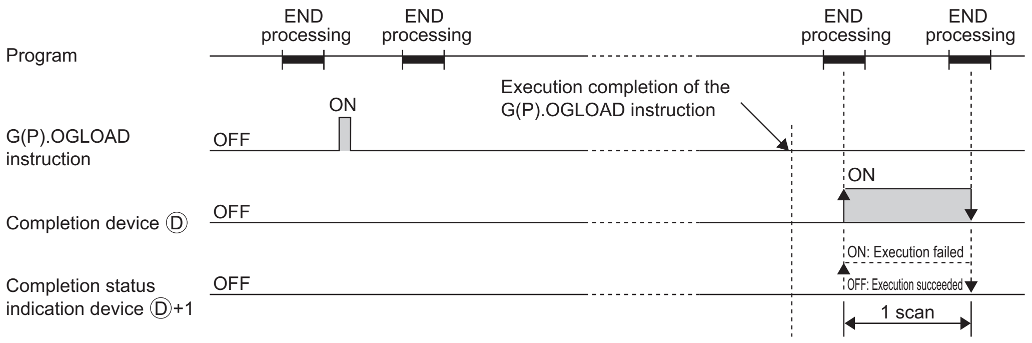
(a) Completion device

The device turns ON at the END processing for the scan where the G(P).OGLOAD instruction is completed, and turns OFF at the next END processing.

(b) Completion status indication device

This device turns OFF → ON → OFF depending on the status of the G(P).OGLOAD instruction completion.

- Normal completion: the device is kept to be OFF.
- Error completion: the device turns ON at the END processing for the scan where the G(P).OGLOAD instruction is completed, and turns OFF at the next END processing.

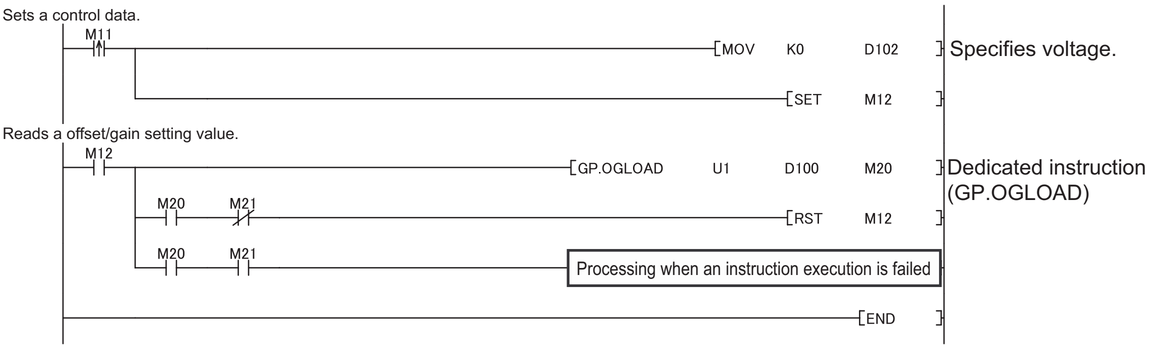

END processing
END processing
END processing
END processing
Program
Execution completion of the G(P).OGLOAD instruction
ON
G(P).OGLOAD instruction
OFF
ON
Completion device Ⓓ
OFF
ON: Execution failed
Completion status indication device Ⓓ+1
OFF
OFF: Execution succeeded
1 scan

(4) Errors

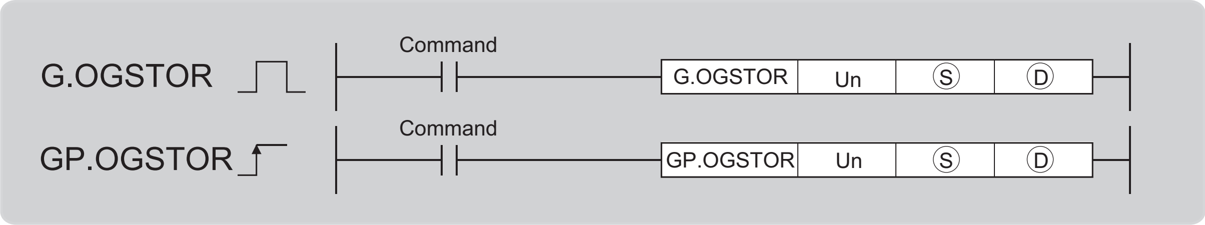
The instruction has no errors.

(5) Program example

The following shows the program to read out the offset/gain setting value of the A/D converter module, installed in I/O number X/Y10 to X/Y1F, by turning ON M11.


Sets a control data.
M11
MOV K0 D102
Specifies voltage.
SET M12
Reads a offset/gain setting value.
M12
GP.OGLOAD U1 D100 M20
Dedicated instruction (GP.OGLOAD)
M20 M21
RST M12
M20 M21
Processing when an instruction execution is failed
END

Appendix 5.4 G(P).OGSTOR



Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	—	○		—					
Ⓓ	○			—					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FE_H	BIN 16 bits
Ⓢ*1	Start number of device where the control data is stored	Within the range of specified device	Device name
Ⓓ	Device which turns ON for one scan at the processing completion of the dedicated instruction. In error completion, Ⓓ+1 also turns ON.	Within the range of specified device	Bit

*1 Specify the device specified to Ⓢ on execution of the G(P).OGLOAD instruction.
Do not change the data which is read out by the G(P).OGLOAD instruction. If the data is changed, the normal operation may not be ensured.

(2) Control data

Device	Item	Setting data	Setting range	Set by
ⓢ	System area	—	—	—
ⓢ+1	Completion status	The status on instruction completion is stored. 0 : normal completion Other than 0: error completion (error code)	—	System
ⓢ+2	Pass data classification setting	The value which is set for Pass data classification setting ⓢ +2 by G(P).OGLOAD instruction is stored. 0: voltage 1: current b15 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1	0000_H to $000F_H$	System
ⓢ+3	System area	—	—	—
ⓢ+4	CH1 Industrial shipment settings offset value (L)	—	—	System
ⓢ+5	CH1 Industrial shipment settings offset value (H)	—	—	System
ⓢ+6	CH1 Industrial shipment settings gain value (L)	—	—	System
ⓢ+7	CH1 Industrial shipment settings gain value (H)	—	—	System
ⓢ+8	CH2 Industrial shipment settings offset value (L)	—	—	System
ⓢ+9	CH2 Industrial shipment settings offset value (H)	—	—	System
ⓢ+10	CH2 Industrial shipment settings gain value (L)	—	—	System
ⓢ+11	CH2 Industrial shipment settings gain value (H)	—	—	System
ⓢ+12	CH3 Industrial shipment settings offset value (L)	—	—	System
ⓢ+13	CH3 Industrial shipment settings offset value (H)	—	—	System
ⓢ+14	CH3 Industrial shipment settings gain value (L)	—	—	System
ⓢ+15	CH3 Industrial shipment settings gain value (H)	—	—	System
ⓢ+16	CH4 Industrial shipment settings offset value (L)	—	—	System
ⓢ+17	CH4 Industrial shipment settings offset value (H)	—	—	System
ⓢ+18	CH4 Industrial shipment settings gain value (L)	—	—	System
ⓢ+19	CH4 Industrial shipment settings gain value (H)	—	—	System
ⓢ+20	CH1 User range settings offset value (L)	—	—	System
ⓢ+21	CH1 User range settings offset value (H)	—	—	System
ⓢ+22	CH1 User range settings gain value (L)	—	—	System
ⓢ+23	CH1 User range settings gain value (H)	—	—	System
ⓢ+24	CH2 User range settings offset value (L)	—	—	System
ⓢ+25	CH2 User range settings offset value (H)	—	—	System
ⓢ+26	CH2 User range settings gain value (L)	—	—	System
ⓢ+27	CH2 User range settings gain value (H)	—	—	System
ⓢ+28	CH3 User range settings offset value (L)	—	—	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+29	CH3 User range settings offset value (H)	—	—	System
Ⓢ+30	CH3 User range settings gain value (L)	—	—	System
Ⓢ+31	CH3 User range settings gain value (H)	—	—	System
Ⓢ+32	CH4 User range settings offset value (L)	—	—	System
Ⓢ+33	CH4 User range settings offset value (H)	—	—	System
Ⓢ+34	CH4 User range settings gain value (L)	—	—	System
Ⓢ+35	CH4 User range settings gain value (H)	—	—	System

(3) Functions

- The offset/gain set value in user range setting stored in CPU module is restored to A/D converter module.
- There are two interlock signals of G(P).OGSTOR: a completion device Ⓓ and a completion status indication device Ⓓ+1.
- The reference accuracy on restoration of offset/gain setting value is lowered three times or less of that of before the restoration.

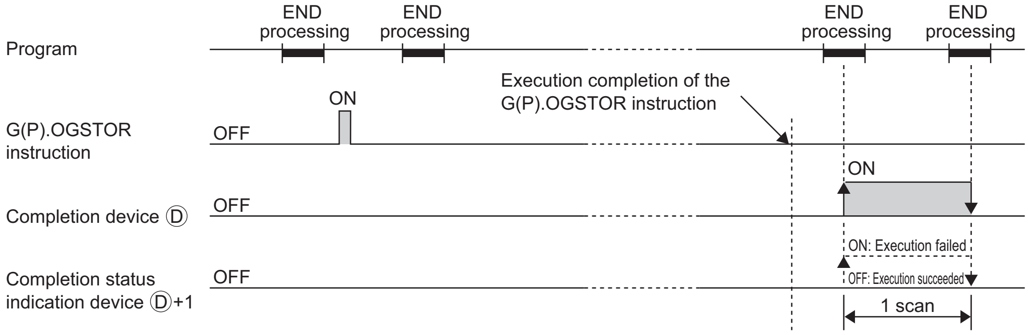
(a) Completion device

The device turns ON at the END processing for the scan where the G(P).OGSTOR instruction is completed, and turns OFF at the next END processing.

(b) Completion status indication device

This device turns OFF → ON → OFF depending on the status of the G(P).OGSTOR instruction completion.

- Normal completion: the device is kept to be OFF.
- Error completion: the device turns ON at the END processing for the scan where the G(P).OGSTOR instruction is completed, and turns OFF at the next END processing.


END processing
END processing
END processing
END processing
Program
ON
Execution completion of the G(P).OGSTOR instruction
G(P).OGSTOR instruction
OFF
ON
Completion device Ⓓ
OFF
ON: Execution failed
Completion status indication device Ⓓ+1
OFF
OFF: Execution succeeded
1 scan

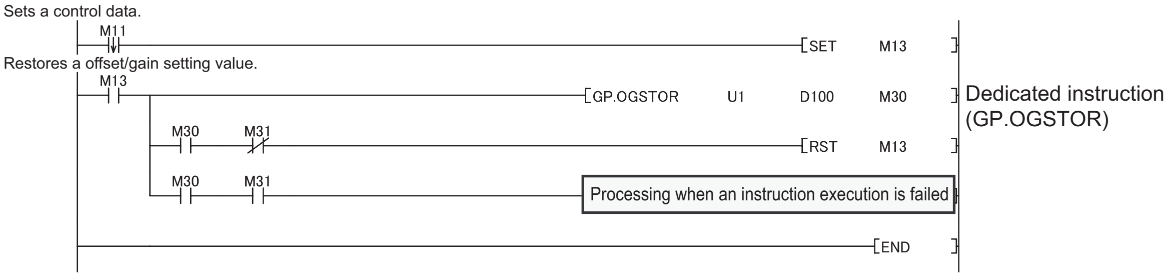
(4) Errors

In the following cases, an error occurs and error code is stored in completion status area Ⓢ +1.

Error code	Description of operation error
161	G(P).OGSTOR instruction is executed in offset/gain setting mode.
162	G(P).OGSTOR instruction is continuously executed.
163	• G(P).OGSTOR instruction is executed to the different model from the one to which G(P).OGLOAD instruction is executed. • G(P).OGSTOR instruction has been executed before the execution of G(P).OGLOAD instruction.

(5) Program example

The following shows the programs to write the offset/gain setting value to A/D converter module, installed in I/O number X/Y10 to X/Y1F, by turning OFF M11.


Sets a control data.
M11
SET M13
Restores a offset/gain setting value.
M13
GP.OGSTOR U1 D100 M30
Dedicated instruction (GP.OGSTOR)
M30 M31
RST M13
M30 M31
Processing when an instruction execution is failed
END

Appendix 6 Checking Serial Number and Function Version

For details on how to check the serial number and function version, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

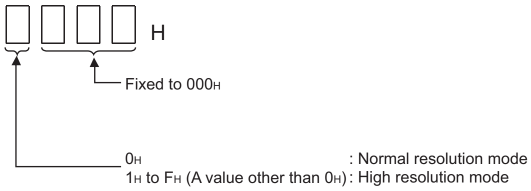
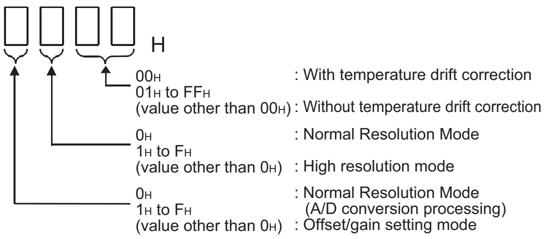
Appendix 7 Differences with Q Series

The following describes the differences between L series and Q series, and the precautions for configuring the L-series system using the Q-series program.

The description in this chapter is in the case of Q64AD.

(1) Specification comparison

The following table shows a comparison of the specifications between the L60AD4 and Q64AD.

Difference	L60AD4	Q64AD
Resolution change function	1 type; 1/20000 (resolution change function is not installed)	2 types; normal resolution (1/4000) and high resolution (1/12000 or 1/16000)
Average time	20μs: 2 to 1500ms 80μs, 1ms: 2 to 5000ms	2 to 5000ms
Averaging process specification	Averaging process specification (used to replace Q64AD) (Un\G9) Averaging process specification (Un\G24)	Averaging process specification (used to replace Q64AD) (Un\G9)
Switch 4 in switch setting	 H Fixed to 000H 0H : Normal resolution mode 1H to FH (A value other than 0H): High resolution mode	 H 00H : With temperature drift correction 01H to FFH (value other than 00H): Without temperature drift correction 0H : Normal Resolution Mode 1H to FH (value other than 0H) : High resolution mode 0H : Normal Resolution Mode (A/D conversion processing) 1H to FH (value other than 0H) : Offset/gain setting mode
Digital output value, scaling value	When Operating condition setting request (Y9) is turned from OFF to ON, digital values and scaling values are held.	When Operating condition setting request (Y9) is turned from OFF to ON, digital values are cleared. (Q64AD has no scaling value.)

Appendix 7.1 Precautions for Applying Q Series Sequence Program

The initial setting program of a Q-series A/D converter module is applicable to the program of the L60AD4 for the input signals and the buffer memory assignment of the L60AD4 are compatible between the L60AD4 and Q64AD.
The resolution is also applicable with the use of the module scaling function.

(1) Input signals and assignment of buffer memory

Refer to the following table to change the sequence program.
Note the precautions for averaging process specification of channel isolated A/D converter modules (Q64AD-GH, Q68AD-G, Q66AD-DG).
The following shows the applicable module list.

Module		Averaging process specification	Description of application
Applied from	**Applied to**	**Applied from**	
Q64AD	L60AD4	Sampling Averaging process Count average (Setting: Un\G9)	Applicable without making any change. • Precaution Apply the sequence program with the conversion speed setting of 80μs.
Q68ADV/Q68ADI		Sampling Averaging process Count average (Setting: Un\G9)	Applicable without making any change. • Precaution Apply the sequence program with the conversion speed setting of 80μs.
Q62AD-DGH /Q64AD-GH		Sampling Averaging process Count average Moving average First-order delay filter (Setting: Un\G9)	Partial changes in the sequence program are required. Set the data in the buffer memory address (Un\G9) in the applying sequence program to the buffer memory address (Un\G24) of the applied sequence program. (If the first-order delay filter is set in the buffer memory address (Un\G9), set the other averaging processing to the buffer memory address (Un\G24).) • Precaution Set 0 to the buffer memory address (Un\G9) of the module.
Q68AD-G		Sampling Averaging process Count average Moving average First-order delay filter (Setting: Un\G24)	Applicable without making any change. (If the first-order delay filter is set in the buffer memory address (Un\G9), set the other averaging processing to the buffer memory address (Un\G24).) • Precaution Set 0 to the buffer memory address (Un\G9) of the module.
Q66AD-DG		Sampling Averaging process Count average Moving average First-order delay filter (Setting: Un\G24)	Applicable without making any change. (If the first-order delay filter is set in the buffer memory address (Un\G9), set the other averaging processing to the buffer memory address (Un\G24).) • Precaution Set 0 to the buffer memory address (Un\G9) of the module.

Point

- For details on the averaging process specification of the L-series A/D converter module, refer to the following.
  Detail of buffer memory (☞ Page 102, Appendix 2)
- For details on averaging process specification of Q-series A/D converter modules, refer to the user's manual for each module.

(2) Resolution

Since the module has 1/20000 resolution, the sequence program can be applied from Q-series A/D converter modules just by using the scaling function.

Note that it is the prior condition of the sequence program, applied from a channel isolated A/D converter module (Q68AD-G or Q66AD-DG), does not have the scaling function program.

When applying the sequence program, having the scaling function, from a channel isolated A/D converter module (Q68AD-G or Q66AD-DG), set the scaling upper and lower limit value corresponding to the setting in the sequence program applied from.

The following shows the scaling function setting when applying the sequence program from a Q-series A/D converter module.

Resolution of applied module	**Resolution**							
	1/4000		**1/12000**		**1/16000**		**1/32000**	
	Digital output value		**Digital output value**		**Digital output value**		**Digital output value**	
	0 to 4000	**-4000 to 4000**	**0 to 12000**	**-12000 to 12000**	**0 to 16000**	**-16000 to 16000**	**0 to 32000**	**-32000 to 32000**
Scaling upper limit value	4000	4000	12000	12000	16000	16000	32000	32000
Scaling lower limit value	0	-4000	0	-12000	0	-16000	0	-32000
Target module	Q64AD Q68ADV Q68ADI Q68AD-G Q66AD-DG		Q64AD Q68ADV Q68ADI Q68AD-G Q66AD-DG		Q64AD Q68ADV Q68ADI Q68AD-G Q66AD-DG		Q64AD-GH Q62AD-DGH (16 bit)	Q64AD-GH (16 bit)

Applying the sequence program of the Q64AD-GH or Q62AD-DGH with 1/64000 resolution by using the scaling function is not available.

Change the digital output value ranges in the program.

Appendix 8 When Using GX Developer or GX Configurator-AD

Appendix 8 describes the operating procedure when using GX Developer and GX Configurator-AD.

(1) Compatible software version

For compatible software version, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

Appendix 8.1 Operation of GX Developer

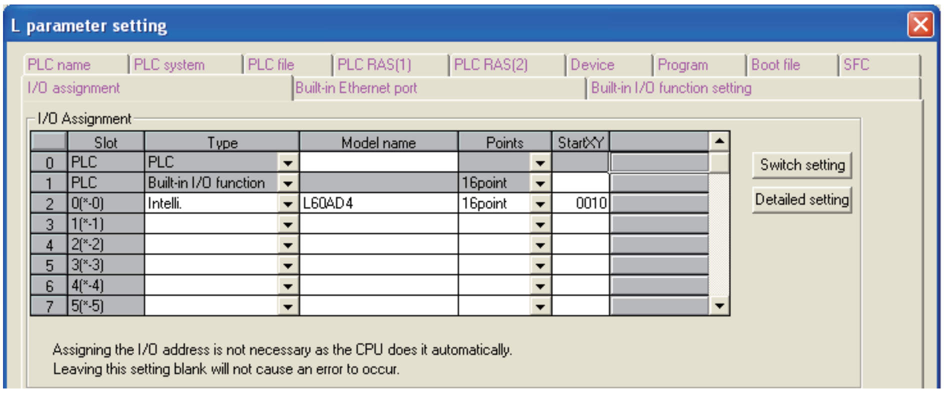
Configure the setting on the following screen when using GX Developer.

Screen name	Application	Reference
I/O assignment	Set the type of module to be installed and the range of I/O signal.	Page 132, Appendix 8.1(1)
Switch setting	Configure the switch setting of an intelligent function module.	Page 133, Appendix 8.1(2)
Offset/gain setting	Configure the setting when using the user range setting for the input range.	Page 134, Appendix 8.1(3)

(1) I/O assignment

Configure the setting from "I/O assignment" in "PLC parameter".

Parameter ➪ [PLC parameter] ➪ [I/O assignment]


L parameter setting
PLC name
PLC system
PLC file
PLC RAS(1)
PLC RAS(2)
Device
Program
Boot file
SFC
I/O assignment
Built-in Ethernet port
Built-in I/O function setting
I/O Assignment
Switch setting
Detailed setting

	Slot	Type	Model name	Points	StartXY
0	PLC	PLC			
1	PLC	Built-in I/O function		16point	
2	0(*-0)	Intelli.	L60AD4	16point	0010
3	1(*-1)				
4	2(*-2)				
5	3(*-3)				
6	4(*-4)				
7	5(*-5)				

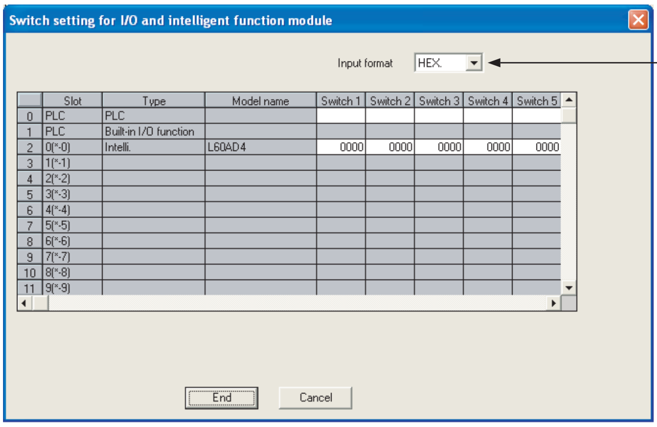
Assigning the I/O address is not necessary as the CPU does it automatically.
Leaving this setting blank will not cause an error to occur.

Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the A/D converter module.
Points	Select "16 point".
Start XY	Enter a desired start I/O number of the A/D converter module.

(2) Intelligent function module switch setting

Configure the setting from "Switch setting" in "PLC parameter".

Parameter ➪ [PLC parameter] ➪ [I/O assignment] ➪ Click the Switch setting button.

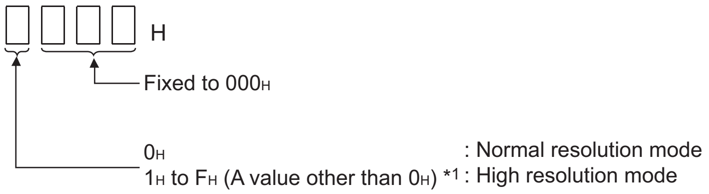


Switch setting for I/O and intelligent function module

Input format: HEX.

	Slot	Type	Model name	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5
0	PLC	PLC						
1	PLC	Built-in I/O function						
2	0(*-0)	Intelli.	L60AD4	0000	0000	0000	0000	0000
3	1(*-1)							
4	2(*-2)							
5	3(*-3)							
6	4(*-4)							
7	5(*-5)							
8	6(*-6)							
9	7(*-7)							
10	8(*-8)							
11	9(*-9)							

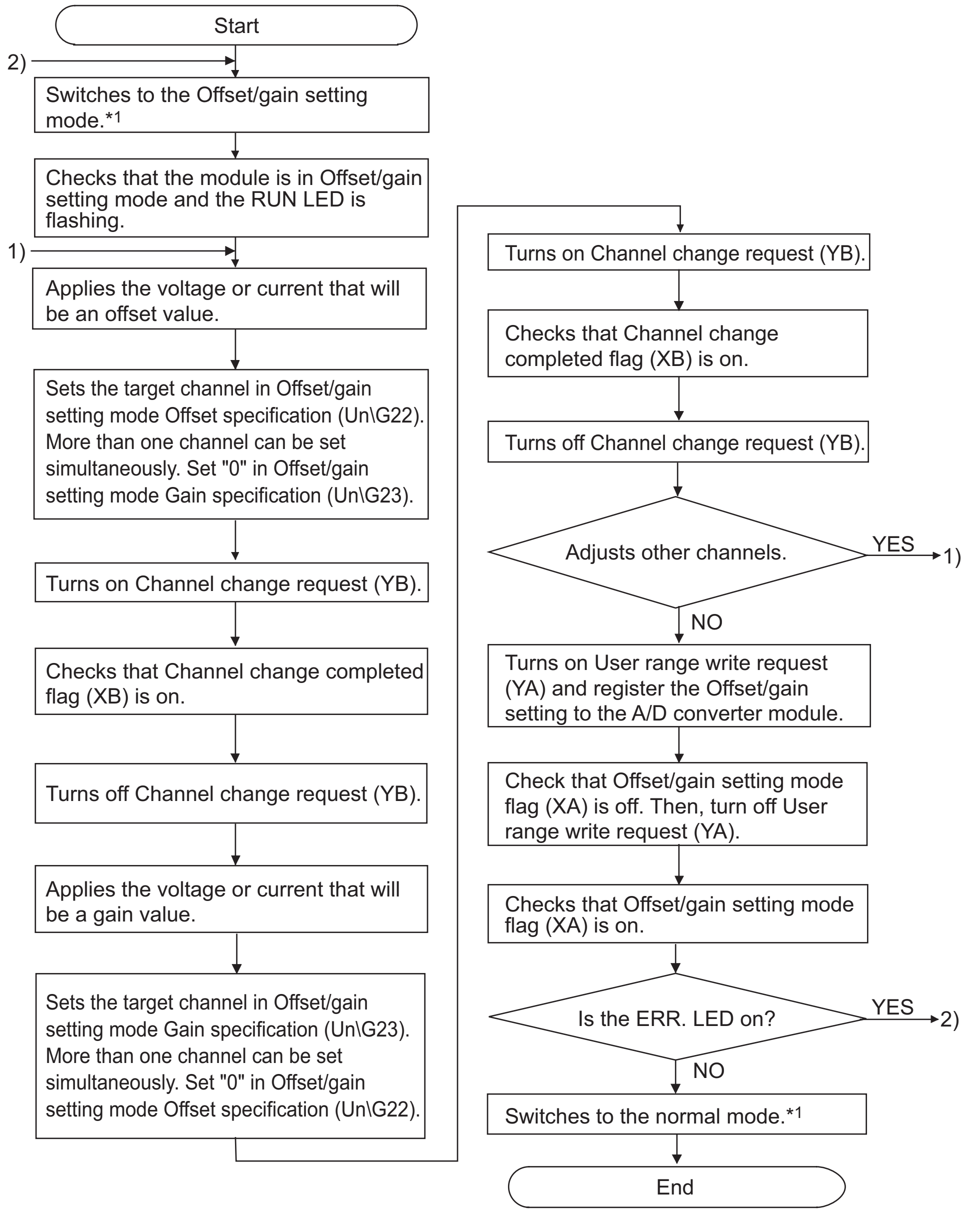
Select "HEX.".

Item	Setting item		
		Analog input range	**Input range setting**
Switch 1	Input range setting (CH1 to CH4) □□□□H CH4 CH3 CH2 CH1	4 to 20mA	0_H
		0 to 20mA	1_H
		1 to 5V	2_H
		0 to 5V	3_H
		-10 to 10V	4_H
		0 to 10V	5_H
		User range setting	F_H
Switch 2	0: Fixed (blank)		
Switch 3	0: Fixed (blank)		
Switch 4	 □□□□ H Fixed to 000_H 0_H : Normal resolution mode 1_H to F_H (A value other than 0_H) *1 : High resolution mode		
Switch 5	0: Fixed (blank)		

*1 The operation is the same when any value within the setting range is set.

(3) Offset/gain setting

When using the user range setting, configure the offset/gain setting in the following procedure.
When using the factory default setting, the offset/gain setting is not necessary.


Start
2)
Switches to the Offset/gain setting mode.*1
Checks that the module is in Offset/gain setting mode and the RUN LED is flashing.
1)
Applies the voltage or current that will be an offset value.
Sets the target channel in Offset/gain setting mode Offset specification (Un\G22). More than one channel can be set simultaneously. Set "0" in Offset/gain setting mode Gain specification (Un\G23).
Turns on Channel change request (YB).
Checks that Channel change completed flag (XB) is on.
Turns off Channel change request (YB).
Applies the voltage or current that will be a gain value.
Sets the target channel in Offset/gain setting mode Gain specification (Un\G23). More than one channel can be set simultaneously. Set "0" in Offset/gain setting mode Offset specification (Un\G22).
Turns on Channel change request (YB).
Checks that Channel change completed flag (XB) is on.
Turns off Channel change request (YB).
Adjusts other channels.
YES
1)
NO
Turns on User range write request (YA) and register the Offset/gain setting to the A/D converter module.
Check that Offset/gain setting mode flag (XA) is off. Then, turn off User range write request (YA).
Checks that Offset/gain setting mode flag (XA) is on.
Is the ERR. LED on?
YES
2)
NO
Switches to the normal mode.*1
End

*1 The following shows the procedure for switching the mode (normal mode → offset/gain setting mode → normal mode).

Dedicated instruction (G(P).OFFGAN) (☞ Page 119, Appendix 5.2)

- Setting for Mode switching setting (Un\G158, Un\G159) and OFF → ON → OFF of Operating condition setting request (Y9) (☞ Page 112, Appendix 2(21))
- Intelligent function module switch setting (☞ Page 40, Section 7.2 (1))

Point

- Configure the offset/gain setting in accordance with the actual use situation.
- Offset and gain values are recorded in the flash memory in the A/D converter module by turning OFF → ON → OFF User range write request (YA). Once recorded, the values are not deleted even after turning the power off.
  When the values are written 26 times in succession, an error occurs and the error code is stored in Latest error code (Un\G19) to prevent an improper write to flash memory.
- Configure the offset/gain setting in the range satisfying the following condition.
  When the setting value out of the range is configured, the resolution and accuracy of the module may not fall within the range shown in the following performance specifications.
  - I/O conversion characteristic of A/D conversion (☞ Page 114, Appendix 3)
- Offset/gain setting can be configured for multiple channels at the same time, however, the setting must be configured for offset and gain channels separately.
  When configuring the setting for offset and gain channels at the same time, an error occurs and ERR. LED turns on.
- When turning ON User range write request (YA), the integrity between the offset values and gain values is checked. When error occurs even in one channel, offset/gain value is not written to the module.
  Check the value in Latest error code (Un\G19) and perform the following procedures to reconfigure the offset/gain setting from the beginning.
  - Error code list (☞ Page 89, Section 11.4)
- When the mode is switched from the offset/gain setting mode to the normal mode by the setting of the dedicated instruction (G(P).OFFGAN) or Mode switching setting (Un\G158, Un\G159), Module READY (X0) turns from OFF to ON. Note the initial setting process is executed at the switching of the mode if the sequence program executes the initial setting at Module READY (X0) ON.
- To validate the intelligent function module switch setting after writing the setting to the CPU module, reset the CPU module or turn the power supply from OFF to ON.

(4) Program example

(a) Device

Ex. I/O number of the A/D converter module is X/Y30 to 3F (when the L26CPU-BT is used).

The following shows the devices used in the program example.

Device	Functions
M0	Channel selection
M1	Offset setting
M2	Gain setting
M3	Channel change command
M4	Write command to module of offset/gain setting value
M5	Mode switching
D0	Channel-specified storage device
D1	Storage device for the setting value of the dedicated instruction (G(P).OFFGAN)

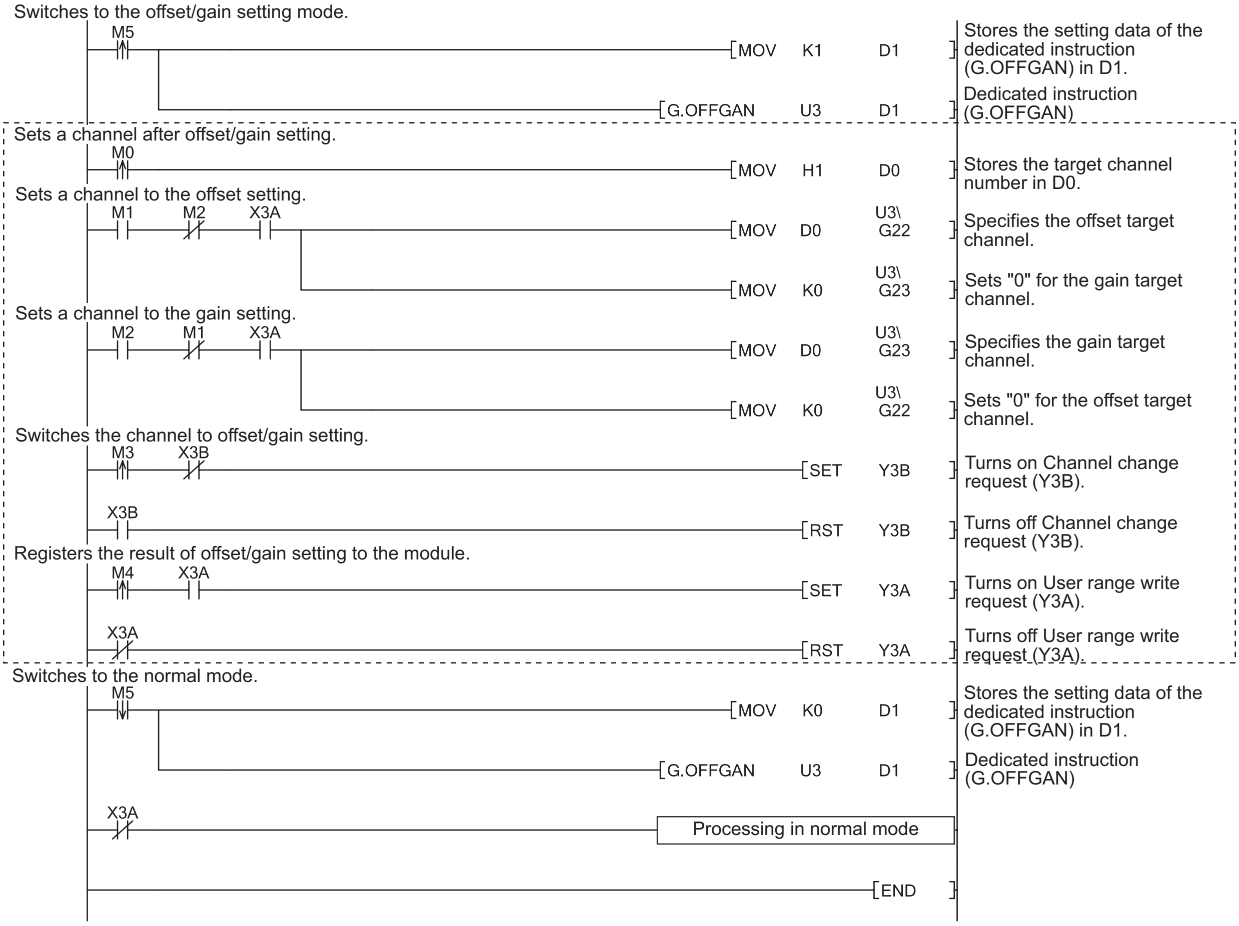
Point

When using the L02CPU, set the I/O assignments of the A/D converter module to X/Y30 to 3F so that the I/O assignments be the same as that of the system configuration above.

(b) Switching the mode by the dedicated instruction (G(P).OFFGAN)

This program performs the followings:

- first, switches the mode to the offset/gain setting mode by the dedicated instruction (G(P).OFFGAN),
- second, switches the channels for which the offset/gain settings is configured,
- third, writes the offset/gain value to the A/D converter module,
- finally, switches the mode back to the normal modes.



Switches to the offset/gain setting mode.

M5 — [MOV K1 D1] Stores the setting data of the dedicated instruction (G.OFFGAN) in D1.

[G.OFFGAN U3 D1] Dedicated instruction (G.OFFGAN)

Sets a channel after offset/gain setting.

M0 — [MOV H1 D0] Stores the target channel number in D0.

Sets a channel to the offset setting.

M1 M2 X3A — [MOV D0 U3\G22] Specifies the offset target channel.

[MOV K0 U3\G23] Sets "0" for the gain target channel.

Sets a channel to the gain setting.

M2 M1 X3A — [MOV D0 U3\G23] Specifies the gain target channel.

[MOV K0 U3\G22] Sets "0" for the offset target channel.

Switches the channel to offset/gain setting.

M3 X3B — [SET Y3B] Turns on Channel change request (Y3B).

X3B — [RST Y3B] Turns off Channel change request (Y3B).

Registers the result of offset/gain setting to the module.

M4 X3A — [SET Y3A] Turns on User range write request (Y3A).

X3A — [RST Y3A] Turns off User range write request (Y3A).

Switches to the normal mode.

M5 — [MOV K0 D1] Stores the setting data of the dedicated instruction (G.OFFGAN) in D1.

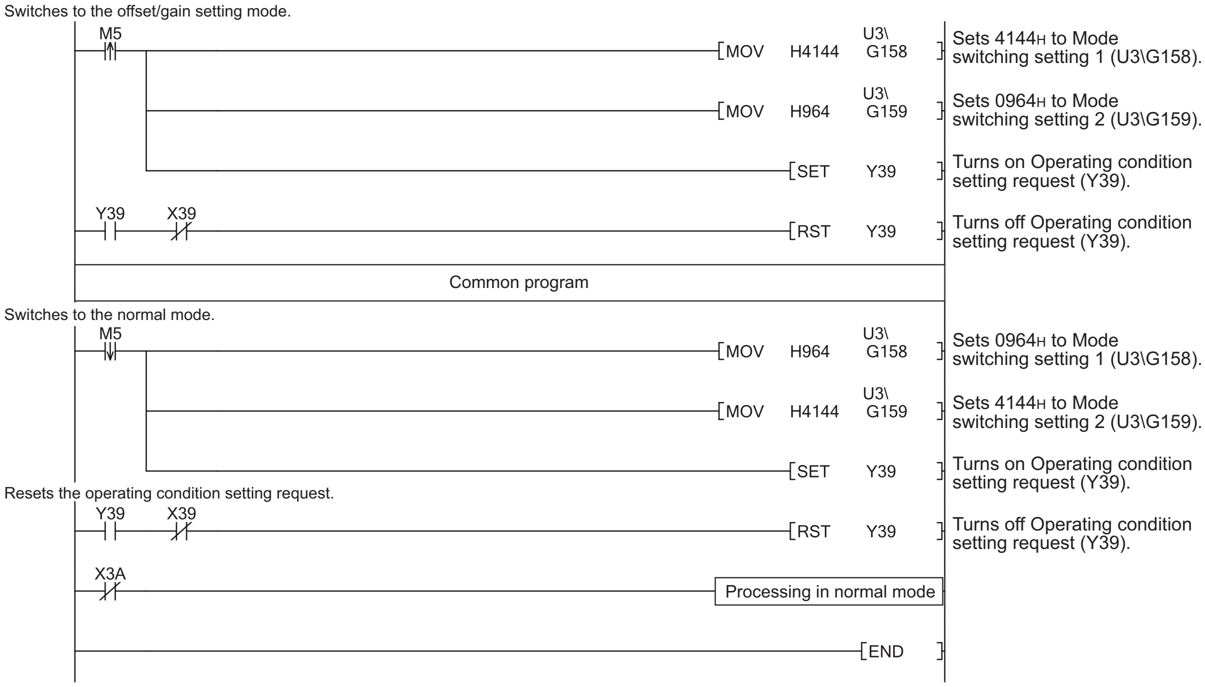
[G.OFFGAN U3 D1] Dedicated instruction (G.OFFGAN)

X3A — Processing in normal mode

[END]

The program in the dotted line is the common programs.

(c) Switching the mode by Mode switching setting (U3\G158, U3\G159) and Operating condition setting request (Y39)


M5
MOV H4144 U3\G158
MOV H964 U3\G159
SET Y39
Y39
X39
RST Y39
Common program
M5
MOV H964 U3\G158
MOV H4144 U3\G159
SET Y39
Y39
X39
RST Y39
X3A
Processing in normal mode
END

Switches to the offset/gain setting mode.

Sets 4144H to Mode switching setting 1 (U3\G158).

Sets 0964H to Mode switching setting 2 (U3\G159).

Turns on Operating condition setting request (Y39).

Turns off Operating condition setting request (Y39).

Switches to the normal mode.

Sets 0964H to Mode switching setting 1 (U3\G158).

Sets 4144H to Mode switching setting 2 (U3\G159).

Turns on Operating condition setting request (Y39).

Resets the operating condition setting request.

Turns off Operating condition setting request (Y39).

(d) Switching the mode by the intelligent function module switch setting

The programs other than the common program is not necessary.

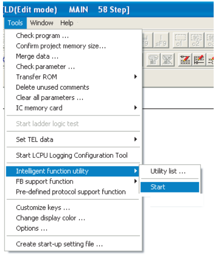
Appendix 8.2 Operation of GX Configurator-AD

When setting the A/D converter module parameter using GX Configurator-AD, the display method such as a setting screen differs from that of GX Works2.
This section describes the screen display method of GX Configurator-AD.

The setting contents are the same as GX Works2. (☞ Page 39, CHAPTER 7)
When using GX Configurator-AD, configure the settings on the following screens.

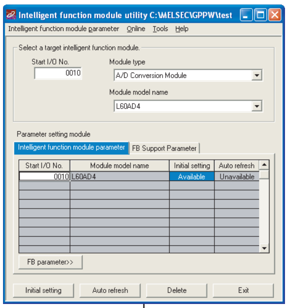
Screen name	Application
Initial setting	This setting configures the settings such as A/D conversion enable/disable setting.
Auto refresh setting	This setting transfers data in the buffer memory to specified devices.
Monitor/test	This function enables the user to monitor/test the buffer memory and I/O signals, and configure the operating condition setting and offset/gain setting.
FB conversion	This function generates FB automatically from the intelligent function module parameter (initial setting/auto refresh).

GX Developer screen


[LD(Edit mode) MAIN 58 Step]
Tools
Window
Help
Check program ...
Confirm project memory size...
Merge data ...
Check parameter ...
Transfer ROM
Delete unused comments
Clear all parameters ...
IC memory card
Start ladder logic test
Set TEL data
Start LCPU Logging Configuration Tool
Intelligent function utility
FB support function
Pre-defined protocol support function
Customize keys ...
Change display color ...
Options ...
Create start-up setting file ...
Utility list ...
Start

[Tools] - [Intelligent function utility] - [Start]

Screen for selecting a target intelligent function module


Intelligent function module utility C:\MELSEC\GPPW\test
Intelligent function module parameter
Online
Tools
Help
FB parameter>>
Initial setting
Auto refresh
Delete
Exit

Select a target intelligent function module.
Start I/O No.: 0010
Module type: A/D Conversion Module
Module model name: L60AD4

Parameter setting module
Intelligent function module parameter | FB Support Parameter

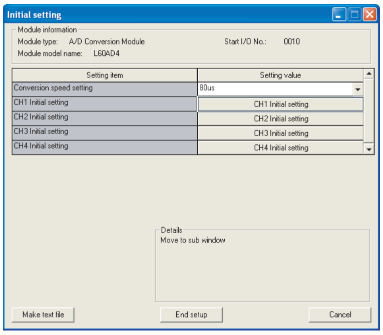
Start I/O No.	Module model name	Initial setting	Auto refresh
0010	L60AD4	Available	Unavailable

Initial setting

Auto refresh

1)

Initial setting screen

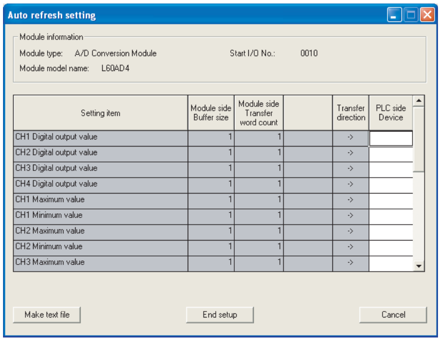

Initial setting
Make text file
End setup
Cancel

Module information
Module type: A/D Conversion Module
Start I/O No.: 0010
Module model name: L60AD4

Setting item	Setting value
Conversion speed setting	80us
CH1 Initial setting	CH1 Initial setting
CH2 Initial setting	CH2 Initial setting
CH3 Initial setting	CH3 Initial setting
CH4 Initial setting	CH4 Initial setting

Details
Move to sub window

Auto refresh setting screen

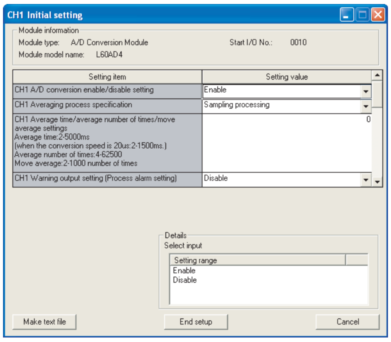

Auto refresh setting
Make text file
End setup
Cancel

Module information
Module type: A/D Conversion Module
Start I/O No.: 0010
Module model name: L60AD4

Setting item	Module side Buffer size	Module side Transfer word count		Transfer direction	PLC side Device
CH1 Digital output value	1	1		->	
CH2 Digital output value	1	1		->	
CH3 Digital output value	1	1		->	
CH4 Digital output value	1	1		->	
CH1 Maximum value	1	1		->	
CH1 Minimum value	1	1		->	
CH2 Maximum value	1	1		->	
CH2 Minimum value	1	1		->	
CH3 Maximum value	1	1		->	

CH☐ Initial setting

CH☐ Initial setting screen


CH1 Initial setting
Make text file
End setup
Cancel

Module information
Module type: A/D Conversion Module
Start I/O No.: 0010
Module model name: L60AD4

Setting item	Setting value
CH1 A/D conversion enable/disable setting	Enable
CH1 Averaging process specification	Sampling processing
CH1 Average time/average number of times/move average settings Average time:2-5000ms (when the conversion speed is 20us:2-1500ms.) Average number of times:4-62500 Move average:2-1000 number of times	0
CH1 Warning output setting (Process alarm setting)	Disable

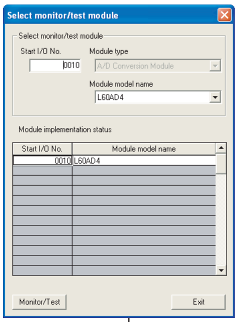
Details
Select input

Setting range
Enable
Disable

1)

[Online] - [Monitor/Test]

Select monitor/test module screen


Select monitor/test module
Select monitor/test module
Module implementation status
Monitor/Test
Exit

Start I/O No.: 0010

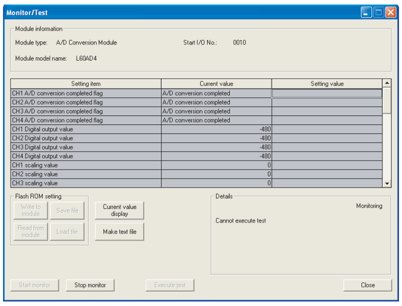
Module type: A/D Conversion Module

Module model name: L60AD4

Start I/O No.	Module model name
0010	L60AD4

Select a module to be monitored/tested.

Monitor/Test screen


Monitor/Test
Module information
Flash ROM setting
Write to module
Save file
Read from module
Load file
Current value display
Make text file
Details
Start monitor
Stop monitor
Execute test
Close

Module type: A/D Conversion Module

Start I/O No.: 0010

Module model name: L60AD4

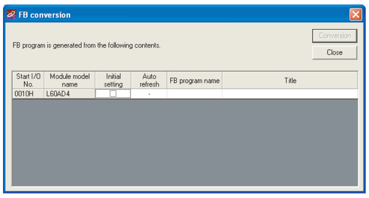
Setting item	Current value	Setting value
CH1 A/D conversion completed flag	A/D conversion completed	
CH2 A/D conversion completed flag	A/D conversion completed	
CH3 A/D conversion completed flag	A/D conversion completed	
CH4 A/D conversion completed flag	A/D conversion completed	
CH1 Digital output value	-480	
CH2 Digital output value	-480	
CH3 Digital output value	-480	
CH4 Digital output value	-480	
CH1 scaling value	0	
CH2 scaling value	0	
CH3 scaling value	0	

Monitoring

Cannot execute test

<<FB Support Parameter>> tab - FB conversion

FB conversion screen


FB conversion
Conversion
Close

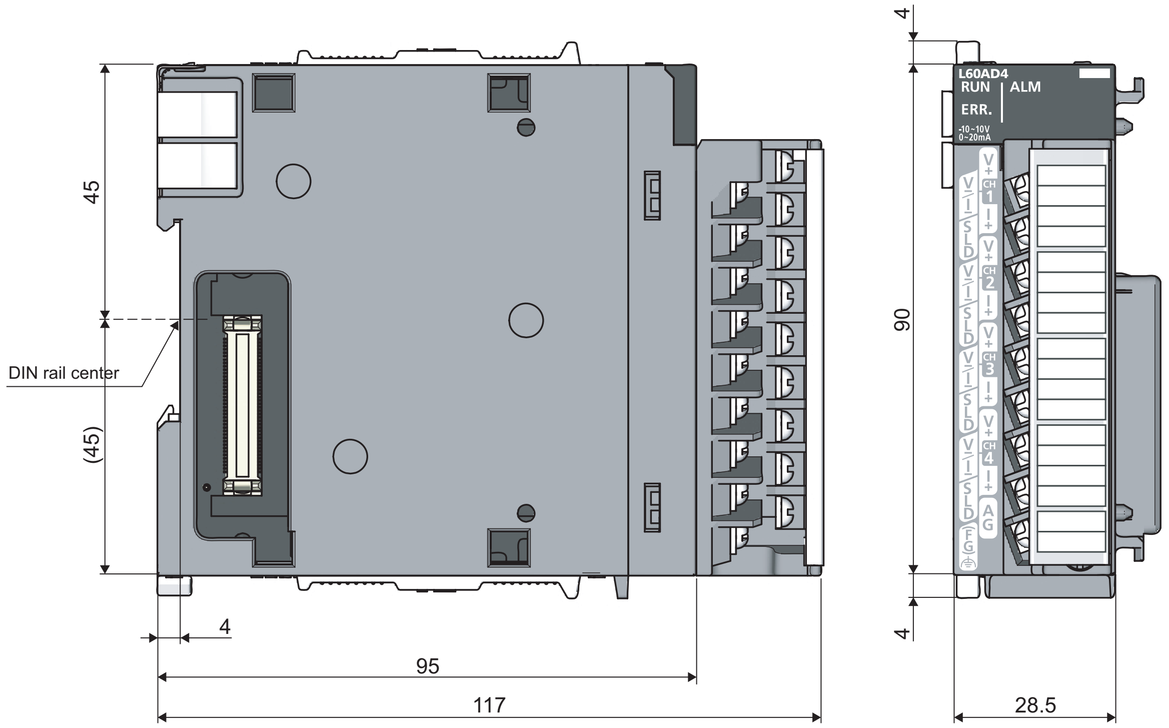
FB program is generated from the following contents.

Start I/O No.	Module model name	Initial setting	Auto refresh	FB program name	Title
0010H	L60AD4	☐	-		

Appendix 9 External Dimensions

The following shows the external dimensions of A/D converter module.

(1) L60AD4



45
DIN rail center
(45)
4
95
117
4
90
4
28.5
L60AD4
RUN
ALM
ERR.
-10~10V
0~20mA

(Unit: mm)

INDEX

A

A/D conversion completed flag (Un\G10) 103
A/D conversion completed flag (XE) 99
A/D conversion enable/disable function 48
A/D conversion enable/disable setting (Un\G0). . . . 102
A/D conversion method 48
  Averaging processing 48
  Sampling processing 48
Addition of modules 39
Alarm output function (process alarm) 56
Auto refresh 43
Averaging process specification (Un\G24) 105
Averaging process specification (used to replace Q64AD) (Un\G9) 103

C

CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233) 113
Channel change completed flag (XB) 97
Channel change request (YB) 100
CH☐ Average time/Average number of times/Move average settings (Un\G1 to Un\G4) 102
CH☐ Digital output value (Un\G11 to Un\G14) 104
CH☐ Input signal error detection setting value (Un\G142 to Un\G145). 111
CH☐ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) 106
CH☐ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37) 106
CH☐ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98) 110
CH☐ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99) 110
CH☐ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100) 110
CH☐ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101) 110
CH☐ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68) 109
CH☐ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69) 109
CH☐ Scaling value (Un\G54 to Un\G57) 109
Conversion speed setting (Un\G26) 106
Conversion speed switch function 52
Count Average 49
Current input characteristic 116

D

Digital output value 47

E

Error clear function 65
Error clear request (YF) 101
Error history No.☐ (Un\G1810 to Un\G1969) 113
Error log function 62
Error occurrence flag (XF) 99
External wiring 38

G

Gain value 114

H

Hardware LED information. 94
Hardware switch information 94

I

I/O assignment 132
Input signal error detection flag (Un\G49) 107
Input signal error detection function 53
Input signal error detection setting (Un\G47) 106
Input signal error detection signal (XC) 98
Intelligent function module switch setting 133

L

Latest error code (Un\G19) 104
Latest error code address (Un\G1800) 113

M

Maximum and minimum values hold function 52
Maximum value/minimum value reset completed flag (XD) 98
Maximum value/minimum value reset request (YD) 100
Mode switching setting (Un\G158, Un\G159) 112
Module error collection function 64
Module READY (X0) 95
Moving Average 50

O

Offset value 114
Offset/gain setting. 44
Offset/gain setting mode flag (XA) 97
Offset/gain setting mode Gain specification (Un\G23) 105
Offset/gain setting mode Offset specification (Un\G22) 105
Operating condition setting completed flag (X9) 96
Operating condition setting request (Y9) 100

P

Parameter setting 41
Pass data classification setting (Un\G200). 112
Process alarm output setting (Un\G48) 107

R

Range reference tables 70

S

Saving and restoring offset/gain values 66
Scaling enable/disable setting (Un\G53) 108
Scaling function 59
Scaling value. 47
Setting range (Un\G20). 104
Switch setting 40

T

Time Average 49

U

User range write request (YA) 100

V

Voltage input characteristic 115

W

Warning output flag (Process alarm) (Un\G50) . . . 108
Warning output signal (X8) 95

INSTRUCTION INDEX

G

G(P).OFFGAN 119
G(P).OGLOAD 121
G(P).OGSTOR 125

REVISIONS

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

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SPREAD
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MELSEC-L Analog-Digital Converter Module User's Manual

MODEL	L-A/D-U-E
MODEL CODE	13JZ42
SH(NA)-080899ENG-A(1001)MEE	

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